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An Empirical Investigation in Turkish Mobile Network Market

Türk Mobil Ağ Pazarında Ampirik Bir Araştırma

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Abstract

The purpose of this study is to investigate the impacts of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues. In this study, the effects of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues are tested by using Generalized Method of Moments. The data cover the period of 2010:01-2019:03 (quarterly) for Turkish mobile network market. The Turkish mobile network market is dominated by the three major firms Turkcell, Vodafone, and Avea. According to findings of this study, the most efficient variable that affects net sales revenues is the total mobile data traffic in Turkcell. However, the most efficient variable that affects net sales revenues is the number of total subscribers in Vodafone and Avea. While the number of total subscribers does not have a statistically significant effect on net sales revenues in Turkcell, does significant effect on net sales revenues in Vodafone and Avea. Also, total mobile data traffic does not have effect on the net sales revenues in Avea, but others.

Keywords: Mobile market, net sales revenues, GMM

Öz

Bu çalışmanın amacı, toplam abone sayısı, net yatırım, mobil veri trafiği ve mobil numara taşınabilirliğinin net satış gelirleri üzerindeki etkilerini incelemektir. Bu çalışmada, toplam abone sayısı, net yatırım, mobil veri trafiği ve mobil numara taşınabilirliğinin net satış gelirleri üzerindeki etkileri, Genelleştirilmiş Momentler Yöntemi kullanılarak test edilmiştir. Veriler, Türk mobil ağ pazarı için 2010:01-2019:03 (çeyreklik) dönemini kapsamaktadır. Türk mobil ağ pazarı, Turkcell, Vodafone ve Avea'nın üç büyük firması tarafından domine edilmektedir. Bu çalışmanın bulgularına göre, net satış gelirleri üzerinde en etkili değişken Turkcell'de toplam mobil veri trafiğidir. Ancak, net satış gelirleri üzerinde en etkili değişken Vodafone ve Avea'da toplam abone sayısıdır. Turkcell'de toplam abone sayısının net satış gelirleri üzerinde istatistiksel olarak anlamlı bir etkisi yokken, Vodafone ve Avea'da net satış gelirleri üzerinde anlamlı bir etkisi vardır. Ayrıca, Avea'da toplam mobil veri trafiğinin net satış gelirleri üzerinde bir etkisi yoktur, ancak diğerlerinde vardır.

Anahtar Kelimeler: Mobil piyasası, net satış gelirleri, GMM.

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Introduction

In the electronic communications sector, there are strong competitors with rapidly changing infrastructure possibilities, constantly growing economic structures and increasing service diversity along with the developing technology. However, it is observed that the market structures of the organizations operating within the sector have an oligopolistic structure and their concentration levels are high (Durukan & Hamurcu, 2009, p.76; Yıldız, 2012, p.46). Especially in the 1990s, with the spread of 2G, countries started to allow companies to enter the mobile market in order to increase competition between operators. Its oligopolistic structure (as a result of the presence of a small number of operators) has brought some problems in this mobile telecommunications market. The most important issues were obstacles for companies to enter and exit the market, missing information, cost of changing numbers and incomplete competition (Narin & Genç, 2016, p. 93). In addition, the oligopolistic structure creates serious problems for new companies to enter the market due to high market entry and exit costs, significant cost advantages of existing companies in the sector, benefit from economies of scale and product differentiation (Santos, 2011, p. 10). Despite, the above-mentioned problems in the mobile technology market, it is worth noting that there is a serious increase in the number of mobile subscribers. The number of mobile subscribers in the world, which was 962 million in 2001, increased to 8,304 billion in 2019, and the penetration rate of technology increased from 15.5% to 108% (ITU, 2020). In addition, broadband mobile connections starting with 3G have contributed to the spread of the internet by providing fast internet access with the usage of mobile technologies, and as a result, the need for spectrum required for high speed connections such as 4.5G and 5G (in the near future) has increased. Thus, the competition between companies around the world has accelerated and new firms have started to form in the market.

The mobile telecommunications services in Turkey began in 1994 with the establishment of Turkcell and Telsim. The licensing of Turkcell and Telsim became possible as a result of the legislative changes. Thus, concession agreements were signed between the Ministry of Transport and Turkcell and Telsim on April 27, 1998. While there were 175 thousand subscribers in 1994, the number of mobile subscribers started to increase rapidly after 1998 due to impacts such as rise of competition in the market and the price decrease in telephone devices (Atiyas & Doğan, 2007, p. 505). By the end of 2020, the number of subscribers reached 73,639,261. During the period when there were two companies in the market, Turkcell was the dominant firm. With the number of subscribers, Turkcell's market share decreased from 78% in 1994 to around 46% in 2015. With the entrance of Aria and Aycell to the market after 2000, the two-firm duopoly market has left its place to the four-firm oligopoly market. However, the formation of competition in this market has been prevented due to reasons such as the late market entry of Aria and Aycell, the lack of applications that can facilitate new market entry, and the defects in the national freedom of movement regulations. In 2004, with the merger of Aria and Aycell under the name Avea, the mobile telecommunications market with three companies was formed (Atiyas & Doğan, 2007, p. 507).

In recent years, Turkey's mobile communications market led by Turkcell, Vodafone and Turk Telekom. These three companies have a very high penetration rate in terms of both individual and corporate users. Considering the high number of subscribers, the importance of the direct or indirect effects of this market on the country's economy is easily comprehensible. The taxation made on the income of these three GSM operators, their employment creation effects and their interactions with other sectors are only a part of their contribution to the economy.

Turkcell has always been the market leader in the Turkish telecommunications market. However, while Turkcell's market share was 75.58% in 2018, it decreased to 41.28% in 2019. This situation raises the following questions; telecommunications firms whether there is a variation in revenue in Turkey, what are the main factors affecting revenue in the company. Fig.1 shows the number of subscribers of total and Mobile Network Operators in Turkey.

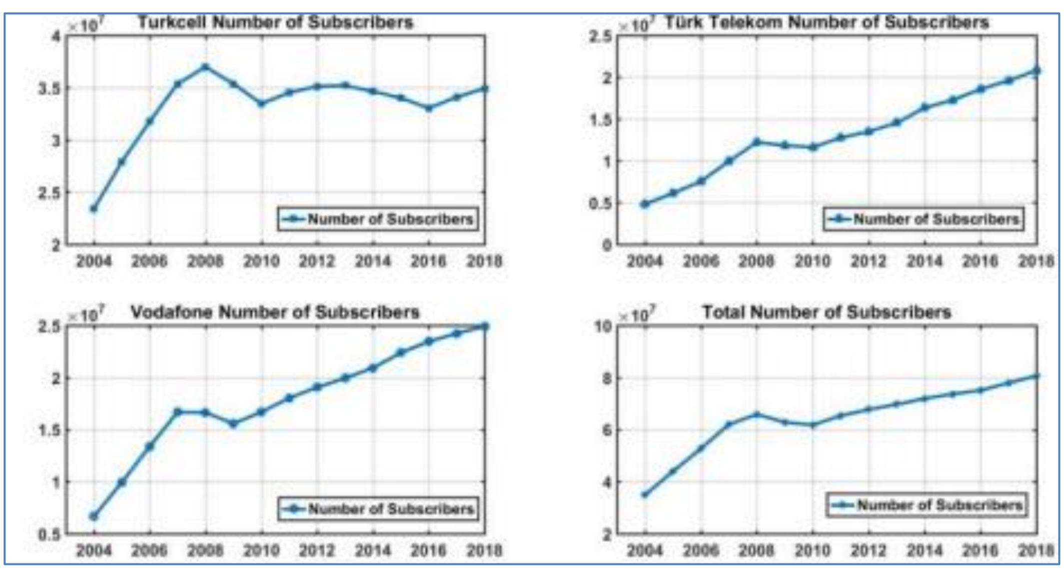

Figure 2.

The number of subscribers (Sources: Önal et. al (2019))

In 2018, the total number of subscribers in Turkey reached 80,117,999. This represented a 3% increase compared to the figures in 2017, as depicted in Fig. 1. Notably, Turkcell consistently maintains a dominant position in the market. In terms of market share based on the number of subscribers in 2018, the distribution is as follows: Vodafone at 31%, Turkcell at 42.1%, and Turk Telekom at 26.9%. Additionally, when considering the distribution of total revenues for the same year, it is allocated as follows: Vodafone holds 35.6%, Turkcell with 42.4%, and Turk Telekom with 22% (Önal, 2019, p. 44).

However, in empirical literature the factors such as; GDP and telecommunications investments, growth and efficiency in telecommunications investments, economic growth and increase in per capita GDP, economic growth with the telecommunications industry, and also growth in industrial production and an increase in the number of phones per person in the urban area have been determined that there is a positive relationship among them (Cronin et al., 1991, Cronin et al., 1993; Kurt, 2007; Güvel & Aytun, 2013; Schreyer, 2000; Pohjola, 2002; Nasab & Aghaei, 2009; Madden & Savage, 1998; Brock & Sutherland, 2000).

The study that attracts attention in the literature is the study of Kaynak & Koç (2021). Their paper aims to identify the most effective pricing strategy among mobile operators in the Turkish mobile telecommunications market. The analysis presented here represents one of the initial studies examining price competition in the Turkish mobile market using game theory. Differing from most other studies, they estimate the payoff or demand function of three oligopolistic competitors using the Autoregressive Distributed Lag approach. Under the assumption of complete information in a noncooperative static game, they investigate the normal form game and the new game cube. Their findings indicate that, regardless of the movements of other mobile operators, a price reduction strategy emerges as the best response for each operator, resulting in a pure strategy Nash equilibrium. Furthermore, the prices set by each operator are lower than before, potentially leading to a long-term price war. As a result, they recommend that mobile operators consider investing in their technological infrastructure to enhance service quality or explore discrimination strategies as a means of gaining a competitive advantage.

In this context, unlike the literature, this study investigates the effects of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues for three major firms Turkcell, Vodafone, and Avea in Turkey. This study delves into the inquiry of identifying the factors that impact firms' revenue. In this study, the effects of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues are tested by using Generelized Method of Moments. The study is organized as follows. The data and methodology are described in Section 2. Empirical findings are given in Section 3 and the conclusion is presented in Section 4.

Data and metholodgy

Data

In this study, the effects of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues are analyzed by using Generalized Method of Moments (GMM) for mobile network providers in Turkey. The Turkish mobile network market is dominated by the three major firms Turkcell, Vodafone, and Avea. In the study, the effects of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues are tested for Turkcell, Vodafone, and Avea, individually. The data used in the study are quarterly and cover the period of 2010:01-2019:03. All the data obtained from The Information and Communication Technologies Authority (ICTA) (Turkey). The details of variables are summarized in Table 1 (See Table 1 in Appendix).

Methodology

This paper first examines breakpoint estimation using the endogenous break unit root test of Perron (1989), Perron and Vogelsang (1992), and Vogelsang and Perron (1998), for all variables. Then the paper compares the performances of the factors that affect the net sales revenues for Turkcell, Vodafone, and Avea by using GMM. The generalized method of moments (GMM) , introduced by Hansen (1982), has become an increasingly significant method for estimation in econometrics. The GMM method acknowledges for the estimation of statistical models with a consistent and asymptotically normal distribution. Also, autocorrelation and heteroskedasticity problems that may arise in a model, can be eliminated with the GMM method.

In contrast to the widely used econometric tests, the GMM test has significant advantages. The GMM method estimates simultaneous system of equations by adapting the estimator's covariance matrix. Thus, it eliminates possible endogenous and exogenous problems. In the process, lags of variables in the system or outside of the system can be determined externally, and lags of variables can be used as instrumental variables. To estimate a regression equation under the Least Squares (OLS) method, the model must be linear in terms of coefficients. In the GMM method, the regression model does not have to be linear. The GMM method enables equation estimations without applying linearization techniques and losing valuable information in the process. The GMM method has the same characteristics as instrumental variable estimators, especially under conditions of uncertainty. As in the GMM method, as in the OLS method, there is no relationship between the independent variables and error terms (Gan & Yu, 2009, p. 69). Compared to the GMM method, the maximum likelihood (ML) method assumes that the probability distribution of the statistical population is determined. In contrast, the GMM method considers the statistical population moment conditions that do not need to determine the probability distribution of the statistical population. Especially in nonlinear models, (ML) method restricts the distribution of data, and if the assumed distribution is not correct, the estimators of the ML method gives inconsistent results. At this stage, it is recommended to use the GMM method instead. The GMM method makes parameter estimates based on information derived from the base model. The GMM method uses each observation and calculation by adapting the estimator's covariance matrix. Adaptation for the covariance matrix is not only to determine the direction of the moving average of error terms but also to identify the variance problem (Hansen & West (2002)).

The models estimated in this study by GMM are of the following forms:

$$LT1_t=\beta_0+ \beta_1 LT2_t+ \beta_2 LT3_t+\beta_3 T4_t+\beta_4 LT5_t+u_t \quad (1)$$

$$LV1_t=\partial_0+ \partial_1 LV2_t+ \partial_2 LV3_t+\partial_3 V4_t+\partial_4 LV5_t+\varepsilon_t \quad (2)$$

$$LA1_t=\varphi_0+ \varphi_1 LA2_t+ \varphi_2 LA3_t+\varphi_3 A4_t+\varphi_4 LA5_t+\varphi_t \quad (3)$$

where β_0, ∂_0, and φ_0 are constant terms, β_1, β_2, β_3, β_4, ∂_1, ∂_2, ∂_3, ∂_4, φ_1, φ_2, φ_3, and φ_4 coefficients of related variables of Model 1, 2, and 3, separately. u_t, ε_t, and φ_t are random-error terms of models.

Empirical findings

Table 2 (See Table 2 in Appendix) gives the descriptive statistics of all series. As seen in the table, from 2010 to 2019, mean values of net sales revenues of Turkcell, Vodafone, and Avea are 21.66, 21.31, and 20.88, respectively. When both descriptive statistics are analyzed, it is understood that the maximum net sales revenues of Turkcell are 22.16, Vodafone is 21.98 and Avea is 21.57 in 2019:03. The minimum values of net sales revenues are 21.39 in 2010:04, 20.44 in 2010:01, 20.28 in 2010:02 for Turkcell, Vodafone, and Avea, respectively. Turkcell has always maintained its leadership in the electronic communications industry, which includes Turkcell, Vodafone and Avea. While the market share of Turkcell was 755.83% in 2008, it decreased to 41.28% in 2019.

The statistics that draw attention to the results given below contained the mobile number portability. As can be seen in Table 2, the average value of the mobile number portability of Turkcell is -270.3364. It received the highest value in 2017:02, and the lowest value in 2018:04. The average value of Vodafone 's mobile number portability is 95.12. It received the highest value 2010:01, and the lowest value is in 2014:01. If the number of Avea's mobile number portability is examined, the average value is found as173,732. Avea's mobile number portability received the highest value compared to Turkcell and Vodafone. Avea's mobile number portability takes on its highest value in the first period of 2014 and on its lowest value in the second period of 2017. Avea received the highest value in 2014:01, and the lowest value in 2017:02. Also, Turkcell has the maximum value of total mobile data traffic.

We follow the basic framework outlined in Perron (1989), Perron and Vogelsang (1992), and Vogelsang and Perron (1998). Following Perron (1989), Perron and Vogelsang (1992), and Vogelsang and Perron (1998), we consider four main models for data with a one-time break. Table 3 (See Table 3 in Appendix) shows the results of breakpoint unit-root test. As seen from Table 3, all variables were found to be stationary in their levels at least 10% significance level, except LV1, LV2, LA2. Break dates are reported in parenthesis.

Also, the KPSS unit root test was applied for the level of all variables. Table 4 (See Table 4 in Appendix) presents the results of the KPSS test statistics. According to the results of the KPSS unit root test, all variables were found to be stationary in their levels at 1% significance level.

Table 5 (See Table 5 in Appendix) presents the results of Model 1,2, and 3 using GMM. In all the estimated equations, the null hypothesis that the overidentifying restrictions are orthogonal to the error terms cannot be rejected by the estimated J-statistic. The set of instruments includes different lags of the total subscribers, the net investment, the mobile data traffic, the mobile number portability, and the net sales revenues. The J -statistic is the Hansen (1982) statistic for testing the null hypothesis that the over-identifying restrictions are valid. All the values reported in parenthesis are the Newey-West (1987) robust standard errors. The values reported in square brackets are the marginal levels of significance.

As seen from Model 1, the estimated coefficients of LT2, LT3, T4, and LT5 are -0.29, 0.04, -0.000146, and 1.46, respectively. The coefficients are statistically significant at least 10% level, except LT2. The elasticity coefficient of net investment of Turkcell implies that net sales revenues of Turkcell increases (decreases) by 0.4 percent if the net investment of Turkcell increases (decreases) by 10 percent. The elasticity coefficient of total mobile data traffic of Turkcell implies that net sales revenues of Turkcell increases (decreases) by 14.6 percent if total mobile data traffic of Turkcell increases (decreases) by 10 percent. Since in Model 1, the dependent variable is in logarithm form, and the independent variable (T4) is in level (or original) form. Therefore, the estimated elasticity coefficient of T4 is calculated as 0.0395 ("β" _"3" x(T4)̅). If Turkcell mobile number portability increases (decreases) by 10 percent, net sales revenues of Turkcell inc¬reases (decreases) by 0.4 percent.

In Model 2, the estimated coefficients of LV2, LV3, V4, and LV5 are 3.67, 0.01, 0.000108, and -0.23, respectively. The coefficients are statistically sig-nificant at 1% level, except net investment of Vodafone. The coefficient of net investment of Vodafone is are statistically significant at 10% level. The elasticity coefficient of the number of Vodafone total subscribers is 3.67. According to this coefficient, when the number of Vodafone total subscribers increases (decreases) by 10 percent, net sales revenues of Vodafone increases (decreases) by 36.7 percent. If the net investment of Vodafone increases (decreases) by 10 percent, net sales revenues of Vodafone increases (decreases) by 0.1 percent. As the same as Model 1, the dependent variable is in logarithm form, and the independent variable (V4) is in the level (or original) form in Model 2, and the estimated elasticity coefficient of V4 is calculated as 0.0102 (∂_"3" x(V4)̅). If net sales revenues of Vodafone increases (decreases) by 0.1 percent, Turkcell mobile number portability increases (decreases) by 10 percent. However, the estimated coefficient sign of total mobile data traffic of Vodafone is negative. As total mobile data traffic of Vodafone increases (decreases) by 10 percent, net sales revenues of Vodafone decreases (increases) by 2.3 percent.

According to findings of Model 3, the estimated coefficients of LA2, LA3, A4, and LA5 are 1.40, -0.02, -0.000122, and 0.18, respectively. The coefficients are statistically significant at least 10% level, except total mobile data traffic of Avea. If net sales revenues of Avea increases (decreases) by 14 percent, the number of Avea total subscribers increases (decreases) by 10 percent. When net investment of Avea increases (decreases) by 10 percent, net sales revenues of Avea decreases (increases) by 0.2 percent. The estimated elasticity coefficient of A4 is calculated as -0.02 (ϕ_"3" x(A4)̅). If net sales revenues of Avea decreases (inc¬reases) by 0.2 percent, Avea mobile number portability increases (decreases) by 10 percent.

Conclusions

In this study, the effects of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues are analyzed by using Generalized Method of Moments (GMM) for mobile network providers in Turkey. The Turkish mobile network market include the three major firms Turkcell, Vodafone, and Avea. In the study, the effects of total subscribers, net investment, mobile data traffic, and mobile number portability on the net sales revenues are tested for Turkcell, Vodafone, and Avea, individually. The data used in the study are quarterly and cover the period of 2010:01-2019:03.

This paper first tests breakpoint estimation using breakpoint unit root test for all variables. Then the paper analysises the performances of the factors that affect the net sales revenues for Turkcell, Vodafone, and Avea by using GMM. The generalized method of moments (GMM), introduced by Hansen (1982), has become an increasingly significant method for estimation in econometrics.

According to the findings of this study, the most efficient variable that affects net sales revenues is the total mobile data traffic in Turkcell. However, the most efficient variable that affects net sales revenues is the number of total subscribers in Vodafone and Avea. While the number of total subscribers does not have a statistically significant effect on net sales revenues in Turkcell, does significant effect on net sales revenues in Vodafone and Avea. Also, total mobile data traffic does not have effect on the net sales revenues in Avea, but others. These findings contribute to the growing body of research on the telecommunications industry. While our study focused on the Turkish market and these specific variables, future research can expand upon these findings and explore further factors that may affect net sales revenues in this dynamic sector. Our analysis underscores the importance of tailoring strategies to the unique characteristics of individual providers and markets within the telecommunications industry.

These findings contribute to the existing body of literature in several meaningful ways. Firstly, they provide valuable insights into the dynamics of the Turkish mobile telecommunications market, which is a significant and evolving sector. Understanding the specific factors that impact net sales revenues for major providers like Turkcell, Vodafone, and Avea is crucial for both industry stakeholders and policymakers.

Secondly, our research underscores the need for tailored strategies within the telecommunications industry. The fact that the most influential variable differs among these providers highlights the importance of customization in business strategies. For Turkcell, it's the total mobile data traffic that significantly affects net sales revenues, whereas Vodafone and Avea benefit more from an increased number of total subscribers. This insight can guide providers in optimizing their marketing, investment, and network expansion strategies.

Additionally, our study contributes to the broader literature on econometric methods, specifically the application of the Generalized Method of Moments (GMM) in estimating relationships within the telecommunications sector. By successfully using GMM, we demonstrate its effectiveness as a method for analyzing the dynamic relationships between variables in this context. Researchers in the field of econometrics can find value in this methodological contribution.

In conclusion, our research extends the understanding of the Turkish mobile telecommunications market while highlighting the importance of personalized strategies in this industry. Furthermore, it showcases the efficacy of the GMM methodology for studying similar economic phenomena. These contributions collectively enrich the scholarly discourse on the telecommunications sector, providing a foundation for further research, strategic decision-making, and policy development.

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APPENDIX

Table 1

The Details of Variables

The Descriptions of Variables	Abbreviations
Net Sales Revenues of Turkcell	LT1
The number of Turkcell Total Subscribers	LT2
Net Investment of Turkcell	LT3
Turkcell Mobile Number Portability	T4
Total Mobile Data Traffic of Turkcell	LT5
Net Sales Revenues of Vodafone	LV1
The number of Vodafone Total Subscriber	LV2
Net Investment of Vodafone	LV3
Vodafone Mobile Number Portability	V4
Total Mobile Data Traffic of Vodafone	LV5
Net Sales Revenues of Avea	LA1
The number of Avea Total Subscribers	LA2
Net Investment of Avea	LA3
Avea Mobile Number Portability	A4
Total Mobile Data Traffic of Avea	LA5

Note: L represents logarithm. Before starting the analysis, all variables were seasonally adjusted by using the Census X12 method, except V4.

Table 2
Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev	J-B
LT1	21.6614	22.157	21.3839	0.2185	3.8521
LT2	3.5321	3.5610	3.4833	0.0200	4.0896
LT3	19.7888	21.9966	18.7434	0.6776	12.4948***
T4	-270.3364	43.3833	-513.4203	135.3377	1.1714
LT5	3.0022	3.2166	2.6064	0.1640	2.2839
LV1	21.3121	21.9770	20.4387	0.4628	2.5175
LV2	3.0367	3.2439	2.7573	0.1447	2.5824
LV3	19.2700	21.8290	18.0983	0.5821	124.6538***
V4	95.1282	435.000	-119.000	114.6962	3.1448
LV5	2.8340	3.1899	2.1993	0.3082	3.7987
LA1	20.8801	21.5731	20.2757	0.3773	2.2000
LA2	2.7718	3.3178	2.4362	0.2238	1.1963
LA3	19.3196	21.2955	18.0817	0.5644	18.5688***
A4	173.7374	605.7710	-18.1760	125.2711	18.1943***
LA5	2.5660	2.9986	1.9557	0.3436	3.6209

Note: An *** indicates statistical significance at the 1 percent level. J-B is Jarque-Bera statistics.

Table 3
The Results of Breakpoint Unit-Root Test

	Intercept	Trend and Intercept		
		Intercept	*Trend and Intercept*	*Trend*
LT1	-0.3599	-3.9043	-4.7364	-4.8306** (2016:02)
LT2	-4.2397*** (2015:03)	-4.3531	-4.5756	-2.7747
LT3	-4.9461** (2015:04)	-7.3420*** (2015:04)	-7.3481*** (2015:04)	-5.4392*** (2018:04)
T4	-5.1111*** (2016:02)	-5.3334** (2016:02)	-4.7738	-3.5793
LT5	-5.1949*** (2014:01)	-4.2540	-4.1492	-4.1070
LV1	-3.1143	-3.5384	-3.4443	-3.2359
LV2	-3.6659	-2.6575	-3.7933	-3.7164
LV3	-5.6565*** (2013:04)	-5.6849*** (2014:01)	-5.6921** (2013:04)	-5.2679*** (2016:01)
V4	-4.6273** (2015:02)	-4.9364** (2014:01)	-5.0839* (2014:01)	-4.4889* (2011:03)
LV5	-6.8566*** (2010:04)	-2.7746	-4.4321	-3.5871
LA1	-0.4513	-7.5987*** (2013:02)	-7.7994*** (2013:02)	-4.5988 (2014:04)
LA2	-0.2097	-2.0337	-2.0282	-2.0229
LA3	-5.0900*** (2015:04)	-5.0538** (2015:04)	-4.9735* (2015:03)	-4.1070
A4	-5.3700*** (2014:01)	-4.5324	-5.3300** (2014:01)	-3.6626
LA5	-3.9061	-2.3356	-4.4994	-6.0856*** (2016:4)

Note: An ***, ** and * indicates statistical significance at the 1, 5 and 10 percent levels, respectively

Table 4
The Results of KPSS

	Intercept	*Intercept and Trend*
LT1	0.7183***	0.2134
LT2	0.1328***	0.0913***
LT3	0.7596	0.0718
T4	0.1832***	0.0644***
LT5	0.7309	0.1075***
LV1	0.7645	0.1757***
LV2	0.7711	0.0752***
LV3	0.4192***	0.0582***
V4	0.0809***	0.0838***
LV5	0.7398	0.1799***
LA1	0.7645	0.1757**
LA2	0.7711	0.0752***
LA3	0.4192**	0.0582***
A4	0.0810***	0.0838***
LA5	0.7398	0.1799***

Note: An *** indicates statistical significance at the 1 percent levels.

Table 5
GMM Estimates of Model 1, 2, and 3

	Model 1	Model 2	Model 3
Variable	LT1	LV1	LA1
C	17.39867*** (1.2828)	10.61187*** (0.2538)	16.87135*** (0.2931)
LT2	-0.291818 (0.3332)	-	-
LT3	0.043172* (0.0226)	-	-
T4	-0.000146*** (5.25e-05)	-	-
LT5	1.455317*** (1.2997)	-	-
LV2	-	3.667504*** (0.1606)	-
LV3	-	0.010711* (0.0052)	-
V4	-	0.000108*** (3.12e-05)	-
LV5	-	-0.230106*** (0.0787)	-
LA2	-	-	1.402741*** (7.8635)
LA3	-	-	-0.017157** (0.0082)
A4	-	-	-0.000122* (6.36e-05)
LA5	-	-	0.184492 (0.1109)
$\bar{R}^2$	0.868956	0.992457	0.969630
J-Stat	7.889338 [0.9521]	8.109220 [0.8364]	8.093402 [0.8375]

Note: An ***, ** and * indicates statistical significance at the 1, 5 and 10 percent levels, respectively. $\bar{R}^2$ represents adjusted R-squared.