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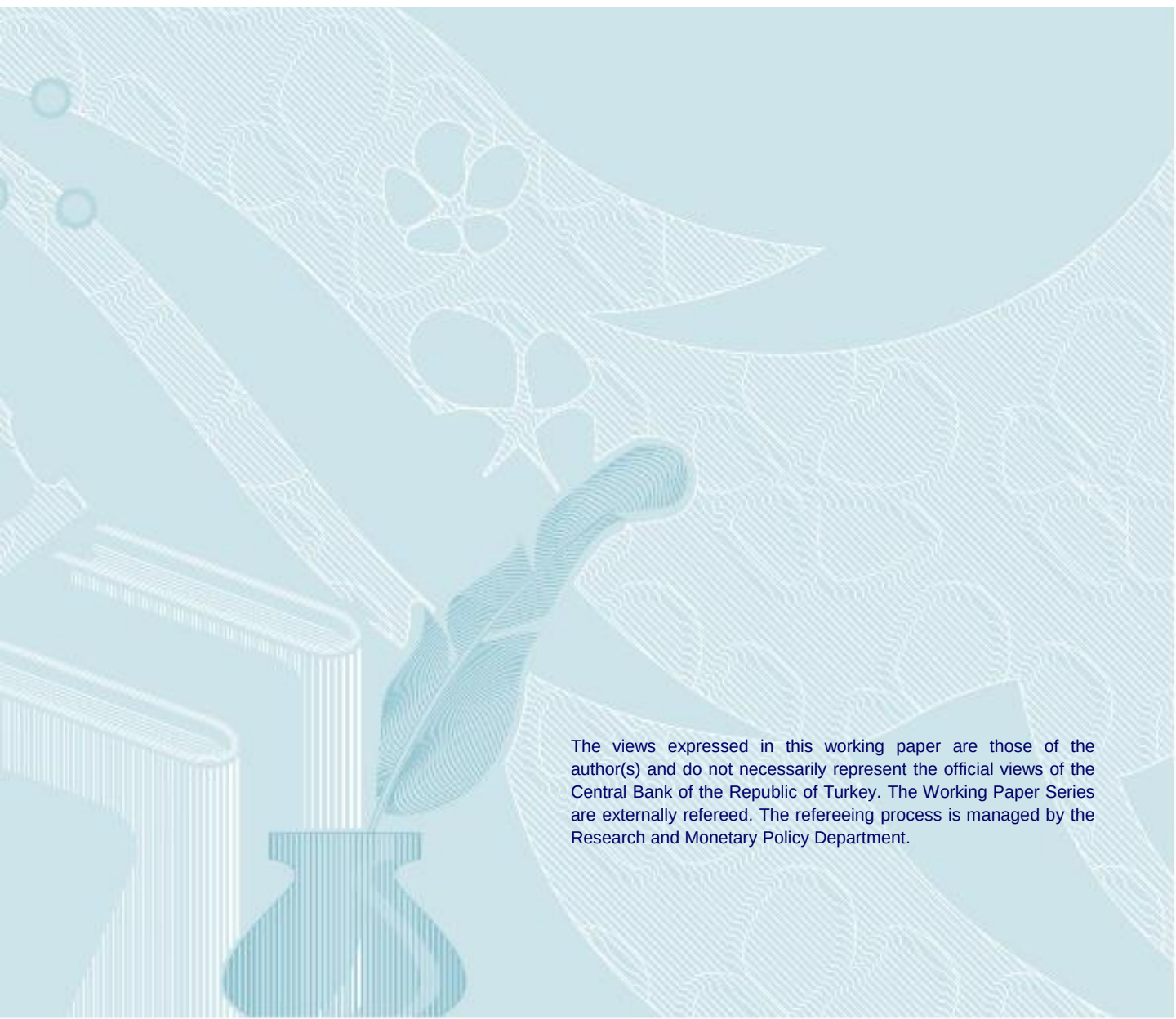

Quantifying the Effects of Loan-to-Value Restrictions: Evidence from Turkey*

Yavuz Arslan[†] Gazi Kabaş[‡] Ahmet Ali Taşkın[§]

Abstract

We examine the effect of loan-to-value restriction on automobile loans using primary market car sales in Turkey. We identify the effect of the policy using the specific nature of the regulation that imposes higher downpayment restriction for automobile loans with higher prices. We observe that the drop in automobile sales growth is higher for more expensive cars net of other controlled factors.

Keywords: macroprudential policy, loan-to-value policy, automobile loans, car sales
JEL Codes: G21, G28, E44

1 Introduction

The importance of households' indebtedness was recalled with the global crisis in 2008.[1] Following the crisis many countries have devised and applied new macro-prudential policies to limit the excessive indebtedness of households. Loan-to-value ratio (LTV), debt-to-income ratio (DTI), dynamic loan-loss provisioning, limits on foreign currency loans, reserve requirement ratios are some of the tools which are parts of policy agendas. While using macro-prudential policies has become the mainstream, their effects on the macroeconomy have been difficult to quantify. The main reason is that there is little time variation in these policies. Moreover, countries implementing these policies generally implement other policies as well making the identification of the separate effects very difficult. One possibility would be to do a cross country analysis. The problem with that approach is that countries in general choose different sets of macro-prudential policies. In this paper we argue that we are able to quantify the effects of LTV policies by using the specific design of the policy implemented in Turkey.

*The views expressed are those the authors and should not be attributed to Central Bank of Turkey. We thank Saadet Alpago from Automotive Distributers Association for sharing their data with us.

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[1]Mian and Sufi (2010) show that cities that experienced soaring average indebtedness prior to the 2009 crisis suffered more from the crisis in terms of housing prices, unemployment and housing investment for the US economy.

In November 2013, Banking Regulation and Supervision Agency of Turkey (BRSA here and henceforth) announced new arrangements on consumer credit that put into effect on February 1, 2014. Among this arrangements, BRSA introduced LTV limits to automobile loans which is critical for this study . Different from many other macroprudential policies, BRSA regulations imposed that the maximum LTV of an autombile credit decreases with the price of the car. According to the new regulation, for automobiles which have prices up to 50,000 Turkish Lira (TL), the downpayment restriction was set to 30 percent. For the automobiles which have prices above 50,000 TL, the remaining part of the loan has a downpayment restriction of 50 percent. For instance, a car with a price of 100,000 TL has a downpayment of ((50,000*0.3)+((100,000-50.000)*0.5)) 40,000 TL which corresponds to 40 percent downpayment restriction. In other words, due to this feature of the regulation, there is a punishment for expensive cars. As the price of the car increases downpayment converges to 50 percent (Figure 1).

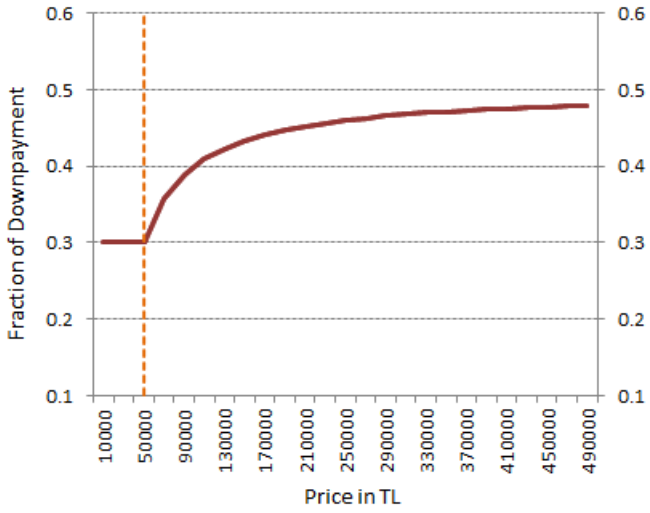

Figure 1: Downpayment Restriction by Price

The design of the LTV policy outlined above implies that the automobiles in Turkey are subjected to different LTV ratios. Using this heterogeneity of maximum LTV ratios across automobiles as well as the changes in sales dynamics of the automobiles with different prices we find evidence for the strong effects of LTV policy on curbing the sales growth. In particular we find that a 1 percent increase in price is associated with 2 percent decrease in car sales growth as a consequence of lower LTV imposed by the policy. In sum this effect aggregates up to 19 percent drop for cars with values above 50,000 TL, explaining one-third of the overall change.

2 Policy Experience and Literature

Emerging markets aim to increase private savings ratios to boost domestic financial capital and to make local financial markets more resilient to capital flow fluctuations. However, in low global

interest rate environment, raising interest rates for this purpose might attract more capital inflows, which might in turn fuel domestic credit growth and threaten financial stability. On the other hand, having low domestic interest rate without other controls on credit, though discourages external capital flows, might still accelerate the domestic credit growth. Ekinci et al. (2014) show that "at the early stages of financial development, acceleration in the credit growth might cause a larger deterioration in the current account balance." For these reasons, since 2011, both Central Bank of the Republic of Turkey (CBRT) and BRSA provided guidance on credit growth emphasizing the financing of production rather than financing of consumption (CBRT Inflation Report 2014 III). To this end, in a series of measures, BRSA increased the risk weights of credit cards in 2008, consumer loans in 2011 and automobile loans in 2013. Moreover, as mentioned in the introduction, BRSA introduced new measures on consumer loans including LTV on automobile loans. These arrangements aimed at improving the household indebtedness, and therefore, achieving a high and stable growth for the Turkish economy.

Claessens (2014) identifies LTV as the most common macroprudential measure that is used. Although some advanced countries employ previously, LTV has mostly been implemented during mid-2000s in Asian countries such as Korea, Hong Kong, Singapore and China without being referred to as a macroprudential measure until recently. Studies based on these countries show that LTV measures on housing loans have been effective. The analysis by Funke and Paetz (2012) on Hong Kong housing markets indicates that cyclical loan-to-value policy decreased the possibility of the formation of a bubble in housing markets and contained the effect of the volatility in housing prices on the real economy. According to Igan and Kang's (2011) study on the Korean housing markets for the 2001-2010 period, tightening in the LTV and debt-to-income ratio (DTI) decreased buying and selling activities in housing markets at a significant rate. Following the tightening, buying and selling activities declined within 3 months and deceleration of prices takes up to 6 months. Furthermore, the fluctuation in prices is more responsive to LTV tightening. Using panel data on 13 countries, Wong et al. (2011) examined the effect of the LTV policy and found that in countries implementing the LTV policy, fall in prices significantly diminishes the effect of the default rate in housing loans. Using a panel data of 57 countries, Kuttner and Shim (2013) analyzed the effect of various macroprudential measures on housing loans, and concluded that LTV and DTI policies significantly lower the growth of housing loans. More consistent results are obtained in various models using DTI limits. Crowe et al. (2011) praises LTV since it can be designed to target specific objectives. They show that when a real estate bubble occurs, LTV is best option to curb it. Lim et al. (2011) shows that after the implementation of LTV, credit growth and asset price inflation declines. In addition, LTV reduces the procyclicality of credit growth by 80 percent. These studies all together suggest that LTV can be useful for controlling systemic risks generated by credit growth or asset price inflation in housing markets. Our study instead focuses on an LTV policy targeted to automobile loans.

Regarding the relationship between financial accelerator and LTV, Almeida et al. (2006) provide important findings. They state that in countries with higher LTV ratios, housing prices and new

mortgage loans are more sensitive to aggregate income shocks and "empirical relation between LTV ratios and income sensitivities is stronger in countries in which the income constraint is less likely to bind." These findings suggest that in high LTV ratio countries, debt capacity is more strongly procyclical. In Turkey, the BRSA put a 75 percent LTV limit on housing loans effective as of 2011. As a result, the growth rate of housing loans has recorded a decline in annualized and 13-week moving average terms.

Although the coverage is not as extensive as housing loans, LTV is also implemented on automobile loans in some countries. "To bring down probability of default on automotive loans from nearly 10 percent" the Bank Indonesia adopted LTV policy for automobile loans in June 2012 which varies between 70-80 percent. This decision was followed by a slowdown, which was then succeeded by negative values in the growth rate of automobile loans. In May 2013, growth rate of automobile loans started to recover and two years after the policy implementation, the loans' growth rate has reached its previous values (BoI, FRS Feb 2014). Secondly, the Monetary Authority of Singapore launched the LTV on automobile loans to curb credit growth and inflation in February 2013. For automobiles with prices up to 20,000 USD LTV ratio is set to 60 percent and for automobiles with prices above 20,000 USD the ratio is 50 percent. This led the total automobile loans stock in Singapore to decrease from 13.8 billion to 12.7 billion USD in the third quarter of 2013. As of the third quarter of 2014, year-on-year growth rate of automobile loans is -19 percent. These observations, however, are descriptive in nature and does not provide causal evidence regarding the effect of LTV policy.

Due to boom in automobile loans with high maturities and larger LTV ratios, the Central Bank of Brazil (CBB) raised risk weight applied on some of new automobile loans from 75 percent to 150 percent, in December 2010. Specifically, CBB takes into consideration maturity of loan as well as LTV. According to new implementation, the automobile loans with high maturity and/or high LTV ratio will be faced with higher risk weight. Martins and Schechtman (2013) studies this policy and shows that for the same borrowers and for similar automobile loans, policy causes higher interest rate spread in targeted loans. The authors argue, this finding reflects that facing with higher funding costs due to higher capital requirements; banks pass these additional costs to their customers. Such an increase in spreads does not exist in untargeted loans implying that a spill-over from targeted loans to untargeted loans is limited. Moreover, the policy helps to improve the origination standards (Afanasieff et al., 2015). Similar to our study, these papers use micro level data to assess the effect of capital requirement policy on automobile loan market. The policy introduced in Brazil brought limits to loan supply whereas in Turkey, the restriction is imposed on loan demand. Moreover, we instead use micro level car sales data to estimate the effect of LTV policy on automobile loans.

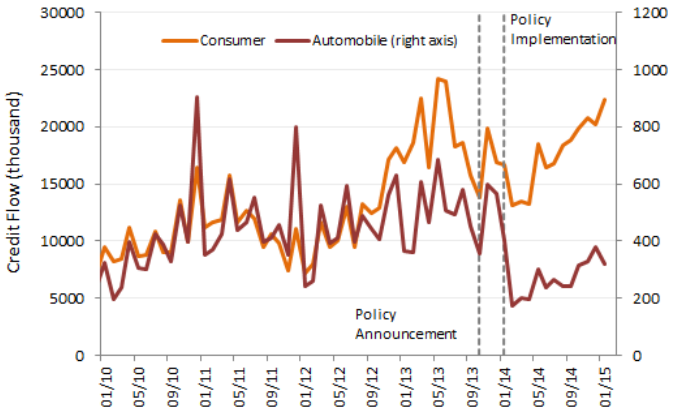

Figure 2: Consumer vs Automobile Loans in Turkey
Source: CBRT

These findings across various countries provide evidence for the effectiveness of LTV policy on curbing the loan growth. Similarly in Turkey, Figure 2 displays that after the policy implementation, new automobile loans have dropped more and experienced a slower recovery relative to other consumer loans over the course of 2014.[2] However, one should also bear in mind that this period coincides with tight monetary policy measures. For that reason, from this figure it is difficult to disentangle the effect of the LTV regulation from other coinciding policy changes. Therefore we turn to micro data of car sales that provides monthly information on sales for every car model within primary dealers market.

The remainder of the paper is organized as follows. Section 3 describes our data and provides the relationship between car prices and car sales. Section 4 presents the empirical model and results. Section 5 concludes.

3 Data

In this paper, we use primary dealers' monthly car sales statistics which is obtained from Automotive Distributers' Association (ADA).[3] This detailed data set contains brand, model, version, options, engine capacity and power, transmission, type, fuel and the country of which the car is produced. Thanks to this data set, we can identify every unique automobile (car model from here and henceforth) that consumers are facing . In 2014, there existed 42 brands, 263 models and 2972 uniquely identified cars. Around 10% of these car models are domestically produced. Monthly sales numbers indicate that there is a strong seasonality in December when the sales are more than twice of a regular month (Figure 3). On annual basis, the total numbers of car sales are 556,276 in 2012, 664,653 in 2013 and 587,196 in 2014. This shows that the sales were increasing by 18% in

[2]It is important to note that part of the strong divergence in this figure is the due to increasing share of financing companies since 2012. Table 1 describes the change in the stock of automobile loans during 2013 and 2014 with and without financing companies. With financing companies, growth in automobile loans is higher in 2013 and the drop is milder in 2014.

[3]www.odd.org.tr

2013 whereas it decreased by 12% in 2014.

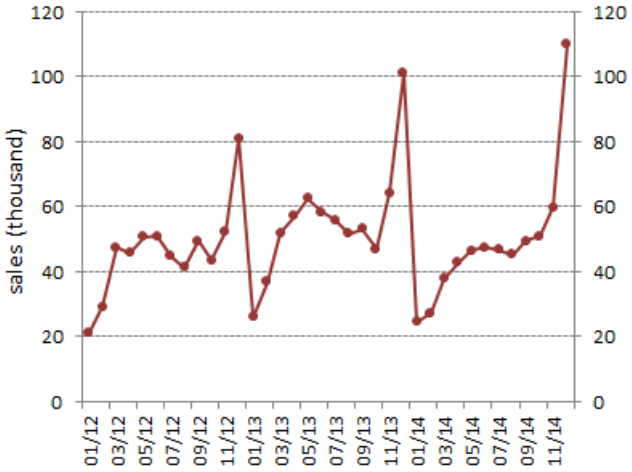

Figure 3: Primary Market Car Sales in Turkey
Source: ADA

The prices are collected from the internet sites of the dealers as of November 2014 and manually matched with sales data. After matching the sales and prices and excluding the cars with no sales, 1148 unique cars remain in the sample. The relationship between prices and sales is depicted in Figure 4. As expected, except for the cars with 30-40 thousand price interval, car sales are lower for more expensive cars. Overall, approximately 75% of the cars being sold in 2014 have prices higher than 50,000 TL. This means that the additional downpayment restriction that kicks in after that cutoff affects an important portion of the market.

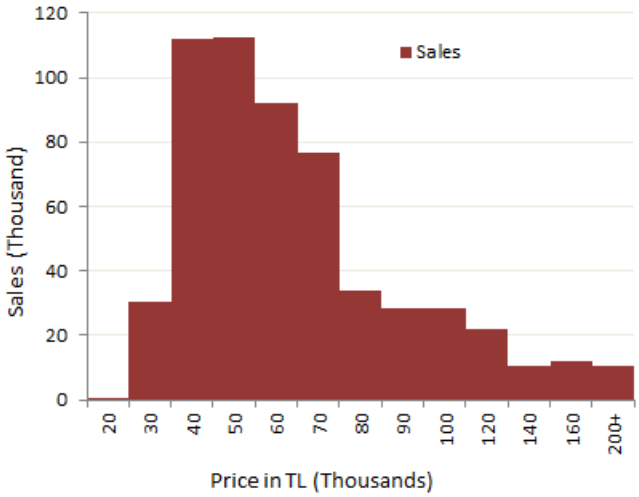

Figure 4: Car Sales by Price
Source: ADA, authors' calculations

Finally we would like to see whether there is a shift in sales trend in primary car sales. For that we draw change in sales growth between 2014 and 2012 against the log price in Figure 5. First we observe that the simple linear fit of log price and change in sales growth is positive before the cutoff value and turns almost flat afterwards. The difference between these two slopes reveals the result of the implementation and it potentially points out the fact that after 50,000 TL the additional downpayment restriction affects the sales. We explore the robustness of this observation throughout the rest of the paper. Second, the range of percentage changes is quite wide and scattered around the positive and negative sides. This compromises the economic and statistical significance of our results since it may yield slope estimates with large magnitudes. In the next section we introduce new variables and impose certain sample restrictions to alleviate this problem.

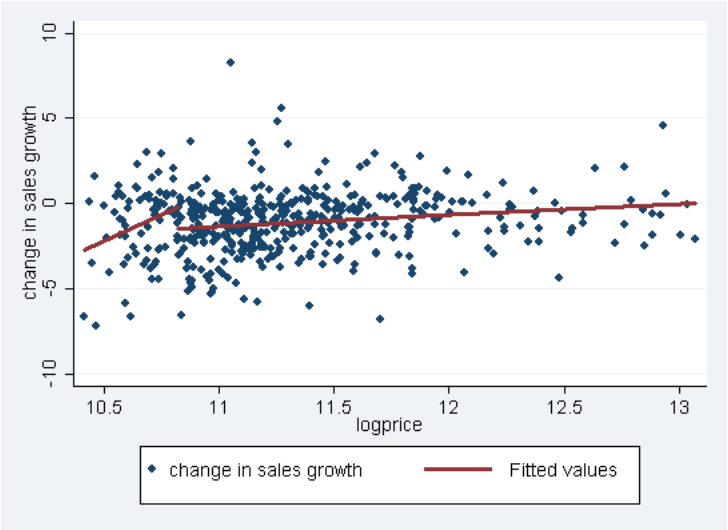

Figure 5: Car Sales Growth by Price
Source: ADA, Authors' calculations

4 Empirical Model and Results

We would like to know whether there is a significant change in car sales since the inception of the LTV regulation on automobile loans. For that we have a simple model of the following form:

$$\Delta SG_i = \beta_0 + \beta_1 logP_i + \beta_2 P_{i50} + \beta_3 P_{i50} logP_i + X_i + Y_i + \epsilon_i \tag{1}$$

Here ΔSG_i denotes the change in sales growth between 2014 and 2013. The change in sales growth specification allows us to get rid of any trend in sales for a particular car model. In the main analysis we compute total log sales in each year for months between February and October since the policy is put into effect on February 2014. This will make of 9 months for each year. Excluding the time period between November and January will help us attenuating the positive

bias due to possible reactionary response from the market within that period.[4]

$logP_i$ is the log of the current price of each car model i as of November 2014 collected manually from each primary dealer. Although it is quite possible that since the inception of the policy the prices have changed due to several factors such as changes in interest rates, exchange rates etc., we argue that it will not directly affect our results since the LTV policy by BRSA discriminates the credit availability for different price ranges in a certain way. We have P_{i50} as an indicator cutoff variable for prices higher than 50,000 TL and an interaction term $P_{i50}logP_i$ which assumes a separate relationship between prices and sales growth change after the specified cutoff value. This specification comes from the fact that BRSA regulation has the same downpayment restriction for loans below 50,000 TL and it rises gradually as the price increases. Our variable of interest, β_3, identifies the additional effect of downpayment restriction (summarized by log prices) on sales growth.

We argue that since the policy dictates a higher downpayment for higher prices, conditional on other variables, the drop in sales growth should be higher for more expensive models. Here, the constant term will identify the change in sales growth due to aggregate factors (including the BRSA policy) and the log price itself will capture any factors that have different effects on sales growth for different price segments.[5] The fact that our identification strategy relies on the relative effect of downpayment restriction based on the policy description helps us avoiding potential endogeneity problems regarding the prices. More specifically, in order for our results to be contaminated one would need disproportionately higher change in prices along the price range since the inception of the policy.[6] Moreover we have Y_i defined as car characteristics that would capture some of the potential changes pertaining to different brands, car segment, engine size and domestic production.[7]

Finally X_i is a set of variables aimed to capture volatile nature of the sales growth of car models which is depicted in Figure 5. We argue that excessive movements of our dependent variable over the period of interest could be summarized by relative sale shares of that model within brand and brand-segment categories. That way a sudden jump or fall in our dependent variable will also appear in share of sales of that model within a specified category. We use initial shares as of 2012, double change in shares between 2014 and 2012, and several interactions with the cutoff variable and with each other to mitigate these sudden jumps between periods.

It is important to note that the year 2014 is also associated with tightening monetary policy conditions, lower consumer confidence, slow down in consumer credit growth, depreciation in the

[4]The first news regarding the regulation appeared in the media as early as November 2013, therefore prior to this date it was generally unexpected.

[5]One potential candidate would be credit availability for different price segments expected to be higher for more luxurious, hence more expensive, car models.

[6]One could also argue that change in prices since the implementation of the policy could reflect a reaction to the policy itself. Here the question of interest is whether the change in prices have a different pattern before and after the 50,000 TL cutoff, hurting our identification. However, in that scenario it is more likely to expect a higher drop in prices for more expensive cars simply because the policy introduced higher cost of financing for them. This, then induces an increase in demand, hence sales, which would bias our estimate downwards in magnitude.

[7]A complete list of variables used in regression analysis is described at the end of the paper.

currency basket and overall slow down in economic activity.[8] However these developments do not compromise our results to an extent that they have the same affect on car sales over the price range and/or their effects change in a linear fashion with the price of the car. In such cases constant term and the log price itself will be able to capture these movements. Throughout the analysis we repeat a weighted OLS where weights are characterized by corresponding total sales as of 2014. For precision we exclude models that are more expensive than 500,000 TL, and drop those observations with change in sales growth as big as 200% and with last period total sales in the top 10 percentile.

4.1 Results

We present the results for our main specification in Table 2. In the first column we have the regression of change in sales growth with our main variables and volatility factors (i.e. X_i). Here we see that as the price increases the sales growth also increases. On the other hand the additional effect of the policy after the 50,000 TL cutoff is negative and significant. When we add other fixed effects the new slope after the cutoff becomes slightly smaller but still significant. More specifically according to column 2, 1% increase in the price corresponds to a 2% decline in sales growth. For comparison purposes column 3 presents results based not on the 9 month total sales (our ideal specification) but on 11 month total sales since February 2014. Here the additional effect of price turns insignificant. This potentially points out the fact that the effect of the policy is fading away with time.

In order to assess the effect of the BRSA policy over time we repeat the same regression for 3 different specifications: 1- change in 4 month total sales growth through February-May, 2- change in 4 month total sales growth through June-September, 3- change in 3 month total sales growth through October-December. We expect the effect of the policy to be stronger in the first few months after the inception of the policy since for some group of individuals it might only delay the purchase. The results in Table 3 confirm our hypothesis: The coefficient of interest is more than 4% in the first 4 months and turns positive but insignificant in the last 3 months. We conclude that after the first few months the automobile market recovered to a certain extent and downpayment constraint became less binding.[9]

One could argue that the additional effect coming from the 50,000 TL cutoff might be related to other unobserved factors such as a non-linear relationship between the price segments and sales growth. Although we cannot jointly identify both the effect of the policy and a non-linear relationship between price and sales growth, we could play with the cutoff price to assess the robustness of our results. For instance since the policy dictates a constant downpayment for prices cheaper than 50,000 TL, we should not see any additional effect before that cutoff. For that we mechanically move our cutoff value between 42,000 TL to 50,000 TL. In Table 4 column 1 to 5 we present the results for each cutoff specification using 9 month total sales. Here we see that as we move further away from the policy cutoff the significance of our coefficient fades away. Moreover the magnitude

[8] Table 1 describes these developments in detail.

[9] Note that this is also apparent in Figure 3.

of the coefficient is very similar to the benchmark estimate for close cutoff ranges. This suggests that the main effect presented in tables 2 and 3 comes directly from 50,000 TL limit which is the policy design.

We then turn to investigate whether there is additional effect coming from additional non-linear specifications besides from the policy itself. For that we put additional slopes on prices above 67,000, 100,000 and 200,000 TL.[10] We repeat the same exercise for our main period (i.e. 9 month) and two subsequent 4 month periods since February 2014. The results in Table 5 columns 1-3 suggest that the main effect is coming from the 50,000 TL limit and having additional controls above does not provide additional information. Only for the 9 month specification we have an additional negative effect after 200,000 TL. However the number of cars above that price and their sales are comparably smaller and the suggestive effect is unrealistically higher. Therefore we conclude that this effect does not bare any economic significance.[11]

Finally we would like to check whether there is any pre-order response after the announcement of the regulation in November 2013. For that we repeat the same model specification with one month sales separately for each 3 months between the announcement and the implementation dates. Table 6 columns 1-3 respectively present results for January 2014, December 2013 and November 2013. Here we see that for January 2014 and November 2013 there is no significant relationship between price and sales growth and having an additional slope after 50,000 TL does not add any significance as well. Interestingly for December 2013 the coefficient in our variable of interest is negative and significant. This suggests that the effect of the policy is already observed within the last month of 2013, which is a high sale month, before the policy to be put into effect. However one should note that we lose a big number of observations compared to specifications discussed above, hence the results here should not be taken at their face value.

How much of the drop in the car sales growth come from the BRSA regulation? Although not perfect, our econometric setup allows us answer this question in a very simple way. For that we use the predicted values of our dependent variable with and without the policy variables. More specifically we predict our baseline model:

$$\widehat{\Delta SG_{it}} = \widehat{\beta}_0 + \widehat{\beta}_1 logP_i + \widehat{\beta}_2 P_{i50} + \widehat{\beta}_3 P_{i50} logP_i + X_i + Y_i \tag{2}$$

We then force $\widehat{\beta}_2$ and $\widehat{\beta}_3$ to be 0 and predict the outcome of the restricted model as $\widetilde{\Delta SG_{it}}$. The difference between these two predictions (i.e. $\widetilde{\Delta SG_{it}} - \widehat{\Delta SG_{it}}$) accounts for the effect of the policy for each car model. We then aggregate these individual contributions weighted by the total sales of the estimation period. We find that of the 59% drop in sales growth change for cars with prices higher than 50,000 TL, 19% is due to the policy. This corresponds to a one third of the overall change. Note that by design, we estimate the effect of the additional downpayment restriction gradually increasing after 50,000 TL.

[10] These limits respectively correspond to downpayment restrictions of 35, 40 and 45 percent

[11] For the benchmark analysis in Table 2, we repeat the same model excluding cars that are more expensive than 200,000 TL and find that our main results hold.

5 Conclusion

This paper studies the effect of BRSA's loan-to-value policy on automobile loans using primary market car sales in Turkey. The policy imposes downpayment restriction of 30 percent for those cars with value below 50,000 TL, and the downpayment restriction increases gradually above that value. We make use of this non-linear nature of the policy to identify the effect of additional LTV limits put forth above the 50,000 cutoff. We use monthly primary market car sales growth between 2014 and 2012 and link these sales with their associated prices for the end of 2014. For our benchmark model we find that after the 50,000 TL cutoff value 1 percent increase in price is associated with 2 percent decrease in sales growth. This effect is stronger for the early months of the policy and fades away by later months. The results are robust in the sense that it strongly holds around the cutoff value specified by the regulation and imposing additional cutoffs does not provide new information. We assess the overall contribution of the policy by using the coefficients on the variables above the cutoff value and find that these variables explain one third of the drop in car sales growth between 2014 and 2012.

Table 1: Macroeconomic Developments

Macroeconomic Variables	feb.-oct. 2013	feb.-oct. 2014
Consumer Loan Interest Rates (avg.)	11.44	14.17
Automobile Loan Interest Rates (avg.)	10.55	13.70
Consumer Loan (pct. change)	21.36	10.23
Automobile Loan w/o Financing Comp. (pct. change)	4.89	-18.93
Automobile Loan with Financing Comp. (pct. change)	11.95	-9.07
Currency Basket (avg.)	2.19	2.54
GDP (pct. change)	3.84	2.68
Consumer Confidence (avg.)	76.02	73.50
Car Sales (pct. change)	14.40	-16.18

Consumer loan interest rates are weighted average interest rates of housing and personal loans within specified periods. Automobile loan interest rates are average interest rates of automobile loans -excluding financing companies- within specified periods. Consumer loan indicates the percentage change in housing and personal loans from February to October. Automobile loans indicate the percentage change in automobile loans -with and without financing companies- from February to October. Currency basket indicates daily average of euro and US dollar within specified periods. GDP indicates the change in monthly frequency GDP levels with the previous year. Consumer confidence is the average of consumer confidence index values within specified periods. Car sales is the change in car sales compared to previous year. Source: CBRT, Turkstat, ADA.

Table 2: Estimation results : Main Model

	(1)	(2)	(3)
Variables	feb. 9 month	feb. 9 month	feb. 11 month
Constant	-37.125***	-33.587***	0.901
	(9.098)	(9.972)	(11.915)
logprice	3.336***	2.862***	-0.192
	(0.842)	(0.927)	(1.108)
price>50	27.493***	22.353**	-9.154
	(9.381)	(10.192)	(12.854)
price>50*logprice	-2.584***	-1.998**	0.889
	(0.866)	(0.950)	(1.200)
Volatility Factors	Yes	Yes	Yes
Fixed Effects		Yes	Yes
Observations	469	469	514
Adj. R-squared	0.52	0.68	0.61
F($\beta_1 = \beta_2 = \beta_3 = 0$)	9.93	7.83	2.13
p value	0.000	0.000	0.096

Standard errors in parentheses. Stars indicate significance levels: ***:p<0.01, **:p<0.05, *:p<0.1. Volatility factors include share of sales of each model within brand and brand-segment categories as of 2012 separately for prices below and above 50.000 TL, double change in share of sales between 2014 and 2012 separately for prices below and above 50.000 TL, triple interaction of these variables, indicator for being observed since 2011 and its interaction with the price cutoff. Fixed effects include brand and segment fixed effects, engine size fixed effects based on the most recent tax code specification and indicator for whether the car is produced in Turkey or not.

Table 3: Estimation results : The Effect of the Policy Over Time

	(1)	(2)	(3)
Variables	feb. 4 month	jun. 4 month	oct. 4 month
Constant	-45.176***	-24.508*	0.396
	(16.801)	(14.626)	(12.141)
logprice	4.106***	2.126	-0.045
	(1.564)	(1.352)	(1.120)
price>50	43.674***	14.945	5.671
	(16.605)	(15.450)	(13.079)
price>50*logprice	-4.111***	-1.313	-0.435
	(1.573)	(1.423)	(1.214)
Volatility Factors	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes
Observations	337	365	373
Adj. R-squared	0.59	0.72	0.67
F($\beta_1 = \beta_2 = \beta_3 = 0$)	2.55	2.55	3.83
p value	0.056	0.056	0.010

Standard errors in parentheses. Stars indicate significance levels: ***:p<0.01, **:p<0.05, *:p<0.1. Volatility factors include share of sales of each model within brand and brand-segment categories as of 2012 separately for prices below and above 50.000 TL, double change in share of sales between 2014 and 2012 separately for prices below and above 50.000 TL, triple interaction of these variables, indicator for being observed since 2011 and its interaction with the price cutoff. Fixed effects include brand and segment fixed effects, engine size fixed effects based on the most recent tax code specification and indicator for whether the car is produced in Turkey or not.

Table 4: Estimation results : Main Model with Different Cutoffs

	(1)	(2)	(3)	(4)	(5)
Variables	feb. 9 month	feb. 9 month	feb. 9 month	feb. 9 month	feb. 9 month
Constant	41.261	-55.667	-26.307**	-34.839***	-33.587***
	(64.788)	(37.380)	(10.722)	(10.425)	(9.972)
logprice	-4.055	4.962	2.199**	2.975***	2.862***
	(6.048)	(3.489)	(0.995)	(0.970)	(0.927)
price>42	-48.453				
	(64.349)				
price>42*logprice	4.647				
	(6.025)				
price>44		47.965			
		(37.460)			
price>44*logprice		-4.353			
		(3.494)			
price>46			19.254*		
			(10.995)		
price>46*logprice			-1.703*		
			(1.018)		
price>48				24.884**	
				(10.847)	
price>48*logprice				-2.233**	
				(1.011)	
price>50					22.353**
					(10.192)
price>50*logprice					-1.998**
					(0.950)
Volatility Factors	Yes	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	469	469	469	469	469
Adj. R-squared	0.65	0.65	0.66	0.68	0.68

Standard errors in parentheses. Stars indicate significance levels: ***:p<0.01, **:p<0.05, *:p<0.1. Volatility factors include share of sales of each model within brand and brand-segment categories as of 2012 separately for prices below and above the specified cutoff, double change in share of sales between 2014 and 2012 separately for prices below and above the specified cutoff, triple interaction of these variables, indicator for being observed since 2011 and its interaction with the price cutoff. Fixed effects include brand and segment fixed effects, engine size fixed effects based on the most recent tax code specification and indicator for whether the car is produced in Turkey or not.

Table 5: Estimation results : Main Model with Additional Cutoffs

	(1)	(2)	(3)
Variables	feb. 9 month	feb. 4 month	jun. 4 month
Constant	-33.919***	-42.744**	-24.976*
	(10.221)	(18.188)	(14.848)
logprice	2.888***	3.892**	2.167
	(0.949)	(1.696)	(1.372)
price>50	26.531*	33.237	18.566
	(15.141)	(20.583)	(21.562)
price>50*logprice	-2.380*	-3.141	-1.644
	(1.400)	(1.937)	(1.982)
price>67	-3.982	1.714	-4.717
	(17.785)	(24.068)	(21.367)
price>67*logprice	0.356	-0.221	0.436
	(1.601)	(2.157)	(1.921)
price>100	-18.827	-3.863	15.148
	(19.882)	(22.731)	(22.284)
price>100*logprice	1.624	0.349	-1.300
	(1.714)	(1.970)	(1.925)
price>200	157.636***	30.159	0.442
	(59.091)	(55.135)	(48.039)
price>200*logprice	-12.838***	-2.371	0.061
	(4.820)	(4.489)	(3.918)
Volatility Factors	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes
Observations	469	337	365
Adj. R-squared	0.69	0.60	0.72

Standard errors in parentheses. Stars indicate significance levels: ***:p<0.01, **:p<0.05, *:p<0.1. Volatility factors include share of sales of each model within brand and brand-segment categories as of 2012 separately for prices below and above 50.000 TL, double change in share of sales between 2014 and 2012 separately for prices below and above 50.000 TL, triple interaction of these variables, indicator for being observed since 2011 and its interaction with the price cutoff. Fixed effects include brand and segment fixed effects, engine size fixed effects based on the most recent tax code specification and indicator for whether the car is produced in Turkey or not.

Table 6: Estimation results : Months Prior to the Policy

	(1)	(2)	(3)
Variables	jan.14 1 month	dec.13 1 month	nov.13 1 month
Constant	-9.153	-28.703	-17.303*
	(32.114)	(19.473)	(10.155)
logprice	0.068	2.794	1.551
	(2.834)	(1.844)	(0.952)
price>50	11.435	48.129**	23.401
	(31.609)	(22.557)	(14.520)
price>logprice	-0.825	-4.491**	-2.184
	(2.874)	(2.084)	(1.342)
Volatility Factors	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes
Observations	194	210	194
Adj. R-squared	0.62	0.78	0.69
F($\beta_1 = \beta_2 = \beta_3 = 0$)	4.48	3.07	1.12
p value	0.005	0.030	0.344

Standard errors in parentheses. Stars indicate significance levels: ***:p<0.01, **:p<0.05, *:p<0.1. Volatility factors include share of sales of each model within brand and brand-segment categories as of first year in the regression sample (2011 or 2012) separately for prices below and above 50.000 TL, double change in share of sales between last and the first years separately for prices below and above 50.000 TL, triple interaction of these variables, indicator for being observed since 2011 and its interaction with the price cutoff. Fixed effects include brand and segment fixed effects, engine size fixed effects based on the most recent tax code specification and indicator for whether the car is produced in Turkey or not.

Description of Variables

- Volatility Factors:
  - share of sales within brand as of 2012
  - share of sales within brand-segment as of 2012
  - double change in share of sales between 2014 and 2012 within brand
  - double change in share of sales between 2014 and 2012 within brand-segment
  - indicator for having sales in each year since 2011
- Fixed Effects:
  - brand fixed effects
  - segment fixed effects
  - engine size fixed effect based on the most recent tax code specification
  - domestic production indicator

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