

# **Developments of Credit Demand and Supply in Armenian Banking System**

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## **Abstract**

The recent developments in Armenian banking system give rise to different debates about the level of financial intermediary in Armenia. The given research aims to investigate the developments of financial intermediary in Armenia and give comprehensive answers to this and a number of related questions through an empirical analysis. Following the research objectives a panel data of 21 Armenian banks for the period 2004Q1-2015Q3 was employed to estimate an empirical model with two-stage least squares estimation approach. We get strong empirical results which correspond to our initial beliefs and are going to have strong policy implications during the decision making process in the Central Bank of Armenia.

**Keywords; Credit demand and supply; Armenian banking system; Two-stage least squares for panel data,**

**JEL: E52, E58**

### **Research Highlights**

- Estimate the influences of the main factors affecting credit demand and supply in Armenian banking system.
- Estimate historical developments of credit supply and demand and compare them with the actual levels of loans in Armenia.
- Based on the results produce policy recommendations.

## Introduction

Armenian financial system consists of mainly banking sector with 21 commercial banks, small insurance sector, and insignificant capital markets. The small but continuously growing financial system of Armenia is both well capitalized and has relatively low level of non-performing loans. In 2014 according to the World Bank the nonperforming loans (NPL) ratio in gross loans was about 6.97% and with this number Armenia was at the 6<sup>th</sup> place among the 12 CIS countries<sup>1</sup>. More than the half of the banking sector assets belongs to the foreign capital, originating from Russia, France, UK, Cyprus and Kazakhstan. Among the foreign owners we can also find many international organizations, like EBRD, IFC, KFW, or OPEC Fund for International Development. In comparison domestic banks, except the one, are relatively smaller.

Financial intermediary in Armenia has always displayed continuously growing trends. However, according to many reports and the views of leading experts, including the staff of the International Bank for Reconstruction and Development FSAP (2012), Armenia has still low level of financial intermediary, in terms of low credit to GDP ratio. According to the given report there are a numerous opportunities to increase the financial intermediary in Armenia which will have reasonable contribution to economic growth of this country. The main factors they claim concern to the underdeveloped market infrastructures, especially outside the capital city Yerevan, complicated procedures relating to the collateral for loans, high level of intermediation spreads, underdeveloped capital markets, and finally low share of non-banking sector.

In the statement of conclusion of an IMF Mission to Armenia in 2007 led by Ms. Marta Castello-Branco, we can find another opinion stating that the recent increase in financial

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<sup>1</sup> Former CIS country Georgia was also included for comparison as it is the neighbor of Armenia.

intermediation is a positive development for Armenian economy and the Central bank of Armenia should encourage this trend, meanwhile it should further provide high prudential standards for banks to keep efficient risk management and transparency.

In the Coleman et al (2012) again we can find an opinion that the banking sector in Armenia remains relatively small and unsophisticated. According to the authors, although the recent developments in financial intermediation are spectacular, there are still rooms left for further financial deepening in Armenia.

Another opinion is by the head of EBRD Yerevan Resident Office, Mark Davis. In response to the question about the possible effects of the Central bank`s decision about the increase in the level of minimum capital requirement since 2017, he answered that this will result to the possible increase in capital inflow to Armenian banking system, hence the financial deepening, and this effect should be welcomed.

Despite all these opinions and views there are also a common fear that financial intermediation in Armenia has already exceeded the payable demand and further deepening may bring to the increase of risk in the banking system. In support to these visions one can bring the recent developments in the share of bank nonperforming loans to total gross loans. According to the World Bank, during the recent five years this number was always growing and compared with 2010 it increased approximately three times and was about 9.13% in 2015. Another argument can be the fact that Armenia has already high financial intermediation ratio, compared to its neighbors. According to the World Bank, in 2014 the share of domestic credit to private sector by banks was about 41.08%, and with this number Armenia was third country among the CIS countries, staying behind only from Russia and Ukraine.

However, the literature lacks researches which investigate the level of financial intermediary in Armenia and will try to answer to these questions. The following research comes to fill this gap and aims to investigate historical developments of credit demand and supply, and by comparing them with the developments of actual level of private credit in Armenian banking system is likely to answer to the question whether the financial intermediation in Armenia is big enough. The empirical model also will give the opportunity to implement mid-term forecasts of credit demand and supply in Armenia and understand future possible developments explained by the fundamentals. Research targets of this study will also enable us to estimate the influence of the main factors on the changes of credit demand and supply, analyze the behavior of Armenian banks, concerning to their risk averseness, calculate the optimal level of income spread for the banks.

The rest of the given paper is constructed as follows; the next section gives a brief literature review, this will be followed by the theoretical model explanation, then the introduction of the main empirical analyses and the used dataset, finally we will end up with summary and conclusions, including possible policy recommendations.

## **Literature Review**

Banking sector has its significant role in the overall economy of any country so it is not surprising that the literature suggests a number of empirical researches dedicated to the investigation of credit demand and supply in the banking system. The literature review of this research is started with the paper which served as the main theoretical reference for the given empirical analyses, Melitz and Pardue (1973). In this paper, to estimate the supply and demand

of commercial bank loans, the authors employed a simple simultaneous equation model, theoretical basis of which was derived from general theory, starting at the microeconomic level. Based on the general theory, the authors assumed that one of the main driving factors for credit demand is the individual income. However, they assumed that the influence of income on the credit demand is not straightforward and theoretically hypothesized that permanent income has positive influence and transitory income has negative influence on the demand of commercial bank loans. By using quarterly data, the authors were able to get strong empirical results, which they claim to be the first satisfactory results in the literature concerning to commercial bank loans.

The next paper which was examined from the topic is Panagopoulos and Spiliotis (1998). In this paper the authors investigated the main determinants of commercial banks' lending behavior on the Greek experience for the period 1971Q1 to 1993Q2. For modeling the behavior of banks' lending and estimation of the main determinants of credit supply and demand the authors employed very similar functional forms for the demand and supply equations. For modeling the changes in the loans supply to industrial, handicraft and trade companies, they controlled for the lending interest rates, commercial banks reserves, interest rate on three-month treasury bills, consumer price index, commercial banks' deposits invested on treasury bills, the stock exchange price index, and a variable representing quality factors (collateral, maturity and the repayment period). In the supply equation the authors also controlled for consumer price index, lending interest rates, the stock exchange price index, and a variable representing quality factors. In addition they also controlled for employment costs, proxied by wage bills, costs of raw materials proxied by the costs of imports of basic materials and semi manufactured goods, and corporate payments of Greek tax. It is also interesting that they assumed that the bank loans`

demand and supply behavior has an adaptive nature and are influenced also by the previous period's decisions. The empirical estimation procedure they utilized is based on the cointegration analytical approach (Granger and Engle, 1987). By using the Johansen approach, they found long term cointegration relationship between the variables and for empirical estimation constructed an error-correction dynamic model.

Calza, Gartner and Sousa (2001) employed a Vector Error Correction Model to investigate the main determinants of the demand for loans to the private sector in the Euro area. According to their results the behavior of real loans in Euro area is mainly explained by the domestic factors. First of all, they found statistically significant error correction term with correct sign, which approved the choice of the approach they used. From the long-term part they conclude that real loans are positively related to the real GDP and negatively related to real short-term and long-term interest rates. The negative signs of interest rates make the authors to conclude that the model they used is describing a demand for loans. Finally, they also found significantly higher influence for long-term interest rates than for short-term interest rates, which was consistent with their beliefs about the maturity structure of loans to the private sector in the Euro area.

In another paper Aoki, Hasegawa and Watanabe (2009) the authors investigated the main factors for the post crisis period decline in bank lending in the USA and Europe, and also implemented comparison analyses with the case of Japan. The main theoretical framework they employed for their analyses is the loan supply curve and the loan demand curve. The upward-sloping loan supply curve shows the positive relationships between the lending rate and the willingness of banks to increase the lending levels. They took the lending rate, the cost of wholesale funding and the amount of capital buffer as the main factors for the changes in the

loan supply. The downward sloping demand curve shows the negative relationships between the lending rate and the demand for loans by households and non-financial firms. To explain the changes in loan demand they mainly controlled for the lending rate, capital investment, asset prices, residential investment, and other factors which influence on the demand for money. Based on the analyses, the authors came to several broad conclusions about the developments in credit supply and demand of these countries after the crisis. According to them during the crisis period although the bank lending rates remained relatively constant and low, the lending growth rates decreased in these countries. Although the influence of expansionary monetary policy in the USA and European countries comparatively restrained the decrease in lending volumes, however the full positive effects was not observed yet. The main explanation to this phenomenon they bring as the tightening of credit standards and conditions by the banks. They also concluded that after the crisis the effectiveness of monetary policy transmission in Japan decreased and Japan`s economy is now more dependent on external factors, such as foreign demand.

A more recent paper analyzing the factors of demand and supply on bank loans to non-financial corporation is Plašil, Radkovský and Řežábek (2013). Like in Calza, Gartner and Sousa (2001) the authors also utilized Johansen approach and constructed a Vector Error Correction Model for estimating the effects of the main factors on the bank loans to non-financial firms in Czech Republic and implemented forecasts for the credit characteristics of the corporate sector. The main contribution of this paper is that the authors used bank lending survey in the Czech Republic as the factors of credit supply. This information was used for the first time as it was not available previously because of the short history. The empirical results showed that in the long-run credit supply significantly correlates with the credit conditions. The results also indicated that in normal periods, bank loan supply and demand are significantly correlated. From these

results the authors concluded that in normal conditions the credit supply adjusted to demand pressures. However, during the global financial crisis in 2008 the situation was dramatically changed after the influence of significant credit restrictions by banks, which partly mirrored in the subsequent economic slowdown.

### **The Theoretical Model**

For estimating the bank loan supply and demand in Armenia, a simultaneous equation model was employed, the specifications of which are based on the general theory and the features of Armenian banking system. The bases for credit demand equation go to the hypothesis suggested by Milton Friedman (Friedman, 1957), who stated that the demand for a good depends on both the permanent and the transitory income of an individual. In the credit demand equation this research uses the specification suggested by Melitz and Pardue (1973) who also include the credit rate with the beliefs coming from the theory that the increase in credit rates makes bank loans expensive for consumers and hence decreases the demand. To summarize, the general demand equation can be presented as;

$$D = f(r, I_t, I_p) \quad (1)$$

Where, D is credit demand, r is credit rate,  $I_t$  is transitory income of consumers, and  $I_p$  is permanent income of consumers.

To understand the essence of possible influence of transitory and permanent income on the changes of credit demand, the figures and explanations suggested by Melitz and Pardue (1973) were used, meanwhile to be consistent with them the same definitions were kept.

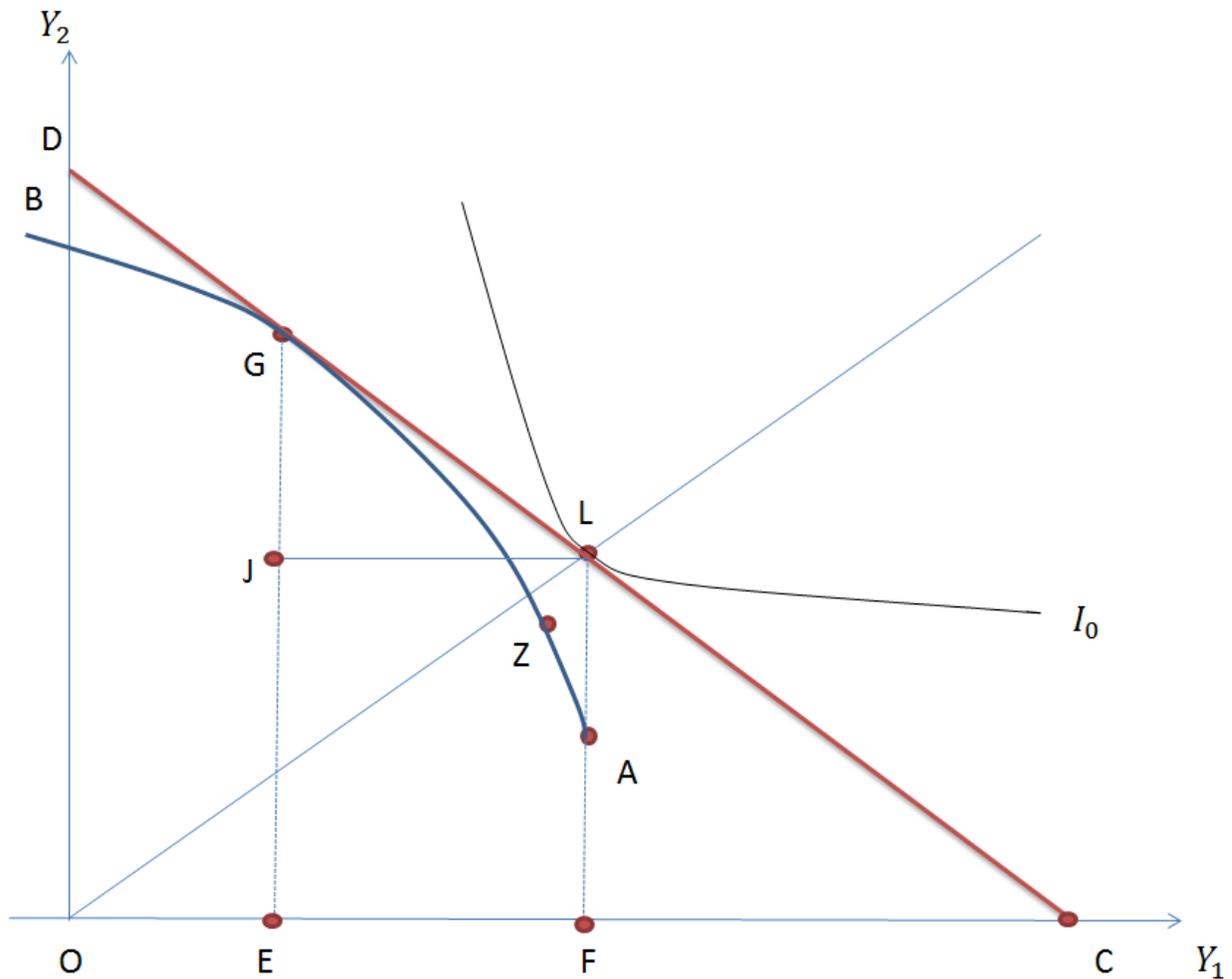


Figure 1 - Theoretical explanation of the influence of transitory and permanent income on the bank loan demand.

Source; Jacques Melitz and Morris Pardue "The Demand and Supply of Commercial Bank Loans", *Journal of Money, Credit and Banking*, Vol. 5, No. 2 (May, 1973)

In the figure 1 the  $OY_1$  axes shows the current income, and  $OY_2$  axes shows the future expected income of a representative individual.  $45^\circ$  line shows all the possible combinations for which the current and future incomes are equal to each other, so for the points outside this line the individual either has to save or borrow. The curve AB is the production opportunity curve, CD line represents the credit market which is available for the individual at the given level of production function ( $\tan(\angle DCO) - 1 = \text{slope}(CD) - 1 = \text{credit rate}$ ).  $I_0$  is the

consumption indifference curve for the given level of income. The point G shows the initial optimal level of consumption which the individual can afford at the given levels of income without the credit market. Through the credit market the individual gets a possibility to increase its current income due to a possible decrease in the future earnings, and as a result the optimal level of consumption moves to the point L. So, the individual, who has current income equal to OE, may borrow by EF and consume OF. Instead, from his future income EG he may only consume EJ, as he has to pay JG for his previous borrowings.

After obtaining general overview about the credit markets, one can suppose the situations of changes in transitory and permanent income and examine the possible influence on the credit demand. Suppose we have an increase in transitory income, which assumes that only the current income has increased. In this case the production curve will move to the right,  $A'B'$  (figure 2), and the new equilibrium point without the credit market will be  $G'$ . To understand the possible influence of these changes on the credit demand, one shall compare the new level of borrowing SK with the old level EF. In the right triangles  $\Delta JGL$  and  $\Delta J'G'Q$  the hypotenuses have the same slopes as we assumed no changes in credit rates, and  $GJ = G'J'$  as there was no change in the future income. As a result, we have two congruent triangles with equal angles and sides, therefore  $EF = JL = J'Q > SK$ . Accordingly, the new level of credit is less than the old credit demand, which brings us to the conclusion that the increase in transitory income decreases the demand for bank loans.

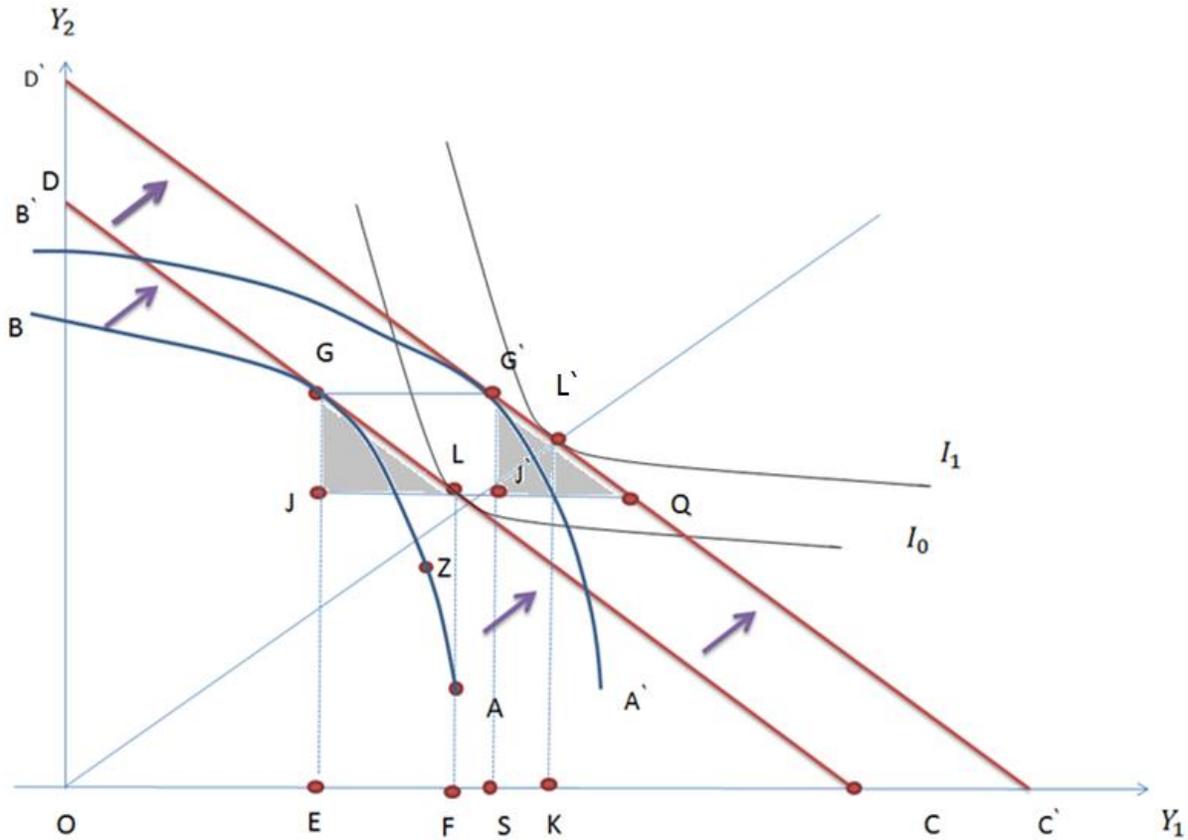


Figure 2 - The influence of transitory income on the bank loan demand.

Source; Jacques Melitz and Morris Pardue "The Demand and Supply of Commercial Bank Loans", *Journal of Money, Credit and Banking*, Vol. 5, No. 2 (May, 1973)

Next, one can assume that there was not only increase in the current income of an individual, but also in his future expected income. This situation can be described as an increase in permanent income. In this new situation the production curve moves to the up and right  $A'B'$ , and the new equilibrium without the credit market is set at the point  $G'$ , (figure 3). As before to understand the possible influence of these changes on the credit demand one shall compare the new level of borrowing  $SK$  with the old level  $EF$ . The triangles  $\Delta OG'J'$  and  $\Delta OGJ$  are similar (the ratio of sides and the angles are equal) and  $\Delta OG'J' > \Delta OGJ$ , so  $G'J' > GJ$ . At the same time from the similar triangles  $\Delta Q'J'G'$  and  $\Delta QJG$ ,  $SK = Q'J' > QJ = EF$ . In consequence, the new



banks. Therefore, the economic model we used as the basis for our empirical research can be presented as;

$$S = g(S, r, r_{alt}, \text{Spread}) \quad (2)$$

Where,  $S$  is credit supply,  $r$  is credit rate,  $r_{alt}$  is the yield of alternative opportunities, and Spread is the income spread of the banks.

It is assumed that the bigger banks have broader opportunities and can supply more credit resources. The increase in credit rate promotes credit supply as it becomes more profitable. The increase in the yields of alternative opportunities decreases the sources that banks direct to the loans. Finally, the increase in the income spread may increase the credit supply if the banks are risk lovers, and may decrease the credit supply if the banks are risk averse.

### **The Used Dataset**

The overview of the empirical analyses of the given research is started with the detailed introduction to the used dataset. Although the general forms of the economic models for the empirical analyses are similar to Melitz and Pardue (1973), the empirical estimations are completely different. The biggest difference is that, instead of using average information for the banking system, disaggregated information of separate banks in Armenia were utilized. For the empirical estimation the data set of 21 Armenian banks for the period 2004Q1-2015Q3 were used. For both the demand equation and the supply equation, as the dependent variable the actual levels of total loan volume in billion AMD (stock, monthly average) given by the particular bank during the given period were employed. The credit rate was controlled in the both equations, and

as the bank loan rate was used average interest rate of loans given by the particular bank during the given period. The historical developments of bank loan`s volumes and rates by different banks, along with the developments of the system, are given in the figures 4 and 5. The first thing one can observe from the two figures is obvious heterogeneity in the data. For bank loan`s volume this heterogeneity round the mean value of the system increases over time, especially after 2008. For the credit rate scattered data slightly tightens over time. The next things to notice from the figures are continuously upward going trend of loan volume and gradually downward going trend of credit rates. Although, from time to time, by responding to global and domestic developments (global financial crisis in 2008, exchange rate depreciation pressures at the end 2015) the banks shifted up their credit rates.

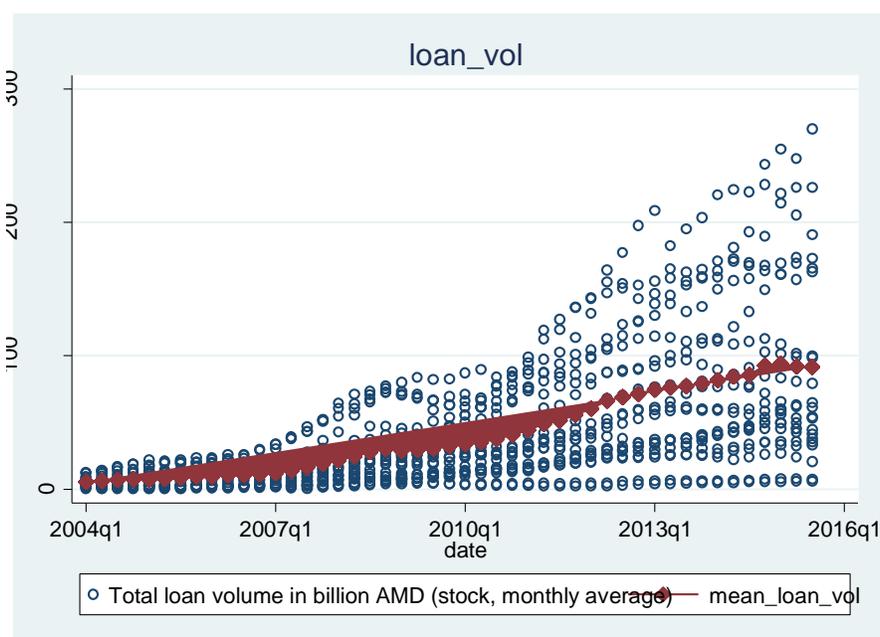
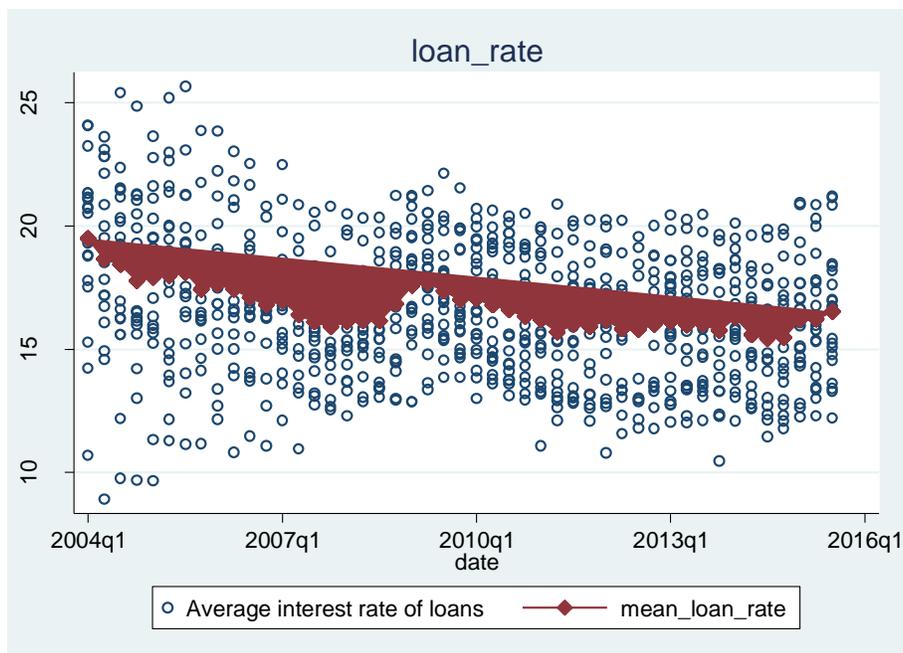


Figure 4 - The developments of bank loan`s volume by banks.

Source; author`s calculations

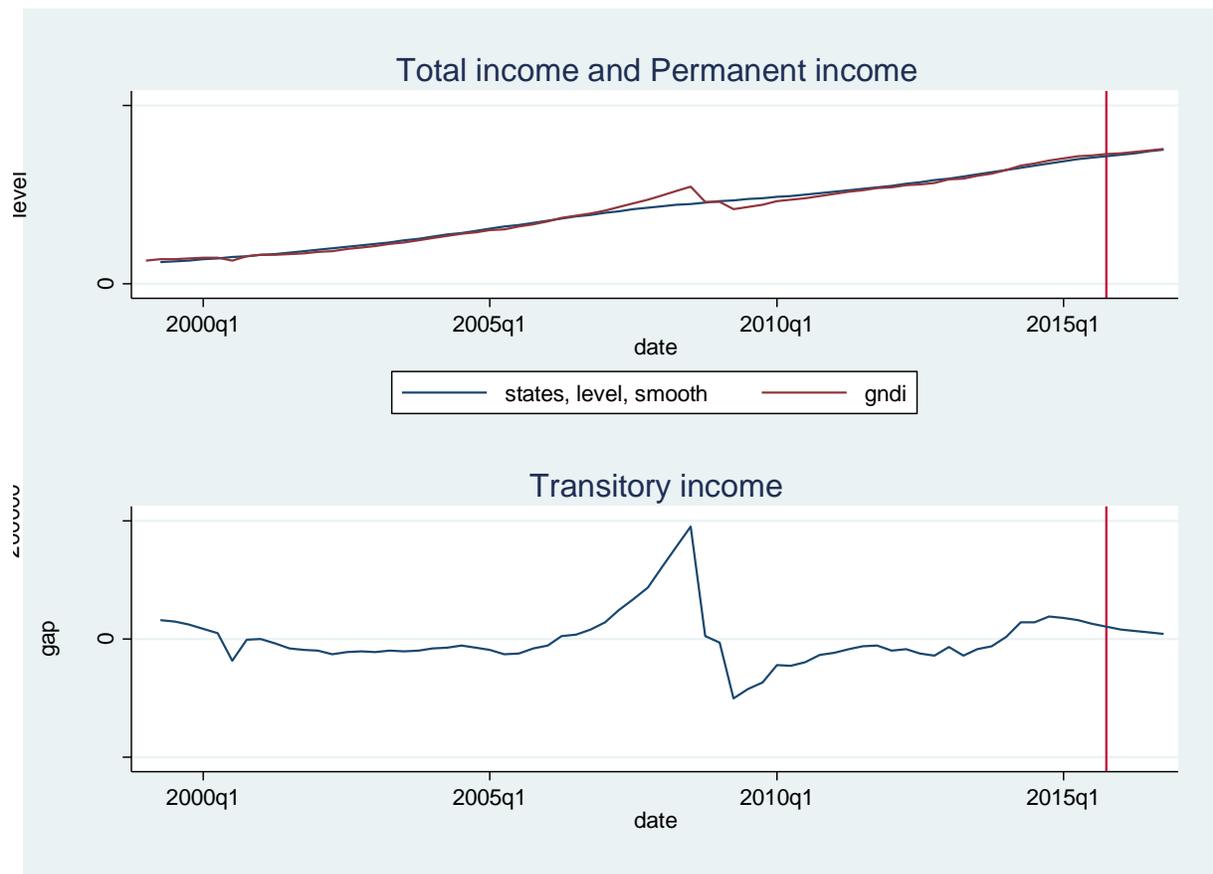


*Figure 5- The developments of bank loan`s rate by banks.*

*Source; author`s calculations*

In the demand equation besides the credit rate we also controlled for the individual income. As was suggested in the Melitz and Pardue (1973) the income was divided between permanent income and transitory income, and was assumed that transitory income impacts negatively and permanent income impacts positively on the credit demand. Kalman filtering approach was employed for disaggregating the total income between the transitory and permanent components. The seasonally adjusted gross national disposable income (GNDI) was utilized as the proxy variable for total income of all individuals and firms in the Armenian economy. The Kalman filter is used to write the likelihood function in prediction-error form, assuming normally distributed errors. In Hamilton (1994a, 1994b), Harvey (1989), and Brockwell and Davis (1991) one can find thorough introductions to Kalman filter and state-space models. The given research assumed that the total income is equal to the sum of unobserved permanent income and transitory income. Permanent income was assumed to be a random walk

process and the transitory income was assumed to be an autoregressive process. The filtering results are given in the figure 6, where the upper figure shows the permanent income (blue line) and actual seasonally adjusted GNDI, and the lower figure shows transitory income.



*Figure 6 - Obtaining permanent and transitory income.*

*Source; author`s calculations*

In the supply equation besides the credit rate we also control for the size of the bank, alternative opportunity rate, and the income spread. To control for the size of the banks, based on the level of assets, we grouped them into 3 main groups; small, medium and large banks. The grouping was done based on the following principle; banks which have assets smaller than the 25<sup>th</sup> percentile of assets during the given period, were considered as small banks, banks with

assets in the interval of 25<sup>th</sup> - 75<sup>th</sup> percentile were considered as medium banks, and the banks with assets greater than 75<sup>th</sup> percentile were considered as large banks. However, instead of creating a categorical variable and using them in the empirical model, we constructed linear splines, which gives the opportunity to estimate the relationship between the dependent and independent variables as a piecewise linear function. This function is composed of linear segments, where the first group represents the function for values of  $x < x_0$  another linear segment handles values  $x_0 < x < x_1$ , and so on. This approach enabled to estimate the slopes for each group of banks which show the influence of changes in bank assets on credit supply. More detailed explanation about the construction and usage of linear spline function can be found from Gould (1993), Greene (2012), and Harrell (2001). An example, of grouping during the third quarter of 2015 is presented in the figure 7.



*Figure 7 - Bank grouping at 2015Q3.*

*Source; author`s calculations*

As an alternative opportunity rate we took government treasury bills rate. The developments of this rate are given in the figure 8. This rate was taken the same for all the banks which means that it does not deviate across the individual banks.

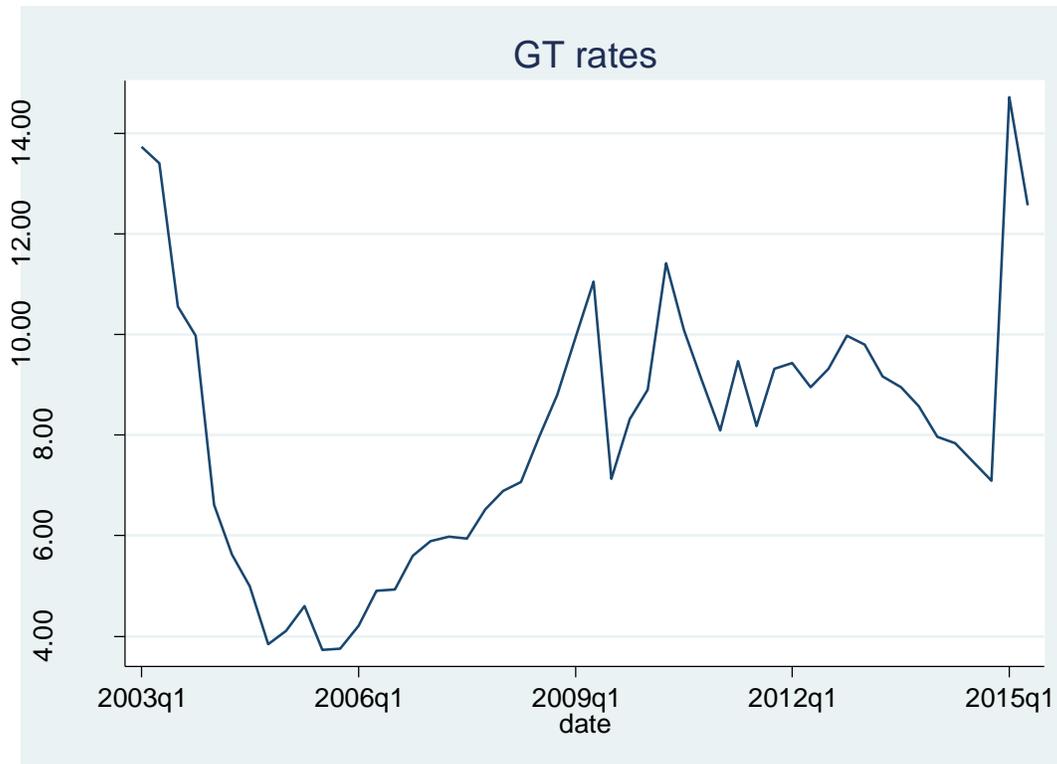
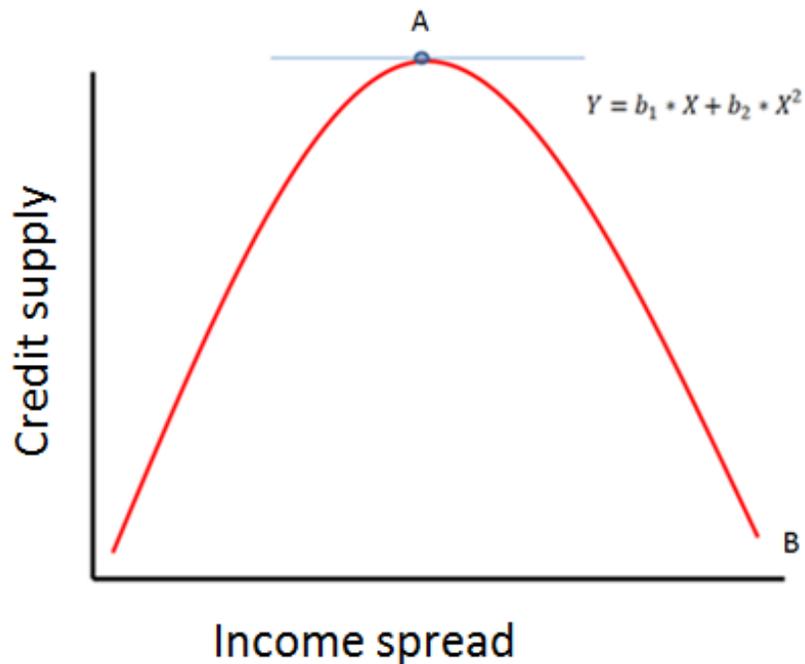


Figure 8 - Government treasury bills rate.

Source; author`s calculations

Finally, we also controlled for the income spread of the banks. As a measure of income spread, the difference between the share of interest income in interest bearing assets and the share of interest expenses in the interest bearing liabilities were used. Inclusion of this variable makes it possible to understand the risk averseness of the banks. If the banks increase their credit supply in response to the increase of income spread, this will mean that the banks are risk lovers and are ready to earn more money with the existence of high risk, but if this relationship is negative, this is a signal that the banks are risk averse and are not going to take extra risk. However, it was assumed that the both effects may exist in Armenian banking system, so again based on the linear splines approach we constructed two groups of income spread. The first group is the one with the increase of which the credit supply increases, and the second group

shows the negative relationships between the income spread and credit supply. To find the critical point after which the relationship between the credit supply and income spread changes from positive to negative, we assumed that this relationship has quadratic polynomial functional form and empirically estimated this function.



*Figure 9 - Critical point of income spread.*

*Source; author`s calculations*

Assume that the point A in the figure 9 is the critical point after which the positive effect of income spread on the credit supply changes to negative effect, hence after this points banks become more risk averse. To find the point A we estimated a regression model, where as a dependent variable we took credit volume and as explanatory variables we took income spread

and the square of income spread<sup>2</sup>. After estimation of the parameters  $b_1$  and  $b_2$ , we solved a simple optimization problem and found the maximum point of the line (point A).

From the optimization problem

$$\max_x: b_1 * X + b_2 * X^2$$

We got the optimal point A

$$A = -\frac{b_1}{2 * b_2} = 1.02$$

Having the critical point A by using the linear spline construction we were able to control for the both effects of income spread on the credit supply of Armenian banks.

As was mentioned earlier, the research employs two-stage least-squares (2sls) generalization of simple panel-data estimators. In the 2sls estimation procedure parameters are estimated in the two steps; in the first step endogenous right-hand side variables are taken as dependent variables with explanatory variables taken as other exogenous right-hand side variables and instrumental variables, and then by applying least squares estimation the predicted values are obtained, then in the second stage endogenous right-hand side variables are replaced by their predicted values and the final estimation of the parameters is done by least squares. In large samples the 2SLS estimator is approximately normally distributed. We took nominal AMD/USD exchange rate and interest spread between loan rate and deposit rate as the instruments for loan rate in the demand equation, and loan volume, alternative yield opportunity, and income spread as instruments for credit rate in the supply equation.

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<sup>2</sup> See the estimation results in the appendix 1.

2sls estimations for fitting panel-data models have five different estimators; 2sls generalizations of simple panel-data estimators for exogenous variables, 2sls with between estimator, within estimator with the fixed effects option, 2sls with random-effects estimator, and 2sls with first-differenced estimator. In Baltagi (2008) we can find more detailed introduction to panel-data models with endogenous covariates. Based on the Hausman specification test we chose the random effects models, where we assumed random variation across the individuals<sup>3</sup>.

Finally, in the both equation we assumed that there is delayed impact of control variables, so we took all the explanatory variables with one lag.

## Empirical Results

Based on the empirical estimation, we got strong results which are summarized in the table 1.

	Loan volume	
	Demand equation	Supply equation
<b>Loan rate</b>	-0.04 (2.54)***	0.32 (5.21)***
<b>Permanent income</b>	3.53 (37.19)***	
<b>Transitory income</b>	-0.06 (2.81)***	
<b>Small banks` assets</b>		1.35 (25.16)***
<b>Medium banks` assets</b>		1.04 (14.37)***
<b>Large banks` assets</b>		0.71 (4.11)***
<b>Alternative yield</b>		-0.01 (0.42)
<b>Spread (negative influence)</b>		-0.17 (2.24)**
<b>Spread (positive influence)</b>		0.07 (1.98)**

<sup>3</sup> See the test results in the appendix 2.

<b>_constant</b>	-20.15    (22.00)***	-7.05    (6.34)***
<b>N</b>	881	800
<b>R<sup>2</sup> (overall)</b>	0.4417	0.8001

*Table 1 - Empirical estimation results,*

*\*p<0.1, \*\* p<0.05, \*\*\* p<0.01*

*z-statistics are in the parenthesis*

*Source; author`s estimations*

The first thing to notice is the signs and magnitudes of the effects of loan rate on the credit volumes. We can see that both in the demand equation and the supply equation loan rate is statistically significant and have correct signs. As we expected from the theory the increase in credit rate should decrease the demand for credit resources and increase the supply for credit resources. From the estimated coefficients we can say that 1% increase in bank loans` rate decreases the demand for credit resources by about 0.04% and increases the supply for them by about 0.32%. This significant difference between the elasticities of demand and supply is also logical and indicates that supply of credit resources in Armenian banking system is more responsive to the changes of credit rates than demand.

For the different components of income in the demand equation we also got statistically significant parameters with correct sigs and reasonable magnitudes. As we saw in the theoretical part, the increase in permanent income of individuals makes them more confident about their future incomes, hence they increase their demand for credit resources, and meanwhile the increase in their transitory income, decreases their demand for bank loans as they can substitute the demand for money by the current unpredicted rise in their income. From the estimated coefficients we can see that when permanent income increases by 1%, the demand for bank loans increases by about 3.53%. This number is reasonable as when they expect permanently to earn

more money in the future, they may afford to spend more today and significantly increase their demand for the credit resources. At the same time when transitory income increases by 1%, demand for credit decreases only by about 0.06%. This small coefficient is reasonable as the rise in transitory income was not expected and individuals only slightly adjust their demand for credit resources.

We got statistically significant coefficients for the influence of assets for different groups of banks. From the coefficients we can state that 1% increase in assets brings to 1.35% increase in credit supply by small banks, 1.04% increase in supply by medium banks, and 0.71% increase in supply by large banks.

Another interesting result we got from the empirical estimation is that in the supply equation the alternative yield does not have statistically significant influence on the credit supply. This means that, Armenian banks do not respond to the changes of government treasury bill's rate, which is an indicator for a weak monetary policy transmission mechanism in Armenia.

Finally, as was expected we got positive influence of income spread on the credit supply up to the critical point (1.02%), and negative influence of income spread on the credit supply after the critical point. So 1% increase in income spread increases credit supply by 0.07% up to the critical point, after which it decreases credit supply by about 0.17%.

After the estimation of the models we can now implement historical estimation of credit supply and demand in Armenian banking system and try to answer to the main hypothesized question we put in the research objectives of this paper. The estimated bank loans` supply and demand along with the actual credit volumes are presented in the figure 9.

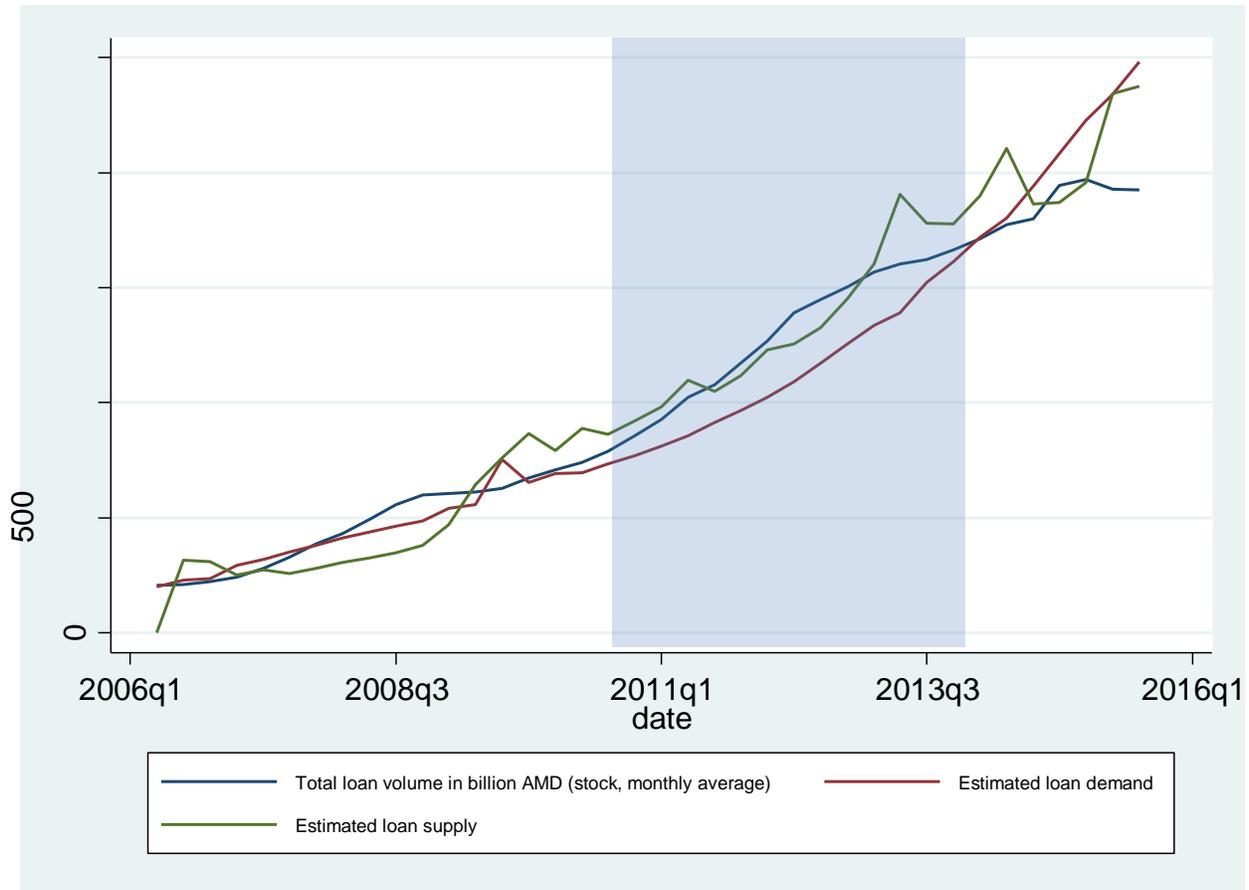


Figure 9 - Credit supply, demand and actual volumes.

Source; author`s estimations

From the graph we can obviously observe that during a long period, started from 2009 to the end of 2014 credit demand (red line) was mainly below the actual levels (blue line) and supply (green line). This long lasting trend rises a natural question whether during this period banks implemented appropriate credit policy. According to this results the demand for loans explained by the fundamentals was lower than the supply and in most cases even lower than the actual levels. This results come to prove that during this period financial intermediation in Armenia was higher than it should be.

However the picture changes after 2014 when the actual level of loans was lower than fundamentally explained supply and demand. This trend is a signal that banks now are more cautious and do not lend as much as they can or as the demand is. On the other hand we need to be careful here to make fundamental conclusions, as the reason could also be the sudden devaluation of Armenian dram at the end of 2014. This effect may artificially increase demand and supply of the dollarized loans.

## **Summary and Conclusions**

The following research aimed to investigate the historical developments of credit supply and demand in Armenian banking system. Based on the general theory, an empirical model was employed to estimate the influence of the factors on the changes of credit supply and demand. For empirical estimation the panel data of 21 Armenian banks for the period 2004Q1 to 2015Q3 was utilized. The methodology for empirical model was two stage least squares for panel data with random effects.

From the empirical model we found that credit rates have statistically significant positive effect on the credit supply and statistically significant negative effect on the credit demand, meanwhile, the response of bank loans` supply is much bigger than the response of demand. From the demand equation we found that permanent income has positive influence and transitory income has negative influence on the changes of credit demand. Both the effects are statistically significant; however the effect of permanent income is much stronger than the effect of transitory income. From the supply equation three different statistically significant effects were found for different groups of banks for assets on the credit supply. Another interesting result is that banks

do not respond to the changes of government treasury bill's rate, which can be a signal of weak monetary policy transmission mechanism. Finally, we found that banks respond positively to the increase in income spread until the optimal point after which the response changes and the increase of income spread decreases the credit supply.

Having estimated the credit supply and demand it was possible to compare the historical developments of credit demand and supply with the actual bank loans. The comparison enabled us to understand when the financial intermediary in Armenia complied with the demand and supply explained by the fundamentals. This result has very important implications and may serve as crucial policy recommendations. We got strong empirical results and believe that they will have important policy implications as during the recent years in Armenia many experts dispute about the level of financial intermediary.

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## Appendix

### Appendix 1

Source	SS	df	MS			
Model	46568.3884	2	23284.1942	Number of obs = 933		
Residual	2028011.5	930	2180.65753	F( 2, 930) = 10.68		
				Prob > F = 0.0000		
				R-squared = 0.0224		
				Adj R-squared = 0.0203		
				Root MSE = 46.698		
Total	2074579.89	932	2225.94409			

loan_vol	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
inc_spread	4.689347	1.599801	2.93	0.003	1.549708	7.828985
inc_spread2	-2.293294	.5637161	-4.07	0.000	-3.399597	-1.186991
_cons	40.95368	2.79041	14.68	0.000	35.47745	46.42991

### Appendix 2

Hausman test for demand equation (null hypothesis random effect model is better)

	— Coefficients —			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
L.loan_rate	-.1067926	-.1043742	-.0024183	.0014133
L.ln_y_perm	3.388904	3.396702	-.0077971	.0048344
L.ln_y_tr	-.0866322	-.0856634	-.0009688	.0007772

b = consistent under Ho and Ha; obtained from xtivreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtivreg

Test: Ho: difference in coefficients not systematic

$$\begin{aligned}
 \text{chi2}(3) &= (b-B)' [(V_b-V_B)^{-1}] (b-B) \\
 &= 3.01 \\
 \text{Prob}>\text{chi2} &= 0.3900
 \end{aligned}$$

### Hausman test for supply equation (null hypothesis random effect model is better)

```
. hausman fixed random
```

	Coefficients			sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) random	(b-B) Difference	
L.loan_rate	.0860194	.2049813	-.1189619	.
L.small_	1.226169	1.320878	-.0947089	.
L.medium_	1.222384	1.280402	-.0580186	.
L.large_	.7652513	.7109227	.0543286	.
L.r_alt	.0108976	-.0003836	.0112813	.
L.spread_n	.0388498	-.0759234	.1147731	.
L.spread_p	.0623608	.0700439	-.0076831	.

b = consistent under Ho and Ha; obtained from xtivreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtivreg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
 = 14.71  
 Prob>chi2 = 0.0399

Although the p-value = 0.0399, we decided to choose random effect model to be consistent with demand equation.