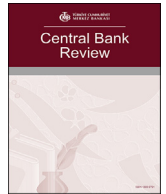


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# Estimating light-vehicle sales in Turkey<sup>☆</sup>

Ufuk Demiroğlu, Çağlar Yüncüler\*

*Central Bank of the Republic of Turkey, Research and Monetary Policy Department, Anafartalar Mah. İstiklal Caddesi No.10, 06050, Ulus, Altındağ, Ankara, Turkey*

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## ABSTRACT

This paper is motivated by the surprising rapid growth of new light-vehicle sales in Turkey in 2015. Domestic sales grew 25%, dramatically surpassing the industry estimates of around 8%. Our approach is to inform the sales trend estimate with the information obtained from the light-vehicle stock (the number of cars and light trucks officially registered in the country), and the scrappage data. More specifically, we improve the sales trend estimate by estimating the trend of its stock. Using household data, we show that an important reason for the rapid sales growth is that an increasing share of household budgets is spent on automobile purchases. The elasticity of light-vehicle sales to cyclical changes in aggregate demand is high and robust; its estimates are around 6 with a standard deviation of about 0.5. The price elasticity of light-vehicle sales is estimated to be about 0.8, but the estimates are imprecise and not robust. We estimate the trend level of light-vehicle sales to be roughly 7 percent of the existing stock. A remarkable out-of-sample forecast performance is obtained for horizons up to nearly a decade by a regression equation using only a cyclical gap measure, the time trend and obvious policy dummies. Various specifications suggest that the strong 2015 growth of light-vehicle sales was predictable in late 2014.

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## 1. Introduction

The motor vehicle sector is a significant part of the Turkish economy. It accounts for 6.6 percent of industrial production, which corresponds to 40.3 percent of capital goods production.<sup>1</sup> Considering its backward linkages to other sectors, its total influence on the Turkish economy should be much higher. It is the leading sector in Turkish exports. Automotive exports were 18.5 billion US dollars in 2015, which was 12.9 percent of all Turkish exports in that year. From the demand side, automobile sales are an important component of domestic demand, accounting for 4.5 percent of all expenditures and 38.3 percent of expenditures on

durables by households.<sup>2</sup> Turkey's position in the global motor vehicle sector is not negligible. As of 2015, Turkey is the 15th largest producer in the world and 5th largest producer in Europe. Moreover, Turkey ranks 18th in the world and 6th in Europe in total sales.

Our aim is to estimate a trend for the domestic sales of light vehicles, i.e. automobiles plus light commercial vehicles, in Turkey. This springs from our quest to understand the surprisingly large 25 percent growth rate of light-vehicle sales in Turkey during 2015, a year in which there were doubts regarding how strong the pace of macroeconomic activity was. Data from different sectors of the economy were sending mixed signals, raising concerns whether overall growth was weakening or not. Meanwhile, each data release for the light vehicles sales was suggesting that the demand was strong. The time series data on new sales did not offer a clear picture as to where the unexpected strength of demand came from, given that the economy grew 4.0 percent (a rate near its estimated

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\* Corresponding author.

E-mail addresses: [ufuk.demiroglu@tcmb.gov.tr](mailto:ufuk.demiroglu@tcmb.gov.tr) (U. Demiroğlu), [caglar.yunculer@tcmb.gov.tr](mailto:caglar.yunculer@tcmb.gov.tr) (Ç. Yüncüler).

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<sup>1</sup> According to the official weights in Industrial Production Index (2010 = 100) published by Turkish Statistical Institute (Turkstat).

<sup>2</sup> According to the official weights in Consumer Price Index (2003 = 100) published by Turkstat for 2016.

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potential), automobile prices increased, and financial conditions tightened. We examine the sales of light vehicles using an approach similar to Greenspan and Cohen (1999) by looking at the progress of the light-vehicle stock (the number of cars officially registered in the country) and scrapped vehicles separately and estimating their trends. Greenspan and Cohen (1999) write that an important advantage of this approach is that it does not require extensive assumptions about the determinants of sales such as demographic trends, the state of the economy, and consumer preferences. In the Turkish case, other advantages are that the data for the stock-of light vehicles extend much farther back (1966 as opposed to 1993), and, more crucially, the trend in light-vehicle demand is much clearer in the stock data than in sales data, even in the overlapping shorter part of the sample.

There are two main approaches in the literature to analyze the evolution of vehicle sales. The first one is to use a macro perspective and seek for the relationship between aggregate sales and associated macroeconomic indicators. Vehicles are treated as homogeneous products, whereas product heterogeneity, brand differentiation, consumer preferences or vehicle characteristics are not paid much attention in this approach. The alternative approach has a micro perspective, paying more attention to consumer choices, vehicle properties as well as market structure and hedonic pricing. Those two approaches both have advantages and disadvantages. The macro approach is more convenient for macroeconomic policy making purposes, viewing vehicles as durable consumption goods and understanding the influence of macroeconomic indicators such as household income, prices, interest rates, etc. on sales (Carlson, 1978; Levinsohn, 1988; Arguea et al., 1994; McCarthy, 1996; Verboven, 1996).<sup>3</sup> These studies in general estimate the price elasticity of car sales to be below unity, whereas some studies find price elasticity little over unity. Income elasticities are found to be around 2. On the other hand, the micro perspective helps understand individual behavior/preferences in car ownership (Brendemoen, 1994), making a better market analysis such as segment differentiation across cars (Bordley and McDonald, 1993; Bordley, 2006) and investigating the impact of sector specific policy changes easier such as tax exemptions or scrappage programs (Fiuza, 2002; Cantos-Sánchez et al., 2015). This study has a macro perspective as we deal with aggregate sales. Consequently, vehicle properties and consumer choices are not considered in our estimations. We nevertheless bring to bear some facts from the Turkish household surveys and sales by brand in the Turkish market to help understand the rapid growth of Turkish demand for cars.

The studies on automobile demand in Turkey are scarce compared to the extensive literature for other countries, especially for the US. Among them, Alper and Mumcu (2007) find that both the country of origin as well as the quality of brands are important for automobile demand in Turkey. Furthermore, the demand for new automobiles is found to be price inelastic in the short run. Yavaş et al. (2014) find that equipment, design, motor size and fuel type are the main criteria in deciding to buy a car. On the other hand, Özçam and Özçam (2014) find that the demand for automobiles is price elastic, and observe that it is strongly correlated with the business cycle, with an informally estimated elasticity of 5 to 10 with respect to cyclical GDP changes. Against this background, to the best of our knowledge, our study is the first in Turkey to estimate the underlying trend in light-vehicle sales by examining the progress of the light-vehicle stock and scrapped vehicles.

Our results show that while the growth trend of light-vehicle sales is not evident in its own time series, it is evident in the time series of its stock. After adding the estimated scrappage rate (0.84 percent of the light-vehicle stock per year) to the growth rate of the projected trajectory of the light-vehicle stock, we arrive at a total annual number of light-vehicle sales of roughly 7 percent of the existing stock (or 7.5 percent of the last year's stock) for the current cyclically adjusted level of domestic demand. The ongoing increase in the household budget share of automobiles, the low number of registered vehicles per capita compared to other countries, and also possibly the steadily growing car leasing sector, are factors that support this estimated trend to continue in the years ahead. Empirical analysis points out that the demand gap calculated from the final domestic demand explains most of the deviation of sales from its growth trend. Other factors such as real interest rate, fuel prices and automobile prices may provide extra information depending on the sample period; however, their relationships are not as robust as that of the demand gap. Finally, a simple specification (consisting of the vehicle stock's trend, output gap, and a dummy variable controlling for the scrappage program of 2004) produces fairly good out-of-sample forecasts to follow the underlying trend in new sales and identify the ups and downs of light-vehicle sales. Finally, we look at the ability of the wider set of specifications that include additional variables to forecast the strong demand of 2015 out of sample. We find that the sales performance in 2015 should not be considered as a surprise and could have been estimated with the information available at the end of 2014.

The study proceeds as follows: In the second and third sections, we introduce the data and the methodology for estimating the trend for light-vehicle sales. The fourth section elaborates on the trend estimations. The fifth section discusses potential factors supporting the sales growth trend. The sixth section presents an empirical analysis on the determinants of the deviation of sales from the estimated trend and the out-of-sample forecasts of various models. The last section concludes.

## 2. Data

The domestic sales data for light vehicles are taken from Automobile Distributors' Association (ADA) and are seasonally adjusted by the authors. In the literature, the majority of the studies analyze only the automobile sales. However, the degree of substitution for the two components of light vehicles, i.e. automobiles and light commercial vehicles, is very high in Turkey, and they behave similarly except when a regulation that differentiates their behavior from each other is introduced. The rate of sales tax is substantially lower for light commercial vehicles than for automobiles, encouraging the substitution of light commercial vehicles for automobiles in noncommercial usage. However, the regulations affecting the tradeoff between the two categories change from time to time, as, for example, in 2012, when a change took place in the regulation for light commercial vehicle sales. That regulation restricted the usage of light commercial vehicles for noncommercial purposes and brought extra costs for acquiring these vehicles. Subsequently, unlike previous periods, the two components' sales paths moved in opposite directions and the composition of demand has shifted in favor of automobiles immediately (Fig. 1a). When those limitations were partially reduced at the beginning of 2014, the two began to move in tandem again. Against this background, taking light vehicles as the unit of analysis instead of decomposing it into two is particularly important in the Turkish case. The time series for the total light-vehicle sales is shown in Fig. 1b.

The light-vehicle stock data is taken from Turkish Statistical Institute (Turkstat). The stock value for a specific period is the total number of vehicles registered in the country as of the last day of that period. The data is available in both monthly and annual

<sup>3</sup> See Kang and Lee (2014) for a summary of different studies on automobile demand.

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