

Araştırma Makalesi

Rational and Irrational Dynamics of Automobile Demand in Turkey

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Abstract

The automobile, which was invented for the purpose of carrying passengers and freight, with the increase in sales, it has become an indispensable part of daily life. However, due to various factors, automobile demand fluctuated throughout the periods. This study discusses rational and irrational dynamics affecting the demand for automobiles in Turkey and it aims to analyze the effect of macroeconomic variables on automobile demand by using ARDL approach. The findings show that the most important variables affecting the demand for automobiles in Turkey are unemployment, car prices and in short term is inflation.

Keywords: Automobile Demand, Unemployment, Exchange Rate, ARDL Analysis

JEL Codes: C22, E31, L62.

Türkiye’de Otomobil Talebinin Rasyonel ve İrrasyonel Dinamikleri

Öz

Ulaşım ve taşıma ihtiyaçlarını karşılamak için icat edilen otomobil zaman içerisinde satış sayılarını artırmış ve günlük hayatın vazgeçilmezlerinden olmuştur; ancak çeşitli etkenler nedeniyle otomobil talebi dönemler boyunca dalgalı bir seyir izlemiştir. Bu çalışma Türkiye’deki otomobil talebini etkileyen rasyonel ve irrasyonel dinamikleri tartışmayı, rasyonel dinamik olarak kabul edilen makroekonomik değişkenlerin otomobil talebi üzerindeki etkisini ARDL yaklaşımıyla analiz etmeyi amaçlamaktadır. Elde edilen bulgular Türkiye’de otomobil talebini etkileyen en önemli değişkenlerin, işsizlik, otomobil fiyatları ve enflasyon olduğunu göstermektedir.

Anahtar Kelimeler: Otomobil Talebi, İşsizlik, Döviz Kuru, ARDL Analizi

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1. Introduction

Historically, the first cars were invented and developed in the late 19th century in France and Germany. Despite a lack of consensus, 1901 Mercedes classifies as the first modern car. The first diesel powered car was introduced into the market by Citroen in 1933. The major change to the market came in 1908 when Henry Ford introduced the first mass produced car. Mass production allowed economies of scale which made it possible to have a moderate price of \$650.

The diesel cars gained popularity especially in Europe. After the emission scandal of Volkswagen in 2015, the diesel cars started losing market share. Environmental issues also forced countries to ban gasoline powered and diesel powered cars by the year 2030-2050. While state constraints affect producers decision to produce, economic and social factors such as environmentalism affect consumers purchasing decision. Therefore, both production and consumption preferences are being reshaped in the automobile market. Consequently the automotive market nowadays is trying to shift from diesel and gasoline powered automobiles to hybrid and electrical automobiles.

There are several factors affecting the demand for automobiles. The reasons for the demand specific to Turkish Automotive Market have both rational and nonrational dynamics. Rational dynamics are interrelated with numerous macroeconomic variables. These variables include the price of the automobile (Alper, et al, 2000; Zeng, Schmitz and Madlener, 2018), fuel prices (Nanaki 2018) car loan interest rates (Eken et al, 2009; Özçelebi et al, 2018; Erdem and Nazlioğlu, 2013), gas prices (Önder and Akın, 2018), euro rates (Işık, et al, 2017; Karaatlı et al, 2012; Smusin and Makayeva 2009), consumer confidence index (Karaatlı, et al., 2012) inflation, unemployment, tax (Önder and Şahin, 2018), income distribution and population density. (Jetin, 2015) business cycles and many others.

Nonrational factors for Turkey, include the perception of the automobile being an investment with a positive return and liquidity as a substitute for other financial instruments. The return in an investment sense is lower than the financial instruments, however since the automobile prices are directly linked to euro rates, it provides a natural hedge against price increases. Conspicuous consumption is the second nonrational factor. The consumption of individuals are not just based on needs but also on wants. An automobile might be a necessary need for a consumer but it transforms into a want if the automobile purchased is above the corresponding income level. One reason is peer comparison which is the urge to compare yourself to your peers and purchase a similar segment automobile.

The aim of this study is to discuss the nonrational factors which are crucial in automobile purchasing decision and analyze the effects of the rational factors on Turkish automobile sales between 2005-2018. The sections of the study are as

follows. Section 2 provides information about the Turkish Automobile Market. Section 3 discusses the nonrational and rational dynamics which may have an impact on automobile sales. Nonrational dynamics are hard to quantify nonetheless can range between insignificant to somewhat significant. Section 4 summarizes the studies that analyze the determinants of automobile demand. Section 5 describes the data related to the rational dynamics used in the empirical study and presents the empirical framework. Section 6 is devoted to the presentation and discussion of the results. The last section concludes.

2. Automobile Market in Turkey

The Turkish Automotive Market is an attractive market based on sales and market share. In 2005 Turkish Market was the 8th largest market in terms of sales. In 2018 despite a fall in sales, the Turkish market was still 8th largest after Germany, UK, France, Italy, Spain, Belgium and Poland. Out of 16,110,807 automobile sales in Europe in 2018, Turkey had a market share of 3,02%. (ODD, 2019)

In 1960, per capita income in terms of 1995 purchasing power parity (PPP) was 2,500 USD in Turkey. In 2002 per-capita income increased to 6,100 USD. Vehicles per thousand population in 1960 was only four. The expected automobile ownership per thousand people in Turkey for 2017 was 212 (Piskin, 2017, p. 10). This expectation was still not met in 2018. According to TÜİK, (2019) the automobile ownership per capita in 2018 was 151. The ownership in the European Union (ACEA) is 573 automobiles. (ACEA, 2017). With an average growth of 7.7% automobile ownership has increased to 96 per thousand population. Still there is a long time needed to reach the European Union average.

Based on the projections done by Dargay, Gately and Sommer (2007) the per-capita income would increase to 14,000 USD in 2030. Vehicles per thousand population on the other hand would increase to 377, with an average growth rate of 5%. Despite this increase the automobile ownership would be the lowest among OECD North American and European countries. These projections imply that although Turkey's automobile ownership will increase by 5% compared to the OECD increase of 0.6% between 2002 and 2030, the gap will narrow but will be far off the target of matching the OECD automobile ownership averages. Turkey's vehicle per thousand population will still be 52.9% of the OECD average.

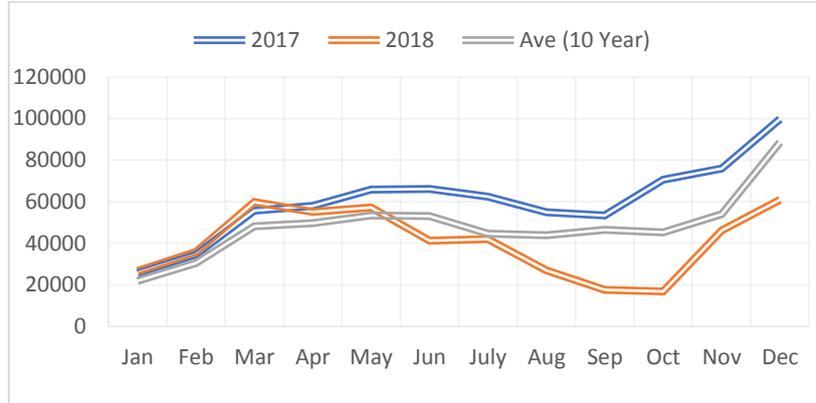


Figure 1: Turkey Total Automobile Sales

Source: Automotive Distributors's Association.

The total domestic market has been fluctuating around 500,000 to 600,000 automobiles for several years. According to Turkish Automotive Distributors Association (ODD), in 2018, passenger automobile sales went down by 32,71% in comparison to the previous year and were 486,321. In the previous year, the sales were 722,759. 10 year average for annual sales were 579,268 units. (ODD, 2019)

3. Nonrational and Rational Dynamics

Automobile sales are affected by nonrational factors as well as macroeconomic variables. Nonrational dynamics are the factors based on behavioral aspects of decision making. Rational dynamics are based in contrast on financial and economical factors.

3.1. Nonrational Dynamics

The automobile, which was invented for the purpose of carrying passengers and freight, has gained many different additional equipment with the development of technology and the needs differentiated over time. It was demanded by many people from almost all walks of society. The development of production technology and the possibility of personalization has increased the demand for differentiated products that will make individuals feel special rather than mass production.

The automobile is not merely a normal commodity. The limited production of different brands, differentiated products, led to the classification of automobiles. In 2005 the Turkish Market automobile sales had a following distribution based on segments: A segment 1%, B segment 47%, C segment 37%, D segment 12%, E segment 2% and F segment 1%. In 2018 there were minor changes in market shares for all but B and C segments. From 47% market share in 2005, the B segment dropped to 26,4%. At the same time the C segment increased it's market

share from 37% to 56,7%. Some of the increase may be due to economic factors, while the rest may be due to conspicuous consumption and peer comparison.

When individuals demand automobiles, they consider many factors instead of just meeting the need for transportation. One of the nonrational factors affecting demand is conspicuous consumption according to Veblen. As Veblen (1994, p. 29) thinks, property is becoming evidence of the power that the owner has provided to the rest of the group. Conspicuous consumption is a tool used to influence people, to message through possessions, to be accepted in society and to be included in the upper classes.

In demanding goods and services, there is a need to emulate the wealthy people, to establish privileges and social connections (Karoui, Khemakhem, 2018, p. 2). Duesenberry (1949) conceptualized the motive behind this behaviour of “keeping up with the Joneses”. The same concept applies to automobile demand. Therefore, individuals do not consider their own needs while demanding a property; they also pay attention to how their goods are perceived by their environment.

Another nonrational factors affecting the demand for automobiles in Turkey, consumers are buying an automobile for investment purposes. The logic behind treating an automobile purchase as an investment in Turkey can be difficult to grasp at first. According to the statistics issued by Fleeteurope (2017) the average depreciation rate of automobile prices globally range between 29,4% and 53,6%. It's important to note that the depreciation percentages can mask differences in performance in terms of actual money lost. In Turkey the depreciation rate was 29,5% which is the lowest after China. Certain buyers in Turkey are purchasing automobiles believing that the depreciation will not be very high since the automobile prices are directly linked to mainly Euro rates. Stated differently, European automobile buyers' highest automobile related expense is depreciation. On average a four year automobile loses 50% of its value or more. In contrast the depreciation rate in Turkey is much lower. The new automobile prices go up in line with the increase in euro. When the prices go up the secondhand automobile prices track the new automobile prices. These opposing factors lower the depreciation cost for most of the automobile buyers. Most of the time the secondhand price of an automobile would be higher than the original purchase price, making the customers believe in the notion of not losing money when they purchase a new automobile. Furthermore the depreciation of Turkish Lira against Euro increases the automobile prices every year. In practice a buyer uses a automobile for 4 years and sells it at a higher price than the purchase price.

3.2. Rational Dynamics

The effect of rational factors on determining automobile demand is higher than nonrational factors. The most important factor in effective demand for automobiles in Turkey is perhaps tax. In Turkey, there is a value added tax and a

special consumption tax. First the special consumption tax is calculated based on the basic price. Then special consumption tax and basic price is added together. The value added tax is based on the new total. This is a pyramid taxing system since one tax is based on another tax (Tepav, 2013). In addition the government classifies automobile according to their engine sizes. The private consumption tax for automobile will be between 30-60%. If the engine size is between 1,600cc and 2,000cc the tax will be between 100% and 110%. The larger engine automobiles of 2,000cc and above will be taxed 160%. (Official Gazette, 2018). If the sale price of the car is 100,000, and the engine size is less than 1,600cc, the VAT will be 18% and the private consumption tax (PCT) will be 18%. The total tax will be 34,811 TL. 34.8% of the sales price will be paid for the taxes. If the sales price goes up to 150,000TL, VAT is 18% and the PCT is 35%. The share of the total taxes go up to 37,2%. The dramatic increase in taxes start with a bigger engine size. If the engine size is between 1.600-2.000cc and the car price is 150,000TL, VAT is 18% and PCT is 100%. 57,6% of the sale price consists of taxes. Finally when the engine size is above 2,000cc and our sample price of 150,000TL is considered, the VAT is 18% and the PCT is %160. In this case the total taxes are 67,4% of the sales price. As the examples show clearly the tax issue for automobiles has the utmost importance for the demand in the market. The tax revenues originating from the new automobile sales is a great source of income for the Turkish Government.

In Turkey, where about 65% of imported automobiles sold, the exchange rate is an important determinant of demand. The exchange rate increase against Turkish Lira is a direct factor affecting the automobile prices. In developed countries the exchange rate changes are absorbed by automobile companies to a large extent and only a small percentage adversely affects the automobile prices. For instance despite an increase in Euro against USD by 15%, the price of German automobiles in USA might only go up by 2-3%. In Turkey, some brands list prices based on Euro which changes everyday. This means that there is no time lag between Turkish Lira depreciation and price increase. The other brands list prices in Turkish Lira and they reflect the effects of the depreciation in installments in couple of months. If Turkish Lira loses value against Euro by 15%, the prices of all automobiles would increase by 10-15% in a couple of months.

Unemployment has negative consequences both economically and socially. High unemployment rates lead to reduced purchasing power and uneven distribution of income. While unemployed individuals are less likely to buy new automobiles, this may not true to for the whole economy in general; the fact that the low-income group is unemployed often affects the demand for automobiles negatively. Moreover, there is a two-way relationship between unemployment and automobile demand. First, unemployment affects automobile sales, on the other hand, with reduced demand for automobiles, manufacturers employ fewer people.

Many people take into account credit accessibility and interest rates when making an automobile purchase decision. People who do not have income to buy an automobile and cannot find credit will postpone the purchase decision. Particularly, people with limited liquidity have a greater response to interest rates and changes in maturity (Attanasio et al., 2008, p. 433). In times of high interest rates, people often give up the demand for automobiles they want to buy or prefer a lower model.

4. Literature Review

Most of the studies undertaken regarding automobiles were empirical studies trying to find the factors that are influential on the demand for automobiles in several countries. A study used data of 80 countries to analyze the relationship between household expenditures, degree of urbanization, population density, gini coefficient for income inequality against passenger car ownership. The results indicate that automobile ownership is positively correlated with the level of urbanization and household expenditures but negatively correlated with unequal income distribution and population density. (Jetin, 2015)

A study which covered the years between 2000-2010 compared automobile ownership to the per capita income at an annual level. The income elasticity calculated was 1.75 which means that a 1% increase in GDP per capita leads to a higher (1.75%) increase in car ownership. (Duruiz and Erdem, 2015) A similar study by Dargay and Sommer (2007) externalized income elasticity for Turkey for the years between 2002-2030 as 1.67.

A number of studies analyzed the relation of several economic variables on auto sales. Smusin and Makayeva (2009) focused on auto sales in Ukraine, Russia and Belarus. The result of the study was a medium level relationship between auto sales and exchange rate, GDP and interest rates. The relation between passenger car sales and GDP were studied by Babatsou and Zervus (2011). There was a 0.95 linear correlation between those two variables. GDP increase definitely increases the auto sales. If the household expenditure increases, the likelihood of purchasing a auto decreases. On the other hand a general increase in national income rises the number of potential customers which leads to a rise in demand for automobile. (Alper and Mumcu, 2005)

A study undertaken in Turkey found out that the profession of the family household head, the disposable annual income of the family and the monthly expenses were statistically significant in determining the automobile sales. (Akay and Tümsel, 2015) One study used artificial neural networks to predict the forthcoming automotive sales, in this study, monthly data between January-2007 and June-2011 has been used. Gross domestic product, real sector confidence index, investment expenditures, consumer confidence index and USD exchange rate has been used as determinants of automobile demand. The results were

promising since the Mean Absolute Percentage Error (MAPE) was 16,82%. (Karaatlı, et all., 2012)

Nanaki (2018) investigated how the 2008 Financial Crisis affected the Greek automobile market. In the study of regression analysis, inflation rate, fuel prices, automobile loans and disposable income data between 2000-2016 were used. According to the results of the regression analysis, net disposable income moves with automobile sales, while it moves in the opposite direction with unemployment, inflation and fuel prices.

An econometric study made for the German Market (Zeng, Schmitz and Madlener, 2018) came with the conclusion that GDP and government incentives are important macroeconomic factors while price, gasoline consumption, quality and facelift of the cars strong predictors of auto sales at the microeconomic level. Another study analysed 13 EU countries from January 1999 to August 2010. The results of this study showed that automobile sales have a direct relationship with trade volume, interest rates and industrial production (Erdem and Nazlıoğlu, 2013).

One study concentrated on the relationship between fuel prices and demand for automobiles. The study showed that increases in gasoline prices had significantly reduced demand for automobiles, but declines had no significant effect (Kilian and Sims, 2006). Final study to be mentioned tried to find the relation between auto loans and the auto sales. Empirically the results showed that during the purchasing process auto loans play a very important role. (Eken and Çiçek, 2009).

5. Data and Methodology

This study investigates the relationship between automobile sales and independent economic variables. Monthly data were used covering the period from the January of 2005 to the December of 2018. All variables except inflation and unemployment are transformed into log form to provide that all the data are stationary. The automobile price index was formed by taking the average prices of vehicles using gasoline and diesel and weighting them according to the number of sales. All variables used in this study given in the appendix.

Our focus in this study will be the passenger automobile market. The difficulty of analyzing the passenger automobile market is due to the lack of past data of fleet automobiles and automobiles purchased based on operational leasing. The dynamics of private purchasers, operational leasers and fleet purchasers are not based on the same factors. The deciding factors for companies buying fleet cars include depreciation regulation, tax advantages and tax deductibility of expenses. For private buyers price of the automobile, cpi, unemployment and the automobile loan rates become more significant. Due to the complexity of the tax system and the daily changing fuel prices, tax rates and fuel prices are excluded from the

analysis. Our study will analyze the several factors that might affect the automobile sales using the ARDL method.

5.1. Autoregressive distributed lag (ARDL) cointegration analysis

In order to examine the relationship between automobile sales, automobile prices, cpi, loan interest and unemployment, linear natural logarithm equation is specified as following:

$$\ln SALES = \beta_0 + \beta_1 \ln price_t + \beta_2 \ln CPI_t + \beta_3 INT_t + \beta_4 UNEMP_t + \varepsilon_t \quad (1)$$

Pesaran and Shin (1995) and Pesaran et al. (2001) introduce a new method of testing for cointegration called the “Autoregressive Distributed Lag” (ARDL) approach. The ARDL estimate both the long-run and short-run relationships simultaneously in an automobile demand model. In the ARDL bounds analysis, the variables of the model are allowed to possess mixed integration (Pesaran et al, 2001)

$$\begin{aligned} \Delta \ln SALES = & \alpha_0 + \sum_{i=1}^m \beta_{1i} \Delta \ln SALES_{t-1} + \sum_{i=1}^n \beta_{2i} \Delta \ln CPI_{t-1} + \sum_{i=1}^p \beta_{3i} \Delta INT_{t-1} + \\ & \sum_{i=1}^r \beta_{4i} \Delta UNEMP_{t-1} + \sum_{i=1}^r \beta_{5i} \Delta UNEMP_{t-1} + \delta_1 \ln SALES_{t-1} + \delta_2 \ln CPI_{t-1} + \\ & \delta_3 \ln_{t-1} INT_{t-1} + \delta_4 \ln_{t-1} UNEMP_{t-1} + \varepsilon_i \end{aligned} \quad (2)$$

where Δ and ε_i are the first difference operator and the white noise term, respectively. The ARDL method estimates regressions to obtain the optimal lag length for each variable. The Vector Error Correction model used to analyze the relationships between variables is formulated as follows.

where residuals are independently and normally distributed with zero mean and constant variance. It can be defined as the error correction term. After a shock indicates the speed of adjustment to the equilibrium level. How quickly the variables approach the equilibrium are also the outcome of this parameter. Pesaran (1997) and Pesaran et. al. (2001) argued that is important to as certain the constancy of the long-run multipliers by testing the error correction model for the stability of its parameters.

6. Results

6.1. Unit Root Test

Firstly, the order of integration of the variables is examined. In the study, ADF (Augmented Dickey-Fuller) unit root test developed by Dickey and Fuller (1981) was used to test of order of integration for each variable. The ARDL boundary test is based on the assumption that the variables are I (0) or I (1). Stability tests

are performed at levels and then first difference to determine the presence of unit roots and the order of integration in all variables. The results indicate that Unemployment is stationary at the level I(0) and lnCpi, Interest, lnSales and lnPrice are stationary at the first difference, I(1). It is confirmed that all variables are stationary in I (0) or I (1). We also used the Akaike info criterion (AIC) to determine the optimal number of lags.

Table 1: Unit Root Test Results

Variables	Level		First Differences		Results
	Constant	Constant and Trend	Constant	Constant and Trend	
lnCpi	1,6968	1,0251	-9,7235***	-9,9143***	I(1)
Interest	-0,8202	0,2681	-9,2030***	-9,5235***	I(1)
lnPrice	0.8050	-1.1821	-11.222***	-11.3123***	I(1)
lnSales	-1,4762	-1,7175	-4,3719***	-4,3924***	I(1)
Unemployment	-3,5917***	-2,7451	-2,6053*	-2,5937	I(0)

* Significant at 10% level. ** Significant at 5% level. *** Significant at 1% level.

6.2. Co-Integration Analysis

The ARDL approach to co-integration is preferred over other conventional cointegration techniques such as Engle and Granger (1987) and Allan and Hansen (1996). The overall F- and t-statistics are used to determine the presence of long-run relationship.

Table 2: Estimated ARDL Models and Bounds F-test for Cointegration

ARDL model	F-statistics	CV 1%		CV 5%	
		I(0)	I(1)	I(0)	I(1)
lnSales (4 3 4 1 3)	5.212	-3.43	-4.60	-2.86	-3.99

The results indicate that in all the specifications, the F-statistic is greater than the upper critical value (CV) at 5% and 1% significance level. This study therefore rejects the null hypothesis of no co-integration. This indicates that there is a long-run equilibrium relationship between automobile sales and other regressors.

Table 3: Estimated Long-Run Coefficients Using the ARDL (4 3 4 1 3)

Variable	Coefficient	Standard error	t-ratio [Prob]
lnPrice	1.040	0.379	2.74 [.007]
lnCpi	-0.513	0.471	-1.09 [.278]
Interest	-0.072	0.171	-4.21 [.000]
Unemployment	-0.188	0.037	-0.50 [.616]
Constant	3.745	1.816	2.06 [.041]

The long run elasticities results are also displayed in Table 3. The estimated coefficients of the long-run relationship are significant for lnprice and interest but not significant for lncpi and unemployment. The long run impact of interest on automobile sales is generally negative as expected. According to the results of the analysis, in the long run, the effect of prices on sales is not as expected, lnprice and automobile sales move in same direction.

Table 4: Estimated Short-Run Error Correction Model (ECT)

Variable	Coefficient	Standard error	t-ratio [Prob]
$\Delta \ln \text{Sales}(-1)$	-0.309	0.123	-2.507 [.013]
$\Delta \ln \text{Sales}(-2)$	-0.340	0.099	-3.437 [.000]
$\Delta \ln \text{Sales}(-3)$	-0.188	0.072	-2.615 [.009]
$\Delta \ln \text{Price}$	-1.454	-0.638	-2.276 [.024]
$\Delta \ln \text{Price}(-1)$	0.495	0.882	-0.562 [.574]
$\Delta \ln \text{Price}(-2)$	-1.884	0.676	-2.283 [.006]
$\Delta \ln \text{Cpi}$	-2.798	3.330	-0.840 [.024]
$\Delta \ln \text{Cpi}(-1)$	-7.547	5.036	-1.498 [.136]
$\Delta \ln \text{Cpi}(-2)$	25.533	5.052	5.053 [.000]
$\Delta \ln \text{Cpi}(-3)$	-15.516	3.330	-4.658 [.000]
$\Delta \text{Interest}$	-0.113	0.024	-4.569 [.000]
$\Delta \text{Unemployment}$	-0.002	0.066	-0.044 [.964]
$\Delta \text{Unemployment}(-1)$	-0.008	-0.121	0.726 [.468]
$\Delta \text{Unemployment}(-2)$	-0.098	-0.678	-1.444 [.150]
ECT(-1)	-0.601	0.136	-4.411 [.000]
R-Squared	0.689678	Adjusted R-Squared	0.605044
F-statistic	8.148.999	Prob(F-statistic)	0.000000

The short run dynamics are generally consistent with the long run findings. However, cpi is significant in the short term, as we cannot find a significant relationship in the long term. In the short term, the increase in automobile prices negatively affects the sales volume as expected. Contrary this finding in the long price increases do not the affect the automobiles of demand negative. As expected credit interest rates negatively affect automobile sales both in the short and the long run. The results indicate that there is an insignificant relationship between unemployment in Turkey's auto sales.

The coefficient on the lagged error-correction term is significant at 1% level with the expected sign, which confirms the result of the bounds test for cointegration. This indicates a rapid speed of adjustment to equilibrium. The results indicate that, on average, the disequilibrium of the previous period is corrected by about 60% in the following period.

Plot of CUSUM and CUSUMSQ tests for the parameter stability

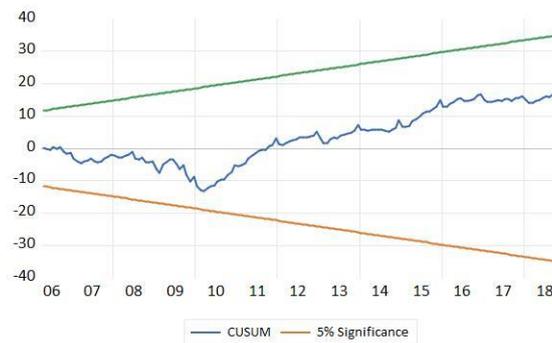


Figure 2: Plot of Cumulative Sum of Recursive Residuals

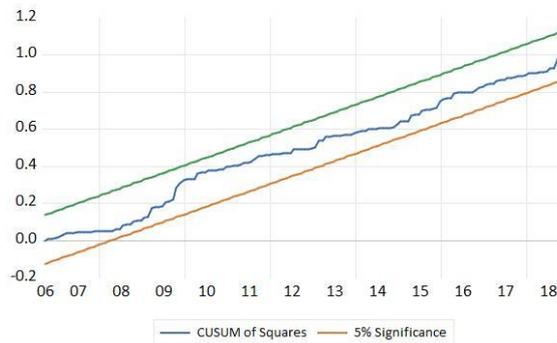


Figure 3: Plot of Cumulative Sum of Squares of Recursive Residuals

To ensure that model pass the stability test, CUSUM and CUSUMSQ tests are applied to the residuals of the error correction model. (Brown et al. 1975). The results of the test are shown in figure 1. The lines indicate the limits of 5% significance levels. From the figures, it appears that the parameters are stable; The sum of the square residuals moves within the critical limits of 5% significance.

7. Conclusion

The automotive market is vital for the Turkish Economy both in terms of the size of the local market and the manufacturing plus export capability. The main goal of this study was to dissect the factors influential in the automobile purchasing behavior in the Turkish Market. We believe that there are nonrational as well as rational factors determining the automobile sales over the years. Nonrational behavior is discussed under two topics. The first one is the conspicuous consumption. The automobile buyers basically push their budget limits in order to afford a higher segment car or a more expensive car in the same segment. This type of behavior needs to be analyzed further to generate data that can be used in a study. The second nonrational behavior being the overshadowed depreciation effect. In developed countries where the currency movements are less volatile, customers lose almost the half value of their cars due to depreciation. In Turkey during four years the depreciation of the car and the depreciation of TL against Euro counter balance each other creating a less dramatic cost of buying a new automobile.

The rational factors we have selected for our study were consumer loan interest rates, , unemployment rates, consumer price index and finally the car price index. Both short term and long term effects of these variables were analyzed.

The results of the study showed that there was a negative relationship between the loan interest rates and the car sales both in the short term and the long term. One study has found a similar relationship between interest rates and car sales.

Unemployment rates had no significant effect on automobile sales both in the short term and the long term. The reason might be the family structure in Turkey where an unemployed person is taken care of by the family in financial terms. The second reason might be that the unemployed people will be in the middle-lower or lower income class where they do not have any purchasing power for cars. This fact is supported by the low car ownership in Turkey. In our research we did not come across a study analyzing the relationship between unemployment and car sales.. The inflation rate (CPI) is significant in the short run and have a negative relation with car sales. In the long run the results were insignificant. Hence the short term inflation is in negative relation with car sales, the higher the inflation the lower the sales. This causality disappears for the long term suggesting that the automobile buyers income levels adjust to inflation rates and does not stop

customers from purchasing a new car. Another study made in the Greek market found that inflation had a negative effect on car sales.

Finally the price of the cars are found out to be significant by our model both short term and long term. However while there is a negative relation between the prices and the car sales in the short term, the situation reverses itself and the relation becomes positive. Short term negative relation needs no further discussion. Long term on the other hand needs further reasoning. As explained at the section two, car prices and Euro rates are directly linked. Furthermore the customers' income levels in the long run are adjusted after a currency shock. In other words TL loses value first, the automobile prices go up lowering the demand for cars in the short run. Since depreciation of TL does not continue after a period, the buyers income catch up with the price changes and in the long run prices and car sales move in the same direction. One study has found a medium level negative relationship between exchange rates and the car sales. Another study has found a negative relation between car prices and the automobile sales where the relation changed from one segment to the other segment.

Our study findings show that the outcomes show some similarities with other academic studies, however Turkish automobile market has a specific character where a short term relationship between a variable and car sales might be reduced to an insignificant level or reverse itself in the long run.

The results of this study can help us make some suggestions for the automobile manufacturers and the automobile retailers. The unemployment and consumer price index are uncontrollable factors for the automotive sector. Car prices can be controlled by the sector but eventually the foreign exchange rate changes have to be integrated to the price. The results show that in the short term the car prices and the car sales have a negative relation though the relationship reverses direction in the long run. Shock price changes have to be avoided as long as possible until a reasonable time period passes for the inflation to catch up with the consumer's perception.

The results also displayed that the car loan interest rates were significant. Automotive sector may use this fact either by establishing a finance company to offer attractive rates for the car loans or establish more competitive relations with the commercial banks.

Appendix

Table A1: Variables and Sources

Variable	Source
Auto Sales	Automotive Distributers Association
Automobile Prices Index	Turkish Statistical Institute (TurkStat)
Consumer Price Index	Turkish Statistical Institute (TurkStat)
Interest Rate	Turkish Statistical Institute (TurkStat)
Unemployment	Turkish Statistical Institute (TurkStat)

Table A2: Descriptive Statistics of Variables

	Mean	Max.	Min.	St. dev.
Log Sales	10.589	11.646	9.358	.473
Log Price	10.629	11.755	9.973	.423
Log CPI	5.295	5.994	4.740	.327
Interest	10.960	14.780	9.973	1.135
Unemployment	10.761	16.1	8	1.481

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