CREDIT DEMAND AND SUPPLY IN THE ARMENIAN BANKING SYSTEM *

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Abstract – This paper examines the extent of financial intermediation in Armenia and the factors shaping it. A panel data on 21 Armenian banks is employed over the period 2004Q1-2015Q3. The empirical findings suggest that credit rates have statistically significant positive effect on credit supply and statistically significant negative effect on credit demand, with the response of supply being much bigger than the response of demand (in absolute value). We find that permanent income has positive influence and transitory income has negative influence on changes of credit demand. Both effects are statistically significant, but with the effect of permanent income being much stronger than the effect of transitory income. Banks do not seem to respond to changes in the Treasury bill rate, which can be a signal of weak monetary policy transmission mechanism. Finally, we find that banks respond positively to an increase in income spread up to the optimal point after which the response changes and an increase of income spread decreases credit supply.
Keywords: Credit demand and supply; Armenian banking system; panel data; Armenia
JEL: E52, E58

1. INTRODUCTION

The Armenian financial system primarily consists of the banking sector with its 21 commercial banks, a small insurance sector, and insignificant capital markets. The small but continuously growing financial system of Armenia is both well capitalized and has relatively low levels of non-performing loans (NPL). According to the World Bank (2014), nonperforming loans ratio in gross loans was about 6.97%, and with this number Armenia ranks in 6th place among the 12 CIS countries.[1] More than the half of the banking sector assets is of foreign capital, originating from Russia, France, UK, Cyprus and Kazakhstan. Partially foreign owners include several international organizations such as EBRD, IFC,

*The views expressed are those of the authors and do not necessarily represent those of the Central Bank of Armenia. Comments by an anonymous reviewer are appreciated.
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[1]Neighboring and former CIS country Georgia was also included for comparison purposes as it shares many common attributes with Armenia.

KFW or OPEC Fund for International Development. In comparison banks with domestic capital are relatively smaller.

Financial intermediation in Armenia has been expanding over the years. However, according to, among others, the staff of the International Bank for Reconstruction and Development [FSAP (2012)], Armenia has still low level of financial intermediation, in terms of low credit to GDP ratio. The main factors, they claim, concern the underdeveloped market infrastructures, especially outside the capital city Yerevan, complicated procedures relating to collateralizing loans, high level of intermediation spreads, underdeveloped capital markets, and low share of non-banking sector. Similarly, and as portrayed in Coleman et al (2012), the banking sector in Armenia remains relatively small and unsophisticated. The authors state that although the recent developments in financial intermediation are spectacular, there is still room left for further financial deepening in Armenia.

However, and notwithstanding the views expressed above, there is little in the way of research that examines the level of financial intermediary in Armenia and the factors shaping it. The aim of this paper is to fill this void. It examines trends in credit demand and supply, and addresses the question whether financial intermediation in Armenia is consistent with its potential level. It further explores the primary factors shaping credit demand and supply, analyzes the behavior of Armenian banks, and calculates the optimal level of income spread for the banks.

The rest of the given paper is organized as follows. Section 2 provides a brief literature review. This is followed by a discussion of theoretical modeling issues in Section 3. Section 4 describes the data sources and the empirical estimation strategy. The findings are reported in Section 5, and the paper concludes in Section 6.

2. Literature Review

The banking sector plays a significant role in economy of any country. Thus, is not surprising that a vast body of the literature has examined the credit demand and supply in

banking systems. In a classical paper on the topic, Melitz and Pardue (1973) estimate supply and demand of commercial bank loans, by employing a simple simultaneous equation model. Based on the theoretical evidence, the authors assume that main driving factors for credit demand are two different components of individual income; permanent income, which has a positive influence on the demand of commercial bank loans, and transitory income, which has negative influence on the demand of commercial bank loans. By using quarterly data for US, the authors obtain strong empirical support of their model.

Panagopoulos and Spiliotis (1998) investigate the main determinants of commercial bank lending behavior on the Greek experience for the period 1971Q1 to 1993Q2. In modeling the changes in the loan supply to industrial, handicraft and trade companies, they control for lending rates, commercial banks reserves, interest rate on three-month treasury bills, consumer price index, commercial bank 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 control for consumer price index, lending interest rates, the stock exchange price index and a variable representing quality factors. In addition they also control 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. Finally, they suggest the behavior of demand and supply for bank loans to have an adaptive nature and be influenced by decisions in previous periods. The empirical estimation procedure is based on the cointegration analytical approach [Granger and Engle, (1987)], suggesting long term cointegration relationships between the variables.

Calza, Gartner and Sousa (2001) employ a Vector Error Correction Model (VECM) to investigate main determinants of the demand for loans to private sector in the Euro area. According to their results the behavior of real loans in Euro area is mainly explained by domestic factors. From the long-term part they conclude that real loans are positively related to 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 describes

the demand for loans. Finally, they also find significantly higher influence for long-term interest rates than for short-term interest rates, which is consistent with their beliefs about the maturity structure of loans to private sector in the Euro area.

Aoki, Hasegawa and Watanabe (2009) investigate the main factors for the post crisis period decline in bank lending in the US and Europe and implement comparison analyses with the case of Japan. The theoretical framework is based on loan supply and demand curves. The upward-sloping loan supply curve shows positive relationships between lending rate and willingness of banks to increase lending levels. They take cost of wholesale funding and amount of capital buffer as the main factors for the changes in loan supply. The downward sloping demand curve shows negative relationships between lending rate and demand for loans by households and non-financial firms. The lending rate, capital investment, asset prices, residential investment are considered to be the main factors of demand for money. Based on the analyses, the authors come to several broad conclusions; during the crisis period although bank lending rates remained relatively constant and low, the lending growth rates decreased in these countries, although influence of expansionary monetary policy in the US and European countries comparatively restrains the decrease in lending volumes, the full positive effects are not observed yet. The main explanation to the latter phenomenon is tightening of credit standards and conditions by the banks. They also conclude that after the crisis effectiveness of monetary policy transmission in Japan decreased and Japan‘s economy is now more dependent on external factors, such as foreign demand.

And last, Plašil, Radkovský and Řežábek (2013), similar to Calza, Gartner and Sousa (2001), use a VECM model for estimating effects of the main factors on bank loans to non-financial firms in Czech Republic. Authors use the results of bank lending survey in the Czech Republic as the factors of credit supply. This information is used for the first time as it was not available previously because of the short history, and this is claimed to be among the main contributions of the paper. The empirical results show that in the long-run credit supply significantly correlate with credit conditions. Additionally, in normal

periods, bank loan supply and demand are significantly correlated. From these results the authors conclude that in normal conditions credit supply adjusts 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.

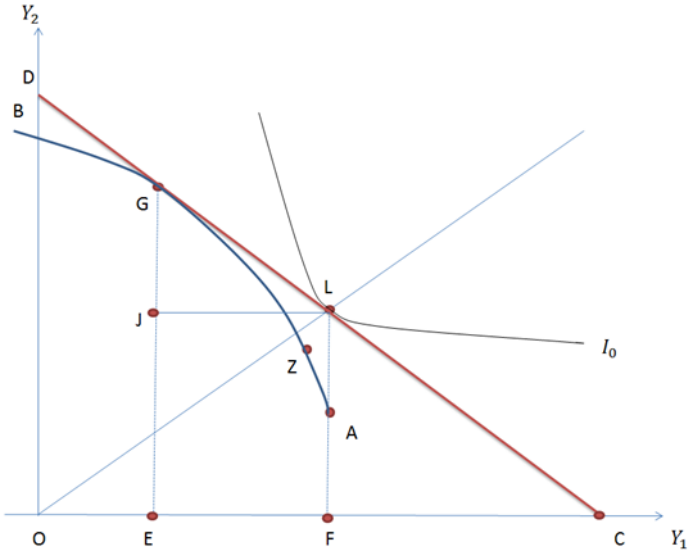
3. Theoretical Modeling of credit demand and supply

The theoretical bases for credit demand equation go to Friedman (1957) hypothesis, suggesting that demand for a good depends on both permanent and transitory income of an individual. Following Melitz and Pardue (1973), we also control for credit rate, the increase of which makes bank loans more expensive for consumers and hence decreases the demand. Equation (1) summarizes the general demand equation, where D is credit demand, r is credit rate, I_t is transitory income of consumers, and I_p is permanent income of consumers;

$$D = f\left(r,\, I_p,\, I_p\right) \tag{1}$$

To understand the possible impact of transitory and permanent income on changes in credit demand, we use the figures and explanations suggested by Melitz and Pardue (1973). In Figure 1, reproduced from Melitz and Pardue (1973), the OY_1 axis shows current income and OY_2 axes shows future expected income of a representative individual. The 45 degree line shows all the possible combinations for which current and future incomes are equal to each other, so for the points outside this line an 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 an individual at the given level of production function (credit rate=$slope(CD) - 1$). I_0 is the consumption indifference curve for the given level of income. The point G shows the initial optimal level of consumption which an individual can afford at the given levels of income without credit market. Through credit market an

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

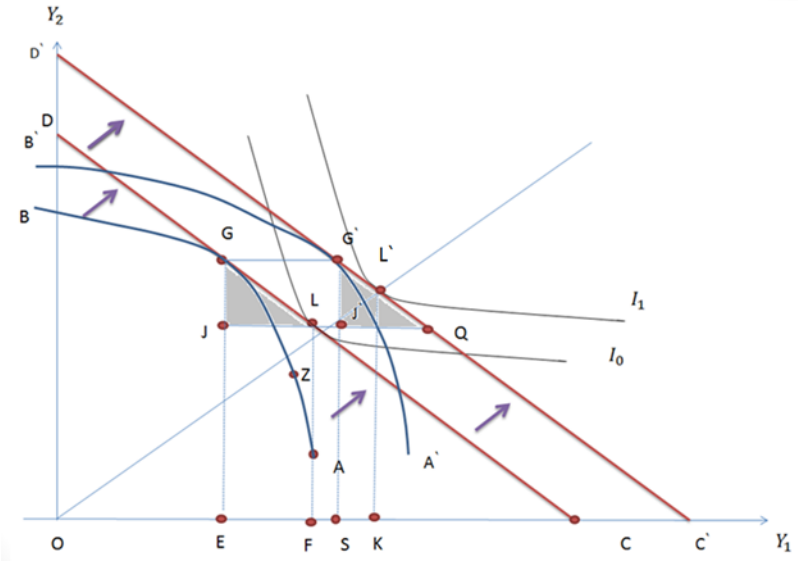


Source: Melitz and Pardue (1973)

individual gets a possibility to increase her 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, an individual, who has current income equal to OE, may borrow by EF and consume OF. Instead, she may only consume EJ from her future income EG, as she has to pay JG for her previous borrowings.

Next consider the case of changes in transitory and permanent income and their possible influence on credit demand. An increase in transitory income, holding permanent income constant, moves the production curve to the right, $A'B'$ as in Figure 2, and a new equilibrium point, without the credit market, is achieved at point G'. To understand possible influence of these changes on credit demand, we should compare the new level of borrowing SK with the old level EF. In the right triangles ΔJGL and $\Delta J'G'Q$ the hypotenuses have the same slopes as we assume no changes in credit rates, and $GJ = G'J'$, as there is no change in 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 an increase in transitory income decreases demand for bank loans.

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

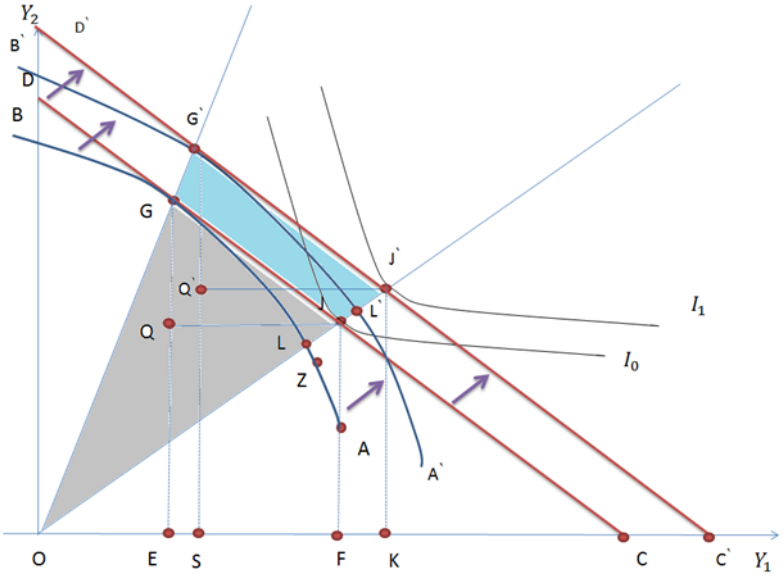


Source: Melitz and Pardue (1973)

Next, further consider the case when there is an increase in both current income and in future expected income, or in other words the increase in income has a permanent nature. In this new condition the production curve moves to up and right $A'B'$, and a new equilibrium without credit market is set at the point G'as in Figure 3. As before to explain the possible influence of these changes on credit demand, we need to compare the new level of borrowing SK with the old level EF. The triangles $\Delta OG'J'$ and ΔOGJ 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 ΔQJG, $SK = Q'J' > QJ = EF$. Consequently, the new level of credit is greater than the old credit demand, which brings us to the conclusion that an increase in permanent income increases demand for bank loans.

To model the credit supply, Melitz and Pardue (1973) assume that the main explanatory factors are scale constraints, credit rates, yields of alternative opportunities, and cost per dollar of bank deposit liabilities. We heavily follow this functional form, with the only difference is that we use the income spread of the banks instead of the last factor. The latter decision suggests that Armenian banks are not heavily constraint with funding and

FIGURE 3. The influence of permanent income on the bank loan demand



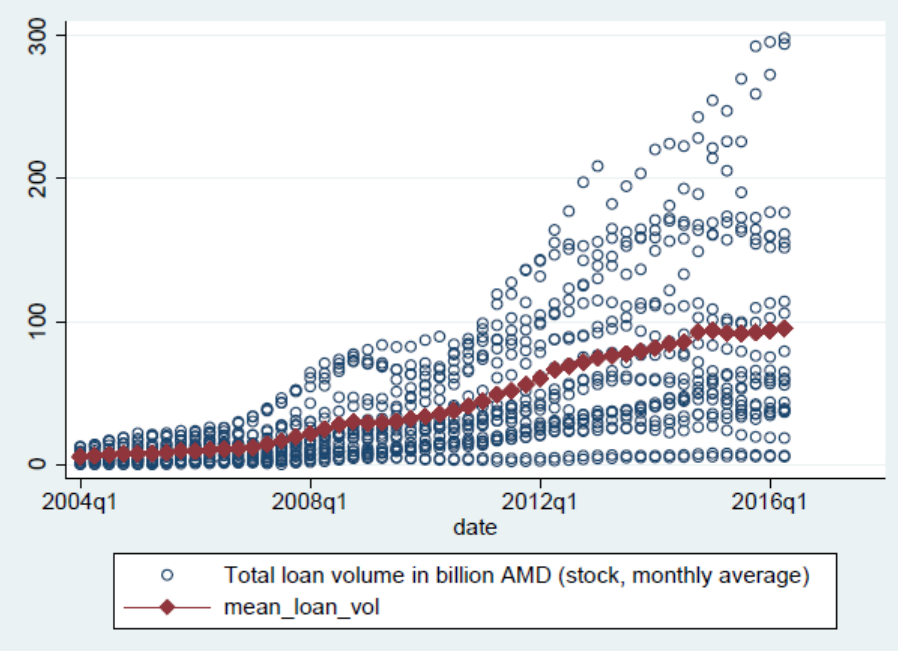
Source: Melitz and Pardue (1973)

they are more sensitive to possible benefits of their activity. Equation (2) shows the general functional form of supply equation, where S is credit supply, r is credit rate, r_{alt} is the yield of alternative opportunities, and Spread is income spread of banks.

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

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

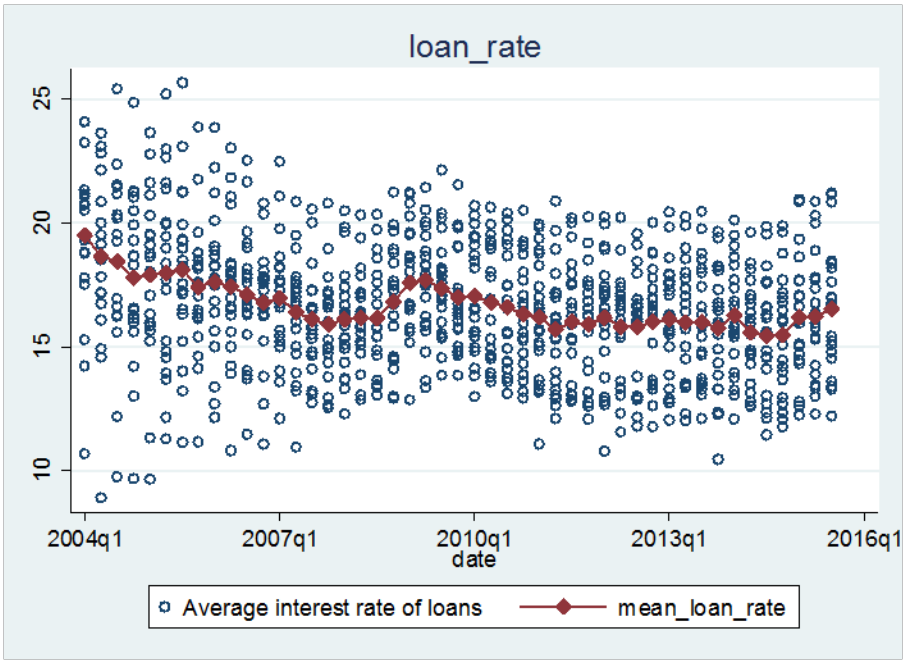
FIGURE 4. Trends in bank loan volume for each bank



4. DATA AND EMPIRICAL ESTIMATION

We begin the empirical analyses with detailed introduction to the data employed. Although the general model specifications are similar to Melitz and Pardue (1973), the empirical estimations are completely different. The biggest difference is in the essence of the data; instead of taking average information for banking system, we use disaggregated information of 21 Armenian banks for the period 2004Q1-2015Q3. In both demand and supply equation the dependent variable is actual level of total loan volume in billion AMD (stock, monthly average) given by a particular bank during the given period. Credit rate is controlled in the both equations; we take average interest rate of loans given by a particular bank during the given period. The historical developments of the above mentioned variables are given in the Figures 4 and 5. The first thing to notice is obvious heterogeneity in the data. For volumes this heterogeneity round the mean value increases over time, especially after 2008. For rates scattered data slightly tightens over time. Next, there is a continuously upward going trend of volumes and a gradually downward going trend of rates; although, from time to time to respond the global and domestic developments banks shift up their credit rates.

FIGURE 5. Trends in bank loan rates for each bank



The next control variables in the demand equation are permanent and transitory incomes. Through a Kalman filtering technique, we disaggregate the total income between transitory and permanent components. Seasonally adjusted gross national disposable income ($GNDI$) is used as a proxy variable for total income of all individuals and firms. The Kalman filter is used to write the likelihood function in prediction-error form, assuming normally distributed errors. Hamilton (1994a, 1994b), Harvey (1989), and Brockwell and Davis (1991) give a thorough introduction to Kalman filter and state-space models. We assume that total income is the sum of unobserved permanent and transitory components, where permanent income follows a random walk process and transitory income follows an autoregressive process. The filtering results are given in figure 6, where the upper figure shows permanent income (blue line) and actual seasonally adjusted $GNDI$, and the lower figure shows transitory income.

In the supply equation we also control for size of banks, alternative opportunity rate, and income spread. Based on the level of assets, banks are clustered in three groups; banks, with assets level smaller than the 25th percentile of assets level during the given period, are considered as small banks, banks, with assets level in the interval of 25th - 75th

FIGURE 6. Obtaining permanent and transitory income

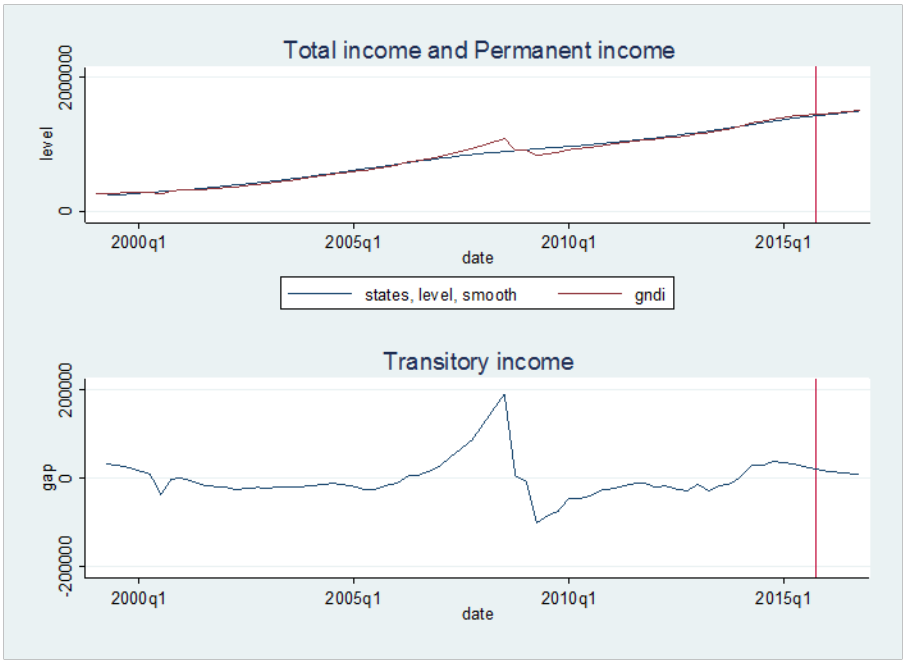
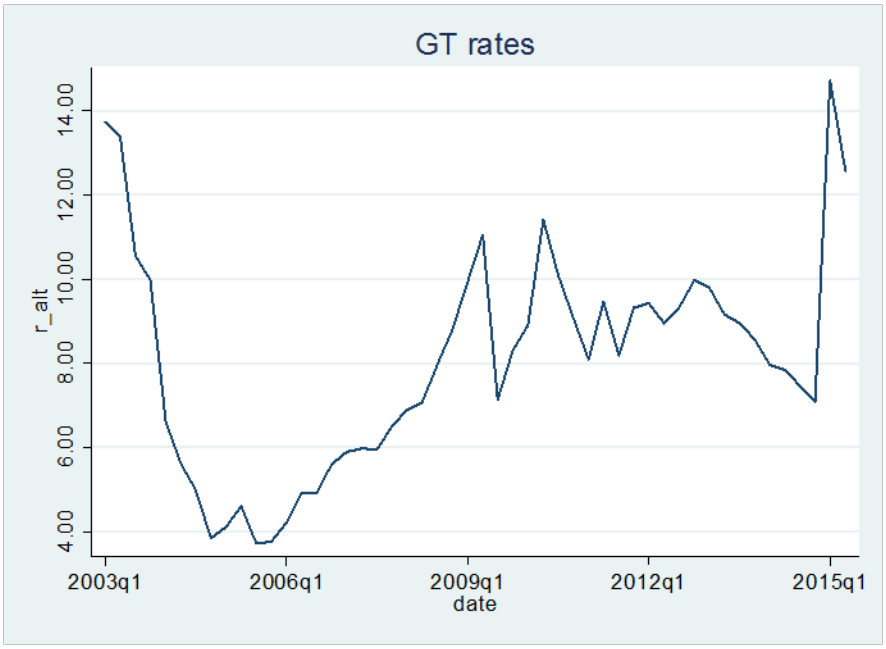


FIGURE 7. Bank grouping at 2015 Q3

percentile of assets level, are considered as medium banks, and banks, with assets level greater than 75th percentile of assets level, are considered as large banks; an example of grouping during the third quarter of 2015 is presented in Figure 7. However, instead of creating a categorical variable and using them in the empirical model, we construct linear splines, which gives the opportunity to estimate a relationship between dependent and independent variables as a piecewise linear function. This function is composed of linear segments, where the first group represents a function for values of $x < x_0$ another linear segment handles values $x_0 < x < x_1$, and so on. This approach enables to estimate slopes for each group of banks.[2]

[2]More detailed explanation about the construction and usage of linear spline function can be found from Gould (1993), Greene (2012), and Harrell (2001).

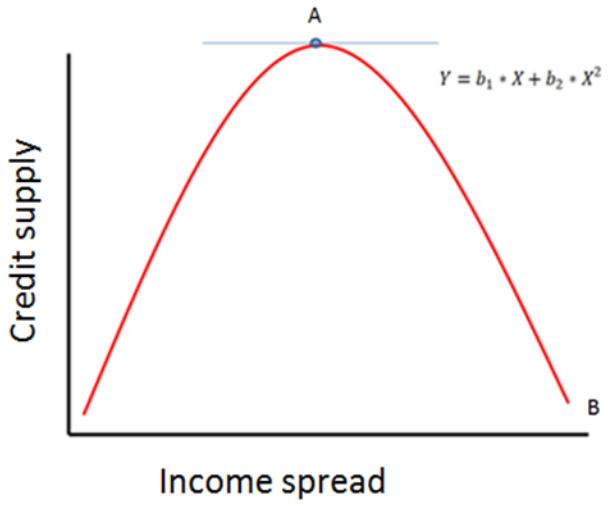
FIGURE 8. Trends in government treasury bills rates



As an alternative opportunity rate, we employ the government Treasury bill rat. The developments of this rate are given in Figure 8. This rate is taken the same for all the banks and does not deviate across individual banks.

Finally, in the supply equation we control for income spread of banks. The latter is measures as the difference between share of interest income in interest bearing assets and share of interest expenses in interest bearing liabilities. Inclusion of this variable controls for risk averseness of banks. If a bank increases its credit supply in response to increase of income spread, then it is a risk lover tending to earn more money with the existence of high risk, but if this relationship is negative, then the bank is risk averse and is not ready to take the extra risk. We propose that the both effects may exist, so again based on the linear splines approach we construct two groups of income spread; the first group is the one with positive relationships between income spread and credit supply, and the second group is the one with negative relationships between income spread and credit supply. The critical point, after which the relationship between the credit supply and income

FIGURE 9. Critical point of income spread



spread changes from positive to negative, is estimated by using a quadratic polynomial functional form of the relationship between these variables as illustrated in Figure 9.[3]

As was mentioned earlier, the research employs two-stage least-squares (2SLS) generalization of simple panel-data estimators. In 2sls estimation procedure parameters are estimated in two steps; during 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 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 2SLS estimator is approximately normally distributed. We take nominal exchange rate and lag of loan volume as instruments for

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Assume that the point A is the critical point after which positive effect of income spread changes to negative effect, hence after this point banks become more risk averse. To find the point A we regress credit volume on income spread and the square of income spread (detailed estimates available upon request). Using estimated parameters b_1 and b_2, we solve a simple optimization problem and find the maximum point of the line (point A):

$\max b_1 X + b_2 X^2$

We obtain optimal point A as:

$A = -b_1/(2\,b_2)$

loan rate in the demand equation, and interest spread, lag of alternative yield opportunity and lag of loan volume as instruments for credit rate in the supply equation. We choose random effects specification with random variation across individuals.[4] Finally, in both equations we assume that there are delayed impacts of control variables, thus we consider all the explanatory variables with one period lag.

5. Empirical Results

The empirical results are summarized in Table 1. In both demand and supply equations, loan rates are statistically significant and have the expected signs; an increase of 1% increase in interest rates decreases the demand for credit resources by about 0.04 percent and increases the supply for them by about 0.32 percent. This large difference between two elasticities indicates that supply of credit resources is more responsive to changes of credit rates than demand is. In the demand equation permanent and transitory components of income have statistically significant opposite impacts on changes of credit demand. An increase of one percent in permanent income raises demand for bank loans by about 3.53 percent, while a concomitant increase of one percent in transitory income decreases demand for credit decreases by about 0.06%. The big elasticity of permanent income is explained as follows; when an individual expects permanently earn more money in the future, she becomes more free to spend today and significantly increases her demand for credit resources. The small coefficient of transitory income is reasonable as well and indicates that the rise in transitory income is not expected and individuals only slightly adjust their demand for credit resources. Next, we get statistically significant coefficients for the influence of assets for different groups of banks; 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 get, is that alternative yield does not have statistically significant influence on credit

[4]Hausman test results are available upon request. We find greater support for the Random effect in estimating the demand equation (χ^2=3.01, p=0.39), but less so in estimating the supply equation (χ^2=14.71, p=0.0399).

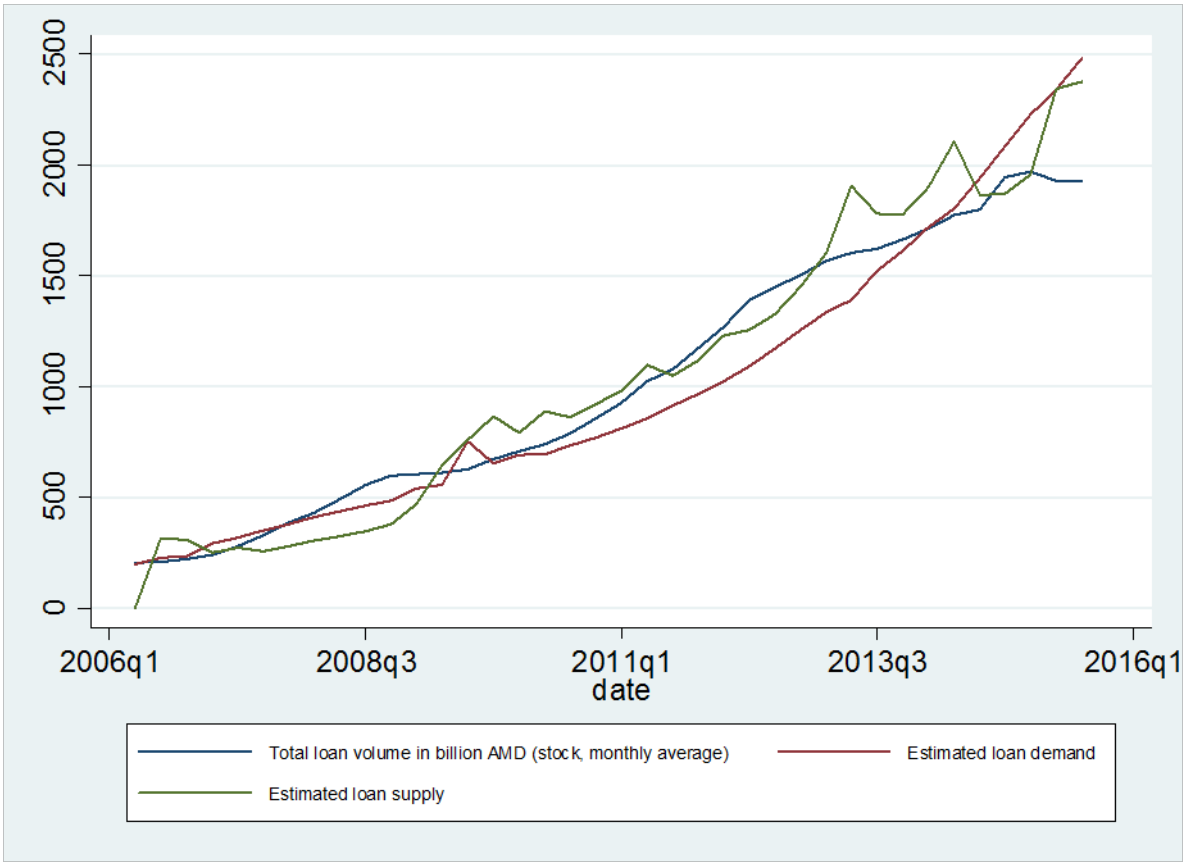
TABLE 1. Loan volume estimates

	Demand equation	Supply equation
Loan rate	-0.04	0.32
	(2.54)***	(5.21)***
Permanent income	3.53	
	(37.19)***	
Transitory income	-0.06	
	(2.81)***	
Small banks' assets		1.35
		(25.16)***
Medium banks' assets		1.04
		(14.37)***
Large banks' assets		0.71
		(4.11)***
Alternative yield		-0.01
		(0.42)
Spread (negative influence)		-0.17
		(2.24)**
Spread (positive influence)		0.07
		(1.98)**
constant	-20.15	-7.05
	(22.00)***	(6.34)***
N	881	800
$\overline{R}^2$	0.4417	0.8001
*p<0.1, ** p<0.05, *** p<0.01; t-test in parenthesis		

supply. This means that, Armenian banks do not respond to changes of government Treasury bill rate, which can be an indicator for a weak monetary policy transmission. Finally, we get positive influence of income spread up to the critical point and negative influence of income spread after the critical point; 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%.

We can now estimate of the supply and demand for credit in the Armenian banking system and try to answer our main hypothesized question. The estimated supply and demand along with actual credit volumes are presented in Figure 10. We observe that during a long period, starting from 2009 to the end of 2014, credit demand (red line) is mainly below the actual levels (blue line) and supply (green line). This long lasting trend rises a natural question whether during this period banks have implemented appropriate

FIGURE 10. Loan Volume



credit policy. According to this results demand for loans, explained by the fundamentals, is lower than the supply and in most cases even lower than the actual levels. This results come to prove that during this period according to the fundamentals financial intermediation in Armenia was higher than it was supposed to be. However the picture changes after 2014 when the actual level of loans is lower than fundamentally explained supply and demand. This trend is a signal that banks now are more prudent 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.

6. Summary and Conclusions

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

The empirical findings suggest that credit rates have statistically significant positive effect on credit supply and statistically significant negative effect on credit demand, with the response of supply much bigger than the response of demand (in absolute value). We find that permanent income has positive influence and transitory income has negative influence on changes of credit demand. Both effects are statistically significant, but with the effect of permanent income being much stronger than the effect of transitory income. From the supply equation three different statistically significant effects are found, for different groups of banks, for assets on credit supply. Another interesting result is that banks do not respond to changes of government Treasury bill rate, which can be a signal of weak monetary policy transmission mechanism. Finally, we found that banks respond positively to an increase in income spread up to the optimal point after which the response changes and an increase of income spread decreases credit supply.

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