Research Article / *Araştırma Makalesi*

EFFECT OF USING DERIVATIVES ON RISK MANAGEMENT, FINANCIAL PERFORMANCE AND FIRM VALUE[*]

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ABSTRACT

This study investigates the impact of derivatives on risk management, financial performance, and firm value in non-financial firms from 2016-2021, spanning pre-pandemic and pandemic periods. It first examines firms' derivatives usage intensity through annual reports, then assesses the direct effects using panel data analysis. According to derivatives usage intensity observations, it is seen that the approach of firms to use derivatives hasn't changed based on the pandemic. Approximately %30 of firms stated that they use derivatives in risk management while other firms stated they use in-house methods in risk management. Moreover, according to the results of the panel data analysis, this study, which is based on limited data and examines the impact of the pandemic period, finds that the use of derivative instruments increases risk and negatively affects financial performance. On the other hand, any relationship between derivatives usage and firm value hasn't been found to be statistically significant. These results suggest that derivatives are not an effective risk management tool for the sector, prompting firms to reconsider their risk management strategies and explore why derivatives fail to mitigate risk effectively.

Keywords: Derivatives, Risk Management, Financial Performance, Firm Value.

JEL Classification: C33, G30, G32.

TÜREV ARAÇLARIN RİSK YÖNETİMİ, FİNANSAL PERFORMANS VE FİRMA DEĞERİ ÜZERİNE ETKİSİ

ÖZET

Bu çalışma, 2016-2021 yılları arasında, pandemi öncesi ve pandemi dönemlerinde, Kimya, İlaç, Lastik ve Plastik Ürünler Sektör'ünde yer alan firmaların türev araç kulanımının firmaların risk yönetimi, finansal performansı ve değeri üzerindeki etkiyi incelemektedir. Çalışmada ayrıca pandemi döneminde türev araç kullanımına ilişkin bir değişiklik olup olmadığı incelenmiş ve firmaların yüksek riskli dönemlerde nasıl hareket ettiği gözlemlenmeye çalışılmıştır. Bu kapsamda ilk önce türev araç kullanım yoğunluğu tespit edilmiş, konuyla ilgili finansal rapor dipnotları incelenmiş ardından türev araçların etkisi panel veri analizi yardımıyla test edilmiştir. Finansal raporlardan elde edilen bilgilere göre firmalar türev araçları risk yönetimi amacıyla kullandıklarını belirtseler de pandemi döneminde türev araç kullanım yoğunluklarının değişmediği ve sektördeki firmaların yaklaşık olarak %30'unun türev araç kullandığı görülmüştür. Panel veri analizi sonuçlarına göre, sınırlı veri ile çalışılan ve pandemi döneminin etkisinin incelendiği bu

çalışmada, türev araç kullanımının riski artırdığı, finansal performansı olumsuz etkilediği, ancak firma değerini etkilemediği şeklinde bulgular elde edilmektedir. Bu sonuçlar, türev araçların sektör için etkili bir risk yönetimi aracı olmadığına işaret etmekte ve firmaları risk yönetimi stratejilerini yeniden gözden geçirmeye ve türev araçların riski neden etkili bir şekilde azaltamadığını araştırmaya sevk etmektedir.

Anahtar Kelimeler: *Türev Araçlar, Risk Yönetimi, Finansal Performans, Firma Değeri.*

JEL Sınıflandırması: *C33, G30, G32.*

1. Introduction

Internationalization of firms has made enterprises vulnerable to risks both in their country and in other countries (Yılmaz & Aslan, 2016: 664). Any recession, volatility or uncertainty in the global area will affect enterprises' operations. Therefore, an effective risk management system will provide them competitive advantage. This situation has pushed businesses to search for effective risk management tools. Recently, derivative instruments are pervasively used for hedging purposes since it enables transferring risk to other parties (Yenisu et al. 2021: 531). However, derivatives usage among non-financial sectors is not widespread, they barely use derivatives compared to financial sectors (Bodnar et al. 1995, Durmuş & Coşkun, 2019). In addition, these firms prefer derivative instruments to manage fluctuations in cash flows rather than speculation in contrast to finance sector firms (Bodnar et al. 1995; Bodnar & Gebhardt, 1999). Many studies conducted regarding intensity and purposes of using derivative instruments revealed that derivatives usage depends on firms' countries, economic characteristics, the industries which they operate; moreover, the firms that are active in foreign markets, prefer to use derivatives more (Prevost et al., 2000; Jalilvand et al., 2000; Brunzell et al., 2011).

In last decades, many financial crises have occurred such as 2008 mortgage crisis, 2014 Russia - Ukraine War crisis, 2015 Chinese stock market crisis, 2018 Turkish currency and debt crisis and 2020 pandemic crisis and those crises affected other countries as well. Countries and firms that have structural problems and have low levels of savings are usually influenced more severely than advanced countries or large companies in crisis times (Alpagu, 2018: 1148). Firms prefer to increase their borrowing levels during financial crisis periods (Alves & Francisco, 2015: 140). As the leverage level of firms increases, their derivatives usage increases too (Geyer-Klingeberg et al., 2019; Durmuş & Coşkun, 2019). Statistics show that total derivatives usage around the world have increased approximately %22 between years of 2016-2022 (BIS, 2023)

In the literature, the effects of derivative instruments are examined from different aspects such as its impact on economic growth (Şendeniz-Yüncü et al., 2018; Vo et al., 2019; Vo et al., 2020), how derivatives play a role in risk management (Murungi et al., 2014; Bartram, 2019), whether they have an effect on firm value (Fauver & Naranjo, 2010; Ahmed et al. 2014) or firm performance (Lau, 2016; Lenee & Oki, 2017). However, scholars couldn't find common results related to derivatives effects which means that derivatives usage have varying effects according to industry, country, time etc. In general, when literature is examined, it's seen that scholars mostly prefer to examine derivatives use of financial sectors since financial sector firms use derivatives with speculation purposes and give more detailed information related to derivatives such as cost of contracts, time duration, amount of derivatives.

In the context of discussion above, this study aims to analyze how derivative instruments usage of Turkish Chemical, Pharmaceutical, Petroleum, Rubber and Plastic Sector firms affect their risk management, financial performance and firm value. In addition, the effect of the pandemic crisis will be taken into account. Analyzing this topic is important for three reasons. First, in last a few years Turkish Lira has depreciated rapidly, and this situation caused many reel industry firms to face with more risk and increase in their costs. Therefore, it's important to observe whether firms could successfully manage their risk through derivatives instruments and also measure its effect on profitability and firm value. Second, in the literature, scholars mostly focused on the banking sector (Akkaya & Torun, 2020; Yenisu et. al., 2021; Tanrıöven & Yenice, 2014; Anbar & Alper, 2011). Thus, it's been thought that analyzing non-financial firms in Türkiye will gain significant perspective to the literature. Third, measuring the impact of the pandemic crisis might give insight to firms regarding derivative instruments usage in such crisis times.

To this extent, the first section introduces the topic in general aspects. Section two discusses the studies that examined impact of derivatives. In the next section, dataset is introduced. Subsequently information regarding derivatives intensity of the sector, risks that firms face and the procedures that they conduct to manage these risks are shared thereafter panel data analysis is briefly explained and empirical results have been reported. Finally in the conclusion part, we interpreted the results and provided some implications.

2. Literature Review

2.1. Derivatives and Risk Management

When the literature is examined, studies can be summarized with two perspectives: i) approaches of firms against derivative usage for risk management and ii) impact of derivative usage on risk management. In terms of approaches of firms against derivative usage, Yücel et al. (2007) say that Turkish firms don't apply to using derivatives in risk management, in addition, firms don't give adequate information regarding risk management procedures. Danışman & Demirel (2019) associated the fact that non-financial firms don't prefer using derivatives intensively with the information asymmetry related to derivatives and low level of financial literacy. On the other hand, firms may use different derivative tools according to the risk that they face (Alsu, 2019; El-Masry, 2006).

In terms of impact of derivative usage on risk management, firstly, it can be said that studies use variety of indicators representing risk such as debt ratio, leverage ratio, growth rate of sales, cost of debt, foreign sales as represent variables of risk (Bartram et al. 2011; Bae et al. 2018; Lee, 2019). While there are studies indicating that derivative usage reduces risk (Bartram et al., 2011; Lee, 2019), there are also studies finding opposite results (Bae et al., 2018). By moving forward from these varying results, Atif Bashir et al. (2019) have examined 46 different studies conducted to measure impact of derivatives on risk management, thereafter concluded that although many researchers say using derivatives is useful for risk management, the impact of derivatives may differ according to countries, industries etc. Despite different findings, the studies have found relation between derivatives usage and risk. Therefore our study hypothesises that;

H1: Derivatives usage has impact on risk measures of firms.

2.2. Derivatives and Firm Performance

It is believed that derivative instruments have emerged mainly due to the needs of farmers and traders to cope with uncertainties about the future (Hull, 2011: 2). Therefore, it can be inferred that derivative instruments' main function is to manage risk. However, derivative contracts related to important investments or regarding firms' cash flow volatility (Bodnar, 1995) may help firms to sign profitable businesses and find opportunities to grow. Hence, it's important to answer the question of whether derivatives have any impact on firm performance. In the literature, it is observed that the return on assets ratio and return on equity ratio are mostly used as indicators of financial performance (Wen et al., 2021; Lenee & Oki, 2017; Lau, 2016; Ahmed et al., 2014). Lenee & Oki (2017) concluded that when futures and forwards are used together, firms' performance increases but when firms use solely swaps, firm performance decreases. Ahmed et al. (2014) reached similar results that different derivatives tools have different effects on firm performance. Yu-Rung Rang et al. (2021), found that derivative instruments increase profitability and riskiness. Wen et al. (2021), analyzed 2529 Chinese firms by panel data analysis and found that derivatives have a negative impact on financial performance. In addition, Wen et al. (2021) compared the results with the studies examined developed markets firms and saw that while developed market firms' performances increased by using derivatives on the other hand Chinese firms' performance negatively affected by derivative usage. In scope of the discussions above it can be deduced that impact of derivatives on firms' financial performance differ by the countries' development level that firms operate or the specific derivative tools that firm uses against any risk.

In the context of studies above, our next hypothesis is determined as;

H2: Derivatives usage has impact on performance measures of firms.

2.3. Derivatives and Firm Value

Scholars have also associated derivatives which are usually used to manage financial risks with the firm value. Since derivatives aren't used for only hedging purposes, managing risk effectively may influence their value besides financial performance. Herein, Öztürk et al. (2022) have claimed that financial risks have negative impacts on firm value. Thereby it can be said that financial risk management including derivatives usage enhances firm value. Researches conducted to search for impact of derivatives on firm value mostly used Tobin's Q ratio or market value as a proxy for firm value variable (Fauver & Naranjo, 2010; Nguyen & Faff, 2010, Jin & Jorion, 2006; Ece, 2020). Clark & Mefteh (2010), found that derivatives have positive influence on firm value of especially large companies in France. Kim et al. (2017), found that derivative instruments increase the value of the company. Riaz et al. (2021), in a study in which they analyzed 90 non-financial companies in Pakistan with the GMM estimator, revealed that derivative instruments reduce cash flow volatility and increase firm value. On the other hand, Fauver & Naranjo (2010), revealed that derivatives usage has a negative impact on firm value with 1746 USA firms sampled research. Konak & Türkoğlu (2021) found similar results that derivatives negatively affect the value of 16 non-financial firms in the ISE 30. Apart from these studies, Aytürk et al., (2016) in their study which conducted for Turkish companies found that derivatives have no impact on firm value. Jin & Jorion (2006) in their research which investigated USA gas and petroleum firms stated that derivatives don't affect firm value.

According to discussion related firm value and derivatives, our third hypothesis is determined as;

H3: Derivatives usage has impact on firm value.

3. Variables, Dataset and Sample

In the study, 28 companies involved in the Chemical Pharmaceutical Petroleum Rubber and Plastic sector, whose all financial reports can be accessed between 2016 and 2021, were selected as sample. Quarterly reports of these 28 firms were examined for the time span of 2016-2021. Although there are 38 firms in the sector in 2021, 10 firms are excluded because of unavailability of data for years between 2016-2021. Chemical Pharmaceutical Petroleum Rubber and Plastic sector firms are mostly dependent on imported raw materials; this makes the sector vulnerable to any financial crisis in the world. In addition, according to statistics of The Ministry of Industry and Technology, the sector postulates approximately 54% of the trade deficit of Türkiye in 2022. Therefore, the sector is determined as sample for our study. When the derivative usage density of the sector is examined, it is seen that the number of firms use derivates vary between 8 to 12 firms but usually 10 certain firms use derivatives. These 10 firms constitute approximately %30 of the whole sector. In other words, this rate has not changed much over the years. Indeed, although the sector is highly relied on import and therefore influenced by high volatility, derivatives usage among the industry can be assessed as low rate. This low rate of derivatives usage is not particular to our sample, derivatives usage rate of non-financial firms in Türkiye is low in general, this could be seen as one of the reasons that derivatives usage studies conducted in Türkiye mostly focused on financial sector firms. In order to test the impact of derivatives usage on risk management, firm value and financial performance the panel data analysis method was used. For our investigation, we collected data from the official website of Public Disclosure Platform (www.kap.org.tr), website of Investing.com (www.investing.com) and website of Fintables (www.fintables.com).

3.1. Dependent Variables

Dependent variables are risks, firm value and financial performance which were tested through various proxies. The proxies were selected from mostly used variables in literature and also other new variables which were considered as suitable for research were included into the analysis. The list of dependent variables proxies are shown in Table 1;

Table 1: List of Dependent Variables

Dependent Variable	Proxy	Measurement
Risk	Current Ratio	Current assets / current liabilities
	Acid-test Ratio	(Current assets - inventories) / short term liabilities
	Cash Ratio	Cash and cash equivalents / short term liabilities
	Total Debt Ratio	Total debts divided / total liabilities.
	Currency Risk	Net foreign currency position / equity
Financial performance	ROA	Net profit / total assets
	ROE	Net profit / equity
	Finance costs/Net profit Ratio	This proxy is suggested as financial performance proxy by authors.
	Finance income/Net profit Ratio	This proxy is suggested as financial performance proxy by authors.
	Other Income from Operating Activities	This proxy is suggested as financial performance proxy by authors.
	Other Expenses from Operating Activities	This proxy is suggested as financial performance proxy by authors.
Firm Value	Tobin Q Ratio	Tobin q: (MVE + PS + DEBT) / TA[1]

3.2. Independent and Control Variables

We used derivatives usage as an independent variable; firm age, GDP, firm size as control variable and pandemic as dummy variable in investigation. Derivatives usage is a dummy variable that equals to 1 if firms use derivative instruments, 0 otherwise. Firm size is the natural logarithms of total assets. Pandemic is another dummy variable that equals 1 for pandemic duration and 0 for pre-pandemic term.

4. Analysis and Results

Results will be divided into two parts. First part, include number of firms that use derivatives by time and information related to their risk management procedures. Next comes the explanation of panel data analysis method and the report of empirical results.

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1   The Tobin q ratio, which was first calculated by Tobin in 1969, has been studied in the literature on different calculation alternatives due to the fact that it is difficult to calculate the replacement cost (Ersoy et al. 2011). In order to eliminate the difficulties in calculating the Tobin q value, the approximate q ratio calculation was proposed by Chung & Pruitt (1994). Calculation formula of Tobin q ratio proposed by Chung and Pruitt is follows (Canbaş et al. 2014):
Tobin q: (MVE + PS + DEBT) / TA
MVE: Multiplication of the market value of the stock by the total number of shares
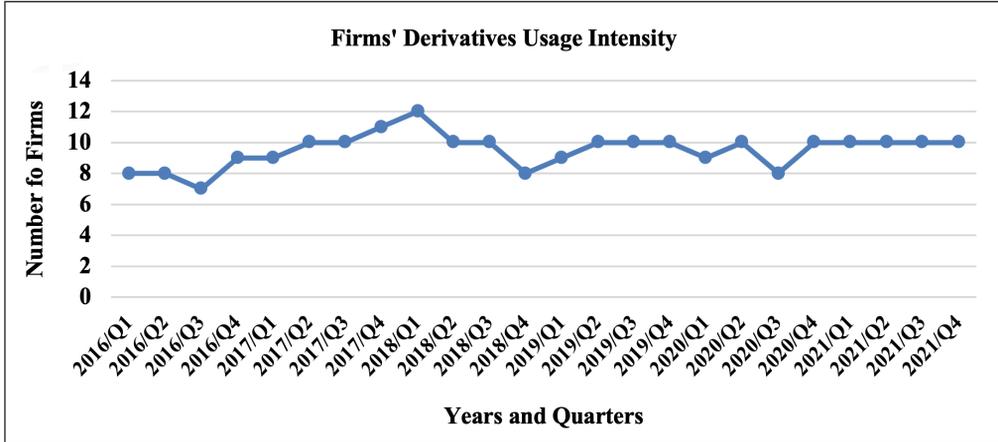DEBT: (Short term liabilities – current assets) + long term liabilities
TA: Total assets.
The fact that the Tobin q ratio is greater than 1 generally indicates that the company uses its resources effectively and that the company is financially strong.

4.1. Derivatives Usage of the Sector and Deep Notes Related Derivatives

Derivatives usage among Turkish non-financial companies is not pervasive (Yücel et al. 2007; Alsu, 2019). It's considered that this stems from firms having insufficient financial literacy about derivatives instruments (Aksoy & Şengül, 2021). As it is seen in Figure 1 Chemical, Pharmaceutical, Petroleum, Rubber and Plastic Sector firms also don't use derivatives intensively.

Figure 1: Number of Firms Use Derivatives

Source: Researcher's own table, based on firms' financial statements

Data related to derivatives usage collected from financial statements announced on Public Disclosure Platform. Since we aim to observe firms' derivative usage preference during pandemic besides derivatives impacts on risk management, financial performance and firm value, we examined derivatives use intensity and examined deep notes related to derivatives usage purpose. According to Figure 1, although there had been changes in the number of derivatives user firms over time in the pre-pandemic period, there were no changes in tendency of non-users during the pandemic period. According to information given in operating reports, firms use derivatives just for the purpose of risk management. It is thought that the main reason why firms use derivative instruments especially for risk management purposes is that the use of derivative instruments for speculative purposes is exclusive of the main activities of firms and that firms need to maintain certain working capital to carry out their main activities (Aydın, 2023: 58).

When derivative use intensity is considered, though firms said they use derivatives for risk management, it is seen that the derivatives usage intensity is low. Therefore, we examined annual financial reports and operating reports to see which methods the firms use in risk management. As far as the annual operation reports are examined, it is seen that all companies have established an early detection of risk committee to evaluate the risks that firm face and manage those risks. According to article of Turkish Commercial Code 378, of all companies listed on the stock exchange have to establish an "early detection of risk committee". In addition, Turkish Commercial Code 398. to the extent of its article, there must be an auditor who inspects

the establishment and further activities of the committee. Early detection of the risk committee should meet every two months, give a report to the board of directors about the company situation, in case any danger has been detected, warn the firm, suggest remedies for risk and also inform the auditor about the situation. Although the committee usually meets every two months, it can increase the frequency of meetings in extraordinary cases. For instance, Aygaz, one of firms in the sector, reported that the committee met 8 times in 2020, moreover, the committee defined more risks that can affect the firm in the pandemic period.

Furthermore, the companies stated in their operating reports that they mostly face market risk which contains currency risk, price risk and interest risk, liquidity risk, credit risk and various operational risks. Market risk management approach of derivatives user and non-user firms differs. While derivatives user firms prefer options against price and currency risk and swaps against interest risk on the other hand non-user firms manage currency risk by sensitivity analysis and controlling net foreign exchange position and manage interest risks by borrowing at fixed interest rate. All firms in the sample prefer similar ways to manage other risks that they encounter. Firms indicated that they usually keep a close watch on the debt of clients, receive collateral, use insurance services and make provision for credit risk management. Moreover, entire companies remarked that they conduct various in-company training programs, make R & D investments, and receive consultancy service on operational risks.

4.2. Panel Data Analysis and Empirical Results

Similar to Ece (2020), Aksoy & Şengül (2021), Konak & Türkoğlu (2021), panel data analysis method has been used to investigate the effect of derivative usage on risk management, firm value and financial performance. Panel data is a combination of both cross-sectional and time series data (Gujarati & Porter, 2009: 22). Panel data analysis allows to control differences that are peculiar to cross-sections such as countries, firms, individuals etc. and it enables to measure these differences. Moreover, by combining cross-sectional observations and time series, it provides more comprehensive information, less multicollinearity between variables, more degrees of freedom and more effectivity (Tarı, 2012: 476). Because of these advantages panel data analysis has been considered as a suitable technique for the investigation. A linear panel data model is shown as follows (Güriş et al. 2020: 230);

$$Y_{it}:\ \alpha_i\ +\ \beta_{1it}X_{1it}\ +\ \beta_{2it}X_{2it}\ +\ \beta_{3it}X_{3it}\ +\ \dots + \beta_{kit}X_{kit} + u_{it} \tag{1}$$

or

$$Y_{it}:\ \alpha_i\ + \sum_{k=1}^{K} \beta_{kit}X_{kit}\ +\ u_{it} \qquad Y_{it}\ ve\ X_{it}\ :\ i= 1, \dots, N \qquad t = 1, \dots, T \tag{2}$$

Where Y is the dependent variable, X is the independent variable, α is constant coefficient, β is slope coefficient, is the i. unit value which k explanatory variable receives at t time and is the error term. There are examples of the econometric model of the study below. Since there are 12 dependent variables in the research all models haven't been written;

$$ROA_{it}= \alpha_{it}+ \beta_1 DRV_{it}\ + \beta_2 SIZE_{it}\ + \beta_3 AGE_{it}\ + \beta_4 GDP_{it}\ + \beta_5 PAND_{it}\ + u_{it} \tag{3}$$

$$TOBIN_{it}= \alpha_{it}+ \beta_1 DRV_{it}\ + \beta_2 SIZE_{it}\ + \beta_3 AGE_{it}\ + \beta_4 GDP_{it}\ + \beta_5 PAND_{it}\ + u_{it} \tag{4}$$

i = 1, 2, …., 28 and t = 1, 2,…,24 (there are 24 quarters in years between 2016-2021)

In the panel data analysis method, the equations of models above are analyzed through one of classical model, fixed effects model or random effects model. Classical model assumes that constant coefficients and slope coefficients don't differ according to units or time (Alptekin, 2012: 208). Fixed effect model postulates that constant coefficients vary among units, of time or vary among both units and time but there are no changes in slope coefficients (Alptekin, 2012: 208) On the other hand, random effects model hypothesizes that the differences among units which are randomly selected will be random as well (Alptekin, 2012: 209). According to the random effects model, changes that occur depending on units or both units and time are included in the model as a component of the error term (Alptekin, 2012: 209).

In order to decide on a proper test model, certain steps need to be followed. First step is using the F test and Breusch Pagan LM tests which enables to make selection between classical model and fixed effects model or between classical model and random effects model, respectively. Second step is carrying out the Hausman test to decide on an appropriate test from among fixed effects and random effects model. Third step is testing the assumption which includes autocorrelation, cross sectional dependence and heteroskedasticity. Fourth step is conducting unit root tests. Final step is applying the most suitable test for each variable and interpretation of results.

According to F test and Breusch-Pagan LM test conducted, most suitable test for ROE is classical model, according to results of Hausman test most proper test for current ratio and currency risk variables is fixed effects model, lastly for the variables remained have been estimated through random effects model.[2] After the variables are estimated with the appropriate models, final results are gathered together in Table 2 below;

Table 2: Panel Data Analysis Results

	Derivatives Usage		Firm Size		Firms Age		GDP		Pandemic Effect	
Dependent Variables	coefficient	P value	coefficient	P value	coefficient	P value	coefficient	P value	coefficient	P value
ROA	-0.017	0.002**	0.064	0.037**	0.004	0.152	0.003	0.148	0.023	0.015**
ROE	-266.83	0.734	4707.83	0.120	-17.28	0.491	-7.590	0.992	-630.01	0.424
F_Costs/Nprofit	6216.63	0.282	-6591.92	0.510	117.31	0.154	-666.36	0.757	-5490.99	0.084*
F_Income/Nprofit	-581.07	0.272	1412.51	0.491	57.174	0.861	903.44	0.352	-925.88	0.056*
Other Expenses from Operating	2.483	0.000***	0.285	0.602	0.041	0.000***	-0.254	0.003**	0.806	0.000***
Other Income from Operating	2.169	0.000***	0.940	0.162	0.042	0.000***	-0.219	0.002**	0.730	0.000***
Current Ratio	-0.830	0.000***	-0.290	0.254	-0.086	0.113	0.123	0.278	-0.223	0.062*
Acid-test Ratio	-0.490	0.000***	-0.298	0.231	-0.055	0.059*	0.039	0.633	-0.134	0.118
Cash Ratio	-0.040	0.320	0.026	0.865	-0.002	0.106	-0.030	0.449	0.098	0.061*
Total Debt Ratio	0.056	0.002**	0.117	0.001***	0.002	0.754	-0.029	0.090*	0.045	0.044**
Currency risk	0.297	0.002**	0.027	0.809	-0.002	0.161	-0.032	0.181	0.047	0.312
Tobin Q	-0.036	0.693	-1.783	0.000**	0.002	0.956	-0.056	0.529	0.131	0.000**

Significance levels: 0.01***, 0.05**, 0.10*

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2   Related tests are shared in Appendix part.

Results show that derivatives usage and the return on asset (ROA) are negatively related, on the other hand GDP's coefficient is positive and statistically significant which means that any increase in GDP may increases the ROA as well. Any significant relationship between ROE and independent or control variables haven't been defined. As another finding, pandemic has negative relationship with both finance income/net profit ratio and finance costs/net profit ratio. Other expenses from operating activities have been positively associated with derivatives usage and results show that during the pandemic period, those expenses have increased. Moreover, similar results have been detected for other income from operating activities that derivatives usage positively related to it and in addition, other income from operating activities has increased during the pandemic period. To this extent, similar to the study of Lau (2016) it can be deduced that derivatives usage has different effects on different proxies of financial performance. Except that, derivatives usage and pandemic are negatively correlated with current ratio. Similar to the current ratio, acid-test ratio and derivatives usage have negative nexus. On the other hand, any nexus between derivatives and cash ratio haven't been detected however, in the pandemic period cash ratio have increased. This situation may stem from firms' conservative behaviors in crisis times. Furthermore, derivatives usage and pandemic are positively related total debt ratio which means that firms' debt have increased in pandemic in addition derivatives usage couldn't help companies to manage their liabilities. Another important finding is that derivative usage and the currency risk have positive association for the firms in the sample. As can be seen in the table of results, derivative use and risk indicators such as current ratio and acid-test ratio are negatively related, while derivatives and risk indicators such as total debt ratio and currency risk are positively related, which may imply that derivative use is not an effective way for firms in the sector to deal with risks. Although this evidence is inconsistent with findings of Bartram et al. (2011), the findings that derivatives usage positively associated with the risks is consistent with results of the study conducted by Yu-Rung Rang et al. (2021). Finally, evidences show that although pandemic have a positive impact on Tobin q which is the proxy of firm value, derivatives usage doesn't have any significant effect on it. Although Riaz et al. (2021), found a positive effect of derivatives on Pakistan firms, Fauver & Naranjo (2010) found that derivatives usage decreases firm value in the USA, in our study any relationship between derivatives and firm value haven't been confirmed. Similar to our study Jin & Jorion (2006) have found that there is no relation between derivatives usage and firm value.

5. Conclusion

In this research, we have examined the effect of using derivatives on risk management, financial performance and firm value of Chemical, Pharmaceutical, Petroleum, Rubber and Plastic Sector firms for the period of 2016-2021. Also, this study aimed to observe the tendency of firms to use derivatives during pandemic period. To this extent, financial reports of firms have been investigated to see whether firms use derivatives. It has been seen that even though the number of firms using derivatives changed over time there were no changes in derivatives usage based on pandemic. Firms stated that they use derivatives with the purpose of risk management. Approximately %30 of firms prefers derivative instruments which means that derivatives usage intensity of the sector is low. This result supports the other studies conducted in Türkiye (Yücel et al., 2007; Danışman & Demirel, 2019; Alsu, 2019; Aksoy & Şengül, 2021). This situation may be associated with the fact that firms have insufficient literacy related to

derivatives and their concerns about information asymmetry regarding derivative instruments (Danışman & Demirel, 2019).

Since firms said that they use derivatives with hedging purpose, to compare and understand those firms' risk management procedures among derivatives users and non-users, financial reports have been examined. As for that information gathered, firms mostly face price risk, currency risk, interest risk, credit risk, liquidity risk and operational risks. Derivatives user firms apply various derivatives related to risks they come across like insurance, factoring, forfaiting on the other side non-user firms follow the procedures such as sensitivity analysis, hold high amounts of cash, control the net foreign exchange position. Furthermore, all companies in the sample use in-house methods such as R&D investment, employee training, limiting accounts receivable, tailing customers' credit notes and using factoring services so as to manage the risks. Broadly, it can be inferred that although firms have common risk management procedures, derivatives user firms apply more extensive, various and advanced risk management tools.

In order to test the impact of derivatives usage statistically, panel data analysis has been used. Empirical results have shown that derivatives usage negatively related with ROA on the other side positively correlated with both Other Income from Operating Activities and Other Expenses from Operating Activities which may imply that derivatives usage may has a negative effect on financial performance of the firms in the sector. According to the literature, this situation may be caused by various factors such as the type of derivative tools (Lenee & Oki, 2017), timing of usage (Bae et al. 2018) or firms' quality and experience (Wen et al., 2021). Another finding is that derivatives usage has negative nexus with cash and acid-test ratios. On the contrary, derivatives usage is positively correlated with total debt ratio and currency risk. Although, Ece (2020) found derivatives usage decreases risk of manufacturing sector firms in Türkiye, our results show opposite way. This may be explained by two views; first it can be inferred that using derivatives hasn't been an effective way to manage risks for the companies in the sector, in order words this result is particular to our sample sector. Second, since our study addressed the topic with small sample and pandemic also had effect on risk which may imply that pandemic affected the results of the study or there are other variables such as import reliance that should be considered. Finally, findings have demonstrated that derivatives usage has no statistically significant effect on firm value. This result supports the study of Jin & Jorion (2006) which examined USA firms and also the findings of Aytürk et al. (2016) which investigated Turkish firms. However, the fact that firms don't share detailed information related to derivatives amount, contract cost, income earned through contract, maturity of derivatives contract made us to use dummy variable instead, that limits explanatory power of our study.

According to another important results, it is observed that other income from operating activities and other expenses from operating activities has increased remarkably. Firms stated that other expenses from operating activities have increased especially because of currency volatility. On the other hand, other income from operating activities increased because interest incentives paid during the pandemic period and concessions related to rent payments by the government and extreme exchange rate returns which means that firms went toward other profitable actions except their essential industry during the crisis. Therefore, the government should develop programs which help firms to cope with high volatility, incentives or politics related to the firms' essential operations to keep them in their major business.

This investigation's results showed that firms should revise their procedures related to derivatives usage. They must understand the reasons why derivatives usage couldn't help companies to control risks and implicitly increase financial performance and firm value. However, the fact that firms which use derivatives do not disclose clear information on the type of derivative instrument they use, the maturity of the instrument and the position in which they use it against the type of risk they face, limitates our study. The absence of such information results in resorting to dummy variables in the analysis based on whether derivatives are employed or not, thereby restricting the explanatory capacity of the findings. Besides, since sample size is small (it consists of 28 firms and 24 quarterly financial data), itis hard to generalize the finds. In order words, because of lack of some needed informations and small sample size we cannot reach precise and generalized evidences. Related to our limitations, for the future studies, it will be helpful to compare derivatives user and non-user companies in addition to make surveys about their risk management and their approach to using derivatives. In addition, larger sample size and making comparison among different industries may extend the derivatives usage literature.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Author Contributions

Equal Contributions.

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Appendixes

F Test Results

F test is used to determine most appropriate model from Classicial Model and Fixed Effects Model.

H0: Classical model is better for the analysis

H1: Fixed Effects Model is better for the analysis.

Appendix 1: F Test Results

	Derivatives Usage		Firm Size		Firm's Age		GDP		Pandemic	
Dependent Variables	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value
ROA	-0.005	0.517	**0.028**	**0.000***	**-0.012**	**0.000***	**0.022**	**0.000***	**0.024**	**0.001**
ROE	-2152.0	0.115	58.154	0.967	95.499	0.854	-313.03	0.669	-524.22	0.687
F_Costs/ Nprofit	9737.89	**0.046**	3103.35	0.53	360.36	0.845	**4732.60**	**0.070***	**-11084.89**	**0.017**
F_Income/ Nprofit	1475.68	0.455	1838.62	0.359	-1410.73	0.06	**4304.58**	**0.000***	-521.09	0.782
Other Expenses from Operating	-0.123	0.368	**1.008**	**0.000***	0.002	0.976	**0.572**	**0.000***	-0.208	0.112
Other Income from Operating	0.043	0.749	**1.075**	**0.000***	-0.039	0.446	**0.557**	**0.000***	-0.162	0.204
Current Ratio	0.051	0.706	**-0.994**	**0.000***	**0.106**	**0.038**	0.053	0.464	0.106	0.407
Acid-Test Ratio	0.053	0.575	**-0.699**	**0.000***	**0.104**	**0.004**	0.043	0.397	0.014	0.873
Cash Ratio	0.036	0.44	**-0.118**	**0.014**	0.010	0.577	0.020	0.439	**0.146**	**0.001**
Total Debt Ratio	**0.041**	**0.002**	0.081	**0.000***	0.004	0.437	-0.008	0.247	**-0.023**	**0.063***
Currency Risk	**0.266**	**0.000***	**0.140**	**0.017**	-0.007	0.735	0.043	0.163	-0.065	0.235
TobinQ	-0.040	0.874	0.338	0.188	0.001	0.993	-0.007	0.957	**1.014**	**0.000***

Significance levels: 0.01***, 0.05**, 0.10*

Breusch Pagan LM Test Results

It is used to decide the appropriate model between Classical Model and Random Effects Model.

H0: Classical model is valid.

H1: Random Effects Model is valid.

Appendix 2: Breusch Pagan LM Test Results

	Derivatives Usage		Firm Size		Firm's Age		GDP		Pandemic	
Dependent Variables	**Coefficient**	**P value**	**Coefficient**	**P value**	**Coefficient**	**P value**	**Coefficient**	**P value**	**Coefficient**	**P value**
ROA	-0.005	0.501	-0.002	0.691	0.000	0.534	**0.018**	**0.000*****	**0.012**	**0.026****
ROE	-1183.3	0.222	371.3	0.151	-29.49	0.229	-277.12	0.641	-385.56	0.64
F_Costs/ Nprofit	**7631.21**	**0.075***	-581.16	0.679	147.1	0.35	**5981.0**	**0.005****	**-8474.6**	**0.005****
F_Income/ Nprofit	252.63	0.858	-80.07	0.832	8.907	0.803	**3483.65**	**0.000*****	**-2776.20**	**0.021****
Other Expenses from Operating	-0.138	0.296	**1.050**	**0.000*****	-0.003	0.718	**0.567**	**0.000*****	**-0.221**	**0.013****
Other Income from Operating	0.002	0.987	**0.935**	**0.000*****	0.003	0.703	**0.555**	**0.000*****	**-0.180**	**0.039****
Current Ratio	0.074	0.583	**-0.629**	**0.000*****	0.023	0.122	0.034	0.589	0.092	0.334
Acid-Test Ratio	0.066	0.48	**-0.414**	**0.000*****	0.013	0.216	0.053	0.235	0.062	0.351
Cash Ratio	0.039	0.398	**-0.062**	**0.034****	0.000	0.988	0.014	0.529	**0.137**	**0.000*****
Total Debt Ratio	**0.039**	**0.003****	**0.078**	**0.000*****	-0.002	0.273	-0.001	0.819	-0.007	0.469
Currency Risk	**0.226**	**0.000*****	**0.085**	**0.010****	-0.007	0.133	**0.059**	**0.026****	-0.033	0.393
TobinQ	-0.052	0.835	-0.048	0.734	-0.010	0.634	0.112	0.336	**1.266**	**0.000*****

Significance levels: 0.01***, 0.05**, 0.10*

Hausman Test Results

The Hausman test is used to decide which is the appropriate model between the Fixed Effects Model and the Random Effects Model.

H0: Random Effects Model is valid.

H1: Fixed Effects Model is valid.

Appendix 3: Hausman Test Results

Dependent Variables	Chi Square	Probability
ROA	0.69	0.7075
ROE	0.87	0.8323
FCosts/Nprofit	0.03	0.8713
FIncome/Nprofit	1.8	0.4064
Other Expenses from Operating	0.24	0.8851
Other Income from Operating	**3.56**	**0.0593***
Current Ratio	2.16	0.1418
Acid-Test Ratio	1.69	0.4305
Cash Ratio	2.75	0.2523
Total Debt Ratio	**22.89**	**0.000***
Currency Risk	-0.27	Numberless

Significance levels: 0.01***, 0.05**, 0.10*

Fixed Effects Model Assumption Tests

Heteroscedasticity Test in the Fixed Effects Model

Modified Wald Test

*Ho: The variances are constant according to the units

*H1: The variances are variable according to the units

Autocorrelation Tests in the Fixed Effects Model

Bhargava, Franzini, Narendranathan's Durbin-Watson and Baltagi-Wu test;

*Ho: There is no Autocorrelation

*H1: There is an Autocorrelation

Durbin Watson critical values for 1%, 5% and 10% significance levels, respectively, are 1.232, 1.625, 2.269; if the test result is lower than this critical value, H0 is rejected; means that there is autocorrelation.

Appendix 4: Fixed Effects Model Assumption Test Results

Model	Heteroscedasticity		Autocorrelation Tests		
	X^2		F (27,576)	Modif. D-W	Baltagi Wu LBI
Current Ratio	**63798.82**	**(0.000)*****	4.82	**0.7430***	0.9163
Currency Risk	**85648.27**	**(0.000)*****	5.65	**0.6797***	0.8959

Significance levels: 0.01***, 0.05**, 0.10*

Random Effects Model Assumption Tests

Heteroscedasticity Test in the Random Effects Model

Levene, Brown and Forsythe Tests

*Ho: The Variances are Constant According to the Units

*H1: The Variances are Variable According to the Units

Autocorrelation Test in the Random Effects Model

Bhargava, Franzini, Narendranathan's Durbin-Watson test

*Ho: There is No Autocorrelation

*H1: There is an Autocorrelation

Appendix 5: Random Effects Model Assumption Tests

Model	Heteroscedasticity (the same result was obtained in all models)		Autocorrelation	
	W0 (27,605)		Modif. D-W	Baltagi Wu LBI
ROA	5.413117	(0.000)***	1.13458***	1.36278
F_Costs/Netprofit	5.413117	(0.000)***	1.62891*	1.87346
F_Income/Netprofit	5.413117	(0.000)***	1.5984**	2.3630
Other Expenses from Operating Activities	5.413117	(0.000)***	0.8039***	1.6002
Other Income from Operating Activities	5.413117	(0.000)***	0.8689***	1.5474
Current Ratio	5.413117	(0.000)***	0.7430***	0.9163
Acid-Test Ratio	5.413117	(0.000)***	0.9983***	1.1418
Cash Ratio	5.413117	(0.000)***	0.7168***	0.9175
Total Debt Ratio	5.413117	(0.000)***	0.3958***	0.6067
Currency Ratio	5.413117	(0.000)***	0.6788***	0.8928
Tobin Q	5.413117	(0.000)***	0.6898***	1.3958

Significance levels: 0.01***, 0.05**, 0.10*

Unit Root Tests for Dependent Variables

> *Philips-Perron Unit Root Test Hypotheses*
>
> *Ho: There are unit roots in series.
>
> *H1: The series is stationary.
>
> *Im, Pesaran, Shin Unit Root Test Hypotheses*
>
> *Ho: All series are unit rooted (not stationary.)
>
> *H1: Some series are stationary.
>
> *Levin, Lin, Chu Unit Root Test Hypotheses*
>
> *Ho: The series is not stationary, there is a unit root.
>
> *H1: The series is stationary.

Appendix 6: Unit Root Tests for Dependent Variables

Dependent Variables	Philips-Perron Fisher Panel PP Unit Root Test Results		Im Pesaran, Shin Unit Root Test Results		Levin, Lin, Chu Unit Root Test Results	
	Constant	**Constant and Trend**	**Constant**	**Constant and Trend**	**Constant**	**Constant and Trend**
ROA	111.540 (0.000)****	169.177 (0.000)***	-2.72669 (0.0032)***	-1.94837 (0.0257)***	-1.37470 (0.0846)*	0.05841 (0.5233)
ROE	368.573 (0.000)****	406.659 (0.000)***	-2.63125 (0.0043)***	-2.14159 (0.0161)***	-1.12371 (0.1306)	-0.31448 (0.3766)
F_Costs/Nprofit	105.847 (0.000)***	166.299 (0.000)***	-0.14960 (0.4405)	-4.59285 (0.000)***	-1.71822 (0.0429)***	-4.54231 (0.000)***
F_Income/Nprofit	103.423 (0.0001)***	224.046 (0.000)***	0.50367 (0.6928)	-3.86599 (0.0001)***	-0.83826 (0.2009)	-3.66151 (0.0001)***
Other Expenses from Operating	751.013 (0.000)***	726.708 (0.000)***	-14.9222 (0.000)***	-14.2458 (0.000)***	-18.4413 (0.000)***	-19.4717 (0.000)***
Other Income from Operating	478.312 (0.000)***	494.444 (0.000)***	-15.5981 (0.000)***	-14.5786 (0.000)***	-26.1338 (0.000)***	-24.4997 (0.000)***
Current Ratio	125.686 (0.000)***	93.5913 (0.000)***	-4.60940 (0.000)***	-1.93256 (0.0266)***	-4.40922 (0.000)***	-1.96370 (0.0248)***
Acid-Test Ratio	86.1418 (0.0059)***	108.811 (0.000)***	-3.61909 (0.0001)***	-2.89597 (0.0019)***	-3.86120 (0.0001)***	-1.86711 (0.0309)***
Cash Ratio	162.995 (0.000)***	124.931 (0.000)***	-4.80389 (0.000)***	-3.93260 (0.000)***	-2.95532 (0.0016)***	-4.42778 (0.000)***
Total Debt Ratio	75.2422 (0.0441)***	94.7568 (0.0009)***	-1.03765 (0.1497)	-1.90057 (0.0287)***	-1.50994 (0.0655)**	-0.96926 (0.1662)
Currency Risk	139.972 (0.000)***	127.614 (0.0000)***	-4.30957 (0.000)***	-4.65335 (0.000)***	-2.32685 (0.0100)***	4.14782 (0.000)***
TobinQ	57.5825 (0.4164)	60.3077 (0.3229)	-0.28721 (0.3870)	-1.43663 (0.0754)**	1.99254 (0.9768)	-0.59274 (0.2767)

Significance levels: 0.01***, 0.05**, 0.10*

Unit Root Tests for Control Variables

Appendix 7: Unit Root Tests for Control Variables

Control Variable	Philips-Perron Fisher Panel PP Unit Root Test Results		Im Pesaran, Shin Unit Root Test Results		Levin, Lin, Chu Unit Root Test Results	
	Constant	**Constant and Trend**	**Constant**	**Constant and Trend**	**Constant**	**Constant and Trend**
Firm Size	12.8621 (1.000)	71.5638 (0.0786)*	14.0911 (1.000)	4.35397 (1.000)	9.16623 (1.000)	4.08392 (1.000)
Firm's Age	4.20631 (1.000)	625.446 (0.000)***			-2.19454 (0.0141)***	-26.8507 (0.000)***
GDP	596.558 (0.000)***	7374.94 (0.000)***	13.4990 (1.000)	10.6299 (1.000)	38.2152 (1.000)	211.507 (1.000)

Significance levels: 0.01***, 0.05**, 0.10*