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RESEARCH ARTICLE

Linking Dynamic Capabilities and Market Performance of SMEs: The Moderating Role of Organizational Agility

Bülent Akkaya¹ , Iqbal Qaisar² 

Abstract

The purpose of this study is to highlight the moderating role of organizational agility (OA) between dynamic capabilities (DC) and market performance (MP) in SMEs in Turkey and Malaysia. The data was collected from 198 managers in both countries. The data was analyzed by Partial Least Squares Structural Equation Modelling (PLS-SEM). The research has found that there is a significant relationship between organizational agility and market performance, dynamic capabilities and market performance. The finding also reveals that organizational agility has a moderating role between dynamic capabilities and market performance. This research contributes to boosting scientific research, particularly in terms of testing the model content, as well as the variables and the factors affecting them. In addition, this research pointed to the need for organizations to practice organizational agility and dynamic capabilities in order to improve market performance. Dynamic capabilities and organizational agility vary according to environmental dynamism for a firm's market performance and high levels of dynamic capabilities may lead to upper market performance, as market performance is often more directly tied to SMEs organizational agility. Moreover, managers should account for dynamic capabilities while assessing the effects of it on organizational agility and firm performance.

Keywords

Organizational Agility, Dynamic Capabilities, Market Performance, SMEs, Turkey, Malaysia

Introduction

The global competition has forced many industry sectors to progress to a hyper-competitive environment from slow-moving (Esper et al., 2007). Manufacturers are able to introduce new goods and improvements in operating systems in an attempt to surpass each other (Mangan et al., 2008). Today's market is known as more volatile, increasingly competitive and time-sensitive customers and clients (Gunasekaran, 1998; Gunasekaran et al., 2008), and firms has faced to agility because of an increase in market complexity and uncertainty (Brown & Besant 2003; Yusuf et al. 2004). Due to these uncertainties, significant changes in market trends, rapid change in customer demand, technological innovation, the manufacturing industries have faced an intensive challenge (Gunasekaran et al., 2008; Richard et al., 2009). Here

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agility plays a key role. Because agility has occurred in order to enable organizations, which are relevant to their rapidly changing needs, to meet the challenges of demanding, needs and expectations of customers (Fliedner & Vokurka, 1997).

Whereas standard mass production takes care of a few long-lasting products, an agile enterprise works on manufacturing a large range of frequently updated products (Bernardes & Hanna, 2009), and has become less time-consuming (Kurniawan & Zailani, 2010). For manufacturing industries, managers aim to supply their enterprises with the shortest possible lead times to meet their needs expectations and requirements. Because it is known that to respond slowly the demands of changing market can damage the firms and cause to lose their competitive advantage. The firms must explore the structure and management of their manufacturing activities in order to keep their competitive advantages (Christopher et al., 2006). This process is related to organizational agility.

The idea of organizational agility has been conceptualized in literature as a mechanism through which organizations can achieve competitive advantages by meeting the needs of their customers rapidly and adapting to the changing environment. Organizational agility means the collection of business initiatives which allow businesses to achieve competitive advantage, manufacturing processes that achieve speed and cost-effectiveness (Porter, 1996), and refers to the efficiency and effectiveness of the day-to-day activities of a company to meet changing business needs in a rapidly changing environment (Cao and Dowlatsahi, 2005; Zehir et al. 2008). This process is related to the capabilities of organizational agility and dynamic capabilities, too. Organizational agility includes internal and external capabilities, which are mainly used for creating organizational ability and retaining a competitive advantage for the longer term (Gripsrud et al., 2006) and the source of competitive ability for organizations, which build and use packages of quality resources that are not easily imitated by other organizations (Gregory et al., 2019; Lam et al., 2019; Mazzarol & Reboud, 2020).

Due to the dynamic business environment, agile capabilities are important to ensure that internal and external components can be rapidly integrated, built and reconfigured to address environments (Teece, 2009). With this dynamic view, organizational agility stresses the ability to feel and respond to market changes and opportunities (Sambamurthy et al., 2003; Chakravarty et al., 2013) and focuses on the ability to learn and upgrade existing operating abilities with new knowledge, integrate new expertise into the reconfigured operating abilities, and introduce the operational capabilities reconfigured (Paul & Omar, 2011).

One the most important tasks for enterprises and managers is to manage uncertainties in this dynamic and constantly changing environment. It is critical for their task to search, to respond to and to exploit change as an opportunity (Koh & Simpson, 2005). Enterprises and their managers need new analytical and effective vision, new capacity and conviction in order to seize, learn and reconfigure emerging opportunities, and guide in a challenging

environment. Teece et al (1997) calls them as dynamic capabilities. And they define dynamic capabilities as a “*firm’s ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments (p.516)*”. They also stressed that a strategic approach will help to create a framework for policy that could give managers an understanding of how to develop competitiveness and sustainability to establish in the long term. Dynamic capabilities in rapidly changing markets are simple and clear, rapid and new learning systems, unconfirmed knowledge and outcomes can be volatile. Learning strategies lead to the development of dynamic capabilities (Eisenhardt & Martin, 2000; Wang and Ahmed, 2007; Weerawardena, & Liesch, 2019; Salunke et al., 2019; Hernández-Linares et al., 2020). Teece (2007) described dynamic capabilities consisting of different organizational skills, systems, methods, frameworks, decision regulations and orders that provide the opportunity to make good long-term profit.

Successful managers in a highly competitive organization know and take advantage of opportunities. Managers aim to preserve, develop and reconfigure resources in order to get the highest profit in a competitive environment. This process is related to firms’ marketing performance. It can be achieved by meeting customers’ needs and demands in a volatile environment. While many researchers have emphasized and agreed upon the positive influence of organizational agility (Nagel & Dove, 1991; Sharifi & Zhang, 1999) and dynamic capabilities (Teece et al.,1997; Helfat et al., 2009; Doz & Kosonen, 2010; Lewis et al., 2014; Teece et al.,2016; Vorhies & Morgan, 2003; Roberts & Grover, 2012; Akkaya & Üstgörl, 2020) on organizational performance, there is still no research about the relationship among those these variables. Moreover, studies related to information sharing as a moderating variable between dynamic capabilities and marketing performance are very few. Therefore, the present study fills this gap existing in those variables in this aspect. In other words, studies on organizational agility and market performance linked with dynamic capabilities are insufficient, thus, this study focuses on the role of dynamic capabilities and processing in agile organization practices, and its influence on the marketing performance of small and medium size manufacturing companies. In addition to emphasizing the role of dynamic capabilities, this study also evaluates the relationships among dynamic capabilities and organizational agility on marketing performance.

Literature Review

Dynamic Capabilities

One of the first pioneers in the dynamic capabilities field was Teece et al. (1997). Dynamic capability as a priority is on improving management competencies and integrating other competencies, such as operational and technological. The sector is, thus, focused on a variety of fields, such as research and development management, process development and techno-

logy transfer. The authors say that a dynamic approach will help to create a strategic theory that can give business people a sense of how competitiveness and efficiency can be built in the long-term run. Dynamic capabilities are the company's ability to adapt, build and reconfigure internal and external competences to respond to changing environments (Teece et al., 1997). Dynamic capabilities can be defined as to adapt the resources of an organization to new forms of competitive advantage.

Dynamic capabilities include different methods, such as product development, strategic decision taking and partnership. Dynamic capabilities also have some common characteristics, are identifiable, not ambiguous. The development of dynamic capabilities is driven by learning mechanisms (Eisenhardt & Martin 2000). Dynamic capabilities of company systems are intended to create efficiency by designing solutions for some processes in production development or pricing (Cavusgil et al. 2007; Cavusgil & Knight, 2015). In terms of the sustainability of an organization, dynamic capabilities are critical to renewing and upgrading the key capability (Barney 2001; Cavusgil et al. 2007). In other words, dynamic capabilities underline an on-going challenge by a company to maintain, build and restructure resources and are the key abilities to respond to environmental changes.

To have the ability to change and adjust rapidly has grown more important for companies (Schreyögg & Kliesch-Eberl, 2007; Şen & Bolat, 2015). Because companies can earn a competitive return when having dynamic capabilities, utilizing dynamic capabilities enables the chance to bring high profits in the long term (Teece & Augier, 2009). Good managers that can sense, seize and configure opportunities in a dynamically competitive company, can achieve this. Such skills are very difficult to strengthen and use for the company. Shortly, it can be stated that dynamic capabilities emphasize that a company is continuously aiming to preserve, develop and reconfigure resources, capabilities to adjust to environmental changes through sensing, seizing and configuring opportunities.

Organizational Agility

Organizational agility concept originates from agility. The agility concept firstly was introduced in the Iacocca Institute of Lehigh University in 1991 (Ren et al., 2003). Agility refers to a company's ability to survive and succeed in a competitive environment with constant and unpredictable market change—to respond quickly to fast-paced, fractured world markets (Goldman, 1991; Adeleye & Yusuf, 2006).). Agility also refers to the ability to adapt quickly and efficiently by merging and recombining separate resources without compromising day-to-day activities, an operational capacity and a significant strategic priority in manufacturing operations (Sheppard & Young, 2006; Wieland & Wallenburg, 2012; Kisperska-Moron & Swierczek, 2009).

Organizational agility as a term has first been researched from manufacturing and work-

force viewpoints among others, before extending the concept to cover whole company operations (Sherehiyet al., 2007). Organizational agility refers to a number of business strategies that allow businesses to gain competitive advantage, manufacturing processes that achieve quality, precision and economic costs (Porter, 1996), and refers to the efficiency and effectiveness of daily activities of a company in order to meet the changing business climate requirements (Cao & Dowlatshahi, 2005). Organizational agility enables firms to respond to the volatile, unpredictable business environment in a flexible, innovative way quickly and efficiently (Zhang & Sharifi, 2007; Wieland & Wallenburg, 2012). Organizational agility has some characteristics listed by McCann and Selsky (2009).

- ✓ The ability to build a vision and atmosphere for strong action across the entire company.
- ✓ The ability to understand and decide where the organisation ends to create principles and strategies for practice.
- ✓ The ability especially considering to receive and share information and to use it even in the most critical areas of the company.
- ✓ The ability to get new resources and integrate them with human resources into the organization rapidly.

The competition that accompanied globalization transformed many companies into a hyper competitive environment from slow-moving. Therefore, the manufacturers aim to outperform each other easily and introduce new models and improvements to operational processes (Esper et al., 2007; Mangan & Lalwani., 2016). The importance of agility comes from its ability to change processes quickly and efficiently by combining and reintegrating organizational resources without disrupting day-to-day activities or process changes. (Meyer & Stensaker 2006; Wieland & Wallenburg, 2012). For manufacturers organizational agility is important to survive in a changeable environment.

Market Performance

Undeniably, the success of an enterprise is mainly due to its organizational performance (Drucker, 1997) and marketing performance. The marketing performance of a company in the competition is critical among the several indices of agility and competitiveness (Mackenzie et.al. 2001). Marketing performance is defined as the outcomes of marketing operations in the form of changes in market share profit and customer responsiveness of customer needs and expectations and total sales performance of a company (Ambler et.al., 2004; Farris et.al., 2010), as financial performance of a company (Morgan, 2011) and the firm's profitability, productivity (O'Sullivan & Abela, 2007). Marketing performance can be influenced by different factors such as; leadership, learning and market orientation (Lee & Tsai, 2011; Wang,

Chih-Chien & Wang, P.-H & Yang, Yolande, 2014). Vorhies et.al (2010) and Wang et.al. (2010) claimed that marketing performance is the central driver of organizational performance in all business functions.

Organizational Agility, Dynamic Capabilities and Market Performance

The dynamic capabilities are the updated and advanced process of developing the agility of the organization. The agile organizations are more responsive, competitive and flexible. Thus, it allows the company to develop their management and strategies for better marketing performance. The dynamic capabilities are essential as it allows the organization to develop their organizational agility (Teece et al., 2016). In order to survive in the modern market, the companies have adopted their capabilities and to be more agile. The dynamic capabilities could improve firm marketing performances (Morgan et al., 2009). The dynamic capabilities are particularly important, as they can assist SMEs in overcoming resource constraints and increasing their performance (Eikelenboom & Jong, 2019). Moreover, organizational agility shapes firm performance (Chakravarty & Sambamurthy, 2013; Cegarra-Navarro et al., 2016). Taking the above factors into account, it is likely that dynamic capabilities may increase the ability of SMEs to invest in constant adjustments of their market performance (Dangelico et al., 2017).

Many studies have been separately done on organizational, agility, dynamic capabilities and firm performance in the literature. For example, Murphy (2013) researched the impact of firm culture on firm performance, Teeratansirikool et.al (2013) studied the relationship between competitive strategies and firm performance, Dawar (2014) examined the link between capital structure and firm performance. Moreover, Mason (2010) discussed organizational agility as a dynamic capability for maintaining competitive advantage, Gardner (2004) focused on dynamic capabilities and the need to be flexible on subunit level activities in an organization.

As the above results clearly shows, different studies have concluded differently about the critical factor behind firm performance. But there are limited studies about the relationship between organizational agility and dynamic capabilities with firms' market performance in the literature. In this context, this research aims to connect the relationship among those three variables by trying to answer the question of whether organizational agility has a moderating role in the relationship between dynamic capabilities and firms' perceived marketing performance? Therefore, we designed the research model and formulated the following hypotheses.

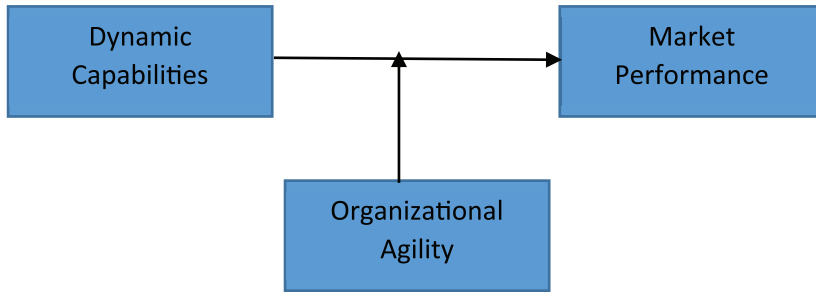


Figure 1. Research Model

Hypotheses

H₁: Dynamic capabilities have statistical impact on market performance in medium size manufacturing companies in Turkey and Malaysia at ($p < 0.05$) level.

H₂: Organizational agility has statistical impact on market performance in medium size manufacturing companies in Turkey and Malaysia at ($p < 0.05$) level.

H₃: Dynamic capabilities have statistical impact on market performance with moderating role organizational agility in medium size manufacturing companies in Turkey and Malaysia at ($p < 0.05$) level.

Methodology

Research Sample Selection and Data Collection

As the research intends to gather data from a large number of participants, a quantitative research method is used. The sample of this research is composed of SMEs operating in Turkey and Malaysia. Simple random sampling was used to get data from managers in different levels from April to September, 2019. This research used three scales to collect data. The first one is Dynamic Capabilities, created by Teece (2007) and then was developed and translated to Turkish by Bezci (2015). It consists of 14 items that measure an organization's dynamic capabilities. The second one is Organizational Agility developed by Sharifi and Zhang (1999) and adapted to Turkish by Akkaya and Tabak (2018). It consists of 17 items that measure an organization's agility. The last scale measuring a firm's perceived marketing performance developed by Xiao, L. (2007) was used to gather data. It consists of 4 questions. All items are measured on a five-point Likert-type scale (1=strongly disagree to 5 = strongly agree).

In this study, frequency analysis revealed that most of the respondents are from Turkey i.e. 54% of the total respondents. Most respondents in the present study are male i.e. 67%. 37%

of respondents are aged between 36-40 years followed by another group aged 31-35 years old i.e. 24% of respondents. Furthermore, 44% of respondents in this study have 5-10 years work experience followed by another group with professional experience of less than five years.

Validity and Reliability

In this section, Cronbach's alpha coefficient is used to test the internal consistency for each item of the research. Table 1 shows acceptable levels of reliability to all three scales, where the reliability coefficient ranged between (0.701-0.879), and all constructs were above (0.7) (Hair et al., 2010), this indicator lets us know that the design and scale of the questionnaires was able to measure the study variables and dimensions, and the items in the questionnaire were able to represent each variable of the study.

Table 1
Cronbach's Alpha Coefficient for Study variables

Construct	Cronbach's Alpha
Dynamic Capabilities	0.879
Organizational Agility	0.865
Market Performance	0.701

As recommended by Sekaran and Bougie (2013), there are three categories i.e. low, less than or equal to 2.99, medium (from 3 to 3.99) and high where mean score is greater than four. Mean values of all the variables in the present study lie in the range of 3 and 3.99 so all variables come in the category of medium. In this study, organizational agility has the highest mean score i.e. 3.707. Dynamic capability has the lowest mean score i.e. 3.216. Table.1 exhibits the mean and standard deviations scores of all variables of the study.

Table 2
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Dynamic capability	198	3.00	15.00	3.478	2.832
Organizational agility	198	4.00	20.00	3.707	3.739
Market performance	198	6.00	30.00	3.619	5.540
(Valid N (listwise	198				

Data Distribution

PLS-SEM analysis is not strict to the data normality, but it is imperative to check the severity of the data (Hair et al., 2010). Non-normal data inflate the standard deviation and parameter significance of the model. Kolmogorov-Smirnov and Shapiro-Wilks test explains whether to accept the null hypothesis of normally distributed data or not. These tests do not conclude the position of data from the non-normal distribution. Therefore, Hair et al. (2017) has recommended applying skewness and kurtosis tests to check the normal distribution in the research. Skewness refers to the values around mean of data either positively skewed

(longer tail on right side) or negatively skewed (longer tail on left side). Kurtosis measures the flatness and height of the distribution. Data is normally distributed providing values of skewness and kurtosis lies in the range of +2 and -2 (George & Mallery, 2010). Based on the data analysis, the skewness and kurtosis values of all variables in the study lies in the range of +2 and -2. Therefore, there is normally distributed data.

In this study, correlation revealed that there is a strong positive correlation between dynamic capability and organizational agility. All three variables in this study are highly positive correlations as shown in below table 3.

Table 3
Data Distribution and Correlation Analysis

	N		Skewness		Kurtosis		Correlations		
	Statistic	Std. Error	Statistic	Std. Error	Statistic	Std. Error	1	2	3
Dynamic capability	198	173.	385.-	173.	048.-	344.	1		
Organizational agility	198	173.	774.-	173.	424.	344.	418.	1	
Market performance	198	173.	519.-	173.	052.-	344.	298.	301.	1

Measurement Analysis and Hypotheses Testing (Direct relationship)

PLS-SEM analysis of the relationship between independent variables and the dependent variables were applied to test and verify the research hypotheses.

Before conducting structural model analysis, the present research has assessed the measurement validity. Measurement validity evaluates the internal consistency and construct validity. Construct validity is ensured through convergent validity and discriminant validity. In the present study, there is enough convergent validity as values of the all factor loadings were found to be higher than 0.70 and values of average variance extracted (AVE) of all constructs were also higher than 0.5. So, there is acceptable convergent validity. For discriminant validity, this study has employed Fornell-Larcker criterion. Based on the Fornell-Larcker criterion, values of square root of AVE values of all constructs were found to be higher than the simple inter-construct correlations. So, there is enough discriminant validity as well. So, the proposed framework has sufficient measurement validity in this study.

Results

PLS-SEM analysis of the relationship between independent variables and the dependent variables were applied to test and verify the research hypotheses. The hypotheses tested the impact of both dynamic capabilities and organizational agility on market performance and the moderating role of organizational agility between dynamic capabilities and market performance.

The mean of dynamic capabilities was 3.216, and the standard deviation was 0.065. This finding had a statistical significance (p value) .017 showing an acceptance of the H₁. This finding showed a strong correlation value between dynamic capabilities and market performance.

The mean of organizational agility was 3.707, and the standard deviation was. 0.041. This finding had a statistical significance (p value) .000 showing an acceptance of the H₂. This finding showed a strong correlation value between organizational agility and market performance, too.

Moderation testing model had a *T* test of 3.278 and the standard deviation was. 0.039. The *T*-test value and significance (p value) 0.012 showed that this model is statistically significant which shows H₃ is accepted.

The results of the proposed hypotheses are presented in below Table.3. At large, all proposed hypotheses are supported in this study. It is confirmed that dynamic capability ($\beta = 0.322$, $\rho < 0.05$), organizational agility ($\beta = 0.504$, $\rho < 0.05$) have a positive and significant effect on the consumer's attitude.

Table 4
Hypotheses Testing

Hypotheses	B	.S. D	T-values	P	LLCI	ULCI
Dynamic capability > Market performance	0.322	0.065	3.250	0.017	0.127	0.304
Organizational agility > Market performance	0.504	0.041	4.836	0.000	0.308	0.834

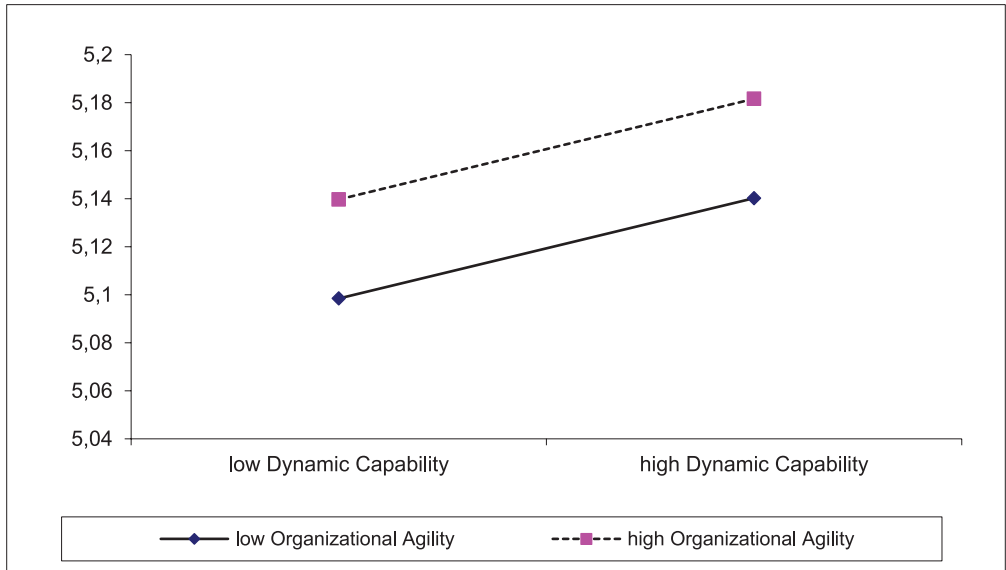
Moderation Analysis of Organizational agility

This study has investigated the role of organizational agility as a moderator between dynamic capability and market performance. Data analysis has concluded that organizational agility significantly strengthens the relationship between the dynamic capability and market performance ($\beta = 0.0127$, $P < 0.05$). So, the moderating role of organizational agility is confirmed. Results have been exhibited in below Table 5.

Table 5
Moderation Testing

Hypotheses	B	.S.D	T-values	P	LLCI	ULCI
Dynamic capability*Organizational agility > Market performance	0.0127	0039.	3.278	0.012	0.005	0.020

Based on the data analysis, this study has also presented the graphical results of moderator-organizational agility. The graphical analysis shows that in the presence of higher organizational agility, dynamic capability amplifies its impact on the market firms of SMEs.



Graph-1. Moderating role of Organizational Agility

Discussions and Conclusions

The moderating role of organizational agility between dynamic capabilities and market performance of SMEs companies in Turkey and Malaysia was the focus of study in this research. The results advance the debate about SMEs market performance in significant ways. In other words, organizational agility handled by managers is a good moderator between dynamic capabilities and the firm's market performance. Moreover, our results showed that dynamic capabilities and organizational agility vary according to environmental dynamism for a firm's market performance. There were some starting points with the theoretical articles about dynamic capabilities and organizational agility (Eisenhard and Martin, 2000; Sharifi and Zhang, 2001; Zollo and Winter, 2002; Teece, 2007) but soon it became clear that the research would emphasize works by some scholars more (Zhang and Sharifi, 2007; Wang and Ahmed, 2007; Teece, 2009; Helfat et al., 2009 and McCann et al., 2009). Moreover, there are some recent studies related to our research. Hernández-Linares et al. (2020) concluded that dynamic capabilities individually affect firm performance and the moderating role of the market in SMEs. Wilden et al. (2019) found that dynamic capabilities relate to service provision and firm performance. Zhou et al. (2019) uncovered the mechanisms through which dynamic capabilities influence firm performance. Eikelenboom and De Jong (2019) concluded that dynamic capabilities are closely related with sustainability performance in SMEs. Pulakos and Kantrowitz (2020) and Hoonsopon and Puriwat (2019) concluded that organizational agility is one of the most important keys for firms to manage their own performance

in a changeable environment. Felipe et al. (2020) concluded that capabilities enhance firm performance in medium-tech intensity industries. Günsel et al. (2018) remarked that SMEs management capability and firm performance are closely related. Nafei (2016) has found that there is a significant relationship between organizational agility and performance. These studies support our hypotheses in this study.

This study has some contributions to the theory and SMEs managerial implications. This study provides valuable information to SMEs that wish to address their market performance. First, SMEs should notice that they can enhance their market performance (Morgan et al., 2009; Eikelenboom & Jong, 2019) by fostering dynamic capabilities. Second, this study showed that SMEs may need to extend their view on organizational agility to enhance their market performance (Chakravarty & Sambamurthy, 2013; Cegarra-Navarro et al., 2016). High levels of dynamic capabilities may lead to upper market performance, as market performance is often more directly tied to SMEs organizational agility. Third, this study contributes to the dynamic capabilities of organizational agility and the market performance literature by providing a detailed and refined theoretical framework.

Finally, SMEs aim to increase their market performance may thus largely benefit from evaluating their dynamic capabilities in light of organizational agility. It can also be stated that this research contributes to the international strategic management literature by researching in two important countries and exploiting the ideas of the dynamic capabilities, organizational agility and market performance research field. This work has attempted to take note of as many researchers as possible from these fields within the limits of comparative research. Managers should account for dynamic capabilities while assessing the effects of it on organizational agility and firm performance.

This study has some limitations. For example, the study has one hundred and ninety-eight participants in two countries. Future researchers may use larger size groups in more countries. It may also be noted that, even though this research was open to global organizational agility and dynamic capabilities with market performance professionals, managers from only two countries participated, a more diversified study population may additionally give more clear results. Expanding the scope of study to other sectors apart from SMEs for analysing the influence of dynamic capabilities on organizational performance by including other aspects and practices of it can be an area for future research.

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RESEARCH ARTICLE

An Analysis of the Stock Market Volatility Spread in Emerging Countries

Murat Akkaya¹

Abstract

This article provides results on the volatility spread for stock markets in emerging economies. Empirical studies on determining or predicting volatility in national and international financial markets provide information for investors. The aim of this study is also to analyze volatility spreads from the United States of America, France, Germany, Japan Turkey, China, India, Indonesia from emerging markets within the scope of EGARCH models, which take into account the asymmetric effects using daily stock returns for the period of January 2008 - April 2020. The a symmetric effect parameter (λ or $\mu\text{-i}/\text{ht-1}$) appears to be negative and statistically significant at 1% for all countries, except the Shanghai Composite Stock Exchange, China. This result shows that the asymmetric effect, or the leverage effect in other words, is valid in stock markets other than China. The volatility spreads from the Dow Jones Industrial Average Index – USA to Borsa Istanbul and the Shanghai Stock Exchange – China. Also, the S & P 500 Index – USA is significant on the volatility spread of the Borsa Istanbul and Shanghai Stock Exchange. The volatility spread between Jakarta Stock Exchange - Indonesia and Borsa Istanbul is two-way and mutual.

Keywords

Volatility, Contagion, Stock Market, E-Garch, Emerging Countries

Introduction

The concept of volatility means “sudden leaps up and down,” “sudden change” or “variability.” Financial globalization, technological innovations, competition and foreign capital investments increase the interdependence of financial markets and lead to the spread of volatility between markets. Volatility spread begins with a shock occurring in a market that increases volatility in other markets. Stock price volatility is also a sudden variation in the price of any security. Volatility can make stock investments risky and affects investors’ decision making processes in financial markets by creating uncertainty. Thus, return, volatility and

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their interactions should be taken into consideration to realize an effective portfolio management. Also, the protection of investors in the capital market is closely related to the concept of an efficient market. However, unexpected events such as Corona Virus (COVID-19) cause sudden changes in the prices of financial assets. In other words, they cause significant and high volatility in asset prices. High levels of volatility mean high risk, which further increases the need to measure risk and provide protection from those risks. The volatility spread occurs when the prices determined by investors trading in the international financial markets are affected by the information flow. The United State of America Central Bank (Fed) announced that it would start to decrease bond purchases on May 22, 2013. Then, foreign investment funds flowing into the emerging market economies started to decrease. The Fed also started to increase interest rates in December 2016 after a 10-year break. The Fed increased the funding interest rate to 2.25 - 2.50 percent on December 19, 2018. Volatility in the markets of emerging countries increased in parallel with the Fed's increasing funding interest rates. The turbulence experienced in international financial markets in the last 20-25 years and the intensive uses of derivative products for the purpose of hedging and speculative income lead to huge interest in forecasting the actions in financial markets. Thus, many studies have been conducted to model volatility in financial markets. Volatility is a measure of the width of a series relative to the rhythm of deviation from a certain mean. When the risk of the series is revealed, the knowledge of the volatility structure can serve as an input in investors' decisions (Gujarati, 2011). In order to model the volatility in the financial time series, it is necessary to determine the features such as kurtosis, volatility clustering and the leverage effect first introduced by Black (1976). The variances of errors in the financial time series are not stationary, but they are also usually heteroscedastic. Thus, traditional time series analysis models based on the homoscedasticity assumption are insufficient. Engle (1982) developed the Autoregressive Conditional Heteroscedasticity (ARCH) model to predict the variance varying over time by considering the dynamic structure of financial assets. Both the presence of various restrictions on the ARCH model and the existence of drawbacks such as negative parameter estimates are eliminated with the model developed by Bollerslev (1986) and the ARCH model has been converted into the GARCH (Generalized Autoregressive Conditional Heteroscedasticity) model.

The Corona Virus (COVID-19) epidemic, which started in China at the end of December 2019, increased the volatility in the stock and foreign exchange markets and created significant pressure for the markets. This study examines the impact of volatility on stock markets in emerging countries. The aim of the study is to analyze volatility spreads in United States of America (USA), France, Germany, Japan from developed markets and Turkey, China, India, Indonesia from emerging markets within the scope of EGARCH models, which take into account the asymmetric effects using daily stock returns for the period of January 2008 - April 2020.

Motivation

Determining the mechanism of the spread of volatility from one market to another will initially guide investors in the decision-making process. In addition, it will provide important information to policymakers regarding the evaluation of relations between markets and policy making within this scope. Thus, the spread of volatility between stock markets has a large place in finance literature. But the studies on the relationship between expected returns and volatility have conflicting results. Most of them examine developed countries' markets, particularly the U.S. stock market, and typically employ ARCH and GARCH models instead of linear time series models. Earlier studies determined a positive and significant relationship (French et al. 1987; Eun & Shim, 1989). The volatility spreads from the USA towards Japan and England and from England to Japan (Hamao et al. 1990). Sheng and Tu (2000) emphasize that the US stock market index has a dominant effect on Asian countries during the crisis period. But Baillie and DeGennaro (1990), Shin (2005) and Theodossiou and Lee (1995) observe a positive but insignificant effect.

ARCH models, called volatility models, started to be used in the literature with the emergence of time series with heteroscedasticity by Engle (1982). Another type of study is on the asymmetric volatility spread in financial markets. GARCH models are generally preferred in such studies. Kanas (1998) examines the volatility spread in London, Frankfurt and Paris stock markets with the EGARCH model for the period of 01.01.1984-12.07.1993. A mutual relationship between London-Paris and Paris-Frankfurt occurs. One-way spread occurs from London to Frankfurt. These markets are more interconnected in the post-collapse period. Ng (2000) shows the magnitude of the volatility spread from Japan and the USA towards stock markets in six Pacific markets using the two-variable GARCH (1.1) model. Features such as liberalization, exchange rate changes, and trade size significantly affect the world and regional market over time. Volatility spreads from Hong-Kong, the USA, Japan and UK stock markets towards Singapore (Bala & Premaratne, 2004). The volatility of Asian stock exchanges is more affected by the Japanese stock market than the US stock market (Miyakoshi, 2003). Engle et al. (2012) investigated the daily volatility spread in eight East Asian markets for the period 1995-2006 by the Multiplication Error Model. The September 2001 terrorist aggression had little effect and the Asian crisis swell outs the spread of the volatility. Also, volatility spread among 6 Asian exchanges increased after the Asian crisis (Lee, 2009). Volatility spread and effects are available in CAC40-French Stock Market Index, DAX-German Stock Market Index, FTSE100 - England Stock Market Index and S&P 500 Index - USA in the period of 05.01.2004 - 01.01.2009 using the BEKK GARCH and DCC GARCH model (Xiao & Dhesi, 2010). Significant information flows from Hong Kong, Korea, Singapore and Thailand to India without many lags. The unforwarded information reaches the markets the next day (Mukherjee & Mishra, 2010). The USA stock index significantly affects Egypt and Israel stock indices (Abou-Zaid, 2011). Also, continuous volatility spread from the

USA to South Africa occurs (Yonis, 2011). Joshi (2011) examines the return and volatility spread in Asian stock markets with the GARCH-BEKK model using data from 02.02.2007-29.02.2010. It turns out that bilateral returns, shock and volatility spread among most of the stock exchanges, and their volatility spreads are more than cross volatility spreads. The bad news in the stock markets of the six emerging countries (Brazil, Russia, Mexico, India, China, South Africa) have a greater impact on the volatility of prices, and negative shocks in stock returns cause disproportionate increases in volatility (Tripathy & Garg, 2013). Considering the pre-crisis and crisis period, volatility in the US markets affects both the Euro and Emerging Market Economies, but it is not affected by any of these markets. In addition, volatility in emerging markets has an impact on eurozone volatility in both periods, but volatility in the eurozone does not affect emerging markets in the pre-crisis period (Büberkökü, 2013). The United States and Islamic stock markets (Turkey, Indonesia, Pakistan, Qatar, Malaysia) had a weak relationship for the period of January 2008-January 2013 (Majdoub & Mansour, 2014). For the eight major economies of the Asia/Pacific region in the period 1997-2013, volatility spread was more pronounced compared to the contagion effect (Islam et al. 2013). The four stock indices in China have also a very strong ARCH effect on returns (Xie & Huang, 2013). However, in the period of 01.01.2007-31.12.2013, US market news significantly affected BRICS (Brazil, Russia, India, China and South Africa) markets except Brazil and China (Kishor & Singh, 2014). Also, significant returns and volatility spreads occur between the US and BRICS exchange rates and trading sectors (Syriopoulos et al. 2015). Li and Giles (2015) report a one-way volatility spread from the USA to Japan and other Asian countries. In the stock returns between 1994 and 2016, the relationships between emerging markets were lower than those between developed markets and tended to increase during financial crises (Bala & Takimoto, 2017). In the period of January 1999 - January 2015, the volatility of the Malaysia stock exchange and 14 developed and developing country stock exchanges is related not only to its lagged values but also to the spread of volatility from other countries. Also, significant volatility spread occurs on the Malaysian stock market, which is evidence of the growing market integration of most of the stock indices (Qian & Diaz, 2017). In the period of 09.12.2008-01.22.2016, both one-way and two-way volatility spreads occurred between the stock markets of Developed 7 countries. There is evidence of asymmetric causal relationships between volatility shocks (Özer et al. 2016).

The determination of volatility spread and testing of volatility models in indices within Borsa Istanbul have become widespread especially since the 2000s, and Borsa Istanbul 100 Index volatility has an ARCH effect (Doğanay, 2003; Duran & Şahin, 2006; Akgün & Sayyan (2007); Sevüktekin & Nargeleçekenler, 2006; Atakan, 2009). After the 2008 financial crisis, studies testing the effects of volatility on Borsa Istanbul Stock Exchange with the help of GARCH models have increased significantly (Tülin, 2009, Çağıl & Okur, 2010; Yorulmaz & Ekici, 2010; Güriş & Saçıldı, 2011; Demir & Çene, 2012; Evlimoğlu & Çondur, 2012; Çukur

et al. 2012; Kutlar & Torun, 2013; Er & Fidan, 2013; Samırkaş & Düzakın, 2013; Demirhan, 2013; Demirgil & Gök, 2014; Karabacak et al. 2014; Gürsoy & Balaban, 2014; Gökbulut & Pekkaya, 2014; Eryılmaz, 2015, McMillan et al. 2016; Kırkulak & Ezzat, 2017, Baykut & Kula, 2018; Kocabaş, 2019,). In addition to GARCH models, the EGARCH model can estimate volatility, taking into account the asymmetry of the shocks. Yıldız (2016) tests the validity of the conditional variance models in Borsa Istanbul with daily data covering the period between January 05, 2000 and December 9, 2015. The returns on the stock exchange are more affected by the negative or bad news coming to the market and volatility in the indices is valid. Following the shocks experienced in the emerging markets, permanent deviations occur in the returns of the stock markets. Negative shocks increase volatility compared to positive shocks, and the volatility spread mechanism between the markets is asymmetrical (Bayramoğlu & Abasız, 2017). Değirmenci and Abdioğlu (2017) analyze the volatility spread from USA, Canada, China, Japan, South Korea, Germany, Britain, Switzerland and Greece to fragile markets (Brazil, India, Indonesia, South Africa, Turkey, Hungary, Poland and Chile) between January 2006 and June 2015 with the EGARCH model. Except for the American, Asian and European stock markets and Indonesia, the leverage effect for the fragile octets' stock markets and the volatility spread from the stock markets of developed countries towards the stock markets of the fragile octets take place. For the period of 2013 - 2017, Indonesia, Mexico, Nigeria, the Philippines and Turkey stock markets have no advantage over the others in terms of information and market efficiency. Similar to the spread of returns, information shocks spread asymmetrically across countries (Çelik et al. 2018). Turkey and United Kingdom stock markets don't expose to volatility spread from other markets, but it takes place in Germany, China and Russia for the period of 2011–2016 (Dedi & Yavaş, 2016). Except for the stock markets of America, Indonesia, Asia and Europe, there is a leverage effect in the stock markets of fragile countries and the volatility spreads from developed markets to the fragile markets. The stock markets of Indonesia, Mexico, Nigeria, the Philippines and Turkey had no superiority over others in terms of information and market efficiency in the 2013 - 2017 period. Similar to the spread of returns, information shocks also spread asymmetrically between countries (Çelik et al. 2018). Turkey and UK stock markets were not exposed to the volatility spread from other markets, but the volatility spread occurred in Germany, China and Russia for the period of 2011-2016 (Dedi and Yavaş, 2016).

Data and Methodology

An economic crisis could spread to other economies for unexplained reasons. The term “contagion” was first proposed by Masson (1998) to distinguish this sprawl from those based on economic connections. The process in question is described by Dornbusch et al. (2000) and is defined as “irrational events” and “financial contagion,” which is also defended by the World Bank. Fry et al. (2008) uses the contagion effect to describe changes in the moments of distribution during a financial crisis that cannot be explained by market fundamentals.

Volatility spread is also another type of contagion. Thus, this study attempts to determine volatility spreads of United States of America (USA), France, Germany Japan from developed countries and Turkey, China, India, Indonesia from emerging markets using daily stock returns for the period of January 2008 - April 2020 and covers nine countries and 3.108 observations. Thus, this study attempts to determine volatility spreads from developed markets to emerging markets using daily stock returns for the period of January 2008 - April 2020 and covers nine countries and 3,108 observations. Table 1 shows variables and abbreviations. The null hypothesis of this study is that there is no volatility spread among emerging markets stock exchanges. The alternative hypothesis is that there is a volatility spread among emerging markets stock exchanges.

Table 1
Variables

Abbreviation	Variable
BIST100	Borsa İstanbul 100 Return Index - Turkey
DOW JONES	Dow Jones Industrial Average Index - USA
SP 500	S&P 500 Index -USA
NIKKEI 225	Tokyo Stock Market Exchange - Japan
DAX	German Stock Market Index
CAC40	French Stock Market Index
INDIA	NIFTY 50 - India Stock Market Index
SHANGHAI	Shanghai Composite Stock Exchange - China
INDONESIA	Jakarta Stock Exchange - Indonesia
BOVESPA	Brazil Stock Exchange

Source: Author

Descriptive statistics of the stock markets of developed countries are shown in Table 2.

Table 2
Descriptive statistics of the stock markets of developed countries for the period of January 2008 - April 2020

	SP 500	DOW	DAX	CAC40	NIKKEI
Mean	2479.52	16611.52	8970.97	4333.27	15225.96
Median	1846.11	16179.37	9250.10	4318.60	15157.20
Maximum	29551.42	29551.42	13789.00	6111.24	24270.62
Minimum	676.53	6547.05	3666.41	2519.29	7054.980
Std. Dev.	4018.68	5690.21	2678.42	795.98	5012.80
Skewness	5.69	0.47	0.01	0.07	0.11
Kurtosis	34.88	2.13	1.68	2.07	1.62
Jarque-Bera	148476.70	209.92	225.82	113.71	254.29
Sum	7706373	51628591	27881790	13467812	47322296
Observations	3108	3108	3108	3108	3108

Source: Author

DOW has the highest standard deviation, and CAC40 has the lowest standard deviation. The skewness coefficients of the stock returns series of all countries are positive. In other words, the distribution of returns is right-skewed. Jarque-Bera statistics show that the series are normally distributed.

Descriptive statistics of the emerging countries' stock markets are presented in Table 3.

Table 3

Descriptive statistics of the stock markets of emerging market for the period of January 2008 - April 2020

	BIST100	BOVESPA	INDIA	INDO
Mean	73487.05	64066.48	7258.12	4401.87
Median	75476.30	60760.50	6324.78	4584.84
Maximum	123556.10	119528.00	12362.30	6689.28
Minimum	21228.30	29435.00	2524.20	1111.36
Std. Dev.	22558.89	16755.52	2494.26	1407.22
Skewness	- 0,16	1.16	0.32	- 0,49
Kurtosis	2.53	4.17	2.01	2.34
Jarque-Bera	42.58	868.80	177.98	179.49
Observations	3108	3108	3108	3108

Source: Author

Borsa İstanbul, Turkey has the highest standard deviation and Jakarta SME, Indonesia has the lowest standard deviation. Bovespa and Indian SME are right-skewed as Borsa İstanbul, Turkey and Jakarta SME, Indonesia are left-skewed. The kurtosis coefficients of all countries' return series except BOVESPA are greater than 3. In other words, they are leptokurtic. Jarque-Bera statistics show that the series are not normally distributed.

GARCH model is the one of best explanatory methods to determine the asymmetrical effect of the volatility spread from a stock market to another and the shocks in the stock markets. EGARCH is a widely used method to detect the asymmetric effect in the stock markets, or in other words, leverage effect. Thus, this study prefers the EGARCH model.

In classical linear regression models, the variances of the error terms of the predicted models are assumed to be constant over time, in other words, homoscedastic. However, it has been observed that the variance of the error term can be changed in the findings resulting from the estimation of econometric models that use both horizontal section and time series data. In the literature, this is called Heteroscedasticity. Thus, the constant variance assumption in traditional time series models is abandoned. It is possible to model the conditional mean and variance of a series simultaneously with the Autoregressive Conditional Heteroscedastic (ARCH) model that was introduced to the econometrics literature by Engle (1982). The Generalized ARCH (GARCH) model, which is the extension of the ARCH model, was developed by Bollerslev (1986) in order to overcome the practical difficulties of the ARCH model. The difference of the GARCH model from the ARCH model is that conditional variance lags are also included in the conditional variance equation. Thus, the conditional variance model carries properties of autoregressive and moving averages together. In symmetrical ARCH and GARCH models, the effect of positive and negative shocks on variance is assumed to be the same. However, it has been observed that negative shocks, which represent bad news in financial markets in general, affect volatility more than positive shocks representing good

news. Therefore, the EGARCH model, expressed as the exponential GARCH model by Nelson (1991), is developed from the point that the weaknesses neglected by symmetric models should be eliminated. The most important difference that distinguishes this model, which was first introduced by Black (1976) from symmetric models, is the existence of a leverage effect which is structured on the basis that negative news coming to the market affects volatility on financial assets more than positive news. This model has several advantages over the GARCH model. Since $\log(\sigma_t^2)$ is modeled first, even if the parameters are negative, (σ_t^2) will be positive. Therefore, there is no need to impose artificially non-negative constraints on model parameters. Secondly, asymmetries are allowed under the EGARCH formula, because if the relationship between volatility and return is negative, it will be negative. In the original formulation, Nelson (1991) uses the Generalized Error Distribution (GED) structure for errors. GED is a very large distribution family that can be used for many series. But almost all EGARCH applications use conditional normal errors rather than using GED due to ease of calculation and intuitive interpretation (Brooks, 2008). By developing the EGARCH model, multivariate EGARCH models have emerged in the literature. The EGARCH model is shown as below:

$$\log(\sigma_t^2) = \omega + \sum_{k=1}^q \beta_k g(Z_{t-k}) + \sum_{k=1}^p \alpha_k \log \sigma_{t-k}^2$$

Volatility is modeled using the EGARCH method developed by Nelson (1991) in the study, due to the fact that asymmetry has a widespread leverage effect in stock returns and its non-negative constraint on GARCH parameters. The EGARCH model for stock returns is shown as below:

$$R_t = \alpha_0 + \sum_{i=1}^r \alpha_i R_{t-i} + \mu_t \quad \mu_t / \Omega_{t-1} \sim N(0, h_t) \tag{1}$$

$$\log(h_t) = \exp[\alpha_0 + \sum_{i=1}^q a_i g(Z_{t-i}) + \sum_{i=1}^p b_i \log(h_{t-i})] \tag{2}$$

$$g(Z_t) = \theta z_t + [|z_t| - E|z_t|] \tag{3}$$

In the equations above, R_t means stock returns; μ_t , the term stochastic error; Ω_{t-1} is the information set in the period $t-1$; h_t indicates conditional variance and Z_t standardized error term ($\mu_t / \sqrt{h_t}$). It is assumed that h_t is normally distributed.

Equation (1) represents the conditional average equation, and (2) equation represents the conditional variance equation. According to the EGARCH model, variance is conditional to its lags and standardized error term. The stickiness of volatility is measured by $\sum_{i=1}^p b_i$ shown in equation (2).

The second part of the equation (3) shows the effect of ARCH, while the parameter θ represents the effect of the asymmetric ARCH. If $\theta = 0$, a positive shock has the same effect as a negative shock of similar size. In other words, the ARCH effect is symmetrical. If $0 > \theta > -1$, a negative shock (bad news) increases volatility more than a positive shock (good news). Negative and statistically significant θ indicates the presence of leverage effect. Ljung-Box statistics of models estimated for p and q lags are taken into consideration in the selection of the EGARCH model for stock returns series for each country.

Analysis and Results

Kanas (1998) has an approach based on the determination of volatility spread to emerging stock markets from the US, Germany, France and Japan stock markets. According to the Kanas (1998) approach, the most recent error squares obtained from the conditional average-conditional variance equations of developed markets are added to the conditional variance equation of the developing markets as an exogenous variable. Looking at the coefficient signs and their significance determines whether there is volatility or not.

Let us assume that the volatility spread from Dow Jones to Borsa İstanbul is examined by considering the EGARCH (1,1) model.

$$\log(h_{BIST100,t}) = \alpha_0 + \theta_1 \left(\frac{u_{t-1}}{\sqrt{h_{BIST100,t-1}}} \right) + \alpha_1 \left| \frac{u_{t-1}}{\sqrt{h_{BIST100,t-1}}} \right| + \beta_1 \log(h_{BIST100,t-1}) + \varphi_1 \log(U_{DOW,t}) \quad (4)$$

In equation (4) α_1 shows the effect of ARCH; θ_1 , asymmetric ARCH effect; β_1 represents volatility stickiness and $U_{DOW,t}$ represents squares of error terms derived from the EGARCH model estimated for the USA. The volatility spread is determined by looking at the statistical significance of the φ_1 coefficient. If φ_1 the coefficient is statistically significant, the volatility spreads from the United State to Turkey.

High correlation occurs between all stock exchanges except Shanghai Composite Stock Exchange and S&P 500 and it is positive as expected (APPENDIX 1). Augmented Dickey Fuller unit root analysis results are presented in Table 4.

Table 4
ADF Test results

Variables	t-Statistic	Prob.*	1. Diff.	Prob.*
BIST100	-1.205496	0.6743	-2.945.833	0.0000
DOW JONES	-0.621017	0.8636	-1.705.044	0.0000
SP 500	-1.047.217	0.7382	-5.775.788	0.0001
NIKKEI 225	-1.028.438	0.7452	-5.716.508	0.0001
DAX	-1.198.382	0.6774	-5.489.324	0.0001
CAC40	-2.036.687	0.2711	-5.621.374	0.0001
INDIA	-0.862377	0.8004	-2.330.561	0.0000
SHANGHAI	-4.043.100	0.0012	-2.502.041	0.0000
INDONESIA	-1.367.053	0.5999	-5.231.025	0.0001
BOVESPA	-1.666.819	0.4481	-2.004.786	0.0000

Source: Author

Table 4 shows that all series sustain unit root at 1% significance level. That is, they are not stationary and they become stationary at the first difference. Transformations are made for correction. Then, conditional mean equations are estimated by determining the appropriate ARIMA model for each series. The most suitable ARMA models are presented in Table 5.

Table 5
ARMA Test Results

		MODEL	AIC Value
BIST100	2	0	-5,4172
BOVESPA	4	0	-5,1689
INDIA	4	0	-5,6717
INDO	4	0	-5,8679
SHANGHAI	3	0	-5,4569
NIKKEI	2	0	13,5984
CAC40	2	0	-5,3167
DAX	4	0	-5,6513
SP500	0	0	-3,5191
DOW	3	0	-5,9099

Source: Author

Heteroscedasticity is not a cross-sectional data problem. Also, autoregressive conditional heteroscedasticity occurs in time series data. The reason to model a series with ARCH/GARCH models is that one does not model it with linear methods. This type of data has the characteristics of leptokurtosis, volatility clustering, long memory and leverage effect. Heteroscedasticity and ARCH effect are valid for all countries and test results are presented below in Table 6.

Table 6
ARCH LM Test Results

	F-statistic	Prob.
BIST100	504912,8	0,0000
BOVESPA	363014,8	0,0000
INDIA	574535,7	0,0000
INDO	1126815	0,0000
SHANGHAI	201903,6	0,0000
NIKKEI	296459,5	0,0000
CAC40	160950,7	0,0000
DAX	183279,6	0,0000
SP500	144604,8	0,0000
DOW	477280,9	0,0000

Source: Author

ARCH graphics are presented in APPENDIX 2. The changes of Borsa Istanbul, NIFTY 50 - India, Jakarta- Indonesia, French, German and Tokyo Stock Market Exchange - Japan are symmetrical. Although the Dow Jones Industrial Average Index - USA, S&P 500 Index - USA and Brazil Stock Exchange differ, their volatility spread in 2020 are exactly the same except Shanghai Composite Stock Exchange - China. All stock exchanges started by rising to 2020 At the beginning of 2020, all stock markets rose and dropped very quickly after the Corona Virus was declared an epidemic by the World Health Organization. Interestingly, the volatility of Shanghai Stock Exchange remains stable even though the virus started in China in December 2019. As shown in the correlation table, the Shanghai Composite Stock Exchange and S&P 500 Index behave completely differently.

EGARCH model estimation results for the return series of exchanges are given in Table 7. Conditional variance models are determined as EGARCH (1,1).

Table 7
EGARCH Test Results

Variables	ϕ	μ	η	λ	θ
BIST100	0.386739	0.065808	0.153447	-0.058635	0.963805
BOVESPA	0.194434	0.040915	0.150435	-0.058525	0.977478
INDIA	0.190546	0.036629	0.152999	-0.123520	0.964244
INDO	0.120525	0.027029	0.149068	-0.080943	0.969199
SHANGHAI	-0.050041	0.007068	0.121020	0.014922	0.994689
NIKKEI	0.147437	0.035851	0.188447	-0.079969	0.972452
CAC40	0.230189	0.025245	0.118560	-0.173844	0.958782
DAX	0.179792	0.0273370	0.135230	-0.108743	0.969413
SP 500	4.537.190	0.0001620	9.445.853	-6.805.739	0.383239
DOW	0.215775	0.031793	0.227569	-0.148013	0.960549

Source: Author

When the EGARCH model conditional equation of variance, which is a function of past knowledge and conditional variance, is examined, it is understood from the coefficients that similar to the return spread, information shocks also spread asymmetrically across countries in a multi-directional manner and that most of them are statistically significant. The asymmetric effect parameter (λ or $\mu t-i/ht-1$) appears to be negative and statistically significant at 1% for all countries, except Shanghai Composite Stock Exchange (prob. 0.1165). This shows that the asymmetric effect, or in other words, the leverage effect, is valid in the stock markets other than China. The a symmetrical effect indicates that bad news increases stock return volatility more than good news. In addition, the volatility stickiness parameter is very close to zero for emerging markets. S&P 500 is the stock market in which the volatility stickiness has the highest value. BIST 100 has the highest value of the volatility stickiness. The volatility stickiness parameter indicates that a volatility shock in the t-1 period can have a long-term effect on the conditional variance in the t period. Also, Ljung-Box (LB) statistics for standardized error terms and squares obtained from EGARCH models show that error terms are not autocorrelated and the ARCH effect does not remain in the error terms, respectively.

The volatility spreads from Dow Jones Industrial Average Index – USA to Borsa Istanbul and Shanghai Stock Exchange – China. Also, the S&P 500 is significant on the volatility spread of Borsa Istanbul and Shanghai Composite Stock Exchange. DAX, CAC40 and NIKKEI have no effects on the volatility spread n emerging countries (Table 8). BOVESPA's volatility is affected by only the Dow Jones Industrial Average Index – USA. There is no effect of volatility spread in NIFTY 50 – India and Jakarta- Indonesia.

Table 8
Volatility Spread in Emerging Markets

Variables	DOW	SP500	DAX	CAC40	NIKKEI
BIST100	0,0000	0,0006	0,6229	0,7044	0,1968
BOVESPA	0,0004	0,8086	0,1622	0,8335	0,0549
INDIA	0,5367	0,6488	0,7923	0,7166	0,3052
INDO	0,0676	0,9996	0,2163	0,3468	0,7644
SHANGHAI	0,0024	0,0188	0,0945	0,0909	0,2908

Source: Author

The volatility spread between Jakarta Stock Exchange - Indonesia and Borsa Istanbul is two-way and mutual. Also, the volatility on the NIFTY 50 - India Stock Market Index affects Borsa Istanbul and Jakarta Stock Exchange - Indonesia. Interestingly, the Brazil Stock Exchange has an effect on NIFTY 50 - India Stock Market Index. Surprisingly, Shanghai Composite and Brazil Stock Exchange have no effects on the volatility spreads in emerging countries (Table 9). China's stock markets are dominated by domestic investors. Foreign investors owned an estimated 7.3% of the stock market capitalization on China's domestic equity market, according to UBS estimates. Even though China is open to the outside, it is still ruled by the socialist central committee government. Also, Hong Kong faces social and political problems such as human rights marches. Most recently, Hong-Kong has had international problems with connecting to itself. Therefore, the country's stock market is very open to government intervention. Hence, it is considered to be outside the volatility spread effect.

Table 9
Volatility Spread between Emerging Markets

Variables	BIST100	BOVESPA	INDIA	INDO	SHANGHAI
BIST100	-	0,0808	0,0000	0,0000	0,1165
BOVESPA	0,3771	-	0,1612	0,9008	0,8086
INDIA	0,0625	0,0001	-	0,0649	0,0810
INDO	0,0001	0,2568	0,0021	-	0,5678
SHANGHAI	0,0810	0,4996	0,4075	0,8691	-

Source: Author

Peer-review: Externally peer-reviewed.

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Conclusion

This article provides a discussion on volatility spread in emerging markets. The theories based on the Modern Portfolio Theory of Harry Markowitz and the innovations that emerged in the field of technology and communication in the 1990s gave a significant impetus to the speed of integration of financial markets. Thus, the direction and the size of the interaction between the markets increases each day. This situation leads to a differentiation in the risk

and return perceptions of current and potential investors in the markets due to systematic and nonsystematic risk factors. Risk also causes fluctuations in the prices of financial assets, which are described as volatility in the literature.

Volatility and uncertainties in financial markets affect developing economies in more depth. It is a known fact that developing countries are open to risks. In addition, the fact that the negative news coming from the market has a greater impact compared to the positive news creates a multiplier effect, namely a leverage effect, and increases the risks for the investors. It is noteworthy that after the global 2008 financial crisis that emerged in the USA, there was a significant level of volatility spread from the USA. Also, the CoronaVirus (COVID-19) epidemic that emerged in China in December 2019 and affected almost the whole world, has also turned all markets upside down, from stock exchanges to oil prices, from interest rates to gold prices. There is a CoronaVirus shock in the markets. In fact, the term collapse can also be used. ARCH graphics in APPENDIX 2 clearly show that there is a huge volatility spread in all markets. On Thursday, March 12, 2020, the US Stock Exchange made their strongest decline since 1987. VIX Index, or the Chicago Board Options Exchange Volatility Index, that shows the uneasiness and volatility in the markets has reached its highest level since the 2008 global crisis period. Time is needed to build trust again. Expectations are distorted, and expectations for a slowdown and stagnation prevail in the global economy. The USA and Europe have revised their annual growth expectations downwards. Economic data have already started to deteriorate in Japan and China. Countries including Turkey continue CoronaVirus (COVID-19) measures related to everyday life. Interest rates will remain low for a long time. Oil and commodity prices have declined. Low interest and abundant liquidity will not be a solution this time. It is time to think about new solutions and new models.

The study proves that the asymmetric effect parameter (λ or $\mu t-i/ht-1$) appears to be negative and statistically significant at 1% for all countries, except the Shanghai Composite Stock Exchange. This shows that the asymmetric effect, in other words the leverage effect, is valid in stock markets other than in China. The volatility spreads from Dow Jones Industrial Average Index – USA to Borsa Istanbul and Shanghai Stock Exchange – China. Also, S&P 500 Index – USA is significant for the volatility spread of Borsa Istanbul and Shanghai Stock Exchange. The volatility spread between Jakarta Stock Exchange - Indonesia and Borsa Istanbul is two-way and mutual. The European region stock markets do not have a significant effect on the emerging economies.

Moreover, the contagion effect is present in emerging markets. In particular, there is a volatility spillover from the US stock markets to the stock markets of developing countries. Such a result is normal when all eyes of the world are on the USA and the US Federal Reserve. The USA is still the world's financial giant. There is also a contagion and volatility spread among developing countries. Although countries have their own macroeconomic determinants and risks, it has been seen that financial markets act together instantly with financial globalization.

Finally, future studies would be to determine the volatility spread for all or other emerging markets and to observe the volatility spread and financial contagion together or separately during the Coronavirus (COVID-19) period.

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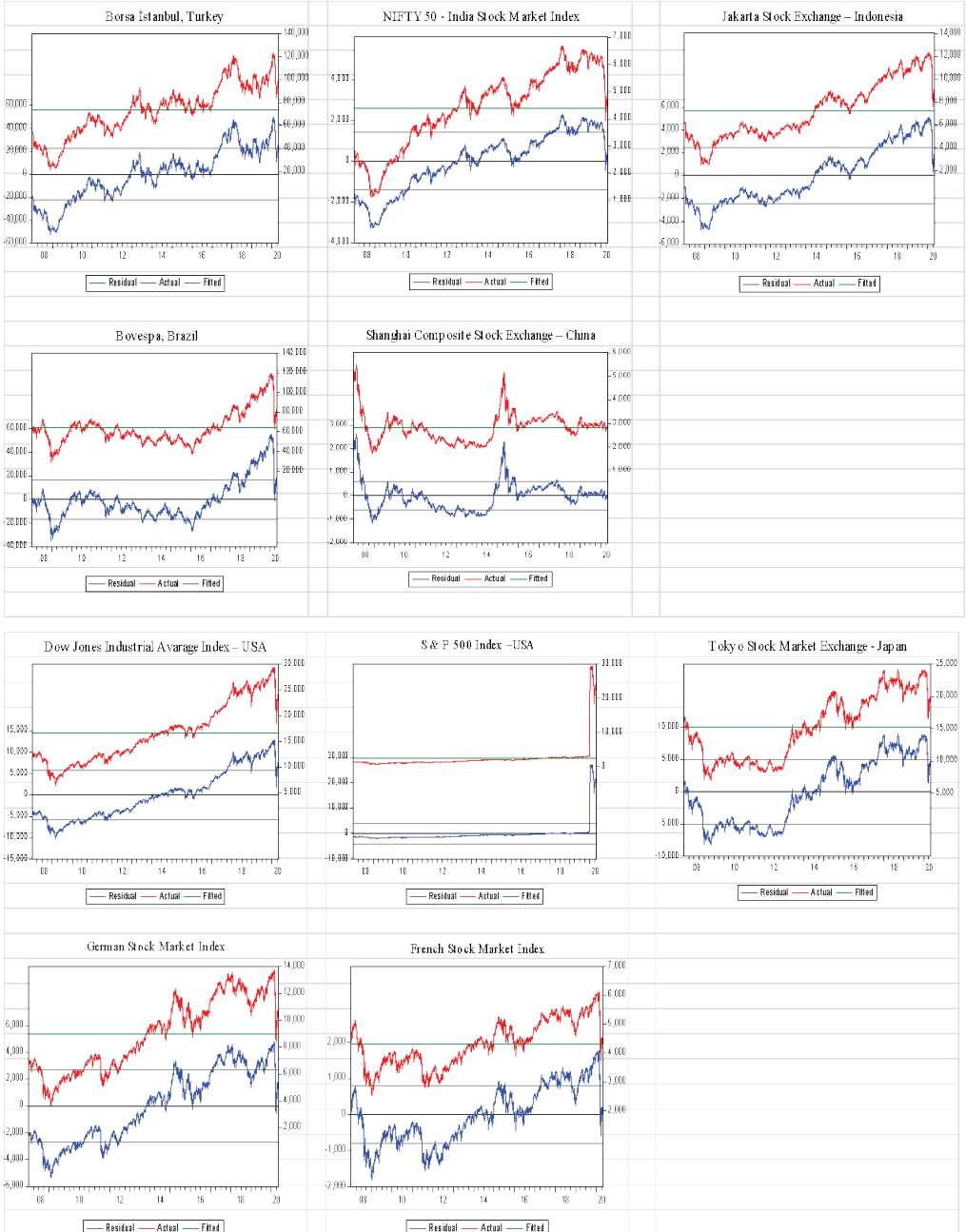
APPENDIX 1

Correlation Matrix

	BIST100	BOVESPA	CAC40	DAX	INDIA	INDO	NIKKEI	SHANGAI	SP500	DOW
BIST100	1	0.6082	0.7993	0.9156	0.9158	0.9494	0.8076	0.1718	0.3923	0.9073
BOVESPA	0.6082	1	0.6206	0.5239	0.6914	0.5435	0.5536	0.1812	0.4414	0.7072
CAC40	0.7993	0.6206	1	0.9099	0.8937	0.7699	0.9246	0.4910	0.3365	0.8869
DAX	0.9156	0.5239	0.9099	1	0.9427	0.9461	0.9188	0.9349	0.3059	0.3323
INDIA	0.9158	0.6914	0.8937	0.9427	1	0.9132	0.9147	0.2970	0.3869	0.9729
INDO	0.9493	0.5435	0.7699	0.9461	0.9132	1	0.7976	0.1337	0.2620	0.9081
NIKKEI	0.8075	0.5536	0.9246	0.9188	0.9147	0.7976	1	0.4008	0.3503	0.9265
SHANGAI	0.1718	0.1812	0.4910	0.9349	0.2970	0.1337	0.4008	1	0.0586	0.2136
SP500	0.3923	0.4414	0.3365	0.3059	0.3869	0.2620	0.3503	0.0586	1	0.4277
DOW	0.9073	0.7072	0.8869	0.3323	0.9729	0.9081	0.9265	0.2136	0.4277	1

APPENDIX 2

ARCH LM Test Graphics





RESEARCH ARTICLE

Direct and Indirect Effects of Cash Dividend Policies on Firms' Capital Accumulation in Selected Developed Markets*

Mustafa Çayır¹ , Nasuh Oğuzhan Altay² 

Abstract

The effects of cash dividend policies on the capital accumulation of non-bank firms operating in The United States (S&P 500), The United Kingdom (FTSE 100), Japan (Nikkei 225), and France (CAC 40) have been investigated in this study. The dataset used in the study consists of annual observations between 2010 and 2015. Also, the data were retrieved from the Thomson Reuters database. The system in GMM is employed in the econometric estimations in this paper. "Total effect" of cash dividend policies on capital accumulation has been bisected as "direct" and "indirect" effects. In this study, we call the effect of the cash dividend policies on investments via financial and liquidity constraints as "direct effect" and the effect of the policies on the accumulation via market value and business reputation as "indirect effect".

Obtained results show that the indirect effect is positive, whereas the direct effect is negative. However, the magnitude of the direct effect is larger than that of the indirect. Therefore, the total effect of cash dividend policies on the accumulation of capital and investments is negative.

The fact that movements in stock prices of firms have an effect on the capital accumulation has shown that the financial markets could affect real economic variables. Also, the results that the cash dividend policies positively affect the market value of firms are mounting evidence to the validity of Signalling and Information Content Approach and Bird in Hand Theory.

Keywords

Capital Accumulation, Dividend Payouts, Financial Constraints, Market Value of Firms, System in GMM

Introduction

Financial management consists of three main factors. These factors are investment, financing and dividend policies. While none of these factors is superior or inferior to others, they affect each other. Therefore, dividend policies affect capital accumulation via investment policies and financial policies.

Cash dividend payouts cause cash outflows from firms. Out-flows of cash resources decrease capability of financing of the firms especially that have limited borrowing opportunity.

* This study has been derived from Ph.D. dissertation of Mustafa ÇAYIR at Ege University.

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A decrease in financing capability causes the firms postpone or cancel investments (Fazzari et al., 1988, p.183-4), (Cleary, 1999, p.685), (Alti, 2003, p.721), (Moyen, 2004, p.2075) and (Moyen and Platikanov, 2013, p.44-5). In addition, even if firms have borrowing capacity, there are usually some differences between borrowing cost and the cost of equity. The cost of internal funds is almost always lower than the external funds' cost. (Opler et al., 1999, p.4-9), (Chay and Suh, 2009, p.88), (Denis and Sibilkov, 2010, p.247), (Harford et al., 2014, p.978) and (Duong et al., 2020, p.2). Thus, if a firm prefers borrowing to equity in the financing of investment, the firm's weighted average cost of capital will be raised, and as a result of this, the firm's investment will go down. On the other hand, lots of studies in the relevant literature state that excess cash holding firms have been faced with the agency problem such as Jensen (1986), Harford (1999), Dittmar and Mahrt-Smith (2007), Harford et al. (2008) and Denis and Sibilkov (2010).

Within the frame of explanations in the previous paragraph, many studies have discussed the relationship between growth opportunities, investment decisions and cash dividend policy. Also, lots of papers have presented theoretical and empirical evidence about the relevant field. In this framework, Abor and Amidu (2006) determined a negative relationship between dividend payouts and growth. Also, a negative relationship between dividend yield and the growth opportunities was stated by Gul (1999), Gul and Kealey (1999) and (Danila et al., 2020). (Harakeh, 2020) shows that dividend policy has a constraining effect on corporate investment via information asymmetry and agency problems. Besides, a negative relationship has been found between investment opportunity set and dividend payout policy by Abor and Bokpin (2010) and Jabbouri (2016). On the other hand, some studies in the literature have reached different results about the relationship between growth and dividend policy. For instance, there is no significant relationship between dividend policy and firm growth according to Ressay and Chariri (2013). Also, Ghosh and Sun (2014) demonstrated that there is a statistically significant positive relationship between externally financed growth and dividend payments for REITs.

It's thought that dividend policies affect stock prices and there are many theoretical approaches to the explanation of this effect. The approaches are listed below:

- Irrelevance Theory: This theory suggests that the market value of the firms and the stock prices determined by the expected return and any other variable cannot influence the market value (Modigliani and Miller, 1958, p.265). In this context, dividend policies do not affect the market value of the firms.
- Signalling and Information Content Approach: This approach is based on information asymmetry and imperfection of the financial markets (Ross, 1977, p.39). Firms' managers have more information than the stockholders about firms' current and future situations. For this reason, dividend policies provide information to the

market and stockholders. An increase in dividend payout ratio of a firm creates an expectation that increases the firm's income in the future. And so, the firm's market value is influenced by the expectation as positive. From this point of view, a raise in the dividend payout ratio increases the market value and stock price of the firms.

- Bird in Hand Theory¹: Stockholders would prefer the profits made by the firms being under their own control rather than the firms' control. Because, it's dubious whether or not the firms will distribute the profit in the future and the future includes uncertainty and risk. Therefore, stockholders would like the distribution of profits as immediate as possible. Within this scope, the stocks of firms with high dividend payout ratio are traded at a lower discount rate than the stocks of firms with low dividend payout ratio.
- Tax Differential Theory: This theory is based on the idea that the capital gains and dividends are taxed at different rates. For instance, if the public authority excised dividends at a higher rate than capital gains, stocks of firms with high dividend payout ratio would be traded at a discounted price (vice versa). Then, the difference in the rate of taxation between dividends and capital gains can affect stock prices and dividend decisions of the firms (Farrar and Selwyn, 1967, p.453-4) and (Brennan, 1970, p.426).
- Clientele Effect²: Like the whole economy, stock market investors also consist of different social groups and levels of income. Each social and income group are in different tax brackets and expectations. For this reason, some of the investor groups prefer stocks of firms with high dividend payout ratios, and the others prefer stocks of firms with low dividend payout ratios or non-dividend-payers. In that case, according to the Clientele Effect, whether dividend payments increase share prices can't be generalized and this depends on dividend expectation of investors.
- Catering Theory: Actually, Catering Theory is a continuation and generalised form of Clientele Effect. Implementation of dividend policies by firms must satisfy expectations and serve the interests of shareholders according to Catering Theory. And different from the Clientele Effect, Catering Theory suggests that expectations and interests of shareholders change over time. Therefore, before deciding a dividend premium on stock prices, firm managers must also be aware of the change in shareholders' expectations and interests, in short, they must give the shareholders what they currently want. (Fama and French, 2001), (Baker and Wurgler 2004a, p.287) and (Baker and Wurgler, 2004b, p.1160-1).

1 The Theory was constructed by Myron J. Gordon and John Lintner. For details; Gordon (1959) and Lintner (1962).

2 For details; Allen, F. and Michaely, R. (2003), and Berk, J. and DeMarzo, P. (2017).

There is a considerable amount of empirical evidence that a relationship exists between stock price movements and capital accumulation of firms. Bischoff (1970) puts forward that firms' dividend-price ratio is the best measure of the cost of capital. Bosworth (1975) suggests that Bischoff's results are valid just in the long run. If the stock markets adjust themselves so quickly, because temporary price movements of stocks at the short-term can't influence the fundamentals of firms, the managers won't scrap investment plans (Bosworth, 1975, p.286). Firm managers are willing to make their investment when the expected returns on marginal investment plans are higher than the shares yield on the existing capital stock. On the other hand, the rational managers would purchase either their or other firms' shares when marginal investment projects had a lower return than that of shares. (Fisher and Merton, 1984, p.36-41). All these results are corroborated by Barro (1990), Galeotti and Schiantarelli (1994) and Durham (2000), while Blanchard et al. (1993) and Bolbol and Omran (2005) are in opposition to the results.

The relationship between growth opportunities, the investment decision, capital accumulation of firms and dividend policy has been investigated in a single-sided approach in the literature up to now. However, we investigate the relationship between dividend policy and capital accumulation with a dual-sided view. Therefore, our main contribution to the literature is to investigate cash dividend policy with a dual-sided view as the cash constraining effect of dividend policy and the price effect of dividend policy on capital accumulation.

In the light of the explanations above, on the one hand, dividend policies influence investment and capital accumulation of firms via capability of financing or financing constraints which are called "direct effects" in this paper, and on the other hand, dividend policies can affect the market value of the firms. At this point, considering that the firms' market value is related to investment, dividend policies must affect capital accumulation via stock prices, which is called "indirect effects" in the paper. From this point of view, the primary aim and the main contribution of this study is: (1) to distinguish the effects of dividend policies on capital accumulation as "direct effects" and "indirect effects", and also (2) to detect the total effects of dividend policies on the capital accumulation. Therefore, we have developed the following hypotheses.

Hypothesis - I: Cash dividend payments affect the capital accumulation and growth of firms with two-ways as "direct" and "indirect".

Hypothesis - II: The direct effect of cash dividend payments on capital accumulation and growth is negative.

Hypothesis - III: The indirect effect of cash dividend payments on capital accumulation and growth is positive.

Hypothesis - IV: The mathematical sign of the total effect of cash dividend payments on capital accumulation and growth varies depending on which effect is greater.

The next section describes the models that reveal the effects of dividend policies on the capital accumulation and market value of firms along with variables and dataset. The employed econometric method is discussed, and the empirical results reached are reported in Section 3. Finally, Section 4 includes concluding remarks of the study.

Models and Dataset

We established two different models in the present study with the help of the theoretical approaches and studies from the relevant literature. One of the models (Model (1)) has aimed for the explanation of the effects of dividend policies on the capital accumulation. The purpose of the other model (Model (2)) is to reveal dividend policies' effects on the market value of firms. Abbreviations of the variables used in Model (1), Model (2) and all of the result tables have been presented Table 1 which takes part in "Tables" of the study.

Table 1
Abbreviations of the Variables Used in the Result Tables

Variables	Abbreviations			
Constant	C			
(Δ(Capital Stock) / Capital Stock)	δK/K			
(Market Value / Book Value)	MV/BV			
(Cash Flow / Capital Stock)	CF/K			
(Sales / Capital Stock)	S/K			
(Cleary, 1999)	CLRY			
(Δ(Stock Price) / Stock Price)	δP/P			
(Cash Dividend Paid / Total Profit)	CDPR			
(Return On Equity)	ROE			
(Leverage Ratio)	LR			
(Δ(Total Profit) / Total Profit)	δπ/π			
(Δ(Total Assets) / Total Assets)	δTA/TA			
2010 Dummy	2011 Dummy	t - 10	t - 11	
2012 Dummy	2013 Dummy	t - 12	t - 13	
2014 Dummy	2015 Dummy	t - 14	t - 15	
United States Dummy	United Kingdom Dummy	d - US	d - UK	
Japan Dummy	France Dummy	d - JP	d - FR	

Model (1) is as follows:

$$\Rightarrow \left(\frac{\delta K}{K}\right)_{i,t} = C + \beta_{1.1} \left(\frac{MV}{BV}\right)_{i,t} + \beta_{1.2} \left(\frac{CF}{K}\right)_{i,t-1} + \beta_{1.3} \left(\frac{S}{K}\right)_{i,t-1} + \beta_{1.4} (CLRY)_{i,t} + \beta_{1.5} \left(\frac{\delta P}{P}\right)_{i,t} + \beta_{1.6} (CDPR)_{i,t} + \beta_{1.7} (t-10) + \beta_{1.8} (t-11) + \beta_{1.9} (t-12) + \beta_{1.10} (t-13) + \beta_{1.11} (t-14) + \beta_{1.12} (t-15) + \beta_{1.13} (d-US) + \beta_{1.14} (d-UK) + \beta_{1.15} (d-JP) + \beta_{1.16} (d-FR) + \varepsilon_{i,t}$$

$\left(\frac{\delta K}{K}\right)$ is the logarithmic difference in total capital of the firms between periods t and $t-1$. The variable indicates the rate of the firms' capital accumulation.

$\left(\frac{MV}{BV}\right)$ is used as investment opportunity set beside Tobin's q^3 by some studies from existing literature such as Aivazian et al. (2003). Higher investment opportunities must be a reason for higher actual investments. In that case, the relationship between $\left(\frac{MV}{BV}\right)$ and investments of firms should be in the same direction. Therefore, we expect that the sign of the coefficient ($\beta_{1,1}$) will be positive.

$\left(\frac{CF}{K}\right)$ is the representation of liquidity and cash making capability of the firms. There is a considerable amount of study which reveals that liquidity or cash flow affects firms' investment, at least dividend payments and financial constraints. Fazzari et al. (1988) and Agca and Mozumdar (2017), respectively, are two of the most prominent and the latest instances of relevant literature. Cash-rich firms can make more investment expenditures than cash-poor ones. Thus, $\beta_{1,2}$ must be positive as supported by Fazzari et al. (1988), Moyen (2004), Hirth and Viswanatha (2011) and Agca and Mozumdar (2017) like many others in the existing literature. Finally, due to the endogeneity problem, lagged values of the variable are used in the model.

$\left(\frac{S}{K}\right)$ consists of sales revenue over the capital stock. The variable stands for the market demand for the goods produced by the firms. Harrod (1939) and Domar (1946) claim that the market demand determines the capital accumulation, and the capital accumulation moves in the same direction with the market demand. In that case, in a similar manner to $\left(\frac{CF}{K}\right)$, $\left(\frac{S}{K}\right)$ shows up as a Keynesian variable which is the indicator of demand. Within this scope, we expect a positive relationship between $\left(\frac{S}{K}\right)$ and the capital accumulation.

(CLRY) is a financing constraint index⁴ revealed by Cleary (1999). The decrease in the values of Cleary financing constraint index reduces the firms' financing capacity. On the other hand, an increase in the financing capacity must enhance the investment expenditures and the capital accumulation. Within this framework, the sign of $\beta_{1,4}$ is expected to be positive.

$\left(\frac{\delta P}{P}\right)$ is the logarithmic difference in stock prices of firms from period $t-1$ to t . As we

3 Tobin q ; . There are some measurement errors in the calculation of Tobin's q , instead of Tobin's q , is selected as a variable which represents the investment opportunity set in the model due to the dubious situation of Tobin's q .

4 Calculation of Cleary financing index takes part in the "Appendix" of the study. See for details; Cleary (1999).

mentioned in the introduction of the study, stock price movements can affect the accumulation of capital. The stock prices or the market value is an indicator of the business reputation of the firms. Also, an increase in the market valuation raises the business reputation and commercial credit of the firms. The firms with high business reputation can reach sources of credit easier and at a lower cost than others. Therefore, stock price movements must affect capital accumulation in the same direction. For these reasons, we anticipate that the sign of $\beta_{1,5}$ will be positive. Also, $\left(\frac{\delta P}{P}\right)$ is used as an independent variable in the Model (2) that is established in order to expose indirect effects of dividend policies on capital accumulation.

(*CDPR*) is the amount of cash dividend paid over the total profit of firms. The variable that is called “cash dividend payout ratio” is used in the Model (1) and Model (2) as a proxy for cash dividend policies of firms. Cash dividend payouts cause cash outflows from firms, and by doing so decrease cash resources of the firms. Therefore, for Model (1), it can be expected that there is a negative relationship between cash dividend payout ratio and the capital accumulation rate of the firms. On the other hand, for Model (2), it depends on the validity of the theoretical approaches which are used in the investigation on the relationship between stock price movements and the dividend policies. In consequence, there is no expectation about whether a positive or negative relationship exists between stock returns and the dividend policies, if there is a significant relationship.

Model (2) is as follows:

$$\begin{aligned} \Rightarrow \left(\frac{\delta P}{P}\right)_{i,t} = & C + \beta_{2,1} (CDPR)_{i,t} + \beta_{2,2} (ROE)_{i,t} + \beta_{2,3} (LR)_{i,t} + \beta_{2,4} \left(\frac{\delta \pi}{\pi}\right)_{i,t} + \\ & \beta_{2,5} \left(\frac{\delta TA}{TA}\right)_{i,t} + \beta_{2,6} \left(\frac{\delta P}{P}\right)_{i,t-1} + \beta_{2,7} (t-10) + \beta_{2,8} (t-11) + \beta_{2,9} (t-12) + \beta_{2,10} (t-13) + \\ & \beta_{2,11} (t-14) + \beta_{2,12} (t-15) + \beta_{2,13} (d-US) + \beta_{2,14} (d-UK) + \beta_{2,15} (d-JP) + \beta_{2,16} (d-FR) + \varepsilon_{i,t} \end{aligned}$$

(*ROE*) can be defined as the net income over the shareholder's equity of the firms. Also, ROE has been used as an indicator of firms' performance in the relevant literature as well as return on assets, net profit margin, and earnings per share. An improvement in a firm's performance must raise the stock price of the firm. Therefore, we can expect that $\beta_{2,2}$ will be positive.

(*LR*) shows how much capital comes from external sources and equities. The leverage ratio is also known as the financial leverage ratio. Also, the leverage ratio has been obtained by the total debt over the total equity of the firms. Firms' indebtedness goes up when there is an increase in the leverage ratio of firms. Going up (going down) in the indebtedness means that there is an increase (decrease) in the risk of firms' payments failure. Hence, the relationship between leverage ratio and stock return or $\beta_{2,3}$ coefficient must be negative in theory.

$\left(\frac{\delta\pi}{\pi}\right)$ is the logarithmic difference in total profits of firms from period t-1 to t. As explained before, the Irrelevance Theory asserts that stock or market prices of firms are determined by the expected returns. If the assertion of the t theory is true, the coefficient of the variable will be positive. In other words, we can say that when the firm's profit increases, the stock price of the firm must also rise.

$\left(\frac{\delta TA}{TA}\right)$ is the logarithmic difference in total assets of the firms from period t-1 to t. The variable represents the proportional change in firms' size over time. The increase in total assets must enhance the income generating ability of the firms. Therefore, the coefficient sign of $\left(\frac{\delta TA}{TA}\right)$ or the relationship between stock return and change in total assets of the firms must be positive.

Lagged values of stock returns were used as an independent variable in the models that are established for the explanation of current stock returns by lots of studies in the relevant literature like Zhou and Ruland (2006) and Huang et al. (2009). Indeed, shareholders pay regard to the previous returns of shares when investing in a stock. Within this scope, Model (2) established by us, includes a variable that has one period of lagged values of stock returns. On the other hand, each economy has different agendas, cycles, and also business, political and social processes each year. Thus, Model (1) and (2) have included both the time dummies and the market dummy variables.

The dataset used in the study consists of annual observations between 2010 and 2015 of 683 non-bank firms selected from S&P 500, FTSE 100, Nikkei 225 and CAC 40 indexes. In the selection process of the firms, special attention has been paid that the firms had been listed at least once in the relevant indexes, through the period from 2010 to 2015. In this context, respectively, 372, 87, 184 and 40 of 683 non-bank firms come from S&P 500, FTSE 100, Nikkei 225 and CAC 40 indexes. The total market cap ratio of the relevant indexes and their countries is above 70 % of the world's market cap. Also, the relevant countries are the four biggest markets all over the world in market cap. Within this scope, for their representative power to the world, we have selected the markets for our analyses.⁵ At the end of the section, we would like to point out that all of the data used in analysis (1) and (2) were taken from the Thomson Reuters (Datastream) database.

5 For details; https://www.weforum.org/agenda/2015/08/what-the-world-would-look-like-if-countries-were-the-size-of-their-stock-markets?utm_content=bufferba473&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer.

Econometric Method and Empirical Results

First of all, we should indicate that there are some missing values in the dataset, which means that the type of dataset is an unbalanced panel. First-differences of variables augment missing observations in the unbalanced panel datasets. Two equations are constituted by the lagged values of first-differenced variables for the level equations and the lagged values of level variables for the first-differenced equations. Then, both equations are estimated together to minimise the missing observations. The econometric method that estimated the equations both together is called the “System in Generalized Method of Moments (GMM)”⁶. On the other hand, the number of the cross-section (683) is larger than the number of time series (6) of the dataset. Also, both Model (1) and (2) include endogenous variables. The System in GMM has been preferred in the econometric estimation of the models due to the above mentioned reasons.

The econometric analyses⁷ were made in Stata 13 software using the “xtabond2” command that was developed by Roodman. Roodman’s command makes an estimation that is robust to heteroscedasticity and autocorrelation. Also, it allows more diagnostic tests than the other GMM estimator commands. (Roodman, 2009, p.128-9). In addition to them, we have used the technique developed by Windmeijer⁸ to make an efficient calculation of standard errors.

Summary statistics in Table 2 has been obtained from the annual data belonging to 683 non-bank firms operating in the United States, United Kingdom, Japan and France at the period of 2010-2015.

Table 2
Summary Statistics

DEVELOPED MARKETS (US – UK – JP – FR)				
Analysis (1)				
Variable	Mean	Standard Deviation	Minimum	Maximum
$\delta K/K$	0.03	0.187	- 2.207	1.573
MV/BV	2.463	6.189	- 326.08	52.497
CF/K (-1)	0.147	0.098	- 0.615	1.528
S/K (-1)	1.294	0.912	0.089	18.096
CLRY	0.205	0.308	- 0.926	1.319
$\delta P/P$	0.058	0.258	- 0.886	0.945
CDPR	0.442	3.019	- 3.09	131.1
Analysis (2)				
$\delta P/P$	0.05	0.29	- 2.558	1.409

6 For details; Arellano and Bover (1995) and Blundell and Bond (1998).

7 Outlier observations at the dataset were determined with the “bacon” command. And then, the determined observations as outliers were removed from the dataset. See for details Weber (2010) about the “bacon” command.

8 See for details of Windmeijer Correction; Windmeijer (2005).

Variable	Mean	Standard Deviation	Minimum	Maximum
CDPR	0.441	2.994	- 3.09	131.102
ROE	0.149	0.351	- 13.109	10.897
LR	0.259	0.146	0	0.795
$\delta\pi/\pi$	0.081	0.305	- 1.016	1.21
$\delta TA/TA$	0.021	0.102	- 0.341	0.404
$\delta P/P (-1)$	0.076	0.279	- 2.558	1.409

The expression “(-1)” next to the variables shows that one lagged values of the variables are used.

The firms in the database had accumulated capital average 3 % per year during the period of 2010-2015. Also, the stock prices of the firms had gone up on average 5 % per year during the same period. Furthermore, the firms had paid on average 44.15 % of their total profits as cash dividend per year of the relevant period.

Correlations between the variables used in Model (1) and (2) are shown in Table 3. Variance inflation factor tests⁹ show that there is a considerable risk of multicollinearity due to the high correlations between some variables. Therefore, CF/K, $\delta P/P$, and CDPR were normalised at Analysis (1). On the other hand, CDPR, LR, and $\delta\pi/\pi$ were normalised at Analysis (2). Multicollinearity was not determined by the employed tests of variance inflation factor after the normalisation process of relevant variables.

Table 3
Correlation Matrices

DEVELOPED MARKETS (US – UK – JP – FR)							
Analysis (1)							
	$\delta K/K$	MV/BV	CF/K (-1)	S/K (-1)	CLRY	$\delta P/P$	CDPR
$\delta K/K$	1						
MV/BV	0.233	1					
CF/K (-1)	0.166	0.006	1				
S/K (-1)	0.014	0.146	0.032	1			
CLRY	0.37	0.393	0.048	- 0.291	1		
$\delta P/P$	0.103	0.146	- 0.092	- 0.073	0.099	1	
CDPR	- 0.071	0.005	- 0.01	- 0.021	- 0.026	- 0.031	1
Analysis (2)							
	$\delta P/P$	CDPR	ROE	LR	$\delta\pi/\pi$	$\delta TA/TA$	$\delta P/P (-1)$
$\delta P/P$	1						
CDPR	- 0.125	1					
ROE	0.169	- 0.027	1				
LR	- 0.163	0.155	0.037	1			
$\delta\pi/\pi$	0.241	- 0.299	0.022	- 0.065	1		
$\delta TA/TA$	0.233	- 0.092	0.254	0.06	0.111	1	
$\delta P/P (-1)$	0.098	- 0.052	0.246	- 0.091	0.085	0.071	1

The expression “(-1)” next to the variables show that one lagged values of the variables are used.

Summary statistics and correlation matrices regarding variables used in the analyses were represented in Table 2 and Table 3, respectively. Results reached from the econometric analyses are going to be demonstrated in the rest of the paper.

9 Variance Inflation Factor Tests take part in Appendix of the paper.

Results of the econometric analyses of both Model (1) and (2) estimated by System in GMM fall into Table 4. As it can be seen in the table, the signs of all coefficients of variables are in accordance with the theoretical expectations. Also, the coefficients of variables are statistically significant. Therefore, when the first variable of Model (1), namely MV/BV, increases, the rate of the capital accumulation goes up.

Table 4
Effects of Cash Dividend Policies on the Capital Accumulation and Firms' Market Value

DEVELOPED MARKETS (US – UK – JP – FR) (US – GB – JP – FR)					
Variable	System in GMM (1)		Variable	System in GMM (2)	
C			C	- 0.103** (0.048)	
MV/BV	0.012* (0.007)		CDPR	0.124*** (0.032)	
CF/K (-1)	0.062** (0.025)		ROE	1.292*** (0.187)	
S/K (-1)	0.035* (0.021)		LR	- 0.137*** (0.05)	
CLRY	0.275*** (0.78)		$\delta\pi/\pi$	0.247*** (0.039)	
$\delta P/P$	0.115*** (0.027)		$\delta TA/TA$	0.36*** (0.086)	
CDPR	- 0.051* (0.029)		$\delta P/P (-1)$	- 0.251*** (0.097)	
t – 10	-		t – 10	-	
t – 11	0.035** (0.014)		t – 11	-	
t – 12	- 0.003 (0.011)		t – 12	- 0.153*** (0.018)	
t – 13	- 0.025** (0.012)		t – 13		
t – 14	- 0.051*** (0.008)		t – 14	- 0.152*** (0.018)	
t – 15	-		t – 15	- 0.253*** (0.018)	
d – US	- 0.191*** (0.054)		d – US	0.006 (0.023)	
d – UK	- 0.204*** (0.054)		d – UK	-	
d – JP	- 0.136*** (0.038)		d – JP	0.099*** (0.024)	
d – FR	- 0.165*** (0.047)		d – FR	0.048* (0.029)	
Regression Diagnostic Tests			Regression Diagnostic Tests		
Test	Test Statistic	Prob. Value	Test	Test Statistic	Prob. Value
Wald Test	422.31	0.000	Wald Test	562.84	0.000
AR (1)	- 7.93	0.000	AR (1)	- 4.08	0.000
AR (2)	- 1.28	0.201	AR (2)	- 1.22	0.223
AR (3)	- 1.29	0.198	AR (3)	-	-
Sargan Test	35.95	0.056	Sargan Test	36.25	0.052
Hansen Test	22.62	0.542	Hansen Test	23.78	0.474
Data Set	Cross Section = 580 Number of Observation = 2194		Data Set	Cross Section = 380 Number of Observation = 1275	

The numbers in brackets show the standard deviation of the coefficients at the table. “***”, “**” and “*” symbols indicate respectively, 1 %, 5 % and 10 % statistical significance of the coefficients. Also, exclusive Hansen Tests' results belonging to variables are reported in the Appendix of the paper. On the other hand, the rate of capital accumulation ($\delta K/K$) is independent variable at the analysis (1) and proportional change in firms' value ($\delta P/P$) is independent variable at the analysis (2). Finally, the expression “(-1)” next to the variables shows that one lagged values of the variables are used in the regressions.

An increase in CF/K and S/K enhances the accumulation of capital at the subsequent term. However, the sensitivity of capital accumulation to CF/K is almost two times higher than that of S/K. Also, CLRY can affect the capital accumulation of firms. According to this result, an increase in the constraint of firms' financing reduces capital accumulation of the firms. In this

context, it can be said that the Cleary financial constraint index is a useful indicator of financial constraints in view of the statistical significance of the coefficient. In addition to them, CLRY is the most sensitive variable to the capital accumulation in comparison with CF/K and S/K. Achieved results on the variables CF/K, S/K and CLRY are consistent with Fazzari et al. (1988), Moyen (2004), Bolbol and Omran (2005), Moyen and Platikanov (2013) and the overwhelming majority of relevant literature.

An increase in ROE, which is an indicator of the firm performance, enhances the market value of firms. While our results about ROE are consistent with a part of literature like Ahsan (2012), they are incompatible with some other studies like Anwaar (2016). On the other side, when the indicator of firms' indebtedness LR goes up, stock prices of firms come down. So, we can say that there is a negative relationship between the level of indebtedness and the market values of the firms. While the result is supported by some studies in the literature like Shah and Noreen (2016), some others, like Zhou and Ruland (2006), stand against it.

$\delta\pi/\pi$ and $\delta TA/TA$ influence the market values of the firms positively. According to these results, if a firm's profits increase 1 %, the market value of the firm goes up about 0.247 %. Likewise, if the firm's total assets increase 1 %, stock prices of the firm rise roughly 0.36 %. Our results about profits and total assets of firms are consistent with Huang et al. (2009), Hunjra et al. (2014), and Shah and Noreen (2016).

According to the results in this paper, when the increase in the market value of the firm is 100 %, the capital accumulation rate of a firm raises about 11.5 %. Then, it can be said that pricing in the financial markets affects real economic indicators like investment expenditures, credit costs and capabilities via the business reputation of corporations. Also, movements in the market values of firms have a negative effect on the subsequent market values of the firms to about 25 % of the stock price movements. On the other hand, if a firm distributed all of its profits to shareholders as cash dividend, the capital accumulation rate of the firm would come down about 5.1 %. Also, the market value of the firm would rise about 12.4 % in the same fiscal year.

Model (1) was established to determine the direct effects of the cash dividend on the capital accumulation. Also, as noted earlier, Model (2) is a mediation model that is an attempt to reveal indirect effects of the cash dividend on capital accumulation. Mediation models' independent variables take part as a dependent variable in the base models. If there are two equations, and one of them is a mediation equation like below, direct effects must be calculated as follows according to Sobel (1982).

$$Y = C_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \varepsilon_1$$

$$\Rightarrow \text{Direct Effect : } X_3 \xrightarrow{(\beta_3)} Y$$

$$X_2 = C_a + \beta_a X_a + \beta_b X_b + \beta_c X_3 + \dots + \varepsilon_a$$

$$\Rightarrow \text{Indirect Effect : } X_3 \xrightarrow{(\beta_c)} X_2 \xrightarrow{(\beta_2)} Y$$

$$\beta_{\text{indirect}} = \beta_c \times \beta_2, \quad \text{Total Effect : } \beta_3 + \beta_{\text{indirect}}$$

In the present case, direct effects, indirect effects, and the sum of the effects of the cash dividend policies on the capital accumulation of firms are in Table 5.

Table 5
Direct, Indirect, and Total Effects of Cash Dividend Policies on Capital Accumulation

	Variables	Developed Markets (US – GB – JP – FR)
Direct Effects	CDPR → δK/K	- 0.051
	δP/P → δK/K	0.115
	CDPR → δP/P	0.124
Indirect Effects	(CDPR → δP/P) × (δP/P → δK/K)	0.124 × 0.115 = 0.014
Sum of the Effects	Direct Effects + Indirect Effects	- 0.051 + 0.014 = - 0.037

It is clear from Table 5 that the direct effect of cash dividend policies on capital accumulation is about negative 5.1 %. Also, the indirect effect of cash dividend policies upon the capital accumulation is obtained by multiplying the influence of cash dividend policies upon the market values of firms by the impact of market values on the accumulation of capital. Therefore, the cash dividend policies have a positive indirect effect on the capital accumulation of about 1.4 %, which is obtained by multiplying 12.4 % by 11.5 % as pointed out above.

Finally, the total effect of the cash dividend policies on the accumulation consists of the summation of direct and indirect effects. Hereunder, the total effect, - 5.1 % (direct effect) plus 1.4 % (indirect effect), is equal to -3.7 %. In that case, cash dividend policies have about 3.7 % negative effect on the capital accumulation.

Conclusion

The effects of cash dividend policies on the capital accumulation of non-bank firms operating in The United States (S&P 500), The United Kingdom (FTSE 100), Japan (Nikkei 225) and France (CAC 40) have been investigated in this study. Different from relevant literature, in this paper we bisected the “total effect” of cash dividend policies on investments or capital accumulation as “direct effect” and “indirect effect”.

Cash dividend payouts cause cash outflows from firms, and as a result of this, they operate under these financial constraints. For this reason, firms squeeze investment expenditures

and reduce capital accumulation as long as there is an increase in cash dividend payout ratio which is used as the dividend policy variable. In the study, we called the effect of the cash dividend policies on investments via financial and liquidity constraints “direct effect”.

On the other hand, cash dividend payouts have a positive effect on market values or stock prices of firms. Also, according to the empirical results, market values of firms affect investment expenditures and capital accumulation via business reputation and capital cost. Therefore, cash dividend policies can influence the capital accumulation indirectly. In this paper, we called the effect of cash dividend policies on capital accumulation via market value, business reputation, and the capital cost “indirect effect”.

The “total effect” of cash dividend policies on capital accumulation consists of the summation of “direct” and “indirect” effects. The “indirect effect” is positive, whereas the “direct effect” is negative. In addition to this, the magnitude of the direct effect is larger than that of the indirect. Thus, the “total effect” of cash dividend policies on the accumulation of capital and investments is negative in our sample, but it is not as much as the “direct effect”. Within this framework, obtained results in our study about the “total effect” are consistent with results of the study that Abor and Amidu (2006), Gul and Kealey (1999), Danila et al. (2020) and Harakeh (2020). On the other hand, we could not find satisfactory evidence to support Ressy and Chariri (2013) and Ghosh and Sun (2014).

The fact that movements in stock prices of firms have an effect on the capital accumulation has shown that the financial markets could affect real economic variables like the investment expenditures. Also, the empirical results that the cash dividend policies positively affect the market value of firms are mounting evidence to the validity of Signalling and Information Content Approach and Bird in Hand Theory.

On the other hand, stock prices have been influenced by the return of firms. However, according to the obtained results, the market values or stock prices of the firms have been affected by not only returns but also some other variables. Therefore, our results have partially supported the Irrelevance theory in terms of the relationship between return and stock price of firms.

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Appendix

A.1. Cleary Financing Constraint Index

$$\Rightarrow \text{Cleary} = -0.017 \times \text{Current Ratio} + 0.0003 \times \text{Fixed Charge Coverage Ratio}$$

$$+0.0007 \times \frac{\text{Slack}}{\text{Net Fixed Assets}} + 3.904 \times \text{Net Income Margin}$$

$$+0.467 \times \frac{\Delta(\text{Sales})}{\text{Sales}} - 0.439 \times \text{Leverage Ratio}$$

$$\Rightarrow \text{Slack} = \text{Cash and Short Term Investment} + 0.5(\text{Inventory})$$

$$+0.7(\text{Accounts Receivable}) - \text{Notes Payable}$$

A.2. Variance Inflation Factor Tests (VIF Tests)

Table A.2.1
VIF Test for Analysis (1)

Variables	VIF	1/VIF
MV/BV	4.13	0.242
δP/P	3.34	0.3
S/K	3.27	0.306
CF/K	2.56	0.39
CDPR	2.18	0.458
CLRY	2.11	0.473
Mean VIF	2.55	

Table A.2.2
VIF Test for Analysis (2)

Variables	VIF	1/VIF
ROE	3.21	0.312
LR	2.43	0.412
CDPR	2.37	0.422
δπ/π	2.27	0.441
δP/P	1.63	0.614
δTA/TA	1.16	0.863
Mean VIF	2.05	

A.3. The Results of Exclusive Hansen Tests

Table A.3.1
Exclusive Hansen Test Results of Variables at Analysis (1)

Explanation	Test	Test Statistic	Probability Value
GMM Instruments for Levels	Hansen	10.58	0.102
	Difference	12.05	0.845
Gmm (CF/K, lag (3 4))	Hansen	12	0.8
	Difference	10.62	0.156
Gmm (S/K, lag (4 4))	Hansen	17.97	0.391
	Difference	4.65	0.702
Gmm (CLRY, lag (3 4))	Hansen	18.8	0.34
	Difference	3.82	0.8
Gmm ($\delta P/P$, lag (2 2)c)	Hansen	22.54	0.488
	Difference	0.08	0.776
Gmm (CDPR, lag (3 5))	Hansen	16.06	0.246
	Difference	6.57	0.833
Instrument Variables (t-10, t-11, t-12, t-13, t-14, t-15, d-US, d-UK, d-JP, d-FR)	Hansen	16.14	0.514
	Difference	6.48	0.485

Table A.3.2
Exclusive Hansen Test Results of Variables at Analysis (2)

Explanation	Test	Test Statistic	Probability Value
GMM Instruments for Levels	Hansen	12.14	0.206
	Difference	11.65	0.706
Gmm (CDPR, lag (1 2))	Hansen	12.27	0.725
	Difference	11.52	0.174
Gmm (ROE, lag (1 5)c)	Hansen	21.13	0.39
	Difference	2.66	0.617
Gmm (LR, lag (4 5)c)	Hansen	23.54	0.316
	Difference	0.24	0.97
Gmm ($\delta\pi/\pi$, lag (2 3))	Hansen	20.83	0.106
	Difference	2.96	0.982
Gmm ($\delta TA/TA$, lag (1 4)c)	Hansen	21.96	0.343
	Difference	1.83	0.767
Gmm ($\delta P/P$, lag (4 4))	Hansen	20.84	0.346
	Difference	2.94	0.709
Instrument Variables (t-10, t-11, t-12, t-13, t-14, t-15, d-US, d-UK, d-JP, d-FR)	Hansen	15.56	0.623
	Difference	8.22	0.222



Istanbul Business Research

RESEARCH ARTICLE

Do Machine Learning and Business Analytics Approaches Answer the Question of ‘Will Your Kickstarter Project be Successful?’

Murat Kılınc¹ , Can Aydın² , Çiğdem Tarhan³ 

Abstract

Kickstarter is one of the popular crowdfunding platforms used to implement business ideas on the web. The success of crowdfunding projects such as Kickstarter is realized with future financial support. However, there is no platform where users can get decision support before presenting their projects to supporters. To solve this problem, a platform where users can test their projects is required. Within this scope, a business intelligence model that works on the web has been developed by combining business analytics and machine learning methods. The data used for business analytics has been brought to a state that can provide inferences through visualization, reporting and query processes. Within the scope of machine learning, various algorithms were applied for success classification and the best results were given by 91% Random Forest, 85% Decision Tree, 84% K-Nearest Neighbors (KNN) algorithms. F1-Score, Recall, Precision, Mean Squared Error (MSE), Kappa and AUC values were analyzed to determine the most successful models. Thus, Kickstarter users will be able to see their shortcomings and have a prediction about success before presenting their projects to their backers.

Keywords

Machine Learning, Business Analytics, Decision Support System, Business Intelligence

Introduction

Crowdfunding, a new generation investment system, is a good alternative for entrepreneurs and projects. In particular, the process of financing ventures over the internet has gained great importance with the maturity of technologies that come with web 2.0 and the success of resource utilization (Zvilichovsky et al., 2015). Accordingly, the interest in crowdfunding platforms has been increasing over the years, as it provides easier access to large audiences. The crowdfunding market size, which was 597 million dollars in 2014, was stated as 10.2 billion dollars in 2018. In 2025, the crowdfunding market size is expected to be 28.8 billion

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dollars (Szmigiera, 2019). Many crowdfunding platforms have been developed nowadays for the increasing market. Thanks to platforms like Kickstarter, Indiegogo, GoFundMe, Fundable, and Patreon, project developers can collect hundreds of millions of dollars of support each year (Etter et al., 2013). Only within the Kickstarter platform, approximately 180,000 projects have received a total of \$ 5 billion since the platform was established (Kickstarter Project Stats, 2020). After financial and tactical support provided through crowdfunding platforms, the ideas of entrepreneurs; come to life thanks to supporters, angel investors, and capital funds (Kuppuswamy and Bayus, 2018). Ideas that are disliked or who cannot find adequate support can fail because they cannot find adequate support financially. Within the Kickstarter ecosystem, 300.000 unsuccessful projects have not found adequate support since its establishment. Accordingly, statistics published in July 2019 show that the success rate on the Kickstarter platform is 37.3% (Statista, 2020a). For this reason, getting sufficient support in the venture ecosystem is very important in terms of realizing that idea. Therefore, providing a prediction on whether the idea of the initiative or the project will be successful before presenting the project to the supporters has a positive impact on the entrepreneurs. This prediction can be used to attract backers on crowdfunding platforms. Factors forming the dynamics of the project such as information, content, texts, images used in the project profile, in short, all the features of the project are directly related to the interest of the backers (Cheng and Others, 2019). Because the backers give more priority to the projects that were well expressed in the stage before the detailed review of the project. However, entrepreneurs on crowdfunding platforms cannot test their projects for success before presenting them to the supporters. For this reason, it is not possible to compare projects in the crowdfunding ecosystem with other projects before they are added to the platform and to have a prediction about their success. This problem can be solved by providing forecasting, data visualization, reporting, listing, querying operations to the entrepreneurs in a hybrid way on the web. Similarly, in a study conducted in 2015, 12 years of historical data of a consultancy company were analyzed and then an interactive decision support system was created using business analytics and machine learning (Cook et al., 2015). In this direction, the research question we have raised has been “do business analytics and machine learning methods affect the decision support processes for entrepreneurs in a hybrid way”. In our study, which provides a prediction in terms of success for the Kickstarter initiatives, a data set containing the project features were analyzed and evaluated primarily within the scope of business analytics. Afterward, the data on the system was trained and made ready for classification by machine learning methods. In the last stage, the features of the project of the user were taken as input, and a comparison was made with the other projects in the business analytics processes, and the project success estimation was made by using machine learning methods. To provide decision support, user interaction should be planned within the system development cycle. For this reason, user interaction was created by ensuring that this entire process is shown on the dashboard.

Related Works

In the research, crowdfunding platforms were examined within the scope of business analytics and machine learning, and many different studies were encountered. The support vector machine method was used in the system development work by Chen in 2013 to predict whether a Kickstarter project would be successful in advance. With the study, using the initial features of the projects, a success estimation of 67% accuracy was provided (Chen et al., 2013). In the research carried out by Kindler in 2019, propagation mechanisms on crowdfunding platforms such as Kickstarter, Indiegogo, and Sellaband were investigated. Because the spread of the project is directly related to virality and success (Kindler et al., 2019). In the research put forward by Chung, Kickstarter datasets, supporter-campaign graphics and Naive Bayes, Random Forest, and Adaboost classification methods were used. Adaboost classification method, which gives the highest value, made a success estimate with an accuracy rate of 76% according to the data set examined (Chung & Lee, 2015). In the study put forward by Rao and his team in 2014, it was emphasized that the success rate of the projects in the crowdfunding structure is less than 50%. Also, the relationship between money pledged and campaign success, which was made using decision trees, was examined. According to the review, it was determined that the duration of the campaigns had a significant impact on the success of the project. Besides, it was emphasized that with a predictor to be created, the success of the campaigns can be estimated correctly by 84%. (Rao et al., 2014). In the study by Jensen and Özkil in 2018, factors that may cause failure in crowdfunding platforms were examined. According to the review, the ability of campaign starters to make promises about product features and the project features created in this context plays an important role in the success of the project. The study also shows how crowdfunding platforms can be used in research with both data libraries and product development cases (Jensen & Özkil, 2018). The research conducted by Qianzhou and his team focuses mainly on the main points of the projects such as category and target. In this context, a large data set obtained from Kickstarter was used. According to the research result, there is a direct proportion between the information provided in the project descriptions and the financial support obtained. The model introduced can predict the financial success of the project with an accuracy rate of 73%. Also, the research proposes the Support Vector Machine (SVM) classification method to further increase the predictive accuracy rate (Du et al., 2015). In another study by Sheng Bi and his team in 2016, based on a detailed probability model, it was investigated how online information in the ventures affected investors' decisions. In the research carried out with the data of crowdfunding websites operating in China, it was revealed that a higher number of likes, online feedback, more detailed project description and video introduction of the project had a positive effect on fund investment decisions. The data analysis in the study also emphasized that different project categories should be evaluated with different perspectives (Bi et al., 2016). In the research carried out by Mortensen and his team, the method of learning and defining the success

factor was done with machine learning methods. In the research, it is examined what drives the success of a packaging company on the Fortune 500 list and a model is presented accordingly. It is observed in the study that using statistical modeling techniques improves both revenue and profit revenues by affecting shortening sales cycles and decreasing sales costs. The best model with the use of machine learning methods, decision tree, gradient boost, and random forest algorithms; accuracy 80%, precision 86%, recall 77% results (Mortensen et al., 2019). Finally, in another study, it was observed that the use of ensemble artificial neural networks in the prediction of success of crowdfunding projects yielded better results than other algorithms. With the accuracy values varying according to the parts, Logistic Regression can make predictions with 88.38%, Artificial Neural Networks (ANN) 88.62% and Ensemble Neural Networks (ENN) 89.18% (Yeh & Chen, 2020).

Summarizing the studies examined, it is observed that the presentation of the projects in crowdfunding platforms to the backers with a detailed explanation increases the success. This explanation can be effective by determining the project features correctly. Also, another remarkable point in the literature is that the success rate in crowdfunding is in a downward trend. One of the main reasons for this can be described as the increasing interest in crowdfunding and the sloppy preparation of projects uploaded to crowdfunding platforms. On the other hand, the success of the classification results for crowdfunding projects has been increasing over the years. Because, especially in 2018 and after, machine learning algorithms, which can give better results when operated together (ensemble), have been used more. For this reason, a better classification can be made with both the selection of algorithms suitable for the data set and the ensemble approach. When the literature is evaluated in terms of business analytics, it is observed that decision support increases with visual reporting, analysis and user interaction.

Methodology

In the process of creating a decision support with machine learning and business analytics, the Cross-Industry Standard Process Model for Data Mining (CRISP-DM) was used and 6 steps in the cycle were applied in order. Since the chosen method is accepted as a flexible and circular model, it is frequently preferred in data science projects. Also, it is possible to go to the previous step in the model and make changes. Because there may be changes in needs or data structure. Therefore, re-evaluation should be made when similar situations are encountered. In other words, the CRISP-DM method; It can be considered as a supportive tool for improvement, error analysis and quality management, data analysis and mining projects (Schäfer et al., 2018, Weimer et al., 2019).

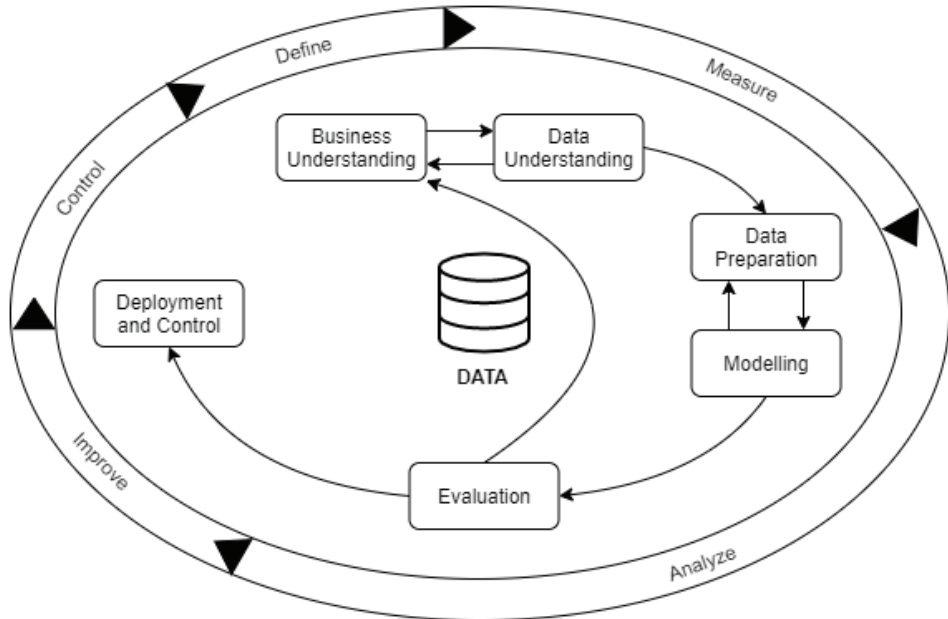


Figure 1. Cross Industry Standard Process Model for Data Mining (Huber et al., 2019)(Fahmy et al.,2017)

In the CRISP-DM process used; After evaluating possible problems at the first stage, a literature review was conducted and which software libraries to use were determined (Table 1). In the second stage, the quality, accessibility, and sustainability of the data were discussed. In the third stage, the data set that has undergone pre-processing has been applied to a model in terms of the path and analysis structures that the data will follow. In the evaluation section, the results of the classification algorithms are compared and the algorithms that can make the best classification are used for the application. Also, the functions such as querying the data, user interaction, listing, and reporting were inspected and the business analytics process was evaluated. Finally, during the deployment process, the model is provided to be displayed on the dashboard. Accordingly, a web application was developed and transferred to entrepreneurs through the control of all processes, business analytics, and machine learning methods. The aim at this point is to create an inference mechanism by combining the reports of business analytics with the results of classification algorithms.

Table 1
Software Libraries and Tools

	Web Application Section	Machine Learning Section	Data Preprocessing
Python Libraries and Structures	Flask Framework	Sklearn Library	Pandas, Numpy
Object-Oriented Programming Languages	PHP, Javascript, Python (Compiled by VS Code.)	Python (Compiled by Spyder VS Code.)	Python (Compiled by Jupyter)
Other Tools and Libraries	HTML, CSS, Bootstrap, Chart.js	Google Colab	Weka

Data

Kickstarter is the most popular among crowdfunding platforms, thousands of projects are added to the platform daily. The features of the added projects constitute the focus of our study for the analysis processes. The results of business intelligence, business analytics, and machine learning methods have been put forward based on the characteristics of these projects. In this context, the data file provided by Kaggle, which covers more than 300.000 Kickstarter initiatives with various features, was used in the research. The projects created in 2017 and after are filtered out and the number of analyzed project data is reduced to around 50,000 (Mouillé, 2018). This filtering process was carried out to research with the most recent project data in the data set.

Data Preprocessing: During the preparation of the data in the CRISP-DM method, the data set used was prepared for analysis (Table 2).

Table 2
Data Set States Before and After Data Preprocessing

Before Preprocessing Data			After Preprocessing Data		
378.661 line	15 column	Size: 43.3 MB	52.184 line	20 column	Size: 8.0 MB
<pre><class 'pandas.core.frame.DataFrame'> RangeIndex: 378661 entries, 0 to 378660 Data columns (total 15 columns): ID 378661 non-null int64 name 378657 non-null object category 378661 non-null object main_category 378661 non-null object currency 378661 non-null object deadline 378661 non-null object goal 378661 non-null float64 launched 378661 non-null object pledged 378661 non-null float64 state 378661 non-null object backers 378661 non-null int64 country 378661 non-null object usd_pledged 374864 non-null float64 usd_pledged_real 378661 non-null float64 usd_goal_real 378661 non-null float64 dtypes: float64(5), int64(2), object(8) memory usage: 43.3+ MB</pre>			<pre><class 'pandas.core.frame.DataFrame'> RangeIndex: 52184 entries, 0 to 52183 Data columns (total 20 columns): id 52184 non-null int64 name 52184 non-null object category 52184 non-null object main_category 52184 non-null object currency 52184 non-null object deadline 52184 non-null object goal 52184 non-null int64 launched 52184 non-null object pledged 52184 non-null float64 state 52184 non-null object backers 52184 non-null int64 country 52184 non-null object usd_pledged 52184 non-null float64 usd_pledged_real 52184 non-null float64 usd_goal_real 52184 non-null float64 category_numeric 52184 non-null int64 category_main_numeric 52184 non-null int64 currency_numeric 52184 non-null int64 state_numeric 52184 non-null int64 country_numeric 52184 non-null int64 dtypes: float64(4), int64(8), object(8) memory usage: 8.0+ MB</pre>		

In the data set consisting of 15 columns, there are columns like name, category, main category, currency, deadline, goal, launched, pledged, state, backers, country, USD pledged, USD pledged real, USD goal real. For efficient analysis, rows of data with missing content were cleaned from within the data set. Also, columns with string values have been converted into numerical data within the scope of data pre-processing and made ready for analysis. Within the scope of data pre-processing, the following 2 different determinants were emphasized:

- 1) State: The State column is a feature that shows how the projects are in terms of success. Kickstarter projects data set includes 5 different project statuses: successful, failed, live, suspended, canceled. As part of our study, all project statuses were used for business analytics. But for classification methods, only successful and failed states were used to make the binary classification. For this reason, the number of data used for business analytics is 52,184, while the number of data used for machine learning is 43,304.
- 2) Data Profile: The data set used is in a scattered structure. Therefore, the application should be transferred to the database in a relational way. For this, the relationships between the main-sub categories have been numerically established and each project feature has been transferred correctly into the application.

Along with the 2 determinants, the pre-processing stage was completed and a data set ready for the analysis stage was obtained.

Data Splitting: Within the scope of the study, the data set is divided into 2 separate sections in order to train our classification models and to understand how they perform. In this context, the data set for training and testing processes is divided into 70% training and 30% testing. The ratios used are observational and determined in the most appropriate way for the data set. This use, random subsampling, is probably one of the most used methods to divide the data set in a study.

Data Scaling: Since the values in the columns in the data set cannot be converted into each other, they need to be rescaled. Scaling enables classification methods to work more accurately and give meaningful results (1).

$$X_{std} = \frac{(X - X.min(axis = 0))}{(X.max(axis = 0) - X.min(axis = 0))} \quad (1)$$

For this reason, the data set was scaled in the range of 0-1 using the min-max scaler.

Modeling

The modeling process refers to a decision support process created by including the most appropriate elements in the business structure desired to be developed. In this context, how to

use business analytics for a web application developed, which algorithms to use from machine learning methods, and how to follow it are determined at this stage (Figure 2). According to the modeling, the user who wants to test his interference on the system is included in the system with the project features he enters. After the Kickstarter dataset, which consists of approximately 50 thousand data, has been pre-processed with the Pandas and Numpy libraries of Python, the database of the web application has been created. The data in the created database are included in the extraction process in two different ways. Firstly, data analysis and reporting are provided with PHP. Later, with the chart.js library compiled with Javascript, the data was visualized in graphics and transferred to the web interface.

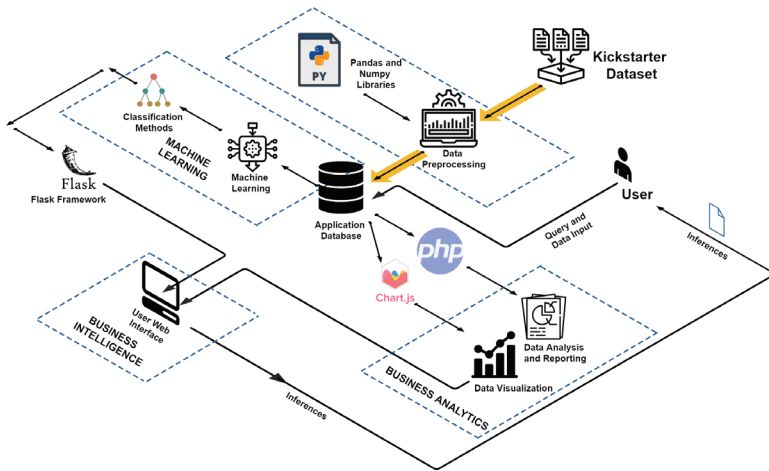


Figure 2. System Flow Chart Modeling Process

Secondly, the data kept numerically in the database were tested by machine learning methods after normalization. The methods are then displayed on the web interface with their accuracy rates. The decision support platform, which combines the reporting, data analysis, and data visualization capabilities of business analytics with the predictive ability of machine learning methods, provides inferences to the user. In this way, the query and data input made by the user on the system is returned to him as inference and decision support (Figure 2).

Business Analytics and Intelligence

Business analytics and intelligence emerged as an important field of study for both implementers and researchers, reflecting the magnitude and impact of problems related to data to be resolved in contemporary business organizations (Chen et al., 2012). In other words, to make more accurate decisions about the future, it is the business processes that enable the data to be transformed into information by examining the past or current data. Especially in the last 20 years, the usage rates of business intelligence and analytics have increased significantly both academically and industrially (Forbes, 2017; Statista ,2020b; Laudon, 2014). These methods,

which contribute significantly to the decision support processes of large-scale formations, are also among the important branches by the companies that direct technology. Business analytics; It increases the interaction of users with data such as predictive modeling, making the data meaningful and optimization. All the methods used by transferring the whole process onto the dashboard assist the decision support processes, making the data interpretable and analyzable. This structure, which has been used frequently by organizations until recently, has also become a supporter of individual uses over time. Decision support processes that are revealed by taking certain data from users are the best examples of this. For example, in our research, machine learning and business analytics were brought together and entrepreneurs received decision support about their projects.

Selection of the Algorithm

Scope of work; Decision Tree (J48), Random Forest (RF), K-Nearest Neighbors (KNN), Support Vector Machine (SVM), Naive Bayes (NB), Logistic Regression (LR) algorithms were used to classify Kickstarter projects.

Decision trees are one of the basic classification algorithms and multiple decision trees come together to form the Random Forest algorithm (Leiva et al., 2019). The basis of the algorithm is based on a hierarchical tree structure (Berhane et al., 2018). However, although this structure is simple and understandable, in cases where one of the biggest problems of the algorithm is overfitting, the number of decision trees in the Random Forest method should be determined and the results obtained should be reviewed.

Random Forest Classification is one of the most successful classification methods used. The algorithm consists of decision trees, independent of the input vector of each classifier. Each tree in the hierarchy gives a unit vote to classify the input vector (Pal, 2005). This classification method gives better results in datasets and categorical variables with an unbalanced distribution. The data set used during the development of the application has many data categorically and has been tested within the scope of this algorithm since it has an unbalanced distribution (Ahmad et al., 2017).

The KNN algorithm is one of the simplest methods used to solve classification problems. It has important advantages over some data mining methods since it generally gives competitive results (Adeniyi et al., 2016). In particular, it can provide fast results with Decision Tree and Random Forest among the methods run on the webserver. This provides increased usability on the web interface. Also, KNN performs well on large data sets because it does not have scalability problems.

SVM is a classification algorithm that finds the best line at the point of separating two classes. Although it is an easy-to-train algorithm, it has two types of linear and nonlinear (Jain

et al. 2020). But it usually tries to classify the data on the class linearly. In nonlinear cases, a third dimension (Kernel Trick) can be classified using the SVM algorithm.

The NB algorithm is a classifier that calculates the probability set by counting the frequency and value sets in a given data set (Saritas and Yasar, 2019). Good results with fewer education data and the ability to work on unbalanced datasets are among the advantages of the NB algorithm.

The LR algorithm is frequently used to reveal the binary state of the result after training the used dataset. Since the Kickstarter data set is classified as binary classification, the LR algorithm is also preferred among the methods analyzed. With the LR algorithm, the effects on the independent variable result variables can be calculated probabilistic.

Evaluation

In the evaluation phase, which constitutes the 5th part of the CRISP-DM cycle, the methods used in the research and their performances are discussed. The web platform where entrepreneurs will test their projects in terms of success has been developed with both business analytics and machine learning methods. For this reason, the evaluation section was examined under two separate topics.

Evaluation of Classification Algorithms: It is necessary to measure how accurately the classification methods used can classify. Confusion Matrix was used to test the classification methods. The properties of the Confusion Matrix are compatible with integration into machine learning classification methods and provide more semantic explanations (Xu et al. 2020). Besides, the Confusion Matrix is used to describe the performance of the classification method on test data with true values. Accordingly, the data set containing two classes, successful and failed, was analyzed with Decision Tree, Random Forest, KNN, SVM, Naive Bayes, and Logistic Regression algorithms. Afterward, the heat map analyzes were visualized and Confusion Matrix values appeared (Figure 3).

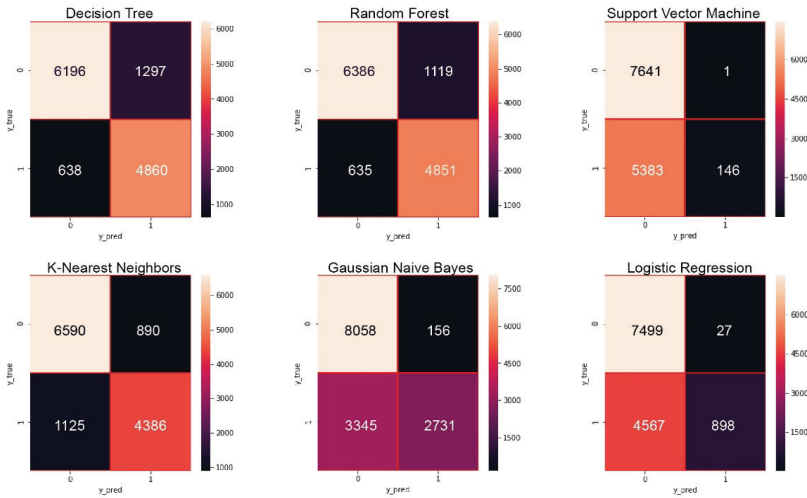


Figure 3. Confusion Matrix Results of the Classification Algorithms Used

(Failed = 0, Successful = 1)

After exposing the confusion matrix, classification metrics need to be evaluated. In this direction, it should be stated how much of the results obtained from the model that was first put forward is estimated correctly. For this, accuracy rate measurement is used for classification methods (Yang et al., 2019), (2).

$$AccuracyRate = \frac{TP + TN}{TP + FP + FN + TN} \quad (2)$$

The other two of the calculations using the confusion matrix after the accuracy rate are the Recall and Precision measurements (Fawcett, 2004), (3), (4).

$$Recall = \frac{TP}{TP + FN} \quad (3), \quad Precision = \frac{TP}{TP + FP} \quad (4)$$

F1 Score is a classification method evaluation metric in which extreme situations are not ignored (5). The main reason for looking at the F1 score value instead of the accuracy rate in the classification method choices is to not make a wrong model selection in the data sets that are not evenly distributed. Since the Kickstarter data set consists of unevenly distributed samples, the F1 score of the 6 classification methods used was determined.

$$F1Score = \frac{2 * Recall * Precision}{Recall + Precision} \quad (5)$$

$$MeanSquaredError(MSE) = \frac{1}{n} \sum_{i=0}^n (y_i - y'_i)^2 \quad (6)$$

MSE measures the average size of errors in the classification made (6). Separating from the complexity matrix, Cohen’s Kappa coefficient (κ) is a statistical metric that measures the mismatch between two different values (Cohen, 1960). The resulting measurement value is between -1 and +1. The closer the κ value closes to the +1 value, the better the compatibility between the two different values (Table 4).

$$KappaScore(\kappa) = \frac{(P_0 - P_c)}{(1 - P_0)} \quad (7)$$

Similarly, the closer the coefficient κ is to the value -1, the incompatibility between the two values is high and does not make sense in terms of reliability. If $\kappa = 0$, it is stated that the agreement between the two evaluators may depend on chance.

Table 3
Evaluation of the Kappa Score

κ (Kappa Score)	Evaluation
$\kappa < 0$	Poor
$\kappa > 0.0$ ve ≤ 0.20	Slight
$\kappa \geq 0.21$ ve ≤ 0.40	Fair
$\kappa \geq 0.41$ ve ≤ 0.60	Moderate
$\kappa \geq 0.61$ ve ≤ 0.80	Substantial
$\kappa \geq 0.81$ ve ≤ 1	Almost Perfect

Source: Landis and Koch, 1977.

Kappa value is found with the above equation, $P_0 = AcceptedRate$, $P_c = ExpectedRate(7)$. $\kappa \geq 0.4$ appears to be an appropriate value (Table 3). The model evaluation metrics mentioned above were used to test how many classifications of the methods used for Kickstarter attempts can be done. The results in this context are compared with each other (Table 4).

Table 4
Comparison of the Results of the Classification Algorithm

Machine Learning Algorithms	Accuracy Score	Precision	Recall	F1 Score	AUC	Mean Squared Error (MSE)	Kappa Score
Decision Tree	0.85	0.86	0.86	0.86	0.860	0.143	0.710
Random Forest	0.91	0.91	0.91	0.91	0.912	0.088	0.819
K-Nearest Neighbors (KNN)	0.84	0.85	0.85	0.84	0.837	0.154	0.681
Support Vector Machine (SVM)	0.58	0.76	0.59	0.44	0.513	0.414	0.030
Gaussian Naive Bayes	0.76	0.81	0.76	0.74	0.728	0.239	0.484
Logistic Regression	0.63	0.77	0.64	0.55	0.576	0.364	0.169

As a result of the comparison, Decision Tree, Random Forest, and KNN algorithms perform the best classification processes. SVM, Naive Bayes, and Logistic Regression algorithms give lower values in the classification of Kickstarter projects than other methods. Finally, Decision Tree, Random Forest, and KNN algorithms that give the best results were also evaluated in terms of ROC Curves (Figure 4).

$$TruePositiveRate(TPR) = \frac{TP}{TP + FN} \quad (7), \quad FalsePositiveRate(FPR) = \frac{FP}{FN + TP} \quad (8)$$

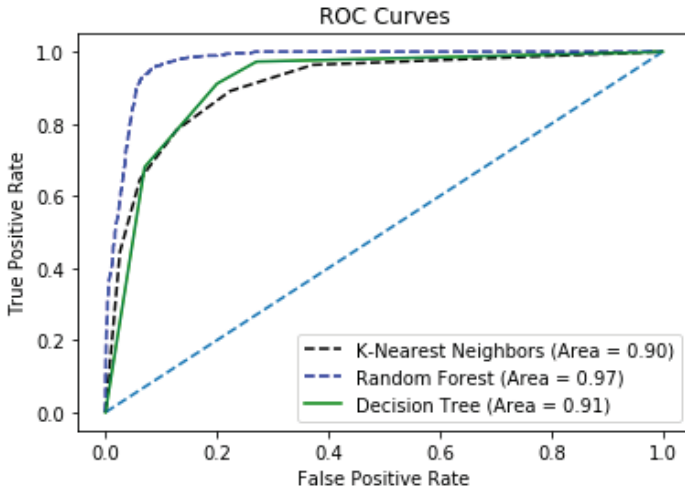


Figure 4. ROC Curves for Classification Algorithms

As a result of the evaluation, it is seen that Decision Tree, Random Forest, and KNN algorithms can successfully classify Kickstarter projects. For this reason, these 3 classification methods were used in the web application developed.

Evaluation of Business Analytics Methods: During the evaluation of the business analytics we use while developing the web application, the visualization, querying, listing, and meaningful reporting of the data recorded in the database were analyzed. Thanks to the relational database structure created, each recorded data takes an active role in the process leading to decision support.

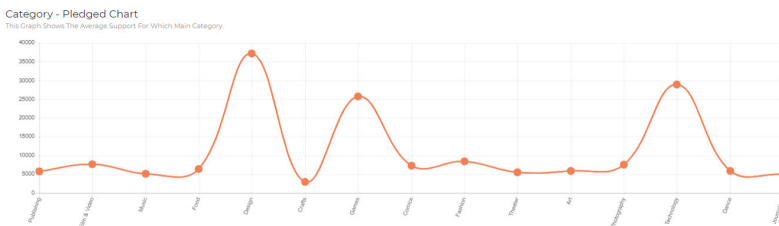


Figure 5. Visualization of Kickstarter Data

After the recorded data in the database is displayed on the dashboard with SQL queries, the relationships between the data are visualized and made easier to interpret (Figure 5). So much so, with this interpretation, entrepreneurs can make inferences about their projects and see what they need to do to make their projects successful thanks to the reporting screen. Users who can also see their deficiencies in creating a successful project can make detailed inquiries about other projects within the web application. Queries also cover the status of other projects. The table below shows the project status distributions in the categories (Table 5).

Table 5
Kickstarter Category and Project States Table

Categories	Project States					Project Count
	Successful	Failed	Canceled	Live	Suspended	
Publishing	%34.24	%51.28	%8.52	%5.68	%0.29	5.248
Film&Video	%34.5	%49.58	%9.53	%5.97	%0.42	5.508
Music	%43.34	%44.04	%6.41	%5.76	%0.45	4.864
Food	%22.29	%63.17	%8.13	%5.71	%0.69	3.185
Design	%38.54	%39.7	%15.78	%5.19	%0.8	5.862
Crafts	%25.88	%58.63	%9.73	%4.93	%0.84	1.542
Games	%41.49	%37.23	%16.53	%4.16	%0.58	6.895
Comics	%61.87	%27.84	%6.35	%3.8	%0.15	2.001
Fashion	%27.35	%54.96	%11.15	%5.92	%0.62	4.205
Theater	%53.6	%35.33	%6.42	%4.54	%0.11	903
Art	%42.46	%44.23	%7.86	%4.88	%0.58	3.957
Photography	%33.94	%52.07	%8.58	%4.63	%0.77	1.037
Technology	%19.4	%58.77	%14.02	%6.27	%1.54	5.984
Dance	%55.01	%33.06	%6.78	%4.88	%0.27	369
Journalism	%19.71	%62.18	%12.5	%4.97	%0.64	624

When the database is analyzed within the scope of business analytics, it is seen that the success rates of the projects put forward in the comics, theater, and dance categories are high (Table 5). There is a great failure in the categories of publishing, food, crafts, fashion, photography, technology, and journalism. In order to make such inferences more determinative, data visualization and reporting have been applied for other features such as location, currency, targeted amount of support, and the number of backers in the data set. Thus, all the data in the process was presented to the user in an analyzed format within the dashboard.

Deployment and Control

In the deployment process of the CRISP-DM cycle, the developed web application is implemented ready to use. In this context, the classification methods used are shown in the web interface via the Flask Framework (Figure 6). The results that appear with the user interaction in the web application change as the project features differ. In other words, a classification based estimate is made for the success of the project, taking into account the previous data. Therefore, examples of the contribution of methods of machine learning to business intelligence have been seen (Wang et al., 2005).

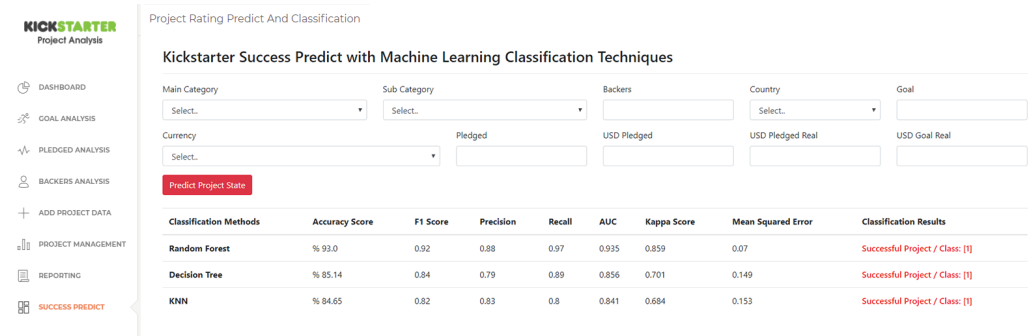


Figure 6. Demonstration of Classification Algorithms with Flask Framework in the User Interface

It is also observed that by enabling decision support, solutions to complex problems are provided through the dashboard (Cook et al., 2015).

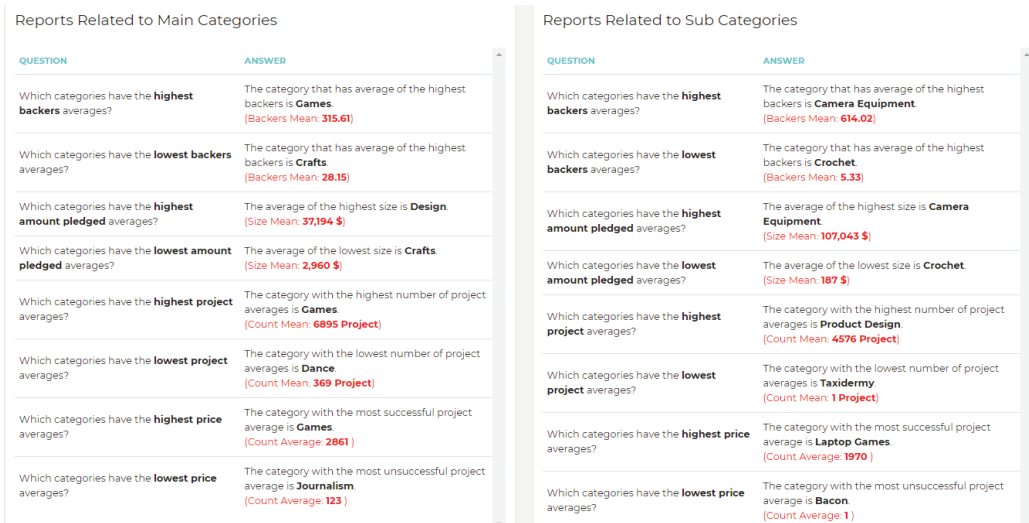


Figure 7. Business Analytics Reporting and Inference Screen

Within the scope of business analytics, after the data used has been made meaningful with PHP and SQL queries, it has been transferred to the web interface for decision support on the reporting screen (Figure 7), (Figure 8). In this way, together with user interaction, entrepreneurs will be able to compare their projects with other projects and see their shortcomings better.

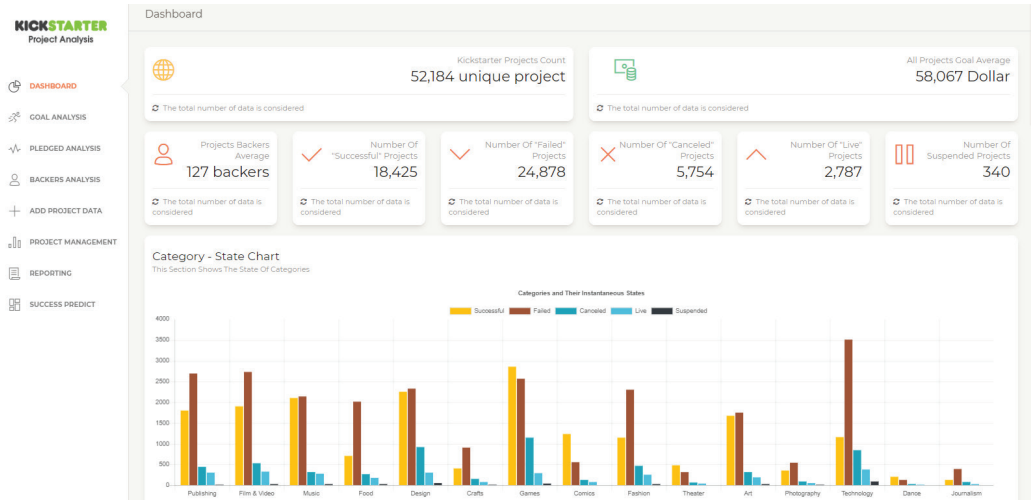


Figure 8. Dashboard Developed for Kickstarter Users

Also, as a dynamic structure is created, the reporting interface can update itself as data is added to the application. Therefore, the validity of the system has been maintained.

Discussion and Conclusion

The growth of interest in crowdfunding platforms tends to continue in the coming years, as online resources can be used practically for creative entrepreneurs (Szmigiera, 2019). However, the decrease in project success rates is striking, inversely proportional to this increase in interest (Rao et al., 2014). In this context, there are many factors that affect the success rate. While some of these factors are in the data set we use; factors such as project visuals, audio materials and past experiences of the project owner are not included in the data set we use. For this reason, more accurate estimates can be obtained by performing studies with other factors in similar studies. On the other hand, the classification results we have revealed are at a satisfactory level with an upper limit of 91% at the point of predicting success. Other results shown in the web interface are also close to the upper limit and are shown in Table 4. This upper limit can be further increased with ensemble models that can be used and data to be added to the web application. As a matter of fact, in a recent study; It is seen that a better classification is made compared to previous years by using decision tree, gradient boost and random forest algorithms together (Mortensen et al., 2019). Another important point we noticed in the study is that the selection of the appropriate algorithm for the data set can affect the success of the classification. Especially good results can be obtained with random forest and decision tree algorithms in analyzes to be made with a scattered and irregular data set. Therefore, choosing an algorithm suitable for the data set to be used increases the success of the results. In the KNN algorithm, a high ratio was obtained by determining the most appropriate K value

and classifying it. For this reason, it is necessary to find the value that gives the best result among the K selections during the study. When we look at the data visualization, listing and reporting features of the application we have developed, decision support is provided with the active use of user interaction. This decision support becomes more active with the use of the web (Shim et al., 2002). In other words, the classification results; since user interaction can be evaluated in terms of visualizing summaries and seeing alternative scenarios, users in the web application can have a prediction about their projects.

As a result, although there are many studies in the literature about crowdfunding projects, it was not possible for end users to test success because these studies were not presented on the web. The application we developed to overcome this deficiency creates a business intelligence environment by combining business analytics and machine learning methods. Users who can test the features of the project on the platform we developed can get decision support that will enable them to make necessary changes in their projects in line with the resulting report and success predict. Accordingly, if we summarize the results;

1) Using business analytics and machine learning methods together is highly effective for creating decision support. For this reason, similar processes should be carefully considered when analyzing other crowdfunding platforms.

2) A web-based decision support system has been established that entrepreneurs can use while preparing their projects. As the data is added to the established system, there is a dynamic structure because the forecast values can change.

3) Supervised learning algorithms that give the best results in web application are used for success prediction. In this context, Random Forest can classify with 91%, Decision Tree 85% and KNN 84% accuracy. In addition, the consistency of these results was tested with Recall, Precision, F1 Score, MSE and ROC curves and the agreement between the variables of the data set was measured with Kappa Score. The fit and test results support the accuracy values (Table 3, Table 4).

4) Query speed is of significant importance for effective user interaction. For this reason, structures that can be queried quickly should be used in similar systems. Django and Flask Frameworks were tried during the display of our work on the web application and the fastest query results were obtained with Flask. This situation may vary depending on the size of the data set.

5) An analysis was made according to the project characteristics, and the data were visualized, listed and reported. Thanks to the data categorized on the Kickstarter platform and with a certain success; detailed graphics, lists, reports and decision support were provided.

Future Works

There are many platforms in the crowdfunding ecosystem, aside from Kickstarter. The data on these platforms can also be analyzed and integrated into the system. Also, since the Ensemble algorithm approaches can generally classify better, they should be tested and monitored within the system. Apart from these, images containing project promotion can be evaluated within the scope of the web-based decision support system. In particular, it should be investigated whether the colors used correspond to the project category, whether the objects in the image express the project, and image processing should be done within the scope of the project's success.

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RESEARCH ARTICLE

A Study on the Relationship between CDS Premiums and Stock Market Indices: A Case of the Fragile Five Countries

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Abstract

International investors should have a pioneering knowledge of the country's risk level before investing their savings in a country. For this purpose, Credit Default Swap (CDS) Agreements that serve as insurance against investor's risk of not collecting their receivables have been developed. These contract premiums are called CDS premiums. The relationship between the Fragile Five countries' CDS premiums and the stock market index prices has been examined by various researchers. The present study is unique because it is one of the pioneering studies examining the relationship between the CDS premiums of the Fragile Five countries and their Stock Market Indices. First, augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were performed for this purpose. Then, the Granger Causality test, Johansen Cointegration, and Pearson Correlation analyses were conducted to reveal the relationship between two variables. The results obtained in the study indicated that for India and Turkey, among the Fragile Five, there was a causality relationship between the stock market indices and the CDS premiums, a short-term relationship. In addition, there was a long-term cointegration relationship between the CDS premiums and the stock market indices of Turkey.

Keywords

Credit default swap, Causality, Cointegration, Financial risk, Correlation

Introduction

International financial markets have shown significant development in recent years with the advancement of technology. With this development, the inflow and outflow of capital to countries have accelerated. Investing in financial markets has become much more advantageous for investors, in terms of both cost and time.

In emerging markets, all investors want to make a profit from their savings by investing in a good investment. For this reason, they provide credit opportunities to those who need a loan through various instruments traded in the financial markets. On the other hand, these credit opportunities, bring about certain risks such as credit risk that the investor would not

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want to bear. The existence of the products based on interest, foreign exchange, stocks, and commodities enables financial derivatives to gain popularity day by day in the financial markets (Bhaskar, 2003).

Since the investors who want to make a profit by using the savings have to protect their assets against the possibility of loss due to threats, they use credit derivatives minimizing the credit risk to be faced. In the financial markets, the investor who buys protection in return for an individual premium protection seller the opportunity to earn compensation in case the credit event does not occur. In general, the credit derivatives include Total Return Swaps, Credit Spread Options, Loan-linked Securities, Collateralized Debt Obligations, and Credit Default Swap (CDS) contracts. Among these, the most commonly one used in the financial markets are CDS contracts.

The CDS contracts allow transferring the credit risk of the underlying asset subject to the agreement to another person by selling. The core asset can be private sector bonds issues by companies or government bonds issued by the countries. The CDS premiums of countries arise through the CDS contracts made on the bonds issued by the governments. These CDS premiums are regarded as the most critical indicator of country risks in recent years.

Literature Review

There is no specific study in the literature examining the relationship between the CDS premiums of only the Fragile Five countries and their stock markets. However, there are some studies including some of these countries. Many studies in the literature investigate the relationship between the CDS premiums and the stock markets of various countries, including developed and developing countries. The studies on the subject in the literature will be summarized under two sub-headings in the present paper.

Studies On The Fragile Five Countries

Pan and Singleton, 2008, investigated the relationship between the CDS premiums of Turkey, Korea, and Mexico and 10-year US government bonds, interest rates, exchange rate volatility, and the VIX Volatility Index (fear index) by the regression analysis. Using the data covering the period of March 19, 2001–August 10, 2006. Their results showed that the most robust relationship was between the CDS premiums of the analyzed countries and the VIX index.

Chan et al., 2009, examined the national CDS premiums and stock market index values of seven Asian countries, namely China, Japan, Korea, Indonesia, Malaysia, Philippines, and Thailand, using the data for the time period of January 2001-February 2007, and discussed the dynamic relationship between the CDS premiums and the stock prices. They found a very high and significant negative correlation between the CDS premiums and the stock indices for six of the seven Asian countries except China.

Özkaplan, 2010, used the data covering the time period of between March 3, 2002 and January 22, 2010. To examine the relationship between Turkey's CDS premiums and BIST-100 index as well as Dow Jones and Eurobond, and FX indices by VAR (Vector Auto Regression) analysis and regression analysis. They concluded that there was a significant relationship between the CDS premiums and the variables such as BIST-100 index, Dow Jones and Eurobond.

Balı and Yılmaz, 2012, examined the relationship between the closing prices of the weekly ISE-100 index and CDS premiums for January 2002- April 2012 using the correlation analysis and regression analysis, and found a correlation between the CDS premiums and the ISE-100 index.

Hancı, 2014, investigated the volatility of Turkey in the period from January 2008 to December 2012 using the BIST-100 index daily returns and the CDS premiums with the help of GARCH models. She determined that there was an inverse relationship between the CDS premiums, an indicator of country risk, and the stock prices of companies traded on the stock market. In addition, she stated that there was very high volatility between CDS premiums and BIST-100 index returns, and that it took a long time, to resist the shocks and return to the averages, and concluded that this high volatility, indicating the level of fragility had a great impact on the production.

Şit et al., 2014, analyzed how the CDS premiums and the political risks in Turkey impacted the stock market, using the monthly from data 2005 to 2014. They conducted the VAR, and action-reaction analyses and the Granger causality test, and determined that the effect of Turkey's stock exchange and political risks on the CDS premiums was not significant. However, the causality analysis results revealed the existence of various causality relationships among the variables.

Yenice and Hazar, 2015, studied relationships between the country's CDS premiums and the daily closing prices of the stock market in some emerging countries, namely Indonesia, China, Malaysia, Turkey, Brazil, and Argentina by using the Regression Analysis. The data used in the study belonged to the period of April 2009 and April 2014. They reported that, the correlation between the CDS premiums and the closing prices was highest in Malaysia and lowest in Indonesia. On the other hand, the relationship between Turkey's CDS premium and the stock prices was neither too strong nor too weak. They were of the opinion that this might be due to some measures taken as a result of financial crises frequently encountered.

Kadooğlu, 2015, analyzed the relationship between the 5-year CDS premiums of 10 developed and developing countries covering the period of January 2010-January 2015 and the index closing prices of the stock markets using the Regression Estimation Models. The results of the study, indicated that the correlation between CDS premiums and index closing prices

both in developed and developing countries was significant. However, they stated that this relationship was more robust in the developed countries compared to the developing countries.

Başarır and Keten, 2016, assessed the long and short-term relationships between the CDS premiums and the exchange rates as well as the stock indices by employing the Johansen Co-integration and the Granger Causality, analyses using the monthly data between January 2010 and January 2016 of 12 developing countries included in the JP Morgan EMBI index. They found that there was a bidirectional causality relationship between the CDS premiums and the stock indices in the short run. In addition, a one-way causality relationship was observed from the CDS premiums to the exchange rates. There was no long-term relationship between the CDS premiums and the exchange rates and the stock indices in the specified period for the countries analyzed in the study.

Değirmenci and Pabuçcu, 2016, compared Turkey's 5 year (2010-2015) CDS premiums and the BIST-100 indices and 100 daily closing prices of the same years with the use of NARX, the Granger causality and the VAR analysis methods. It was found that there was a two-way Granger causality relationship between the CDS premiums and the stock prices, and the two variables mutually affected each other. They were able to determine in advance to what extent the changes in the CDS premiums and the BIST-100 indices would affect each other and what measures need be taken. In this context, they stated that the study's models could be used as an early warning mechanism.

Kadooğlu A. et al., 2016, examined the daily data of 10 developing and developed countries over the period January 2010-January 2015 using the Regression Analysis Estimation models to determine the interaction between the stock market index values and the CDS premiums. They found that among the countries with strong financial structure, the most sensitive relationship was in Ireland, and that Indonesia had the weakest relationship in the developing countries.

Eren and Başar, 2016, studied whether specific macroeconomic indicators and the CDS premiums affected the BIST-100 Index analyzing the monthly data between December 2005 and March 2014 with the ARDL test. They found that the effect on stock prices turned out to be negative in the expected direction. Although it was observed that the CDS premiums hurt the stock prices in the short run, it was concluded that the effect was positive in the long run and an increase in the CDS premiums caused a decrease in the stock prices in the short run.

Bektur and Malcıoğlu, 2017, investigated the interaction between the BIST 100 Index and Turkey's CDS premiums using the daily data between December 10, 2000 and February 17, 2017 period, with the Hacker Khatami-J (2006) Causality Test and the Khatami-J (2012) Asymmetric Causality Test. According to the results of the Hacker-Hatemi-J (2006) test, there was a one-sided interaction between the CDS premiums and the BIST-100 Index value. In

addition, it was determined that there was a causality relationship from the CDS premium to the BIST-100 index. On the other hand, the Hatemi-J test indicated that the positive shocks occurring in the CDS premiums provided information that would help predict BIST100 index values in advance. However, the positive shocks occurred in the BIST-100 Index did not provide helpful information to explain the positive shocks occurring in the CDS premium.

Şahin and Özkan, 2018, analyzed the existence of the relationship between the CDS premiums, the BIST-100 Index, and the exchange rates in the long- and short-term. In this context, the Panel Data Analysis was performed using the monthly CDS premiums of Turkey, the BIST-100 Index values, and the exchange rates over the period 2012-2017. The results of the analysis revealed that there was a two-way causality relationship between the CDS premiums and the BIST-100 Index, while no causality relationship was detected between the exchange rates and the BIST-100 Index.

Sovbetov and Saka, 2018, investigated the long and short-term interaction between the BIST-100 Index and the CDS premiums for the period January 2008-May 2015, using the ARDL model. As a result, they found an inverse relationship between the CDS premiums and the BIST-100 Index in both the long- and short-term.

Sadeghzadeh, 2019, explored the relationship between the CDS premiums and the stock index prices with the Panel Causality and the Panel Cointegration analyses, using the stock market index and the CDS data for UK, China, USA, Korea, France, and Turkey over the period 2007-2018. They determined that there was a long-term cointegration relationship between the stock market indices and the CDS premiums in the countries except the UK and USA. In addition, it was found that there was a mutual causality relationship between the stock indices and the CDS premiums considering the short-term period.

Atmışdörtoğlu, 2019, examined the relationships between the CDS premiums and the stock market indices, the USD exchange rate parity and 2-year government bond interest rates for China, Russia and Turkey. The daily data from April 08, 2010 to March 15, 2019 period were analyzed in the study using the VAR method. According to the study's findings, it was determined that the most effective variable among the specified variables was stock market index, while the interest rate and the exchange rate did not have a significant effect. Also, it affected the changes in the CDS premium. The standard deviation of the stock index values among the countries analyzed indicated that this effect was quite high in Turkey.

Studies On The Other Countries

Using the relevant data for the USA over the period 2001-2007, Fung et al., 2008, analyzed the relationship between the stock market index and the CDS premiums with the VAR analysis method. They found a mutual feedback relationship between the stock market index

and the CDS premiums in terms of volatility and pricing. They also stated that this relationship was highly dependent on the credit quality of the underlying asset.

Norden and Weber, 2009, examined the interaction between the CDS premiums and the stock market, and bond prices by employing the VAR analysis method using the data of the period 2000-2002. As a result of the study, it was observed that there was a significant interaction between stock returns and the CDS and bond prices, and the effect of the change in the CDS premiums was more pronounced on the stock market prices than the bond prices. In addition, the authors also noted that the effect of the CDS premiums on the stock prices was significantly related to the average credit quality of the enterprises and their bond issues.

Using the data covering the period of 2004-2009, Apergis and Lake, 2010, investigated the relationship between the international stock market indices of the USA, Germany, England, and Greece and the European CDS index in terms of average and volatility with the MVGARCH-M model. They found that the stock returns in the US and European markets negatively related to the changes in the European CDS premiums. In addition, they stated that information leaking from within an enterprise affected the CDS premiums before affecting the stock markets, that the CDS markets led the stock markets, and that the volatility in CDS premiums had a positive impact on the stock index returns.

Asandului et al., 2015, analyzed the data of the period between 2004 and 2014 using the Johansen Cointegration analysis to determine whether there was a relationship between the CDS premiums of the five Eastern European countries (Poland, Czech Republic, Romania, Bulgaria, and Hungary) and their stock markets. They found that before and after financial crises, the CDS premiums affected the pricing in the stock markets, and that there was an inverse relationship between government bonds and stock exchanges in financial crises.

Esen et al., 2015, analyzed the relationship between the 52-week data covering April 22, 2013- April 15, 2014 of the CDS premiums and the stock exchanges belonging to 13 G20 countries using the Panel Cointegration and the Panel Causality tests. As a result of their studies, they observed a causality relationship between the stock exchanges and the CDS premiums for seven countries, namely Russia, Italy, England, France, Argentina, South Korea, and Germany. In addition, they concluded that the increase in stock exchanges in general reduced the financial risk of the countries, in other words their CDS premiums.

Fonseca and Gottschalk, 2018, examined the relationship between the CDS premiums of four Asia-Pacific countries (Korea, Hong Kong, Japan and Australia) and their stock markets between 2007 and 2010 using the VAR analysis method, and reported that the CDS premiums were affected by stock returns and volatility in these returns.

General Literature Review

As can be seen in the literature review given in detail above, many studies have been conducted to examine the relationship between CDS premiums and stock market data, stock market index data and other various economic variables. These studies in general included the regional studies or analysis among the countries with different economic development. Considering the results in those studies, it can be seen that different results were obtained depending on the analysis method used. It is striking that the relational approaches such as causality and correlation were generally used in the analyses conducted. The present study focuses on the causality and the short- and long-term cointegration relationships between the CDS premiums and the national stock market indices, as well as the correlation relationship of countries with different regions and economic cultures known as the Fragile Five. In other words, the study is considered to be an original study examining the relationship between the CDS premiums and the stock market indices for the Fragile Five countries.

Credit Default Swaps (CDS)

As a result of the developments in the international markets, many types of investment instruments have emerged, and some of those have become a guiding indicator for the investors. The presence of problematic loans is known to be the most important reason of the 2008 Global Financial Crisis, at the same time, the fact that the risks were not appropriately measured is considered another reason. The CDS contracts are regarded as loan derivatives. Today, any foreign investor would want to analyze some financial data of the country to invest before making an investment decision. Among these data, the essential loan derivative product to be analyzed is Credit Default Swaps (Koy, 2014).

The CDS, which protects the creditor against the loss or loss of value of the asset related to the collateral, is the most commonly used contract type among credit derivatives and has a financially lean structure. The CDS is when any creditor insures his/her receivables for a fee. The fee paid to a third party for this insurance transaction is called the CDS Spread or the CDS premium. In this way, the creditor party off-loads the risk of non-payment of its receivables to the CDS seller (Danaci et al., 2017). The CDS premiums are calculated using the method shown below.

$$\text{CDS Premium} = (\text{Nominal Value of Contract} \times \text{Base Point} \times \text{Number of Days} / 360)$$

Source: (Reyhan, 2019)

According to the research results regularly published by the British Banks Association every two years, more than 50% of the contracts in the credit derivative markets are CDS contracts. The main reason why the CDS contracts are so much preferred in international markets and their remarkably fast growth is that these contracts offer their users the oppor-

tunity to effectively manage the credit risk they have to bear, just like an insurance policy. Another reason is that the CDS contracts are bought and sold for hedging purposes only, rather than the formation of the large transaction volumes due to the continuous buying and selling of those who are interested in this business in the markets (Kunt, 2008).

CDS Premiums as an Indicator of Country Risk

International investors, who will invest in a country in the form of portfolio investment or direct investment, should make a correct assessment of the country's risks in the process before making an investment decision. The CDS premiums are generally used to measure the country's risk and evaluate the risks of the country in which foreign investors will invest (Kilci, 2017).

Since the ratings, which are used as an indicator of country risk, are not flexible like CDS in instant price changes in the markets, the investors have started to use the CDS premiums as an indicator of country risk, especially after the 2008 Global Financial Crisis. While the ratings of rating companies provide information about the solvency of an asset such as country, institution, company, and bond; the CDS premiums provide information about the repayment adequacy of the loans used by the country, institution, or companies (Conkar and Vergili, 2017).

The CDS contracts have four main elements: credit element, nominal amount, risk premium (spread), and expiry (Çakır, 2019).

- The credit element is related to the credit risk of the financial asset subject to the transaction in the CDS contracts.
- The nominal amount determines the amount of credit risk transferred from one party to another.
- The spread refers to the periodic premium payments that are generally made every six months. However, in practice, it is seen that payments are sometimes made every three months.

The expiry date refers to the date on which the CDS contracts expire. In general, a reference length or a coverage period of a CDS contract is five-years in the market. Premium payments can also be completed after the possibility of default or the expiry of the contract period.

Table 1 shows the real-time values of the CDS premiums of the five fragile countries in the period under review.

Table 1
Fragile Five Countries CDS Premiums

Date	Indonesia	Brazil	S.Africa	India	Turkey
Mar.19	103,8	238,2	196,8	95,1	419
Feb.19	104,4	217,3	174,8	80,3	300,6
Jan.19	113	227,7	173,5	80,4	299,8
Dec.18	136,6	269,4	221,1	80,4	358,8
Nov.18	140,9	269,9	228,2	80,4	386,5
Oct.18	156,9	263,8	233,9	80,3	383,3
Sep.18	129	317,7	200,3	80,4	371,2
Aug.18	124,5	360,4	228,1	80,3	582
July.18	112	274,2	180,1	80,3	317,5
June.18	137,5	331,9	212,4	80,3	290
May.18	117,1	288,4	174,1	80,3	267,4
Apr.18	104,1	232,8	159,6	80,4	193,5
Mar.18	102,9	221,1	149,1	80,4	191,4
Feb.18	86	213,4	143,9	80,3	166,3
Jan.18	82,3	201	143	80,3	165,8
Dec.17	86,7	217,1	157,8	80,3	166,6
Nov.17	93,7	225,7	178,5	80,3	197,6
Oct.17	94,2	224,8	182,9	80,3	184,4
Sep.17	105,2	247,5	184,5	80,3	184,3
Aug.17	100,7	248,4	168,6	80,3	159,8
July.17	110,8	266,7	180,8	80,3	181,6
June.17	117,7	297,9	197,6	80,3	193,2
May.17	124	293,4	188,3	80,3	196
Apr.17	125,2	276,6	191,3	136	203,9
Mar.17	125,7	282,1	215,2	136	235,4
Feb.17	128,5	282,1	189,4	136	237,9
Jan.17	146,6	311,1	209,4	136	262,5
Dec.16	156,6	363	213,2	136	268,3
Nov.16	168,6	363	236,5	136	283,2
Oct.16	153,3	340,5	239,6	135,9	251,7
Sep.16	151,6	336,7	251,2	135,9	258
Aug.16	142,5	333,1	254,6	134,3	241,6
July.16	160,9	360,9	248,1	152,4	271,7
June.16	184,2	388,1	277,4	152,5	239,6
May.16	188,4	435,1	310,9	152,5	264,5
Apr.16	188,2	404,2	277,5	152,4	236,2
Mar.16	195,5	430,2	296,3	152,4	252,9
Feb.16	230,3	519,5	348,6	150,6	293,3
Jan.16	228	533	341	150,6	275,6
Dec.15	230,5	552,8	331,3	150,6	267,5
Nov.15	218,7	511,5	263,2	150,6	261,6
Oct.15	217,7	510,6	252,2	150,6	252,2
Sep.15	271,9	535,8	292	148,8	312
Aug.15	225,6	414,3	246,3	148,8	260,7
July.15	181,2	350,2	216,6	148,8	233,9
June.15	174,9	312,9	208,2	148,8	223,1
May.15	163,8	299,6	203,4	148,8	208,4
Apr.15	159,9	302,5	208,8	148,8	223,2

Table 2
G7 Countries CDS Premiums

Date	Usa	Germany	Canada	Italy	England	Japan	France
Mar.19	120,8	15,1	33,3	107,4	22,2	35,8	31,9
Feb.19	114,3	15,1	33,3	100	19,2	39,6	27,5
Jan.19	131,5	14,6	33,3	127,1	20,2	45,2	33,4
Dec.18	135,2	13,6	33,3	104,9	18,8	39,5	30,9
Nov.18	145	12,6	33,3	103,5	18,2	37,8	30,9
Oct.18	174,9	14	33,3	110,9	17,3	47,3	30
Sep.18	150,6	12,3	30,7	91,6	17,2	43,4	28
Aug.18	153,1	12,1	30,7	85,2	17,1	51,7	25,5
July.18	169,3	12,1	30,7	86,7	18,2	50,1	23,8
Jun.18	193,5	12,6	30,7	102,5	19,8	49,6	26
May.18	195,5	23	30,7	130,6	29,2	51,3	31,9
Apr.18	160,7	18,3	32,2	116,7	41,3	47,3	30,4
Mar.18	161,8	17	32,2	113,8	40,3	36,7	34,4
Feb.18	170,5	18	32,2	114,8	37,5	34,2	34,9
Jan.18	154,3	19	32,2	138,4	42,8	41,2	38,8
Dec.17	150	15,6	29,9	120,2	35,5	35,9	29,9
Nov.17	137,6	15,6	29,9	123	34,3	33,2	26,5
Oct.17	163,5	17,1	31,4	139,1	34,3	35,7	27
Sep.17	153,8	18,6	31,4	135,7	39,5	33,7	28,4
Aug.17	177,5	21	31,4	158,8	39,3	33,2	37,3
July.17	154,9	20,1	31,4	142,6	32,6	30,2	34,4
Jun.17	165,6	18,6	31,4	153,8	29,6	28,4	37,8
May.17	141	18,1	31,4	146	30	24,4	36,8
Apr.17	128,5	15,1	32,7	126	30,5	25,2	26
Mar.17	117,6	14,6	32,7	113,2	26,7	25,6	21
Feb.17	119,4	13,6	32,7	108,8	25,5	26,6	19,5
Jan.17	113,3	12,6	32,7	89,6	21,8	25,7	15,6
Dec.16	102	10,4	32,7	82,5	18	26,5	12,6
Nov.16	101	10,6	32,7	94,6	21,5	29,9	15,3
Oct.16	110,1	10,6	33,8	93,6	24,9	39,2	16,1
Sep.16	106,4	9,6	33,8	81,8	24,9	34,2	14,3
Aug.16	102	7,9	33,8	74,1	20,7	30,5	11,9
July.16	105,6	7,4	33,8	76,3	20	26,9	12,1
Jun.16	97	6,6	33,8	62,8	16	18,8	11,6
May.16	105,9	7,2	33,8	67	16,7	20,4	12,1
Apr.16	108,6	7,9	34,8	70,5	18,8	22,7	11,9
Mar.16	114,7	7,8	34,8	61,6	17,5	25,2	11,9
Feb.16	139,6	8,9	34,8	138,4	25,1	24,2	18,6
Jan.16	133,2	8,8	34,8	131	24,1	25,3	18,1
Dec.15	113,2	7,7	34,8	129,1	24,2	26,7	16,6
Nov.15	118,7	8,4	34,8	163,1	29,1	25,9	16,8
Oct.15	112,2	8,2	34,8	151,1	28,8	25,9	17,1
Sep.15	144,1	8,9	34,8	162,2	29	24,1	18,7
Aug.15	148	9,7	34,8	147,2	35,4	18	19,6
July.15	154,4	10,8	34,8	127,2	39,7	24,6	22,4

Date	Usa	Germany	Canada	Italy	England	Japan	France
Jun.15	134,3	10,2	34,8	123,8	36	21,9	22,1
May.15	122,5	9,6	34,8	126,6	35,4	21,8	18,2
Apr.15	121,4	9,8	36,3	127,8	33,5	22,4	16,9

Table 2 shows the real-time values of the CDS premiums of the G7 countries in the period under review.

Methodology

The study analyzed the relationship between the CDS and the stock market indices in five countries (Brazil, India, South Africa, Indonesia, and Turkey) with the most fragile economy, called “Fragile Five”.

In the study, by using the 5-year CDS premiums of the Fragile Five countries and the closing price data of the stock market indices;

- The stationarity of the series,
- The causality and cointegration relationships between the variables,
- The interaction between the CDS premiums of the specified countries and their stock markets were examined.

Furthermore, the results were interpreted by various methods and analyzes. As a result, it was tested whether there was a significant relationship between the national stock market index values and the CDS premiums of these countries.

In this study, the CDS premiums of Brazil, India, South Africa, Indonesia, and Turkey were used together with the stock market price data of those countries. For this purpose, month-end closing prices of the stock markets were taken for the period of April 2015 - March 2019.

The 5-year CDS premiums of five countries subject to analysis were collected from the Datastream data terminal, and the stock market index values from the Matrix data terminal. The CDS premiums were in US Dollars, while the index values for the stock markets were obtained in the currency of the country analyzed.

The stock market indices included in the study are indices defined as a benchmark index for each country. In this context, the indices, namely BVSP for Brazil, BSEN for India, JTOP for South Africa, IDX Composite for Indonesia, and BIST-100 for Turkey were used.

The analyses were conducted with the help of the E-Views 9 software package. In the

study first, the stationarity tests were performed. The use of Augmented-Dickey-Fuller (ADF) method and the Phillips-Perron (PP) method further increased the reliability of the study.

Then, the Johansen Cointegration analysis was used in the study to reveal the long-term cointegration relationship between the variables. Additionally, the direction of causality among the variables was determined by the Granger Causality analysis. Finally, the Pearson Correlation Coefficients were found to analyze the direction and strength of the relationship between variables.

Analysis and Findings

Unit Root Analysis

The stationarity tests of the data used in the study were carried out separately by using ADF and PP unit root tests in both level values and first differences in the fixed and fixed trend models. The results obtained are shown in Table 3.

Table 3
Fragile Five-stock market Index Stationary Test Results

Fragile Five Countries Index Data			ADF		PP	
			Test Statistics	Probability	Test Statistics	Probability
Brazil	Fixed	Level	0.038	0.9572	0.148	0.9662
		Difference 1	-4.247	0.0018	-6.390	0.0000
	Fixed and Trended	Level	-4.441	0.0053	-3.465	0.0551
		Difference 1	-4.178	0.0111	-6.435	0.0000
Indonesia	Fixed	Level	-0.423	0.8965	-0.547	0.8721
	Fixed and Trended	Difference 1	-5.562	0.0000	-5.614	0.0000
		Level	-2.595	0.2842	-2.710	0.2374
South Africa	Fixed	Difference 1	-5.597	0.0002	-5.651	0.0001
		Level	-2.039	0.2697	-2.063	0.2601
	Fixed and Trended	Difference 1	-7.182	0.0000	-7.327	0.0000
		Level	-2.825	0.1958	-2.877	0.1787
India	Fixed	Difference 1	-7.105	0.0000	-7.231	0.0000
		Level	-0.248	0.9245	0.040	0.9574
	Fixed and Trended	Difference 1	-6.026	0.0000	-6.879	0.0000
		Level	-2.822	0.1970	-2.708	0.2382
Turkey	Fixed	Difference 1	-6.173	0.0000	-7.027	0.0000
		Level	-1.380	0.5840	-1.335	0.6055
	Fixed and Trended	Difference 1	-7.170	0.0000	-7.170	0.0000
		Level	-1.813	0.6824	-1.813	0.6824
		Difference 1	-7.072	0.0000	-7.075	0.0000

As can be seen from Table 3, the ADF test results indicated that the Brazilian index value was not stationary in the level value in the fixed model, but stationary in the first difference. In the fixed trend model, it was observed to be stable in the level value. For the other countries

in Table 3, India, Indonesia, South Africa, and Turkey, it was found that the level values were not stationary in both the fixed model and the fixed trend model. However, all other countries except Brazil were stationary in their first difference. According to the PP test, all countries were stationary at the 1st difference level in both the fixed and the fixed trend models.

Table 4
Fragile Five-CDS premiums Stationary Test Results

Fragile Five Countries CDS Premiums			ADF		PP	
			Test Statistics	Probability	Test Statistics	Probability
Brazil	Fixed	Level	-1.184	0.6735	-1.465	0.5420
		Difference 1	-5.993	0.0000	-6.029	0.0000
	Fixed and Trended	Level	-2.439	0.3554	-2.577	0.2917
		Difference 1	-5.999	0.0000	-6.035	0.0000
Indonesia	Fixed	Level	-1.126	0.6975	-1.161	0.6831
		Difference 1	-6.537	0.0000	-6.540	0.0000
	Fixed and Trended	Level	-2.314	0.4183	-2.314	0.4183
		Difference 1	-6.485	0.0000	-6.482	0.0000
South Africa	Fixed	Level	-1.674	0.4372	-1.674	0.4372
		Difference 1	-7.621	0.0000	-7.650	0.0000
	Fixed and Trended	Level	-2.399	0.3753	-2.399	0.3753
		Difference 1	-7.571	0.0000	-7.603	0.0000
India	Fixed	Level	-1.115	0.7022	-1.115	0.7022
		Difference 1	-6.601	0.0000	-6.601	0.0000
	Fixed and Trended	Level	-1.651	0.7568	-1.691	0.7393
		Difference 1	-6.541	0.0000	-6.541	0.0000
Turkey	Fixed	Level	-2.361	0.1579	-2.226	0.1999
		Difference 1	-9.286	0.0000	-9.355	0.0000
	Fixed and Trended	Level	-2.626	0.2709	-2.554	0.3019
		Difference 1	-9.211	0.0000	-9.279	0.0000

According to the stationary test results of the CDS in Table 4, it was seen that all Fragile Five countries were not stationary in their level values in both the fixed model and the fixed trend model in the ADF and PP tests. However, they were found to be stationary in their first difference.

Determination of the appropriate Lag Length

In order to determine the appropriate lag lengths, the VAR analysis was performed for each country separately using the stock market index values and the CDS data of all countries included in the study.

The abbreviations in the tables define as;

AIC = Akaike Information Criterion,

SC = Schwarz Information Criteria

HQ = Hannan-Quinn Information Criteria.

The star symbol in the tables represents the best value of the information criterion it contains. In the study, Akaike Information Criterion (AIC) selected the appropriate information criterion since the information criteria should be closest to 0. The obtained results are given separately in the tables below.

Table 5
Brazil's Lag Length Table

VAR Lag Length Selection Criteria						
Internal Variables: Brazil Index Brazil Cds						
External Variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6.461.740	NA	4.07e+11	32.40870	32.49314	32.43923
1	-5.732.546	134.9010*	1.30e+10*	28.96273*	29.21606*	29.05432*
2	-5.727.228	0.930560	1.55e+10	29.13614	29.55836	29.28880
3	-5.680.127	7.771.702	1.50e+10	29.10063	29.69174	29.31436
4	-5.636.687	6.733.216	1.49e+10	29.08343	29.84343	29.35822
5	-5.585.302	7.450.814	1.42e+10	29.02651	29.95539	29.36236
6	-5.564.729	2.777.283	1.60e+10	29.12365	30.22142	29.52057
7	-5.540.585	3.018.069	1.78e+10	29.20292	30.46958	29.66091
8	-5.488.190	6.025.448	1.74e+10	29.14095	30.57650	29.66000

When Table 5 is examined, it was seen that the most suitable lag length was 1 for Brazil according to Akaike Information Criteria.

Table 6
Indonesia's Lag Length Table

VAR Lag Length Selection Criteria						
Internal Variables: Indonesia Index Indonesia Cds						
External Variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4.733.250	NA	71880747	23.76625	23.85070	23.79678
1	-4.159.386	106.1649*	4983990.*	21.09693*	21.35026*	21.18853*
2	-4.142.061	3.031.897	5593860.	21.21031	21.63253	21.36297
3	-4.133.773	1.367.520	6585569.	21.36887	21.95997	21.58259

Lag	LogL	LR	FPE	AIC	SC	HQ
4	-4.123.600	1.576.794	7709108.	21.51800	22.27800	21.79279
5	-4.106.457	2.485.706	8759002.	21.63229	22.56117	21.96814
6	-4.051.337	7.441.259	8284036.	21.55668	22.65446	21.95360
7	-4.008.184	5.394.074	8386069.	21.54092	22.80758	21.99891
8	-3.964.893	4.978.558	8570381.	21.52446	22.96001	22.04351

When Table 6 is examined, according to Akaike Information Criteria, the most suitable lag length is concluded to be 1 for Indonesia.

Table 7

South Africa's Lag Length Table

VAR Lag Length Selection Criteria

Internal Variables: South Africa Index South Africa Cds

External Variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5.804.707	NA	1.52e+10	29.12354	29.20798	29.15407
1	-5.315.654	90.47477*	1.62e+09*	26.87827*	27.13160*	26.96987*
2	-5.285.353	5.302.757	1.70e+09	26.92676	27.34898	27.07943
3	-5.255.386	4.944.507	1.80e+09	26.97693	27.56804	27.19066
4	-5.221.263	5.289.053	1.86e+09	27.00632	27.76631	27.28111
5	-5.201.462	2.871.117	2.09e+09	27.10731	28.03620	27.44317
6	-5.155.823	6.161.338	2.07e+09	27.07911	28.17689	27.47603
7	-5.153.361	0.307707	2.57e+09	27.26681	28.53347	27.72479
8	-5.130.573	2.620.596	2.91e+09	27.35287	28.78841	27.87192

When Table 7 is examined, according to Akaike Information Criteria, the most suitable lag length is concluded to be 1 for South Africa.

Table 8

India's Lag Length Table

VAR Lag Length Selection Criteria

Internal Variables: INDIA Index INDIA Cds

External Variables: C

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5.448.152	NA	2.56e+09	27.34076	27.42521	27.37129
1	-4.735.556	131.8303*	88861774*	23.97778*	24.23111*	24.06938*
2	-4.725.114	1.827.364	1.03e+08	24.12557	24.54779	24.27823
3	-4.719.301	0.959257	1.23e+08	24.29650	24.88761	24.51023
4	-4.674.782	6.900.454	1.21e+08	24.27391	25.03390	24.54870
5	-4.651.865	3.322.964	1.34e+08	24.35932	25.28821	24.69518
6	-4.625.632	3.541.382	1.46e+08	24.42816	25.52593	24.82508
7	-4.610.142	1.936.282	1.70e+08	24.55071	25.81737	25.00869
8	-4.606.874	0.375768	2.12e+08	24.73437	26.16992	25.25342

When Table 8 is examined, according to Akaike Information Criteria, the most suitable lag length is concluded to be 1 for India.

Table 9
Turkey's Lag Length Table

VAR Lag Length Selection Criteria						
Internal Variables: TURKEY Index TURKEY Cds						
External Variables: C						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6.288.805	NA	1.72e+11	31.54403	31.62847	31.57456
1	-5.651.458	1.179.093	8.66e+09	28.55729	28.81062*	28.64888
2	-5.593.770	1.009.542	7.94e+09	28.46885	28.89107	28.62151*
3	-5.547.274	7.671.759	7.73e+09	28.43637	29.02748	28.65010
4	-5.523.593	3.670.518	8.45e+09	28.51797	29.27796	28.79276
5	-5.443.400	11.62801*	7.01e+09*	28.31700	29.24588	28.65286
6	-5.422.791	2.782.218	7.88e+09	28.41396	29.51173	28.81087
7	-5.372.097	6.336.784	7.68e+09	28.36048	29.62714	28.81847
8	-5.320.452	5.939.204	7.53e+09	28.30226*	29.73781	28.82131

When Table 9 is examined, according to Akaike Information Criteria, the most suitable lag length is concluded to be 8 for Turkey.

Using the appropriate lag lengths determined, the VAR models for the Fragile Five countries were calculated as follows.

Table 10
Vector Autoregression Estimates (VAR 1)

VAR(1) Model	Brazil	Brazil CDS	Indonesia	Indonesia CDS	South Africa	South Africa CDS	India	India CDS
Brazil (-1)	.6539 [4.731]	.0003 [0.289]	-.0067 [1.042]	-.0004 [-0.752]	.0056 [0.089]	.0010 [1.157]	.0778 [1.716]	-.0003 [1.073]
Brazil CDS(-1)	-1.462 [-0.679]	0.7439 [3.787]	-0.7093 [-0.703]	0.0232 [0.228]	-3.096 [-0.312]	0.2535 [1.839]	-9.619 [-1.360]	-0.0164 [-0.304]
Indonesia (-1)	1.178 [2.567]	-0.0770 [-1.839]	0.6149 [2.859]	-0.0158 [-0.730]	0.6094 [0.288]	-0.0570 [-1.943]	-1.213 [-0.804]	-0.010 [-0.873]
Indonesia CDS(-1)	6.544 [1.177]	0.3085 [0.609]	-3.490 [-1.341]	0.8121 [3.099]	1.642 [0.643]	-0.4404 [-1.238]	7.012 [0.384]	0.0483 [0.347]
South Africa (-1)	-0.0723 [-0.224]	-0.0001 [-0.057]	0.0053 [0.355]	-0.000 [-0.463]	0.7008 [4.732]	-0.0013 [-0.648]	0.0981 [0.927]	0.0005 [0.718]
South Africa CDS(-1)	4.329 [1.628]	-0.500 [-2.064]	3.678 [2.955]	-0.190 [-1.522]	-5.610 [-0.459]	0.487 [2.865]	7.631 [0.874]	0.039 [0.595]
India (-1)	-0.0204 [-0.045]	0.0055 [1.440]	-0.0048 [-0.238]	0.0041 [2.000]	-0.2598 [-1.291]	0.0024 [0.887]	0.6194 [4.312]	-0.001 [-1.206]
India CDS(-1)	-5.120 [-1.141]	0.2650 [0.649]	-2.947 [-1.403]	0.3240 [1.533]	-4.285 [-2.078]	0.1506 [0.524]	-2.591 [-1.759]	0.752 [6.702]

Table 11
Vector Autoregression Estimates Turkey (VAR 8)

VAR(8) Model	Turkey	Turkey_CDS
Turkey (-1)	1.027 [5.336]	-0.0024 [-1.290]
Turkey (-2)	0.360 [1.304]	-0.0045 [-1.686]
Turkey (-3)	-0.055 [-0.197]	0.0030 [1.104]
Turkey (-4)	-0.332 [-1.222]	-0.0021 [-0.791]
Turkey (-5)	0.493 [1.808]	0.0020 [0.754]
Turkey (-6)	0.1659 [0.545]	-0.0024 [-0.814]
Turkey (-7)	-0.1232 [-0.399]	0.0063 [2.107]
Turkey (-8)	-0.9032 [-2.580]	0.0022 [0.669]

Table 12
Vector Autoregression Estimates Turkey_CDS (VAR 8)

VAR(8) Model	Turkey	Turkey_CDS
Turkey_CDS (-1)	6.961 [3.139]	-0.031 [-0.143]
Turkey_CDS (-2)	-1.134 [-0.490]	-0.099 [-0.438]
Turkey_CDS (-3)	2.005 [0.854]	0.380 [1.656]
Turkey_CDS (-4)	-3.742 [-1.578]	-0.1760 [-0.759]
Turkey_CDS (-5)	6.808 [2.964]	-0.008 [-0.035]
Turkey_CDS (-6)	1.227 [0.485]	-0.297 [-1.201]
Turkey_CDS (-7)	-2.560 [-0.992]	0.707 [2.805]
Turkey_CDS (-8)	-1.279 [-2.122]	0.294 [0.499]

Granger Causality Analysis

In order to determine the short-term relationship between the CDS and the index variables belonging to the Fragile Five countries and the direction of this relationship, a separate Granger causality test was conducted for each country. The hypotheses to be tested are as follows;

H_0 : There is no Granger causality between the variables. ($p > 0.10$)

H_1 : There is Granger causality between the variables. ($p < 0.10$)

The analysis results obtained are shown below in Table 8.

Table 13
Fragile Five Countries, Granger Causality Test Results

Granger Causality Test for the Fragile Five Countries			
Sample: 1 48			
Lag: 1	F-Statistic	Probability	Causality
Brazil Index does not granger cause Brazil CDS	0.4957	0.4851	No
Brazil CDS does not granger cause Brazil Index	0.0662	0.7980	No
Indonesia Index does not granger cause Indonesia CDS	219.28	0.1458	No
Indonesia CDS does not granger cause Indonesia Index	0.0059	0.9387	No
S. Africa Index does not granger cause S. Africa CDS	167.34	0.2026	No
S. Africa CDS does not granger cause S. Africa Index	111.49	0.2968	No
India Index does not granger cause India CDS	661.88	0.0135	Yes
India CDS does not granger cause India Index	492.22	0.0317	Yes
Turkey Index does not granger cause Turkey CDS	172.01	0.1471	No
Turkey CDS does not granger cause Turkey Index	298.33	0.0190	Yes

When Table 13 was examined, there was a short-term relationship between India's CDS premium variable and the index values, and these two variables were mutual Granger reasons for each other. In addition, there was a Granger causality between Turkey's CDS premium and the index variable. One-sided causality relationship was observed from the CDS premiums to the index values. No Granger causality relationship was seen between the CDS premiums and the index values for Brazil, Indonesia, and South Africa.

Johansen Cointegration Analysis

After looking at the short-term relationship between variables with the Granger Causality Analysis, the Johansen Cointegration Analysis was conducted to determine whether there was a long-term relationship between variables. The hypotheses to be tested are as follows;

H_0 : There is no cointegration relationship between variables. ($p < 0.10$)

H_1 : There is cointegration relationship between variables. ($p > 0.10$)

Each country analyzed in the study was separately taken into consideration. The results of the Johansen Cointegration Analysis are shown in the tables below.

When Table 14 was examined, since the probability value of p was higher than 0.10, the H_0 hypothesis was not rejected indicating that Brazil's CDS premiums and the index values were not co-integrated, and that there was no long-term relationship between these two variables.

Table 14
Brazil Johansen Cointegration Analysis Results

Series: BRAZIL CDS - BRAZIL INDEX
Observations Included: 46 (after adjustment)
Trend assumption: No Deterministic Trend
Sample (adjusted): 3 48
Lag Range (at first differences): 1 - 1

Hypothesis		Max-Eigenvalue	0.1	
CE(s)	Eigenvalue	Statistics	Critical Value	Probability
No	0.122860	6.030.059	9.474804	0.3463
No more than 1	0.028290	1.320103	2.976163	0.2929

Table 15
Indonesia Johansen Cointegration Analysis Results

Series: INDONESIA CDS - INDONESIA INDEX
Observations Included: 46 (after adjustment)
Trend assumption: No Deterministic Trend
Sample (adjusted): 3 48
Lag Range (at first differences): 1 - 1

Hypothesis		Max-Eigenvalue	0.1	
CE(s)	Eigenvalue	Statistics	Critical Value	Probability
No	0.293475	15.98024	17.23410	0.1461
No more than 1	0.083045	3.988056	10.66637	0.7438

When Table 15 was examined, the H_0 hypothesis was not rejected as the probability value of p is higher than 0.10. Thus, it was concluded that Indonesia’s CDS premiums and index values were not co-integrated, and that there was no long-term relationship between these two variables.

Table 16
South Africa Johansen Cointegration Analysis Results

Series: SOUTH AFRICA CDS - SOUTH AFRICA INDEX
Observations Included: 46 (after adjustment)
Trend assumption: No Deterministic Trend
Sample (adjusted): 3 48
Lag Range (at first differences): 1 - 1

Hypothesis		Max-Eigenvalue	0.1	
CE(s)	Eigenvalue	Statistics	Critical Value	Probability
No	0.075317	3.602014	9.474804	0.6922
No more than 1	9.82E-05	0.004519	2.976163	0.9557

The examination of Table 16 revealed that the H_0 hypothesis was not rejected due to the fact that the p-value was higher than 0.10. Therefore, it could be stated that South Africa’s CDS premiums and the index values were not cointegrated, and there was no long-term relationship between these two variables.

Table 17
India Johansen Cointegration Analysis Results

Series: INDIA CDS – INDIA INDEX
Observations Included: 46 (after adjustment)
Trend assumption: No Deterministic Trend
Sample (adjusted): 3 48

Lag Range (at first differences): 1 - 1

Hypothesis	Eigenvalue	Max-Eigenvalue Statistics	0.1 Critical Value	Probability
CE(s)				
No	0.198531	10.18024	12.29652	0.2004
No more than 1	0.020931	0.973024	2.705545	0.3239

When Table 17 was examined, since the probability value of p was higher than 0.10, the H_0 hypothesis was not rejected. That is, India's CDS premiums and index values were not co-integrated, and there was no long-term relationship between these two variables.

Table 18
Turkey Johansen Cointegration Analysis Results

Series: TURKEY CDS – TURKEY INDEX
Observations Included: 39 (after adjustment)
Trend assumption: Quadratic Deterministic Trend
Sample (adjusted): 10 48

Lag Range (at first differences): 1 - 8

Hypothesis	Eigenvalue	Max-Eigenvalue Statistics	0.1 Critical Value	Probability
CE(s)				
No*	0.415111	20.91698	15.00128	0.0135
No more than 1*	0.090122	3.683.361	2.705545	0.0550

The results presented in Table 18 revealed that since the probability value of p was less than 0.10, the H_0 hypothesis was rejected in favor of the H_1 hypothesis, indicating that Turkey's CDS premiums and index values were co-integrated, and there was a long-term relationship between these two variables. Therefore, it was assessed that there was a cointegration relationship as well as a long term relationship between the CDS premium and the index values of Turkey.

Vector Error Correction Model (VECM)

In cases where there was at least one cointegration relationship between the variables, the Vector Error Correction Model (VECM) was used. For the vector error correction model to be statistically significant, the p -value must be less than 0.10, and the error term coefficient must be between -1 and 0.

The results of the VECM analysis of the countries with a cointegration relationship between the CDS premiums and the stock market indices are shown in the tables below.

Table 19
Turkey Vector Error Correction Model Results

Variable	Coefficient	Std. Error	t-Statistics	P-Value
D(TURKEY CDS)	-0.005449	0.001186	-4.594.185	0.0000
Error Term (-1)	-0.561342	0.137174	-4.092.200	0.0002
C	-6.028.129	6.405.113	-0.941143	0.3518
R-square	0.464889	The dependent variable		-4.165.957
Adjusted R-square	0.440566	Connected		5.864.277
Residual sum of squares	84650.71	Akaike information criterion		1.046.168
F- Statistics	1.911.296	Schwarz information criterion		1.057.977
P value (F-statistic)	0.000001	Hannan-Quinn information criterion		1.050.612
		Durbin-Watson		2.019.464

The data of Turkey were analyzed, and it was observed that the error term coefficient was between -1 and 0. In addition, the p-value was less than 0.10. Therefore, the relevant model was statistically significant at the 0.10 significance level. In other words, approximately 56 % of the deterioration in the previous period's balance will recover in the next period.

Correlation Analysis

The Pearson correlation coefficient reveals the direction and strength of the relationship between the CDS premiums and index values of the countries included in the study. In order for the correlation coefficients to express a meaningful result, the variables must conform to the normal distribution. For this purpose, first, the least squares estimation was made for each of the Fragile Five countries by using the index values and the CDS premiums. The normality test results of the error terms resulting from the estimation are given in the table below. ($\alpha=0.05$)

Table 20
Jarque-Bera Test Results

Variables	Jarque-Bera Statistics	Probability	Decision
Brazil – Brazil CDS	1.7439	0.4181	Accept
Indonesia – Indonesia CDS	4.3887	0.1114	Accept
South Africa - South Africa CDS	0.6412	0.7257	Accept
India - India CDS	2.004	0.3669	Accept
Turkey -Turkey CDS	4.3273	0.1149	Accept

It was seen that the error terms conformed to a normal distribution in all regression models examined in table 20.

When the results in Table 21 were examined, the ρ values of Brazil, Indonesia, South Africa, and India were less than - 0.5. In other words, it could be said that there was an inverse and strong relationship between the CDS premiums of these countries and their index values. On the other hand, the ρ value of Turkey, was higher than -0.5 indicating there was a weak inverse correlation between the index value and Turkey's CDS premium.

Table 21
Fragile five countries Pearson Correlation Coefficients

Country	Correlation Coefficients (ρ)
Brazil	-0.8279
Indonesia	-0.9280
South Africa	-0.6133
India	-0.8985
Turkey	-0.2743

Conclusions

International capital markets have significantly developed with the technological advancements in recent years. Due to these developments, the inflow and outflow of capital to countries have accelerated, and investing in international markets has become very advantageous for investors in terms of time and cost. Accordingly, a serious capital flow has mostly started towards the “fragile” and “developing” countries, which previously did not have sufficient capital inflows but offered attractive return opportunities for the investors. Today, when capital can turn into investment within seconds, the CDS premiums offer investors to insure the risks of countries quickly and instantly. This feature has been defined as the most critical indicator of country risk in recent years.

When we look at the previous studies examining the relationship between the CDS premiums and the stock market indices, it was realized that those studies have generally either compared the developed countries and developing countries or analyzed a single country. The primary starting point of the present study is that although the Fragile Five countries are among the developing countries, they do not show similar trends with the other countries in the same group.

In this regard, the relationship between the CDS premiums and the stock indices were separately discussed for the countries, namely Brazil, Indonesia, South Africa, India and Turkey, defined as the “Fragile Five” by Morgan Stanley, that have the most fragile economies. The short-term relationship was examined with the Granger Causality analysis and the long-term relationship with the Johansen Cointegration analysis. Then, the correlation relationship between the CDS premium and stock market index values were evaluated.

The examination of the relationship between the CDS premiums, an indicator of country risk, and the stock market indices, was made for the countries belonging to the Fragile Five group. As a result of the econometric analysis made in this context, it can be stated that there was a short-term relationship between India’s CDS premiums and the index values and that these two variables were the Granger cause of mutual change. However, there was no long-term relationship between these two variables. When the correlation analysis results were examined, it can be said that there was an inverse and strong relationship between the CDS

premiums and the index values.

It was observed that there was a one-sided causality relationship between Turkey's CDS premium and the stock market index values in the short run and the causality relationship was from Turkey's CDS premium to the index values. In addition, the presence of a long-term relationship between the index value and Turkey's CDS was also determined. The results of correlation analysis conducted for the data belonging to Turkey revealed a weak inverse correlation between the index value and the CDS premium. When we look at the other Fragile Five countries, there was no short- or long-term relationship between the CDS premiums of Brazil, Indonesia, and South Africa and their index values. According to correlation analysis results, there were an inverse and strong relationship between the CDS premiums and the index values for those countries.

As a result, the investors operating in international markets should take into consideration the CDS values of India and Turkey as an indicator when making short-term investment decisions in the stock markets of the Fragile Five countries. On the other hand, it could be said that, only Turkey's CDS premium can be used as an indicator in long-term investment decisions.

It was concluded that the effect of CDS premiums on the stock market indices was not the same for each country. However, in the globally developing capital markets, CDS premiums, which show the country risk instantly, are considered an indicator that investors will use much more in the coming years. After this study, in addition to the CDS premium, various macroeconomic variables can be used as an indicator of country risk. New studies on the effects of these variables on the stock markets can contribute to the literature. In terms of investors, it can be stated that among the Fragile Five countries, the CDS premiums of India, and Turkey, can be used in short-term investment decisions, while only Turkey's CDS premium in long-term.

When the findings were analyzed in terms of Turkey, it was seen that there were both long-term and short-term relationships between Turkey BIST-100 index and its CDS premiums, in addition a one-way causality relationship between variables also existed (Sahin & Ozkan, 2018), (Sovbetov & Saka, 2018), (Sadeghzadeh, 2019) and (Atmisdortoglu, 2019). The findings obtained in the present study contradict with those in the study conducted by Sit et al., 2014 in which they claim that the CDS premium had no effect on the Turkish stock market. In our study, we determined a unilateral causality and cointegration relationship between the variables in both the short- and long-term. In addition, although the findings they obtained did not directly conform to the results of the present study, their results also contradicted some other studies. For example, Norden & Weber found in their 2009 study that a change in CDS premiums had a significant impact on the stock prices. Chan et al., in their 2009 study, revealed a very high and significant negative correlation between the CDS premiums and the

stock indices. Foncesa & Gottschalk observed in their 2018 study that the CDS premiums were affected by volatility in the stock returns. Our study is compatible with these studies for these reasons.

When looking at the other studies that contradict the results of our study, it is seen that our results are incompatible with the results of (Basarrı & Keten, 2016), (Degirmenci & Pabuccu, 2016) and (Sahin & Ozkan, 2018). These studies indicated that there was a double-sided causality relationship between the CDS premiums and the stock market indices or stock prices. However, in our study, a unilateral causality was determined from the CDS premiums of Turkey to the BIST-100 index.

In conclusion, the key findings of the study can be listed as follows;

- CDS premiums are a variable that has gained popularity in the last 10 years and can now be used as a financial confidence indicator for countries.

- In today's world, where mobility is very fast, international stock market indices are affected by this confidence variable. For this reason, governments are required to implement stable economic policies, especially in a way to prevent significant volatility in the stock markets.

- It is recommended that both the monetary and fiscal policies of the countries be long-term and consistent.

CDS contracts are now becoming an indicator that expresses the insurable margin of the financial assets issued by the governments. In order to ensure the stability of CDS premiums, especially the principle of transparency should be exercised. It is very important that the political and military stabilities support the economic stability.

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The Effect of Psychological Capital and Emotional Labor on Job Performance: A Study on Five Star Hotel Enterprises in Antalya

Neslihan Kan Sönmez¹

Abstract

Service quality and customer satisfaction, which are basic goals of hotel enterprises, can be achieved by the high job performance of qualified staff. The focal point of this study was the key role that psychological capital and emotional labor play in high job performance. In this study, which aimed to determine the effect of psychological capital and emotional labor on job performance, the sample group consisted of 400 personnel employed by 16 five-star hotel enterprises operating in the centre of Antalya, specifically in the districts of Kemer and Alanya. The data collected by questionnaire technique were analysed by statistical techniques, such as frequency and percentage distribution, arithmetic mean, standard deviation, Pearson's correlation analysis, multiple linear regression analysis, independent samples t-test, and one-way analysis of variance. What is more, a factor analysis was administered for validity and reliability, and Cronbach's Alpha coefficients were calculated. Obtained data suggested that the psychological capital levels of employees were positive above the medium level. The general emotional labor performance of employees was at the medium level. The job performance levels perceived by employees were high. As a result of the correlation analysis performed in the study, positive correlations were identified between psychological capital and emotional labor at $r=0.529$, psychological capital and job performance at $r=0.717$, and emotional labor and job performance at $r=0.595$. The regression analysis showed that one unit of change in the psychological capital caused an increase of 0.543 on the job performance, and a change of one unit in the psychological capital resulted in an increase of 0.712 on the job performance. In addition, according to the t-test and variance analysis results, while psychological capital, emotional labor, and job performance did not differ significantly according to gender, marital status, age, or education level, psychological capital levels of the hotel employees differed significantly according to their departments, and emotional labor performance differed significantly in line with their departments and working durations.

Keywords

Psychological Capital, Emotional Labor, Job Performance, Hotel Enterprises

Introduction

The rising importance of tourism in the economic growth of a country necessitates tourism employees from the sector to show their best performance at all times. Since hotel employees constitute the largest labor force component in tourism services, their performance have a sig-

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nificant effect on the service quality and satisfaction perceptions of national and international tourists. In recent years, the emotional labor shown by employees during their work, which is considered a closely related concept for employees to achieve the desired performance so that enterprises can obtain a sustainable competitive advantage, is discussed (Miranda & Godwin, 2018; Begenirbaş & Çalışkan, 2014; Hochschild, 1983/2012; Grandey, 2000). In addition to physical and mental contributions of employees, enterprises expect them to show emotions in line with the emotional display rules specified by the enterprises (Sohn & Lee, 2012).

According to Hochschild (1983/2012), who was the first to discuss emotional labor comprehensively, emotional labor is a process for employees to manage their emotions during guest interaction so that they comply with organizational expectation. The basis of emotional labor is the necessity to show the required effort at the workplace in order to create appropriate impressions and establish neutral and positive communication with others (Wharton & Erickson, 1993). The obligation of employees to display emotions complying with the emotional rules specified by enterprises increases service quality and customer satisfaction but may affect employees negatively due to possible emotional problems (Bickes, Yılmaz, Demirtaş, & Uğur, 2014). Employees' negative emotions decrease positive organizational outcomes, such as job performance, job satisfaction, and organizational commitment, and increased negative consequences, such as organizational stress, intentions to quit, organizational alienation, and burnout (Aslan & Büyükbeşe, 2019; Tokmak, 2014; Scott & Barnes, 2011). It is of importance to increase the psychological capital of employees in order to prevent negative consequences that are likely to occur based on emotional labor (Büyükbeşe & Aslan, 2019; Özyılmaz Misican & Türkoğlu, 2019). Investigated as a concept focusing on revealing and developing individuals' existing abilities and characteristics in terms of organizational behaviour, psychological capital (Seligman & Csikszentmihalyi, 2000) suggests that personal negativities, such as weakness, incompetence, and defects, have a positive equivalence and can be developed (Demir & Şen Demir, 2019).

Related literature suggests that psychological capital and emotional labor are important prerequisites of job performance (Miranda & Godwin 2018; Nasurdin, Ling & Sabrina, 2018; Begenirbaş & Çalışkan, 2014; Hochschild, 1983/2012; Shahnawaz & Jafri, 2009; Grandey, 2000). In tourism literature, however, there are few studies on the relationship between psychological capital and emotional labor with job performance (Çolak, 2018; Nasurdin, et al., 2018; Kızanıklı & Çöp, 2017; Eşitti, 2015; Dönmez, 2014; Karatepe, 2014; Ünlü & Yürür, 2011). In studies carried out on tourism enterprises, it can be seen that psychological capital has an effect on organizational behaviour fields, such as job satisfaction, organizational commitment, organizational citizenship behaviour, organizational identification, work-life quality, job burnout, individual innovativeness, and career adaptability (Demir & Şen Demir, 2019; Safavi & Bouzari, 2019; Suna & Okun, 2019; Kodaş, 2018; Kumlu & Güçlü Nergiz, 2018; Kim, Perrewe, Kim, & Kim, 2017; Jung & Yoon, 2015; Paek, Schuckert, Kim,

& Lee, 2015; Lin, 2013). The studies conducted in the tourism enterprises on emotional labor behaviours showed that emotional labor affected job satisfaction, service quality, intentions to quit, organizational citizenship behaviour, and emotional burnout (Genç & Gümüş, 2017; Kim, et al., 2017; Kaplan & Ulutaş, 2016; Yakar, 2015; Pala & Tepeci, 2014; Lu, Shih, & Chen, 2013). As there are relatively fewer studies on the effects of both variables on job performance, this study aimed to determine the effects of psychological capital and emotional labor on job performance regarding employees of five-star hotel enterprises. What is more, psychological capital, emotional labor, and job performance were compared according to the demographic characteristics of the employees.

Conceptual Framework

Emotional Labor

Used first by Hochschild (1983) in his book named *The Managed Heart*, the term emotional labor (Shapoval, 2019) is considered a key subject today in organizational studies (Gabriel & Diefendorff, 2015). It is described by Hochschild (1983/2012) as the management of facial and body expressions by employees when they serve customers. Hochschild (1983/2012) regards emotional labor as a service delivery stage. In this stage, service is considered a “show,” a service employee “an actor,” a customer “an audience,” and service delivery “an act” of a play (Chu & Murrmann, 2006). The communication between the actors and the audience is based on the form of the show, which is organized in line with organizational norms and rules and their individual perceptions (Duran & Gümüş, 2013).

Brotheridge & Grandey (2002) divide emotional labor into two categories: the first of these categories emphasizes the feature of work, and the second one focuses on the emotion management process of employees. The first is called “work-focused emotional labor,” consisting of the frequency, duration, and diversity of the emotional labor. The second is named “employee-focused emotional labor,” which is an emotion management technique used by employees during their communication with customers. This category covers surface acting and deep acting (Ko & Jeng, 2016). Most of the literature on emotional labor in the service sector has discussed these two kinds of acting. Surface acting consists of a simulation or effort to manage the expressions and gestures that have emotional meaning in front of clients and other collaborators. In this regard, the emotions expressed do not match those genuinely felt and are designed to follow the emotional rules determined by the enterprise. Deep acting, however, means a mental effort aiming to change real emotions in order to express the emotions specified by the enterprise. The third strategy, natural and genuine acting, is when the emotions needed by an enterprise are felt by the employee and occur spontaneously (Humphrey, Ashforth, & Diefendorff, 2015). This third form was discussed in few empirical studies

(Santos & Fontenelle, 2019). Surface and deep acting have been exemplified by Grandey (2000) as follows: surface acting, reflecting that desired emotions are not real, is like an artificial smile on the face of an employee while they are indeed sad and angry. Deep acting is the effort of an employee to change the emotions they consider improper before a guest with their own positive emotions. For example, an employee begins to feel bored at the end of a long shift. This employee may think about some positive events (an approaching holiday or going out with friends) in their life during a service delivery. The service provider tries to feel the real emotion in the emotion they show towards a guest. Therefore, although that emotion is real, it is not related to that guest (Shapoval, 2019).

Grandley & Gabriel (2015), researchers studying this subject, have defined a theoretical perspective which is determinant in understanding emotional labor. This perspective refers to harmony between an employee and a job; in other words, it focuses on an employee who has characteristics, such as extroversion, positive effectiveness, and emotional management skills, that are appropriate to the emotional needs of the job. This perspective asserts that employees complying with the job most should show less emotional labor. Such congruence between person-work and person-organization is of importance for functions requiring direct contact with guests, especially because employee perceptions fit their jobs and organizational values. Often, it serves as the definers of their performance. Therefore, it is important to analyse and select employees who can adapt to the job more properly; thus, deep acting may occur with little effort (Dahiya, 2017).

When employees' deep acting is performed with more effort in an enterprise, positive organizational outcomes, such as job performance, job satisfaction, and organizational commitment, decrease and negative consequences, such as organizational stress, intentions to quit, organizational alienation, and burnout, increase (Aslan & Büyükbeşe, 2019; Tokmak, 2014; Scott & Barnes, 2011). It is of importance to increase the psychological capital of employees in order to prevent such negative events that are likely to occur based on emotional labor (Büyükbeşe & Aslan, 2019; Özyılmaz Misican & Türkoğlu, 2019). Psychological capital can direct the actions and attitudes of employees thanks to its regulatory role in the building of their emotions (Tüzün, Çetin, & Basım, 2014). Psychological capital affects the cognitive processes of employees. Accordingly, the positive attitudes and actions that employees may have with psychological capital will trigger the positive power they need for the rights they can achieve (Hur, Rhee, & Ahn, 2016).

Psychological Capital

Psychological capital answers the questions of “who you are” and “what you can be” and is different from human capital (what you know), social capital (who you know), and financial capital (what you have) (Luthans, Luthans, & Luthans, 2004). Luthans, Norman, Avolio, &

Avey (2008) argue that human capital is your present knowledge, thought, skill, experience, and education while social capital covers the norms and communication networks that allow joint cooperation, and financial capital refers to your concrete assets with material value. The indicators representing psychological capital are self-efficacy, hope, optimism, and resilience (Luthans, Youssef, & Avolio, 2007). Self-efficacy is the emotion individuals feel towards themselves regarding whether they can do a job successfully or not. The belief of individuals with high self-efficacy for overcoming difficult duties is higher (Bouzari & Karatepe, 2016). Hope is the will needed for achieving goals and is a road map for reaching these goals. Hopeful individuals determine certain goals and find roads going to desired goals; hope activates these paths (Avey, Luthans, & Youssef, 2010). Optimism is a term referring to feelings and thoughts of individuals related to future expectations. Optimistic individuals are those who are more satisfied, have higher morale and expectations, have positive goals, do not give up in the face of difficulties, and can become more motivated to achieve any given task (Hırlak, Taşlıyan, & Sezer, 2017). Resilience is the ability to show a positive change and development against negative events, such as uncertainty and failure. Individuals with high resilience can cope with new and difficult conditions effectively, can generate alternative ideas and thoughts, and can adapt to new circumstances (Altunkol, 2011). These personality variables, constituting psychological capital, ensure higher job performance and higher quality service in today's competitive working environment.

Psychological capital is being examined as a concept focused on revealing and improving the potentially strong abilities and characteristics of individuals in terms of positive organizational behaviour (Seligman & Csikszentmihalyi, 2000). The concept suggests that personal negativities, such as weakness, incompetence, and defects, have a positive equivalence and can be developed (Demir & Şen Demir, 2019). Luthans' model (Psychological Capital Intervention) determined that individuals' psychological capital levels could be developed in a group training provided in almost three hours. In this benefit analysis made, the investment made on psychological capital provided a 270% increase. In this respect, psychological capital has a structure, which can be developed regarding the increase in job performance (Luthans, Avey, Avolio, Norman, & Combs, 2006).

Job Performance

Related literature suggests that psychological capital and emotional labor are important prerequisites of job performance. These two variables are emphasized as effective tools in increasing job performance (Miranda & Godwin 2018; Nasurdin, et al., 2018; Begenirbaş & Çalışkan, 2014; Hochschild, 1983/2012; Shahnawaz & Jafri, 2009; Grandey, 2000). Munc-hinsky (2003) argued that job performance is a set of actions that can measure, monitor, and evaluate employees' success (Almutairi, Moradi, Idrus, Emami, & Alanazi, 2013). Murphy (1989) defined job performance as fulfilling the responsibility of a certain task, which covers

familiar factors, such as time, speed, and efficiency (Zeb, Abdullah, Bin Othayman, & Ali, 2019). George & Jones (2005) argue that performance level is an evaluation of the results of an individual's job actions. This refers to the determination of the extent an individual shows a good or bad performance in achieving a task (Rezaee, Khoshsima, Zare Bahtash, & Sarani, 2018). Borman & Motowidlo (1993) urged that performance had two dimensions: task performance and contextual performance; Task performance includes the activities anticipated in the role that employees perform for a wage. Contextual performance refers to the tasks beyond a role's definition for employees (Nasurdin et al., 2018). When a receptionist, working at the front office department, carries out a check-in operation for a guest who wants to stay at the hotel, this action refers to task performance. On the other hand, when the same receptionist helps his/her workmates or guests beyond his/her responsibilities, this is associated with contextual performance.

Literature Review

In tourism literature, there are few studies on the relationship among the psychological capital and emotional labor in relation to job performance (Çolak, 2018; Nasurdin, et al., 2018; Kızanıklı & Çöp, 2017; Eşitti, 2015; Dönmez, 2014; Karatepe, 2014; Ünlü & Yürür, 2011). Kızanıklı & Çöp (2017) investigated the relationship between positive psychological capital and job performance perception. According to the research results collected from 280 employees working at 5 stars hotel enterprises operating in Istanbul, there was a very strong positive relationship between both the positive psychological capital and its sub-dimensions and job performance perception. In addition, while the effect levels of self-efficacy, optimism, and hope were close to each other in explaining job performance, the effect level of psychological resilience was less. In the study carried out by Nasurdin, et al. (2018) at private hospitals operating in the medical sector, the researchers reported that while the self-efficacy, hope, and optimism dimensions of psychological capital had a positive effect on job performance, the dimension of resilience did not have a positive impact. The lower effect of resilience on job performance than other components of psychological capital, which was concluded in both studies, may be explained by not providing sufficient managerial support to develop positive coping skills by granting employee-controlled authority when faced with a significant difficulty or a risk in the enterprise. What is more, an investigation was carried out by Dönmez (2014) on 602 employees in the travel industry. The investigation found that the positive psychological capital had a positive and significant relationship with affective well-being, job satisfaction, employee performance, and life satisfaction. In the study conducted by Karatepe (2014) at hotel enterprises, it was concluded that the job involvement had a mediating effect regarding the effect of the dimension of hope of the psychological capital on job performances and service improvement performances of employees.

In another study performed by Çolak (2018) on 400 cabin attendants at an airline en-

terprise, it was concluded that the emotional labor of the cabin attendants had a positive and significant effect on their performances. In the research carried out by Ünlü & Yürür on 214 employees working at tourism and health institutions operating in Yalova, the relationship among emotional labor and emotional exhaustion with task and contextual performance was examined. This study determined that the deep acting from the sub-dimensions of the emotional labor increased the intentions to show task and contextual performance. Eşitti (2015) conducted an investigation on 320 employees working at accommodation establishments operating in the province of İzmir in order to determine the effect of emotional labor on job performance. This study concluded that the emotional labor level had no effect on the job performances of employees.

In addition, studies have been conducted on this subject in different fields. The results of the study performed by Saithong-in (2016) on 102 sworn financial advisors in Thailand determined that the psychological capital dimension of resilience had a positive effect on job performance. The study carried out by Sun, Zhao, Yang, & Fan (2012) on approximately 733 nurses working at five university hospitals in Heilongjiang, China determined that higher psychological capital improved the job performance, both directly and through job engagement. In their study on 179 employees working at a large financial service institution operating in the north-eastern US, Peterson, Luthans, Avolio, Walumbwa, & Zhang (2011) determined that the psychological capital of employees changed over time. Also, in the study, it was determined that a one-unit increase (or decrease) in the psychological capital of the employees caused a one-unit increase (or decrease) in the performance of the employees. The investigation carried out by Erkuş & Afacan Fındıklı (2013) on 572 employees working in different occupational groups found a positive and significant relationship between psychological capital and job performance. In the analyses made regarding the sub-dimensions, the factors of hope and resilience were found to have positive effects on the job performance.

Begenirbaş & Çalışkan (2014) conducted research on 403 employees working in the private sector in Ankara to specify the relationship between emotional labor and job performance. In this study, it was concluded that while there was a negative relationship between surface acting and job performance, a positive and significant relationship was found among job performance and both deep acting and genuine acting. Çağlıyan, Fındık, & Doğanalp (2013) concluded in their study on 128 health personnel working at a health institution operating in Konya province that there was a negative relationship among surface acting with task performance and contextual performance. In addition, in this study, a positive relationship was determined among genuine acting and contextual performance. In their study carried out on 377 employees in the call centres of two large financial institutions operating in Australia, Goodwin, Groth, & Frenkel (2011) stated that the surface acting had a direct relationship with employee turnover and emotional burnout. Also, in this study, the relationship between surface acting and job performance was indirect through the mediation of emotional burnout.

There are also many studies discussing the relationships among psychological capital with other factors in the tourism literature. In the study conducted by Çelik & Bilginer (2018), Yücel (2019) on the relationship between the psychological capital and job satisfaction at hotel enterprises, it was concluded that there was a positive relationship with psychological capital along with its sub dimensions and job satisfaction. In the study carried out by Jung & Yoon (2015) at deluxe hotel enterprises, they determined that there was a positive relationship among the psychological capital dimensions of hope and optimism with job satisfaction. Also, in this study, it was concluded that a positive relationship among the psychological capital dimensions of hope and resilience and organizational citizenship behaviour. In the investigations performed by Kumlu & Güçlü Nergiz (2018) and Kodaş (2018), a positive and strong relationship was found between psychological capital and organizational citizenship behaviour. In the studies conducted on hotel enterprises, Demir & Şen Demir (2019) found a positive relationship between psychological capital and organizational identification. Suna & Okun (2019) determined a positive relationship between the psychological capital and personal innovativeness. Safavi & Bouzari (2019) identified a significant relationship between psychological capital and career adaptability. Kim, et al. (2017) determined that psychological capital increased the quality of job life and service improvement behaviour at hotel enterprises. In the study performed by Kodaş (2018) at hotel enterprises, a significant and negative relationship was detected between the psychological capital and job stress. In the study conducted by Lin (2013) on hotel employees, it was concluded that psychological capital had a strong and negative effect on job burnout. Paek, et al. (2015) determined that front office employees with high-level psychological capital had more job engagement.

Within the framework of the literature on emotional labor, psychological capital, and job performance presented above, the basic hypotheses of this study, aiming to determine the effect of psychological capital and emotional labor on job performance in five-star hotel enterprise employees, are as follows:

Hypothesis 1: Psychological capital has a significant and positive effect on job performance.

Hypothesis 1a: Self-efficacy has a significant and positive effect on job performance.

Hypothesis 1b: Hope has a significant and positive effect on job performance.

Hypothesis 1c: Resilience has a significant and positive effect on job performance.

Hypothesis 1d: Optimism has a significant and positive effect on job performance.

Hypothesis 2: Emotional labor has a significant and positive effect on job performance.

Hypothesis 2a: Surface acting has a significant and positive effect on job performance.

Hypothesis 2b: Deep acting has a significant and positive effect on job performance.

Hypothesis 2c: Natural acting has a significant and positive effect on job performance.

Method

The data of this study were obtained by a questionnaire with four parts. The questionnaire was conducted in June, July, August, September, and October 2019. In the first part of the questionnaire, the demographic characteristics (gender, marital status, age, education level, department, working time in the tourism sector) were included. In the second part, a psychological capital scale developed by Luthans, et al. (2007) and translated into Turkish by Erkuş & Afacan Fındıklı (2013), consisting of four dimensions (self-efficacy, hope, resilience and optimism) and 24 items, was administered. In the psychological capital scale, the self-efficacy dimension can be exemplified by the item "I feel confident while contributing to discussions about the strategy and objectives of the enterprise where I work," and the dimension of hope may be exemplified by the item "I can find many ways to achieve my goals regarding my current job." The item "I can overcome difficulties in my workplace thanks to my previous experience" may be given as an example for the dimension of resilience, and the optimism dimension may be exemplified by the item "I always try to see the glass half-full regarding my job." In the third part, a scale developed by Diefendorff, Croyle, & Gosserand (2005) and adapted into the Turkish language by Basım & Begenirbaş (2012), including three dimensions (surface acting, deep acting, natural acting) and 14 items, was administered in order to determine the emotional labor behaviours of employees. In the emotional labor scale, the item "I act to show the emotions my job requires" may be provided as an example for the surface acting dimension, and the dimension of deep acting may be exemplified by the item "I try to experience a behaviour I have to show a customer" whereas the item "the emotions I show to customers are real" may be given as an example for the natural acting dimension. Each item in the scales of psychological capital and emotional labor was designed in Likert type and rated as follows: "1=Strongly Disagree," "2=Disagree," "3=Agree in Medium Level," "4=Agree," and "5=Completely Agree." In the fourth part, a scale developed by Borman & Motowidlo (1993) and adapted into the Turkish Language by Karakurum (2005), consisting of two dimensions (contextual performance, task performance) and 24 items, was used. Regarding the job performance scale, while the task performance may be exemplified by the item "I consider my professional knowledge to be sufficient," the item "I believe that I work in harmony and cooperation with my co-workers" may be given as an example for the contextual performance dimension. Each item in the job performance scale was rated in Likert type as follows: "1=Very low," "2=Low," "3= Medium," "4= High," and "5=Very high."

The population of this study comprised of the employees of all five-star hotel enterprises operating in Antalya, an important tourism destination in Turkey. A certain sample was taken due to the limitations, such as time and cost. A cluster sampling method was used, and hotel enterprises were considered as a cluster. In this regard, the administration was executed in 16

five-star hotel enterprises operating in the centre of Antalya and the districts of Kemer and Alanya with participation of the questionnaire being voluntary for this study. The formula of $n=s^2Z\alpha^2/d^2$, recommended by Özdamar (2001) for large populations ($N=10,000$), was used in order to specify sample size. The parameters in the formula were determined as a result of previous studies and a pilot application of 35 people. In this regard, $Z_{0.05}=1.96$ and a sampling error, showing effect size, was accepted to be $d=0.1$ for standard deviation $s = 1$ significance level $\alpha = 0.05$, and a minimum sample size was calculated to be 384 after these values were written in the aforementioned formula. In this respect, considering that there might be incorrect, inaccurate, incomplete, and low reliable papers, 525 questionnaires were distributed, and 413 of them were returned with 400 of them being assessed.

The demographic characteristics of the employees were given with frequency and percentage distributions. In addition, mean and standard deviation values for the scale and its dimensions were taken. In order to determine the relationships among the psychological capital, emotional labor, and job performance, a Pearson correlation analysis was administered while the effect of psychological capital and emotional labor on job performance was specified through multiple linear regression analysis. As the data showed normal distribution in the comparison of psychological capital, emotional labor, and job performance according to the demographic characteristics of the subjects, independent samples t-test and one-way analysis of variance (one way ANOVA) were utilised for independent samples. The factor analysis was carried out for the construct validity of the scales used in the study, and Cronbach's Alpha coefficients were calculated for the reliability of these scales. SPSS for Windows program was used in the data analysis.

Results

The distribution of 400 employees according to the demographic characteristics are provided in Table 1. 37.8% of the subjects were female. 62.2% of them were male. 44.3% of them were married. 55.7% of them were single. 68.8% of them were under the age of 35, and 59.8% of them graduated from secondary education. It was found out that while 6% of the subjects worked in the front office department, 28% in food and beverage department, 17.8% in housekeeping department, 14.7% in kitchen, and 33.5% in other departments, 56.3% of them worked in the tourism sectors for 8 years and less.

Table 1
Distribution of the Subject according to Their Demographic Characteristics

Variables	Groups	n	%
Gender	Female	151	37.8
	Male	249	62.2
Marital status	Married	177	44.3
	Single	223	55.7
Age	25 and below	123	30.8
	26-35	152	38.0
	36-45	93	23.3
	46 and above	32	8.0
Education level	Primary School	49	12.2
	Secondary School	239	59.8
	Higher Education	112	28.0
	Front Office	24	6.0
Department	Food and Beverage	112	28.0
	Housekeeping	71	17.8
	Kitchen	59	14.7
	Other	134	33.5
Working Duration	3 years and below	52	13.0
	4-8 years	173	43.3
	9-13 years	123	30.8
	14 years and above	52	13.0
Total		400	100.0

Cronbach’s Alpha coefficients on the factor analysis performed regarding the constructed validity of the scales used in the research and some descriptive statistics are provided in Table 2. Bartlett’s tests and KMO values urged that the factor analysis could be applied for three scales, and the sample size was a sufficient size ($KMO > 0.70$; Bartlett’s Test; $P < 0.001$). When examining the factor analysis results, it was seen that the psychological capital scale had 4 factors explaining 62.713% of the total variance, the emotional labor scale consisted of 3 factors explaining 60.942% of the total variance, and the job performance scale included 2 factors explaining 59.610% of the total variance. Cronbach’s Alpha coefficients of the psychological capital, emotional labor, and job performance scales were calculated to be 0.878, 0.856, and 0.837, respectively. When examining the arithmetic mean values, it was a medium value in the Likert type rating above 3, for general psychological capital ($\bar{X} = 3.86$). While the “self-efficacy” was determined to be the sub-dimension with the highest mean ($\bar{X} = 4.12$), the sub-dimension of “optimism” was found to have the lowest mean value ($\bar{X} = 3.60$). The mean value of general emotional labor behaviour of the employees of the hotel enterprises was concluded to be $\bar{X} = 3.18$. While the sub-dimension of the “surface acting” had the lowest mean value ($\bar{X} = 2.95$), the sub-dimension of “natural acting” was found to have the highest mean value ($\bar{X} = 3.51$). On the other hand, the average job performance of employees was calculated to be $\bar{X} = 4.08$. However, the contextual performance levels ($\bar{X} = 4.11$) of the employees were identified to be higher than the task performance levels ($\bar{X} = 3.92$) despite being close to each other.

Table 2
Validity and Reliability Results of the Scales and Some Descriptive Statistics

Dimensions - Factors / Scales	Number of Items	Eigenvalues	Explained Variance %	Cronbach's Alpha	Mean \bar{x}	SD
Self-efficacy	6	5.313	22.139	0.824	4.12	0.75
Hope	6	3.951	16.463	0.832	4.02	0.70
Resilience	6	3.024	12.600	0.856	3.71	0.60
Optimism	6	2.763	11.511	0.811	3.60	0.58
Psychological Capital	24	-	62.713	0.878	3.86	0.58
Surface Acting	7	8.526	38.754	0.833	2.95	0.83
Deep Acting	4	3.332	15.146	0.798	3.35	0.84
Natural Acting	3	1.549	7.042	0.724	3.51	0.81
Emotional Labor	14	-	60.942	0.856	3.18	0.76
Contextual Performance	20	7.011	46.739	0.812	4.11	0.75
Task Performance	4	1.931	12.871	0.778	3.92	0.91
Job Performance	24	-	59.610	0.837	4.08	0.73

Kaiser-Meyer-Olkin (KMO) = 0.897; Bartlett's Test: $\chi^2= 3542.6$; $P<0,001$ (for psychological capital scale)

Kaiser-Meyer-Olkin (KMO) = 0.828; Bartlett's Test: $\chi^2= 3223.1$; $P<0,001$ (for emotional labor scale)

Kaiser-Meyer-Olkin (KMO) = 0.878; Bartlett's Test: $\chi^2= 3482.4$; $P<0,001$ (for job performance scale)

The Pearson correlation analysis results conducted to determine the relationships among the psychological capital, emotional labor, and job performance are provided in Table 3. When examining these results, it was observed that there were significant and positive relationships between all variables. The correlation coefficients showed that there were significant, positive, and strong relationships between general job performance and general psychological capital ($r=0.717$) and between general emotional labor and general job performance ($r=0.695$). In addition, a significant, positive and intermediate relationship was determined between general psychological capital and general emotional labor ($r=0.529$). It was also concluded that the correlations among psychological capital dimensions and job performance were close to each other but the "surface acting" from the emotional labor dimensions affected the job performance less than other dimensions ($r=0.408$).

The results of the multiple linear regression analysis related to the effect of psychological capital and emotional labor on job performance are provided in Table 4. When examining these results, it is seen that the multiple linear regression analysis is significant ($F=124.553$; $P<0.01$). What is more, the regression coefficients for psychological capital and emotional labor variables were also found to be significant ($P<0.01$). In Table 4, the determination coefficient was calculated to be $R^2=0.487$, this value shows that 48.7% of the changes in the job performance of employees were explained by the variables of psychological capital and emotional labor.

Table 3
Correlation Coefficients for Relationships between Variables

Variables	Surface Acting	Deep Acting	Natural Acting	Emotional Labor	Contextual Performance	Task Performance	Job Performance
Self-efficacy	0.231**	0.285**	0.336**	0.280**	0.493**	0.219**	0.558**
Hope	0.343**	0.397**	0.437**	0.409**	0.556**	0.343**	0.643**
Resilience	0.494**	0.507**	0.573**	0.567**	0.535**	0.520**	0.665**
Optimism	0.617**	0.569**	0.658**	0.681**	0.470**	0.641**	0.634**
Psychological Capital	0.453**	0.479**	0.553**	0.529**	0.608**	0.462**	0.717**
Surface acting	-	0.767**	0.743**	0.911**	0.397**	0.317**	0.408**
Deep acting	0.767**	-	0.807**	0.883**	0.552**	0.768**	0.646**
Natural acting	0.743**	0.807**	-	0.826**	0.552**	0.595**	0.630**
Emotional labor	0.911**	0.883**	0.826**	-	0.579**	0.876**	0.695**

**P < 0,01

Table 4
Multiple Linear Regression Analysis Results

Model	β	SE	t	P	ANOVA
Constant	1.007	0.206	4.890	0.000**	F=124.553
Psychological capital	0.712	0.054	11.522	0.000**	
Emotional labor	0.543	0.039	9.759	0.000**	P=0.000**

**P < 0.01; Dependent Variable: Job Performance; R²=0.487

The multiple linear regression model regarding the effect of the variables of psychological capital (PC) and emotional labor (EL), independent variables, on job performance (JP), the dependent variable, is as follows:

$$\text{Multiple Linear Regression Model: } JP = 1.007 + 0.712.PC + 0.543.EL$$

When this model is examined, it is seen that one unit of change in psychological capital will cause an increase of 0.712 units on job performance, and a change of one unit in emotional labor will result in an increase of 0.543 units on job performance.

The results of t-test and variance analysis, administrated for comparing psychological capital, emotional labor, and job performance according to the demographic characteristics of the subjects, are provided in Table 5. When examining these results, it is observed that psychological capital, emotional labor, and job performance did not show a significant difference according to gender, marital status, age, and education level (P>0.05). According to Table 5, the psychological capital levels of the employees showed a significant difference in accordance with their departments (P<0.05). When considering the arithmetic mean values, the psychological capital levels of the employees working in the kitchen department (\bar{X} =3.69) were determined to be lower compared to other departments. On the other hand, it was detected that the emotional labor behaviours of employees differed significantly according

to department and working durations ($P < 0.05$). The mean values showed that the group with the highest emotional labor behaviour was the front office department ($\bar{X} = 3.40$) while the groups with the lowest emotional labor behaviour were housekeeping ($\bar{X} = 3.05$) and kitchen ($\bar{X} = 2.95$) departments. It was also found out that the employees working in the tourism sector for 0-3 years had the highest emotional labor behaviour ($\bar{X} = 3.48$) while those working in the tourism sector for 14 and more years showed the lowest emotional labor behaviour ($\bar{X} = 2.92$).

Table 5

Comparison of the Psychological Capital, Emotional Labor and Job Performance by Demographic Characteristics of the Subjects

Variables	Groups	Psychological capital		Emotional labor		Job performance	
		\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
Gender	Female	3.79	0.55	3.12	0.74	4.01	0.71
	Male	3.89	0.52	3.22	0.74	4.11	0.68
	P	0.076		0.186		0.150	
Marital	Married	3.85	0.57	3.17	0.77	4.07	0.71
	Single	3.86	0.49	3.20	0.70	4.08	0.67
Status	P	0.921		0.767		0.933	
Age	25 and below	3.89	0.47	3.20	0.67	4.05	0.63
	26-35	3.80	0.53	3.24	0.76	4.03	0.69
	36-45	3.82	0.61	3.34	0.71	4.12	0.76
	46 and above	4.02	0.54	3.14	0.93	4.22	0.72
	P	0.152		0.204		0.442	
Education	Primary School	3.74	0.52	3.28	0.70	4.01	0.67
	Secondary School	3.87	0.55	3.19	0.74	4.12	0.69
Level	P	0.315		0.457		0.277	
Department	Front Office	3.90 ^a	0.48	3.40 ^a	0.70	3.96	0.54
	Food and Beverage	3.85 ^a	0.51	3.24 ^b	0.61	4.07	0.60
	Housekeeping	3.86 ^a	0.65	3.05 ^c	0.83	4.01	0.88
	Kitchen	3.69 ^b	0.59	2.95 ^c	0.76	3.91	0.69
	Other	3.96 ^a	0.46	3.28 ^b	0.75	4.20	0.67
	P	0.024*		0.018*		0.079	
Working Duration	3 years and less	3.84	0.44	3.48 ^a	0.61	4.14	0.63
	4-8 years	3.82	0.53	3.21 ^b	0.69	4.00	0.65
	9-13 years	3.92	0.47	3.15 ^b	0.77	4.15	0.64
	14 years and above	3.82	0.75	2.92 ^c	0.82	4.05	0.95
	P	0.425		0.011*		0.299	

* $P < 0.05$ a,b,c: Different letters within columns show statistical difference between groups

Discussion and Conclusion

It was aimed to determine the effect of psychological capital and emotional labor on the job performance in this study, to which 400 personnel employed by 16 five-star hotel enterprises operating in the centre of Antalya and the districts of Kemer and Alanya participated.

In this research, it has been concluded that general psychological capital levels of the employees have been positive above medium level, and while the most positive dimension was self-efficacy, the least positive dimension was optimism. Similarly, there are many studies urging that the psychological capital levels of hotel employees are high (Suna & Okun, 2019; Yücel, 2019; Çelik & Bilginer, 2018; Kumlu & Güçlü Nergiz, 2018; Yorulmaz & Yavan, 2018; Kaya, Atabay, & Alamur, 2017). As the employees show higher job performance when self-efficacy, the most positive dimension in the hotel enterprises, increases (Luthans & Yousseff, 2007), employing those with high self-efficacy is needed to increase job performance. As the employees with high self-efficacy are persistent and success-oriented against the difficulties they face (Shahnawaz & Jafri, 2009) and have higher self-belief in fulfilling a job successfully (Bouzari & Karatepe, 2016), these features increase the ambition and determination of these employees and provide higher performance formation (Kurt, 2012). As optimism, the most negative dimension at the hotel enterprises compared to other dimensions, can be learned and developed just like helplessness, subjecting this skill in training programs will increase the performance of employees (Seligman, 2011).

In the research, it was found that the general emotional labor behaviours of the employees were at intermediate level, and while the surface acting was determined to be the dimension with most negative views, the most positive dimension was identified to be natural acting. In a similar vein, the studies by Karakaş (2017), Demirel (2015), and Lu et al. (2013) determined that the emotional labor behaviours of employees at hotel enterprises were in the intermediate level. Wen, Huang, & Hou (2019) concluded that the emotional labor behaviour levels of hotel employees were low. Acting mostly by genuine acting in hotel enterprises shows that the employees usually do not need to pretend his / her behaviour at work and can display the emotions that s/he really feels. In other words, there is no difference between the emotions a hotel enterprise employee feels and the emotions his/her job requires. This will decrease the stress level, which is one of the negative situations that a hotel employee is likely to experience (Grandey, 2000). Therefore, the job performance of an employee providing more quality service will increase (Begenirbaş & Çalışkan, 2014). The reason of showing less surface acting may be due to the fact that the employees changing the emotions they actually feel to express the emotions desired by the hotel enterprise requires more intensive mental effort and the negative events that the employee may experience in psychological respect.

As a result of the correlation analysis conducted to determine the relationship between emotional labor and job performance, it was identified that there was a significant and positive relationship between emotional labor and job performance. The conclusion obtained in this study shows that as emotional labor increases, job performance will increase highly. In this regard, it can be said that emotional labor is the determinant factor of job performance. Similarly, in the studies conducted by Giardini & Frese (2006) and Tsai (2001), emotional labor has been described as one of the fundamental determiners of a series of organizational

conclusions covering guest relationships and employee performance. The emotional labor of employees was argued to be an important factor for a successful job performance by Robbins & Judge (2013). The findings of some studies on the relationship between emotional labor and job performance (Çolak, 2018; Ünlü & Yürür, 2011) confirm this result achieved in this study. In the research conducted by Çolak (2018) at an airline enterprise, it was concluded that the emotional labor competences of the cabin attendants affected their performances positively. Moreover, the investigation carried out by Ünlü & Yürür (2011) in tourism and health institutions suggested that the deep acting, a sub-dimension of emotional labor, increased the intention to show job performance. On the other hand, in the study conducted by Eşitti (2015) at accommodation enterprises, it was identified that emotional labor level had no effect on the job performance of employees. In this study, it was also determined that surface acting, from the sub-dimensions of the emotional labor, affected job performance less (positively) compared to deep acting and natural acting. It is possible to explain this result with both biological and psychological pressure created by surface acting on employees. As a matter of fact, Grandey (2000) also stated that surface acting displayed may have an effect on decreasing job performance (Grandey, 2000). Although it is urged in the related literature that emotional labor is an important prerequisite for job performance and this variable can be used as an effective tool in increasing job performance (Çolak, 2018; Miranda & Godwin 2018; Robbins & Judge, 2013; Hochschild, 1983/2012; Ünlü & Yürür, 2011; Giardini & Frese, 2006; Tsai 2001; Grandey, 2000), it is also discussed that employees may have emotional disharmony or emotional exhaustion after a while if they show an intense effort to act in accordance with the emotional behaviour rules required by the job by displaying ostensible emotional behaviours that are disconnected from their real feelings during work processes or by suppressing their real feelings. It is emphasized that showing artificial feelings in relationships with customers, in other words, masking his/her own feelings, may prevent an employee from acting according to his/her own feelings at work (Bolton, 2005). This may be indicated as a negative aspect of emotional labor for employees. In this regard, it has been revealed by a large number of research findings that job performance is affected by negative situations, such as increase in job stress, burnout level, and leave of employment intention (Akdu & Akdu, 2016; Çelik & Yıldız, 2016; Yücebalkan & Karasakal, 2016; Eroğlu 2014; Scott & Barnes, 2011; Oral & Köse, 2011; Furnell 2008; Grandey, 2003; Brotheridge & Grandey, 2002; Pugliesi, 1999).

Multiple linear regression analysis results of the study showed that psychological capital is more effective on the job performance than emotional labor. The lower effect of emotional labor on job performance than psychological capital can be explained by the fact that while the job performance of employees is affected positively when they intentionally display positive emotions towards customers (Goodwin, et al., 2011; Grandey, Fisk, Mattila, Jansen, & Sideman, 2005), their job performance decreases, (Goodwin, et al., 2011; Tice & Brats-

lavsky, 2000) and their job stress, burnout, and leave of employment intention increase when they have to show the actions instructed by enterprises to show for customers, by acting or masking their real feelings (Akdu & Akdu, 2016; Çelik & Yıldız, 2016; Scott & Barnes, 2011; Furnell, 2008; Grandey, 2003; Pugliesi, 1999). In line with this finding, increasing the psychological capital level of employees is necessary to encourage job performance increase. Firstly, hotel managers may consider self-efficacy, hope, optimism, and resilience, which are components of psychological capital, as these affect the job performance positively in their recruitment process. They may prefer individuals wishing to work in hotel enterprises and who have higher scores of psychological capital components, which is consistent with Rich (1999). Human resources departments can assess the psychological capital level of job candidates as part of standard written tests (Hur et al., 2016). Other than that, strategies to develop these psychological capacities can be suggested. In order to develop self-efficacy, training programs and indirect modelling, in which participants can observe and model others in their respective fields, can be used (Luthans, et al., 2004). Observing others who have become successful with sustained effort and seeing that it takes effort for success will urge the participants to think that they have the capacity of becoming successful (Nasurdin, et al., 2018). As hotel employees face the difficulty of attaching and meeting the requests of guests, they should attend training programs designed by hotel enterprises to develop their competences, knowledge, skills, and abilities. In this regard, their self-efficacy will increase, and this increased self-efficacy will instil confidence in employees in their abilities to overcome difficulties and negative conditions, achieve goals, and maintain a positive state of mind (Wang, Mei, & Zhu, 2017) and will finally result in better performance. What is more, as the successful experiences of employees increase their self-efficacy (Bandura, 1997), it may be suggested to divide difficult and complex tasks into smaller pieces in order to increase the experience of managers and employees and then to teach them one by one (Luthans, et al., 2006). When employees become successful in dealing with such little pieces, they will feel the required self-efficacy in themselves, and this positive result will reflect in their job performance. As the physiological and psychological well-being of an individual affects his/her self-efficacy, health programs, aid packages, and a positive and supportive organizational culture provided by hotel enterprises will affect the self-efficacy of employees positively. Setting specific and challenging goals in order to increase hope, developing emergency planning in order to achieve goals, and redefining goals, when necessary, in order to avoid false hopes may help hotel employees to enrich their hope level. (Luthans, et al., 2006). Another strategy to enrich the hope level of hotel employees is to include them in decision processes by providing them with more autonomy and to apply an effective training and award system. Based on the recommendation made by Luthans, et al. (2008), optimism may be reinforced with mentorship and training programs in which the following issues will be learnt: (a) diagnose and identify the beliefs that restrain you when faced with difficulties, (b) evaluate these beliefs, and (c) replace these beliefs with more constructive ones (Nasurdin, et al., 2018). Resilience may be

supported by establishing a professional network providing hotel employees with easy guidance and social support when necessary (Jackson, Firtko, & Edenborough, 2007). Another strategy urged by Hodges, Keeley, & Grier (2005) argues that managers will increase the resilience level of their employees when they acknowledge the achievements of their employees and appreciate them in this regard.

This study has also detected that there is a positive and intermediate relationship between the emotional labor and the psychological capital. The theory of positive emotions confirms this result. In the theory of positive emotions, in which the relationship between the emotional labor and the psychological capital is established (Fredrickson, 2001), it has been observed that employees with higher psychological capital are working at more appropriate mental and emotional levels in an organisational environment (Fredrickson & Losada, 2005). This may suggest that the dimensions of psychological capital may affect the emotions of employees in the job environment. In a similar vein, the affective events theory (Weiss & Cropanzano, 1996) argues that the effects created by past events on the psychological events (psychological capital dimensions) of individuals cause some emotional reactions in working life. In addition, the conclusion obtained in this study in this respect is in accordance with the results achieved in prior studies conducted on emotional labor and psychological capital (Fredrickson, 2001; Fredrickson & Losada, 2005; Hur et al., 2016). When considering the positive results related to emotional labor, such as high performance, high service quality, and high customer satisfaction in hotel enterprises, it is of importance to provide employees, serving as frontline tourism professionals, with the required psychological capital.

It has been determined in this study that psychological capital, emotional labor and job performance did not differ significantly according to gender, marital status, age, and education level. It has been concluded that while the psychological capital levels of the employees have differed significantly according to the departments, the emotional labor acts have differed significantly in line with the departments and working durations. In this regard, the psychological capital levels of employees working in the kitchen department were found to be lower compared to other employees working in other departments. Focusing on revealing and developing the present abilities and characteristics of the employees working in the kitchen department by hotel management (Seligman & Csikszentmihalyi, 2000) will contribute to increasing the psychological capital of employees. In addition, being aware of the fact that the employees' personal negativities, such as weakness, incompetence, and defects, have a positive equivalence and can be developed (Demir & Şen Demir, 2019); thus, acting in line with this awareness will contribute to increasing the psychological capital of employees. What is more, it has been determined that employees in the front office department show higher emotional labor behaviour and the level of displaying emotional labor behaviour decreases as the working time in the sector increases. As the employees in the front office department are in communication with guests more during their reservation, check-in, accommodation, and

check-out processes, they can be said to show higher emotional labor behaviour to fulfil their job properly. It can be stated that as working duration increases, the employees, strengthening their position in the hotel enterprise thanks to the professional experience and competence they have gained, show less emotional labor behaviour.

When considering the conclusions obtained in the study, it is seen that psychological capital is of importance in carrying the performance to a superior level in hotel enterprises. According to the conclusions of the research, emotional labor is an important prerequisite for job performance. Many studies in the related literature confirm this conclusion (Çolak, 2018; Miranda & Godwin 2018; Robbins & Judge, 2013; Hochschild, 1983/2012; Ünlü & Yürür, 2011; Giardini & Frese, 2006; Tsai 2001; Grandey, 2000). In addition, it should not be overlooked that when employees show an intense effort to display emotions in accordance with the emotion display rules determined by the enterprise, they may have emotional disharmony or emotional exhaustion after a while. This may be indicated as a negative aspect of emotional labor for employees. In this regard, it has been supported by a large number of research findings that job performance is affected by negative situations, such as increase in job stress, burnout level, and leave of employment intention (Akdu & Akdu, 2016; Çelik & Yıldız, 2016; Yücebalkan & Karasakal, 2016; Eroğlu 2014; Scott & Barnes, 2011; Oral & Köse, 2011; Furnell 2008; Grandey, 2003; Brotheridge & Grandey, 2002; Pugliesi, 1999).

The result of this study should be interpreted based on three limitations. Firstly, the use of self-report measures of job performance may result in a bias regarding conclusions. To minimize this potential issue, future researchers (such as managers and colleagues) can collect job performance data from more than one source. Secondly, this research can be generalized for the enterprises in the service sector and is limited to an administration to be carried out in 5-star hotel enterprises operating in Antalya Province. Future studies may be conducted by using the enterprises in different sectors in their sample groups. Thirdly, in this investigation, the effect of the emotional labor and psychological capital on job performance has been studied. Investigation of the relationships among these two variables and terms such as organizational health, organizational fit, organizational climate, conflict management, business profitability and efficiency will both contribute to the related literature and will become an important data source for those concerned.

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The Impact of Going Public on Firm-Level Employment: Evidence from IPO Listed Firms on BIST*

Ahmet Usta¹

Abstract

This paper investigates how issuing initial public offerings (IPOs) affects corporate decisions in a firm. We focus on the impacts of capital raised at IPO event dates on subsequent employment growth in IPO listed firms that went public between 2000 and 2016 in Borsa Istanbul (BIST). We find that accessing the public equity market has a positive impact on employment growth through accessing the debt market. As their borrowing abilities improve, firms tend to increase their expenditures on physical capital. In turn, firms need to hire more employees to run their operations. Moreover, we find that reliance on external financing above the median degree or being younger than the median sample age positively and significantly affect employment growth during IPO and in the post-IPO event years. Finally, we calculate the effects of marginal changes in primary capital on firms' assets, cash holdings, capital expenditure, personnel expenditure, and debt, and find that the firms tend to spend an incremental amount of externally generated funds via IPO mostly on physical capital expenditures.

Keywords

IPOs, employment growth, emerging market, corporate decisions

Introduction

What is the impact of going public on firm-level employment growth? Through what channel(s) does going public have an impact on the employment level in a firm? During the life of a company, the decision on issuing initial public offerings¹ (IPOs) can be counted as

1 The stage of an IPO has effects on corporate governance, financial constraints, information environment, and ownership and capital structure of a firm. To identify the main motivation for going public, literature follows different approaches, including surveys with managers, prospectus statements, and accounting information (Andriansyah & Messinis, 2016).

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one of the most important events. Therefore, the interest of academicians² and policymakers³ on IPOs has been long-lasting. Similarly, the dynamics and functioning of labor markets are one of the most important prominent and ageless topics in economics. These issues have received great attention because human capital is an important source for the value of a firm (Zingales, 2000). Although the current literature has research on the effects of having access to the public equity market on employment growth in a firm operating in advanced economies, we have no evidence on the same issue in an emerging economy context. An empirical analysis of whether going public has an impact on employment growth is necessary, especially for policymakers in emerging economies that suffer from unemployment.

In this paper, we fill this gap on this topic and report several facts about firms issuing IPOs in Turkey by using microdata from firms listed on Borsa Istanbul (BIST). In particular, we empirically examine the employment dynamics of IPO firms listed on BIST and analyze how going public affects corporate actions, including firm-level employment growth. We also investigate channels via which this influence occurs. Lastly, we document the use of funds raised on the IPO date by using balance sheet items of IPO firms.

The main empirical results in this paper are as follows. Under various specifications, IPOs make a positive contribution to employment growth at the IPO year and the three years afterward. Furthermore, we find that small firms have higher employment growth. Moreover, firms aged below the median age of the sample have positive and statistically significant employment growth between the IPO event year and the succeeding year. These results highlight the growth-oriented motive of small and young firms. Additionally, firms with greater dependence on external equity financing experience higher employment growth in the first post-IPO year. The results of the regressions conducted to explore whether the relaxation of financial constraints have an impact on employment growth suggest that primary proceeds or the reduction in the relative cost of credit has mostly statistically insignificant impact on employment growth. Our results strongly suggest that firms that experience an increase in debt to assets ratio and increase in capital expenditures have positive employment growth during IPO year and subsequent years after IPO. These results suggest that access to external capital increases employment growth triggered by rises in capital expenditures by debt-financing. Finally, we calculate the effect of one-unit change in capital raised at IPO on balance sheet

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- 2 The literature sheds light on the heterogenous effects of going public across different stock markets. Country-specific empirical studies including the U.S. (Bharat & Kini, 1994), Italy (Carpenter & Rondi, 2006; Pagano et al., 1998), Japan (Takahashi & Yamada, 2015), Indonesia (Andriansyah & Messinis, 2016), and Sweden (Baghai & Silva, 2019) consider the post-IPO performance of firms.
 - 3 Policymakers enact laws to attract more firms to list on exchange markets because they view access to the external equity market as important for firm growth. For example, on the heels of the financial crisis, to encourage startups and support small businesses, Barack Obama, former president of the U.S., signed the Jumpstart Our Business Startups (JOBS) Act in 2012. According to this law, small businesses and high-growth oriented firms are expected to receive higher cash flows through IPO, which leads them to grow faster and hire more workers.

items of firms and find that the injection of fresh funds through IPO increases capital expenditures, debt levels, assets, and cash holdings. However, the effect on personnel expenditures is negligible.

The remainder of this paper consists of literature review and hypotheses, some facts about unemployment in Turkey, data and sample, results, and a conclusion.

A Summary of Literature and Hypotheses

This part surveys the relevant literature and establishes the main hypotheses of the analyses. This paper is related to several strands of the literature. First, it is related to the IPO literature that empirically considers the associations between issuing offerings and firm characteristics. Extant literature on IPO suggests that there are associations between issuing offerings and firms' financial constraints (Carpenter & Rondi, 2006; Pagano, Panetta, & Zingales, 1998; Subrahmanyam & Titman, 1999), firms' innovation activities (Bernstein, 2015), and firms' human capital (Carter, Dark, & Singh, 1998; Chemmanur & Paeglis, 2005; Dong, Michel, & Pandes, 2011; Borisov, Ellul, & Sevilir, 2015; Liu & Arthurs, 2019; Baghai & Silva, 2019; Babina, Ouimet, & Zurutskie, 2020).

This study contributes to the empirical literature on the nexus between corporate decisions and human capital. The literature has considered the role of human capital in IPO listed firms in various dimensions. For example, Carter et al. (1998) and Dong et al. (2011) emphasize the role of underwriters' reputation on the long-run performance of IPO stocks and find that good reputation of underwriter has a positive impact on the performance of IPO firms. Bernstein (2015) investigates the role of skilled inventors and finds that the technology firms that went public experience a decrease in the number of skilled workers following the IPO as the quality of innovation declines because of agency problems between managers and shareholders. The main issue is that shareholders blame managers when the innovation fails, causing the managers to lose their jobs. Such concern for one's career discourages the manager from investing in innovations. Baghai & Silva (2019) consider the effect of going public on the composition of the work force and find that access to public equity has a positive effect on professionalism in the recruitment process, wages, and human capital.

The particular interest of the most recent empirical works by Borisov et al. (2015) and Babina et al. (2020) is the change in firm-level employment level subsequent to going public. Both papers show that IPO firms, on average, experience positive employment growth in their post-IPO period. Borisov et al. (2015) examines employment dynamics of a sample of 3,654 U.S. firms and find that the average firm in the sample experiences employment growth by 39% during the IPO year. Their findings are consistent with the ability of a firm to hire more employees after the influx of fresh capital. Babina et al. (2020), with a sample of 3,400

U.S. IPO firms, find that the average annual employment growth increases by 22% over each of the three years following the IPO event year.

According to the above results, the first hypothesis can be established as follows:

Hypothesis 1: There is an association between going public and employment growth for IPO firms.

If **Hypothesis 1** holds true, we should observe employment growth after the IPO event year. When testing Hypothesis 1, we use number of employees in each firm during the period before IPO and in the subsequent three years after the IPO. Then, we calculate the employment growth in the respective year relative to pre-IPO event year. More detailed information about which variable is used to test which hypothesis is provided in subsection of Variables. Moreover, all variables that are used in testing the hypotheses are explained in Table A.1.

To understand the employment dynamics in more detail, the recent literature investigates the roles of firm size and firm age. While Moscarini & Postel-Vinay (2012) highlight the importance of firm size, Fort, Haltiwanger, Jarmin, & Miranda (2013), Colciago, Lindenthal, & Trigari (2019), and Pugsley & Şahin (2019) consider firm age as the first order determinant of employment dynamics of a firm. Haltiwanger, Jarmin, & Miranda (2013) empirically analyze the relationship between employment growth, firm size, and firm age by using the U.S. business sector data over the period between 1992 and 2005. They find that small firms contribute more to job creation. However, when they control for firm age, the inverse relationship between firm size and job growth disappears. Heyman, Norback, & Persson (2018) examine job creation and productivity dynamics by using Swedish business sector data over the period 1996 to 2013. Their findings suggest that small and young firms create most new jobs. They also find that large and mature firms create more productivity gains. Motivated by these studies, this paper takes age and size characteristics of IPO firms into account while testing **Hypothesis 1** and asserts the following second hypothesis:

Hypothesis 2: Age and size characteristics of firms matter for the degree of association in **Hypothesis 1**.

Hypothesis 2 is supported if we observe that employment dynamics vary with respect to age or size of the firm. We create a dummy variable to indicate whether a firm is young or mature. If the firm's age is below the median age of the sample, the dummy variable takes a value of 1. If its age is above the median age of the sample, the dummy variable takes a value of 0. While testing Hypothesis 2, we control the size effect by using different size measures, including sales and number of employees with different cut-offs.

Second, this study is related to the studies that assess the role of the IPO in relaxing the financial constraints of a firm. Pagano, et al. (1998) empirically analyze the impacts of IPOs on the financial constraints and investment policy of a firm. Their findings suggest that the

external equity gained through an IPO reduces leverage and cost of credit. According to Kim (1999), an IPO can relieve the financial constraints of a firm in several ways. The issuance of external equity by accessing the public equity market can allow a firm to reach external financing opportunities, to improve its bargaining power with banks, and to increase the liquidity of its stocks. Therefore, we can put forward the following hypothesis:

Hypothesis 3: Having access to the public equity market relieves the financial constraints of a firm, which can affect employment growth.

If **Hypothesis 3** holds true, we expect to have evidence that relaxation of financial constraints has an impact on employment growth. We use capital raised at IPO date and reduction in cost of debt to proxy for the relaxation. We also assess the role of accessing the debt- and equity-market in firm level employment.

Third, this study is related to studies that analyze use of externally generated funds in corporate decisions. Fresh equity gained at IPO has an impact on the use of funds. The intended use of funds raised at IPO⁴ affect the firm's performance in the post-IPO period. This idea indicates that there is an empirical link between funds raised at IPO and corporate decisions (Kim & Weisbach, 2008; Erel, Julio, Kim, & Weisbach, 2012; Calomiris, Larrain, & Schmukler, 2018). In their pioneering work, Kim & Weisbach (2008) analyze how the money created in the offering is used by the firms that raise it. To do so, they consider changes in assets, capital expenditures, acquisitions, inventory, R&D, cash holdings, and the long-term debt using 17,226 IPOs and 13,142 SEOs from 38 countries between 1990 and 2003. Their estimates indicate that the largest portion of money created in the IPO is dedicated to funding R&D and capital expenditures. Moreover, firms also hold a significant part of this money in the form of cash. So, it is possible to test the following hypothesis:

Hypothesis 4: Use of external funds generated through accessing the public equity market would indicate the main motive(s) of the IPO.

Hypothesis 4 is supported by our results if we observe a significant use of external funds on a particular balance sheet item(s). To understand the main motive(s) of the IPO, we follow methodology by Kim & Weisbach (2008) and calculate how much of a one-unit increase in capital raised at IPO is spent on which balance sheet item the most.

This study adds to the previous literature in several ways. First, to the best of our knowledge, this paper is the first to analyze the association between going public and employment growth in an emerging economy context. Our sample consists of IPO firms listed on BIST,

4 Kim & Weisbach (2008) list potential motives for offerings as follows: 1) Finance investments; 2) Wealth transfer from new shareholders to existing ones; 3) Liquidity for both insiders and the firm. According to Andriansyah & Messinis (2016), the intended use of proceeds is classified under the following five categories: 1) Fixed asset investment; 2) Working capital financing; 3) Investment in shares of stocks; 4) Debt repayments; 5) Secondary shares.

Turkey. Second, we extend the analysis of Borisov, et al. (2015) and Babina, et al. (2020) by investigating the fraction of funds raised at IPO on personnel expenditures. To explore how much of the externally generated funds are used for employees, we follow the methodology proposed by Kim & Weisbach (2008). The analysis of the use of funds regarding accounting information enriches our results and informs us about mechanisms through which IPOs have an impact on employment level. Third, we differ from Borisov, et al. (2015) and Babina, et al. (2020) by considering the role of firm characteristics (age and size) of IPO firms. By doing so, we investigate the job creation⁵ performance of IPO firms relative to their age and size characteristics. The results are sensitive to different definitions of these two firm characteristics⁶. We use sales and number of employees as size measures. For the age measure, we consider median age of the sample as cut-off.

Some Facts about Unemployment in Turkey

This part provides brief information about the issue of unemployment and job creation policies in Turkey. Moreover, this section addresses some socioeconomic consequences of being unemployed.

Turkey owes its high growth rates at the beginning of the 2000s to foreign capital flows. However, the credit-led growth strategy was accompanied by high unemployment rates. Turkey experienced a jobless-growth period in the post-2001 era (Yeldan & Ünüvar, 2015). On average, the total (youth) unemployment rate in Turkey was around 10% (18%) between 2000 and 2020, according to World Bank data. In the same period, the total unemployment rate for people aged 15 and older in Turkey was almost twice as high as Organization for Economic Co-operation Development (OECD) economies and the World. The youth (aged between 15 and 24) unemployment rate in Turkey exceeded that of the OECD economies and the World, on average, by 4% in the last 20 years. After 2012, both total and youth unemployment in Turkey has increased. Over the last ten years, the rate of total (youth) unemployment reached its peak in 2019 with a rate of 13.5% (23.7%). The wedge between the youth and total unemployment rates in Turkey has continuously expanded between 2012 and 2020. These facts indicate that job creation policies in Turkey were not sufficient to strengthen labor market conditions, especially for the young population.

5 There are voluminous attempts to identify the role of firm age and size in job creation and destruction (Colciago, et al., 2019; Fort, et al., 2013; Hopenhayn, 1992; Jovanovic, 1982; Moscarini & Postel-Vinay, 2012; Pugsley & Şahin, 2019). Recent research by Özlale and Polat (2019) documents a comprehensive summary on the impact of age and size on employment growth, both in advanced and developing economies.

6 According to Moscarini and Postel-Vinay (2012) and Colciago, et al. (2019) a firm is small/medium/large if it has less than 50 employees/between 50 and 999 employees/more than 1000 employees. Other studies, such as Fort, et al. (2013) and Pugsley and Şahin (2019), follow different size cut-offs. They define small/medium/large firms with less than 20 employees/between 20 and 499 employees/more than 500 employees. The age definition in Fort, et al. (2013) is as follows: a young (mature) firm is aged between 0 and 4 (more than 5+). However, Pugsley and Şahin (2019) apply higher age cut-offs, i.e., young (mature) firms are aged between 0 and 10 (more than 11).

The high unemployment rate, especially for the youth portion, has been a severe problem in Turkey. The social consequences⁷ of being unemployed cannot be thought of separately from the functioning of the overall economy. According to Karaçimen (2014), the significant rise in consumer debt in Turkey is attributed to developments in the labor market, including rising unemployment and insecure jobs. To sustain their life, households suffering from unemployment become more dependent on borrowing through credit. So, their debt level increases. Akdoğan et al. (2019) highlight the importance of having secured jobs for households to reach housing credit, which affects home ownership rates.

The meagre performance of employment growth leads authorized institutions to support employers and firms by introducing incentives. To create additional employment, the Turkish Employment Agency (İŞKUR) provides wage subsidies, premiums, and tax support to employers who meet certain conditions. Together, İŞKUR and the Social Security Institution, both of which are funded by the unemployment insurance fund, play a major role in conducting such incentives. Moreover, the Capital Markets Board of Turkey, BIST, the Union of Chambers and Commodity Exchanges of Turkey, and the Turkish Capital Markets Association agreed to sign a protocol at the end of 2008 to contribute to firms to benefit from the capital market opportunities. The proposed rules were designed to encourage more IPOs, which, in turn, provide funds for firms and increase their employment levels. However, an academic evaluation of the consequences of this protocol is still missing.

Data

This paper aims to investigate the impact of accessing the public equity market on firm-level employment growth and the channels through which this influence occurs. This part introduces the sample and variable construction with data sources.

Sample

In this study, we consider both time series and cross-sectional data about the corporate characteristics of IPO listed firms on BIST. Regarding the classes of equity markets, our sample consists of firms traded on BIST Star (formerly National Market), BIST Main (formerly National Market), and the Submarket. To obtain information on firm-level data, we utilize several sources including financial annual reports and related footnotes retrieved from investor relations, BIST, and Public Disclosure Platform. In order to make as many observations as possible, we use data sources going back to 2000. Since we are interested in the developments in selected balance sheet items between the end of the year before the IPO event and the subsequent three years after the IPO, our sample includes IPOs that were issued up to

7 The possible costs of unemployment are as follows: debt, poverty, homelessness and housing stress, criminal activity, drug use, increased social exclusion (Attar, 2013)

2016. Using these restrictions, we have 155 firms with IPO filings between 2000 and 2016.

Variables

To measure how employment level evolves around IPO event year, we consider the pre- and post-IPO event windows. Assuming that an IPO-filing took place at year t , we require fiscal year-end observations of time $t-1$, $t+1$, $t+2$, and $t+3$. This window applies to all variables used in this paper if the relevant observations are available.

Our main variable of interest is the fiscal year-end employment levels in firms around IPO event year. We collect annual employment level data from financial reports by hand.

To investigate channels that establish a link between employment decision and going public, we need firm-specific characteristics. We follow Kim and Weisbach (2008) and Borisov et al. (2015) for these characteristics and consider age, net sales, expenditures made on capital and personnel, total assets, debt issuances, cash holdings, funds raised at IPO and cash flows generated from operating, investment, and financing activities. Annual financial reports are used to gather these characteristics. Table A.1 in the Appendix explains the construction of variables with their definitions used in this study.

Descriptive Statistics

Table 1 displays the distribution of offerings, the total amount of primary capital, and net sales year by year. To calculate the total amount of funds raised on IPO date, we multiply share price and stocks on IPO trading day. While the total amount of net sales is around 84 billion TL, the total amount of capital raised on IPO date is around 10 billion TL over the sample horizon.

Table 1
Number of IPOs, the Amount of Proceeds, and Net Sales (millions TL)

Year	Number of IPOs	Share %	Proceeds at IPOs	Net Sales
2000	31	20	476.56	2,613.88
2001	-	-	-	-
2002	4	2.5	32.18	96.15
2003	2	1.3	15.71	25.22
2004	11	7	310.84	3,690.53
2005	6	3.8	723.12	1,762.29
2006	10	6.4	676.82	6,833.34
2007	7	4.5	2,886.26	32,957.71
2008	2	1.3	841.03	10,476.64
2009	1	0.6	65.91	
2010	22	15	1,721.35	5,501.21
2011	23	15	1,511.80	11,567.79
2012	15	10	316.41	3,410.69
2013	9	6	369.46	3,452.31
2014	9	6	224.40	1,315.54
2015	2	1.3	6.17	68.85
2016	1	0.6	4.43	190.88
Total	155		10,182.46	83,963.02

This table reports the yearly distribution of IPOs in BIST between 2000 and 2016. The third column reports the share of IPOs. The fourth and fifth columns display total amount of capital raised at IPO and net sales in the given year, respectively.

Table 2 reports the summary statistics for main variables including firm characteristics around IPO event year. An IPO filing firm, on average, is around 16 years old, with a median age of 13. The average number of employee that a typical firm has is around 1,354, both in the pre-IPO year and during the IPO year. However, the employment growth rate increases by 4.5% (30%) in the first post-IPO year (in the third post-IPO year) relative to pre-IPO year. Over 17 years, on average, a firm has 65.7 million TL in primary capital. There is an increase in employment growth relative to average number of employees in the pre-IPO year. An IPO firm has 524 million TL and 694 million TL net sales in the pre-IPO and IPO year, respectively. Both assets and capital expenditures display increasing trajectories, while the latter one has a higher growth rate. Data on capital expenditures show that an IPO firm, on average, spent 92 million TL on capital during the IPO year. However, this amount increases to 153 million TL and 242 million TL in the following first and second post-IPO years, respectively. Capital expenditures, by the end of second post-IPO year, more than double.

Table 2
Summary Statistics on Main Variables

Variables	Time	Mean	Median	Obs.
Age	IPO	16.01	12.99	155
Primary Capital (Millions TL)	IPO	65.69	12.19	155
	pre-IPO	1,354.3	166	133
Employment	IPO	1,354.8	193	149
	post-IPO (1)	1,415	192	149
	post-IPO (2)	1,499	207	146
	pre-IPO	523.66	49.71	113
Sales (Millions TL)	IPO	693.91	58.51	121
	post-IPO (1)	794.96	76.96	122
	post-IPO (2)	765.76	90.18	123
	pre-IPO	926.65	71.74	155
Assets (Millions TL)	IPO	1,078.81	89.3	155
	post-IPO (1)	1,310.43	124.46	155
	post-IPO (2)	1,547.87	134.70	153
	pre-IPO	56.44	9.45	149
Capital Expenditures (Millions TL)	IPO	92.30	8.42	154
	post-IPO (1)	153.44	14.81	154
	post-IPO (2)	241.97	17.46	149

This table reports selected summary statistics for main variables used in this study. Age is the difference between IPO event year and founding year of a firm. Primary Capital is the capital raised at IPO event year. Employment is the number of employees of firms in the relevant year. Sales is the total amount of year-end annual sales of a firm in the relevant year. Assets is the total amount of assets that firms have in the relevant year. Capital Expenditures is the total amount of expenditures made by the firms in the relevant year. In the second column, pre-IPO is the year before the IPO event year, IPO is the year in which the firm issued offerings, and post-IPO is the subsequent years after the IPO event year.

In Table 3, we document the total employment statistics with growth rates around IPO year. We categorize firms based on median age in our sample. A firm is young (mature) if its age is below (above) median age. Table 3 displays the average number of employees and their growth rates relative to pre-IPO year. From Panel A, a firm has, on average, 1,354 employees in its pre-IPO year. The change in employment growth gradually increases over a three-year horizon. The average growth rates in Panel B and C imply that young firms have a higher employment growth rate relative to mature firms. While firms aged below 16 experience 26.8% (68.6%) employment growth following the first (third) post-IPO year, firms aged above 16 exhibit -0.72% (11.6%) firm-level employment growth relative to the pre-IPO year. These results indicate that young firms have higher employment growth.

Table 3
Total Employment Statistics Based on Age

Panel A. Sample	pre-IPO	IPO	post-IPO (1)	post-IPO (2)	post-IPO (3)
Sum	180,122	201,867	210,825	218,826	243,401
N	133	149	149	146	145
Average	1,354.30	1,354.81	1,414.93	1,498.80	1,678.62
Δ relative to pre-IPO		0.04%	4.48%	10.67%	23.95%

Panel B. Young	pre-IPO	IPO	post-IPO (1)	post-IPO (2)	post-IPO (3)
Sum	42,014	58,272	61,245	67,231	78,248
N	67	77	77	76	74
Average	627.07	756.77	795.38	884.61	1,057.40
Δ relative to pre-IPO		20.68%	26.84%	41.07%	68.63%

Panel C. Mature	pre-IPO	IPO	post-IPO (1)	post-IPO (2)	post-IPO (3)
Sum	138,108	143,595	149,580	151,595	165,153
N	66	72	72	70	71
Average	2,092.54	1,994.37	2,077.5	2,165.64	2,326.09
Δ relative to pre-IPO		-4.69%	-0.72%	3.49%	11.16%

This table reports the total employment statistics and employment growth rates relative to pre-IPO year. pre-IPO is the year before the IPO event year, IPO is the year in which the firm issued offerings, and post-IPO is the subsequent years after the IPO event year. A firm is Young (Mature) if its age in the IPO event year is below (above) the median age of the sample. Age is the difference between IPO event year and founding year of a firm. In Panel A, employment growth rates around IPO event year are calculated for the whole sample. In Panel B (C), employment growth rates around IPO event year are calculated for Young (Mature) firms.

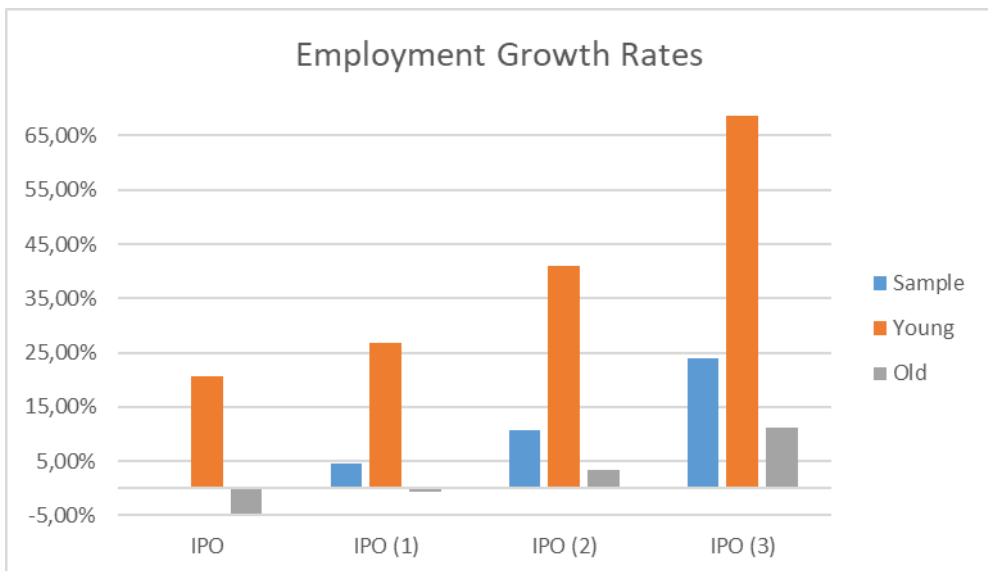


Figure 1: Employment Growth Rates around IPO year
(Source: Author’s Calculation)

Results

The employment growth around IPO year

According to the empirical literature, establishment of a causal relation between going public and employment level is challenging. In this sense, we need to consider employment dynamics over a time interval including pre- and post-IPO periods.

One possible concern in our analysis is a potential endogeneity issue that the IPO decision might be influenced by some circumstances of firms. To address the inherent endogeneity issue, we use a restricted sample of firms that complete IPO filings successfully.

In these two subsequent subsections, we are testing Hypothesis 1 and Hypothesis 2.

Table 4 presents the formal test results from a panel regression in which the dependent variable is employment growth rate relative to pre-IPO year. For each of the specifications, we create and use dummy variables. We list firms according to their IPO event years and rename these years $t=0$, irrespective of actual years. By doing so, we have a common time profile for all firms. To observe the employment dynamics, we expand the time length up to three years ahead of the event year. In the end, we have four time series for all firms, and therefore four dummy variables. $D(IPO)$ takes a value of 1 if the firms are in their IPO year.

A similar argument follows for the rest of the dummies. For example, $D(IPO) +2$ is a dummy variable that takes the value of 1 for a firm that is in their second post-IPO year. To capture size effects, we consider common proxies, sales, and number of employees, which have been extensively used in the literature. In this way, we have a chance to compare the inferences stemming from either of these proxies regarding the size. For the number of employees, we consider two different categorizations. In the first case, we rely on the median value of the number of employees in our sample. We consider firms with the number of employees above (below) median as large (small). In the second case, we follow size definitions by Eurostat. We categorize the firms with respect to the number of employees they have. Firms with 1- 49 employees are identified as small (S); 50-249 employees are identified as medium (M); and more than 250 employees are identified as large (L).

The results show that the IPO firms have significant employment growth during the IPO and in their post-IPO years. The employment growth for IPO firms becomes more pronounced in their second and third post-IPO years. In all columns, positive coefficients for dummies suggest that employment growth increases around IPO event year.

In columns 2 to 6, we control the size by adding various size measures. In column 2, we use sales as a proxy for the size and we have a negative and statistically significant coefficient, which suggests that small firms tend to have employment growth.

When the size is measured by the number of employees in our sample, we have a negative coefficient, as shown in column 3. However, this result is statistically insignificant. When we control for size according to the size intervals depending on the number of employees suggested by Eurostat, we have statistically insignificant coefficients.

Table 4
Annual Employment Changes After the IPO

	1	2	3	4	5	6
0	0.052** (0.01)	0.086** (0.02)	0.067** (0.02)	0.05*** (0.01)	0.04* (0.02)	0.06** (0.02)
D (IPO) + 1	0.056** (0.01)	0.09** (0.03)	0.07** (0.02)	0.05** (0.02)	0.05** (0.02)	0.06** (0.02)
+ 2	0.07*** (0.02)	0.11*** (0.03)	0.08** (0.02)	0.06** (0.02)	0.06** (0.02)	0.08** (0.02)
+ 3	0.072** (0.02)	0.12** (0.03)	0.08** (0.03)	0.07** (0.02)	0.06 (0.02)	0.08** (0.02)
Sales		-0.06* (0.02)				
Employee			-0.028 (0.02)			
S				0.013 (0.02)		
M					0.017 (0.02)	
L						-0.025 (0.01)
Obs.	518	419	518	518	518	518
R-squared	0.07	0.09	0.07	0.07	0.07	0.07

This table reports the estimation results of regressions, in which the dependent variable is annual employment change. The sample includes IPO listed firms on BIST. The sample period is from 2000 to 2016. D (IPO + Y) Y=0,1,2,3 is a dummy variable that takes a value of 1 if a firm is in its respective post-IPO year. Sales and Employees are two different measures for the size used in this study. Defined by Eurostat, firms with 1-49 employees are identified as small (S); 50-249 employees are identified as medium (M); and more than 250 employees are identified as large (L). Clustered robust standard errors are reported in the parentheses. *, **, and *** indicate statistical significance level for p<0.05, p<0.01, and p<0.001, respectively.

A Subsample Analysis

In this part, we provide empirical evidence of the relationship between going public and employment growth by using manufacturing IPO firms alone to investigate whether industry matters for this relationship.

We use all IPO firms to obtain the results in Table 4. One thing that should be noted is the low R-squared values for the regressions⁸. One possible reason for having quite small R-squared values might be the omitted variables. The impact of IPOs on employment growth may vary across industries. Therefore, we conduct industry specific regressions to test whet-

8 Thank the anonymous referee to address this issue and for the helpful comments.

her we observe a significant change in the R-squared values. To serve our aim, we consider manufacturing firms because they comprised 30% of the IPO sample (46 out of 155) in this study. Additionally, we estimate regressions with a sample of IPO firms excluding the manufacturing firms. The estimations results are available in Table A.2 and Table A.3 in the Appendix. Estimation results suggest that the R-squared values for the regressions increase when we consider manufacturing firms only. However, we observe a negligible change in R-squared values when the sample excludes manufacturing firms. These results confirm that the relationship between IPO and employment growth varies from one industry to another.

Dependence on External Equity Finance

As stated in the literature, one of the key motives for issuing offerings is to increase fund opportunities to feed corporate investments. To test whether the link between employment growth and going public depends on external equity finance (DEF), we follow Rajan and Zingales (1998) to construct a measure of equity finance dependence. Firm-level measure of dependence on external equity can be calculated as the ratio of net equity and capital expenditure. It is expected that firms that have employment growth have higher external equity dependence if going public has an impact on employment growth. To examine this, we sort firms based on the median value of DEF and create dummy variable D (DEF) that takes the value of 1 if DEF ratio is above the median, which means firm is defined as highly dependent on external equity. Moreover, we sort firms by their age and create a dummy variable, D (Age), which takes a value of 1 if they are under (above) median and called young (mature). We use D (Age) to observe the effect of age of a firm on its employment growth around the IPO event year. We also employ interaction terms between D (DEF) and D (Age) to capture the employment growth performance of young IPO firms with high dependence on equity finance around their IPO event year.

Estimation results are displayed in Table 5. Coefficients on D (DEF) in the first post-IPO year suggest that firms with high dependence on external equity have positive employment growth. These coefficients on D (DEF) in columns 4 to 6 are statistically significant. These results provide us with some evidence that firms that have a higher dependence on external equity finance tend to generate more employment growth after they go public.

Coefficients on D (Age) in all columns indicate that young firms experience greater employment growth during and in their post-IPO years. However, the results are statistically significant only in the first post-IPO year. This finding suggests that young IPO-listed firms experience higher employment growth.

Overall, the coefficients on the interaction between D (DEF) and D (Age) show that the effect of high dependence on external equity on employment growth is independent of how mature a firm is. However, only in the first post-IPO year, the interaction is statistically sig-

nificant, with negative coefficients displayed in columns 4 and 5. This result suggests that young firms with high dependence on equity finance experience lower employment growth in their first post-IPO year.

The estimation results shown in Table 4 and Table 5 clearly suggest that both Hypothesis 1 and Hypothesis 2 hold true.

Table 5
Dependence on Equity Finance

	Δ Employment 0			Δ Employment 0-1			Δ Employment 0-2		
	1	2	3	4	5	6	7	8	9
D (DEF)	-0.00 (0.03)	-0.02 (0.03)	0.01 (0.03)	0.07* (0.03)	0.1* (0.04)	0.1* (0.04)	0.03 (0.03)	0.00 (0.03)	-0.00 (0.04)
D (Age)	0.06 (0.05)	0.06 (0.06)	0.01 (0.05)	0.17* (0.07)	0.18* (0.08)	0.16 (0.08)	0.12 (0.07)	0.13 (0.08)	0.12 (0.09)
D (DEF) x D(Age)	-0.02 (0.06)	-0.02 (0.07)	-0.06 (0.07)	-0.18* (0.08)	-0.2* (0.1)	-0.18 (0.1)	-0.12 (0.08)	-0.1 (0.1)	-0.08 (0.1)
Controls	NO	YES	YES	NO	YES	YES	NO	YES	YES
Obs.	131	104	99	131	104	104	126	104	103
R-squared	0.02	0.04	0.3	0.07	0.08	0.1	0.03	0.05	0.06

This table reports the estimation results of regressions, in which the dependent variable is annual employment change. The sample includes IPO listed firms on BIST. The sample period is from 2000 to 2016. In Columns 1-3, the dependent variable is the change in employment in the IPO event year relative to the pre-IPO year. In Columns 4-6, the dependent variable is the change in employment in the first post-IPO year relative to the pre-IPO year. In Columns 7-9, the dependent variable is the change in employment in the second post-IPO year relative to the pre-IPO year. D (DEF) is a dummy variable that takes a value of 1 if the dependence on external finance of a firm is above the sample median. D (Age) is a dummy variable that takes a value of 1 if the age of a firm is below the sample median. D (DEF) x D (Age) is the interaction term between D (DEF) and D (Age). The control variables are Sales and change in Sales. More detailed descriptions of variables are available in the Appendix. Robust standard errors are reported in the parentheses. *, **, and *** indicate statistical significance level for $p < 0.05$, $p < 0.01$, and $p < 0.001$, respectively.

Channels: Financial Constraints

On IPO day, firms access the public and sell their shares. This process results in a fund flow into the firm, which relaxes their financial constraints. Capital raised on the IPO day creates an immediate relaxation on the financial constraints of a firm. In addition to an immediate infusion of capital, an IPO firm can access the debt market upon going public. Issuing IPOs enhances a firm’s ability to borrow (Pagano, et al., 1998). To test whether the relaxation of constraints has an impact on employment growth for a firm, we consider capital raised at IPO day and relative cost of credit (RCC), which are suggested by Borisov et al. (2015). The constructions of these two measures are described in the Appendix. If these two underlying channels are effective, we expect them to have a positive relationship with employment growth, as posed by Hypothesis 3. Table 6 displays the estimation results.

Young firms experience higher employment growth in their first post-IPO years. Coefficients on D (Age) in columns from 5 to 9 are statistically significant. This result highlights the job creation impact of young firms (Özlele & Polat, 2019). In all specifications, the

coefficients on Capex/Assets are positive and statistically significant. We have significant evidence on firms with more investment in capital which have positive employment growth. This finding suggests that an increase in physical capital requires more labor to operate these physical assets. Surprisingly, the coefficients on proceeds are insignificant. This result suggests that capital raised at IPO does not have a direct impact on employment growth for a firm. On the other hand, firms facing low cost of credit have employment growth during their IPO year. These results together confirm the findings of Pagano, et al. (1998), who suggest that going public increases a firm's ability to borrow. In columns 4, 8, and 12, we include interactions between D (Age) x Proceeds, and D (Age) x RCC to observe how relaxation of financial constraints in younger firms have an impact on employment growth. However, we find statistically insignificant results. These suggest that the impact of either of the channels is independent of the age of the firm.

As stated previously, an IPO would relax the financial constraints of a firm and allow firm to access the debt market by increasing its borrowing ability. Moreover, IPO firms also have access to the equity market in the post-IPO years. The ability to access both markets would have an impact on employment growth. To test whether the labor decision of a firm is affected through these markets, we consider the debt capital and equity capital of each firm. We normalize each form of capital by pre-IPO total assets. The results of the estimation are displayed in Table 7. As shown in columns 3, 7, and 11, coefficients on Debt/Assets are positive and statistically significant. These findings suggest that debt capital allows a firm to increase its employment. With its ability to borrow, the firm would increase its expenditures on physical capital, and in turn, increase the number of workers it hires. On the other hand, we have a statistically insignificant coefficient for Equity/Assets. Accessing the equity market does not have an impact on employment growth. In the same table, we also test the effect of internally generated funds. To do so, we consider the pre-IPO asset growth rate for each of the firms. If adding the pre-IPO asset growth changes the estimation results, we conclude that internally generated funds have an impact on employment growth. In columns 2, 6, and 10, we observe the effect of inclusion of pre-IPO asset growth in models where we have capital expenditures. In this case, the effect of capital expenditures on employment growth changes. We also have some changes regarding the coefficients on Debt/Asset and Equity/Asset in columns 4, 8, and 12. These results together suggest that internally generated funds in the pre-IPO period have an impact on employment growth.

According to the estimation results displayed in Table 6 and Table 7, Hypothesis 3 holds true.

Table 6
Relaxation of Financial Constraints

	Δ Employment 0			Δ Employment 0-1			Δ Employment 0-2					
	1	2	3	4	5	6	7	8	9	10	11	12
D (Age)	0.05 (0.03)	0.03 (0.02)	0.02 (0.01)	0.03 (0.02)	0.08* (0.03)	0.05* (0.02)	0.06* (0.03)	0.08* (0.03)	0.06 (0.04)	0.02 (0.02)	0.03 (0.03)	0.09* (0.04)
Capex/As-sets	0.006*** (0.00)	0.006*** (0.00)	0.006*** (0.00)	0.006*** (0.00)	0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Primary Capital		-0.008 (0.02)		0.005 (0.06)			-0.00 (0.03)	0.06 (0.06)			0.01 (0.04)	0.17 (0.11)
RCC		-0.01*** (0.00)		0.02 (0.02)			-0.07 (0.05)	0.00 (0.02)			-0.05 (0.02)	-0.05 (0.03)
D (Age) x RCC				-0.04 (0.02)				-0.1 (0.07)				-0.00 (0.05)
D (Age) x Primary Capital				-0.01 (0.06)				-0.09 (0.07)				-0.2 (0.12)
Obs.	132	131	113	113	132	131	114	114	129	126	111	111
R-squared	0.02	0.6	0.8	0.8	0.03	0.5	0.6	0.6	0.02	0.5	0.6	0.6

This table reports the estimation results of regressions, in which the dependent variable is the annual employment change. The sample includes IPO listed firms on BIST. The sample period is from 2000 to 2016. In Columns 1-3, the dependent variable is the change in employment in the IPO event year relative to the pre-IPO year. In Columns 4-6, the dependent variable is the change in employment in the first post-IPO year relative to the pre-IPO year. In Columns 7-9, the dependent variable is the change in employment in the second post-IPO year relative to the pre-IPO year. D (Age) is a dummy variable that takes a value of 1 if the age of a firm is below the sample median. Capex/Assets is the ratio between total expenditures made on capital up to the relevant horizon and the book value of pre-IPO assets. Primary Capital is the capital raised at the IPO event date. RCC is the relative cost of credit of a firm in the relevant horizon. More detailed descriptions of variables are available in the Appendix. D (Age) x RCC and D (Age) x Primary Capital are interaction terms between D (Age) and RCC and D (Age) and Primary Capital. Robust standard errors are reported in the parentheses. *, **, and *** indicate statistical significance level for p<0.05, p<0.01, and p<0.001, respectively.

Table 7
Effect of pre-IPO Growth

	1	Δ Employment 0			Δ Employment 0-1			Δ Employment 0-2				
	2	3	4	5	6	7	8	9	10	11	12	
Capex/Assets	0.005*** (0.00)	0.05 (0.04)			0.001*** (0.00)	0.02 (0.01)			0.00*** (0.00)	0.001 (0.001)		
Debt/Assets		0.006*** (0.00)	-0.017 (0.02)			0.001*** (0.00)	0.002 (0.00)				0.00*** (0.00)	-0.00 (0.00)
Equity/Assets		0.16 (0.08)	0.03 (0.09)			-0.03 (0.06)	0.1 (0.07)				-0.00 (0.00)	0.004 (0.01)
Δ pre-IPO Asset		-0.005* (0.002)	-0.003* (0.00)			-0.01*** (0.00)	-0.01*** (0.00)			-0.01*** (0.00)		-0.01*** (0.00)
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Obs.	131	87	83	131	87	125	83	126	84	120	80	
R-squared	0.6	0.03	0.03	0.5	0.07	0.5	0.06	0.5	0.06	0.5	0.5	0.05

This table reports the estimation results of regressions, in which the dependent variable is the annual employment change. The sample includes IPO listed firms on BIST. The sample period is from 2000 to 2016. In Columns 1-3, the dependent variable is the change in employment in the IPO event year relative to the pre-IPO year. In Columns 4-6, the dependent variable is the change in employment in the first post-IPO year relative to the pre-IPO year. In Columns 7-9, the dependent variable is the change in employment in the second post-IPO year relative to the pre-IPO year. Capex/Assets is the ratio between total expenditures made on capital up to the relevant horizon and the book value of pre-IPO assets. Debt/Assets is the ratio between total debt issuance up to relevant horizon and the book value of pre-IPO assets. Equity/Assets is the ratio between total equity issuance up to the relevant horizon and the book value of pre-IPO assets. To check for the robustness of the impact of the external funds on employment growth in a firm, we add change in pre-IPO Asset growth. In doing so, we investigate whether internally generated funds have an impact on employment growth. Δ pre-IPO Asset is the pre-IPO asset growth rate. The control variables are Sales and change in Sales. More detailed descriptions of variables are available in the Appendix. Robust standard errors are reported in the parentheses. *, **, and *** indicate statistical significance level for p<0.05, p<0.01, and p<0.001, respectively.

Use of Funds

In this section, by using the data on median sized firms in our sample, we estimate and compare the impact of a one-unit increase in both funds raised at IPO and net cash flows, excluding primary capital, on a variety of uses of funds, i.e., expenditures (capital expenditures, personnel expenditures, debt issuances) and asset-based variables (assets and cash accumulation) over different time lengths (one to four years).

To test Hypothesis 4, we follow the methodology by Kim and Weisbach (2008).

Our estimation results rely on the following regressions:

$$Y = \alpha + \beta_1 \log \left[\left(\frac{\text{primary capital}}{\text{Pre-IPO Assets}} \right) + 1 \right] + \beta_2 \log \left[\left(\frac{\text{other sources}}{\text{Pre-IPO Assets}} \right) + 1 \right] + \beta_3 \log[\text{Pre-IPO Assets}] + \varepsilon,$$

where

$$Y = \log \left[\left(\frac{X_t - X_0}{\text{Pre-IPO Assets}} \right) + 1 \right] \text{ for } X = \text{asset-based variables}$$

and

$$Y = \log \left[\left(\sum_{i=1}^t \frac{X_i}{\text{Pre-IPO Assets}} \right) + 1 \right] \text{ for } X = \text{expenditures}$$

and

$$\text{other sources} = \log \left[\left(\frac{\sum_{i=1}^t \text{total sources of funds}_i - \text{primary capital}}{\text{Pre-IPO Assets}} \right) + 1 \right]$$

and $t = 1, 2, 3, 4$ is the years after the IPO event year. Primary capital is the funds raised on the IPO date. Other sources can be obtained by subtracting the primary capital from total sources of funds of each firm that went public. Total sources of funds (net cash flows), which are obtained from the footnotes of financial annual reports, are the sum of flows from operating, investing, and financing activities. To minimize the outliers, both the dependent and independent variables are normalized by pre-IPO total assets.

Table 8
The effect of one-unit change in primary capital on selected items

Items	t	α	t-stat	β_1	t-stat	β_2	t-stat	β_3	t-stat	Obs.	Primary
Assets	1	0.384	2.78	0.367	2.67	0.103	2.9	-0.037	-2.37	76	1.29
	2	0.289	1.78	0.749	3.07	0.186	2.58	-0.0216	-1.17	79	2.02
	3	0.352	1.43	1.088	2.29	0.232	1.01	-0.0249	-0.9	84	2.88
	4	0.594	1.87	0.827	2.16	0.178	1.94	-0.0413	-1.15	85	2.60
Cash	1	0.00035	0.01	0.025	0.51	0.007	1.36	-0.00015	-0.02	76	0.07
	2	-0.094	-1.21	0.19	1.91	0.085	1.85	0.01	1.24	79	0.59
	3	0.27	1.02	0.076	0.41	-0.026	-0.44	-0.03	-1	85	-0.09
	4	-0.0041	-0.05	0.169	1.54	0.002	0.1	0.001	0.1	88	0.16
Capex	1	0.0261	0.26	0.106	0.44	0.0398	0.67	0.00297	0.27	75	0.39
	2	-0.26	-1.1	0.67	1.64	0.0513	0.59	0.038	1.5	78	0.83
	3	0.063	0.11	1.268	1.46	0.16	0.44	0.005	0.09	84	2.36
	4	-0.065	-0.11	1.372	2.01	0.146	0.94	0.03	0.44	87	2.38
Perex	1	0.07	2.69	-0.017	-0.66	0.01	2.29	-0.006	-2.29	71	0.06
	2	0.143	3.04	-0.056	-0.91	-0.0002	-0.03	-0.0138	-2.6	75	-0.05
	3	0.228	3.66	-0.06	-0.71	0.017	0.61	-0.0219	-3.02	80	0.05
	4	0.309	4.15	-0.07	-0.83	0.0076	0.52	-0.0297	-3.34	81	-0.02
Debt	1	-0.773	-2.44	-0.392	-0.89	-0.116	-1.07	0.111	3.1	74	-0.93
	2	-0.469	-1.08	0.141	0.25	0.154	1.17	0.0928	1.89	72	0.84
	3	0.0373	0.06	0.892	0.93	0.463	0.95	0.0482	0.7	78	3.55
	4	0.337	0.48	0.679	0.86	0.363	1.4	0.0332	0.41	81	3.63

This table reports the estimation results of regressions, in which the dependent variable changes for asset-based variables and items on expenditures. The sample includes IPO listed firms on BIST. The sample period is from 2000 to 2016. The last column displays the implied changes in the independent variables listed under items in the first column when the primary capital increases by one unit.

Table 8 reports the estimation results for each of the use of funds for various time intervals from one year to four years. The estimated coefficients on primary capital are positive except for the regression results, in which the dependent variable is expenditures made on personnel. The coefficients on primary capital are all positive and statistically significant in equations

where we estimate the asset variable only. The relatively larger coefficients on assets, cash holdings, and capital expenditure show that funds generated through IPO are likely to be used for the abovementioned items as priority. When we consider the comparison of coefficients on debt, we find that the fresh funds through IPO increase the borrowing ability of firms to finance new investments.

In Table 8, we also report the implied changes in the items from a one-unit increase in funds⁹. Overall results suggest that the expenditures on capital and assets are doubled in response to a one-unit increase in primary capital. In line with these changes, the issuance of primary capital raises debt. The interpretation is as follows: the infusion of new funds increases the credibility of firms. Since the borrowing constraints get relaxed, in turn, firms spend more on capital. The change in asset variable is therefore expected as the book value of assets increases once the new source of funds is introduced. Moreover, as the expenditures on capital increase, the assets that the firm has increase as well. Implied changes in personnel expenditure have mixed implications. Over time, a negligible fraction of primary capital is used to finance the expenditures made on personnel. For the cash item, the estimates show that the largest fraction of one-unit increase in primary capital is kept in the first post-IPO year. Over a four-year interval, firms, on average, keep 16% of a one-unit increase in IPO proceeds as cash.

Conclusion

There is dense literature on IPOs. However, little is known about the impacts of going public on the employment performance of firms, particularly in developing economies. This study provides empirical evidence on this issue by addressing 155 IPO listed firms on BIST over the period between 2000 and 2016. We use micro data from annual financial reports and find several meaningful results regarding changes in the employment level.

Our findings suggest that IPO firms, on average, experience employment growth during their IPO year and in their post-IPO periods, as found in Borisov et al. (2015) and Babina et al. (2020). However, we find that employment growth should not be attributed to the direct effect of capital raised in the IPO. Relaxation of financial constraints through going public helps a firm to access the debt market, which improves its ability to borrow. As the firm's

9 The effect of one-unit increases in funds raised at IPO on assets at $t=1$ can be calculated as follows: From sample distribution, in addition to coefficients from Table 8, we use median primary capital (12.18), median pre-IPO total assets (71.74), and total resources as the sum of cash or cash equivalent funds from operating, investing, and financing activities (3.02). All units are in national currency, TL, in millions. We obtain predicted value as 0.17 from regression equation. The predicted change is $71.74(exp^{0.17} - 1) = 13.67$. We then increase primary capital by one unit and calculate the predicted change under this new scenario. Our calculation yields 14.96. The difference between these two predicted values, 1.29, is the effect of a one-unit increase in primary capital on assets at $t=1$.

capacity for borrowing increases, it invests more in physical capital. In turn, the firm needs more employees to run its operations. These results are in line with the findings of Pagano et al. (1998) and Kim and Weisbach (2008). Moreover, we investigate that a part of the employment growth should be linked to internal asset growth, too. Our estimation results highlight the role of young firms in generating higher employment growth, as argued by Özlale and Polat (2019).

Our analysis on the use of external funds raised on the IPO date verifies our results, as well. A one-unit change in primary capital results in an increase in capital expenditures and debt levels, which explains the financing capital investment motive of IPOs.

Quantity alone should not be the priority in the IPO market. Therefore, regulators should impose requirements that enhance the quality of IPOs and provide incentives for growth. If the IPO market were intended to contribute to job creation, allowing firms to access the public equity market with fewer restrictions may be conditioned on a promise to increase employment level in the prospectus. Moreover, as the results of this empirical study strongly suggest, policy makers should provide incentives to firms to increase their capital investments. So, the firms would hire more workers to run their operations.

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Appendix

Table A.1
Variables with Their Definitions

Variables	Definitions
Δ Employment (0-Y) Y=0,1,2,3	Change in the natural logarithm of number of employees in the relevant year relative to pre-IPO year.
D (IPO + Y) Y=0,1,2,3	Indicator variable that is 1 if the firm is in the relevant year, and 0 otherwise.
D (Age)	Indicator variable that is 1 if the difference between the founding year and the IPO event year is below median, and 0 otherwise.
Primary Capital	Natural logarithm of one plus capital raised at IPO divided by pre-IPO total assets.
Sales	Natural logarithm of net sales.
Assets	Natural logarithm of assets.
Δ Pre-IPO Asset	Natural logarithm of ratio of the difference between book value of assets in the closest reporting date and assets in the pre-IPO fiscal year ending relative to the book value of assets in the pre-IPO fiscal year ending.
PEREX	Natural logarithm of the ratio between the expenditures made on personnel and book value of pre-IPO assets. Numerator is the sum of personnel expenditures up to relevant year.
Capex/Assets	Natural logarithm of the ratio between the expenditures made on capital and book value of pre-IPO assets. Numerator is the sum of capital expenditures up to relevant year.
Debt/Assets	Ratio between total debt issuance up to the relevant year and book value of pre-IPO assets.
Equity/Assets	Ratio between total equity issuance up to the relevant year and book value of pre-IPO assets.
D (DEF)	Indicator variable that is 1 if the firm's dependence on equity is above median, and 0 otherwise. DEF is calculated as the ratio between equity over capital expenditure in the relevant year.
RCC	Ratio of 1 plus cost of debt of an IPO firm and 1 plus the median value of cost of debt of all IPO firms, where the cost of debt is ratio of interest expenses and total debt.
Cash flow	Natural logarithm of sum of cash or cash equivalents from operating, investing, and financing activities.
Cash	Natural logarithm of cash left over after expenses paid.

Table A.2
Annual Employment Changes After the IPO for Manufacturing Industry

	1	2	3	4	5	6
0	0.028** (0.001)	0.02 (0.01)	0.026 (0.01)	0.031** (0.01)	0.026* (0.01)	0.02 (0.01)
D (IPO)	+ 1 (0.01)	0.028 (0.01)	0.034 (0.02)	0.04** (0.01)	0.035* (0.01)	0.03 (0.01)
	+ 2 (0.01)	0.043* (0.01)	0.047** (0.01)	0.052*** (0.01)	0.047** (0.01)	0.046** (0.01)
	+ 3 (0.01)	0.046* (0.01)	0.051** (0.02)	0.044 (0.02)	0.05** (0.01)	0.043* (0.02)
Sales		0.008 (0.01)				
Employee			0.003 (0.01)			
S				-0.053 (0.04)		
M					0.0057 (0.01)	
L						0.007 (0.01)
Obs.	158	139	158	158	158	158
R-sq	0.18	0.20	0.18	0.17	0.15	0.15

This table reports the estimation results of regressions, in which the dependent variable is annual employment change. The sample includes manufacturing IPO listed firms on BIST. The sample period is from 2000 to 2016. D (IPO + Y) Y=0,1,2,3 is a dummy variable that takes a value of 1 if a firm is in its respective post-IPO year. Sales and Employee are two different measures for the size used in this study. Defined by Eurostat, firms with 1-49 employees are identified as small (S), 50-249 employees are identified as medium (M), and more than 250 employees are identified as large (L). Clustered robust standard errors are reported in the parentheses. *, **, and *** indicate statistical significance level for $p < 0.05$, $p < 0.01$, and $p < 0.001$, respectively.

Table A.3
Annual Employment Changes After the IPO excluding Manufacturing Industry

	1	2	3	4	5	6
0	0.063** (0.02)	0.127** (0.04)	0.078** (0.03)	0.06** (0.02)	0.055* (0.02)	0.078** (0.03)
D (IPO)	+ 1 0.064* (0.02)	+ 1 0.135** (0.04)	+ 1 0.079* (0.03)	+ 1 0.06* (0.03)	+ 1 0.056* (0.02)	+ 1 0.08* (0.03)
	+ 2 0.078** (0.03)	+ 2 0.15** (0.05)	+ 2 0.092** (0.03)	+ 2 0.074* (0.03)	+ 2 0.07* (0.02)	+ 2 0.092** (0.03)
	+ 3 0.084** (0.03)	+ 3 0.16** (0.05)	+ 3 0.1* (0.04)	+ 3 0.081* (0.03)	+ 3 0.076* (0.03)	+ 3 0.1* (0.03)
Sales		-0.1* (0.04)				
Employee			-0.033 (0.02)			
S				0.01 (0.03)		
M					0.034 (0.04)	
L						-0.035 (0.02)
Obs.	360	280	360	360	360	360
R-sq	0.07	0.1	0.07	0.07	0.07	0.07

This table reports the estimation results of regressions, in which the dependent variable is annual employment change. The sample includes IPO listed firms excluding manufacturing firms on BIST. The sample period is from 2000 to 2016. $D(IPO + Y) Y=0,1,2,3$ is a dummy variable that takes a value of 1 if a firm is in its respective post-IPO year. Sales and Employee are two different measures for the size used in this study. Defined by Eurostat, firms with 1- 49 employees are identified as small (S), 50-249 employees are identified as medium (M), and more than 250 employees are identified as large (L). Clustered robust standard errors are reported in the parentheses. *, **, and *** indicate statistical significance level for $p<0.05$, $p<0.01$, and $p<0.001$, respectively.



Istanbul Business Research

RESEARCH ARTICLE

Does It Matter How to Fund?: A Research on Turkish Deposit Banks

Mustafa Çelik¹ , Ömer Tekşen² 

Abstract

The Aim of this paper is to examine the possible relationship between liability structure and bank performance. In this context, panel data regression method is used to analyze relationship between bank performance and liability structure of banks. The main data source in this study is The Banks Association of Turkey's banking statistics between 2005-2018. In the analysis, liability preferences of Turkish banks are used as independent variables and CAMELS performance scores of banks are used as dependent variable. Additionally, variables that are admitted in literature as bank performance determinants are taken into consideration in bank performance model as control variables. According to the results, the banks' performance is affected by several liability structure variables. Use of loans-especially long term loans- and to have high saving deposits/total deposits positively affect bank performance; while extensive use of non-deposit liabilities, third alternative liability sources, long-term deposits, and foreign currency loans negatively affect bank performance. As with other liability structure variables, high capital adequacy ratio and leverage also have negative effect on bank performance. Moreover, as control variables GDP per capita, inflation rate, interest rate, bank size, bank efficiency, bank liquidity, bank risk and bank market share have a statistically significant effect on bank performance.

Keywords

Banks' Liability Structure, Fund Preference, Turkish Deposit Banks, Bank Performance, CAMELS Rating System

Introduction

Banks have a wide range of fund options thanks to the increase in diversity of financial instruments and the depth and volume of financial markets. They manage their liabilities in this wide range of fund options and differentiate fund sources according to their fund needs.

Since each fund source has its own pearls and pitfalls; banks' preference in terms of fund sources may have an effect on their performance and this possible relationship should be tested in a scientific perspective. However, studies related to bank performance determinants are not interested in the liability management's effect on bank performance.

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Banks by definition are exposed to high cash flow & investment risk, and cost of liabilities. Therefore, they are obliged to manage asset and liabilities more carefully than any other firm in any sector (Kusy & Ziemba, 1983:1). Banks can prepare for future uncertainties, manage interest, exchange, liquidity and credit risk better (Dash and Pathak,2009:1), perform more efficiently and understand better their overall position in terms of obligations using of asset and liability management (Romanyuk,2010:1). Also, global financial crises in the last decade showed us the vulnerability of countries' financial systems. Today, risks are more contagious in different countries' financial environment. The asset and liability management plays a crucial role in managing these risks thanks to its role in allocation of funds for a given risk structure (Tektaş et al.,2005:135). Until 1960s, asset and liability management was made up of the asset management because banks regard liabilities as exogenous factors contributing to the limitation of asset management. However, today financial system changed radically and liability management is a part of a competition between banks for low cost and strategic financing (Kosmidou and Zopounidis, 2004a:1-2). Therefore, banks need to manage liabilities quite effective to be successful in today's competitive environment. This situation brings the need of question the effect of bank liability structure on bank performance.

Banks' performance is quite influential on general macroeconomic condition of countries (Sevim and Eyüboğlu,2012:212; Karaçor et. al,2017:48) because, it affects business growth, wealth and capital accumulation (Taşkın,2011:289). Since today's banking sector is more competitive and the financial sector is quite influential on general economic condition of countries, banks need to review their performance regularly (Ecer, 2013:172). The main characteristics of survivors in competitive business environment is measuring performance periodically and implementing proactive solutions according to measurement results (Dinçer and Görener, 2011:110). In this perspective, the determinants of bank performance should be known by banks to improve their performance in competitive banking environment. Otherwise, performance review without improvement may cause to fall behind of sector standards and setback in economic condition. Therefore, as a possible bank performance determinant, banks' liability structure should be evaluated carefully like other possible bank performance determinants.

The Aim of this paper is to answer the need for research on relationship between bank liability structure and bank performance. Within this framework, in the first part, bank liabilities are summarized and different fund options that banks can use are presented. In the second part, as a bank performance measure CAMELS scoring system is explained. The third part consists of literature review on bank performance. The fourth part includes analysis on relationship between bank performance and bank liability structure in scope of Turkish deposit banks. Lastly, in the conclusion part, research results are discussed.

Bank Liabilities

Bank liabilities are composed of deposits, non-deposit liabilities and other liabilities. Deposits are the main fund source for banks and they constitute notable percentage of bank liabilities. Non-deposit liabilities are sort of liabilities that compensate the deficiencies of deposits. Non-deposit liabilities can be seen as the second alternative fund sources for banks. Lastly, other liabilities are all of the liabilities that can not be classified as deposits and non-deposit liabilities. These type of liabilities constitute very low ratio of deposit bank liabilities and other liabilities are the third alternative fund sources for banks.

Deposit can be defined as accepted money to be paid when it is demanded or on the maturity date (Turkish Banking Law, 2005: Article 3). Banks use different kinds of deposits according to customer and bank needs. Firstly deposits can be categorized into three types according to the term structure. *Demand deposits* can be withdrawn by customer at any time without bank's permission (Karapınar,2013:39). On the other hand, *time deposits* are accepted deposits that can not be withdrawn before maturity without losing interest income (Yalvaç, 2008:540). As a hybrid type deposit, *notice deposits* are accepted deposits that can be withdrawn only by noticing bank before withdrawal. Secondly, deposits can be categorized into four groups according to the depositor type. *Saving deposits* are type of deposits that belong to a natural person and not to be used for commercial purpose (Güney, 2009:74). *Commercial deposits* are type of deposits that belong to commercial entities or natural person deposits that is used for commercial purpose (Battal, 2004:107). *Government deposits* are kind of deposits that belong to government entities. *Interbank deposits* are banks' deposits that are kept for interbank transaction purposes (Güney,2009:76). Thirdly, deposits can be categorized into *local currency deposits* and *foreign currency deposits* in terms of currency type (Vurucu & Arı,2014:297).

Non-deposit liabilities are composed of *loans borrowed*, *money market payables*, *securities issued* and *investment funds*. Banks need loans for funding and they generally use syndicated loans. Syndicated loans are type of loans that have huge volume and more than one bank come together to give this loan because the risk is quite high as a result of amount of money borrowed (Hurn, 1990:2). In Turkey, deposit banks use loans for long-term fund needs because, average deposit term is 3 months in Turkey. Also, banks use loans for foreign exchange fund needs. In Turkey, about %90 of the loans borrowed are composed of foreign currency loans. Banks can also use money market for funding. They use *interbank exchange market*, *settlement and custody bank market*, *repurchasing agreements* and *central bank money market* in terms of money market options (Çelik, 2018:13-18). Since banks are legal entities, they can issue securities and can use them for their fund needs. Banks can issue *bonds* for long term fund needs (Vurucu & Arı, 2014:300-310) and can issue *commercial bills* for short term fund needs. Banks can also issue asset backed securities. *Asset backed securities* can be

defined as financial instruments that are sold after the pooling of different type of receivables. These receivables are turned into cash before maturity by banks and investors that buy asset backed securities can collect receivables at maturity (Ceylan & Korkmaz, 2014:453). Also banks can use asset backed securities by issuing debt instrument that has collateral of banks' receivables. In this type of asset backed securities, banks continue to report receivables that are collateral for debt instrument on the assets side and the debt instrument in the liability side. In Turkey, deposit banks issued very little amount of securities as late as 2010. After 2010, they concentrated more on securities (The Banks Association of Turkey Database, 2005-2018). Lastly, banks also use a different kind of investment funds according to bank and customer requirement.

As a third alternative fund source for banks, other liabilities are composed of *derivative liabilities, provisions, deferred tax liabilities, subordinated debt instruments, and unclassifiable liabilities*.

Figure 1 shows the distribution of the deposit bank liabilities between 2005 and 2018 in Turkey. According to the figure, the main fund source for Turkish deposit banks is deposits. However, in the analysis period, especially after 2010 the share of deposits slightly decreased and share of the non-deposit liabilities slightly increased. This trend can be explained by short deposit term structure in Turkey. Banks prefer the non-deposit liabilities because of the term advantage. Equity's share is constant because of the capital adequacy ratio regulations. Lastly, other liabilities' share is constant in the analysis period.

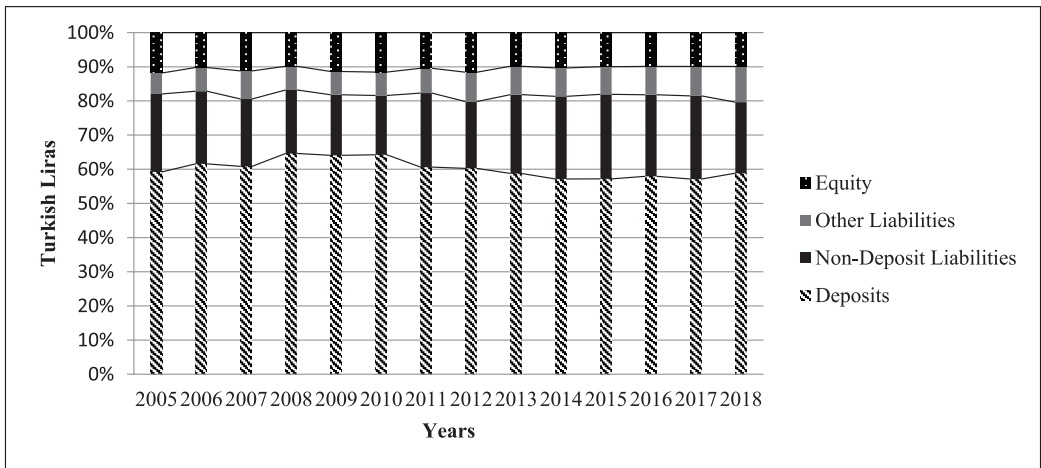


Figure 1. Distribution of Deposit Bank Liabilities in Turkey
 Source: The Banks Association of Turkey Database, 2005-2018

Camels As a Bank Performance Measure

In the literature, different methods and indicators like return on equity (ROE), return on assets (ROA), net interest margin (NIM), efficiency (technical efficiency, scale efficiency etc.), data envelopment analysis (DEA) and grey relation analysis (GRA) are used for bank performance measurement (Mishkin,2004:228; Çelik, 2018:37-45). CAMELS method differentiates from other methods in bank performance measurement with its multi-dimensional structure. This method uses five different dimensions in bank performance measurement (Kaya, 2001:2-6).

As a result of need for standard bank performance evaluation system by regulators like Federal Reserve Bank (FED), Federal Deposit Insurance Corporation (FDIC) and Office of the Comptroller of the Currency (OCC), UFIRS – Uniform Financial Institutions Rating System began to be used in 1979 in United States of America (USA). Later, this rating system became popular with the abbreviation of CAMEL that is formed by first letters of capital adequacy (C), asset quality (A), management quality (M), earnings (E) and liquidity (L). In this system, bank auditors give score on scale of 1-5 to banks in terms of each component of the CAMEL. While 1 is the best score in this scale; 5 is the worse. After 1997, sensitivity to market risk component (S) is added and this method's abbreviation became CAMELS (Feldman & Schmidt, 1999; Lopez, 1999).

In this paper, CAMELS system is preferred because of its multidimensional advantage in bank performance measurement. Another reason to prefer CAMELS performance score as bank performance measure is deficiency of ROA, ROE and NIM in explaining banking failures. ROA, ROE and NIM are profit-oriented ratios in explaining bank performance. However, a bank with high profit ratios may fail because of different reasons. For example, İmar Bankası maintained to be quite profitable in pre-crisis period of 1999-2000 while the banking sector had negative profit ratios in terms of ROA and ROE because of negative economic conditions (The Banks Association of Turkey Database,2000). However, İmar Bankası failed in 2001 economic crisis. In the literature, different determinants like surplus/loan, bond/asset, reserve/deposit, deposit/asset ratios (Wheelock, 1992); managerial inefficiency (Wheelock and Wilson, 1995), technical inefficiency (Berg et. al,1992), and CAMELS components (Cole and White, 2012) are used to forecast bank failures. CAMELS can catch different factors that cause low bank performance thanks to measuring bank performance in terms of five components. Hence, CAMELS is a good method to judge safety and soundness of the commercial banks (Cole and White, 2012:5).

In CAMELS system, scores are obtained through simple calculations (Tükenmez, et. al,2010):

- Firstly, for each ratio (A) that is used in C, A, M, E, L, and S components, reference ratio is calculated by averaging ratio of all banks in the measurement.

- Secondly, for each bank, index value is calculated by formula of $\frac{100 \cdot \text{Bank's Ratio}}{\text{Reference Ratio}}$
- Thirdly, deviation values are obtained:
- If the relationship sign (B) is positive then: Index Value - 100
- If the relationship sign (B) is negative then: 100 – Index Value
- Fourthly, weighted values are obtained through multiplying deviation values with ratio weight (C) formula.
- Fifthly, weighted values are added up to obtain component values in terms of C, A, M, E, L, and S.
- Lastly, CAMELS index score is obtained through formula of $\sum_{i=1}^6 \text{Component Value}_i * \text{Component Weight (D)}_i$ (while 1: Capital Adequacy, 2: Asset Quality, 3: Management Quality, 4: Earnings, 5: Liquidity and 6: Sensitivity to Market Risk).

The ratios, ratio weights, relationship signs and component weights that are used in this paper are demonstrated below (Table.1):

Table1
Ratios Used in CAMELS Score Calculation

Component	Component Weight (D)	Ratios (A)	Ratio Weight (C)	Relationship Sign (B)
C - Capital Adequacy	0.2	Capital Adequacy Ratio	0.5	+
		Shareholders' Equity / Assets	0.3	+
		(Shareholders' Equity-Fixed Assets)/Assets	0.2	+
		Non-Performing Loans/Loans	0.4	-
A - Asset Quality	0.15	Fixed Assets/Assets	0.3	-
		Total Loans & Receivables/Assets	0.3	+
		Non-Performing Loans/Loans	0.4	-
M-Management Quality	0.15	Operating Margin/Assets	0.3	+
		Net Profit Per Branch	0.3	+
		Net Profit / Assets	0.3	+
		Net Profit/Shareholders' Equity	0.3	+
E - Earnings	0.15	Earnings Before Taxes/Assets	0.2	+
		Net Profit / Paid Capital	0.2	+
		Liquid Assets/Assets	0.35	+
		Liquid Assets/Short-Term Liabilities	0.35	+
L - Liquidity	0.2	Foreign Currency Assets/Foreign Currency Liabilities	0.3	+
		Foreign Currency Assets/Foreign Currency Liabilities	0.35	-
		Net Interest Margin Before Special Provisions/Assets	0.35	-
S - Sensitivity to Market Risk	0.15	Foreign Exchange Position/Shareholders' Equity	0.3	-

Source: Kandemir & Demirel Arıcı, 2013:71-72

Literature

Literature on bank performance determinants can be summarized in two categories of studies. In first category of studies, macroeconomic determinants' effect on bank performance is analysed, while in the second category of studies, bank-specific variables' effect on bank performance is analysed. This paper's contribution to the literature is to perform an analysis on the effect of liability structure on bank performance with a more detailed point of view relative to other studies. Literature on bank performance determinants is presented below at **Table.2.**

Table 2
Literature on Bank Performance Determinants

Author	Method & Scope	Findings
Hunter & Srinivasan (1990)	Probit Model -Newly Chartered US Banks	Inefficiency By The Ratio Of Wage And Salary Expenses To Total Assets(-), Riskiness By Loan Losses (-)
Molyneux & Thornton (1992)	Panel Data Analysis-European Countries	Inefficiency By The Ratio Of Wage And Salary Expenses To Total Assets(+)
Swamy et al. (1995),	Panel Data Analysis- US commercial Banks	Unemployment Rate (-), Real-Estate Loans/Assets (-)
Naceur & Goaided (2001)	Panel Data Analysis-Tunisia	Labour Productivity(+)
Grigorian & Manole (2002)	Logit Analysis-Transition Economies Of Eastern Europe And Former Soviet Union Area	Strict Capital Adequacy Regulations (+), Tighter Foreign Exchange Policy(-), Private Ownership(+), Medium Size(+)
Guru et. al (2002)	Panel Data Analysis-Malaysia	Inflation Rate(+), Interest Rates(+), Inefficiency By The Ratio Of Total Expenses To Assets(-), Loans-Assets Ratio(-)
Hassan & Bashir (2003)	Panel Data Analysis-21 Countries' Islamic Banks	GDP Growth Rate(+), GDP Per Capita(+), Taxation(+), Loans-Assets Ratio(-), Small Size(+)
Staikouras & Wood (2004)	Panel Data (OLS And Fixed Effect)-EU	GDP Growth Rate(-), Interest Rates(-), Loans-Assets Ratio(-), Riskiness By Loan Loss Provisions/Total Loans Ratio (-), Market Share(+)
Barros et al. (2007)	Mixed Logit Analysis -EU	Deregulation(+), Loans-Assets Ratio(+), Small Size(+)
Adams & Mehran (2008)	Panel Data (OLS) Analysis -USA	Board Size(-)
Athanasoglou et al. (2008)	Panel Data (GMM) Analysis -Greece	Inflation Rate(+), Market Concentration By Herfindal -Hirschman Index (-), Inefficiency By The Ratio Of Total Expenses To Assets(-), Expected Credit Risk(-)
Heffernan & Fu (2008)	Panel Data (GMM) Analysis -China	GDP Growth Rate(+), Unemployment Rate(-), Inefficiency By The Ratio Of Total Costs To Income(-), Foreign Ownership(+), Riskiness By Loan Loss Provisions/Total Loans Ratio(+)
Ata (2009)	Panel Data Analysis (OLS And Fixed Effect)-Turkey	Loans-Deposits Ratio(+), Small Size(+), Riskiness By Loan Losses(-)
Vong & Chan (2009)	Panel Data (GLS) Analysis -Macao	Inflation Rate(+), Riskiness By Loan Losses(-)
Sufian & Habibullah (2010)	Panel Data Analysis -Bangladesh	Inflation Rate(-)

Author	Method & Scope	Findings
Alper & Anbar (2011)	Panel Data Analysis -Turkey	Interest Rate(+), income diversification by non interest income to total assets(+), large size(+), loans-assets ratio(-), riskiness by loan losses(-)
Sastroswito & Suzuki (2011)	Panel Data Analysis -Indonesia	Market Concentration By Herfihndal -Hirschman Index (+), Inefficiency By The Ratio Of Operating Expenses To Operating Income(-), Loans-Assets Ratio(-)
Sufian (2011)	Panel Data (Fixed And Random Effect Models) Analysis -South Korea	Crisis Dummy(-), Inflation(-), Market Concentration By Largest 3 Banks' Assets/Total Assets(+), Income Diversification By Non Interest Income To Total Assets(+), Liquidity By Loans/Assets(+), Expected Credit Risk(-)
Taşkın (2011)	Panel Data Analysis -Turkey	Industrial Production Index(+), Inefficiency By The Ratio Of Wage And Salary Expenses To Income(-), Loans-Assets Ratio(-), Riskiness By Loan Losses(-), Foreign Ownership(+), Small Size(+)
Gülhan & Uzunlar (2012)	Panel Data (Fixed) Analysis -Turkey	Inflation Rate(+), inefficiency by the ratio of wage and salary expenses to total assets(+), liquidity by liquid assets/assets(+), market share(+), large size(+), riskiness by loan losses(-)
Kutan et. al (2012)	Panel Data Analysis (OLS And GMM)-Dollarized Countries	Inflation Rate(+)
Francis (2013)	Panel Data (Fixed, Random Effect, FGLS Models) Sub-Saharan Countries	Inflation Rate(-), Inefficiency By The Ratio Of Expenses To Income(-), Liquidity By Net Loans/Assets(-)
Lee & Kim (2013)	Panel Data (Fixed Model) Analysis -South Korea	Foreign Ownership(+), Government Ownership(-)
Nasreddine et al. (2013)	Cognitive Mapping Technique -Tunisia	Private Ownership(+), Large Size(+), Riskiness By Loan Losses(-)
Bertin et. al (2014)	Panel Data (GMM) Analysis -South America Countries' Banks	GDP Growth Rate(+), Inflation Rate(+), Market Concentration By Largest 3 Banks' Assets/Total Assets(+), Inefficiency By The Ratio Of Operating Expenses To Assets(+), Income Diversification By Non Interest Income To Total Assets(+), Large Size(+), Liquidity By Liquid Assets/Assets(-), Expected Credit Risk(-)
Lelissa (2014)	Panel Data Analysis -Ethiopia	Inflation Rate(+), Riskiness By Loan Loss Provisions/Total Loans Ratio(-)
Osuagwu (2015)	Panel Data Analysis -Nigeria	Nigerian Naira And US Dollar Rate(+), Reserve Requirement(-), Market Concentration By Herfihndal-Hirschman Index(-), Inefficiency By The Ratio Of Operating Expenses To Assets(+), Income Diversification By Non Interest Income To Operating Profit(+), Loans-Assets Ratio(-), Riskiness By Loan Losses(-)
Owusu-Antwi et. al (2015)	Panel Data (GMM) Analysis -Ghana	Inefficiency By The Ratio Of Costs To Income(+), Liquidity By Liquid Assets/Assets(+), Large Size(+)
Reis et. al (2016)	Panel Data (Fixed) Analysis -Turkey	GDP Growth Rate(-), Loans-Assets Ratio(-)
Sevim & Eyüboğlu (2016)	Panel Data Analysis -Turkey	Loans-Assets Ratio(-)
Yalçınkaya et. al (2016)	Panel Data Analysis -Turkey	Volatility Of Turkish Lira To %50US Dollar-%50 Euro Rate(-), Political Instability(-), Interest Rates(-), loans-assets ratio(+), large size(+)
Çelik (2018a)	CAMELS Analysis -Turkey	Size(-)

EU: European Union; *FGLS*: Feasible Generalized Least Squares; *GDP*: Gross Domestic Product; *GLS*: Generalized Least Squares; *GMM*: Generalized Method of Moments; *OLS*: Ordinary Least Squares; *USA*: United States of America; (+): Positive relationship; (-): Negative relationship

The studies that analyse the bank performance and liability structure relationship in the literature have less detailed point of view relative to this paper. These studies analyse the capital, deposits, leverage, liability deviation and other liabilities' effect on bank performance.

Capital

Demirguc-Kunt & Huizinga (1999), used panel data analysis (OLS, Within and Between Estimates) in scope of 38 countries' banks and revealed the positive relationship between CAR and to attract more deposits. Naceur & Goaided (2001) in their panel data analysis on Tunisian banks showed the positive relationship between CAR and ROA. Guru et. al (2002) in their panel data analysis in scope of Malaysian banks, found out the negative relationship between CAR and ROA/ROE. Athanasoglou et al. (2008) used the panel data (GMM) analysis in scope of Greek banks and presented the positive relationship between CAR and ROA/ROE. Heffernan & Fu (2008), in their panel data (GMM) analysis in scope of Chinese Banks demonstrated the negative relationship between CAR and ROE/NIM. Ata (2009), in his panel data analysis (OLS and fixed effect) on Turkish banks exhibited the negative relationship between CAR and ROA. Koranteng (2012), in his regression analysis on Ghana banks found positive relationship between equity/assets ratio and ROE. Francis (2013) in his panel data analysis (fixed, random effect and FGLS) on 42 sub-Saharan countries' banks revealed the positive relationship between CAR and ROA. Yalçınkaya et. al (2016) used the panel data analysis in Turkish deposit banks and demonstrated the positive relationship between CAR and ROA.

Deposits

Studies in the literature related to deposits effect on bank performance show the positive relationship of deposits-assets ratio and bank performance. Naceur & Goaided (2001), in their panel data analysis on Tunisian banks showed the positive relationship between deposits-assets ratio and ROA. Kosmidou et. al (2004b), in their statistical cost accounting (SCA) model analysis on UK banks, revealed the negative relationship between demand deposits, time & saving deposits and net income. Koranteng (2012), in his regression analysis on Ghana banks presented positive relationship between deposits/assets ratio and ROA,ROE. Belete (2013), in his pooled OLS regression analysis on Ethiopian banks exhibited the negative relationship between saving and fixed deposits and ROA. Francis (2013), in his panel data analysis (fixed, random effect and FGLS) on 42 sub-Saharan countries' banks found the positive relationship between deposits-assets ratio and ROA. Bertin et al.(2014), used the panel data (GMM) analysis in scope of Argentina, Brazil, Chile, Colombia, México, Paraguay, Peru, and Venezuela commercial banks and showed the positive relationship between deposits-assets ratio and ROA/NIM. Zhang (2017), in his regression analysis on Chinese banks presented the positive relationship between deposit share in market and ROA. Wagdi et.al

(2019) in their panel data analysis (WLS) on Egyptian banks revealed the negative relationship between investments/deposits ratio and ROA, ROE. Owusu & Alhassan (2020), in their statistical cost accounting (SCA) model analysis on Ghana banks demonstrated the negative relationship between demand deposits, saving deposits, deposits from banks and net income/net interest income.

Leverage

Hassan & Bashir (2003), presented the positive relationship between liabilities/assets ratio and bank performance that measured by ROA, ROE and NIM. While, Reis et. al (2016) in their panel data (fixed effect model) analysis in Turkish deposit banks showed negative relationship between liabilities/assets ratio and NIM.

Liability Deviation

Özyıldırım & Özdiñer (2009), in their panel data analysis (fixed effect and GMM) on Turkish deposit banks revealed negative relationship between deviation from average liability allocation and ROA. They used third party funds, equity and customer deposits' average share in liabilities.

Other Liabilities

Kosmidou et. al (2004b), in their statistical cost accounting (SCA) model analysis on UK banks, showed the negative relationship between short term funding, other funds (subordinated debt, hybrid capital and long term debt) and net income. Belete (2013), in his pooled OLS regression analysis on Ethiopian banks found out the negative relationship between other liabilities (other banks deposits, provision for taxation, state dividend payables, long term loans) and ROA. Owusu & Alhassan(2020), in their statistical cost accounting (SCA) model analysis on Ghana banks revealed the negative relationship between total long term funding, other short term funding and net income/net interest income.

Research on Turkish Deposit Banks

This research aims to investigate the possible relationship between bank performance and bank liability structure.

Scope of the research is limited to Turkish deposit banks. Turkish deposit banks are exposed to structural policy changes after 2001 local economic crisis. These structural policy changes affect the capital and liability preferences of Turkish deposit banks. Especially demand to non-deposit fund sources, long-term loans and alternative fund sources are increased after 2012 and banks began to issue wide variety of instruments for funding. (Çelik, 2018b: 56-71). Therefore, Turkish deposit bank sector is a good scope to view bank liability structure

changes that happened in a short time. This characteristic of Turkish deposit banks makes it appetizing scope for the research.

Constraints

Results of researches in social sciences have to be interpreted by taking constraints of the research into consideration. This research also has some constraints and they have to be considered carefully in use of results. The main constraints of the research can be summarized as follow:

- The scope of the research is limited with Turkish deposit banks. Therefore, generalization of the results can be misleading.
- Research's method is panel regression that only takes linear relationship between variables into consideration. However, in social sciences, relationship between variables can be in various ways like non-linear or monotonic etc.
- It is assumed that performance measure of banks is CAMELS score, but the fact remains that different variables that are not considered in CAMELS score calculation may also affect banks' performance.
- Research uses 10 deposit banks in Turkey that constitute roughly %85-%90 of the Turkish deposit bank sector in terms of asset size, loans, deposits, number of branches and number of employees.
- It is assumed that banks have similar opportunity in funding decisions. However, like banking sector, in some sectors big size firms have better opportunities in reaching sources because of economies of scale.
- Research is based on the data between 2005 and 2018. Therefore, results should be interpreted according to last 14 years' conditions.

Population and Sample

Population of the research is all deposit banks that operate in Turkey between 2005-2018. Handling with all deposit banks between these years is quite difficult because in each period different banks enter into the sector and some other banks quit the sector. Taking all banks' data into consideration brings the problem of unbalanced data. Therefore, 10 deposit banks (*Table.3*) that have the highest asset size according to 2018 ranking are sampled with assumption of that these banks reflect the general tendency in Turkish deposit banking sector. These banks constitute about %85-%90 of the sector in terms of asset size, loans, deposits, number of branches and number of employees (*Figure.2*).

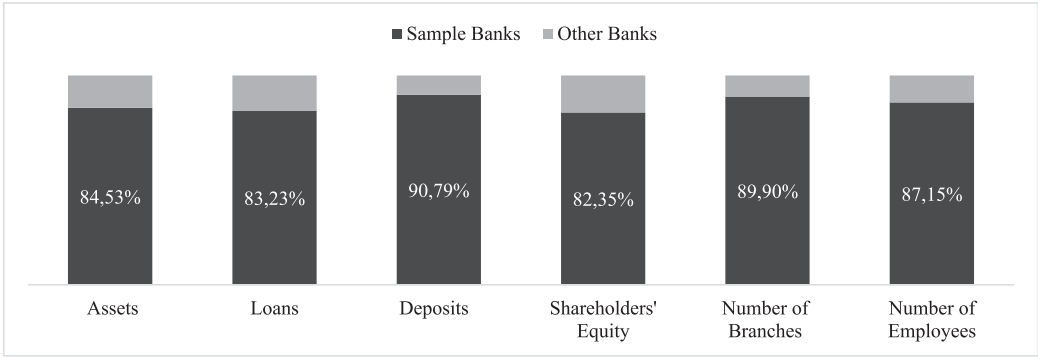


Figure 2. Share of Sample Banks in the Sector

Note: Figure is composed through the data of The Banks Association of Turkey

Table 3
Sample Banks

1	Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	6	Türkiye Vakıflar Bankası T.A.O.
2	Türkiye İş Bankası A.Ş.	7	Akbank T.A.Ş.
3	Türkiye Halk Bankası A.Ş.	8	QNB Finansbank A.Ş.
4	Türkiye Garanti Bankası A.Ş.	9	Denizbank A.Ş.
5	Yapı ve Kredi Bankası A.Ş.	10	Türk Ekonomi Bankası A.Ş.

Model and Variables

Bank performance is the model’s dependent variable and the banks’ CAMELS score is regarded as banks’ only performance indicator. Research model endeavors to explain bank performance (dependent variable) through three type of independent variables. First type of independent variables is macro variables that are gathered by literature review on bank performance determinants. Second type of independent variables is bank specific variables that are also gathered by literature review on bank performance determinants. The first two type of variables are used in the model as control variables. Third type of variables is composed of bank liability structure variables. These variables are policy variables in the model. The data that is used in the model is gathered from The Banks Association of Turkey’s database, Turkey Statistical Institute (TUIK) and Central Bank of Turkey’s (TCMB) database. The Banks Association of Turkey’s database is used for bank-specific variables and liability structure variables and TUIK and TCMB database is used to gather macroeconomic variables. Data covers 10 deposit banks’ information between 2005-2018 years and Turkey’s macroeconomic variables between these years. Research model can be summarized as below:

$$\begin{aligned}
 CAMELS_{it} = & \alpha_{it} + \sum_{i=1}^{10} \sum_{t=2005}^{2018} \beta_{it} Macro\ Variable_{it} + \sum_{i=1}^{10} \sum_{t=2005}^{2018} \beta_{it} Bank\ Specific\ Variable_{it} \\
 & + \sum_{i=1}^{10} \sum_{t=2005}^{2018} \beta_{it} Liability\ Structure\ Variable_{it} + \varepsilon_{it}
 \end{aligned}
 \tag{1}$$

Macro variables are used in the model because of the possible effect of macro changes on finance sector entities. Macro variables in the model are as follows (*Table.4*):

Table 4
Macro Variables in the Model

Macro Variables	Symbol	Explanation	Expected Relationship
<i>Crisis Dummy</i>	<i>dumCRISIS</i>	<i>It is used in the model to take 2009 financial crisis effect into consideration. It is 1 if year is 2008 or 2009 and otherwise it is 0.</i>	(-)
<i>GDP Per Capita Change Ratio</i>	<i>GDP</i>	<i>GDP per capita's yearly % change</i>	(+)
<i>Inflation Rate (Consumer Prices)</i>	<i>INF</i>	<i>Yearly Consumer Price Index % change that is announced by Turkish Statistical Institute (TUIK)</i>	(-)
<i>Unemployment Rate</i>	<i>UNEMP</i>	<i>Yearly Unemployment Rate that is announced by Turkish Statistical Institute (TUIK)</i>	(-)
<i>TCMB O/N Lending Rate</i>	<i>INTEREST</i>	<i>Current Central Bank of Turkey's Overnight Lending Rate by each year's 31th December</i>	(-)

Expected effect of crisis dummy is negative because crisis periods cause decrease in trust to financial sector and this situation affects banks in both of the asset and liability side negatively. Expectation between GDP per capita and performance is positive because increase in disposable income leads an increase in investment and savings. Expected relationship sign for inflation is negative because inflation affects disposable income and expected risk negative by decreasing predictability in economic environment. In the same way, unemployment rate's expected effect is negative because increase in unemployment rate means decrease in economic activity and less investments. Expected relationship between performance and interest rate is negative because rise in interest rate means rise in bank costs in funding and decrease in investments and loan needs.

Variables that are related to banks' specific characteristics also have effect on bank's performance. Therefore, through literature review bank specific variables are also determined to use in the model. These variables are as follows (*Table.5*):

Table 5
Bank Specific Variables in the Model

Bank Specific Variables	Symbol	Explanation	Expected Relationship
<i>Size</i>	<i>SIZE</i>	<i>Asset size</i>	(+)
<i>Efficiency</i>	<i>EFFC</i>	<i>Operating Income / Assets Ratio</i>	(+)
<i>Liquidity</i>	<i>LIQ</i>	<i>Bank's Liquid Assets / Short Term Liabilities Ratio</i>	(+)
<i>Riskiness</i>	<i>RISK</i>	<i>Non-Performing Loan Ratio</i>	(-)
<i>Effectiveness</i>	<i>EFFCTIVE</i>	<i>Loans/Assets Ratio</i>	(+)
<i>Market Share</i>	<i>SHARE</i>	<i>Market Share in the Loan Market</i>	(+)

Expected sign of the size is positive because banks operate in an oligopolistic market and this means that bigger size brings different advantages that can not be reached by small sized market entrants. Efficiency's expected sign is positive because being efficient decrease

costs and increase income. Expectation on the sign of relationship between liquidity and bank performance is positive because banks have to stay liquid because of the banking sector's characteristics. Banks have to make their payment exactly right time; otherwise they face to risk of bankruptcy. Hence, a decrease in liquidity should affect bank performance in a negative way and vice versa. Expectation regard to the sign of relationship between riskiness and bank performance is negative because credit risk measure is used for riskiness in the model and increase in credit risk means deterioration in asset quality and sustainable income. Herewith, the negative relationship between riskiness and bank performance is sensible. The positive relationship between effectiveness and bank performance is expectable because the ratio to measure effectiveness in the model is asset quality ratio and increase in asset quality brings less fluctuating and higher income. Also, expectation regard to relationship sign for market share and bank performance positive, because higher market share results in higher profit, higher customer info, link and higher recognition in the market. These are all good ways to increase performance.

Policy variables in the model are composed of banks' liability structure related ratios. These variables as follows (*Table.6*):

Table 6
Liability Structure Variables in the Model

Liability Structure Variables	Symbol	Explanation	Expected Relationship
<i>Capital</i>	<i>CAP</i>	<i>Capital Adequacy Ratio</i>	(+)
<i>Dependence to Deposits</i>	<i>DEP</i>	<i>Deposits/Liabilities Ratio</i>	(+/-)
<i>Dependence to Non-Deposit Liabilities</i>	<i>NONDEP</i>	<i>Non-Deposit Liabilities/ Liabilities Ratio</i>	(+/-)
<i>Dependence to Loans Borrowed</i>	<i>LOANS</i>	<i>Loans Borrowed / Liabilities Ratio</i>	(+/-)
<i>Dependence to Third Alternative Liabilities</i>	<i>OTHER</i>	<i>Other Liabilities / Liabilities Ratio</i>	(+/-)
<i>Deposit Term Structure</i>	<i>LTDEP</i>	<i>Long Term Time Deposits/Deposits Ratio (In Turkey average deposit term is 3 months. Deposits that have longer term than 3 months are assumed long term deposits)</i>	(+)
	<i>DEMAND</i>	<i>Demand Deposits /Deposits Ratio</i>	(-)
<i>Depositor Structure</i>	<i>SAV</i>	<i>Saving Deposits/Deposits Ratio</i>	(+)
	<i>GOV</i>	<i>Government Deposits/ Deposits Ratio</i>	(+)
<i>Deposit Size Structure</i>	<i>BOT</i>	<i>Bottom Level Deposits/ Deposits Ratio (Bottom level deposits are assumed as deposits that are subject to deposit insurance)</i>	(+)
<i>Deposit Currency Structure</i>	<i>FORGN</i>	<i>Foreign Exchange Deposits/ Deposits Ratio</i>	(+)
<i>Dependence to Securities Issued</i>	<i>SEC</i>	<i>Securities Issued / Non-Deposit Liabilities Ratio</i>	(+/-)
<i>Leverage</i>	<i>LEV</i>	<i>Liabilities/Assets Ratio</i>	(-)
<i>Loan Term Structure</i>	<i>LTLOAN</i>	<i>Long Term Loans / Loans Borrowed Ratio</i>	(+)
<i>Loan Currency Structure</i>	<i>FORGLOAN</i>	<i>Foreign Exchange Loans / Loans Borrowed Ratio</i>	(+)

Expected sign of the capital adequacy ratio is positive because the higher level of capital for each risk measure (market, credit and operational) makes the bank safer and less vulnerable to risks. There is no expected sign for dependence to deposits, dependence to non-deposit liabilities, dependence to third alternative liabilities, dependence to loans borrowed, and dependence on securities issued because each of these fund options has its own pearls and pitfalls and their usage value changes according to the bank needs and characteristics. Positive relationship between long-term deposits/long term loans and bank performance is expected because these funds give advantage of using them for a longer term profitable investments. For the same reason, demand deposits' expected sign is negative because they are not long term fund sources and can be withdrawn any time. Expected sign for foreign deposits-loans is positive because Turkey is a country that has chronic current deficits for years because of the structural deficiencies and financial system needs foreign currency usually. Hence, foreign currency funds are advantageous for banks. The expected sign for saving deposits and bottom level deposits is positive because these deposits constitute huge amount in the total but they are little deposits separately. Therefore, in a short time too much amount of withdrawal in a mass can not be expected for these deposits. For this reason, they are quite permanent funds for banks. In the same way, government deposits' expected sign is also positive because they are also semi-permanent funds for banks since they can not be withdrawn in the short term because of agreements between government agencies and banks. Lastly, leverage's expected sign is negative because too much leverage cause more vulnerable financial condition against risks.

Method

“A panel of data, also known as longitudinal data, has observations on individual micro-units who are followed over time” (Hill et al., 2011:8). For example, ten different families' monthly food budget information across ten years is a panel data. By increase in available panel type data, many researchers begin to use panel data because panel data includes more variability and can help to handle issues that time series and cross sectional data can not explain alone (Kennedy, 2008:282).

In this paper, regression analysis is used on panel data that includes 10 banks' information across 14 years. Regression analysis is a type of analysis that purposes to find the effect of changes in one variable (independent variable) on another variable's (dependent variable) change (Sevüktekin, 2013:231-232).

Since panel data includes both units and times, panel data models may have individual (unit) effect, time effect or both. These effects are taken into consideration through fixed effect and random effect models in panel data regression (Park, 2011:1). In deciding on which model to use in panel regression analysis, unobserved heterogeneity is an important term.

Unobserved heterogeneity is failure of explaining changes in dependent variable with present variables because excluding some variables (Tatoglu, 2016:7).

If the unobserved heterogeneity problem can be dealt with specific intercepts (individual effect) then fixed effect model can be used. If unobserved heterogeneity problem can be dealt with disturbance term then random effect model is applied. With a statistical perspective, if F-test can be rejected fixed effect model is applicable; while if LM test can be rejected random effect model can be used. If both tests (F and LM) can be rejected then Hausman test is used in model decision process. If Hausman Test's H_0 hypothesis can be rejected then fixed effect model is used; otherwise random effect model is used (Park, 2011:16-17).

After deciding on model to use in panel regression; assumption tests should be performed. According to assumption test results, appropriate estimator is selected. Model should be tested against heteroscedasticity, autocorrelation and cross-sectional correlation. If model can not meet assumptions of homoscedasticity, no-correlation and no-cross-sectional correlation then robust estimators are used like Driscoll & Kraay (1998), Beck-Katz (1995) etc.

Findings

In the *Table.7* below, CAMELS scores of the banks between 2005-2018 years are presented. Median is preferred to reflect general condition of the banks because of the reason that calculation method of the CAMELS causes zero average in each year and this situation does not allow to comparison of yearly changes in CAMELS score. In the analysis period government and private banks performed better than foreign banks. 2007,2008, 2013 and 2015 are well performed years for the analyzed banks while 2005, 2010,2011 and 2018 are relatively less successful years.

As a result of the tests that are performed for model and estimator selection, fixed effect model is preferred and estimations are generated through Driscoll-Kraay estimator that is robust against heteroscedasticity, autocorrelation and cross-sectional correlation. Results are presented in the *Table.8* below.

According to the results, at least one variable in the model to explain CAMELS score is statistically meaningful ($F(26,9)=1899.18$ and $p>F=0.0000$). Model can explain %86.78 of the changes in the CAMELS score (within $R^2=0.8678$).

In terms of macro variables, % change in GDP per capita, inflation rate and interest rate have statistically significant effect on bank performance. Parallel to the expectation, rise in interest rate affect bank performance negatively. However, contrary to expectations, rise in GDP per capita and decrease in inflation results in decrease in bank performance. The reason behind this result may be related to reforms of 2001 in finance sector. After crisis period, the main two problems of Turkey were government budget deficits because of public enterprises and financial sector vulnerability. Therefore, bank reforms aimed soundness for banks against negative economic fluctuations. Unexpected GDP per capita growth/inflation rate and bank performance relationship may be result of the soundness of banks in negative business cycles.

Table 7
CAMELS Scores of Banks

	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	Median
Ziraat Bankası	7.52	19.53	26.88	28.79	27.28	18.56	11.54	11.71	23.50	29.15	22.90	37.17	38.17	-138.54	23.20
Akbank	14.20	20.71	21.92	19.13	19.05	14.78	20.59	14.36	22.38	19.40	12.74	24.78	24.82	-82.05	19.26
Garanti Bankası	18.09	14.46	9.51	10.30	9.62	12.57	14.46	23.54	20.72	19.38	16.93	20.20	-3.45	-100.11	14.46
İş Bankası	-3.45	1.70	5.53	4.60	9.28	4.97	4.22	2.26	3.07	4.13	11.80	4.74	-1.37	-40.60	4.18
Halk Bank	-8.07	4.24	1.49	8.70	3.93	16.05	15.38	10.29	4.52	-1.76	-7.65	-2.48	-15.70	-115.98	2.71
Vakıf Bank	0.23	-2.03	-1.60	0.40	-4.44	-3.00	-5.91	-4.98	-10.12	1.44	0.59	5.94	6.82	-45.52	-1.82
Türk Ekonomi Bankası	4.20	-7.73	-10.80	-3.61	-10.89	-9.02	-13.98	-21.26	-8.84	-13.83	3.58	-18.35	-15.95	-94.72	-10.84
Yapı ve Kredi Bankası	-4.67	-15.62	-14.97	-13.05	-7.32	0.38	-8.27	-13.89	-9.56	-20.93	-15.89	-41.58	-48.83	856.05	-13.47
Denizbank	-17.89	-13.86	-13.62	-23.64	-22.98	-29.71	-12.20	-5.76	-28.75	-15.64	-17.49	-17.47	3.27	-100.24	-17.48
QNB Finansbank	-10.17	-21.40	-24.34	-31.63	-23.53	-25.58	-25.83	-16.27	-16.92	-21.35	-27.52	-12.95	12.23	-138.29	-22.46
Median	-1.61	-0.17	-0.06	2.50	-0.26	2.68	-0.84	-1.36	-2.89	-0.16	2.09	1.13	0.95	-97.42	0.44

Table 8
Regression Results with Driscoll-Kraay Estimator

	CAMELS (Dep. Variable)		CAMELS (Dep. Variable)
<i>Constant</i>	1154.136*** (3.42)	Liability Structure Variables	
Macroeconomic Variables		<i>CAP</i>	-1.965026*** (-3.40)
<i>dumCRISIS</i>	-32.07218 (-1.58)	<i>DEP</i>	-0.5182075 (-0.22)
<i>GDP</i>	-1.409204* (-2.07)	<i>NONDEP</i>	-3.652707* (-1.94)
<i>INF</i>	4.489466** (2.92)	<i>LOANS</i>	0.7090021* (1.85)
<i>UNEMP</i>	-1.215025 (-0.23)	<i>OTHER</i>	-3.884178* (-2.08)
<i>INTEREST</i>	-1.38501* (-1.99)	<i>LTDEP</i>	-1.950843* (-2.10)
Bank Specific Variables		<i>DEMAND</i>	0.5202497 (0.42)
<i>SIZE</i>	-0.0002235* (-2.05)	<i>SAV</i>	2.772054*** (4.03)
<i>EFFC</i>	-56.30842*** (-9.55)	<i>GOV</i>	-1.660241 (-0.95)
<i>LIQ</i>	0.277552*** (4.23)	<i>BOT</i>	0.7864697 (0.95)
<i>RISK</i>	-9.833123*** (-5.83)	<i>FORGN</i>	1.070702 (1.22)
<i>EFFCTIVE</i>	0.3684484 (0.59)	<i>SEC</i>	-0.4260985 (-0.81)
<i>SHARE</i>	4.698355*** (3.40)	<i>LEV</i>	-10.72471*** (-4.57)
		<i>LTLOAN</i>	0.5415833** (2.33)
		<i>FORGLOAN</i>	-0.9788127** (-2.49)
Tests & Data Information			
# of observations: 140		Mod. Bhargava et al. Durbin-Watson = 1.7203677	
<i>F</i> (26,9) : 1899.18 (Prob>F:0.0021)		Baltagi-Wu LBI = 1.969851	
<i>LM Test</i> : Prob>=chibar2 = 0.031		Pesaran's Test of Cross Sectional Independence Prob = 0.0013	
<i>Hausman Test</i> : Prob>chi2 = 0.0040		-Values in parentheses are t-statistics.	
<i>Modified Wald Test</i> : Prob>chi2 = 0.0000		-***, **, and * indicate significance at 1, 5, and 10%levels	

As bank-specific variables, size, efficiency, liquidity, riskiness and market share have statistically significant effect on bank performance. The results in terms of riskiness, liquidity and market share are parallel to the expectations. According to the results, there is a negative relationship between riskiness and bank performance. Liquidity and market share's relationships with bank performance are in positive way. However, the results in terms of size and efficiency are contrary to expectations. There is a negative relationship between size and bank performance. Although this result is unexpected, it can be explained by that banks are service firms and shrinking may be good way to serve better because of small size companies' advan-

tage in flexibility and response speed to change in business environment. There is a negative relationship between efficiency and bank performance. This result is also quite unexpected and it may be explained by that in service industry serving the best may be more important than serving the better in terms of utility/cost.

As liability structure variables, capital, dependence to non-deposit liabilities, dependence on loans, dependence on third alternative fund sources, deposit term structure, depositor structure, leverage, loan term structure and loan currency structure have statistically significant effect on bank performance. Contrary to expectation relationship between capital adequacy and performance is negative. Banks are obliged to obey capital adequacy ratios that are determined by regulators. Departing from regulators' minimum limit may mean taking less risk than required. This may be the reason for negative relationship between capital and bank performance. There is a negative relationship between dependence to non-deposit liabilities/third alternative liabilities and bank performance. This result can be explained by that deposits are always primary fund source for banks and less deposit dependent liability structure may result in higher costs and less customer contact although different fund sources give more flexibility to banks. There is a negative relationship between leverage and bank performance as expected. Relationship between dependence to loans and banks performance is in positive way. Loans are fund sources that offer longer term than any other fund source. This characteristic of loans makes them attractive source for banks especially in Turkey, because average deposit term in Turkey is 3 months. Therefore, use of loans -especially for longer term fund needs- is right fund choice for banks. The positive relationship between long-term loans and bank performance also supports this idea. While use of long term loans has positive effect on bank performance; use of long term deposits has negative effect on bank performance contrary to expectation. The reason behind this result may be that use of long term loans rather than long term deposits for longer term fund needs gives quite longer term despite its little higher cost. This relative advantage of loans may be reason of negative relationship between long term deposits and bank performance. According to the results, there is a positive relationship between bank performance and saving deposits as expected. Lastly, contrary to expectation, there is a negative relationship between foreign currency loans and bank performance. This result is related to end of quantitative easing in the world and foreign trade deficit of Turkey. Turkish Lira and other developing country currencies lose value by the end of quantitative easing period. Also, Lira lose value because of Turkey's foreign trade deficits. Therefore, heavy use of foreign loans may result in increase in costs because of value loss in Lira.

Conclusions

Banks have wide variety of funding opportunities and they choose how to fund by comparing advantages and disadvantages of each. This paper, with Turkish deposit bank scope, endeavors to answer question of that "Does how to fund has any effect on bank performan-

ce?”. According to the results that are reached in this paper, liability structure affects bank performance.

According to the research on Turkish deposit banks, parallel to the situation in the very beginning of the banking, deposits are primary fund source for banks and too much departure from deposit dependent liability structure results in decrease in performance. However, this does not mean that banks should not use any different fund options. By considering the research results, different fund options like loans can affect bank performance in positive way because weakness of deposit in terms of term structure can be compensated with use of loans. Especially long-term use of loans is a quite important for better bank performance.

By taking the research results into consideration, saving deposits are important fund sources for banks thanks to their semi-permanent structure. Additionally, heavy use of foreign currency loans may cause increase in costs when local currency lose value. Therefore, use of foreign currency loans should be in accordance with exchange risk management.

According to the research results, although banking is a high leverage sector, excessive use of leverage does not bring better performance for banks. Also, in the same way too much departure from capital adequacy regulations and being excessively prudent in terms of capital brings underperformance.

Major policy recommendations as a result of the findings in this paper can be summarized below:

- Banks have to allocate liabilities very carefully because liability structure affects bank performance.
- Deposits are always primary fund sources for banks. Therefore, banks should avoid too much departure from deposit dependent liability structure.
- Use of loans is a good policy for banks to answer long term fund needs. Banks should prefer long term loans rather than long term deposits for long term fund needs.
- Decision to use of foreign currency loans should be made very carefully and banks should hedge themselves against value loss of local currency in use of foreign currency loans.
- Economic governance should be attentive to interest rates because higher interest rates affect bank performance negatively because of decrease in real sector investments.
- Excessive use of leverage should be controlled and reviewed very carefully by both regulators and bank management.

- Too much departure from capital adequacy minimum limit means taking less risk than required. Therefore, staying close to the limit should be encouraged.
- Solvency level of bank assets in terms of their liability repayment should be controlled and reviewed very carefully by both regulators and bank management.
- Problem loans should be managed and reviewed very carefully by banks.

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RESEARCH ARTICLE

Financial Statement Fraud in the Turkish Financial Services Sector

Lale Aslan¹

Abstract

Financial statement fraud is a huge obstacle to economic growth and it results in the loss of investors' trust in the financial system. In literature, financial statement fraud detected in real sector companies is investigated thoroughly, however, financial statement fraud in financial institutions is somewhat ignored. In this article, the researcher investigates the typologies and frequencies of financial statement fraud detected by the regulator. The financial services sector framework is made up of companies like banks, intermediary institutions and portfolio management companies and the Capital Markets Board of Turkey (CMB) is the regulator and auditor for the Turkish financial services sector. The author based her research on the audit findings of CMB between 2012 and 2020. According to research results, intermediary institutions are found to be the riskiest type of institution with the majority of fraud cases and the most frequently seen type of fraud is asset misappropriation of client assets. Moreover, CMB is likely not to pursue legal allegations if the company in question is awarded a sanction according to the correlation analysis result. This article has a unique approach that combines jurisprudence and fraud cases and draws attention to financial statement fraud in the financial services sector, which is a pioneer for the Turkish economy.

Keywords

Audit, Regulation, Banks, Brokerage Firms, Portfolio Management

Introduction

Fraud can be defined as undercover efforts in publicly or privately owned institutions that are against legal regulations and aim to benefit the performer illegally. Fraud can take many forms from public scams that aim to deceive unsuspecting citizens to the application of complex techniques to financial data. Without any regard to the type of fraud, the consequence concerning the economy is similar to a dark hole in the universe. According to a PwC survey (PwC, 2018), there was an increase in fraud cases in companies from 2016 to 2018 and the majority of the fraud cases were caused by employees. Furthermore, top management is the fraudster in many cases.

The researcher will focus on the financial services sector in Turkey in this study. Financial services institutions are defined as banks, intermediary institutions and portfolio management

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companies for the context of this study. The Turkish financial services sector is a key example of the transformation which occurred in the said sector. Before 1999, the banking sector in Turkey lacked proper regulation as the main regulatory authority, Banking Regulation and Supervision Agency, was only founded in 1999 after a number of banks went bankrupt and a banking crisis. To overcome the tumultuous situation, a major structural reform was implemented, which greatly shaped today's economy. Therefore, Turkey is an important example of developing countries in this sense.

Moreover, in Turkey, capital market regulation underwent a complete makeover by the Capital Markets Board of Turkey (CMB) during 2012 - 2013 and the changes made in the regulation were heavily influenced by European regulations and the 2008 crisis. The research aims to investigate whether this expectation is true or not. Financial statement fraud is inspected by the CMB. Financial services institutions are required to prepare their financial statements according to Turkish Accounting Standards and Turkish Financial Reporting Standards announced by the Public Oversight Accounting and Auditing Standards Authority of Turkey. Furthermore, there are some sector-specific regulations announced by CMB. Auditing of these institutions is performed by CMB auditors, although all of these institutions are required to implement internal audit and control systems.

In this article, the frequencies, financial impact and fraud strategies of financial services institutions will be covered. Data from CMB audits between 2012 and 2020 will be examined. The standards and regulations of the financial services sector are greatly shaped by the 2008 crisis and this has possibly influenced fraudulent activities. Internal auditors of financial services institutions are responsible for informing the CMB of any problems concerning the financial situation of the institution. Moreover, intermediary institutions have to report their capital adequacy levels to the CMB periodically. Before the 2008 crisis, this reporting was required monthly. After the collapse of Lehman Brothers, CMB required capital adequacy reporting every week, which indicates increased measures to ensure strong and healthy financial institutions. The regulators expect that updated regulations after the 2008 crisis contribute to the prevention of financial statement fraud.

This study aims to attract attention to financial statement fraud in the financial services sector, which is a rather neglected topic in literature. Financial institutions are keystones of a healthy and well-functioning economic system. Any disruptions concerning these institutions will undermine the efforts of governments and central banks towards stabilizing the economy as the real sector depends on the finance sector for resources. It is possible to see many papers in the literature about financial scandals in conglomerates like Enron, WorldCom and Parmalat. There is no denying the damaging effect of these scandals on capital markets and the overall economy; however, financial statement fraud seen in the finance sector can cause many severe effects and possibly a nationwide crisis. Therefore, this article is dedicated to analysing the audit findings related to the financial services sector.

Turkish literature concerning financial services fraud is limited to the perspective of employee fraud or bank clients' financial statement fraud. Even though there have been many failed banks in Turkey, not a single article covering these banks has been published. Since the framework of this article is to investigate the cases of fraud in the finance sector, this article holds a unique place in Turkish literature.

The outline of the paper features the theoretical background for financial statement fraud, the importance of the financial services sector, the relation of the economic environment to financial statement fraud, results of the financial statement fraud-related analysis in Turkey and a conclusion.

Background

Fraud is one of the most dangerous threats to a business at the micro level and it is a threat to the overall economy at the macro level. A sound economy can only exist where business transactions are made truthfully, and the bond of trust is not broken by any economic actor. After all, a fully functioning economy depends on the mutual trust of the parties, without it there will be disruption. Investors would like to think that the financial statements of a company show the real situation in a truthful manner. That is one of the reasons why a potential investor places their life savings in the stock markets. If the company's financial statements do not reflect any real problems that the company encounters, then investors are tricked into thinking that such an investment is worthwhile and when fraud is revealed, stock markets crash and all the investor's savings are lost. Therefore, the trust and bond between the investor and the stock market is damaged. This is why scandals like Enron, WorldCom and many others are so laboriously investigated. The economy management is tasked with ensuring the healthy functioning of capital markets and such fraud scandals prevent it from being so.

When top management is involved in fraud, it concerns financial statement fraud because generally, top management aims to exploit the resources of the company to their benefit and to cover their steps, they need to apply window dressing in financial statements. This can be the worst-case scenario for companies because the people who should be responsible for directing and enriching the company, act in their interest which is explained by the agency theory. According to the agency theory, there is an inherent conflict of interest between shareholders and management and consequently, there is a cost of using an agent. The internal control cost factor is the most essential contributor to agency cost as all major actions have to be under scrutiny to avoid fraud. However, it is not always possible to prevent fraud, because top management and shareholders do not give prevention measures the importance they deserve (PwC, 2018).

Shareholders have used compensation plans as a prevention tool for internal fraud. However, over -the-top compensation plans have attracted negative attention from the public,

and whether senior management deserves such payments became questionable after the 2008 economic crisis. According to Acero & Alcalde (2020), the economic performance of a company is independent of the compensation of senior management. This finding suggests that committing fraud has nothing to do with the payments made to top management; instead, fraud is more related to the incentives given to people.

Basics of Financial Statement Fraud

Financial statement fraud may take many different forms, depending on the ownership of the firm. If the organization in question is publicly owned, top management may have different worries concerning the financial statements when compared to a privately owned company. Publicly held firms are under pressure from investors to keep the stock market price high. Top management is inclined to commit financial statement fraud to cover up financial problems and buy enough time to find solutions. Some of the make-up techniques used in this endeavour consist of wrongfully increasing assets and income or decreasing debts and expenditures so that profits are also increased (Association of Certified Fraud Examiners (ACFE), 2003). If the company in question is not a publicly held corporation, then there is no pressure to keep the stock price high. The main concern of private companies is to increase profits and to achieve this goal top management tries to reduce tax payments either by understating sales or by overstating expenses. Therefore, types of financial fraud can be divided into two major categories according to the incentive. ACFE groups financial statements fraud into two categories: Overstating and understating assets and income. Moreover, earnings management, income smoothing, creative accounting, aggressive accounting and big bath accounting are types of manipulations that can be used in accounting. The most popular manipulation technique concerns the recording of expenditures (Zengin, 2018).

Financial statements fraud is either committed in order to make the business look better than it is, which serves to impress shareholders and investors, or to cover up over the top expenses aimed to benefit the senior management rather than the business (ACFE, 2020). Prevention of fraud is important because there is a great cost associated with it. Since the 2008 global crisis, there has been a 56.5 per cent increase in the cost of losses. The total amount of fraud cost is equal to USD 5.127 trillion globally (Gee & Button, 2019). Moreover, companies take measures for the detection of fraud; however, these measures do not necessarily contribute to the prevention of fraud. Therefore, the global cost of fraud keeps on rising. According to ACFE (2018), 10 per cent of all fraud is financial statements fraud and its median is equal to USD 800,000. Even though financial fraud occurrence is relatively low, the significance and cost of financial statements fraud are quite high, therefore it is the most dangerous type of fraud for enterprises and it results in clearing out the capital of companies and a definite loss for shareholders.

In today's complex work environment, detection of financial statement fraud should not be left to conventional methods which provide post-event data. Technological advances have to be applied in fraud detection endeavours if the institution in question wants to implement realistic measures for fraud prevention (Chimonaki, et al., 2019).

One false assumption about financial statement fraud is that it is only committed by the top management of organizations. In some cases, external parties commit financial fraud as well. Generally, financial services companies are victims of such fraud schemes which occur when a client takes a large loan and does not pay it back. Worthless loans become the source of disruption for the financial institution (Carmichael, 2020).

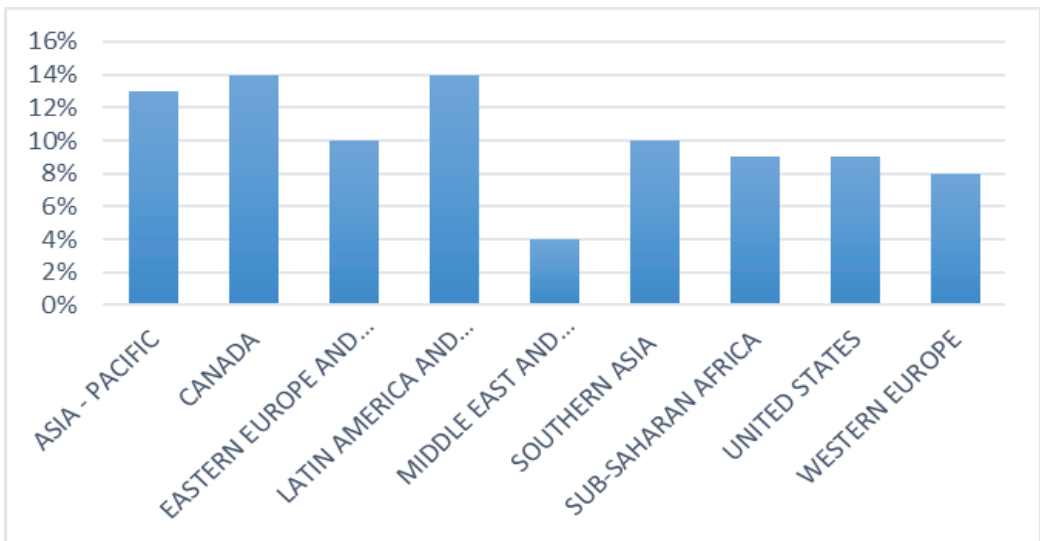


Figure 1. Financial Statement Fraud Percentage of Regions

Source: Adapted by the Author from ACFE (2018)

Figure 1 presented above shows that there are higher percentages of financial statement fraud in Asia – Pacific, Canada and Latin America regions. The rest of the world has financial statement fraud below 10% while the regions stated above have over 10% financial statement fraud. The lowest percentage belongs to the Middle East and North Africa, although this region possibly lacks the qualified personnel to perform complex financial statement fraud techniques. Meanwhile, fraud losses are also highest in Asia – Pacific region with a median of USD 236,000 and the lowest amount of fraud loss is in Sub-Saharan Africa with USD 90,000 (presented in Figure 2 below).

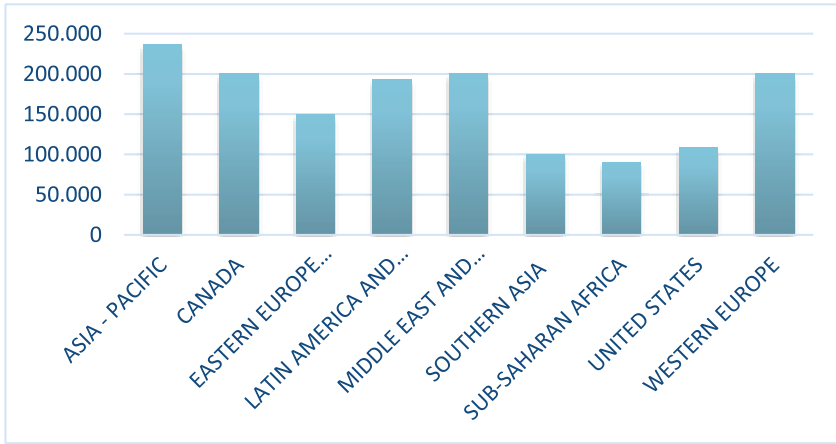


Figure 2. Fraud Losses in USD According to Regions

Source: Adapted by the Author from ACFE (2018)

In Turkey, data concerning fraud is not published, however, a small compilation of several fraud cases is given in Table 1 below. According to the table, the number of cases has stayed constant since 2014. However, any other information concerning these fraud cases is not made public. Therefore, it is not quite possible to present the big picture of fraud in Turkey.

Table 1
Number of Fraud Cases in Turkey

Year	Number of Cases
2020	13
2018	13
2016	15
2014	13

Source: Compiled by the Author from ACFE Report to the Nations 2020.

Financial Statement Fraud and Environment

Financial innovation has brought many financial products that have made our lives easier, such as mobile banking and annuities. However, the 2008 crisis linked financial innovation with complex derivative instruments that are extremely risky and under regulated. Such complex instruments, for instance, asset-backed securities, were used to pump cash into the economy, resulting in a housing bubble. Without proper regulation and poor-quality loans, the bubble burst rapidly and the savings of people vanished as their assets lost value and they were left with credits higher than their assets’ values. Therefore, the public has been suspicious of financial innovation products since the credit crisis.

The 2008 crisis is an indicator of how poor risk management is in the financial services sector. Still, many financial institutions have not integrated enterprise risk management and

prefer to manage risk in silos, as if there is no interaction between risk types or risk-prone departments. Many financial services institutions still focus only on financial risks and ignore other risks they may face. Moreover, the 2008 credit crisis showed that financial institutions were not apt at managing financial risks either. The crisis accelerated the regulation updates needed to secure financial risk management in the finance sector, thus the Basel III accord was penned in 2010 as a response. However, regulators have not succeeded in implementing the accord as the date keeps getting postponed. The final proposed date is January 2022. The postponing of the application date of Basel III leaves banks vulnerable in managing financial risks. Furthermore, as financial institutions have not embraced enterprise risk management, they have not become fully guarded in facing fraud risks.

As the world moves into uncertain times, many different risks arise. According to the World Economic Forum (2019), there are many increased risks concerning financial institutions such as economic and political risks and cyber-attacks. In 2020 a new type of risk emerged. The COVID – 19 pandemic has affected the financial institutions, as the real sector was forced to shut down and many governments announced economic packages that postpone the payment of credits and forced down interest rates. Many financial institutions will start to feel the stress in their financial statements as profits start to decline. This situation will increase the possibility of fraud risk. Employees who have to fill a quota of sales will be unable to make sales with quarantine precautions and profits will plummet. Top management of financial institutions will be under strain from the downturn of the economy, which will act as a catalyst for financial statement fraud.

In the literature, there are very few articles that are concerned with financial statement fraud; whereas there are many theses written on the subject. There are only four articles written concerning financial statement fraud (Selimoğlu & Altunel, 2019; Demir & Arslan, 2018; Terzi & Şen, 2015 and Terzi & Şen, 2012). Selimoğlu & Altunel (2019) present a literature review of master's and doctoral theses written between 2008 and 2018. Demir & Arslan (2018) evaluate the tools used by internal auditors for fraud detection. Terzi & Şen (2015) present a model of neural networks for the detection of fraud in forensic accounting. Terzi & Şen (2012) develop a model of data mining for financial statement fraud detection. None of these articles are concerned with the financial services sector.

The Outlook on Turkish Legislation and Economy

Although: “Tax Procedure Law No. 213” (1961) is the main regulation that covers financial statement fraud in Turkey, it is written from the perspective of tax evasion. Article 359 states that any parties involved in fraudulent records in bookkeeping or financial tables shall serve between 18 months and 3 years in prison. It also defines the difference between forged documents and misleading documents. Forged documents are documents that are prepared

without any relation to real events. Misleading documents are documents that are based on real events and situations; however, they have been altered to reflect an unrealistic event. Both types of documents are considered as evidence for financial statement fraud. Moreover, parties involved in the preparation and usage of forged documents shall serve two to five years in prison according to Article 359.

“Turkish Criminal Code No. 5237” (2004) Article 161 defines fraudulent bankruptcy. According to the article, in the case of fraudulent acts to reduce assets, if bankruptcy is concluded, related parties shall serve three to eight years in prison. Reducing assets has to take place by concealment or loss of value in assets, hiding or destroying related books, records or documents, preparing documents to create an illusion of a debt related to increasing the debts of the company in question and misleading representation of assets in the balance sheet. There aren’t any other regulations in Turkey concerning financial statement fraud.

In the case of a financial statement fraud that results in bankruptcy for banks, there is a deposit insurance system established that will aid the depositors. This deposit insurance system is managed by the Savings Deposit Insurance Fund (SDIF) established in 1983. In 1994, SDIF was authorized to improve the financial situations of banks under its control. In 1999, the Banking Regulation and Supervision Agency (BRSA) was established and structural reformation in the banking sector took place due to a Standby Agreement signed by the International Monetary Fund (IMF) (Eser, 2007, 48). Moreover, SDIF’s representation was also given to BRSA in 1999 . In 2003, SDIF achieved autonomy status. In 2005, SDIF was granted permission to regulate the sector and in 2016 SDIF received trusteeship power (SDIF, 2020).

The transfer process of a Bank to the SDIF begins after the detection of the following in a BRSA audit: the bank’s liquidity does not cover its short term debt, the balance between income and expenses are distorted, capital adequacy is not met, asset quality disrupts financial structure, there are inadequate internal control and audit system and a weakening of the financial structure by inept management decisions. If these conditions are found in a BRSA audit, the bank is given a limited time to improve its finances; otherwise, the bank is transferred to SDIF (“Banking Law No. 5411”, 2005, Article 67). The most important finding in a BRSA audit is the existence of a weakened financial situation borne from the owners or the managers of the bank using the assets for their gain. In this case, the BRSA management board is legally allowed to revoke the operating license of the bank, and transfer the management and control of the bank to the SDIF for sale or consolidation for covering the losses of the bank.

In 2000, the bankruptcy of *Bayindirbank*’s foreign branch triggered a banking sector crisis in Turkey, which resulted in a financial crisis in 2001. After the bankruptcy of *Bayindirbank*, many banks were transferred to SDIF, the common ground in these transfers were the weak financials of these institutions. Not all banks were involved in fraud, however, in any case,

the banking sector was quite fragile in the 2000s and couldn't cushion the shocks directed from outside. With such an experience in its past, the Turkish banking sector was structured to possess better quality assets as Basel I and II were adopted. As the banking sector crisis turned into a financial crisis, it is possible to assume that the health of the banking sector is quite vital to the overall economy. Therefore, any fraudulent activity in the finance sector should be prevented for a well-functioning economy.

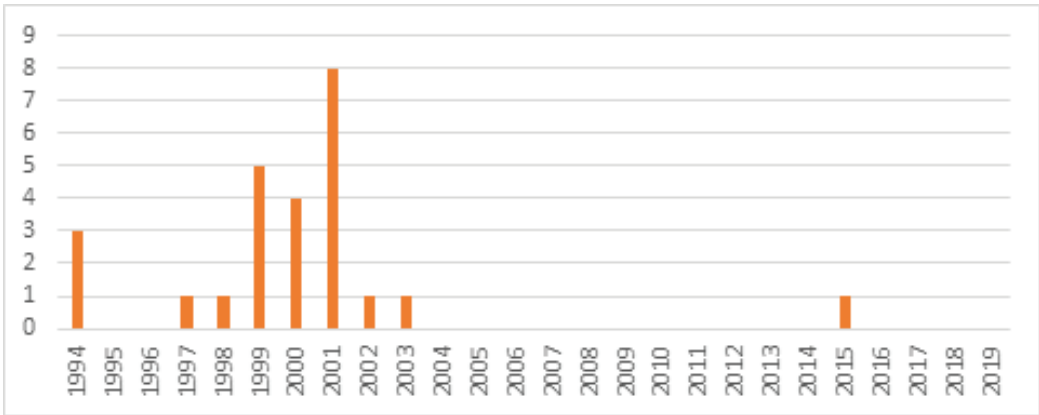


Figure 3. Frequency of Bank Transfers to SDIF

Source: Compiled by the Author from SDIF (2020)

Figure 3 above depicts the frequency of bank transfers to SDIF between 1994 and 2019. According to the figures, the period between 1999 and 2002 shows a density in bank transfers to SDIF as this is the period covered in the IMF Standby Agreement. Table 2 below gives the list of banks transferred to the SDIF between 1999 and 2002. This agreement is of key importance as it required the restructuring of the banking system.

Table 2

List of Banks Transferred to SDIF

Status	Bank	Year It Was Transferred To SDIF
Banks whose operating license has been revoked	TYT Bank	1994
	Marmara Bank	1994
	Impexbank	1994
	Cyprus Credit Bank	2000
	Imar Bank	2003
	Bank Asya	2015
	Bank Ekspres	1998
Banks Resolved by Direct Selling	Demirbank	2000
	Sitebank	2001
	Tarisbank	2001

Status	Bank	Year It Was Transferred To SDIF
Banks Sold After Merging	Egebank	1999
	Yurtbank	1999
	Yasarbank	1999
	Bank Kapital	2000
	Ulusal Bank	2001
Banks resolved by Transferring to Another Bank	Sumerbank	1999
	Pamukbank	2002
	Interbank	1999
Banks merged and resolved	Esbank	1999
	Etibank	2000
	Iktisat Bank	2001
	Kentbank	2001
	Egs Bank	2001
Banks resolved by voluntary liquidation method	Toprakbank	2001
	Turk Ticaret Bank	1997
Existing Banks within the SDIF	Bayindir Bank	2001

Source: Compiled by the Author from SDIF (2020)

Financial Statement Fraud in The Turkish Financial Services Sector

In Turkey, the CMB performs regulation and auditing of the financial services sector. The CMB has critical functions in the financial markets including regulating the said capital markets, approving paperwork for initial public offerings, providing permit for performing capital market activities such as trading of securities, portfolio management and investment advisory, as well as, monitoring of capital market activities performed by financial institutions and publicly held corporations, and auditing and sanctioning of these institutions. Financial statement fraud is a highly sensitive subject in capital markets, and the CMB has the authority to audit financial services institutions for unveiling any kind of financial statement fraud that has taken place in financial institutions. The CMB is responsible for regulating and auditing investment institutions like banks and intermediary institutions, funds, investment trusts, portfolio management companies, real estate appraisal companies, licensing agencies and independent auditing firms. However, the extent of this article is limited to banks, intermediary institutions and portfolio management companies as these institutions make up the core of the financial services sector.

As of September 2019, the trading volume in the equity market equaled TRY 2,120 billion, of which TRY 1,967 billion belongs to brokerage firms and TRY 153 billion belongs to banks. In the fixed income market, brokerage firms' transactions equaled TRY 83 billion and banks performed transactions equal to TRY 354 billion. In the repo - reverse repo market trading volume of brokerage firms amount to TRY 1,587 billion and banks have a trading volume of TRY 6,336 billion. Brokerage firms are more active in futures markets than banks, with a trading volume of TRY 1,176 billion as opposed to TRY 62 billion. The options market

is somewhat smaller than the futures market with TRY 10 billion trading volume of brokerage firms and TRY 3 billion trading volume of banks. The total amount of leveraged FX transactions equals TRY 2,767 billion (Turkish Capital Markets Association, 2020b).

Research Problem

The financial services sector is vital for economics and financial inclusion is the key to stopping growth in the grey economy and directing this growth towards the legal economy. The financial services sector includes commercial and participation banks, intermediary institutions and portfolio management companies. With the 2008 economic crisis, it became clear that the financial services sector is prone to great uncalculated risk. The financial risk of these institutions is so great that it affects their financial statements. Therefore, regulations concerning the financial situation of banks, intermediary institutions and portfolio management companies became a focal point for regulators in the aftermath of the crisis. Moreover, top managers often commit to window dressing techniques and actions which cause public opinion to turn even more negative. The finance sector is built on mutual trust, the trust in clients that they will pay their debts and the trust in the institutions that they will protect the savings of the customers. With such fraudulent schemes, this bond of mutual trust is broken. Therefore, companies have to pay more attention to their public image. The financial security of the financial services sector is of the utmost importance since the health of the overall economy is at stake.

Even though the financial services sector is the most heavily regulated, the majority of financial fraud is seen in financial services companies (Reurink, 2016). The median of loss due to fraud in the financial services sector equals USD 110,000 around the world. The most common fraud types seen in the banking and financial services sector are billing, cash larceny, cash on hand, check and payment tampering, corruption, expense reimbursements, financial statement fraud, noncash, payroll, register disbursements and skimming. The percentage of financial statement fraud in financial services equals 8% (world data). The financial services sector has compliance departments, certified employees and a code of conduct in place.

Moreover, the sector is audited by external auditors. However, these controls are simply not enough to prevent financial statement fraud (ACFE, 2018).

Since the financial services sector is so important to the health of the overall economy, the researcher will focus on investigating the patterns in the financial statement fraud cases that took place in the Turkish financial services sector between 2012 and 2020. Moreover, the researcher suggests that institutions that are awarded legal allegations versus institutions that are awarded only monetary sanctions are significantly different from each other; thus stating that the fraudulent companies are managed somewhat differently.

Data and Methodology

In this study, the audit findings of CMB were investigated and any findings on financial statement fraud were included in the analysis. For this purpose, the period after the major legal developments was covered in the framework of this article. Audit findings of CMB were announced periodically in CMB's weekly bulletin and all weekly bulletins between 2012 and 2020 were reviewed to detect all financial statement fraud cases related to the financial services sector. The investigation period started in 2012 because before this year CMB did not announce audit findings clearly. It is not possible to trace audit findings concerning financial statement fraud before this year. Therefore, any audit findings before 2012 were not included in the analysis. There were 301 financial statement fraud cases between 2012 and 2020 concerning all types of institutions CMB was responsible for auditing. However, 34 real-life financial statement fraud cases belong to financial services companies in the period mentioned above.

CMB can sanction financial institutions or make an allegation to the prosecution office depending on the nature of the audit findings. During the period between 2012 and 2020, CMB sanctioned a total of TRY 1,133,904 for noncompliance with CMB regulations and CMB made allegations on 19 cases.

There are 27 audit findings concerning intermediary institutions, 3 audit findings concerning banks and 4 audit findings for portfolio management companies. Therefore, intermediary institutions are at a higher risk when compared to other financial institutions. Moreover, financial statement fraud differs according to the type of institution. For intermediary institutions, the most common type of financial statement fraud is asset misappropriation. There were 16 cases concerning asset misappropriation in the period between 2012 and 2020.

Since CMB audit findings are highly relevant in the trustworthiness of the financial institutions, the author suggests that institutions subjected to legal allegations have to be significantly different from the institutions that are only sanctioned. Therefore, the following hypothesis is developed for this paper.

H₁: Institutions with sanctions are significantly different from institutions with legal allegations.

There are two variables in the research; these are called "Sanction" and "Legal Allegation". The universe consists of financial institutions involved in fraud for these variables. "Sanction" is a variable that shows the amount of sanction a financial institution has received from CMB between 2012 and 2020. Legal Allegation is a dummy variable that shows whether the financial institution was involved in legal allegations pursued by CMB. Data used in the analysis did not follow a normal distribution as can be seen from Table 3 below. Therefore, nonparametric correlation analysis was used to analyse the data.

Table 3
Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	.Sig.	Statistic	df	.Sig.
Sanction	,301	34	,000	,577	34	,000
Legal allegation	,368	34	,000	,633	34	,000

a. Lilliefors Significance Correction

Banks

The definition of banks includes deposit banks, participation banks, development and investment banks established in Turkey or abroad that have branches in Turkey. Banks are regulated by the Banking Regulation and Supervision Agency (BRSA) concerning compliance with banking law and related regulations in their money market transactions. Banks can also engage in capital market activities, therefore they are also regulated and audited by CMB.

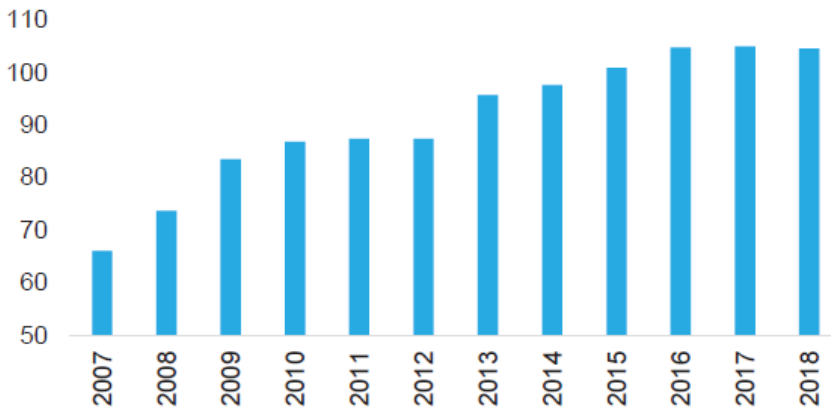


Figure 3. The ratio of assets to GDP (%)
Source: (BRSA, 2019)

There are 43 active banks with 205,157 employees in Turkey as of April 2020. Figure 3 above shows the ratio of bank assets to GDP in percentage. According to the figure, there has been positive growth in the Turkish banking sector since the credit crisis of 2008. Banks have a trading volume of TRY 153 billion in the equity market, TRY 354 billion in fixed income markets, TRY 6,336 billion in the repo-reverse repo market, TRY 62 billion in the futures market, and TRY 3 billion in the options market (Turkish Capital Markets Association, 2020a).

Table 4
Financial Statement Fraud Cases in Turkish Intermediary Institutions

Fraud Type	Related Regulation	Number of Cases	Legal Action
Reduction of the bank's assets	CML No 6362 Articles 21 and 110	3	Legal allegation

Table 4 above shows the only typology of fraudulent activity detected in the banking sector in the period between 2012 and 2020. This fraud type is the reduction of the bank's assets via various transactions. There were three cases detected for the same bank in 2018 and CMB made legal allegations in all three cases. In the first case, the bank's assets were reduced by TRY 5,884,689 (excluding interest) due to paying compensation for employees leaving the bank that did not match similar applications with peers, market practices, or the prudence and integrity of commercial life. In the second case, the bank's assets were reduced by TRY 6,865,294 (excluding interest) by purchasing shares of a real estate investment trust with a price that exceeded similar transactions. The final case concerns the reduction of the bank's assets by a total of TRY 150,777.77 (excluding interest), due to overpayment of the members of the board of directors by more than the amount of attendance at the General Assembly meetings (without a reasonable or legal reason). Note that, this bank went bankrupt in 2016, therefore all audit findings belong to two years after the bankruptcy.

Intermediary Institutions

Intermediary institutions are the go-between between the investors and the issuers that are willing to trade securities in a market organized or over-the-counter. Capital Market Law No 6263 (CML) defines intermediary activities as order transmission to other intermediaries or markets and proprietary trading. Intermediary institutions are also allowed to perform investment advisory, IPO intermediation, custody services and other activities that CMB (2012) decides according to CML Article 37. The CMB is authorized to approve the establishment of intermediary institutions, and such institutions are required by regulation to fulfil several necessities to receive the approval of the CMB. An intermediary institution has to have the amount of capital required by the CMB, founders and personnel have to have clean legal records, have collaterals for the stock market, clearing and investor compensation should be paid and an organizational structure that incorporates constant monitoring with internal audit, risk management and internal control should be established according to Article 9 of Communiqué on Principles of Establishment and Activities of Investment Firms, Serial III-39.1 (CMB, 2013a).

In Turkey, there are 62 active intermediary institutions as of April 2020. Seventeen of these institutions are owned by banks. Figure 4 below shows the aggregated total assets of intermediary institutions. In 2010, the aggregated total assets of intermediary institutions were close to TRY 8 billion, however, with each passing year, total assets kept growing. This growth trend is partially imposed by regulation, since the parliament passed the new CML in 2012, according to which, intermediary institution capital requirements were raised for different activities. However, the capital amount has kept on rising since 2012, therefore it is possible to conclude that there is an organic growth trend in the sector.

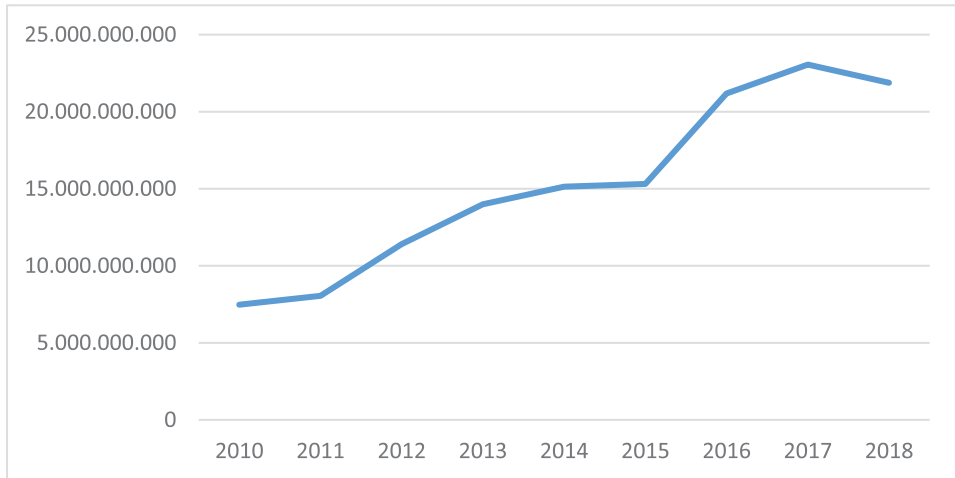


Figure 4. Total Assets of Intermediary Institutions Between 2010 and 2018 (TRY)

Source: Adopted by the researcher from TSPB, 2020.

The following numbers paint a picture of what the Turkish intermediation sector looks like today. The number of investors in Turkish intermediary institutions is equal to 4,654 with 180 corporations and 4,474 individual investors. Assets under the management of intermediary institutions equal TRY 3,595 million with TRY 1,744 million belonging to corporations and TRY 1,852 million belonging to individual investors. Brokerage firms provide credits equal to TRY 2,309 million. Moreover, there are 4,839 people employed in the sector (Turkish Capital Markets Association, 2020a).

Figure 5 presented below shows the distribution of the yearly number of fraud cases in intermediary institutions between 2012 and 2019. The years 2012 and 2016 have the highest numbers and 2017 and 2019 have the lowest number of cases. The frequency of fraud cases shares little information. What matters the most is that each year, there are some cases concerning financial statement fraud in intermediary institutions, whether small or big in scale. This is a major indicator of the problematic nature of brokerage firms, there is most definitely a fraud scheme going on even in the most trusted brands of the sector. Increased regulation has little to no effect on this phenomenon because the CMB has sanctioned many brokerage firms for not installing fully functioning internal audit and internal control systems. If these internal systems do not exist or even if they do exist, they do not function. Under such circumstances, it would not be possible to detect any fraud cases. Moreover, a lacking control environment that feeds the fraud-based culture of these institutions would be created.

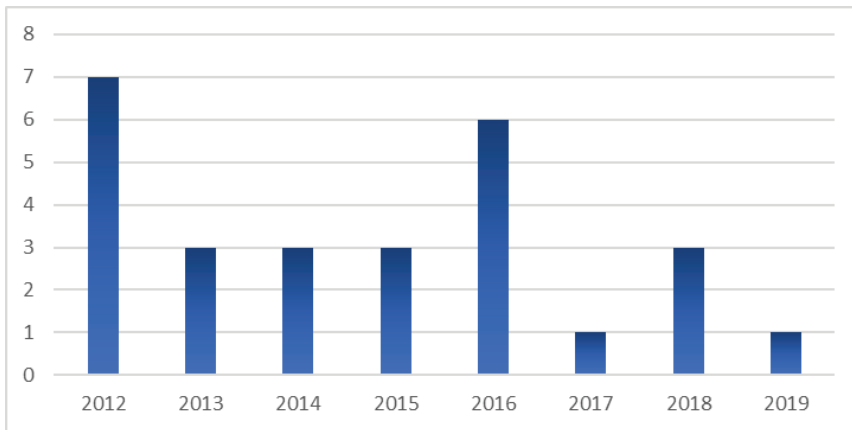


Figure 5. Number of Fraud Cases in Brokerage Firms Between 2012 and 2019

Source: Adopted by the researcher from CMB Weekly Bulletins between 2012 and 2019

Table 5 presented below summarizes the financial statement fraud cases of intermediary institutions between 2012 and 2020. During this period, the CMB either sanctioned intermediary institutions for noncompliance with regulations or made legal allegations. There are 16 cases of legal allegations and the total amount of sanctions is equal to TRY 1,035,995 for 12 cases. There are 27 cases in total (one case includes both an allegation and a sanction). Table 2 further categorizes these fraud cases according to typology.

There are 10 types of financial statement fraud present in the CMB audit findings. Type 1 concerns incorrect adjustment records in the financial statements. This action violates Turkish Accounting Standard 8 Accounting Policies, Changes in Accounting Estimates and Errors. The CMB fined the intermediary institution TRY 18,492. There is only one intermediary institution that is involved in this type of violation.

Type 2 is the violation of the legislation of the intermediary institutions using customer cash collectively and not informing the customers and distributing the income proportionately to related customer accounts. There is only one intermediary institution that committed this violation according to CMB audit findings and CMB fined the institution TRY 38,308.

Type 3 is asset misappropriation by the intermediary institution. In this case, the top management of the brokerage firm used the cash balance in various customer accounts in favour of the institution without the knowledge of customers. This type of fraud is quite dangerous because it damages the mutual trust that the financial services sector is built on. Customers may find that their savings are misused and their trust in the financial system may waver. There is only one intermediary institution that committed this fraud. The intermediary institution is fined TRY 60,000, which is a minor sanction compared to the crime committed.

Type 4 concerns the violation of accounting principles concerning short sale transactions. According to “Communiqué on Principles Regarding Record Keeping and Documentation in

Intermediary Activities” Serial V No 6 Article 28 (CMB, 1992), collaterals for short sales are recorded as a debit to the cash account and credit to margin account if the collateral is cash. In the case of collaterals, they are deposited as securities then related accounts have to be used. The intermediary institution was fined TRY 135,926 for this violation.

Table 5
Financial Statement Fraud Cases in Turkish Intermediary Institutions

Fraud Type	Fraudulent Act	Related Regulation	Number of Cases	Legal Action
1	Incorrect adjustment records in the financial statements	Turkish Accounting Standard 8	1	Fine equal to TRY 18,492
2	Not providing sufficient information to the customer concerning his/her cash situation	Communiqué III-39.1 Article 24 Communiqué III-37.1 Article 66	1	Fine equal to TRY 38,308
3	Asset misappropriation by the institution (Client assets)	Communiqué Serial V No 46 Article 58/1 (g)	1	Fine equal to TRY 60,000
4	Not applying the provisions on accounting for short sale transactions	Communiqué Serial V No 6 Article 28	1	Fine equal to TRY 135,926
5	Capital adequacy miscalculation	Communiqué Serial V, No 34 Article 4 CML No 6362	1	Fine equal to TRY 325,617
6	Irregularity in official documents	Communiqué III-45.1 Article 7/1-a, 14 and 14/1 Communiqué Serial V No 6, Article 5	4	Fine equal to TRY 169,333 and legal allegation
7	Intermediary Institution personnel acting in contradiction with the investor's rights and interests	Communiqué Serial V, No 46 Article 58/1(I)	4	Fine equal to TRY 288,319 and legal allegation
8	Asset misappropriation by personnel (Client assets)	CML No 2499 Article 47/1-(A)-5 CML No 6362 Article 110/1-a	11	Legal allegation
9	Fictitious accounting transactions and misrepresentation in financial statements	CML No 2499 Article 47/1-(B) CML No 6362 Article 112/2-a and c	2	Legal allegation
10	Providing CMB with false information	CML No 2499 Article 47/1-(B)-1	1	Legal allegation

Type 5 is about the calculation of the capital adequacy level. Intermediary institutions are required to calculate and report their capital adequacy levels to the CMB periodically. The principles of this calculation are given in Communiqué on Principles Regarding Capital and Capital Adequacy of Brokerage Houses (CMB, 1998). In this case, the intermediary institution failed to show the unsecured receivables of the intermediary institution from the related

persons as a discount item in the calculation of the capital adequacy base. The CMB fined the institution TRY 325,617 for this violation.

Fraud type 6 detected in the CMB audits is the irregularity in official documents. This violation has some variety, such as non-issuance/incomplete issuance/duplicate issuance of cash receipts, organizing fake portfolio documents to customers, opening false accounts, concealing irregular transactions, imitating the signatures of customers and brokerage firm employees, and using fake company stamps. There are four cases with these violations and in some cases, the CMB sanctioned the institutions, whereas in other cases the CMB made legal allegations. This type of fraud calls for the participation of top management as well as related personnel, therefore it is one of the critical types of fraud and there cannot be any solution from within the company for such cases where the management of the company is not separated from the owners.

Type 7 is the type of fraud where the customer representative misguides the client and performs unnecessary transactions causing the cash deposit (collateral) to slowly decrease in favour of the intermediary institution since every necessary or unnecessary transaction results in commission fee payments for the client. Similar to fraud type 6, the CMB both sanctioned and made legal allegations depending on the nature of the case in question.

Fraud type 8 concerns asset misappropriation by intermediary institution personnel. In these cases, intermediary institution employees created a loss in the client account by transferring the securities to their account and using it for their own or his/her manager's gain. Type 8 is the most frequent type of fraud, with eleven cases. Unfortunately, in none of these cases, internal audit and internal control functions of the brokerage houses could detect the fraud. All cases were found out by client complaints to the CMB. This is an indication of how unreliable and dysfunctional intermediary institutions' internal audit and internal control departments are. Even though CMB regulation has been updated to improve the strictness of the control environment by imposing restricting rules, it hasn't done much improvement in the tone at the top. Moreover, if the same type of fraud is committed by the management of the intermediary institution, no legal allegations are made. However, if personnel commit the same type of fraud, then they face legal allegations and capital market license termination.

Fraud type 9 is misrepresentation in financial statements and reports in an unrealistic way and creating fictitious accounting records. The CMB audit findings do not elaborate on the details of which accounts have been tampered with, therefore it is not possible to say anything more than legal allegations were made in these two cases.

In the final type of fraud, fraud type 10, the intermediary institution employees hid financial information related to the intermediary institution and gave false information to CMB officials. Again, CMB made legal allegations for this case.

Portfolio Management Companies

Portfolio management is defined as managing the pool of assets that are specified by the CMB under the risk and income preferences of the clients. This definition shows that not all assets can be included in the portfolio and the CMB has to approve the funds before they become available for the public. Portfolio management companies are also regulated by the CMB. Portfolio management companies are allowed to establish funds, manage those funds and perform investment advisory for their clients. A distinctive part of the definition above is that the assets of the fund are separated from the assets of the portfolio management company (CML 6362, Article 53).

In Turkey, there are 50 active portfolio management companies as of April 2020. Eleven of these companies are owned by banks. The total assets under management by the sector equal TRY 284,326,472,430 (TSPB, 2020). Figure 6 below presents the growth of mutual funds in Turkey. According to the figure, in 2013 the total amount of mutual funds was close to TRY 50 billion, whereas in 2019 this number reached TRY 250 billion. There is an increasing trend in mutual funds in Turkey, as investors prefer to channel their savings to mutual funds due to significantly lower taxation opportunities.

According to Wang, et. Al. (2019), mutual fund investments serve for the detection of fraud related to financial statements and decrease the firms' disposition towards fraud. Therefore, investing in mutual funds acts as a restriction for top management. Although investing in mutual funds is becoming popular among investors, this interest can also be attached to the detailed scrutiny of portfolio management companies by the CMB. The CMB has imposed many restrictive clauses that are related to the establishment of portfolio management companies. According to Article 44 of CML, not all individuals can be involved in this process. A person who wants to found a portfolio management company has to have a clean criminal record, should not have any unpaid tax obligations or gone bankrupt in the past. In short, a portfolio management company owner is required to have a clean record and possess the financial stability that is required by the CMB. The starting capital requirement for a portfolio management company is equal to TRY 2 million.

Communiqué on Portfolio Management Companies and Activities of Such Companies, Serial III-55.1 (CMB, 2013b) states that portfolio management companies are required to set up internal audit, internal control and risk management systems to ensure the healthy running of daily operations and that portfolio managers adhere to restrictions and rules imposed by the CMB in regulations (Articles 11, 12 and 13). However, the regulation does not define any potential fraud cases or how internal control is required to take precautions to prevent fraud in portfolio management.

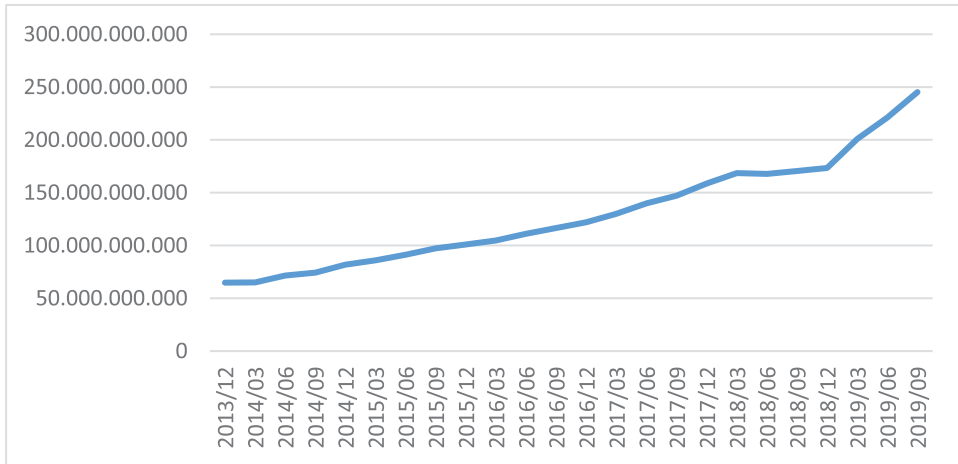


Figure 6. Growth of Mutual Funds in Turkey (TRY)
 Source: Adopted by the researcher from TSPB, 2020.

Table 6
 Financial Statement Fraud Cases in Turkish Portfolio Management Companies

Fraud Type	Fraudulent Act	Related Regulation	Number of Cases	Legal Action
1	Transferring defaulted bonds among the funds managed by the company after the default date; in favour of one or more of the portfolios.	Article 33 Clause 1 (e) Of Communiqué No III-55.1 (Rule of objectivity in management of more than one fund)	2	Fine equal to TRY 57,010 (combined total)
2	Committing fraud by acting in favour of personal gain in case of conflict of interest	Article 33 Clause 1 (d) Of Communiqué No III-55.1 (Rule of acting as a prudent agent)	1	Fine equal to TRY 22,407
3	Non-compliance with the Communiqué in the capital adequacy base calculations	Article 4 Clause 1 (b) of Communiqué Serial V No 34 (Capital Requirements)	1	Fine equal to TRY 18,492

Table 6 above shows the sanctions imposed by the CMB on portfolio management companies between 2012 and 2020. There are four sanctions in total. Even though there are four sanctions given to different portfolio management companies, the typology of fraudulent acts is limited to three. These can be summarized as non-compliance with the rule of objectivity in managing multiple funds, conflict of interest and noncompliance with capital adequacy calculation rules.

According to Article 33 of “Communiqué on Portfolio Management Companies and Activities of Such Companies” (CMB, 2013b), portfolio management companies are prohibited from performing transactions that favour one portfolio over another, therefore portfolio managers have to be objective and cannot take sides. Type 1 is about portfolio management com-

panies invested in junk bonds that defaulted and moved these bonds to a certain fund after the default date and thus resulting in a loss for one fund and preventing loss in the other fund.

In fraud type 2, a portfolio management company acted in its favour instead of looking out for the interest of the clients' assets, therefore, taking advantage of its position as an agent in a conflict of interest situation. According to Article 10 of "Communiqué on Portfolio Management Companies and Activities of Such Companies" (CMB, 2013b), portfolio management companies have to take precautions to prevent any conflict of interest that is bound to come up during daily activities and install a conflict of interest policy that will serve the integrity of the market. The conflict of interest in portfolio management is based on the principal-agent relationship. Portfolio management companies can make any investment-related decision concerning client accounts and if the company is managing multiple funds including proprietary trading, then there is a concern of guarding client interest.

Furthermore, in fraud type 3, the portfolio management company in question tempered with the capital adequacy calculations to create an impression of a healthy financial situation. According to Communiqué Serial III-55.1 (CMB, 2013b), portfolio management companies are required to report their capital adequacy status to the CMB every two weeks and the calculation of capital adequacy status is determined in Communiqué on Principles Regarding Capital and Capital Adequacy of Brokerage Houses - Serial V, No 34 (CMB, 1998). The portfolio management company in question violated Article 4 of the aforementioned Communiqué, which describes the funds owned by the company as receivables from third parties except for client collaterals. It is highly probable that the portfolio management company wrongfully included client collaterals in the capital adequacy calculations.

Findings

According to nonparametric Spearman correlation results, the correlation coefficient is equal to -0.909 which indicates a very strong negative correlation between received sanctions and legal allegations. The correlation analysis is significant at the 0.01 level. Analysis results are presented in Table 6 below. As a result, the null hypothesis is rejected.

Table 7
Correlation Analysis Results

			Sanction	Legal allegation
Spearman's rho	Sanction	Correlation Coefficient	1,000	-,909**
		Sig. (2-tailed)	.	,000
	Legal allegation	N	34	34
		Correlation Coefficient	-,909**	1,000
		Sig. (2-tailed)	,000	.
		N	34	34

** . Correlation is significant at the 0.01 level (2-tailed).

Solutions and Recommendations

The cases described concerning the banks, present fraudulent activities directed by the board of directors. Such cases cannot be prevented by establishing an internal audit department or robust internal controls since auditors are employees of the bank and their jobs depend on the board members' opinions. However, these cases could have been detected by independent auditors before the bankruptcy.

According to the results of the analysis, it is possible to say that intermediary institutions are more prone to fraudulent activities. This situation is more related to the paradigm of the management of these institutions. Top management is more concerned with making a profit and employees are looking for personal gain rather than serving clients. Moreover, the lack of properly functioning internal audit and internal control departments make it possible for fraudsters to reach their goals.

Even though there are a few fraudulent cases, it is possible to say that portfolio management companies have a small amount of noncompliance detected over the years, which makes these companies more trustworthy when compared to intermediary institutions. The lack of legal allegations shows that portfolio management companies are relatively more secure when compared to intermediary institutions.

Analysis results show that financial institutions that are awarded sanctions and subjected to legal allegations are significantly different from each other. If a company is sanctioned, it is highly unlikely that it will be subject to legal allegations. This finding can be considered as an important indicator of the trustworthiness of the financial institution. Furthermore, fraud cases detected between 2012 and 2020 by the CMB show that top management and in some cases board of directors are involved in fraud. In these cases, the CMB should be taking strict action and making legal allegations against the fraudsters with an equal stance. Moreover, the CMB should be requesting periodical reports from internal audit, internal control and risk management departments similar to capital adequacy reports. This will act in favour of increased scrutiny and force top management of financial institutions to take the control environment more seriously. To achieve stricter controls the CMB's resources should be increased to cover related expenses.

FUTURE RESEARCH DIRECTIONS

There is a tendency to increase regulation in financial markets. This is an important result of the 2008 economic crisis. The crisis was a turning point for capital market regulation as it increased fraudulent activities. Moreover, fraud cases are on the rise all over the world and financial market institutions are quite vulnerable to fraud in the current economic environment.

This article's purpose is to draw attention to financial statement fraud in financial institutions which can be overlooked.

The most restricting part of this research is the fact that the CMB's weekly bulletins contain a large amount of information: with more time it would be possible to conduct more detailed research on a larger framework. Further research could be performed to investigate older weekly bulletins and compare the period after 2012 with the period before 2012 to point out how the fraud trends have evolved. This type of research would aid the regulators to enhance their precautions.

Conclusion

In today's world, the robustness of an economy is more dependable than ever and the public tendency is to expect the financial institutions to be sound and healthy because these institutions make up a significant part of the economic system. The economic crisis of 2008 was critical because it involved financial institutions where public savings are evaluated. Any disruption in these institutions has grave results for the real economy, consequently for the employees who work in the real sector. In short, the overall health of the economy depends on the healthiness of its financial services sector.

Fraud is a major disruptive phenomenon concerning the economy whether detected in the real sector or the finance sector. Any fraudulent activity seen in a firm causes the firm to lose a large number of assets, lose credibility and even go bankrupt. In literature, it is possible to see real sector financial statement fraud cases covered in detail, however, the financial services sector is somewhat neglected. Since the financial services sector is so important for economies, financial statement fraud in the Turkish financial services sector was covered in this article. Banks, intermediary institutions and portfolio management companies are included in the financial services sector framework.

The capital market in Turkey is regulated by the CMB and they periodically announce audit findings concerning all regulations of the capital market. This is also valid for financial reporting and accounting related regulations. Therefore, in this article, the audit findings of the CMB concerning financial statement fraud between 2012 and 2020 were investigated for banks, brokerage houses and portfolio management companies. The total number of financial statement fraud cases detected by the CMB in the finance sector during this period is equal to 34. The majority of the cases belong to intermediary institutions. The most common fraud type seen in intermediary institutions is the misappropriation of client assets by employees. Generally, employees transfer client assets (cash and securities) to their accounts and use these assets for personal expenses or use client assets to their pleasure in capital market activities without the knowledge of the clients. There is only one bank involved in financial statement fraud, which was subject to the reduction of assets through misuse, such as overpayments

to related parties. As a result, the bank in question went bankrupt, however, this was not discovered beforehand by independent auditors. For portfolio management companies, the most frequent type of fraud is favouring one portfolio over another by the company. This is achieved by transferring defaulted assets to a certain portfolio and causing a decrease in the portfolio value.

In all cases of fraud in financial services companies, the common ground is that the tone at the top in these institutions is faulty. Generally, top management and even the board of directors is involved in fraud. This situation calls for increased scrutiny in the financial services sector. Even though the CMB went through a major change in 2012 – 2013 and all related regulations were updated, there is still room for improvement concerning the audit staff resources. The increased fraud cases can only be prevented by equally increased audits. To secure the future of capital markets, the CMB needs to be supported furthermore with upgraded resources.

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RESEARCH ARTICLE

The Effect of Institutional Environment, General Self-Efficacy and Desirability On Social Entrepreneurship Intentions in Turkey

Aydın Kayabaşı¹ , Ceren Karavelioğlu² , N. Derya Ergün Özler³ 

Abstract

The purpose of this study is to explore the impact of the institutional environment on general self-efficacy and desirability as well as the impact of general self-efficacy and desirability on social entrepreneurship intentions. For data collection a structured questionnaire was used. In total 500 questionnaires were distributed among university students and 367 usable questionnaires were returned and analysed. The structural equation modelling was used to investigate the relationship between the study variables. The findings revealed significant relationships among the research variables. It was found that the dimension of the regulatory environment has a positive impact on desirability and the dimension of the cognitive environment has a positive impact on general self-efficacy. The findings also showed a positive relationship among general self-efficacy, desirability and social entrepreneurship intentions. This study was carried out by using a convenience sampling method on university students. Within the scope of the research, the variables of the institutional environment, general self-efficacy and desirability are discussed in terms of social entrepreneurship intention. The study provides a new understanding of the factors that affect the intention of social entrepreneurship and provides an insight into which variables can be prioritized in countries with problems such as environmental pollution, migration and unemployment.

Keywords

Institutional Environment, General Self-Efficacy, Desirability, Social Entrepreneurship Intentions

Introduction

Although innovative management and efficient operations can ensure financial sustainability, they alone are not enough to initiate social change. Nevertheless, with increasing interest in the social economy, it is recognized that these factors have the potential to provide a new or more equitable social balance (Urban, 2015). With the increase in social uncertainties around the world, the attention of researchers has been drawn to individuals' and institutions' developing innovative ideas for the creation and realization of social enterprises in order to achieve the long-term social welfare needed by societies (Omored, 2014). Based on soci-

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al value creation and providing necessary funding and market-based strategies and tasks, social entrepreneurship has been tried to be used by almost all organizations (Helvacioğlu, 2013). The classical literature on social entrepreneurship states that the achievement of long-standing social gains is one of the sole goals of social entrepreneurship, which emphasizes various factors (Omoredede, 2014). Social entrepreneurship can be considered as a process that activates social change and varies according to socio-economic, institutional and cultural environments (Urban, 2015). Social entrepreneurship is thought to be a catalyst in the form of social capabilities, especially in terms of social welfare and economic inequalities. In this way, social entrepreneurship plays various roles (social, economic and political) in closing the gaps that may arise in order to achieve the desired social and economic development (Tiwari, Bhat and Tikoria, 2017; Zebryte and Hector, 2017; Hockerts, 2015).

Social entrepreneurship has become a global phenomenon that influences society by using innovative approaches to solve social problems (Jiao, 2011). When macro-level business activities and social trends in the world are evaluated, it is stated that there is a significant change towards the reintegration of business-related activities into deeper social and environmental contexts (Urban and Kujinga, 2017). Works related to social entrepreneurship can be handled in the form of private sector, public sector and non-profit organizations or a hybrid of these (Roper and Cheney, 2005; Jiao, 2011; Petrella and Richez-Battesti, 2014). Identifying the factors that have an influence on social entrepreneurship behavior is especially important (Hockerts, 2015). Some studies in the literature include the way the institutional environment influences entrepreneurial families and the access to social capital (Estrada-Robles, Williams and Vorley, 2018), the role of gender in entrepreneurial intentions (Miranda et al., 2017), pioneers of social entrepreneurship (Lacap, Mulyaningsih and Ramadani, 2018), organizational social entrepreneurship (Kannampuzha and Hockerts, 2019), sustainable decision-making in entrepreneurship (Muñoz, 2018), the impact of institutional environment on social entrepreneurship intentions (Urban and Kujinga, 2017), the relationship between individual self-efficacy beliefs and social activities (Urban, 2015), the effect of individual motivational factors on social entrepreneurship (Omoredede, 2014), the factors that motivate and prevent entrepreneurship (Lee and Tai, 2010), the impact of institutional environment on entrepreneurship (Pinho and Thompson, 2017) and overcoming a challenging and weak institutional environment (Estrada-Robles, Williams and Vorley, 2018). Social and community entrepreneurship has started to attract further attention in recent years (Sundin, 2011). It is stated that most of the studies related to entrepreneurship focus on micro level explanations, namely behavioral factors such as cognition, emotions and being influenced (or their combination). It is also clear that there is a need to interpret entrepreneurship in the context in which it occurs. This includes the institutional context of the economic, political and cultural environment in which the entrepreneur operates (Welter and Smallbone, 2011). In recent years it is stated that attention for social entrepreneurship increases in Turkey as well (Taş and Şemşek, 2017).

Although there is no unity in the social entrepreneurship policies in Turkey, there has been a promising trend thanks to the support of the European Union (British Council, 2019). However, due to the lack of legal and institutional infrastructure social entrepreneurship activities have been carried out in a limited way in Turkey (Işık, 2015). Thus, there are some theoretical and practical contributions of this study in the context of Turkey by analysing both individual and institutional subjects. As being the variables important for social entrepreneurship, the institutional environment, general self-efficacy and desirability are dealt with relationally. In this way, a different perspective can be gained in terms of understanding and applying the factors for social entrepreneurship.

This study aims to examine the effect of perceptions to institutional environment and general self-efficacy on social entrepreneurship intentions. In this respect, answers to the following research questions will be sought:

RQ1: Do the elements of an institutional environment have an impact on general self-efficacy?

RQ2: Do the elements of the corporate environment have an impact on desirability?

RQ3: Does perceived general self-efficacy have an impact on social entrepreneurship intentions?

RQ4: Does desirability have an impact on social entrepreneurship intentions?

Literature Review and Research Hypotheses

Social entrepreneurship, institutional environment and general self-efficacy concepts will be attempted to be explained in order to form the theoretical structure of the research. Following theoretical explanations, the relational structure between social entrepreneurship and institutional environment and psychological self-efficacy perception will be established, and research hypotheses will be developed.

The Concepts of Social Entrepreneurship and Social Entrepreneurship Intentions

The concept of social entrepreneurship has gained popularity in the US and Europe starting from the 1990s (Petrella and Richez-Battesti, 2014) and it is deemed a sub-discipline of entrepreneurship (Tran and Von Korfflesch, 2016). Social entrepreneurship is a comprehensive concept on which there is no consensus (Hockerts, 2006; Omoredede, 2014; Politis et al., 2016). This concept has been defined differently in various studies and its boundaries are not clear-cut (Mair and Marti, 2006). Conceptually, it appears that social entrepreneurship can be used in various fields such as economy, education, welfare and social activities (Urban and Kujinga, 2017). According to Weerawardena and Mont (2006), social entrepreneurship is

dealt within the context of non-profit organizations and defined as a behavioral phenomenon which aims to provide social value by taking advantage of perceived opportunities. According to Hockerts (2006), social entrepreneurship at the individual level focuses on those who drive social change and innovation. In their study, Austin, Stevenson and Wei-Skillern (2012) describe social entrepreneurship as an innovative and social value-creating activity that can take place in non-profit organizations, businesses or the public sector. Social entrepreneurs, by definition, focus on problems stemming from deficiencies in existing markets and social welfare systems and strive to create systematic changes and sustainable improvements (Urban and Kujinga, 2017). Social entrepreneurship is often referred to as a collective process, which depends on the participation of many different actors (Sundin, 2011).

It is understood that the common point in the definitions is the focus on social value in various fields (Petrovskaya and Mirakyan, 2018; Tillmar, 2009; Petrella and Richez-Battesti, 2014). Therefore, the results of social entrepreneurship and the measurement of results differ from traditional entrepreneurship (El Ebrashi, 2013). Accordingly, it is possible to construct a social value framework. The Social Value Creation Framework (SVCF) is presented as a Venn diagram in Figure 1 below. In the figure, opportunity, which is a starting point for entrepreneurship, is located in the upper circle. The other two circles, which are human and capital, are elements that activate resources. This scheme displays the interdependent structure of the three elements, namely opportunity, human and capital. The Social Value Creation Framework (SVCF) stands in the centre as the unifying variable. Others consist of contextual forces that surround and shape the three circles and require analysis by the entrepreneur (Austin, Stevenson and Wei-Skillern, 2012).

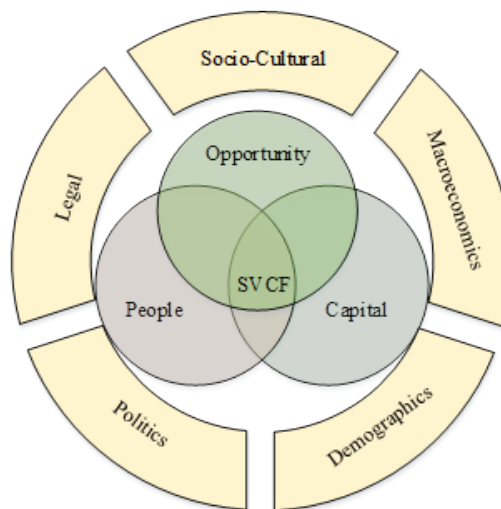


Figure 1. Social Value Creation Framework (SVCF)
 Source: Adapted from Austin, Stevenson and Wei-Skillern (2012).

Social entrepreneurship is defined as downsizing ideas to the organizational dimension in order to create social change and value (Helvacıoğlu, 2013: 200). Here, the attention should be paid to how opportunities are defined and exploited, what these entrepreneurs will do, what will be achieved for the community, what similarities and differences exist with traditional entrepreneurs, the meaning of individual social entrepreneurship and the determination of the characteristics of entrepreneurs (Omoredede, 2014). Researchers argue that in addition to the economic purpose that encourages entrepreneurs' innovation and activates structural changes in the economy, entrepreneurs have also begun to target a social component as well as business goals (Urban and Kujinga, 2017).

Studies related to entrepreneurship intentions are conducted on the axis of the theory of planned behavior, expectation theory, temporal construal theory (Hallam et al., 2012), behavior oriented theories such as cognitive psychology (Welsh and Krueger, 2012) and entrepreneurial motivation theory (Solesvik, 2013), entrepreneurial activity model, entrepreneurial attitude focus model, entrepreneurial potential model, Davidson model (Guerrero, Rialp and Urbano, 2008) and Shapero model (Veciana, Aponte and Urbano, 2005). It is stated that there is no generally accepted theory to explain the intentions of individuals to become an entrepreneur (Solesvik, 2013). Social entrepreneurship is based on intentions. Entrepreneurship intentions are known to be a precursor of future entrepreneurship activities of individuals (Hallam et al., 2016). Entrepreneurship intentions are defined as the mental orientation (desire, wish and hope) that triggers the choice of entrepreneurship (Shahab et al., 2019). Intentions have been proven to be the best predictors of individual behaviour, especially when behaviour is rarely observed and when it includes unpredictable time delays that are difficult to observe (Miranda et al., 2017). A person's willingness to act is almost always influenced by our perceptions of how important people in our lives will support our decision (Welsh and Krueger, 2012). Considering that intent is a precursor of behaviour, it is very important to analyse the relevance of social entrepreneurship intentions tending to behaviours related to activities that create social value individually and institutionally.

Institutional Environment

Entrepreneurship is an important issue that has been extensively studied from a variety of perspectives at the micro level (Welter and Smallbone, 2011; Estrada-Robles, Williams and Vorley, 2018). Studies on entrepreneurship have recently focused on the relationship between institutional factors or environmental factors and entrepreneurship (Diaz-Casero, 2012; Urban and Kujinga, 2017). The main reason underlying this is the increasing efforts by the state institutions to promote entrepreneurship (Shahab et al., 2019) and the emphasis on social entrepreneurship as a concept (Urban and Kujinga, 2017). The institutional structure in the society is seen as informal and formal (Urban and Kujinga, 2017; Urban, 2013; Welter and Smallbone, 2011). Institutions constitute the "rules of the game in a society." This situation

can significantly reduce uncertainty and risk for entrepreneurs when used consistently and efficiently. At the same time, transaction costs related to entrepreneurship may decrease. While in the formal institutional structure, the constitutional, legal and organizational framework is defined, codes of conduct, values and norms are referred to in the informal institutional structure (Welter and Smallbone, 2011; Toledano, 2011).

It is stated that environmental factors with various social, economic and institutional components affect entrepreneurship intentions (Miranda et al., 2017; Otache, 2019). Governments try to support and ensure the initiatives' success through training programs which address attitudes towards businesses in terms of economic development, unemployment, social value and solving social problems, resources, regulatory and institutional barriers, and obstacles in front of entrepreneurs (Solesvik, 2013). In a country, institutional structure plays a very important role in carrying out some activities. The institutional structure ranges from the mass media to the education system, from the press to the trade unions and the government. Researchers argue that entrepreneurial behavior is integrated into the institutional structure. Transparent legal frameworks are therefore largely dependent on the entrepreneurship opportunities supported by the protection of property rights and so on (Turkina, and Thi Thanh Thai, 2013). The interpretation of entrepreneurship in the context in which it takes place involves the institutional context of the economic, political and cultural environment where entrepreneurs operate (Welter and Smallbone, 2011). The institutional framework of a society encompasses the basic political, social and legal rules that form the basis of production and distribution. Individuals and organizations must abide by the basic rules if they intend to receive support and legitimacy for their social activities (Urban, 2013).

It is widely recognized that entrepreneurial activities are enabled or restricted by government agencies (i.e. laws, regulations and policies) and informal institutions within an economy (e.g. norms, values and codes of conduct) (Estrada-Robles, Williams and Vorley, 2018). It is stated that institutional environmental elements are one of the important precursors for social entrepreneurship (Jiao, 2011). It is argued that the institutional environment generally includes three main components: regulative, normative and cognitive (Urban and Kujinga, 2017; Urban, 2013; Seelos et al., 2011; Sine and David, 2010; Pinho and Thompson, 2017). These three dimensions of the institutional environment are guided by various elements (cultures, structures and routines) and function within more than one jurisdiction (Gupta et al., 2014).

Regulative Institutional Environment: It includes the capacity to create laws, taxes, regulations, and government programs that promote and regulate certain behaviours and restrict others (Pinho and Thompson, 2017). These are determined, monitored and implemented through government policies, when necessary, by formal and informal rules (Amine and Staub, 2009). Uncertainties regarding the regulatory context may affect the entrepreneur's level of motivation for the sustainability of the activity (Seelos et al., 2011). It is stated that well-

thought policies have significant effects on entrepreneurship (Farooq et al., 2018). Regulatory factors have been found to affect the feasibility and desirability of social entrepreneurship (Urban and Kujinga, 2017). If a person has the perception that entrepreneurship is difficult and risky, useless or unattractive in his/her country, his/her attitude towards entrepreneurship may be negative (Solesvik, 2013). It has been determined that there is a positive relationship between the government regulations on entrepreneurship programs and starting a business (Pinho and Thompson, 2017). In addition, it is stated that the institutional environment has an influence on entrepreneurship (Gökbulut Özdemir, 2013). The research hypotheses to be tested within the scope of this research related to regulatory environment are as follows:

H₁: Regulatory environment affects general self-efficacy.

H₂: Regulatory environment affects desirability.

Normative Institutional Environment: Entrepreneurs exist in a social environment. Individuals are highly likely to adhere to acceptable behaviours in their environment (Solesvik, 2013). The normative dimension of the institutional environment explains the norms of behavior that individuals must obey and show what is valued in a particular society (Sambharya and Musteen, 2014). According to another definition, a normative environment expresses the perspectives of people living in a country towards entrepreneurship and innovative activities (Urban and Kujinga, 2017). Therefore, countries try to shape the values and behaviours of individuals towards entrepreneurship positively (Urban, 2013). Individuals are influenced by two kinds of norms in their decisions. One of these is prudential social norms, which refer to the perception of behaviours endorsed by others. The other is descriptive social norms, which refer to one's perception of what others are actually doing. Although these two concepts are related to each other, they actually represent different situations. Prudential social norms mobilize people through social evaluation. On the other hand, descriptive social norms mobilize people through social information. Descriptive social norms function as initiating norm-compliant behaviour. The message perceived by the individual is "If many people are doing this, it is probably an appropriate thing" (Cialdini, 2007). It is stated that the normative environment is effective on entrepreneurship (Arasti, Pasvishe, and Motavaseli, 2012). In the literature, there are investigations as to the effect of normative environment on productivity and innovation (Go'mez-Haro et al., 2011), its effect on feasibility and desirability (Urban and Kujinga, 2017), its effect on perception of entrepreneurial self-efficacy (Urban, 2013) and entrepreneurship intentions (Arasti, Pasvishe, and Motavaseli, 2012) and comparison of institutional environment and entrepreneurship internationally (Sambharya and Musteen, 2014). The research hypotheses to be tested within the scope of this research related to normative environment are as follows:

H₃: Normative environment affects general self-efficacy.

H₄: Normative environment affects desirability.

Cognitive Institutional Environment: This dimension of the institutional environment explains the ideologies, logic, or cognitive characteristics that are widespread and deeply embedded in a social environment. The cognitive dimension reveals accepted assumptions about specific processes and organizational forms. The business plan includes general assumptions about how things are done in areas such as the importance of the organization, activities, partners and employees (Sine and David, 2010). Cognitive institutions report axiomatic beliefs about the expected standards of behaviour specific to a culture learned through social interactions, typically by living or growing in a community or community. Basically, the entrepreneur's cognitive perspective enables researchers to understand how entrepreneurs think and why they do things (Urban, 2013). Researchers build on the cognitive processes and characteristics of entrepreneurs that influence the discovery and use of a business idea, entrepreneurial development and continuity (Gökbulut Özdemir, 2013). Cognitive institutions shape entrepreneurial activities through knowledge that is widely accepted socially. This dimension is related to creating a cultural environment in which social entrepreneurs are accepted, encouraged and glorified (Pinho and Thompson, 2017). In some studies, the relationship between cognitive elements and feasibility and desirability of social entrepreneurship (Urban and Kujinga, 2017), the effect of cognitive elements on psychological self-efficacy (Urban, 2013) and the effect of cognitive element on starting a business (Pinho and Thompson, 2017) were tried to be determined. The research hypotheses to be tested within the scope of this research related to cognitive environment are as follows:

H₅: Cognitive environment affects general self-efficacy.

H₆: Cognitive environment affects desirability.

General Self-Efficacy and Desirability

Self-efficacy is one of the concepts addressed in studies that examine areas such as career choice and entrepreneurship (Farrukh et al., 2017). Self-efficacy can be defined as a person's skills and competences to accomplish an assigned job and a set of specific tasks (Shabab et al., 2019). Since this study is designed within the scope of social entrepreneurship, the definition of social entrepreneurship self-efficacy made by TranTran and Von Korfflesch (2016) has been used. According to this definition, social entrepreneurship self-efficacy is a dynamic set of beliefs about the success of starting and realizing a new social enterprise. Self-efficacy is an important motivational structure that affects individual choices, goals, emotional reactions, effort, overcoming a problem, and persistence (Urban, 2013).

Desirability is a product of the social and cultural environment for entrepreneurship. Knowledge of this part of the environment can and should be used by public policy decision makers to take action (Veciana, Aponte and Urbano, 2005). Table 1 below presents the comparison of the Theory of Planned Behavior of Shapero and Ajzen.

Table 1
Conjugates of Different Models for Behavior

Shapero Model	Ajzen's Theory of Planned Behavior
Perceived Desirability	Attitude Towards Behavior
	Subjective Norm
Perceived Feasibility	Perceived Behavioral Control

Source: Veciana, Aponte and Urbano, 2005.

Entrepreneurial Event Model (Shapero's Model) sees setting up a venture as an event that can be explained by the interaction between initiatives, talents, management, relative autonomy and risk (Guerrero, Rialp and Urbano, 2008). This model states that starting a new initiative depends on three personal factors: perceived desirability, likelihood to act and perceived feasibility (self-efficacy) (Uysal and Güney, 2016). According to the theory of planned behaviour, people act according to their own intentions and perceptions of behavioural control (Ajzen, 2001). According to other models, individual and social factors are considered together in explaining the individual differences in the desire to establish their own business and preferences, and high flexibility is thus provided (Buli and Yesuf, 2015). In the theory of Planned Behaviour, Ajzen describes behaviour as a result of three components associated with behavioural intentions and perceived behavioural control. These are a personal assessment (attitude), the level of social pressure on the acceptability of behaviour (subjective norm) and the perception of the individual's ability to start a venture (perceived behavioural control) (Liñán and Chen, 2009).

Social Cognitive Theory suggests that self-efficacy is an important and convergent predictor of a behaviour. At the same time, the effect of self-efficacy on behaviour can also be indirect. Self-efficacy also affects the goals and outcome expectations that predict behaviour (Luszczynska, Scholz and Schwarzer, 2005). Individual self-efficacy perception is influenced by contextual factors such as education and past experiences (Pihie, 2009; Ahmed et al., 2010). Liñán and Fayolle (2015) states that self-efficacy perception is required for individual actions and behaviours. In the literature, some of the investigated issues are social entrepreneurial psychological self-efficacy (Urban and Kujinga, 2017), evaluations of social entrepreneurial outcomes being related to psychological self-efficacy (Urban, 2015), self-efficacy being a precursor of social entrepreneurial behavior (Hockerts, 2015), personal characteristics and the effect of self-efficacy on entrepreneurial intentions (Farrukh et al., 2017), the factors affecting self-efficacy and the relationship between self-efficacy and entrepreneurial intentions (Zhao, Seibert and Hills, 2005), and the institutional environment and social entrepreneurial self-efficacy (Urban, 2013). The research hypotheses to be tested within the scope of this research related to psychological self-efficacy and desirability are as follows:

H₇: General self-efficacy affects social entrepreneurship intentions.

H₈: Desirability affects social entrepreneurship intentions.

Conceptual Framework

The structure of the conceptual framework has been established based on the detailed investigations made reviewing the literature. Below, the relationships between the variables to be tested regarding the conceptual model expressed in Figure 1 are tried to be schematized. The assumption here is that institutional environmental factors affect students' perception, psychological self-efficacy and desirability and that psychological self-efficacy perception and desirability in return affect social entrepreneurship intentions.

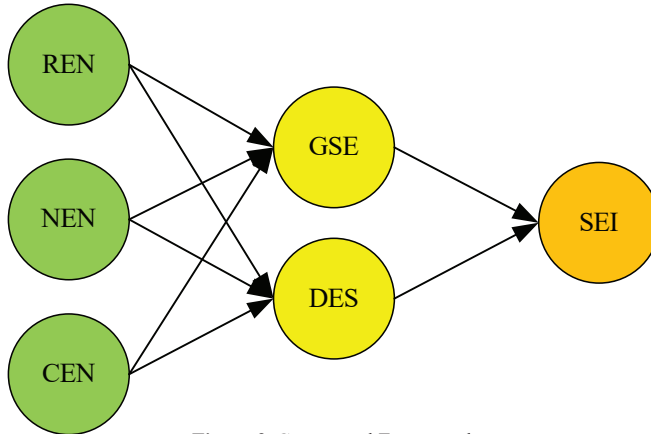


Figure 2. Conceptual Framework

Method

This section explains the methods adopted in data collection and analysis and how the variables of the study were handled.

Research Design

The aim of this study was to make inferences based on the relationships between the variables determined by statistical analyses. To this end, relational-causal research design was adopted in the study. This study was a cross-sectional study since the data obtained from the research units were obtained from the research units through the use of surveys at a certain point of time.

Sampling Method

University students were chosen as the sample unit in the research. Since the study did not aim to make a generalization, the data based on face-to-face interviews were collected from the units selected by convenience sampling. 500 questionnaires were distributed to students and 367 questionnaires were received and analysed. The response rate is 0,73.

Data Collection Method and Scales

In the research, a structured questionnaire was employed as the data collection tool. The items included in the questionnaire were finalized following the translation of the scales used in the literature into Turkish and getting expert opinion on whether or not the same meaning was preserved in the translation. The scales used in the creation of questionnaire items are listed below.

Elements of Institutional Environment: Institutional environment comprises three elements, which are regulatory environment (REN), normative environment (NEN) and cognitive environment (CEN). Institutional environment scale consists of 31 items in total. The studies of Urban and Kujinga (2017) and Urban (2013) were utilized in the structuring of the scale items. The scale items were expressed as ‘1 - strongly disagree’ and ‘5 - strongly agree’ using a Likert type scale.

General Self-Efficacy: General self-efficacy scale consists of 10 items. Jerusalem and Schwarzer’s (1992) study was used in the structuring of the scale. Scale items were expressed as ‘1 - not correct’ and ‘4 - completely correct’ using a Likert type scale.

Desirability: 4 items were used to measure the desirability. The items included in the scale were adapted from Urban and Kujinga’s (2017) study. *The item “I am very enthusiastic about social initiatives” was recommended by the experts evaluating the study* and was accordingly added to the scale. The scale items were expressed as ‘1 - strongly disagree’ and ‘5 - strongly agree’ using a Likert type scale.

Social Entrepreneurship Intentions: The social entrepreneurship intentions were measured through 9 items. The items included in the scale were adapted from Urban and Kujinga’s (2017) study. The scale items were expressed as ‘1 - strongly disagree’ and ‘5 - strongly agree’ using a Likert type scale.

Analyses

The research was structured in accordance with relational-causal research design. In this respect, firstly, exploratory factor analysis and confirmatory factor analysis were conducted. In addition, the structural equation model was used to determine the relationships between variables and the power of independent variables to explain variability in dependent variables.

Common Method Variance Analysis

In a study, it is stated that when data on variables are collected from a single person, the common method variance problem may occur (Otake, 2019). One of the most common techniques used by researchers to overcome this problem is Harman’s single-factor test.

When using this method, all variables are put into factor analysis without being subjected to rotation. Then, the unrotated factor solution is examined in order to assess the number of factors that could cause the variance in the variables. In order to talk about common method variance, either a single factor solution must be obtained from factor analysis or in one general factor must constitute the majority of covariance between scales (Podsakoff et al., 2003). As a result of the factor analysis without rotation, eight factor solutions were obtained. The first factor solution explained 25.540% of the total variance. According to the Harman single-factor test results, it is possible to state that there is no common method variance problem.

Results

This section presents the results of the analyses carried out. These results include descriptive statistics for sample characteristics, exploratory factor analysis, confirmatory factor analysis, validity and reliability values, and structural model tests (hypothesis tests).

Descriptive Statistics

In the literature, students are widely used as a sample unit (Shahab et al., 2019). Demographic variables include gender, age, family income and living place. Descriptive analysis was done in order to determine demographic characteristics. Approximately, respondents consist of 54,8 % of female, 46% of below 20 years old, 44,7% of between 2001-4000₺ income level, 35,7% of living in county. Table 2 presents characteristics of the respondents.

Table 2
Sample Characteristics

	Category	Frequency	Percentage
Gender	Female	201	54,8
	Male	166	45,2
Age	Below 20	169	46,0
	Between 20-23	157	42,8
	Above 24	41	11,2
Income	Below 2000 ₺	104	28,3
	Between 2001-4000 ₺	164	44,7
	Above 4001 ₺	99	27,0
Living Place	Metropolitan	111	30,2
	City	105	28,7
	County	131	35,7
	Other	20	5,4

Exploratory Factor Analysis

Within the framework of the structural validity of the research, descriptive factor analysis was used first. All items included in the questionnaire were subjected to exploratory factor analysis together. Items with a cross-load and factor load less than 0.50 were not subjected to

data analysis. Six factor solutions with eigenvalues greater than 1 were obtained according to the principal components analysis and varimax rotation methods (Hair et al., 2014a). The analysis values for factor solutions are presented in Table 3 below.

Table 3
Exploratory Factor Analysis Results

Dimensions / Items	FL	EV	VE	Pr	α
Social Entrepreneurship Intentions (SEI)					
I will make every effort to establish and operate a social enterprise.	0.800			0.754	
I'm willing to do anything to become a social entrepreneur.	0.786			0.735	
My professional aim is to become a social entrepreneur.	0.777			0.700	
I have no doubt about starting my own social enterprise in the future.	0.742	4.429	15.273	0.646	0.888
Before I started my education, I had a strong intention to start my own social enterprise.	0.728			0.687	
I have a serious idea about starting a social enterprise in the future.	0.726			0.696	
My qualifications contribute positively to my personal interests in starting a social enterprise.	0.565			0.542	
General Self-Efficacy (GSE)					
I think I can take care of sudden events.	0.772			0.670	
I know how to behave in unexpected situations.	0.762			0.643	
I welcome difficulties calmly, because I can always rely on my abilities.	0.727			0.631	
I have a solution to every problem.	0.685	3.639	12.549	0.554	0.835
When I come across a problem, I have many ideas for dealing with it.	0.673			0.588	
I know what to do when I face a new situation.	0.647			0.513	
I do not find it difficult to realize my designs and achieve my goals.	0.590			0.495	
Regulatory Environment (REN)					
National and local public institutions help individuals start social initiatives.	0.772			0.627	
The public sponsors organizations that help develop new social initiatives.	0.762	2.698	9.305	0.617	0.772
Public organizations help people to create their own social initiatives.	0.727			0.524	
Even if they fail, the public supports social entrepreneurs to retry.	0.685			0.537	
Normative Environment (NEN)					
People in this country appreciate those who start their own social initiatives.	0.784			0.614	
In this country, social entrepreneurs are welcomed with admiration.	0.780			0.684	
In this country, the transformation of new ideas into social initiatives is appreciated.	0.715	2.583	8.906	0.691	0.832
In this country, innovative and creative thinking is seen as a way of success.	0.680			0.657	
Cognitive Environment (CEN)					
Starters of new social initiatives know how to manage risk.	0.614			0.664	
Those who start new social initiatives know how to tackle risk.	0.684	2.520	8.689	0.666	0.790
Individuals know how to legally protect a new social enterprise.	0.691			0.601	
Most people know where to find information about markets for their services.	0.657			0.470	
Desirability (DES)					
Social entrepreneurship is exciting.	0.728			0.546	
I would very much like to take a social initiative.	0.672	1.892	6.526	0.515	0.730
I'm very enthusiastic about starting a social enterprise.	0.631			0.602	
KMO: 0.870; BTS: 4.678,016 (0,000); AVE: 61.247					

According to the results of the exploratory factor analysis, the dimensions in the literature were used in naming six factor solutions. The average variance extracted (AVE) was determined to be 61.247%, the eigenvalues of all dimensions (EV) were greater than the value of 1, factor loadings of all dimensions (factor loadings: FL) were determined to be 0.50 and Cronbach Alpha (α) was determined to be greater than 0.70 (Hair et al., 2014a).

Confirmatory Factor Analysis

Testing the Measurement Model

The structural equation model is one of the statistical models to explain the relationships between multiple variables. Similar to multiple regression analyses, it examines the structure of interrelation, expressed as a series of equations. In the structural equation model, first the measurement model test and then the structural model test are carried out (Hair et al., 2014a). Figure 3 below shows the measurement model results.

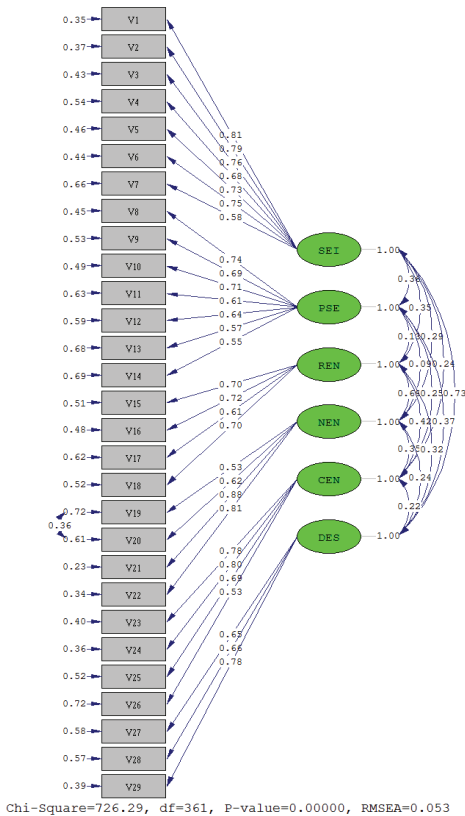


Figure 3. Results of Measurement Model

The construct validity is necessary to verify a measurement model. Construct validity includes evaluation of content validity, convergent validity, discriminant validity and nomological validity (Hair, et al., 2014b; Huang et al., 2013). Content validity, convergent validity, discriminant validity and nomological validity were evaluated within the scope of the validity of the study. It was assumed that content validity was achieved by adapting the research scales from the studies in the literature (Ramseook-Munhurrun, Seebaluck and Naidoo, 2015). As a result of the confirmatory factor analysis performed, it was determined that factor loads (>0.50), t values (>2.58) and composite reliability (>0.70) values were within the acceptable limits (Hair, et al., 2014). In the variance values extracted, it is seen that some dimensions (PSE, REN, DES) were below the acceptable limits (<0.50). In their study, Fornell and Larcker (1981) reported that AVE should be greater than 0.50, but if the composite reliability value is greater than 0.60, the value of 0.40 could also be accepted. According to these values, it is possible to express that convergent validity was provided for. The results of the Confirmatory Factor Analysis are shown in Table 4 below.

Table 4
Confirmatory Factor Analysis Results

Dimensions		λ	t values	AVE	CR
SEI	Social Entrepreneurship Intentions (SEI)	0.58 - 0.81	11.62 - 17.98	0.536	0.889
GSE	General Self-Efficacy (GSE)	0.55 - 0.74	10.61 - 15.38	0.420	0.834
REN	Regulatory Environment (REN)	0.66 - 0.70	11.77 - 14.33	0.468	0.778
NEN	Normative Environment (NEN)	0.53 - 0.88	10.20 - 17.39	0.524	0.809
CEN	Cognitive Environment (CEN)	0.53 - 0.80	9.94 - 16.49	0.501	0.797
DES	Desirability (DES)	0.65 - 0.78	12.40 - 15.37	0.489	0.740

Correlation and AVE square root values related to discriminant validities are shown in Table 4 below. According to the data in Table 4, AVE square root values were determined to be higher than the highest inter-dimensional correlation value (Fornell and Larcker, 1981) and the divergent validity was achieved. Finally, logical validity was also provided with the finding of statistically significant inter-dimensional relationships.

As a result of the confirmatory factor analysis, it is possible to state that the measurement model fit values are within the acceptable limits. Model fit values were measured as $\chi^2=726.29$, $\chi^2/df = 2.01$, RMSEA = 0.053, NFI = 0.93, NNFI = 0.096, CFI = 0.96, and GFI = 0.88. Therefore, it can be said that there is a harmony between the model and the data according to all compliance indicators (Hu and Bentler, 1999; Bagozzi et al. 1991).

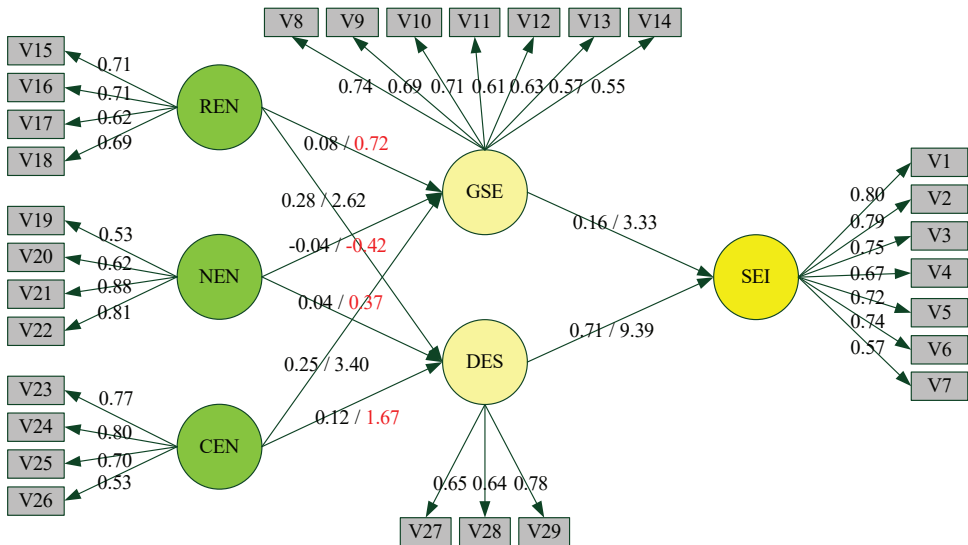
Table 5
Descriptive Statistics and Correlations

Dimensions	Mean	S.D.	SEI	PSE	REN	NEN	CEN	DES
SEI	3.27	0.88	0.732					
GSE	3.01	0.61	0.324**	0.648				
REN	3.36	0.82	0.300**	0.100	0.684			
NEN	3.16	1.02	0.303**	0.114*	0.551**	0.723		
CEN	3.16	0.82	0.251**	0.224**	0.386**	0.387**	0.707	
DES	3.73	0.83	0.597**	0.296**	0.255**	0.247**	0.214**	0.699

** P<0.01; * P0.05; ns: Bold: AVE Square Root Values

Testing the Structural Model

The second step in confirmatory factor analysis is to test the structural model. Structural equation model was used to test the research hypotheses developed for the purpose of the study. According to Schumacker and Lomax, (2004), the structural equation model (SEM) is a multivariate statistical method that uses various models to demonstrate the relationships between observed variables in order to perform a quantitative test of a theoretical model assumed by a researcher. Byrne (2013), on the other hand, defines the structural equation model as a statistical methodology that provides a confirmatory (i.e. hypothesis testing) approach to the analysis of a structural theory based on certain phenomena. In this study, the effect of institutional environment elements on perceived self-efficacy and desirability and the effect of perceived self-efficacy and desirability on social entrepreneurship intentions were tested with structural equation modelling. The Structural Model is shown in Figure 4 below.



Chi-Square= 769,33, df=365, p Value=0.0000, RMSEA=0.055, NFI=0.93, NNFI=0.96, CFI=0.96, GFI=0.87

Figure 4. Structural Model

According to the results of the structural model test, the regulatory environment had an effect on desirability, while the cognitive environment affected perceived self-efficacy. On the other hand, it was determined that perceived self-efficacy and desirability influenced social entrepreneurship intentions. When model fit values were examined, $\chi^2 = 769.33$, $\chi^2/df = 2.10$, RMSEA = 0.055, NFI = 0.93, NNFI = 0.096, CFI = 0.96, and GFI = 0.87 were measured. It is seen that the model fit values are within the acceptable limits (Hu and Bentler, 1999; Bagozzi et al. 1991).

The values of the path coefficients and the model explanation power for the research hypotheses are shown in Table 6 below.

Table 6
Research Hypotheses Results

Hypotheses	Structural Path	Path Coefficients	t values	Conclusion
H ₁	REN → GSE	0.08	0.72	Rejected
H ₂	REN → DES	0.28	2.62	Supported
H ₃	NEN → GSE	-0.04	0.42	Rejected
H ₄	NEN → DES	0.04	0.37	Rejected
H ₅	CEN → GSE	0.25	3.40	Supported
H ₆	CEN → DES	0.12	1.67	Rejected
H ₇	GSE → SEI	0.16	3.33	Supported
H ₈	DES → SEI	0.71	9.39	Supported

Discussion and Future Research

This study was conducted to test the causal relationship between institutional environmental elements, perceived self-efficacy, desirability and social entrepreneurship intentions. Firstly, the effects of regulatory environment, normative environment and cognitive environment elements, which are expressed as elements of institutional environment, on general perceived self-efficacy and desirability were tested. Then, the effect of general perceived self-efficacy and desirability on social entrepreneurship intentions were examined.

When H₁, H₃ and H₅ hypotheses were evaluated, it was determined that the regulatory environment and cognitive environment, which are the elements of an institutional environment, had a statistically significant effect on general perceived self-efficacy. This result can be explained by the regulatory elements that promote or limit entrepreneurship, and how they can affect the belief that an enterprise can be achieved individually, depending on how entrepreneurship is socially perceived or appreciated. When the studies in the literature are considered, it is stated that the institutional environment affects entrepreneurship (Gökbulut Özdemir, 2013). The result reached in the study is inline with the results found in other studies regarding the negative effect of a person’s perceived challenges in the country’s entrepreneurship on his/her attitude towards entrepreneurship (Solesvik, 2013), and the effect of regulatory

factors on feasibility and desirability for social entrepreneurship (Urban and Kujinga, 2017). In addition, Pinho and Thompson (2017) determined in their study that there is a positive relationship between the regulations for entrepreneurship programs and starting a business.

When H₂, H₄ and H₆ hypotheses were evaluated, it was determined that the regulatory environment, one of the institutional environment elements, had a statistically significant effect on the desirability for social entrepreneurship ($p < 0.05$). According to this result, it is thought that government programs or training that encourage or regulate entrepreneurship can improve the desirability of entrepreneurship. The conclusion reached is in line with the conclusion that Urban and Kujinga, (2017) obtained in their study, which stated that the regulatory environment affects desirability and feasibility. Similarly, it is also possible to claim that the conclusion is consistent with the proposition that there is a positive relationship between the government's regulations for entrepreneurship programs and the starting of a business (Pinho and Thompson, 2017) and that the institutional environment affects entrepreneurship (Gökbulut Özdemir, 2013). Omorede (2014) states that people who engage in social entrepreneurship activities not only see social deficiencies, but also make decisions by being influenced by different factors and processes.

When H₇ and H₈ hypotheses were evaluated, it was determined that perceived self-efficacy and desirability of social entrepreneurship had a statistically significant effect on social entrepreneurship intentions ($p < 0.05$). This result was interpreted as an intention to engage in social entrepreneurship if an individual believes that he/she has the skills and abilities to perform social entrepreneurship and has the desire to engage in social entrepreneurship. Self-efficacy perception is one of the most reliable predictors of goal-oriented behaviors (Hallam et al., 2016) and perceived desirability is one of the most powerful elements for understanding and explaining entrepreneurial intentions (Urban and Kujinga, (2017)). The results of the study are similar to those obtained in other studies which found that perceived self-efficacy is related to short- and long-term entrepreneurial intentions (Hallam et al., 2016), that feasibility and desirability affect social entrepreneurial intentions (Urban and Kujinga, 2017), that perceived self-efficacy affects entrepreneurial intentions (Zhao, Seibert and Hills, 2005), that the reliability explained by desirability and self-efficacy has an impact on entrepreneurial intentions (Guerrero, Rialp and Urbano, 2008), and that attitude, subjective norm and perceived behavioral control are effective on entrepreneurial intentions (Solesvik, 2013).

The environmental and social problems experienced in the world show that the need for social enterprises is becoming more and more important. In this context, when the research results are evaluated, it is important to focus on the practices that will direct individuals to social enterprises. In the context of the institutional environment, it is necessary to analyse the regulatory, normative and cognitive aspects and clarify the points that affect social entrepreneurship. In this way, individuals' general self-efficacy perception and their desirability

towards social entrepreneurship can be directed. It will also be possible to shape individual intentions and behaviours by focusing on areas such as education and social support (Hockerts, 2015).

According to literature in recent years, there has been increasing interest in social entrepreneurship in Turkey, but it is stated that there is not enough infrastructure for social entrepreneurship (Işık, 2015). With the rapid implementation of legal and institutional structural arrangements, social entrepreneurship can be encouraged. In addition, it needs to be supported in the individual's perceived feasibility and perceived self-efficacy. It is clear that Turkey's especially encouraging social entrepreneurship-oriented work in the corporate restructuring will construct its own system of support and the European Union. It is important to ensure the government, individual and institutional unity in making best practices related to social entrepreneurship. In this context, all stakeholders should act jointly on the basis of the institutional structure. Therefore, first of all, the role of an institutional environment is of great importance to be established of sustainability for social entrepreneurship and gaining social entrepreneurship spirit to individuals. At this point, governments need to formulate a new strategy for social entrepreneurship. Thus, mechanisms that will act integrally in increasing social welfare can be activated. The analysis of individual traits is extremely important in establishing such a strategy. This study emphasizes two aspects that can be addressed by social enterprises and governments: institutional and individual. Within the framework of these two points, the economic, educational and sociological policies required to promote social initiatives should be implemented. In this way, more efficient results will be achieved with the cooperation to be established between various institutions and individuals.

This study presents an institutional and perceptual conceptual model related to social entrepreneurship. Scientific studies play a major role in perception and understanding of social entrepreneurship. These studies for social entrepreneurship in Turkey, it is reported to remain limited in the field of educational sciences, sociology and business (British Council, 2019). In terms of the studies to be conducted in Turkey, it is also important to attract the interest and attention of different disciplines for social entrepreneurship. The future scope of work to be done in Turkey in the field of social entrepreneurship, researchers can benefit from models with the integration of individual and institutional factors. The results obtained from this study show that perception of feasibility and perceived self-efficacy is an important determinant of social entrepreneurship. In addition, the results of this study can be supported by qualitative research. In addition, new variables can be added to the variables used or the same variables can be verified by mixed research. In addition, according to the demographic variables, research related to the social entrepreneurship behavior, attitudes and intention will be able to theoretically and practically contribute to the practitioners and politicians.

Limitations and Implications for Future Research

This study has some limitations. One of the main limitations of this study is that it is handled within the scope of attitude, perception and intention towards social entrepreneurship. The way to compensate for this limitation is to deal with actual social entrepreneurship behavior as well. Using the convenience sampling method is another limitation of the study as it is not aimed for generalization. In addition to this, the units of the study are students. Therefore, it may be suggested to researchers to conduct research on different sample units.

Within the scope of the research, the variables of the institutional environment, general self-efficacy and desirability are discussed in terms of social entrepreneurship intention. In addition to these variables, analyzing demographic characteristics such as education and income level may yield interesting results. It is also recommended to researchers considering that examining the emotional aspects of social entrepreneurship can produce interesting results and solutions.

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RESEARCH ARTICLE

The Effect of Individual and Environmental Motivations on YouTuber Followers' Behavioral Changes*

F. Görgün Deveci¹ , Sevtap Ünal² 

Abstract

This study aimed to determine the effective factors on the behavioral changes of YouTuber followers. Accordingly, it was targeted to determine the effect of the individual, environmental motivations, and YouTuber characteristics on the change of followers' behavior through the online flow process. Meanwhile, the mediating role of opinion seeking and the moderator role of the fear of missing out have been discussed. The main mass consisted of 520 female consumers who live in Istanbul, are at least 18 years of age, and follow at least one YouTuber in the makeup/cosmetic/beauty segment. Structural equation modelling was used to analyze the data. Findings showed that three subdimensions of knowledge-sharing motivations, which are consumer interactivity, trust, and consumer expertise; four subdimensions of fundamental interpersonal relation orientations, which are the need to be part of a group, avoidance of similarity and unpopular choice counter-conformity, creative choice counter-conformity, and the need for personal growth; and social presence have a positive, community identification and that YouTuber characteristics have a negative effect on online flow. However, social norms have no effect. Meanwhile, online flow is effective on the behavioral changes of followers. Finally, opinion seeking has a mediating role whereas the fear of missing out has a moderating role.

Keywords

Individual Motivations, Environmental Motivations, YouTuber Characteristics, Online Flow Theory, Behavioral Changes

Introduction

Nowadays, knowledge-sharing and communication between individuals have been carried out mostly through social media tools, and video content consumption has also increased (Khan, 2017). At this point, understanding individual motivations is important. Therefore, an attempt to reveal individual motivations' effects on online flow has been made. YouTube attracts individuals by emphasizing a sense of community and promoting web-based social relationships (Yang, Hsu, & Tan, 2010). Therefore, the social interactivity needs of the users

* "This research is derived from the first author's doctoral dissertation. This research derived from "The Effect of Individual and Environmental Motivations on YouTuber Followers' Behavioral Changes (Bireysel ve Çevresel Motivasyonların YouTuber Takipçilerinin Davranışsal Değişimleri Üzerine Etkisi)" doctoral dissertation, which was completed on 29.04.2019 by F. Görgün DEVECİ and under the supervision of Professor Sevtap ÜNAL in Atatürk University, Erzurum/Turkey, Institute of Social Science, Department of Business Administration, Product Management and Marketing Field."

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are another factor to be taken into consideration. Therefore, an attempt to examine the environmental motivations' effects on online flow has been done. YouTubers are becoming increasingly famous and have become individuals who are searched for, praised, and imitated by millions of followers (García-Rapp, 2016). It is important to determine the characteristics of following YouTubers and to know which of their characteristics drives people to follow them. For this reason, an attempt has been made to determine YouTuber characteristics' effects on online flow. Online flow theory is important to understand online consumer behavior (Hsu, Chang, & Chen, 2012). Since the conceptual model has a consumer-oriented perspective, change of behaviors has been attempted to be examined through the online flow theory. Because of the changing roles of individuals in online environments, the question of whether opinion-seeking has a mediating effect on the relationship between online flow and followers' behavioral changes was examined. The fear of missing out (FoMO) is a basic source of motivation that arises from an individual's desire for interpersonal attachment and is shaped by the need of being a part of a group (Franchina, Abeele, van Rooij, Lo Coco, & De Marez, 2018). It was thought that individuals with FoMO would become more quickly involved in the online flow process and assumed that the relationship between individual motivations and online flow towards behavioral change would strengthen. Therefore, revealing the moderating role of the FoMO in the relationship between these two variables has been sought. The variables used in the conceptual model were brought together to explain the actions of YouTuber followers and were considered important variables in terms of explaining consumer behaviors. There are many studies on different social media tools in the relevant literature. YouTube has been a relatively neglected tool among the other social media sites. Due to the limited number of studies on this platform, the current study is based on the YouTube platform. In accordance with this, consumer-oriented model proposal, individual motivations, environmental motivations, and YouTuber characteristics can be understood and will enable new and different studies in this field. The findings will provide some insights for researchers. Meanwhile, this study will contribute to the individuals who want to be YouTubers, establish partnerships, and create their own collaborations.

Theoretical Background

Individual Motivations

Knowledge sharing motivations

Knowledge-sharing is defined as “the communication process between two or more participants involving the provision and acquisition of information” (Cited by, Jadin, Gnamb, & Batinic, 2013:2011). Several studies have emphasized the importance of knowledge-sharing motivations in online communities (Lai & Chen, 2014) and asserted that online communities

facilitate knowledge-sharing (Zhang, Liu, Deng, & Chen, 2017). In this study, five knowledge-sharing motivations were addressed.

Consumer interactivity is “the degree to which users of a medium can influence the form or content of the mediated environment” (Steuer, 1992:84). Researchers have found that perceived interactivity affects online consumer behavior, memory, choices, attitudes toward a website, and evaluations of the website’s effectiveness (Wu, Hu, & Wu, 2010).

Reciprocity is a fair and mutual knowledge-exchange behavior (Liu, Cheung, & Lee, 2016:692). This dimension facilitates information-sharing in social networking sites (Tang, Zhao, & Liu, 2016) and the effective quality of sharing (Chang & Chuang, 2011).

Reputation is how an individual is perceived by others (Choi, 2015). Reputation in online communities will increase expertise, and individuals will be able to demonstrate their expertise to others (Yan, Wang, Chen, & Zhang, 2016).

Trust is the belief that someone or something is honest, trustworthy, good, and influential (Safa & İsmail, 2013). As trust level increases, knowledge-sharing also increases (Chang & Chuang, 2011), and trust has a positive effect on word-of-mouth communication (Choi, 2015).

Consumer expertise is “the ability to perform product-related tasks successfully” (Alba & Hutchinson, 1987:411). Generally, consumers with high expertise are less sensitive to interpersonal effects and rely on their own experience in purchasing decisions (Cheung, Xiao & Liu, 2012). They also share their knowledge more than low expertise consumers (Ku, Wei, & Hsiao, 2012). Accordingly, the following hypotheses have been developed:

- **H1.** Knowledge-sharing motivations are effective on online flow.
- **H1a.** Consumer interactivity is effective on online flow.
- **H1b.** Reciprocity is effective on online flow.
- **H1c.** Reputation is effective on online flow.
- **H1d.** Trust is effective on online flow.
- **H1e.** Consumer expertise is effective on online flow.

Fundamental Interpersonal Relations Orientation Theory (FIRO)

Fundamental interpersonal relations orientation theory is one of the interpersonal behavior theories and is abbreviated as FIRO (Jenster, 2010). According to the theory, three basic interpersonal needs are satisfied through interaction with others: inclusion, affection, and

control, and there are four fundamental needs in terms of online content. These are the need to be a part of a group, the need for individualization (uniqueness), the need to be altruistic, and the need for personal growth (Ho & Dempsey, 2010).

According to Schutz (1966), *inclusion* is the idea that individuals can establish interpersonal interaction and togetherness; it is also the need to be different from others (Cited by, Hochanadel, 2014:23). The need to be a part of a group, which is the first subdimension of inclusion, is when an individual experiences a system/environment and then feels himself as an inseparable part of it (Zhao, Lu, Wang, Chau & Zhang, 2012: 576). The need for individualization, which is the second subdimension of inclusion, is the desire that the individual has a unique product which will make it different from other individuals (Ruvio, Shoham, & Brenčič, 2008). The need for individualization consists of three main dimensions. These are creative choice counter-conformity, unpopular choice counter-conformity, and avoidance of similarity (Bhaduri & Stanforth, 2016).

Affection is the ability to communicate with others more easily at the point of interaction and communication. This dimension is linked with the concept of altruism (Ho & Dempsey, 2010). Altruism refers to “the degree to which a person was willing to increase other people’s welfare without expecting returns” (Hsu & Lin, 2008:68).

Control is the desire to affect other individuals in direction of the need for personal growth (Huang, Chen & Wang, 2012; Ho & Dempsey, 2010). Personal growth, which is a subdimension of control, is the determinant of an individual’s need to control their life (Robitschek, 1998:184). The desire of personal growth enables knowledge-sharing and expertise (Hochanadel, 2014).

Hochanadel’s (2014) research results have shown that the “need to belong” is the predictor variable in terms of both opinion-seeking, passing, and giving. Besides this “inclusion” dimension was the main motivation for e-word-of-mouth communication behaviors. Ho & Dempsey (2010) determined that individualistic and altruistic internet users tend to use and receive online content more. Accordingly, the following hypotheses have been developed:

- **H2.** FIRO is effective on online flow.
- **H2a.** The need to be part of a group is effective on online flow.
- **H2b.** The need to be different is effective on online flow.
- **H2c.** The need to be altruistic is effective on online flow.
- **H2d.** The need for personal growth is effective on online flow.

Environmental Motivations

Community identification

Identity is the answer to the question of “Who am I?” (Ma & Agarwal, 2007:45). In online communities, users often share their statuses, interests, and behaviors with other users. This data reflects users’ personalities, experiences, statuses, and social attitudes. Meanwhile, it helps individuals understand the social and personal identification of other individuals (Jin, Li, Zhong, & Zhai, 2015). Shen, Lee, Cheung, & Chen (2010) found a positive relationship between knowledge-sharing and social identity in online communities. Accordingly, H3 hypothesis has been developed.

- **H3.** Community identification is effective on online flow.

Social norms

According to Wang & Chen (2012:571), social norms are “the common beliefs and acceptable behavioral standards of the social group”. Consumers adjust their behavior in accordance with social norms and aim to make a good impression on other individuals (Wang, Oppewal, & Thomas, 2017). Zhou (2011) found that social identity and group norms have an effect on online community user participation. Yang et al. (2010) stated that the intention to use YouTube for video-sharing is affected by social norms. Accordingly, H4 hypothesis has been developed.

- **H4.** Social norms are effective on online flow.

Social presence

Social presence is the degree to which an individual is perceived as “real” in a mediated communication environment (Thomas, West, & Borup, 2017). While social presence is uni-dimensionally examined, it is also studied multi-dimensionally (Kim, Song, & Luo, 2016). In their study, Shen & Khalifa (2008) proposed a three-dimensional structure. Since the awareness dimension is similar to the reputation dimension, affective and cognitive presences were included in the conceptual model.

Affective social presence means the emotional association of users with others in the online community. Online community members who have affective social presence are more willing to share useful knowledge and establish social relationships (Shen et al., 2010).

Cognitive social presence means the perceived reciprocal understanding between communicators. Users who have cognitive social presence are more likely to maintain more effective, efficient, and satisfactory communication (Shen et al., 2010). Accordingly, the following hypotheses have been developed:

- **H5.** Social presence is effective on online flow.
- **H5a.** Affective social presence is effective on online flow.
- **H5b.** Cognitive social presence is effective on online flow.

YouTuber Characteristics

Source credibility is one of the most important factors that determine individuals' attitudes and behavioral intentions and ultimately determine their behaviors (Hu, 2015). For this reason, YouTuber characteristics were addressed in the source credibility theory. Trustworthiness, expertise, and attractiveness are defined as the most important characteristics of source (Kim, Lee, & Prideaux, 2014; Ohanian, 1990). In addition to these characteristics, authenticity, which has appeared in the literature recently, was addressed.

Trustworthiness is the confidence towards a source and the message and accordingly the degree of acceptance of the message (Teng, Khong, Goh, & Chong, 2014). A YouTuber's trustworthiness depends on the followers' belief that the YouTuber shares their real opinions and experiences related to the products or brands in the video (Zang, 2014).

Expertise is the perception of the source as a valid and correct source of information (Ananda & Wandebori, 2016; Ohanian, 1990). Beauty-related YouTubers' expertness is interpreted as whether they have adequate knowledge about the matter discussed in the video (Zang, 2014).

Attractiveness is to what extent the message is defined by the recipients as appealing (Teng et al., 2014). The attractiveness of a source increases as the "interaction" or replay viewing increases (Lee & Watkins, 2016). It has been revealed that physically attractive sources are more successful in changing opinions than unattractive sources (Wang, 2014).

Authenticity according to Moulard, Garrity, & Rice (2015:173) is the behavior of an individual according to their true self. Zietek (2016) found that authenticity is one of the four basic components for influencer marketing. Accordingly, the following hypotheses have been developed:

- **H6.** YouTuber characteristics are effective on online flow.
- **H6a.** Expertise is effective on online flow.
- **H6b.** Trustworthiness is effective on online flow.
- **H6c.** Attractiveness is effective on online flow.
- **H6d.** Authenticity is effective on online flow.

Online Flow Theory

The most comprehensive definition of online flow is “the state occurring during network navigation which is characterized by a seamless sequence of responses facilitated by machine interactivity, intrinsically enjoyable, accompanied by a loss of self-consciousness, and self-reinforcing” (Hoffman & Novak, 1996:57). In this study, the following flow dimensions were discussed:

Perceived enjoyment, regardless of the performance results arising from system use, is the degree to which using the virtual world is perceived as pleasurable (Pelet, Ettis, & Cowart, 2017).

Perceived control is the degree to which a person feels powerful in an environment (Wang & Hsiao, 2012). Therefore, this dimension is generally used in attitude-based models of consumer behavior and acceptance of innovations (Esteban-Millat, Martínez-López, Huertas-García, Meseguer, & Rodríguez-Ardura, 2014).

Concentration is the focus of an individual's attention on an activity (Shim, 2012). Kaur, Dhir, Chen, & Rajala (2016) have developed a 26-item scale to examine flow experience in social networking services. In the results of their study, six dimensions of flow experience were revealed, one of which was concentration.

Tele-Presence is the perceived experience of presence in an environment through a communication medium (Steuer, 1992). Interactivity affects the level of telepresence (Liu, 2017). It was found that there is positive relationship between interactivity and telepresence. Meanwhile, social presence and telepresence have an impact on instinctive purchases (Shen & Khalifa, 2012).

Time distortion, in terms of the web, means that time seemingly passes quickly and without the perception of the individual in a computer-mediated environment (Bridges & Florsheim, 2008). The use of social media is “immersive and gratifying.” Therefore, users forget the elapsed time (Pelet et al., 2017:118). Besides this, time distortion increases opinion leadership behavior (Song, Cho, & Kim, 2017).

According to Csikszentmihalyi (1990:53), the *mergence of action and awareness* is the integration of the individual with the activity. Therefore, this activity becomes spontaneous and automatic, and the individuals do not see themselves different from this activity. Similarly, according to Csikszentmihalyi (1988:33), the *loss of self-consciousness* is a temporary loss of self-awareness (Cited by, Guo, 2004:14).

van Noort, Voorveld, & van Reijmersdal (2012) determined that the flow is the main determinant which explains the cognitive, attitudinal, and behavioral responses of a brand website. At the same time, interpersonal interaction factors are positively associated with flow experience, and flow experiences affect purchase intention and behavior (Yang, Huang,

Yang, & Yang, 2017; Liu, Chu, Huang, & Chen, 2016; Liu & Shiue, 2014). Accordingly, H7 hypothesis has been developed:

- **H7.** Online flow is effective on behavioral changes of followers.

Opinion Seeking

Opinion seekers imitate the purchase and consumption behaviors of the people they admire, collect information from other consumers in the social communication process, and get advice from more knowledgeable and experienced people than them (Flynn, Goldsmith, & Eastman, 1996:137). These individuals are followers of opinion leaders and are sensitive to interpersonal effects. While these consumers try to construct their own opinion, they are under the influence of other individuals (Rose & Kim, 2011). For this reason, opinion seekers see social networking sites as an environment where they can get information and trust these sites (Chu & Kim, 2011). Kang, Johnson, & Wu (2014) cited from Senecal and Nantel's (2004) study that the individuals who receive online product recommendations are twice as likely to purchase those products as those who do not. Accordingly, the hypothesis H8 has been developed:

- **H8.** Opinion seeking has a mediating role in the relationship between online flow and the behavioral changes of followers.

Fear of Missing Out (FoMO)

FoMO is the desire of being constantly connected with what other individuals are doing (Przybylski, Murayama, DeHaan, & Gladwell, 2013:1841). FoMO is actually a source of individual motivation and is associated with the need of belonging (Huguenel, 2017). Yin, Liu, & Lin (2015) found that FoMO is positively associated with continuance intention of using social network sites. Therefore, individuals who have more FoMO are more opinion-seeking (Oberst, Wegmann, Stodt, Brand, & Chamarro, 2017). Accordingly, the hypotheses have been developed in Table 1.

Table 1
FoMO Hypotheses

H9. FoMO has a moderating role in the relationship between individual motivations and online flow.

H9a. FoMO has a moderating role in the relationship between knowledge-sharing motivations and online flow.

H9a.a. FoMO has a moderating role in the relationship between consumer interactivity and online flow.

H9a.b. FoMO has a moderating role in the relationship between reciprocity and online flow.

H9a.c. FoMO has a moderating role in the relationship between reputation and online flow.

H9a.d. FoMO has a moderating role in the relationship between trust and online flow.

H9a.e. FoMO has a moderating role in the relationship between consumer expertise and online flow.

H9b. FoMO has a moderating role in the relationship between FIRO and online flow.

H9b.a. FoMO has a moderating role in the relationship between the need to be part of a group and online flow.

H9b.b. FoMO has a moderating role in the relationship between the need to be different and online flow.

H9b.c. FoMO has a moderating role in the relationship between the need to be altruistic and online flow.

H9b.d. FoMO has a moderating role in the relationship between the need for personal growth and online flow.

Behavioral Changes

The AIDMA model is important in terms of identifying psychological causes in consumer purchasing processes. In the AIDMA model, the consumer goes through the attention, interest, desire, memory, and action steps (Wei & Lu, 2013). The consumer is passive in the attention, interest, desire, and memory steps but are active in the action step. This model guides the consumer purchase decision process in the internet era (Cao, 2015). In Gomes, Sales, Cavalcante, & Carvalho's study in 2014, an attempt to understand the purchasing behavior of consumers who consider web videos was made. As a result of the research, a purchasing decision process model which is based on knowledge shared in videos was developed. At the same time, according to Wei & Lu's (2013) study, celebrity usage in advertising enables the consumer to have more feelings of attention, desire, and action. It also has a significant effect on online customer reviews. In this study, three main dimensions of the theory, which are interest, desire, and action, were discussed.

Methodology

Research Model

The research model is shown in Figure 1.

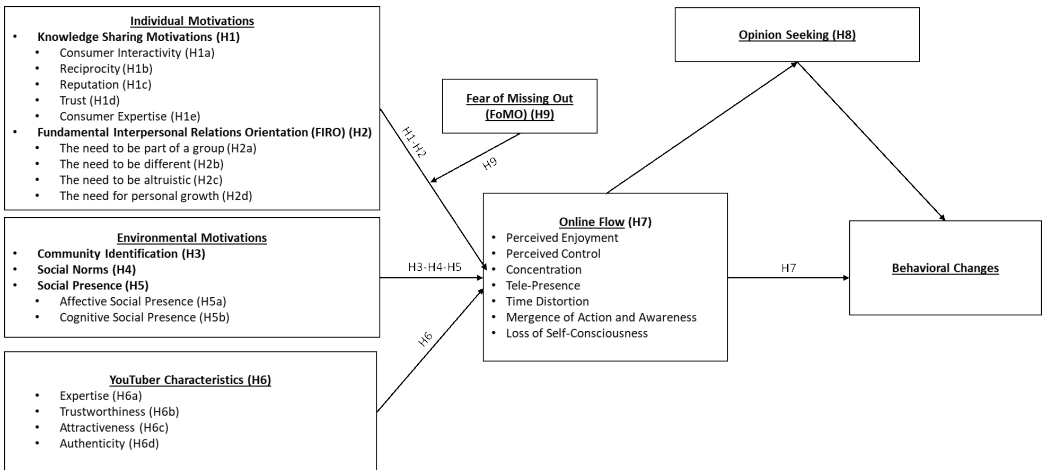


Figure 1. Research Model

Sampling Process

The main mass consisted of female consumers who live in Istanbul, are at least 18 years of age, and follow at least one YouTuber in makeup/cosmetic/beauty segment. This sample was chosen because Istanbul is a cosmopolitan city and can represent female consumers with different lifestyles. Within the scope of the study, it was not focused on any product group, brand, or YouTuber and/or YouTuber follower, only a specific segment was selected. This segment was makeup/cosmetic/beauty. In order to obtain accurate and reliable information, the respondents were to follow one or more YouTubers in the makeup/cosmetic/beauty segment as a prerequisite. Convenience sampling was used as the sampling method, and a survey procedure was conducted by a research company in Istanbul. The sample size was determined as n=384 with 95% confidence interval and 5% margin of error (Kurtuluş, 2004: 186). A total of 850 questionnaires were applied. As a result of the elimination of incomplete and incorrect questionnaires, 520 questionnaires were evaluated.

Measures

The research scales were adapted from the studies shown in Table 2.

Scales	Adapted From
"Why do you follow makeup/cosmetics/beauty YouTuber(s)?"	Whiting & Williams (2013)
Knowledge Sharing Motivations	Wu et al. (2010), Lee, Park, Kim, Kim, & Moon (2011)
Consumer Interactivity (ET)	Hsu & Lin (2008)
Reciprocity (KFB), Reputation (ITI) and Trust (G)	Sohn (2005)
Consumer Expertise (TU)	
FIRO	
The need to be part of a group (AIT)	Leary, Kelly, Cottrell, & Schreindorfer (2013)
The need to be different (BEN, YAR)	Ruvio, et al. (2008)
The need to be altruistic	Ma & Chan (2014)
The need for personal growth (KGL)	Robitschek (1998)
Environmental Motivations	
Community Identification (TK)	Hsu & Lin (2008)
Social Norms (SN)	Wang & Chen (2012)
Social Presence (SM)	Shen & Khalifa (2008)
YouTuber Characteristics (YOU)	
Expertise (U), Trustworthiness (GV), Attractiveness (C) and Authenticity (O)	Ohanian (1990), Chapple & Cownie (2017)
Online Flow (OAT)	
Concentration (KON), Perceived Enjoyment (AZ) and Perceived Control (AKO)	Koufaris (2002)
Time Distortion (ZB)	Agarwal & Karahanna (2000)
Tele-Presence (TM)	Novak, Hoffman & Yung (2000), Guo (2004)
Mergence of Action and Awareness and Loss of Self-Consciousness	Guo (2004).
Opinion Seeking (FIA)	Flynn et al. (1996)
FoMO	Przybylski et al. (2013)
Behavioral Changes (DD)	
Interest (IB), Desire (AB) and Action (HG)	Wei & Lu (2013)

Individual and environmental motivations, online flow, opinion-seeking, FoMO, and behavioral changes were measured with the 5-point Likert scale (5 = Totally agree, 1 = Strongly disagree), and YouTuber characteristics were measured by a 7-Point Scale (1= Close to me, 7= Not close to me). The data was analyzed using SPSS and AMOS. In the analysis of the data, descriptive statistics, reliability, exploratory and confirmatory factor analyses, structural equation modeling, and mediating and moderating analyses were employed.

Results

Sample Characteristics and Descriptive Statistics

Participants generally were single (56%), in 18-25 (35.4%) and 26-33 (33.6%) age range, university graduates (51.2%), and private-sector employees (33.8%). They had a monthly household income of 4301 TL and above.

Many of the participants (55.6%) stated that they have followed YouTuber(s) for one year or longer and that they watched the video contents “1-3 hours a week.” Finally, they generally followed the YouTubers for “entertainment” (49.2%), “providing convenience and benefits” (41.1%), “searching for information” (42.1%), “sharing information” (%40.0), and “time passing” (34.6%).

Reliability, Exploratory and Confirmatory Factor Analysis

Firstly, the reliability of the scales was separately tested.

After this analysis, an exploratory factor analysis was applied to determine the reliability and sampling adequacy of the scales. Due to the sample size, factor loads of 0.40 and above were considered. According to the exploratory factor analysis results, FIRO has five factors. Therefore, in the direction of the new factor structure, H2 and H9b and its sub-hypothesis were *revised*.

Meanwhile, according to the exploratory factor analysis results, online flow has five factors. Eliminated variables were the variables of the “mergence of action and awareness” and the “loss of self-consciousness” dimensions. Therefore, these two dimensions are out of the analysis.

Lastly, a confirmatory factor analysis was applied to determine whether the factors were compatible with the sample. The results of each analysis are shown in Table 3, and the fit index values are shown in Table 4.

Table 3
Reliability, Exploratory and Confirmatory Analysis Results

Scales	Reliability Analysis			Exploratory Factor Analysis				Confirmatory Factor Analysis			
	Eliminated Variables	Cronbach Alpha	Explain Total Variance	Factor Loading (Ranged Form)	Eigenvalue	Cronbach Alpha	Eliminated Variables	CR	AVE	Cronbach Alpha	Eliminated Variables
Knowledge Sharing Motivations		0.935									6
Consumer interactivity			68.499	0.871-0.731	4.110	0.908		0.905	0.705	0.905	
Reciprocity			83.141	0.925-0.901	2.494	0.898		0.899	0.749	0.898	
Reputation			92.102	0.960	1.842	0.914	1	0.915	0.843	0.914	
Trust			72.051	0.878-0.827	2.162	0.804		0.805	0.580	0.804	
Consumer Expertise			62.136	0.866-0.679	6.214	0.932		0.906	0.619	0.920	
FIRO	4	0.899	64.895				3				9
Factor 1: The need to be altruistic			25.761	0.910-0.816	9.274	0.972		0.947	0.749	0.947	
Factor 2: The need for personal growth			12.532	0.819-0.556	4.512	0.879		0.888	0.532	0.885	
Factor 3: Avoidance of similarity and unpopular choice counter-conformity			10.868	0.834-0.663	3.912	0.877		0.879	0.595	0.875	
Factor 4: Creative choice counter-conformity			8.194	0.800-0.628	2.950	0.831		0.819	0.533	0.811	
Factor 5: The need to be part of a group			7.539	0.804-0.545	2.714	0.759		0.771	0.413	0.759	
Environmental Motivations											
Community Identification		0.852	77.288	0.914-0.843	2.319	0.852		0.858	0.669	0.852	
Social Norms	1	0.848	76.740	0.904-0.849	2.302	0.848	1	0.851	0.656	0.848	

Table 3
Reliability, Exploratory and Confirmatory Analysis Results

Scales	Reliability Analysis			Exploratory Factor Analysis				Confirmatory Factor Analysis			
	Eliminated Variables	Cronbach Alpha	Explain Total Variance	Factor Loading (Ranged Form)	Eigenvalue	Cronbach Alpha	Eliminated Variables	CR	AVE	Cronbach Alpha	Eliminated Variables
Social Presence	3	0.892	76.750				1				
Factor 1: Cognitive Social Presence			48.458	0.862-0.686	3.392	0.895		0.890	0.620	0.895	
Factor 2: Affective Social Presence			28.292	0.928-0.908	1.980	0.895		0.898	0.816	0.895	
YouTuber Characteristics	2	0.965	74.530				1				4
Factor 1: Attractiveness			21.676	0.818-0.641	4.769	0.927		0.918	0.736	0.917	
Factor 2: Authenticity			19.530	0.728-0.688	4.296	0.916		0.906	0.660	0.903	
Factor 3: Expertise			17.951	0.823-0.635	3.949	0.922		0.924	0.710	0.922	
Factor 4: Trustworthiness			15.373	0.808-0.530	3.382	0.913		0.885	0.657	0.884	
Online Flow	5	0.929	80.869				7				
Factor 1: Tele-Presence			24.579	0.884-0.784	4.670	0.942		0.938	0.718	0.942	
Factor 2: Time Distortion			16.891	0.870-0.772	3.209	0.909		0.883	0.716	0.878	
Factor 3: Perceived Enjoyment			15.220	0.871-0.698	2.892	0.866		0.872	0.630	0.866	
Factor 4: Concentration			14.378	0.889-0.855	2.732	0.944		0.944	0.849	0.944	
Factor 5: Perceived Control			9.801	0.932-0.927	1.862	0.922		0.922	0.856	0.922	
Opinion Seeking FoMO	3	0.968 0.803	60.223 36.332	0.833-0.586 0.695-0.500	3.011 3.633	0.827 0.803				0.827 0.726	
Behavioral Changes		0.948	84.744				1				
Factor 1: Action			32.537	0.802-0.736	2.603	0.906		0.907	0.765	0.906	
Factor 2: Desire			27.515	0.841-0.609	2.201	0.901		0.915	0.781	0.901	
Factor 3: Interest			24.692	0.869-0.747	1.975	0.822		0.829	0.708	0.822	

Table 4
Fit Index Values

Scales	CMIN/df	GFI	AGFI	RMR	RMSEA	CFI	NNFI	NFI
Knowledge Sharing Motivations	3.030	0.923	0.895	0.043	0.063	0.960	0.952	0.942
FIRO	2.232	0.905	0.887	0.065	0.049	0.948	0.943	0.911
Environmental Motivations	4.294	0.933	0.894	0.056	0.080	0.956	0.940	0.944
YouTuber Characteristics	3.698	0.905	0.877	0.074	0.072	0.954	0.947	0.939
Online Flow	2.897	0.928	0.902	0.072	0.060	0.968	0.962	0.953
Opinion Seeking	4.957	0.984	0.941	0.020	0.087	0.984	0.960	0.980
FoMO	3.584	0.982	0.953	0.048	0.071	0.963	0.930	0.950
Behavioral Changes	2.698	0.980	0.955	0.015	0.057	0.992	0.987	0.988

Generally, goodness of fit values criteria is as follows; CMIN/df is between the range of 1-5, GFI value is $0.90 < GFI < 0.95$, AGFI value is $0.85 < AGFI < 0.90$, RMR value is $0.05 \leq RMR \leq 0.08$, RMSEA value is $0.05 < RMSEA < 0.08$, CFI value is $0.95 < CFI < 0.97$, NNFI value is $0.95 \leq NNFI \leq 0.97$, and NFI value is $0.90 \leq NFI \leq 0.95$ (Schermelleh-Engel & Moosbrugger, 2003). After the confirmatory factor analysis, it was seen that the goodness of fit values are at an acceptable level.

In addition to this, for each scale, Cronbach's alpha values exceed 0.70, CR values exceed 0.70, and the AVE is generally larger than 0.50 (Hair, Black, Babin, & Anderson, 2014). According to discriminant and convergent validity, all the scales are both reliable and valid.

Research Model Testing

The research model comprehensively addresses individual and environmental motivations as well as YouTuber characteristics and analyzes the behavioral changes of followers through online flow. For this reason, model testing was carried out over three different paths, and the results are shown below.

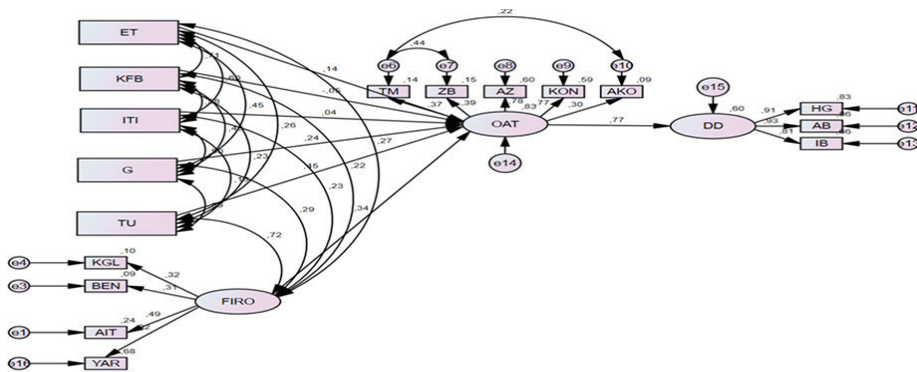


Figure 2. Path 1-The Effect of Individual Motivations on Online Flow and the Effect of Online Flow on Behavioral Changes of Followers

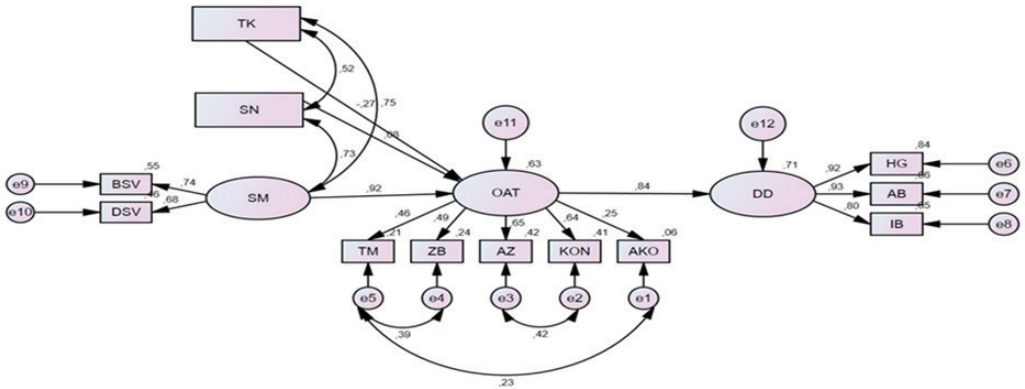


Figure 3. Path 2-The Effect of Environmental Motivations on Online Flow and the Effect of Online Flow on Behavioral Changes of Followers

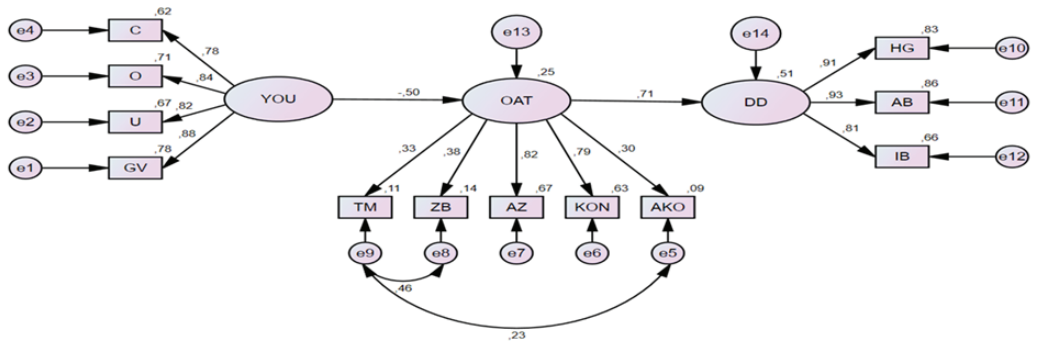


Figure 4. Path 3-The Effect of YouTuber Characteristics on Online Flow and the Effect of Online Flow on Behavioral Changes of Followers

The fit index for the path analyses is shown in Table 5.

Table 5
Fit Index Values of the Paths

Models	Fit Index							
	CMIN/df	GFI	AGFI	RMR	RMSEA	CFI	NNFI	NFI
Path 1	3.626	0.922	0.881	0.059	0.071	0.936	0.913	0.914
Path 2	4.699	0.931	0.882	0.048	0.084	0.944	0.920	0.931
Path 3	4.607	0.946	0.915	0.055	0.071	0.962	0.950	0.949

In the Path 1 analysis, it was seen that the model variables did not have fit values for the individual motivations step, and the recommended modifications were made. The “Altruism”

dimension was excluded from the analysis, and H2d was rejected. After completing the recommended modifications, it was seen that the goodness of fit values are at an acceptable level. Path results are shown in Table 6.

Table 6
Paths Results

PATH 1				
Hypothesis	C.R.	S.R.W.	p	
H1a	3.082	0.145	0.002	H1a (+)
H1b	-1.176	-0.051	0.240	H1b (-)
H1c	1.060	0.043	0.289	H1c (-)
H1d	5.243	0.238	***	H1d (+)
H1e	5.828	0.451	***	H1e (+)
H2	4.307	0.341	***	H2 (+)
H2a		0.493	***	H2a (+)
H2b	5.688	0.307	***	H2b (+)
H2c	9.791	0.824	***	H2c (+)
H2e	5.883	0.320	***	H2e (+)
H7	8.069	0.775	***	H7 (+)
PATH 2				
H3	-2.290	-0.273	0.022	H3 (+)
H4	0.827	0.085	0.408	H4 (-)
H5	3.599	0.915	***	H5 (+)
H5a		0.682		H5a (+)
H5b	14.485	0.743	***	H5b (+)
H7	5.121	0.844	***	H7 (+)
PATH 3				
H6	-5.547	-0.502	***	H6 (+)
H6a	23.202	0.816	***	H6a (+)
H6b		0.882		H6b (+)
H6c	21.789	0.785	***	H6c (+)
H6d	24.467	0.844	***	H6d (+)
H7	6.059	0.711	***	H7 (+)

C.R.= t value, S.R.W.= Standardized Regression Weight, $p < 0.05$, *** $p < 0.001$

Table Note: Accepted hypotheses have been shown with (+), rejected hypotheses have been shown with (-).

Testing the Mediating Effect of Opinion Seeking

Within the scope of the study, it was assumed that opinion-seeking has a mediating effect on the relationship between online flow and behavioral changes. The results are presented in Table 7.

Table 7
Mediation Test Results

	Fit Index Values			Standardized Path Coefficients	
Direct Model	<ul style="list-style-type: none"> • CMIN/df=4.215 • GFI=0.969 • AGFI=0.926 • RMR=0.053 • RMSEA=0.079 • CFI=0.976 • NNFI=0.956 • NFI=0.969 	Online Flow	→	Behavioral Changes of Followers	<ul style="list-style-type: none"> • S.R.W.= 0.712 • C.R.= 6.027 • p=***
		Online Flow	→	Opinion Seeking	<ul style="list-style-type: none"> • S.R.W.= 0.291 • C.R.= 4.456 • p=***
Mediation Model	<ul style="list-style-type: none"> • CMIN/df=3.510 • GFI=0.969 • AGFI=0.933 • RMR=0.050 • RMSEA=0.070 • CFI=0.975 • NNFI=0.957 • NFI=0.966 	Online Flow	→	Behavioral Changes of Followers	<ul style="list-style-type: none"> • S.R.W.= 0.657 • C.R.= 5.950 • p=***
		Opinion Seeking	→	Behavioral Changes of Followers	<ul style="list-style-type: none"> • S.R.W.= 0.191 • C.R.=5.156 • p=***

Sobel Test Results¹

Test Statistics=2.019, Standard Error=0.027, p=0.04

Bootstrap Confidence Intervals

Total Effect=0.013, Direct Effect=0.009, Indirect Effect=0.007, Bootstrap Confidence Interval=0.034–0.083

¹ <http://quantpsy.org/sobel>, 2019, ***p<0.001.

According to the mediation model test results, it was seen that the variables in the mediating effect model are at an acceptable level. The relationship between online flow and followers’ behavioral changes weakened with the addition of opinion-seeking. Thus, mediation conditions were provided, and partial mediating effects emerged (Baron & Kenny, 1986). After the mediation test, the Sobel and Bootstrap Confidence Interval tests were performed. According to the results of both the Sobel and Bootstrap Confidence Intervals Tests, opinion-seeking had a partial mediating effect. The H8 hypothesis was accepted.

Testing the Moderating Role of FoMO

An attempt to determine the moderator role of FoMO in the relationship between individual motivations and online flow was made. For the moderator variable test, participants were grouped as having a low FoMO (score below 3, N=174, M=2.98) and having a high FoMO (score above 3, N=228, M=3.22). After determining the group numbers, a moderator variable test was conducted. For this purpose, Excel macro was used as well as the AMOS program (<http://statwiki.kolobkreatations.com>, 2019). The moderating effect of FoMO is shown in Table 8.

Table 8
Moderating Effect of FoMO

Participants with Low FoMO	C.R.	S.R.W.	p
Online Flow<---Consumer Interactivity	2.110	0.227	0.035
Online Flow<---Reciprocity	-0.184	-0.016	0.854
Online Flow<---Reputation	-0.559	-0.044	0.576
Online Flow<---Trust	2.334	0.220	0.020
Online Flow<---FIRO	3.087	0.674	0.002
The need to be part of a group<---FIRO		0.658	
Creative choice counter-conformity<---FIRO	7.619	0.811	***
Avoidance of similarity and unpopular choice counter-conformity <---FIRO	3.479	0.301	***
The need for personal growth<---FIRO	2.528	0.216	0.011
Tele-presence<---Online Flow		0.283	
Time Distortion<---Online Flow	3.756	0.492	***
Perceived Enjoyment<---Online Flow	3.483	0.882	***
Concentration<---Online Flow	3.400	0.804	***
Participants with High FoMO			
Online Flow<---Consumer Interactivity	0.928	0.075	0.354
Online Flow<---Reciprocity	-0.631	-0.048	0.528
Online Flow<---Reputation	-0.621	-0.044	0.535
Online Flow<---Trust	4.222	0.407	***
Online Flow<---FIRO	3.870	0.571	***
The need to be part of a group<---FIRO		0.397	
Creative choice counter-conformity<---FIRO	5.148	0.897	***
Avoidance of similarity and unpopular choice counter-conformity <---FIRO	3.836	0.342	***
The need for personal growth<---FIRO	4.361	0.423	***
Tele-presence<---Online Flow		0.408	
Time Distortion<---Online Flow	2.838	0.176	0.005
Perceived Enjoyment <---Online Flow	5.162	0.848	***
Concentration<---Online Flow	5.505	0.796	***

C.R.= t value, S.R.W.= Standardized Regression Weight, p < 0.05, ***p<0.001

In the moderation analysis, the model variables did not have fit values, and the recommended modifications were made. The “consumer expertise” and “perceived control” dimensions were excluded from the analysis. After these modifications, it was seen that the goodness of fit values were at an acceptable level. The Fit indexes are CMIN/df=1.750, RMR=0.06, RMSEA=0.043, GFI=0.943, AGFI=0.891, NFI=0.918, NNFI=0.939, and CFI=0.962.

In terms of participants with low FoMO, there are statistically significant relationships between the following variables: consumer interactivity and online flow (Estimate= 0.060; t value= 2.110), trust and online flow (Estimate= 0.075; t value= 2.334), and FIRO and online flow (Estimate= 0.336; t value= 3.087).

In terms of participants with high FoMO, there are statistically significant relationships between the following variables: trust and online flow (Estimate= 0.188; t value= 4.222)

and FIRO and online flow (Estimate= 0.881; t value= 3.870). The chi-square difference test results are presented in Table 9.

Table 9
Chi-Square Differences Test Results

	High		Low		z-score
	Estimates	p	Estimates	p	
Online Flow<---Consumer Interactivity	0.027	0.354	0.06	0.035	0.788
Online Flow<---Reciprocity	-0.018	0.528	-0.005	0.854	0.359
Online Flow<---Reputation	-0.015	0.535	-0.011	0.576	0.118
Online Flow<---Trust	0.188	***	0.075	0.02	-2.058**
Online Flow<---FIRO	0.881	***	0.336	0.002	-2.161**
The need to be part of a group<---FIRO	1		1		
Creative choice counter-conformity<---FIRO	3.005	***	1.263	***	
Avoidance of similarity and unpopular choice counter-conformity <---FIRO	1.247	***	0.511	***	
The need for personal growth<---FIRO	0.88	***	0.261	0.011	
Tele-presence<---Online Flow	1		1		
Time Distortion<---Online Flow	0.49	0.005	1.846	***	
Perceived Enjoyment <---Online Flow	1.788	***	2.559	***	
Concentration<---Online Flow	1.835	***	2.993	***	

The results of the moderator variable test showed that hypotheses H9, H9a and sub-hypothesis H9a.d were accepted. However, H9a.a, H9a.b, H9a.c, and H9a.e were rejected. In addition to this, H9b and sub-hypotheses H9b.a, H9b.b, H9b.c, and H9b.e were accepted, while H9b.d was rejected.

Conclusions

Within the scope of the research, a comprehensive model was proposed by bringing together variables that had not been studied before. The findings obtained are as follows:

In terms of individual motivations, consumer interactivity, trust, and consumer expertise have a positive effect on online flow. According to results, as interactivity level increases, the knowledge-sharing tendency also increases. Therefore, the two-way communication between YouTubers and followers accelerates the online flow process. For trust, it can be stated that if the trust of the followers in both each other and in YouTubers increases, knowledge-sharing increases, and followers are involved in the online flow. Lastly, in regards to consumer expertise, individuals will spend more time in the mediated environment to learn more and

contribute to the process, but as for the reciprocity and reputation dimensions, they have no effect on online flow.

Meanwhile personal growth, avoidance of similarity and unpopular choice counter-conformity, creative choice counter-conformity, and the need to be part of a group have a positive effect on online flow. For personal growth, consumers who are characterized with intense opinion-seeking consume more video content to ensure personal growth and experience all stages of the online consumer behavior decision making process. Followers have an avoidance of similarity and want to be different from others. Therefore, they tend to consume video content which emphasizes on difference. Due to creative choice counter-conformity, they prefer products which are accepted by the society. At this point, the need for uniqueness depends on different usage and applications and brand preference. Finally, in terms of the need to be part of a group, they want to consume the same content and applications as the online community. In this direction, for all individual motivations, the online flow process is accelerated, and the process ends with behavioral change.

In terms of environmental motivations, community identification has a negative effect on online flow whereas affective and cognitive social presences have a positive effect. However, social norms have no effect.

For community identification and social norms, individuals follow a YouTuber and video content. However, they do not consider themselves as part of the community. Followers do not act with a community identity, and this situation causes a negative effect on the online flow. Similarly, this situation does not lead to a behavioral change in terms of social norms. This is because the online consumer is more of an individual and independent. For social presence, it is seen that considering important to the individual both affectively and cognitively, and the community will reveal online flow and behavioral changes.

YouTuber characteristics have a negative effect on online flow. At this point, individuals follow YouTubers and care about their characteristics, but these are not the unique factor in online flow. However, it was seen that the subdimensions of YouTuber characteristics have a positive effect.

Opinion-seeking has a partial mediator role in the relationship between online flow and behavioral changes. Due to followers' need for information and the importance of information, online flow has an effect on opinion-seeking, and opinion-seeking has an effect on behavioral change.

Finally, the results demonstrate that high FoMO individuals have more trust in the information shared by YouTubers. Meanwhile, individuals with high FoMO have more need to be part of a group, need for creative choices, and need for personal growth. However, they avoid

similarity less. Finally, these individuals have fears of missing out, of not being informed, and of falling behind other individuals. For this reason, personal growth needs are also high.

Implications

According to findings, it is seen that individuals attach importance to the knowledge-sharing motivation. YouTubers can concentrate more on videos that explain product promotions, content, and usage. This proposal can also be evaluated in terms of community identification.

Knowledge-sharing between followers has essential for an effective communication process. Therefore, effective content production can be supported with applications such as augmented reality. It is important to offer followers quality content which can draw attention in terms of video structure and fiction. YouTubers can enable their followers to get involved in their content production and sharing process. Also, when businesses can present video content which followers can talk about and which trigger the discussion and commentary process about said video content, they will be able to convert the interaction process to online flow. The increasing number of shares and likes will bring new followers, comments, and popularity at that rate.

To increase the sense of trust in the community, it is necessary to provide effective feedback to the followers, to get feedback from them, and to report the satisfaction or dissatisfaction under the heading “from you.” YouTubers should demonstrate that they are not supported by any brand and are neutral to increase the level of trust from the followers.

Today, customers are connecting with brands to which these customers can access, and the brands can access their customers. Therefore, the consumer should be included in the co-creation process. The emphasis on expertise can be brought to the forefront with “you can improve” competitions.

YouTubers are virtual opinion leaders. However, it should not be ignored that expert consumers also have the potential to become opinion leaders. Businesses can make these people as brand ambassadors who can support the process of creating their own followers.

Followers care about their personal growth. In this sense, “How did I do it?”, “How is it done?”, and “Request videos from followers” videos will have a significant effect.

Followers have an avoidance of similarity. For these consumer groups, “limited” can be a strategy. An “emphasis on uniqueness and different from the others,” “customized products/messages,” and a “perception of high quality” are among the strategies that can be applied. With this strategy, individuals with a high FoMO can also be satisfied. Market segmentation is another strategy that can be recommended. Meanwhile this proposal can also be evaluated in terms of community identification, and one-to-one marketing practices might be preferred.

In terms of the need to be part of a group, YouTube is a platform which emphasizes on community culture. YouTubers tend to share their everyday lives. This can make practitioners' work easier.

Today, individuals are active in two distinct worlds—the real world and the virtual world. For this reason, businesses should effectively integrate them. This can be achieved by creating avatars and developing augmented reality and 3D applications for social presence.

In the online flow process, YouTuber characteristics are not the sole factor. YouTubers should clearly introduce themselves to their followers to provide effective and accurate communication. YouTubers can determine which characteristic stands out in the eyes of their followers and constitute differentiation strategies.

Influencers have considerable importance in the sense of brand storytelling. Therefore, marketers and professionals should look for a way to use these individuals in brand dialogues.

In order to influence opinion-seekers, virtual experiences, testing products, sending a prototype of new products to YouTubers, the use of a product by a YouTuber in a video, and applying for in-video advertising strategies can be used. These applications are valuable for individuals who have a high FoMO as well as individuals who are connected to their electronic devices and can be considered as an “innovator” consumer group. For this reason, it is necessary to act quickly in the communication of these individuals and to make and emphasize this innovation, and behavioral changes can be achieved by creating the perception of “being special.”

Limitations and Future Studies

This study was carried out Istanbul, and within the scope of the research, a particular product group, brand, or YouTuber was not focused on; merely a specific segment was selected. Limitations of the study are that a product/brand group or YouTubers in general were not evaluated since the study was established on a specific segment and city.

In future studies, personality, lifestyles, values, expectations, and different motivational processes can be included in the model. Purchasing and decision-making styles which are active in the virtual world and in online flow can be discussed. Furthermore, opinion leadership and opinion-passing behaviors can be added to the model. Through the consumer-oriented model, consumer characteristics can be determined, and this can create consumer profiles. Similarly, a YouTube consumer inventory can be designed for YouTubers, and market segmentation studies can be carried out. How the model will give results in terms of different social media tools and vlog fields can be investigated, and a comparative study can be carried out.

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Veri Madenciliği Karar Ağaçları Kullanarak Ülkelerin İnovasyon Değerlerinin Tahmini ve Doğrusal Regresyon Modeli ile Karşılaştırmalı Bir Uygulama

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Öz

Ülkelerin sahip olduğu inovasyon seviyeleri ve kapasiteleri, günümüzde hem rekabet edebilirlik hem de yaşamakta olduğumuz Endüstri 4.0 Devrimi açısından son derece önemlidir. Bu kapsamda bakıldığında, ülkeler açısından kapasite ve seviye göreceli bir kavram olarak kalmaktadır ve küresel karşılaştırmalar açısından ortak bir ölçme sistemine gereksinim vardır. Bu ihtiyacı önemli ölçüde karşılayan Ağ Yapılara Hazır Olma Endeksi (AYHOE) ve Küresel İnovasyon Endeksi (KİE), ülkelerin inovasyon seviyelerinin belirlenmesinde etkili ve kapsamlı endekslerdir. Ayrıca her iki endeks de akademik altyapıya sahiptir ve bu nedenle araştırmacılar için önemli bir veri kaynağıdır. Bu çalışma, KİE değeri ve AYHOE endeksine ait alt endekslerin boyutlarında yer alan göstergeler kullanılarak, denetimli makine öğrenmesi temellerine dayanan bir veri madenciliği tekniği olan regresyon ağacı analizi ve doğrusal regresyon analizi uygulamalarını ve karşılaştırmasını içermektedir. Araştırmanın amacı regresyon ağacı uygulayarak, AYHOE göstergelerinden hareketle KİE tahminlemesi yapmak ve en iyi ayrılmayı sağlayan KİE göstergelerini belirlemektir. Analiz için Sınıflandırma ve Regresyon Ağacı ((SRA) - Classification and Regression Tree (CART)) algoritması kullanılmıştır. Analiz sonucunda AYHOE kapsamındaki hangi göstergelerin, KİE değerleri tahmininde ve ülke sıralamasında kullanılabileceği belirlenmiştir. Aynı veri seti kullanılarak doğrusal regresyon analizi uygulanmıştır. SRA algoritması ile elde edilen regresyon ağacı sonuçları, doğrusal regresyon modelinden elde edilen çıkarımlar ile karşılaştırılmıştır.

Ahahtar Kelimeler

Ağ Yapılara Hazır Olma Endeksi, İnovasyon, Karar Ağacı Öğrenmesi, Küresel İnovasyon Endeksi, Sınıflandırma ve Regresyon Ağacı

Prediction of Innovation Values of Countries Using Data Mining Decision Trees and a Comparative Application with Linear Regression Model

Abstract

Innovation levels and capacities of countries are two very important factors for competitiveness as well as the current Industrial 4.0 Revolution. In this context, capacity and level are relative concepts, with a great need for a common measurement system on global-based comparisons. The Network Readiness Index (NRI) and the Global Innovation Index (GII), which meet this need to a significant extent, are globally important indices with an effective and academic infrastructure to determine the innovation levels of countries. This study includes regression tree analysis and linear regression analysis and comparison using the indicators within the dimensions below the subscales of the GII score and

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NRI index based on supervised machine learning. The regression tree application aimed to make the GII estimation based on the NRI indicators and determine the best discriminating GII indicators. Therefore, the Classification and Regression Tree (CART) algorithm is used for analysis. The analysis result determined the indicators within the scope of NRI that are used in the GII scores and country ranking estimation. Linear regression analysis was performed with the same data set, and the regression tree obtained by the CART algorithm was compared with the linear regression model.

Keywords

Networked Readiness Index, Innovation, Decision Tree Learning, Global Innovation Index, Classification and Regression Tree

Extended Summary

In Industry 4.0, which is built on the digital revolution infrastructure, countries are expected to adapt to the characteristics of this age in terms of competitiveness, as with companies of all sizes. Understanding and using factors that triggered the Industrial 4.0 revolution is important to adapt to this era. The most important of these elements is information technology. Therefore, the readiness level in terms of speed, capacity, number, and quality of the equipment that operates in the global network i.e., the adequacy of information infrastructure and network systems, should be addressed. Globally, the information and communications technology (ICT)-based developments of countries were measured by the World Economic Forum and its collaboration with Network Readiness Index (NRI).

Innovation is an important factor of the Industrial 4.0 revolution, since it plays an active role in the growth of countries as a factor that strengthens people and policies and becomes the main tool in creating economic prosperity. Globally, the innovation levels of countries are measured by Global Innovation Index (GII) that was prepared in collaboration with Cornell University, INSEAD, and the World Intellectual Property Organization.

Decision trees in data mining are learning algorithms based on supervised machine learning. The decision tree algorithm that is chosen in this study, like other learning techniques, aimed to create the most appropriate model from the training data. Afterward, the validity of the model created with the training data is evaluated by the test data and used to predict the approved model.

The data set of the research consists of NRI indicator values and GII scores of 123 countries in 2016. This study aimed to construct a classification model and linear regression equation to estimate GII scores by using the NRI indicators. Thus, NRI indicator values are used to determine the level of innovation of countries. Therefore, firstly, decision trees analysis, one of the classification techniques, was used as a predictive data mining task. In the decision tree analysis stage, regression tree analysis was applied, which is rarely encountered in the literature. The regression tree was created by the Classification and Regression Tree (CART) algorithm in R software programming. To develop the predictive model, 0.60 of the data set

was used as a training set for the learning stage of the algorithm, and samples were chosen by cross-validation. The optimal tree was reached by post pruning and by selecting the model that gives least-squares deviation.

Secondly, NRI indicators were determined as independent variables and the overall GII score as the dependent variable to construct an equational cause-effect model. Then, linear regression analysis was applied to the data set using the Statistical Package for the Social Sciences software package. Principal Component Analysis (PCA) was applied to independent variables before linear regression application for dimension reduction. Additionally, all linear regression analysis assumptions were checked using related tests and graphical tools to detect violations on preconditions.

The root node was determined as “ICT Patent Cooperation Treaty (PCT) patent applications per million populations” and the terminal node was determined as “PCT patent applications per million populations.” to estimate the GII according to the optimal tree. These two variables with high factor loadings are included in factor 1 extracted from PCA. Contrarily, factor 1 has the most effect on predicting the dependent variable GII in linear regression analysis. According to these findings, the CART algorithm provides more in-depth information and linear regression provides more superficial information. Further, a more easily interpretable result was obtained by regression tree analysis. In these respects, estimation with the CART algorithm has superior aspects compared to linear regression analysis.

Veri Madenciliği Karar Ağaçları Kullanarak Ülkelerin İnovasyon Değerlerinin Tahmini ve Doğrusal Regresyon Modeli ile Karşılaştırmalı Bir Uygulama

Ekonomik refah yaratmanın temel aracı olan inovasyon; daha geniş çapta iklim değişikliği ile mücadelede katkı sağlamakta, sürdürülebilir kalkınmayı tetiklemekte ve sosyal uyumu da teşvik etmektedir (Gault, 2018, p. 617). Endüstri 4.0 Devrimi'ni üçüncü devrimin bir uzantısı olarak kabul eden görüşler de olmakla birlikte, yaşanan bu yeni evrimi diğerlerinden çok farklı kılan üç özelliğe dikkat çekilmektedir. i-Hız: Bu devrim öncekilerin tersine doğrusal olmayıp, üstel bir hızla gelmektedir. Çok yönlü küresel dünyanın, yeni teknolojilerin sürekli daha yeni ve daha üstün yetenekli teknolojileri üretmesi ile ilgilidir. ii- Genişlik ve Derinlik: Bu devrim dijital teknolojiler alt yapısı üzerine inşa edilmektedir ve iş dünyasında, toplumun diğer kesimlerinde, bireylerde benzeri görülmemiş paradigmlar ile ilerlemekte, hızlı teknolojik değişimler ve donanımlar geliştirmektedir. iii- Sistem Etkisi: Endüstri 4.0 Devrimi, tüm yönetim bilişim sistemleri yanında her şeyin her şeye bağlantılı olabildiği bir ağ sistemi üzerinden gelişirken, dünyada koskocaman sistemlerin, bütünleşik bir dönüşümünü kapsamaktadır. Bu üç özellik altında kökeninde inovasyona dayanmaktadır. Günümüzde inovasyon ve onunla etkileşim içinde olan tüm alanlar büyük önem kazanmaktadır (Fırat ve Fırat, 2017a).

İnovasyon sürekli olarak dış çevreyi ve yaşam tarzlarını değiştirdiğinden, tedarik zincirleri, topluluklar, kuruluşlar, kurumlar, bölgeler ve ülkeler için sürdürülebilirlikte kilit unsurdur. Aslında literatür, inovasyon odaklı yaklaşımlara dayanarak sürdürülebilirliğin ele alınması gerektiğini kabul etmektedir. Hatta literatürde, sürdürülebilir kalkınmanın çevresel ve sosyal boyutlarına etkilerinin düşük ve yüksek olması temel alınarak geleneksel inovasyon, sosyal inovasyon, sürdürülebilir inovasyon ve yeşil inovasyon olmak üzere tipleri ele alınmaktadır (Silvestre ve Trc 2019). Küresel sorunlara bu kadar geniş yelpazede çözüm arayan inovasyon, özellikle son 50 yılda sürdürülebilir küresel rekabet kavramı bakımından da son derece önemli hale gelmiştir.

Günümüzün rekabetçi dünyasında, hem gelişmiş hem de gelişmekte olan ülkelerin küresel zorluklara karşı ortak yenilikçi çözümler bulması ve eşzamanlı olarak kendi nüfuslarının acil ihtiyaçlarını da karşılaması gerekmektedir. İnovasyon, ulusal sınırları aşarak insanı ve politikaları güçlendiren bir unsur olup, ülkelerin büyümesinde kritik bir faktördür.

Artan küresel bağlantı eğilimi, bireysel, toplumsal, bölgesel ve küresel her düzeyde sorunları çözebilme yeteneği ve standartlaştırılmış bir yol gerektirmektedir. Anahtar göstergeler yoluyla inovasyon verilerinin ölçülmesi ve analiz edilmesi mümkün olabilmektedir. Küresel İnovasyon Endeksi (KİE) 2007'den bu yana inovasyon kabiliyetlerine ve sonuçlarına göre, diğer önemli parametreler yanında 2016 yılında; patent uygulamaları, eğitim harcamaları, yaratıcı ürünlerin ihracatı ve diğer uluslararası boyutların ölçütlerini içeren 82 gösterge kullanılarak dünya ekonomilerini sıralamaktadır.

Diğer yandan yeni ve güçlü seçenekler ile dijital, biyolojik ve fiziksel teknolojileri bir araya getiren, yeni sistemler setine geçişi temsil eden Dördüncü Endüstri Devrimi'ni yaşamaktayız. Bu yeni sistemler dijital devrimin altyapısı üzerine inşa edilmektedir. Endüstri 4.0'ın hem alt yapısı hem de araçları bilişim teknolojilerine dayanmaktadır. Bu nedenle küresel ağ da faaliyet gösterebilecek hız, kapasite, sayı ve donanım kalitesinde “hazır olma” düzeyi, yani bilişim altyapısı ve ağ sistemlerinin yeterliliği önem kazanmaktadır (Fırat ve Fırat, 2017b). Küresel Bilgi Teknolojileri Raporu 2016 (Global Information Technologies Report 2016), ülkelerin gelişmekte olan teknolojilerin nimetlerinden faydalanma konusunda hazır olma durumu ile dijital devrimin ve ötesinin sunduğu fırsatları değerlendiren bir içeriğe sahiptir. Bu içerikte KİE, küresel inovasyon bakımından incelemeler için çok elverişlidir.

Bilgi ve İletişim Teknolojilerinin ((BİT) - Information and Communication Technologies (ICT)) gelişimi; bilgi sistemlerindeki inovasyon, yönetme yetkinliklerinin ve profesyonel yeteneklerin sürekli olarak eğitilmesi ve iyileştirilmesi konusunda etkilidir (Kowal ve Paliwoda-Pekosz, 2017, p. 304). BİT devriminin etmenleri AYHOE ile küresel çapta ölçülebilmektedir.

İnsan sermayesi ((İS) - Human capital (HC)) ve BİT perspektifinden inovasyon; işletmeler, hükümetler ya da sosyal topluluklar için yeni BİT bilgisi, beceriler, sosyal ve yönetsel yetkinlikler gibi yeni yetenekler geliştirme kapasitesi anlamına gelmektedir. Bu değişimler, dünyadaki ülkelerin ve ekonomilerin inovasyon performansı hakkında ayrıntılı kriterler içeren KİE ile ölçülmektedir (Kowal ve Paliwoda-Pekosz, 2017, p. 304).

Ülkelerin inovasyon seviyelerinin belirlenmesinde en etkili göstergelerden biri kabul edilen KİE ve inovasyonu BİT temelli olarak ele alan AYHOE, akademik alt yapıya sahip, inovasyon alanındaki önemli iki indekstir. Bu iki endeks gerek kapsam, gerek işlev olarak birbirleriyle benzerlik göstermektedir ve ilişkili görünmektedir.

Her gün, exabyte'ler seviyesinde yeni veri, İnternet Protokolü ((İP) - Internet Protocol (IP)) ağları üzerinden oluşturulmakta ve taşınmaktadır. 2016 yılında dünya “zettabyte dönemi” ne geçmiştir ve küresel IP trafiği 1,1 zettabyte'ye veya 1 trilyon gigabayttan daha fazla bir kapasiteye ulaşmıştır. 2020'ye kadar küresel IP trafiğinin 2.3 zettabyte'ye ulaşacağı tahmin edilmektedir. Bu veri büyümesi ekonomileri körüklemekte ve yaratıcılık dalgaları oluşturarak inovasyonu tetiklemektedir. 2016 yılı Küresel Bilgi Teknolojileri Raporu, küresel yeniliği teşvik etmek için teknolojinin ve özellikle de geniş bant rolünü vurgulamaktadır (World Economic Forum, INSEAD ve Cornell University, 2016). İnternet ağ yapıları olmadan hiçbir inovasyonun gerçekleşmesi mümkün görünmemektedir. IP ağları; her bir kişiyi, her ülkeyi ve her IP özellikli cihazı bağlama kapasitesine sahiptir. Küresel ağlar, verilerin üretimden süreçlere kadar pek çok alanda engelsiz, hızlı bir şekilde büyümesini ve işbirlikçi inovasyonu mümkün kılmalarını sağlamaktadır. Dijital aktiviteyi teşvik etmekte donanımlı olan ülkeler, yeni sektörlerin ortaya çıkmasına ve geleneksel sektörlerin hızla gelişmesine katkıda bulunmaya devam etmektedir.

Donanımların, yazılımların ve hizmetlerin rolü; hükümetler, işletmeler ve bireyler için daha da kritik öneme sahiptir ve bu nedenle, yüksek hızlı geniş bantlı IP ağları, günlük yaşamın bir parçası haline gelmiştir. Aslında, 2020 yılına kadar 26 milyardan fazla internet bağlantılı cihaz ve 4 milyardan fazla küresel internet kullanıcısı olacağı tahmin edilmektedir. Genişbant internet, sosyal yapıları ve tüm ekonomileri önemli ölçüde etkileme yeteneği ile dünyanın en önemli genel amaçlı teknolojilerinden biri olarak kategorize edilmektedir (World Economic Forum ve ark., 2016). Bunlar dikkate alındığında, inovasyonun ağ sistemleri ile ilişkisi daha açık olarak ortaya çıkmaktadır. Ağ sistemleri, gerçek zamanlı, hızlı ve çok büyük miktarlarda veri akışları sağlamak ve toplanan/biriken veriler, depolamadan analize, özetlemeden modellemeye kadar bilgi işlemenin her aşamasında geleneksel teknikler dışında, yeni metodolojilere gereksinimi arttırmaktadır. Veri madenciliği bu ihtiyaçların itici gücü ile son yılların en popüler alanlarından biri olmuştur.

Veri madenciliği, veriler içinde gizli kalmış, bilinmeyen, ilginç ilişkileri keşfetmeye yarayan bir prosedürdür ve tahmin etme konusunda da başarılı bir yaklaşım olarak hem bilimsel çalışmalarda, hem de endüstriyel uygulamalarda yaygın olarak kullanılmaktadır (Purohit ve Sharma, 2017). Özellikle büyük verinin gündeme gelmesiyle birlikte çığ gibi büyüyen yığınlar arasından faydalı ve değerli bilgiyi bulup çıkarmak ve kullanıma sunmak için veri madenciliği teknikleri ve algoritmaları vazgeçilmez araçlardır. Veri madenciliği dijital dönüşüm çağının hızı, depolama hacimlerindeki büyüme ve çeşitlenen ham veri karşısında güçlü analiz teknikleri sunmaktadır.

Veri madenciliği, tanımlayıcı (descriptive) ve tahminleyici (predictive) olmak üzere iki ana kategori de toplanabilen işlevler için kullanılmaktadır. Bu işlevleri yerine getirmek için; veri madenciliğinin kümeleme (clustering), birliktelik kuralı madenciliği (association rule mining), ve sınıflandırma (classification) gibi çok çeşitli ve farklı görevleri bulunmaktadır (Agarwal, Mittal ve Pareek, 2016). Bu üç görev alanında da sayısız algoritma yer almaktadır.

Literatürde, en etkili 10 veri madenciliği algoritmaları arasında SRA da yer almaktadır (Wu ve diğerleri, 2008). Araştırmacılar arasında bu görüş yaygın olmakla birlikte SRA'nın regresyon ağacı uygulamalarına son derece nadirdir. Bu çalışmada; veri madenciliği sınıflandırma algoritmalarından karar ağaçları uygulanmış ve doğrusal regresyon analizi uygulaması sonuçları ile karşılaştırılma yapılmıştır. Karar ağaçları için, literatürde sınıflandırma ağacına göre daha az çalışılmış olan regresyon ağacı analizi uygulaması gerçekleştirilmiştir. Böylece regresyon ağacı analizine ilişkin uygulama eksikliğine katkıda bulunmak ve sonuçlarının doğrusal regresyon ile değerlendirilmesi hedeflenmiştir. Araştırmada son elli yılda küresel çapta ele alınan inovasyon kapsamında, ülkelerin inovasyon seviyelerinin belirlenmesinde en önemli indekslerden olan KİE için tahminleme çalışması yapılmıştır. KİE, teması “Dijital Ekonomide İnovasyon (Innovating in the Digital Economy)” olan BİT temellerine dayanan AYHOE göstergeleri kullanılarak tahminlenmiştir. Günümüzde küresel çerçevede en çok ta-

kip edilen konulardan biri inovasyon performanslarıdır. Bu araştırmada farklı algoritma ve teknikler ile çeşitli göstergeler kullanarak inovasyon performansları için tahmin modelleri sunulmaktadır.

SRA algoritması kullanılarak oluşturulan regresyon ağacı modelinde KİE tahminlemesini yaparken, en iyi ayrılmayı sağlayan AYHOE göstergelerinin belirlenmesi de amaçlanmıştır. Tahmin modelinin en uygun model olması için, en küçük hata kareleri ortalamasını veren model denemeleri yapılmış ve en düşük hata kareleri ortalaması ile KİE'yi tahmin eden optimal ağaç modeli elde edilmiştir. Elde edilen optimal SRA karar ağacı modeli ile; görsel olarak yorumlanabilen, tahmin hataları düşük ve tahminleme yorumu kolay olan bir model oluşturulmuştur. Bu model ile gelecek yıllardaki veriler kullanılarak tahminleme yapılması da öngörülmektedir. Aynı veri seti kullanılarak, doğrusal regresyon modeli de kurulmuş ve SRA algoritması kullanılarak oluşturulan model ile doğrusal regresyon analizi ile elde edilen modelin karşılaştırması yapılmıştır.

İnovasyon ve İlgili Küresel Endeksler

İnovasyonun önemi ilk kez 20. yüzyılın başlarında Schumpeter tarafından vurgulanmıştır. Farklı tanımları yapılan inovasyon kavramı için, 2005 yılında Eurostat ve OECD tarafından ortaklaşa geliştirilen The Oslo Manuel'de tüm yaklaşımlar için kullanılacak, ortak kabul görmüş inovasyon tanımı şu şekilde yapılmıştır: “iş uygulamalarında, iş yeri organizasyonunda ya da dış ilişkilerde; yeni veya önemli derecede geliştirilmiş bir ürünün (mal ya da hizmet) ya da sürecin, yeni bir pazarlama yöntemi ya da yeni bir organizasyonel yöntemin uygulanması” (OECD, 2005, p. 46).

Yeni teknolojilerin geliştirilmesi ve yaygınlaştırılması, resmi ve resmi olmayan ağlar ile bu etkileşimleri düzenleyen kurumsal kaynaklardan oluşan aktörler inovasyon sistemlerinin temel yapısal ögesidir. Firmalar, araştırma kuruluşları, devlet daireleri, STK'lar ve diğer aracı kuruluşlar inovasyonun gelişmesine ve yayılmasına katkıda bulunan başrol oyuncularındır (Binz ve Truffera, 2017, p. 1286).

İnovasyon temel olarak buluş, patent, lisans, diğer fikri mülkiyet hakları, endüstriyel tasarım kategorilerini içeren fikri mülkiyeti kapsamaktadır (Mataradzija, Rovcanin ve Mataradzija, 2013).

İnovasyon küresel gündemin en önemli konularından biridir. Rekabet açısından, daha da önemlisi sürmekte olan dijital devrim (Endüstri 4.0) kapsamında ülkelerin konumlarının belirlenmesi son derece önemlidir. Bu bağlamda World Economic Forum ve diğer uluslararası kuruluşlar bu konuda yoğun çalışmalar gerçekleştirmektedir. Bu çalışmada, ülke karşılaştırmalarında en çok dikkat çeken ve içerdiği göstergeler bakımından akademik alt yapıya sahip iki küresel index (KİE, AYHOE) gözönüne alınmıştır.

Ağ Yapılara Hazır Olma Endeksi ((AYHOE) - The Networked Readiness Index (NRI))

2016 yılında Dünya Ekonomik Forum'un INSEAD ve Cornell Üniversitesi işbirliği ile yayınladığı Küresel Bilgi Teknolojileri Raporu, Ağ Yapılara Hazır Olma Endeksi (AYHOE) kullanılarak BİT devriminin etmenlerini küresel çapta ölçmektedir. 2016 yılı indeksinde 139 ülke kapsamıştır. Küresel Bilgi Teknolojileri Raporu 2016 yılı teması "Dijital Ekonomide İnovasyon (Innovating in the Digital Economy)" olarak belirlenmiştir. "Dijital Ekonomide İnovasyon" teması ile hazırlanan Küresel Bilgi Teknolojileri Raporu 2016, dijital devrimin hem inovasyonun doğasını değiştirdiğine, hem de firmaların sürekli olarak inovasyon yapma konusunda artan bir baskıya maruz kaldığına vurgu yapmaktadır. Rapordan 4 anahtar mesaj çıkarılmıştır:

- i. Dijital devrim inovasyonun doğasını değiştiriyor.
- ii. Firmalar sürekli inovasyon yapmak için artan bir baskıyla karşı karşıya kalıyor.
- iii. İşletmeler ve hükümetler hızla büyüyen dijital nüfusun ihtiyaçlarını karşılamakta eksik kalabiliyor.
- iv. Yönetişim ve düzenlemelerde acil inovasyon isteyen yeni bir ekonomi şekilleniyor.

Bu temel sonuçlar, inovasyonu şekillendiren, tetikleyen ve karşılıklı etkileşim içinde olduğu alanın BİT olduğuna bir kez daha dikkati çekmektedir.

Küresel Bilgi Teknolojileri Raporu ilk olarak 2001 yılından yayınlanmış ve zaman içinde gelişmiştir. 2016 basımında Şekil 1'de görüldüğü gibi, AYHOE yapısını oluşturan 4 alt endeks bulunmaktadır. Alt endekslerin oluşturulmasında 10 boyut, bu boyutların içinde ise 53 göstere bulunmaktadır (World Economic Forum ve ark., 2016).



Şekil 1. Ağ Yapılara Hazır Olma Endeksi 2016 Çerçevesi

Küresel İnovasyon Endeksi ((KİE) - The Global Innovation Index (GII))

İlk kez 2007 yılında yayınlanan Küresel İnovasyon Endeksinin (KİE), 2016 basımı Cornell Üniversitesi, INSEAD ve Dünya Fikri Mülkiyet Örgütü (World Intellectual Property Organization (WIPO)) iş birliği ile yayınlanmıştır. KİE, inovasyon faktörlerinin sürekli değerlendirildiği bir ortam yaratmaya yardımcı olmaktadır. 2016 yılı KİE modelinde 128 ülke kapsamıştır.

Yıllar içinde KİE, herhangi bir ulusun inovasyon kapasitesinin; sadece yerel olarak ne düzeye geldiği ile değil, aynı zamanda tüm dünyayı nasıl etkilediği ile de ölçüldüğünü göstermiştir. Yoksulluk, sağlık, kentleşme, suya erişim ve iklim değişikliği gibi konular küresel niteliktedir. Ancak aynı zamanda hem zorluklar hem de çözümlerin yerel sonuçları vardır.

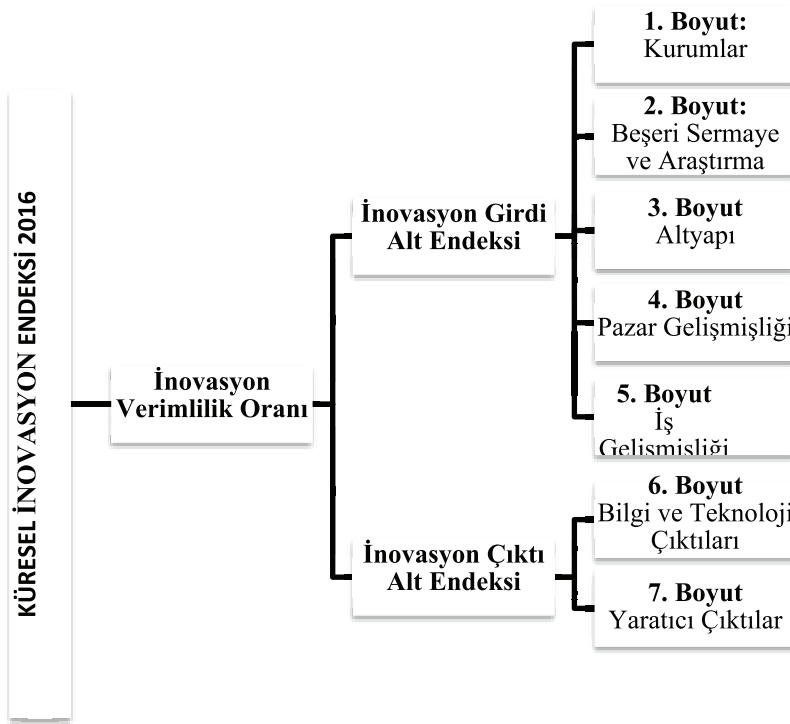
Bu nedenle, gelişmekte olan ülkelerde yerel çözümler sunan yenilikçi atılımlar küresel bir etkiye sahip olabilir ve diğer gelişmekte olan ülkeler arasında karşılıklı yarar sağlamak için paylaşım olanağı sağlayabilir. Bu yaklaşım içinde KİE raporunun 2016 teması “Küresel İnovasyon ile Kazanmak (Winning with Global Innovation)” olarak belirlenmiştir.

KİE dört ölçü hesaplamaktadır:

- i. İnovasyon Girdi Alt Endeksi
- ii. İnovasyon Çıktı Alt Endeksi
- iii. Genel KİE puanı
- iv. İnovasyon Verimlilik Oranı

KİE puanları, girdi ve çıktı alt endeks değerlerinin basit ortalaması olarak hesaplanmaktadır. (Cornell University, INSEAD ve WIPO, 2016).

Şekil 2’de görüldüğü gibi, 2016 yılında girdi alt endeksi 5 boyuttan, çıktı alt endeksi 2 boyuttan, her bir boyut ise 3 alt boyuttan oluşmakta olup, bu alt boyutların içinde ise toplam 82 gösterge bulunmaktadır.



Şekil 2. Küresel İnovasyon Endeksi 2016 Çerçevesi

Bu çerçeve incelendiğinde, girdi alt endeksindeki 3. boyut olan “altyapı” ve çıktı alt endeksindeki 6. boyut olan “bilgi ve teknoloji çıktıları” boyutlarının tamamen BİT alanını temsil ettiği görülmektedir. Yani KİE, içinde AYHOE boyutlarına benzer ve ortak değişkenler de barındırmaktadır.

AYHOE ve KİE’nin Birlikte Değerlendirilmesi

Teknoloji, inovasyon ve bilgi son elli yılda dünya ekonomisi evrimi ve uluslararası iş geliştiriminin temelinde bulunan üç önemli kavramdır (Andersson, Das, Mudambi ve Pedersen, 2016).

BİT, gelişmiş ve gelişmekte olan ülkeler için inovasyon ve büyümeye imkan sağlayan önemli kaynaklardan biridir. BİT’nin gelişmiş pazarlarda ekonomik büyüme için en önemli kaynaklardan biri olduğu ve inovasyona olanak sağladığı gösterilmiştir (Amiri ve Woodside, 2017).

Kononova, 2013 yılında 96 ülke için KİE ile AYHOE arasında 0,94'lük bir korelasyon katsayısı hesaplamıştır (Kononova, 2015). Tabii ki bu korelasyonların anlamlı ve yüksek olmasında iki endeksin kapsadığı ortak sayılabilecek değişkenlerin de etkisi bulunmaktadır. Ancak inovasyon, teorik olarak ağ – internet yapıları gerektirdiği için bu bulgu pratik olarak açıklanabilmektedir.

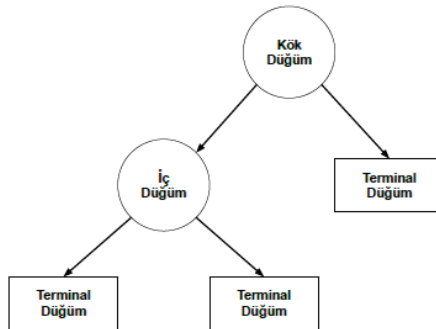
Preda ve diğerleri 2015 yılında Avrupa Birliğine bağlı 28 ülke için KİE ve AYHOE arasında tek değişkenli regresyon denklemi kurmuş ve korelasyon katsayısı olan R değerini 0,918 olarak bulunmuştur (Preda, Crişan, Stănică ve Samuel, 2016). Zoroja'nın araştırmasında ise, BİT'nin yenilikçilik üzerinde pozitif etkisi olduğu belirtilmiştir (Zoroja, 2016). “BİT olmadan inovasyon olmaz” yaygın görüşünü destekleyici sonuçlardır.

Doğruel Anuşlu ve Fırat ise, 2016 KİE ve AYHOE verileri ile yaptıkları betimsel çalışmada, ülkelerin bu iki endeks açısından sıralamalarının benzer olduğunu belirtmiştir. İnovasyonda ön sıralarda olan ülkelerin ağ yapılarının da iyi olduğuna dikkat çekilmiştir (Doğruel Anuşlu ve Fırat, 2019).

Veri Madenciliği Sınıflandırma Modelleri İçin Karar Ağacı Algoritmaları

Veri madenciliğinde bir karar ağacı, hem sınıflandırıcıları hem de regresyon modellerini temsil etmek için kullanılabilen nonparametrik bir tahmin modelidir ve araştırmalarda kararların hiyerarşik modellerini ve sonuçlarını belirtmek için kullanılmaktadır (Rokach ve Maimon, 2015).

Şekil 3'te örneklendirildiği gibi, karar ağaçları düğümler ve uçlardan oluşan hiyerarşik, yönlü bir ağaç yapısındadır. Yaprak olmayan bir düğüm iç ya da bölünmüş düğüm olarak adlandırılırken, yaprak düğüm ise terminal bir düğüm olarak adlandırılmaktadır (Guller, 2015). Ağaç yapısında iki düğüm birbirine ok ile bağlandığında, okun çıkış yaptığı düğüme ebeveyn düğüm, okun giriş yaptığı düğüme de çocuk düğüm denilmektedir.



Şekil 3. Ağaç Yapısı

Karar ağaçları oluşturulurken kullanılan tüm metotlarda tahmin edilecek olan değişken için final değerler kümesine ulaştırılan “eğer-öyleyse” kurallar kümesi oluşturulmaktadır. Elde edilen final değerleri kategorik bir değişkenin olasılıkları ise yaratılan karar ağacı sınıflandırma ağacı; sürekli bir değişkenin nicelikleri ise yaratılan karar ağacı regresyon ağacı olarak nitelendirilmektedir (Putler ve Krider, 2015). Bir sınıflandırma ağacı, karar kurallarının özeti temsil eden bir algoritmadır. Bağımlı değişken kategorik olan bir hedef değişken iken, bağımsız değişkenler tahminleyicilerdir. Her iç düğüm, bir tahmine dayanan kararı temsil etmektedir. Her uç, potansiyel gelecek karara kılavuzluk etmektedir. Her yaprak, bir sınıf ile etiketlenir. Amaç; tahminleyicilerin değerlerine uygun olarak, kökten yapraklara kadar uzanan bir yol izleyerek sınıflandırma yapmaktır. Regresyon ağacı özet ağaç ile temsil edilen bir algoritmadır ancak hedef değişken, sınıf yerine gerçek bir niceliktir. Karar düğümleri sınıflandırma ağacına benzemektedir ancak her yaprak amaç değişkeni için bir nicelik ile etiketlenirilmeye yapılmaktadır (Khoshgoftaar, Allen ve Deng, 2005).

Veri madenciliğinde karar ağaçları, denetimli makine öğrenmesi temellerine dayanan öğrenen bir algoritmalar topluluğudur. Diğer öğrenen algoritmalarda da olduğu gibi karar ağaçları öğrenmesinde de, seçilen karar ağacı algoritması, eğitim verisinden en uygun modeli oluşturmayı hedeflemektedir. Sonrasında test verisi ile oluşturulan modelin geçerliliği sınamakta ve eğer model onaylanırsa tahminleme yapmak için kullanılmaktadır.

Regresyon Ağacı Yapısı ve Aşamaları

Regresyon ağacının amacı, sürekli ve kategorik bağımsız değişkenlerden yararlanarak sürekli bağımlı değişkeni (hedef değişkeni) tahmin etmektir.

Regresyon ağaçlarının temelleri 1963 yılında Morgan ve Sonquist tarafından AID (Automatic Interaction Detection) algoritmasının geliştirilmesiyle atılmıştır. 1984 yılında Breiman ve diğerleri tarafından en popüler versiyon olan SRA (CART - Classification and Regression Trees) algoritması geliştirilmiştir (Tutz, 2012). Literatürde GUIDE, M5, SUPPORT, SECRET, MART, SMOTI, MAUVE, BART, SERT gibi farklı algoritmalar da bulunmaktadır (Yang, Liu, Tsoka, Papageorgiou, 2017).

Regresyon ağacı modelleri oluşturma ve kullanma süreçleri, üç temel algoritmik alt görev içermektedir (Parziale ve ark., 2016, p. 193):

- i. Regresyon ağacı büyütme
- ii. Regresyon ağacı budama
- iii. Regresyon ağacı tahmin etme

SRA Algoritması İle Regresyon Ağacı

SRA (Sınıflandırma ve Regresyon Ağacı) algoritması hem sınıflandırma hem de regresyon ağacı oluşturmak için kullanılan, tekrarlanan ikili ayırmaya göre tahmin yapan, parametrik olmayan (non-parametrik) ve doğrusal olmayan (non-linear) bir karar ağacı algoritmasıdır. Hedef değişken kategorik ise oluşturulan ağaç bir sınıflandırma ağacı ((SA) (Classification Tree, CT)), hedef değişken sürekli ise oluşturulan ağaç bir regresyon ağacı ((RA) (Regression Tree, RT)) adını almaktadır.

SRA, regresyon analizindeki varsayımların sağlanmadığı durumlar için regresyon analizinin bir alternatifidir. Ayrıca SRA, veri setinin karmaşık bir yapıya sahip olduğu durumlarda bile bağımlı değişkeni etkileyen bağımsız değişkenlerin belirlenmesi ve bu değişkenlerin modeldeki önemlerini göstererek birbirleri arasındaki ilişkilerin anlaşılabilir bir görsellikte sunmasından dolayı da regresyon analizinin alternatifi olarak kullanılmaktadır (Ceyhan, 2014).

SRA'nın en önemli avantajlarından biri de eksik veriler olduğunda dahi tamamen otomatik ve etkili bir mekanizma ile çalışabilmesidir (Kuzey, 2012).

Bir regresyon ağacı oluşturmak için, SRA algoritmasının süreci aşağıdaki gibi özetlenebilir (Yohannes ve Webb, 1999; Sumathi ve Paneerselvam, 2010):

- 1- SRA, kök düğümden başlayarak bağımsız değişkenlerin her birinde olası tüm ayrılmaları gerçekleştirir, her ayrılma önceden tanımlanmış düğüm safsızlık ölçütü (node impurity measure) uygular.
- 2- Elde edilen safsızlıktaki azalmayı belirler.
- 3- SRA daha sonra, ayrılma uyum kriterlerini (goodness-of-split criteria) uygulayarak en iyi ayrılmayı gerçekleştirir ve veri setini sağ-sol çocuk düğümlere ayırır.
- 4- SRA özyinelemeli olduğu için, terminal olmayan her bir düğüm için 1'den 3'e kadar olan adımları tekrarlar, mümkün olan en büyük ağacı üretir.
- 5- Son olarak SRA, elde edilen ağaca budama algoritmasını uygular.

SRA ile Regresyon Ağacı Büyütme

Regresyon ağacını büyütmek için, her adımda girdi değişkenlerinden birisi örnekleri ayırmak için seçilmektedir. Seçilen değişken süresince ayrılma noktasına nitelik değer testi (attribute value test) uygulanmakta ve iç düğümün sonraki düğümlere bölünmesi için en iyi ayrılma noktası belirlenmektedir (Kim ve Hong, 2017). SRA, regresyon ağaçlarının oluşturulmasında ayrılmışlemleri için en küçük kareler sapması (least squares deviation) veya en küçük mutlak sapma (least absolute deviation) ölçülerini kullanmaktadır (Kuzey, 2012).

Ağacı büyütürken amaç; tahmini çıktılar ile gerçek çıktılar arasında daha küçük hatalar elde etmek için girdi alanını bölmektir. Genel olarak tahmini çıktılar, bir terminal düğümünden alınan eğitim örneklerinin gerçek çıktılarının ortalaması kullanılarak aşağıdaki şekilde saptanmaktadır (Kim ve Hong, 2017):

$$\hat{y}_i = \frac{\sum_{j \in t_i} y_j}{|t_i|}$$

t_i : i yaprak düğümü

$|t_i|$: i yaprak düğümündeki örnek sayısı

Ayrılma kriteri en küçük kareler sapması safsızlık ölçüsüne dayanır.

$$I(t_i) = \sum_{j \in t_i} (y_j - \hat{y}_i)^2$$

$I(t_i)$ i düğümündeki safsızlık ölçüsü

En küçük kareler sapması kullanarak ayrılma kriteri aşağıdaki gibi hesaplanır (Kim ve Hong, 2017):

$$\Delta I = I(t_p) - P_l I(t_l) - P_r I(t_r)$$

t_p ebeveyn düğüm ve t_l ile t_r , t_p 'nin iki çocuk düğümünü, P_l ve P_r ise sırasıyla sağ ve sol çocuk düğümlere atanan örneklerin oranlarıdır. Ayrılma noktası ΔI maksimuma çıkarmak için belirlenir.

Nümerik ya da ordinal değişken kullanarak ayrılma kuralı üretilirse ve çocuk düğüm sayısı iki ise, ebeveyn düğümdeki örnekler $\{x: x_k > s\}$ ve $\{x: x_k \leq s\}$ olarak iki alt kümeye ayrılır. Burada x_k seçilen değişkeni, s ise ayrılma noktasını ifade etmektedir. Nominal tahminleyiciler için de aynı yaklaşım kullanılır fakat q kategorili sırasız kategorik tahminleyiciler için $2q - 1$ mümkün ayırım bulunmaktadır (Kim ve Hong, 2017, p. 40).

Ardışık bir sıra izleyen süreç, durdurma kuralı uygulanmamışsa, homojenlik kriterleri gerçekleşip maksimum ağaç olana kadar ya da bazı durdurma kuralları uygulanana kadar devam etmektedir (Ceyhan, 2014).

SRA ile Regresyon Ağacı Budama

Eğitim verisi ile öğrenme yapılırken, ağaç yapısı aşırı büyük bir şekilde oluşturulursa, ağacın her bir yaprağı tek bir eğitim durumunda olan, sıfır hataya sahip bir ağaç modeli oluşturulur. Özellikle küçük örnekler ile çalışıldığında model, daha önce karşılaşılabilen durumlara karşı neredeyse hiç genelleme yapamamakta ve dolayısıyla tahminler doğru olmamaktadır. Bu durum, eğitim verisine aşırı uyum (overfitting) olarak bilinir. Bu problemi minimize

etmek için ağacın büyütmesini durdurmada kullanılan ya ön-budama (pre-pruning) olarak bilinen budama kuralları ya da ağacı büyütüldükten sonra yapılan son-budama (post-pruning) yaklaşımı uygulanmaktadır (Soman, Diwakar ve Ajay, 2009).

SRA algoritmasında karmaşıklığı hesaba katmak için popüler bir çözüm, karmaşıklık için açık bir ceza içeren, maliyet karmaşıklığı (cost complexity) olarak adlandırılan bir işlev tanımlamak olmuştur (Berk, 2016). Minimize edilmeye çalışılan hata karmaşıklığı ölçüsü (the error-complexity measure) T ağaç için sınıflandırma hatasının toplam maliyeti ve karmaşıklık için ceza olmak üzere iki kısımdan oluşmaktadır (Sutton, 2005):

$$R_{\alpha}(T) = R(T) + \alpha|T|$$

$R(T)$: T ağaç için sınıflandırma hatasının toplam maliyeti

$|T|$: terminal düğümlerin sayısı

α : her bir terminal düğüme uygulanan ceza değeri

α değeri sıfıra eşit veya sıfırdan büyük bir değerdir. Eğer $\alpha = 0$ ise, ceza değeri yoktur, maliyet karmaşıklığı maksimum seviyededir ve doymuş bir ağaçtır. Eğer α değeri büyütülürse, $R(T)$ değerini azaltan ağacın altında kalan ayrımlar kesileceği için maliyet karmaşıklığı azalacaktır (Kuzey, 2012).

Budama hakkındaki yeni çalışmalarda α , cp ile yer değiştirmektedir (Berk, 2016).

$$R_{cp}(T) \equiv R(T) + cp|T|R(T_1)$$

T_1 : ayrılmamış bir ağaç

$|T|$: bir ağaç için ayrılmaların sayısı

R: ağacın riski

Bir T ağacı için, K terminal düğümündeki genel risk ise aşağıdaki gibidir (Berk, 2016):

$$R(T) = \sum_{j=1}^K P(A_j) R(A_j)$$

Bu değer, her düğümlle ilişkili riskin terminal düğümler üzerinden toplamıdır.

Cp değeri 0 ile 1 arasındadır. Cp=0 olduğunda, doymuş bir ağaç varken, cp=1 olduğunda ayrılma yoktur.

Bağımsız test verisi veya çapraz doğrulama (cross-validation) kullanılarak farklı aday ağaçları arasından optimum büyüklükte ağaç seçilmektedir (Cho ve Kurup, 2011). Eğer veri

seti yeteri kadar büyük değilse, hesaplama karmaşıklığına rağmen çapraz doğrulama yönteminin kullanılması önerilmektedir (Maimon ve Rokach, 2005).

SRA ile Regresyon Ağacı Tahmin Etme

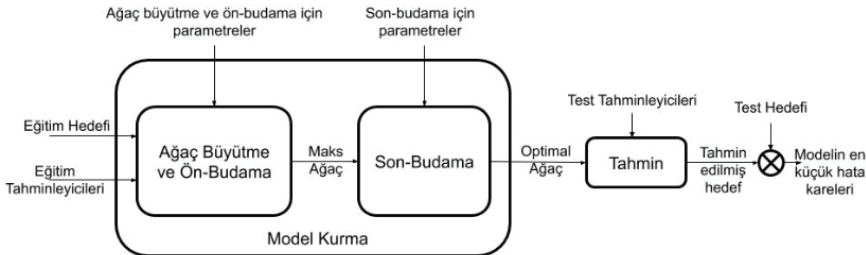
Optimal ağaç seçildikten sonra SRA, her bir terminal düğüm için özet istatistikler hesaplamaktadır. Eğer ayırma kuralı olarak en küçük kareler sapması seçilmiş ise SRA, bağımlı değişkenin ortalamasını ve standart sapmasını hesaplamaktadır. Terminal düğümün ortalaması, bu terminal düğümdeki durumlar için bağımlı değişkenin tahmin edilen değeri olmaktadır. Eğer en küçük mutlak sapma seçilmişse, SRA bağımlı değişkenin medyanını ve mutlak ortalama sapmalarının ortalamasını üretmektedir. Terminal düğüm için, medyan bağımlı değişkenin tahmin edilen değeri olmaktadır (Yohannes ve Webb, 1999).

Uygulama: Küresel İnovasyon Endeksleri İle Tahmin Çalışması

Uygulama için, ilk aşamada SRA algoritması ile optimum regresyon ağacı elde edilmesi, sonra doğrusal regresyon analizi çalışması yapılması ve son aşamada optimum regresyon ağacı ile doğrusal regresyon analizinin karşılaştırılması hedeflenmiştir.

SRA Algoritması İle Regresyon Ağacı

Uygulama aşamalarında SRA algoritması kullanılarak regresyon ağacını oluşturma ve kullanma süreçleri için Şekil 4'teki akış geliştirilerek uygulama bu akış planı doğrultusunda gerçekleştirilmiştir. Uygulamada ilk amaç AYHOE göstergelerini tahminleyici olarak kullanarak hedef değişken KİE'ni tahminlemektir. Diğer yandan, bu tahmin yapılırken en iyi ayrılmayı sağlayan AYHOE göstergelerinin belirlenmesi amaçlanmaktadır. Bu iki amacı bir arada sağlayacak en uygun modelin, SRA analizi ile oluşturulabileceği belirlenmiştir.



Şekil 4. SRA ile Regresyon Ağacının Blok Diyagramı

Analizin uygulanması için R programlama dilinden yararlanılmıştır. Veri seti 2016 yılına ait; AYHOE göstergelerinden oluşan tahminleyiciler ile hedef değişken olan KİE'den oluşturulacaktır. Veri ön işleme sürecinde R dilinde; sadece 2016 yılına ait olan ilgili verilerin seçilmesi, AYHOE göstergelerinin KİE ile eşleşmesini sağlamak amacıyla transpoze işleminin uygulanması, AYHOE gösterge verilerinde ve KİE verisinde farklı şekilde yazılmış ancak aynı ülkeye ait olan verilerin kullanılabilmesi için ülke isimlerinin eşleştirilmesinin sağlanması, AYHOE göstergelerine ait veride olan ancak KİE verisinde olmayan 26 ülkenin ve KİE verisinde olan ancak AYHOE göstergelerine ait veride bulunmayan 3 ülkenin belirlenerek kapsam dışında tutulması, AYHOE gösterge verilerinin ve KİE verisinin ülke isimlerine göre birleştirilmesi ve göstergeleri tamamen boş verilerden oluşan ülkelerin kapsam dışında tutulması gibi çeşitli işlemler yapılmıştır. Sonuçta 123 ülkenin; AYHOE gösterge verilerine ait 53 tahminleyici değişken ve 1 hedef değişken (KİE) olmak üzere 54 değişkenden oluşan bir veri seti elde edilmiştir.

Modelin öğrenme yapabilmesi için; veri setinin 0,60'ı eğitim kümesi olarak kullanılmış ve geriye kalan 0,40'ı ise test verisi olarak ayrılmıştır.

SRA algoritması ile maksimum regresyon ağacını büyütme için R programında "rpart" kütüphanesi kullanılmıştır. İlgili rpart kütüphanesi indirildikten sonra, ağacı büyütme için gerekli argüman değerleri rpart fonksiyonuna tanımlanmıştır. Bu amaçla çapraz doğrulama sayısı olan "xval" değeri 10, düğümde bulunması gereken minimum gözlem sayısı değeri olan "minsplit" değeri 5, herhangi bir terminal düğümde bulunması gereken minimum gözlem sayısı değeri olan "minbucket" değeri 5 ve ön-budama yapılması için karmaşıklık parameter değeri olan "cp" değeri ise 0,001 olarak belirlenmiştir. Cp değeri belirlenirken ağacın çok kompleks olmamasına ancak ayrılmaların da optimum düzeyde belirlenmesine olanak sağlayacak bir değer olmasına özen gösterilmiştir.

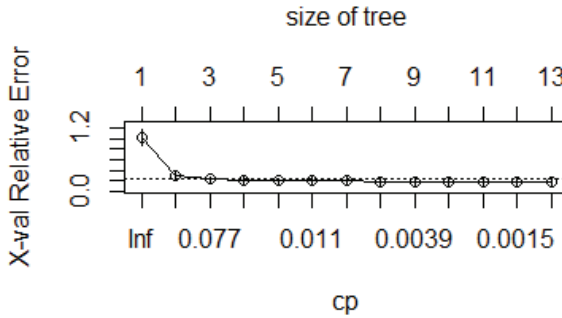
Belirtilen argümanlarla büyütülen ağaçta, hedef değişken olan KİE tahmininde kullanılan en büyük ağaç için ayrılmayı sağlayan 12 iç düğüm ve 13 terminal düğümden oluşan Şekil 5'teki yapı elde edilmiştir.

Belirlenen argüman değerlerine göre oluşturulan en büyük ağaçtan, optimal boyuttaki ağacı bulmak için de son-budama uygulaması yapılacaktır. Son-budama işleminin yapılması için elde edilen maksimum ağacın en küçük çapraz doğrulama hata değerine sahip cp değerinin seçilmesi gerekmektedir.

Tablo 1 ve Şekil 6'da görüldüğü gibi 0,00312 cp değeri ile küçük çapraz doğrulama hata değeri elde edilmiştir.

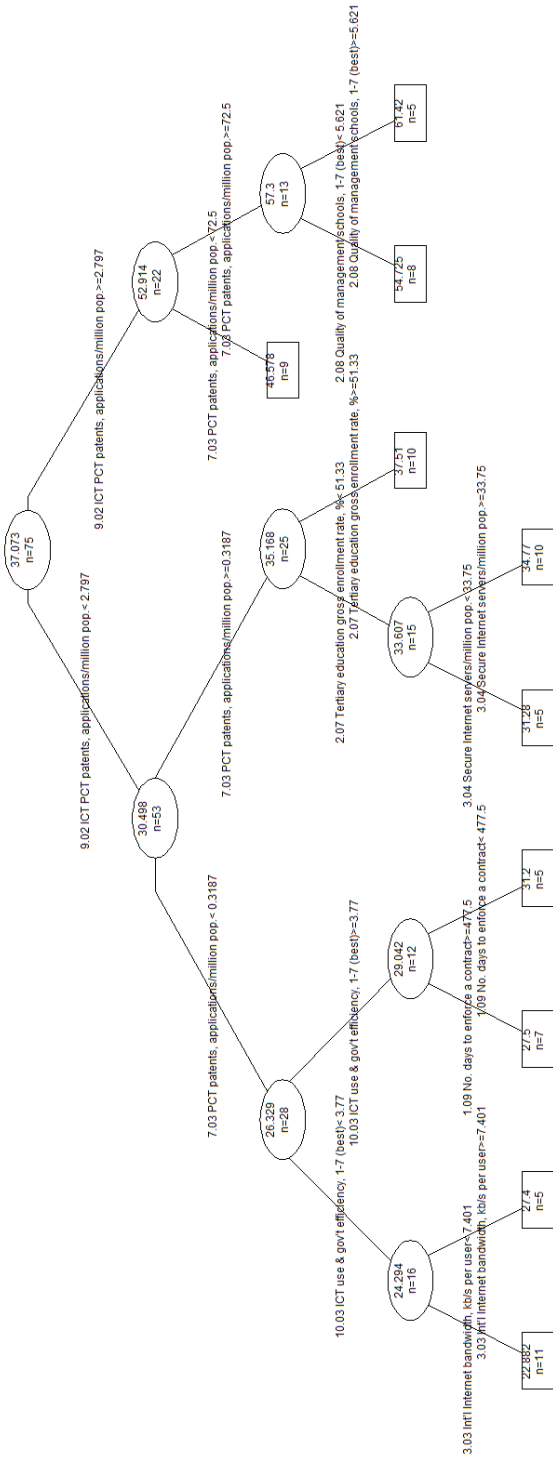
Tablo 1
Çapraz Doğrulama Hataları

	CP	Nsplit	gör.hata	xhata	xssapma
1	0,75311	0	1	1,01565	0,14136
2	0,09949	1	0,24689	0,30702	0,04912
3	0,05895	2	0,14740	0,23740	0,04296
4	0,01490	3	0,08845	0,21487	0,04949
5	0,01330	4	0,07355	0,20895	0,04800
6	0,00881	5	0,06025	0,21170	0,04896
7	0,00677	6	0,05144	0,20485	0,05855
8	0,00391	7	0,04467	0,19666	0,05793
9	0,00385	8	0,04076	0,19687	0,05791
10	0,00312	9	0,03691	0,19478	0,05781
11	0,00160	10	0,03379	0,19623	0,05812
12	0,00132	11	0,03219	0,19530	0,05815
-13	0,00100	12	0,03087	0,19723	0,05826



Şekil 6. Çapraz Doğrulama Hataları

0,00312 cp değeri ile Şekil 7'deki optimal ağaç elde edilmiş olup, optimal ağaçta ayrılma-ya sağlayan 9 iç düğüm ve 10 terminal düğüm bulunmaktadır.



Şekil 7. Optimal Ağaç (cp: 0,00312)

Elde edilen optimal ağaç ile test veri kümesi kullanarak KİE değerleri tahmin edilmiştir. Tahmin edilen KİE değerleri ile gerçek KİE değerlerini kıyaslamak için hata kareleri ortalaması hesaplanmış ve bu değer 15,927 olarak bulunmuştur.

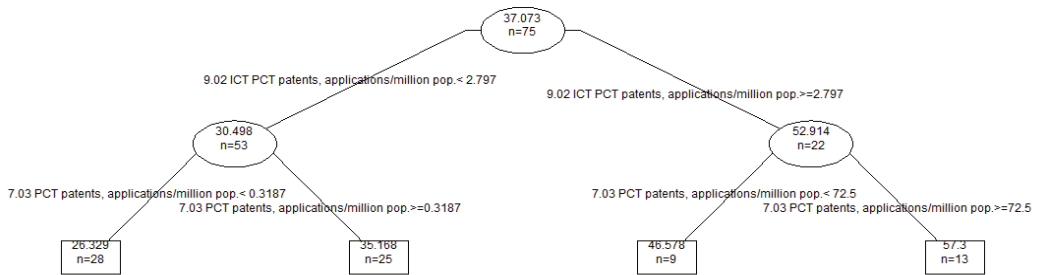
En uygun modelin oluşturulması amacıyla, Tablo 2’de yer alan daha düşük hata kareleri ortalamasının olup olmadığını araştırmak için farklı eğitim küme yüzdeleri ve xval değerleri için (diğer argümanlar sabit tutularak) model denemeleri yapılmıştır.

Tablo 2

Farklı Eğitim Yüzdeleri ve XVAL Değerleri İçin Kurulan Modellerin Hata Kareleri Ortalaması

Eğitim/ XVAL	5	10	15	20	25
0,6	26,345	15,927	*15,550	19,111	15,883
0,7	23,496	23,496	25,604	22,787	22,780
0,8	24,985	24,985	25,215	26,884	26,426

Yapılan denemelerde en düşük hata kareleri ortalamasını veren 0,60 oranındaki eğitim kümesi yüzdesi ve 15 çapraz doğrulama sayısı ile maksimum ağacın büyütülmesine karar verilmiştir. Bu maksimum ağacın en küçük çapraz doğrulama hata değerine sahip cp değeri (0,0149) ile elde edilen optimal ağaç ise Şekil 8’de gösterilmiş olup, tahmin yapmak için bu model kullanılacaktır.



Şekil 8. Optimal Ağaç (cp: 0,0149)

Şekil 8’deki optimal ağaca göre KİE tahmin etmek için kök düğüm “milyon nüfus başına Bilgi İletişim Teknolojileri (BİT) Patent İşbirliği Anlaşması (PİA) patent başvuruları (ICT PCT patent applications per million population)” ve terminal düğüm “milyon kişi başına düşen Patent İşbirliği Anlaşması (PİA) patent başvuruları (PCT patent applications per million population)” olarak belirlenmiştir.

Doğrusal Regresyon Analizi

123 ülkenin AYHOE gösterge değerleri olan 53 bağımsız ve KİE olan 1 bağımlı değişkenden oluşan veri setinde, 13 bağımsız değişken için eksik gözlemler olduğu belirlenmiştir

ve bu değerler değişken ortalamaları ile tamamlanmıştır. Araştırmanın veri setinde satır/sütun sayısının matris işlemleri için regresyon analizi yapılmasına uygun olmaması nedeniyle, AYHOE'ne ait 53 bağımsız değişken, ait oldukları alt endeksler bazında toplanarak yeni değişkenler tanımlanmıştır. Böylece bağımsız değişken sayısı 10'a indirgenmiştir.

10 bağımsız ve 1 bağımlı değişkenden oluşan veri setine ait korelasyon matrisi incelendiğinde, 10 bağımsız değişken arasında oldukça yüksek ve anlamlı korelasyonlar olduğu görülmüş, yani çoklu doğrusal bağlantı problemi ile karşılaşmıştır. Çoklu doğrusal bağlantı probleminde çözüm üretebilmek ve daha yorumlanabilir bir regresyon modeli elde etmek için, 10 bağımsız değişken ile Temel Bileşenler Analizi (TBA - Principal Component Analysis (PCA)) uygulaması yapılmıştır. Kaiser-Meyer-Olkin (KMO) testi ($0,783 > 0,5$) sonucuna göre örneklemin yeterli olduğu saptanmıştır. Bartlett test sonucu da anlamlı bulunarak ($\text{sig.} = ,000$) korelasyon matrisinin birim matrisin anlamlı bir şekilde farklı olduğu sonucuna ulaşılmıştır. Bu iki testin anlamlı bulunmasıyla TBA'nın bu veri seti için uygulanabilir olduğu kabul edilmiştir. Ayrıca anti-image matrisi kontrol edilmiş ve tüm anti-image korelasyonları da anlamlı bulunmuştur. Dirsek yöntemi (elbow method - scree plot) göre de yatay şekil alan noktanın 2 faktör olduğu kabul edilmiş ve varimax rotasyonu ile elde edilen toplam açıklayıcılık yüzdesinin 2 faktör için %63,747 olduğu saptanmıştır. Rotasyon ile elde edilen bileşen matrisi (rotated component matrix) Şekil 9'da verilmiş olup, incelendiğinde; 10 değişkenden 7'sinin (sosyal etkiler, kamu yönetiminin kullanımı, ekonomik etkiler, bireysel kullanım, işletmelerin kullanımı, altyapı) 1. faktörde, 3'ünün ise (iş ve inovasyon çevresi, erişilebilirlik, beceriler) 2. faktörde olduğu görülmektedir. Elde edilen faktörler incelenerek, 1. faktöre "bireysel ve çevresel etkiler", 2. faktöre ise "inovasyonel ve gelişimsel etkiler" adı verilmiştir.

Rotated Component Matrix^a

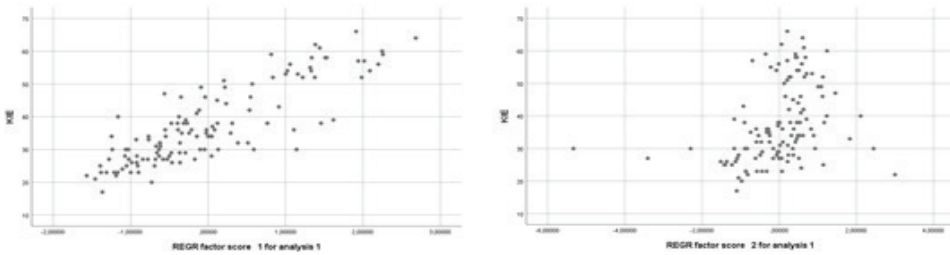
	Component	
	1	2
Sosyal_Etkiler	,920	,090
Kamu_Yonetiminin_Kullanimi	,844	-,260
Ekonomik_Etkiler	,795	,279
Bireysel_Kullanım	,788	,471
İşletmelerin_Kullanimi	,760	,228
Altyapı	,682	,223
Siyasi_ve_Duzenleyici_Cevre	-,545	,187
İş_ve_Inovasyon_Cevre	,042	,759
Erisilebilirlik	,022	-,675
Beceriler	,544	,617

Şekil 9. Birleştirilmiş Bileşen Matrisi

Doğrusal regresyon analizi uygulaması için bireysel ve çevresel etkiler olarak tanımlanan faktör 1 puanları ile inovasyonel ve gelişimsel etkiler olarak tanımlanan faktör 2 puanları bağımsız değişkenler, KİE ise bağımlı değişken olarak belirlenmiştir. Regresyon modelinin kurulmasından önce ise doğrusal regresyon analizine ilişkin çoklu doğrusal bağlantı probleminin olmaması, doğrusallık, hataların eşit varyanslılığı, hataların bağımsızlığı ve hataların normal dağılması varsayımlarının geçerliliği araştırılmıştır.

Faktör analizi yapılarak çoklu doğrusal bağlantı probleminin (multicollinearity) ortadan kalkabileceği bilinmekle birlikte (Fvero ve Belfiore, 2019), Stepwise yöntemi ile regresyon modeli kurulmuş ve daha düşük hata kareleri ortalaması veren modelde iki bağımsız değişken de kalmıştır.

Doğrusallık varsayımının araştırılması için, bağımlı değişken ile bağımsız değişkenler arasında Şekil 10'daki serpilme grafikleri çizilmiş ve doğrusal ilişkiler olduğu kabul edilmiştir. Şekil 10 (a)'da KİE ile bireysel ve çevresel etkiler arasında, Şekil 10 (b)'de KİE ile inovasyonel ve gelişimsel etkiler arasındaki serpilme grafikleri görülmektedir. Ayrıca bağımlı değişken ile bağımsız değişkenler arasında korelasyon katsayıları hesaplanmış ve anlamlı (sig.=0,000) bulunmuştur.

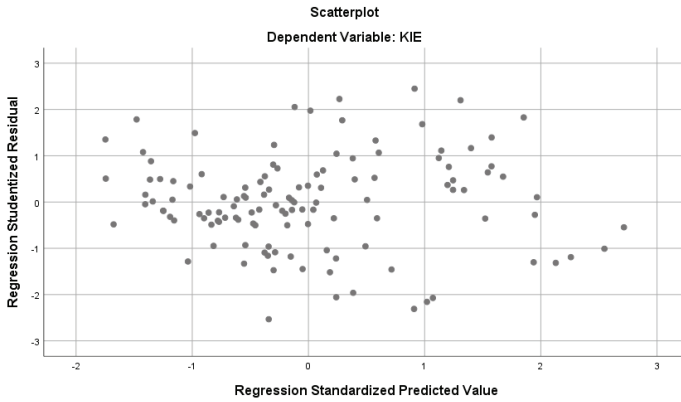


10 (a)

10 (b)

Şekil 10. Doğrusallık İçin Serpilme Grafikleri

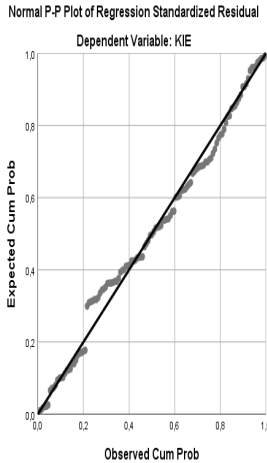
Hataların eşit varyanslılığının (homoscedasticity) kontrolü için standardize tahmini değerleri (ZPED) ile Student (t-dağılım) dağılmış hatalar (SRESID) arasında Şekil 11'deki serpilme grafiği çizilmiş ve bir örüntü olmadığı saptandığı için bu varsayımın da geçerliliği sağlanmıştır.



Şekil 11. Eşit Varyanslılık İçin Serpilme Grafiği

Hatalar arasında ilişki olmaması, bir diğer deyişle hataların bağımsızlığı yani otokorelasyon olmaması varsayımının araştırılması için Durbin-Watson testi yapılmış ve sonuç 1,801 bulunmuştur. %5 anlamlılık seviyesinde Durbin-Watson tablosunda bağımsız örnek sayısı (k) 2 için, örnek birim sayıları 100 ve 150 kabul edilerek alt ve üst sınır değerleri kontrol edilmiş ve elde edilen 1,801 değerinin otokorelasyon olmayan bölgede olduğu saptanmıştır. Dolayısıyla otokorelasyon olmadığı varsayımı kabul edilmiştir.

Hataların normalliği varsayımının araştırılması için ise Şekil 12’de görülen standardize edilmiş hataların normal olasılık grafiği (normal probability plot - NPP) çizilmiş ve elde edilen grafik ile hataların normal dağıldığı kabul edilmiştir.



Şekil 12. Normallik İçin P-P Grafiği

Regresyon modelinin geçerliliği için gerekli tüm varsayımlar sınanmış ve kabul edilmiştir. Varsayımların kabulünden sonra regresyon modeli kurulmuş ve modelin denklemi $KİE=37,350 + 9,991$ Bireysel ve çevresel etkiler + $3,992$ İnovasyonel ve gelişimsel etkiler olarak belirlenmiştir. Model anlamlı ($sig.=0,000$) olup, $R^2=0,833$ olarak bulunmuştur. Bireysel ve çevresel etkiler bağımsız değişkenine ait kısmi korelasyon katsayısı $0,901$ iken, inovasyonel ve gelişimsel etkiler değişkenine ait kısmi korelasyon katsayısı ise $0,638$ 'dir.

Tartışma ve Sonuç

KİE değerlerini, AYHOE aracılığı ile SRA algoritması kullanarak tahminlemeyi amaçlayan uygulamalı bölümde, nihai olarak elde edilen optimal ağaca dayanarak, tahminleyici olarak önerilebilecek değişkenler belirlenmiştir. KİE tahmin etmek için en etkili olan iki tahminleyicinin “milyon nüfus başına Bilgi İletişim Teknolojileri (BİT) Patent İşbirliği Anlaşması (PİA) patent başvuruları” ve “milyon kişi başına düşen Patent İşbirliği Anlaşması (PİA) patent başvuruları” göstergeleri olduğu görülmektedir. Kök düğümü oluşturan “milyon nüfus başına BİT PİA patent başvuruları” tahminleyicisi, AYHOE’yi oluşturan “Etki Alt Endeksi” içinde bulunan 9. boyut olan “ekonomik etki” göstergelerinden biridir. Diğer anlamlı tahminleyici olan “milyon kişi başına düşen PİA patent başvuruları” ise AYHOE’yi oluşturan “Kullanım Alt Endeksi” içinde yer alan 7. boyut olan “işletmelerin kullanımı” göstergelerinden biridir.

SRA regresyon ağacı algoritması ile geliştirilen modelin bulgularına dayanarak ulaşılan sonuçlar aşağıdaki gibi özetlenebilir. Modelde KİE’yi tahmin ederken ayrılmayı en iyi sağlayan değişken “milyon nüfus başına BİT PİA patent” başvuruları değişkenidir. Optimal ağaç modeline göre 4 tane temel kural oluşturulabilmektedir:

KİE’yi tahmin ederken ayrılmayı en iyi sağlayan değişken “milyon nüfus başına BİT PİA patent” başvuruları değişkenidir. Optimal ağaç modeline göre 4 tane temel kural oluşturulabilmektedir:

i- Eğer; milyon nüfus başına BİT PİA patent başvuruları $< 2,797$ ise ve milyon kişi başına düşen PİA patent başvuruları $< 0,319$ ise $KİE = 26,329$.

ii- Eğer; milyon nüfus başına BİT PİA patent başvuruları $< 2,797$ ise ve milyon kişi başına düşen PİA patent başvuruları $\geq 0,319$ ise $KİE = 35,168$.

iii- Eğer; milyon nüfus başına BİT PİA patent başvuruları $\geq 2,797$ ise ve milyon kişi başına düşen PİA patent başvuruları $< 72,469$ ise $KİE = 45,578$.

iv- Eğer; milyon nüfus başına BİT PİA patent başvuruları $\geq 2,797$ ise ve milyon kişi başına düşen PİA patent başvuruları $\geq 72,469$ ise $KİE = 57,300$.

Oluşturulan optimum ağaç modeli kullanılarak 123 ülke için tahmin edilen KİE değerleri ve gerçek KİE değerleri (2016 yılı için) EK-1’de bulunmaktadır. Göz ile incelemede farklar küçük görünse de bir istatistikî metrik ile doğrulamak için korelasyon analizi yapılması uygun görülmüştür. KİE’nin tahmin edilen ve gerçek değerler arasında hesaplanan Pearson korelasyon katsayısı 0,95 (alfa= 0.01) bulunmuş olup son derece yüksek ve anlamlıdır. Bu iki AYHOE göstergesinin etkin olduğu model kullanarak tahmin edilecek KİE değerleri gerçek değerlere son derece yakın olmuştur. Bu çalışmada ulaşılan, araştırma bulgularına dayanarak “Bu iki göstergenin KİE değerlerini tahminlemede kullanılmasının çok uygun olacağı” şeklindeki önerimizi güçlü kılmaktadır. Diğer yandan kullanılan algoritmanın ve elde edilen optimal ağacın metriklerinin de son derece iyi ve geçerli bulunmuş olması, uygulamada ulaşılan kavramsal anlamlılığın güvenilirliğini artırıcı niteliktedir.

Doğrusal regresyon modeli uygulamasında ise, veri setine 53 değişken ayrı ayrı dahil edilememiş, bağımsız değişkenler faktör analizi uygulamasından elde edilen iki faktör ile regresyon analizi gerçekleştirilmiştir. 7 değişkenden oluşan faktör 1’in (bireysel ve çevresel etkiler) kısmi korelasyon katsayısı (0,901) faktör 2’nin (inovasyonel ve gelişimsel etkiler) kısmi korelasyon katsayısından (0,638) çok daha yüksektir. Faktör 1’in KİE üzerinde, faktör 2’ye göre daha fazla etkisi olduğu açıkça görülmektedir.

Doğrusal regresyon analizi elde edilen sonuç ile SRA algoritması ile edilen optimum ağaç karşılaştırıldığında, optimum ağaçta yer alan kök düğüm (milyon nüfus başına BİT PİA patent başvuruları) ve terminal düğümün (milyon kişi başına düşen PİA patent başvuruları) her ikisinin de doğrusal regresyonda KİE üzerinde daha etkili olduğu belirlenen faktör 1’de yer aldığı görülmektedir. Ancak doğrusal regresyonda KİE üzerinde daha etkili olduğu belirlenen “bireysel ve çevresel etkiler” adlı faktörün, SRA algoritması ile elde edilen optimum ağaçta daha derinlemesine bir bilgi edinecek şekilde hangi göstergeler (milyon nüfus başına BİT PİA patent başvuruları ve milyon kişi başına düşen PİA patent başvuruları) ile iyi bir tahmin vereceği de belirlenebilmiştir. SRA algoritması ile ayrıca görsel olarak da yorumlanması kolay bir sonuç elde edilmiştir. Bu açılarından SRA algoritması ile tahminlemenin, doğrusal regresyon analizine göre açıklama ve yorumlama açısından daha üstün yönleri olduğunu söylemek mümkündür. Aynı veri seti için, faktör analizi sonrası kullanılabilen doğrusal regresyon analizi, bazı değişkenlerin bireysel bazda katkılarını görebilmeyi kısıtlamaktadır. Ayrıca doğrusal regresyon analizinin varsayımların test edilmesi gibi ek analizler gerektirmesi, SRA algoritması lehine bir durum ortaya koymaktadır.

En etkili on veri madenciliği algoritması arasında gösterilen SRA’nın, regresyon ağacı sınıflandırması literatürde çok nadir olarak yer almaktadır. Bu çalışmanın hem algoritmanın kullanımı hem de inovasyon göstergeleri tahminleme konusundaki ampirik araştırmalar arasında ilklerden olması nedeniyle literatüre önemli bir katkı sağlayacağı düşünülmektedir.

Sonraki çalışmalarda ve yıllık raporlarda, modeldeki AYHOE göstergeleri aynı kalmak koşulu ile AYHOE veri seti kullanılarak ve önerilen modeli uygulayarak SRA algoritması ile KİE değerlerinin başarılı bir şekilde tahmin edilebileceği öngörülmektedir.

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REVIEW ARTICLE

Blockchain Technology and Its Potential Effects on Accounting: A Systematic Literature Review

Asuman Atik¹ , Göksal Selahatdin Kelten² 

Abstract

With the growth of the business world, autonomous software programs such as MRP, ERP, and SAP have been used to synchronize different units and departments since the 1960s. There have been great technological developments in the last decades, such as Blockchain, the Internet of Things, artificial intelligence, and machine learning. The attention of the accounting world has also been on those technological developments, especially on Blockchain Technology. Accounting academics and professionals have been trying to understand how blockchain technology can affect accounting and what kind of changes might be brought about by that technology. Therefore, the purpose of this study is to make a systematic literature review in order to foresee the potential effects of blockchain on accounting. Selected keywords were searched for on the Scopus database. The results show that most of the studies in this area focus on technical issues and the development of software applications, and a small number of studies make a connection between blockchain and accounting. Although most of the authors are very optimistic about blockchain technology and claim that this technology may change the double-entry accounting system completely and radically, some have discrete approach and express critical views.

Keywords

Blockchain, Cryptocurrency, Accounting, Auditing

Introduction

There are many important milestones in mankind's history. The invention of writing, the industrial revolution, the development of firearms, and geographical explorations are examples of these milestones. The discovery of money also has great importance because it provides a standard measurement of value and it is very difficult to make trade between parties without it. The invention of the Internet also has had a considerable impact on the development of international trade as well as the increase in usage of money in daily life. Furthermore, there have been notable developments in the field of technology in the last century. The widespread use of the Internet has brought digitalization to almost every field. Especially e-commerce

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has reached huge volumes and very large-scaled global shopping sites have appeared like Amazon, Alibaba, eBay, and Walmart. The digitalization that started with the Internet has increased the economic interaction between countries and the world is globally integrated by eliminating the borders in the economic sense.

Due to the digitalization and globalization in the world, new developments, new rules, and new problems have arisen in the areas of accounting, finance, payment systems, fund transfers, storage, and the transfer of data. Blockchain Technology (BCT) and cryptocurrency¹ are two of the most important developments over the last decade. After Nakamoto's (2008) "Bitcoin: A peer-to-peer electronic cash system" article, BCT and cryptocurrencies gained prevalence. Nakamoto (2008) states that the existence of the trusted party in the electronic payment systems is increasing the cost of money transfers from one to another. Therefore, there is a need for a payment system that enables individuals to transfer money between two parties without a third party. To meet this need, an electronic system was developed, which is "peer-to-peer" and based on cryptology, which allows transacting directly with each other. Blockchain has been embedded in a lot of areas, particularly, the digital platforms based on BCT have been developed and submitted to the banking sector and financial industries. "Stella" is a joint project of the European Central Bank and the Bank of Japan. They have been working on assessing the applicability of Distributed Ledger Technology (DLT) solutions in financial market infrastructures since 2016 and they report the aim of "Stella" as "*to contribute to the ongoing broader debate around the potential usability of DLT while not being geared towards replacing existing central bank services with DLT-based solutions*" (European Central Bank and Bank of Japan, 2018).

Accounting professionals and academics cannot stand unresponsive to the development of the BCT and have been searching for possible usage areas of this technology in accounting. Big accounting firms have started to develop software applications based on BCT and to promote the usage of blockchain. New debates have arisen on the accounting of cryptocurrencies and the requirement for new IFRSs, which will conform to BCT.

This study aims to make a systematic literature review to understand the potential effects of BCT on accounting and make some inferences for the future of the accounting profession. In order to increase the understandability of the research topic, blockchain and cryptocurrency concepts are explained in the following part. The research methodology of this study is explained in the third part. The fourth part summarizes the related literature, and the fifth part is the conclusion.

¹ The terms "cryptocurrency" and "virtual currency" are often used interchangeably. In this paper, we only used "cryptocurrency" to avoid confusions.

Cryptocurrency and Blockchain Technology

Human beings used to barter under primitive conditions. When life became more complex and bartering was not sufficient, it became necessary to fix a particular commodity as a “medium of exchange and a measure of value”. This intermediate commodity which is called “money” has appeared in many different forms such as cattle, iron, salt, shells, dried cod, tobacco, sugar, nails, stone, etc. in different times and places (Innes, 1913; Keynes, 1915). Historical records show that leather money was in usage in China approximately 100 B.C. and again the first money which was made from paper also emerged in China in 806 (Central Bank of the Republic of Turkey, 2018) In short, everything can be used as “money” if it has the following three attributions: “mediating to an exchange”, “being used as the unit of account” and “a storage of value” (Asmundson and Oner, 2012; Yermack, 2013).

Cryptocurrency is defined as “a digital representation of value that can be digitally traded and functions as (1) a medium of exchange; and/or (2) a unit of account; and/or (3) a store of value, but does not have legal tender status in any jurisdiction” by Financial Action Task Force in 2014. In other words, cryptocurrencies are neither issued by a central bank nor controlled by a public authority as shown in Table 1, but they represent a value and have been used as an instrument of payment since the beginning of 2009 and have been traded digitally (European Banking Authority, 2014).

Table 1
A Money Matrix

		Form of the Money	
		Physical	Digital
Legality	Regulated	Banknotes and Coins	E-Money Commercial Bank Money (Deposits)
	Unregulated	Certain Types of Local Currencies	Cryptocurrencies

Source: European Central Bank, 2012

Cryptocurrencies are generally under the control of their developers and used as “real” money within the members of a specific group. There are three types of schemes as follows: “closed schemes”, “unidirectional schemes” and “bidirectional schemes”. The closed schemes are generally used in online games. There is only one type (in/out), which flows in a unidirectional scheme. The third type of scheme allows cryptocurrencies to act just like fiat money by setting a buy and sell rate (European Central Bank, 2012). The first cryptocurrency appeared in 2009 in the name of Bitcoin. “Bitcoins are digital coins which are not issued by any government, bank, or organization, and rely on cryptographic protocols and a distributed network of users to mint, store, and transfer” (Ron and Shamir, 2013: 6). Since then, lots of cryptocurrencies have been launched in the financial markets. There are 5,903 cryptocurrencies² in the world as of June 2021, and Bitcoin has the largest market share. Countries have

2 <https://www.investing.com/crypto/currencies> (Investing.com, 26.06.2021)

different approaches on cryptocurrencies. Generally, cryptocurrencies are evaluated from tax and illegal acts perspectives. While some countries have forbidden the usage of cryptocurrencies, some others accepted them as a legal payment tool (Yıldırım, 2019).³

It is not possible to think of trading activities without recording the transactions, so ledger accounts have been used for record-keeping since ancient times. However, their shapes have evolved from tablets to papyrus, parchment to papers, and bytes over time. A new era has started in the ledger accounts with cryptocurrencies and the algorithmic software DLT has been developed in the last decade (Walport, 2015). Because DLT has been implemented in a variety of industries, it does not have a common single definition. The meaning of DLT differs according to the usage area (Mills et al., 2017). Even if the definitions of DLT are different from each other, the “*peer-to-peer network system*” and “*decentralized*” or “*distributed*” terms are fixed parts of all definitions. Another term that has the same meaning as DLT is “*blockchain*”. “*Blockchain is the ledger (book of records) of all transactions, grouped in blocks, made with a (decentralized) virtual currency scheme*” (European Central Bank, 2015). Blockchain or DLT is a kind of database which is based on a “peer-to-peer” network philosophy and it makes the records non-deletable forever (Swanson, 2015) and it is possible to keep records by many people or organizations and no one is superior or inferior to others (Kornfeld et al., 2016).

Blockchain is the combination of blocks that can include a large number of transaction data and follow each other. Each block has a hash value. The first block is called a Genesis block and because there is no block before it, its hash value is zero. Each block contains the previous block’s hash code to keep the connectivity of the blocks (Bamakan et al., 2020).

Members who want to participate in a particular blockchain use nodes (computer devices), which are connected. When one member creates a block, other nodes have the right to accept or reject it. Members should also make an agreement related to the rights of participants in the blockchain. These agreements are called “consensus algorithms”. The blockchain consensus algorithms developed till now are Proof of Work, Proof of Stake, Delegated Proof of Stake, Proof of Elapsed Time, Practical Byzantine Fault Tolerance, Delegated Byzantine Fault Tolerance, Proof of Weight, Proof of Burn, Proof of Capacity, Proof of Importance, Proof of Activity, and Directed Acyclic Graphs. They differ according to their decentralization and security levels, energy consumptions, degree of difficulty, and participation level of nodes (Bamakan et al., 2020; Yu et al., 2020).

According to accessibility and controllability by the network members, there are three categories of blockchain: (1) *a public blockchain* can be accessed, shared, and controlled by

3 The usage of crypto assets as a means of payment has been prohibited in Turkey with a regulation announced in the Official Newspaper published on 16th of April, 2021, (<https://www.resmigazete.gov.tr/eskiler/2021/04/20210416-4.htm>).

all the members, (2) in a *private blockchain*, the access can be with the permission of a third party and it is centralized to some extent, and (3) a *consortium blockchain* is governed by several institutions all of which directly participate in the consensus protocol (Ali et al., 2020; Salimitari et al., 2020).

The intermediary functions or the third parties have disappeared with the blockchain. Blockchain uses a decentralized ledger, so that, it enables each user to copy all records onto their computers. However, it is not possible in the existing system which allows only trusted parties to hold all transaction records, especially in bank accounts. Because the BCT makes the transactions immutable and reduces anonymity, government services may also adopt BCT to increase transparency and accountability (Boucher et al., 2017).

One of the concepts that cannot be separated from the blockchain, especially when we look through an accounting perspective, is the Internet of Things (IoT). “*The Internet of Things (IoT) is set to ubiquitously connect a huge number of devices (embedded with sensors and actuators) to the Internet, digitizing the physical world into computer-based data systems*” (Wang et al., 2019: 1). “*Built-in blockchain*” and “*Blockchain as a service*” are the two types of blockchain for IoT. In the first one, IoT devices are built-in, which means all IoT devices can operate as blockchain nodes and become part of a blockchain network. In the second one, the data collected by an IoT device is entered into the blockchain by a user (Wang et al., 2019).

Although most of the studies focus on the blockchain usage as a means of cryptocurrency transfer, this technology can also be used for non-financial activities, such as supply chain management, voting in elections, healthcare records management, identity management systems, access control systems, decentralized notary and tourism organizations (Boucher et al., 2017; Maesa and Mori, 2020; Rashideh, 2020).

Some researchers suggest different types of blockchains. For example, Back et al. (2014) propose “pegged sidechains”, which allow the transfer of coins between multiple blockchains and makes interoperation with each other easier. Wang and Kogan (2018) take a step further and propose a framework design for a blockchain-based transaction processing system for the implementation of blockchain for accounting and auditing fields. They assume a blockchain-based enterprise and represent its assets and resources with different tokens and different side chains. Every digital coin in the blockchain is a token. Vincent et al. (2020) design a blockchain that enables auditors to participate in the client’s blockchains and use them in audit processes. Lafourcade and Lombard-Platet (2020) go even further and test the interoperability of two blockchains.

There are also some studies mentioning the drawbacks of blockchain, such as execution and storage costs, energy consumption, global warming, and cybercrime problems. Blockchain systems are expensive and consume a huge level of electricity. Additionally, because

countries have not made laws related to bitcoin and blockchain, when there is fraud, cybercrime, terrorist financing, or any conflict between the parties, it is not clear how to solve these problems (Chang et al., 2020).

The Research Methodology of the Study

Bitcoin and blockchain, which occupy an important place in the world's agenda, are mentioned in the article of Nakamoto for the first time in 2008. There are hundreds of studies that have been carried out on Blockchain, Distributed Ledger Technology (DLT), and cryptocurrencies since 2008 in literature. Therefore, this study systematically reviews the academic studies published between 2008 and 2021.

A systematic review is a specific technique which reviews all of the existing articles related to a specific research topic and evaluates the data, analyses, and contributions of articles, and synthesizes them to report a conclusion on what is known and what is unknown about the topic (Denyer and Tranfield, 2009). It tries to find out what literature inspires the practice of and reveals what is unknown to give a lead for future studies (Grant and Booth, 2009). There are six key phases in the systematic review as follows: "mapping the field through a scoping review"; "comprehensive search"; "quality assessment"; "data extraction"; "synthesis"; and the last stage is "write up" (Jesson et al., 2011: 108).

After determining the coverage period as 2008-2021, databases and keywords were selected. In this manner, the keywords: "blockchain and accounting", "cryptocurrency and accounting", "distributed ledgers and accounting", "smart contract and accounting" and "virtual currency and accounting" were searched for on the Scopus database. The categorization of the found studies according to their disciplines is presented in Table 2.

When "blockchain and accounting" was searched, 285 different studies were found. When the search was repeated with different keywords, such as "cryptocurrency and accounting" or "virtual currency and accounting", the results included the same studies obtained with other searches. By using the "save the selected documents to list" feature of Scopus, the results of all keyword searches were integrated, and 334 different studies were listed. 108 of those 334 studies were in the "Business, Management and Accounting" discipline, and we focused more on them.

Table 2
The Disciplines of the 334 studies listed by Scopus

Subject area	# of studies
Business, Management and Accounting	108
Computer Science	192
Economics, Econometrics and Finance	52
Engineering	90
Decision Sciences	57
Social Sciences	40
Mathematics	52
Energy	32
Arts and Humanities	5
Biochemistry, Genetics and Molecular Biology	5
Materials Science	15
Multidisciplinary	3
Medicine	7
Physics and Astronomy	19
Agricultural and Biological Sciences	3
Environmental Science	11
Immunology and Microbiology	1
Chemical Engineering	1
Earth and Planetary Sciences	1
Chemistry	2
Psychology	1
Pharmacology, Toxicology and Pharmaceutics	2
Total	699

Source: Scopus

Because one study can be categorized under different disciplines, the total number of the studies from different disciplines increased to 699.

Table 3 shows the number of studies categorized under different disciplines. As mentioned before, the total number of different studies in “Business, Management and Accounting” discipline is 108, however because one study can be found with other keyword searches, the total number of the studies from different keyword searches increased to 161.

Table 3
Number of Studies Categorized according to Disciplines with Different Keyword Search

Subject area	block-chain and accounting	crypto-currency and accounting	distrib-uted ledgers and accounting	smart contract and accounting	virtual curren-cy and account-ing	To-tal
Business, Management and Accounting	92	18	25	20	6	161
Computer Science	172	19	34	43	5	273
Economics, Econometrics and Finance	37	17	11	6	5	76
Engineering	84	6	17	22	2	131
Decision Sciences	54	4	11	7	3	79
Social Sciences	32	9	5	4	2	52
Mathematics	43	7	6	19	1	76
Energy	27	2	8	7	1	45
Arts and Humanities	4	1	1	0	0	6
Biochemistry, Genetics and Molecular Biology	4	1	0	1	0	6
Materials Science	13	1	2	2	0	18
Multidisciplinary	2	3	0	0	0	5
Medicine	6	1	0	4	1	12
Physics and Astronomy	17	3	5	3	0	28
Agricultural and Biological Sciences	2	1	1	0	0	4
Environmental Science	11	0	3	0	1	15
Immunology and Microbiology	1	0	0	0	0	1
Chemical Engineering	2	0	0	0	0	2
Earth and Planetary Sciences	1	0	1	0	0	2
Chemistry	2	0	1	0	0	3
Psychology	0	1	0	0	0	1
Pharmacology, Toxicology and Pharmaceutics	1	1	1	0	0	3
Total	607	95	132	138	27	999

Source: Scopus

The following figure shows trend of studies by year. The number of studies has started to increase since 2016. However when we examine the percentages presented in Figure 2, we see that only 44% of the studies are articles published in journals and 43.7% are conference papers.

Documents by year

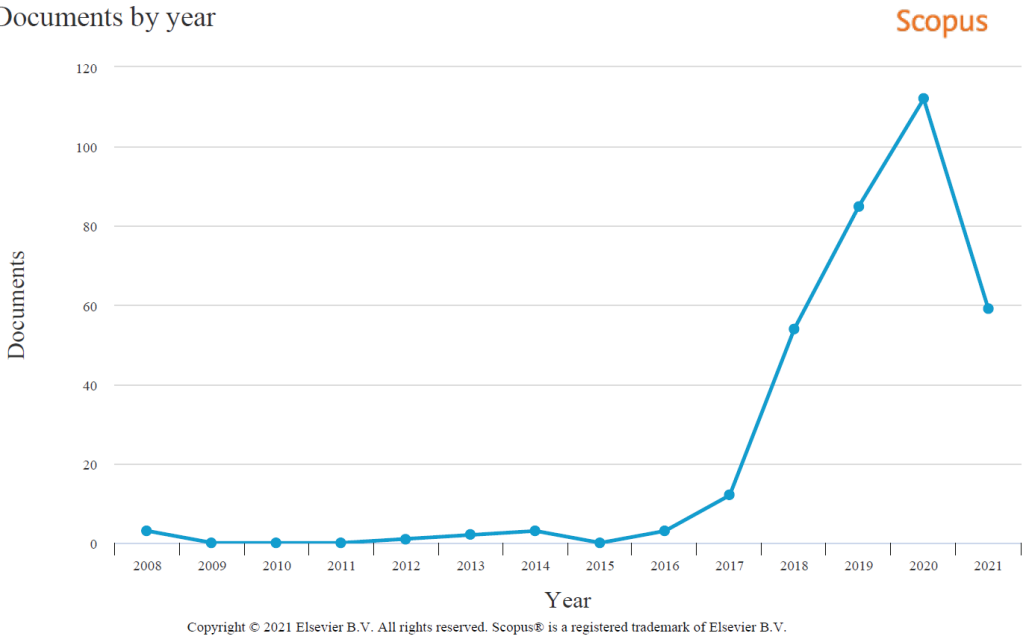


Figure 1. Search Results by the Year

Source: Scopus

Documents by type

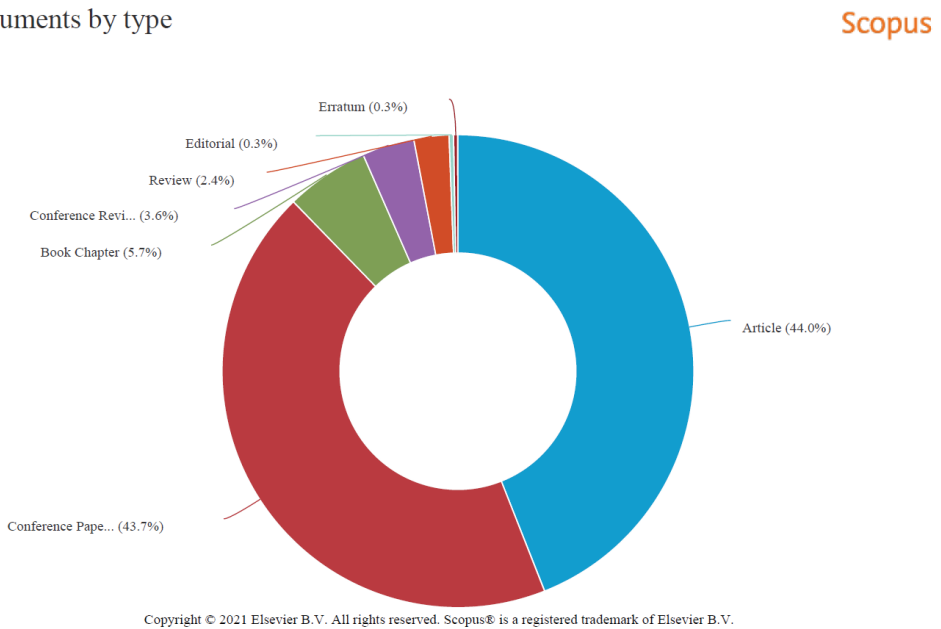


Figure 2. Search Results by Type

Source: Scopus

Literature Review

After reviewing the blockchain and accounting literature, the first finding is that most of the articles are very technical, are written in the computer science area and the articles that try to connect BCT with accounting are struggling with inferences and possibilities rather than showing clear evidence and ways of using BCT in the accounting area. The studies in that area are at a very early stage and the answer to “how will blockchain affect accounting?” is up to the developmental stages in software programs connecting blockchain and accounting.

Integration of Blockchain with Accounting Information Systems

One of the most important studies that connect BCT with accounting belongs to Dai and Vasarhelyi (2017). They propose the use of blockchain as a medium for providing real-time, reliable, verifiable, and transparent accounting information to all related parties such as managers, auditors, creditors, and stakeholders. Real-time accounting and business monitoring can be provided with the integration of physical objects such as products, inventories, and production processes with the objects that have digital capabilities and have access to the Internet. Triple entry accounting, which has been suggested to increase the reliability and verifiability of the journal entries, can be realized with BCT because there is an opportunity to keep the entries in an independent and verifiable environment. BCT also enables managers to have “*smart controls, which are computer programs that would operate on blockchain to automatically control business processes against pre-determined rules.*” Therefore, better control and assurance can be provided within a company with the third entries encoded into the blockchain (Dai and Vasarhelyi, 2017). According to Demirkan et al. (2020) and Kwilinski (2019), BCT may have a destructive effect on the double-entry accounting system, and a triple-entry accounting system may replace it. Currently, Request Network, Balanc3, Ledgerium and Pacio are examples of the accounting software programs that use a triple-entry accounting system (Cai, 2019).

Weigand et al. (2020) argue that DLT may have a major impact on the existing accounting information system shaped by internal participants, not only because of the immutability and traceability of records but also because it may provide an external consensus view. They claim that as a result of the spread of blockchain-based shared ledger technology, the focus of financial reporting will change from a business-centric to exchange-centric model, and this will greatly increase the quality and reliability of financial reporting.

Dai and Vasarhelyi (2017) try to explain the processes in accounting while using BCT with a simple purchase and sale transaction. When the purchaser records inventory and accounts payable in its ERP system (or in its regular accounting system), at the same time the transaction information is encoded to blockchain in the form of a digital token. Each account will have a corresponding blockchain account (like Bitcoin wallet) that contains an account’s unique identifier, current balance, and cryptographic keys for verification.

Bonsón and Bednárová (2019) name the blockchain environment of companies as the BCT ecosystem and divide it into two; the Company's BCT Ecosystem and Audit BCT ecosystem. In these systems, members operate as nodes. In the Company's BCT ecosystem, there are nodes for the company, suppliers, customers, banks, producers, investors, and the public administration and in the Audit BCT ecosystem, the nodes are public administration, auditors, and SEC. While creating an accounting information system in the blockchain ecosystem, the selection of nodes, the structure of the database, authorization, and verification protocols are very important aspects. After mentioning the design requirements, principles and features, Sogaard (2021) suggest governmental authorities use of BCT for the collection of value added tax receivables.

Blockchain is suggested as a management tool for supply chains by Dwivedi et al. (2020). High-value products or drugs need a more careful inquiry during the supply chain and blockchain may be a remedy for problems such as the tampering of products, delays, and fraud. They suggest using BCT with other technologies, especially with the Internet of Things, as an alternative to the ERP system. When all the supply chain activities are followed by the BCT, integrating the accounting systems with blockchain will be inevitable. Calderon and Stratopoulos (2020) show the implementation of BCT in a supply chain. They explain the whole process of initiating, validating and recording a transaction on BCT in one of the segments of Listerine.

The faithful financial information, which is "complete, neutral and free from errors" as mentioned in the Conceptual Framework of IASB, can be provided with the integration of BCT in a supply chain (McCallig et al., 2019). Bakarich et al. (2020) argue that integrating BCT into supply chain management will provide benefits in collecting true and verifiable information for sustainable reports, and so, companies wanting to adopt BCT, should seek ways to integrate BCT and also provide sustainable reporting procedures.

Based on an extensive literature review and from an organizational perspective, Tiron-Tudor et al. (2021) make a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis of adopting BCT for accounting and auditing firms. Pimentel and Boulianne (2020) suggest the co-work and collaboration of academics and practitioners to have a better adoption processes. Roszkowska (2020) and Kwilinski (2019) claim that in the near future BCT may have a big role in accounting; many jobs such as billing, documenting, treating, registering bookkeeping, budgeting, and reconciliation might be done by autonomous programs based on BCT. These developments also have some implications for accounting and finance professionals; BCT may change job definitions and responsibilities (Church et al., 2020). Consequently, the content of accounting education should also conform to those new technologies and developments (Aldredge et al., 2020; Henage, 2020; Qasim and Kharbat, 2020).

Implications to Auditing

Auditors need to collect relevant and reliable evidence to form an opinion. Auditors face many challenges while verifying whether the records are complete and accurate and evaluating the accuracy of the data gathered. The blockchain system architectures that are suggested for use by CPA firms or auditors create benefit in collecting high-quality evidence about the financial data of customers while saving their privacy. Changelog was supposed by Vincent et al. (2020) as a system architecture that will benefit CPA firms and auditors while keeping the customers' information secret.

With the increase of BCT and smart contracts, auditing and assurance services may change fundamentally and a blockchain ledger can be used as a source document by auditors in the auditing processes (Dai and Vasarhelyi, 2017). Rozario and Thomas (2019) extend the discussion of Dai and Vasarhelyi (2017) on the possible applications of blockchain and smart contracts to transform auditing and they suggest an external audit blockchain that can support smart audit procedures. Because the transactions entered into the blockchain by the acceptance of participating nodes, completeness, and accuracy checks are performed proactively, and blockchain attributes increase the integrity and reliability of the data. The information provided by IoT is also helpful in understanding the business risks of clients and the accuracy of auditors' estimates and valuations (Rozario and Thomas, 2019).

In the audit BCT ecosystem, cryptography can be used to design which node can see what information, so it can solve the privacy concerns of participants. Auditors can have continuous access to the ledgers of clients and so can make a continuous audit with BCT (Bonsón & Bednárová, 2019). McCallig et al. (2019) propose a system that will enable the use of blockchain in a supply chain for "accounts receivable" only. If the suppliers and the buyer firm have the same blockchain system, auditors may also participate in the system and can see the receivable balances of suppliers and payable accounts of the purchaser. In order to preserve confidentiality, the system will not allow suppliers to see the balances of each other.

Industry 4.0 has been accepted as the reason for changes in the auditing profession and it has created new tools and new processes for the auditing profession. Audit 4.0 includes audit activities by using the data created by artificial intelligence, smart sensors, and the Internet of Things (Dai et al., 2019).

Big Four audit companies also have a big interest in BCT. The number of projects based on BCT, cloud computing, artificial intelligence, machine learning, and IoT has been increasing rapidly and KPMG's Spark Project is one of them. It is a cloud-based real-time accounting system that integrates artificial intelligence and machine learning (Henage, 2020). Church et al. (2020) claim that cloud computing has been evolving for BCT based accounting information systems. Deloitte offered Rubix, which is a blockchain-based software program that allows users to make smart contracts. KPMG developed its digital ledger services with

Microsoft. EY works on Libra and Ops Chain for invoicing, pricing, digital contracts, and payments. EY also launched Crypto-Asset Accounting and Tax (CAAT) software to assist US firms to report their crypto-asset transaction when filing their tax returns and Tattoo to track wine. PWC launched De Novo as a tool to implement BCT in supply chains (Bonsón and Bednárová, 2019; Bonyuet, 2020; Kokina et al., 2017; Schmitz and Leoni, 2019; Zemánková, 2019; Y. Zhang et al., 2020).

The Need for New Regulations and New Accounting Standards

Blockchain has become popular with the increase in the demand for Bitcoin trade and it is used as a medium to record Bitcoin transactions (Bonsón and Bednárová, 2019; Bonyuet, 2020; Dai and Vasarhelyi, 2017). Bitcoin transactions have led to a new debate on how to account for digital money. While various definitions describe Bitcoin as “digital money” (Financial Action Task Force, 2014; Ron and Shamir, 2013) “what bitcoin exactly is” is still open to discussion. Is cryptocurrency money or an asset? Is it a product or an investment? The possible answers to those questions are debated in the related literature.

It is expected that the spread out of blockchain usage will lead to an increase in business transactions made with cryptocurrencies. However, the absence of legal regulations causes significant difficulties in accounting for cryptocurrency transactions (Sokolenko et al., 2019). Therefore, the need for an accounting standard on the subject is increasing day by day.

The main finding of the systematic literature review, conducted by Corbet et al. (2019), is that there are many gaps in the literature regarding cryptocurrency, such as; the potential benefits and uses of blockchain, evaluation of cryptocurrencies as part of a diversified portfolio, and legal, economic and regulatory issues. White et al., (2020) investigate whether the current regulations are applicable to cryptocurrencies. In that study, the behavior of bitcoin was examined with various methods, and it was found that Bitcoin mostly resembles a technology-based product. They concluded that current currency and security laws should not apply to cryptocurrencies.

Baur et al. (2018) research to analyze whether the Bitcoin is a medium of exchange or a (speculative) investment asset. Because one-third of Bitcoins are held by investors and a minority of users (both in number and Bitcoin balances) appear to use Bitcoin as a medium of exchange, they conclude that the main purpose of keeping Bitcoins is investing rather than using it as a medium of exchange. In addition to the classification of cryptocurrencies, their recognition and evaluation process are also uncertain. Morozova et al. (2020) state that there are four options for classifying cryptocurrencies according to the studies of specialists, professionals, and leading auditing firms: a) money, b) supply, c) financial asset, d) intangible asset. They also propose a prospective model for the valuation of crypto assets after initial recognition. Furthermore, the authors point out the need for a new IFRS standard for the accounting of crypto assets.

According to the 17 characteristics mentioned in Ram's (2015) study, Pelucio-Grecco et al. (2020) investigate the asset classes that suit Bitcoin's characteristics best within the framework of IFRS. They report that 13 characteristics of bitcoin are compatible with currency, 10 are compatible with financial instruments, and 7 are compatible with intangible assets. Therefore, they suggest that the most suitable classification and most faithful representation of cryptocurrencies should be that of a foreign currency.

Procházka (2018) evaluates accounting models for cryptocurrencies under IFRS. The author identifies existing models that may be used for cryptocurrency transactions and then compares competing models that are possible for a certain type of transaction. According to the study, there are three points to be noted regarding the model that can be used in accounting for cryptocurrencies: (1) the business model, (2) the purpose of the transaction, and (3) the expected decision-usefulness of the model.

The Challenges of Using Blockchain in Accounting

Dai and Vasarhelyi (2017) classify the challenges of using BCT for accounting purposes under three categories: technological, organizational, and environmental. The stored data of Bitcoin transactions showed the need for larger storage systems if the data of other transactions are also kept in the blockchain systems. *Would corporate blockchain streams quickly expand to an unmanageable size? What accounting data should be recorded in blockchain? and What other information (such as IoT data) should be loaded to blockchain in order to provide better assurance?* are the important questions that should be answered in the technological context. Investing in new technologies, the need for training of managers, employees, and auditors, the requirement for new regulations, new accounting and auditing standards are supposed as other challenges of BCT (Dai & Vasarhelyi, 2017).

The possibility of being stolen or loss of private keys of digital wallets, errors in smart contract codes, facing with a higher demand for auditing in a blockchain environment, higher computational power, storage capabilities, cybersecurity risk, litigation risk, the vulnerability of smart contracts, and regulatory acceptance of the use of blockchain are the risks of BCT that are mentioned by Rozario and Thomas (2019). O'Leary (2019) points out the lack of generalizability issues related to BCT.

Users of BCT should be aware that without the effective controls of IT infrastructure, the data provided by blockchain may not be reliable (Sheldon, 2019). P. Zhang and Zhou (2020) stress the importance of designing new consensus mechanisms to improve the security and trust of BCT. The increasing use of BCT may create a huge demand for employees who know about blockchain and other new technologies that have started being used in the accounting area. Therefore, the transformation of accounting education is also a challenge and necessity all over the world (Y. Zhang et al., 2020). Stratopoulos (2020) suggest the combination of storytelling and scaffolding approach to teach BCT to accounting students.

Abdennadher et al. (2021) made interviews with accountants and auditors in order to understand possible benefits and challenges of using BCT in accounting and auditing: difficulty in correcting mistakes, information overload, the need for new assurance services and stronger internal audit are challenges that have been mentioned by accountants and auditors.

Critical Views on the Integration of Blockchain and Accounting

One important study that focuses on the necessity of blockchain belongs to Alles and Gray (2020). They criticize the marketing efforts of big audit firms and say that *“the Big-4 aim to persuade clients to hire them to develop blockchain implementations. However, they fail to answer, “What is the problem for which blockchain is the solution?”*. Additionally, they point out the “first-mile problem” which is the problem related to the reliability of the data entered into the blockchain system if it is related to the real-life events other than cryptocurrency transfers. Adapting IoT may increase the reliability of the data, however when the parties in the blockchain enter the data, the correctness of the data will always be questioned.

Rîndașu (2019) tries to answer the following question in her study: “Is blockchain usage in accounting an innovation or is just another well-advertised technology that will not bring any kind of relevant benefits?”. She thinks that the BCT may be beneficial for only some companies, and before adopting it, companies should have a well-designed decision-making process. Bakarich et al. (2020) points out the necessity of assessing internal and external costs and benefits of BCT, otherwise companies will not be eager to invest money, time and human capital.

Maffei et al. (2020) differentiates their literature review by focusing more on risks and threats of adopting BCT in accounting and auditing practices. They point out the following risks of implementing BCT: underestimating the possible manipulative and fraudulent practices, underestimating the threats of wrong classification and valuation of accounts, lack of expertise while evaluating the business performance, and the risks created by unexperienced IT personnel while adopting and operationalizing BCT.

Conclusion

Information technologies are developing very rapidly, and accounting information technologies are following those developments and changes very closely. BCT and cryptocurrencies are two of the current discussion topics in the accounting world. Although it has a history of about ten years, the market cap of crypto coins is nearly \$1.4 trillion. Moreover, the number of companies that accept payments with cryptocurrencies, the number of crypto money ATMs, and the number of users using cryptocurrency as a medium of exchange are increasing day by day.

Blockchain was a medium used to exchange Bitcoin at the beginning, however, different areas that the blockchain can provide benefit to have also been discovered. The finance sector is affected by those developments most. Researchers from different study areas started to conduct research projects on BCT. Accounting is also one of the areas that are expected to be affected by BCT. Accounting academics, accounting journals, and accounting firms have an increasing interest in those new technologies in order not to stay behind those fast developments.

In order to foresee the potential effects of BCT on accounting, a systematic literature review was conducted in the current study. The articles found as the result of database searches are written mainly in the areas of computer science and accounting information systems. Articles in the computer journals focused on the development of BCT and how it can be modified to be more useful in some selected areas. On the other hand, articles that try to connect BCT and accounting have very optimistic assumptions about the usage of BCT in accounting and most of them have the expectation of an accounting system fully based on BCT.

The clear point is that, with the increase in the transactions made by using Bitcoin and other cryptocurrencies, there will be an increasing demand to use BCT. However, the replacement of the current software programs with Blockchain is up to the developments in BTC and the elimination of its drawbacks. High costs, the need for hiring new personnel, difficulty in keeping the security of private information, new business risks, and a lack of regulations and standards are the main obstacles to the spread of BCT.

The contribution of this study is mainly to accounting regulators, professionals, and academics who want to follow the developments in BCT and its potential effects on accounting information systems. The study may help them to adapt to the changes more easily and foresee the potential risks and opportunities. Accordingly, necessary regulations can be made, new standards can be released, and the necessary education can be given to accounting professionals and accounting students.

Lastly, we want to make some suggestions for further research. Conducting case studies to examine the adoption and usage of BCT in accounting and auditing environment will be very valuable. Searching the improvements in usage and adoption of BCT in accounting, internal control and auditing in a particular country setting, such as Turkey, conducting cross country studies and comparative studies between different industries will add much value to the current literature.

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Basic Reference Types

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a) Books

Kamien R., & Kamien A. (2014). *Music: An appreciation*. New York, NY: McGraw-Hill Education.

b) Edited Book

Ören, T., Üney, T., & Çölkesen, R. (Eds.). (2006). *Türkiye bilişim ansiklopedisi* [Turkish Encyclopedia of Informatics]. İstanbul, Turkey: Papatya Yayıncılık.

c) Chapter in an Edited Book

Bassett, C. (2006). Cultural studies and new media. In G. Hall & C. Birchall (Eds.), *New cultural studies: Adventures in theory* (pp. 220–237). Edinburgh, UK: Edinburgh University Press.

d) Book with the same organization as author and publisher

American Psychological Association. (2009). *Publication manual of the American psychological association* (6th ed.). Washington, DC: Author.

Article

a) Journal article with DOI

de Cillia, R., Reislgl, M., & Wodak, R. (1999). The discursive construction of national identity. *Discourse and Society*, 10(2), 149–173. <http://dx.doi.org/10.1177/0957926599010002002>

b) Journal Article with DOI and More Than Seven Authors

Lal, H., Cunningham, A. L., Godeaux, O., Chlibek, R., Diez-Domingo, J., Hwang, S.-J. ... Heineman, T. C. (2015). Efficacy of an adjuvanted herpes zoster subunit vaccine in older adults. *New England Journal of Medicine*, 372, 2087–2096. <http://dx.doi.org/10.1056/NEJMoa1501184>

c) Journal Article from Web, without DOI

Sidani, S. (2003). Enhancing the evaluation of nursing care effectiveness. *Canadian Journal of Nursing Research*, 35(3), 26–38. Retrieved from <http://cjnr.mcgill.ca>

d) Journal Article with DOI

Turner, S. J. (2010). Website statistics 2.0: Using Google Analytics to measure library website effectiveness. *Technical Services Quarterly*, 27, 261–278. <http://dx.doi.org/10.1080/07317131003765910>

e) Advance Online Publication

Smith, J. A. (2010). Citing advance online publication: A review. *Journal of Psychology: Advance online publication*. <http://dx.doi.org/10.1037/a45d7867>

f) Article in a Magazine

Henry, W. A., III. (1990, April 9). Making the grade in today's schools. *Time*, 135, 28–31.

Doctoral Dissertation, Master's Thesis, Presentation, Proceeding

a) Dissertation/Thesis from a Commercial Database

Van Brunt, D. (1997). *Networked consumer health information systems* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9943436)

b) Dissertation/Thesis from an Institutional Database

Yaylali-Yıldız, B. (2014). *University campuses as places of potential publicness: Exploring the politicals, social and cultural practices in Ege University* (Doctoral dissertation). Retrieved from Retrieved from: <http://library.iyte.edu.tr/tr/hizli-erisim/iyte-tez-portali>

c) Dissertation/Thesis from Web

Tonta, Y. A. (1992). *An analysis of search failures in online library catalogs* (Doctoral dissertation, University of California, Berkeley). Retrieved from <http://yunus.hacettepe.edu.tr/~tonta/yayinlar/phd/ickapak.html>

d) Dissertation/Thesis abstracted in Dissertations Abstracts International

Appelbaum, L. G. (2005). Three studies of human information processing: Texture amplification, motion representation, and figure-ground segregation. *Dissertation Abstracts International: Section B. Sciences and Engineering*, 65(10), 5428.

e) Symposium Contribution

Krinsky-McHale, S. J., Zigman, W. B., & Silverman, W. (2012, August). Are neuropsychiatric symptoms markers of prodromal Alzheimer's disease in adults with Down syndrome? In W. B. Zigman (Chair), *Predictors of mild cognitive impairment, dementia, and mortality in adults with Down syndrome*. Symposium conducted at the meeting of the American Psychological Association, Orlando, FL.

f) Conference Paper Abstract Retrieved Online

Liu, S. (2005, May). *Defending against business crises with the help of intelligent agent based early warning solutions*. Paper presented at the Seventh International Conference on Enterprise Information Systems, Miami, FL. Abstract retrieved from http://www.iceis.org/iceis2005/abstracts_2005.htm

g) Conference Paper - In Regularly Published Proceedings and Retrieved Online

Herculano-Houzel, S., Collins, C. E., Wong, P., Kaas, J. H., & Lent, R. (2008). The basic nonuniformity of the cerebral cortex. *Proceedings of the National Academy of Sciences*, *105*, 12593–12598. <http://dx.doi.org/10.1073/pnas.08054171105>

h) Proceeding in Book Form

Parsons, O. A., Pryzwansky, W. B., Weinstein, D. J., & Wiens, A. N. (1995). Taxonomy for psychology. In J. N. Reich, H. Sands, & A. N. Wiens (Eds.), *Education and training beyond the doctoral degree: Proceedings of the American Psychological Association National Conference on Postdoctoral Education and Training in Psychology* (pp. 45–50). Washington, DC: American Psychological Association.

i) Paper Presentation

Nguyen, C. A. (2012, August). *Humor and deception in advertising: When laughter may not be the best medicine*. Paper presented at the meeting of the American Psychological Association, Orlando, FL.

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