



CENTRAL BANK OF  
THE REPUBLIC OF AZERBAIJAN

WORKING PAPER SERIES  
№03/2016



**DETERMINANTS OF DEPOSITORS' BEHAVIOUR:**

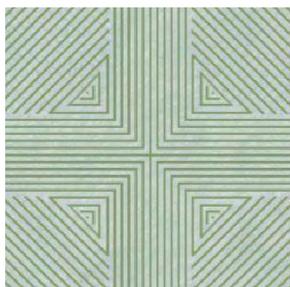
**HETEROGENEOUS PANEL ESTIMATES**



*Leyla Mammadova, Aytan Mammadova,  
Fuad Mammadov, Leyla Yusifzada*



11 May 2016



---

Note: The views expressed in this working paper are those of the author(s) and do not necessarily represent the official views of the Central Bank of the Republic of Azerbaijan.

---

# **Determinants of depositors' behaviour: Heterogeneous panel estimates**

Leyla Mammadova<sup>1</sup>, Aytan Mammadova<sup>2</sup>, Fuad Mammadov<sup>3</sup>, Leyla Yusifzada<sup>4</sup>

**May 11, 2016**

## **Abstract**

This paper empirically evaluates determinants of depositors' behaviour in Azerbaijan. The response of depositors to macroeconomic, alternative investment and bank specific shocks is analyzed by implementing recently developed panel time series methods that are robust to regional heterogeneity and inter-dependencies. We consider that macroeconomic and alternative investment factors are initially exogenous to the banking system and hit all banks simultaneously. Using a monthly panel dataset of Azerbaijan from January 2009 to June 2015, the paper provides a new evidence regarding the importance of relationship between deposits and macroeconomic factors, specifically currency risk. The paper highlights the role of currency risk, as a determinant of depositors' behaviour and conclude that its role overshadow the importance of alternative investment and bank specific factors in Azerbaijan. Despite of wide variation in response of depositors to macroeconomic, alternative investment and bank specific shocks, overall, depositors seem more responsive to risks than previous literatures have recognized.

*JEL Classification: G21, G28, C33*

*Keywords: depositors' behavior, macroeconomic risks, devaluation, official reserves, house price, deposit interest rate*

---

<sup>1</sup>Leyla Mammadova –Financial Sector Intermediation Division, Center for Research and Development, Central Bank of Azerbaijan, email: [mammadova\\_leyla@cbar.az](mailto:mammadova_leyla@cbar.az)

<sup>2</sup>Aytan Mammadova –Financial Sector Intermediation Division, Center for Research and Development, Central Bank of Azerbaijan, email: [aytan\\_mammadli@cbar.az](mailto:aytan_mammadli@cbar.az)

<sup>3</sup>Fuad Mammadov – Modeling and Forecasting Division, Center for Research and Development, Central Bank of Azerbaijan, email: [fuad\\_mammadov@cbar.az](mailto:fuad_mammadov@cbar.az)

<sup>4</sup>Leyla Yusifzade- Financial Stability Division, Center for Research and Development, Central Bank of Azerbaijan, email: [leyla\\_yusifzade@cbar.az](mailto:leyla_yusifzade@cbar.az)

## I. Introduction

Recent decline in oil prices are destabilizing economies and financial markets worldwide. Oil sector has significant contribution to GDP of Azerbaijan, although authorities' has recently made an effort to reduce country's dependence on hydrocarbons and diversifying the economy. Therefore, recent economic challenges like declining oil price, strengthening dollar due to Fed's tightening monetary policy impact the economy of Azerbaijan as well. Increasing pressure on local currency (manat) resulted in currency devaluation in February 2015 which in its turn affected banks' asset quality. Generally, recent episode of economic challenges and currency devaluation affects the banking sector via several channels, one of which is the outflow of deposits in national currency. In order to understand the depositors' reaction to latest economic news, our study aims to find answers to the following questions: 1) What factors determine depositors' behaviour in Azerbaijan? 2) Does macroeconomic environment overshadow importance of market discipline and alternative investment opportunities?.

In current literature, the depositors' behaviour is primarily identified by their response to bank specific characteristics and this kind of response ensures market discipline<sup>5</sup>. However, introduction of deposit insurance scheme undermines of market discipline, as existence of a credible deposit insurance system reduces the incentives of depositors to monitor banks. In countries where deposit insurance funds exist, researchers rely both on bank specific characteristics and macroeconomic factors to understand depositors' decisions. They show that, destabilized economy and weakened financial sector damage the credibility of deposit insurance and as a result can also affect the depositor's behaviour.

For instance, Levy Yeyati et al. (2010) conclude that bank specific characteristics are not the only factors affecting depositors' behaviour. Their paper shows that macroeconomic factors are significant drivers of depositor behaviour in crisis periods, at times overshadowing the role of bank specific characteristics. Moreover, Martinez Peria and Schmukler (2001), Arena (2003) and Dela Torre et al. (2003) argue that during crisis episodes traditional indicators of bank fundamentals tend to become less significant and explain a smaller part of changes of deposit portfolio and interest rates compared to tranquil times. Motivated from their research question,

---

<sup>5</sup> Market discipline in banking is often described as a situation where depositors face costs that are positively related to bank risk and react on the basis of these costs (Berger 1991). In the case of market discipline customers may decide to punish banks because of higher risk taking and tend to either withdraw their deposit or demand higher interest rates. As customers decide to withdraw their deposits from a risky bank, deposit run problem arises which will lead to failure of banking sector as a whole mostly because of liquidity problem.

our paper also considers the effect of macroeconomic risk to banking system of Azerbaijan by applying a new methodology of heterogeneous Cholesky reduced form panel VAR estimation. In addition, this paper includes not only bank specific and macroeconomic variables, but also alternative investment factor in Azerbaijan. We introduce a new variable of alternative investment factor - house price, as a possible driver of depositors' behaviour. Hence, this research analyzes depositors' response to macroeconomic, alternative investment and bank specific shocks in Azerbaijan.

The remainder of the paper is structured as follows: Section 2 reviews the literature with a specific focus on market discipline in emerging countries. Section 3 and 4 introduces our sample data with its source of information and methodology. In Section 5 and 6 we provide empirical results and robustness check accordingly. Finally, concluding remarks are discussed in the last section.

## **II. Literature Review**

Past experiences show that large-scale deposit withdrawals can quickly cause bank run during critical times. An investigation of depositors' behaviour helps policymakers to predict "deposit run" (better known in literature as "banking panics"<sup>6</sup>) and offer policy recommendations that can prevent deepening of withdrawal and its negative impact on economy as a whole. Hence, a wide range of researchers investigated depositors' withdrawal behaviour.

Up to date, vast academic literature on depositors' behaviour can be divided into two groups. The first group includes works exploring depositors' response to certain bank specific characteristics which is known as market discipline in literature. The existing literature on market discipline primarily studies whether market discipline exists in a particular country within given period. Most of the papers focus on the US commercial banking sector and provide evidence of existence of market discipline. Among them Park and Peristiani (1998) find evidence of market discipline in the US thrift industry throughout the 1980s, as depositors were shown to demand a higher interest rate. Whereas the literature on market discipline is quite vast, there is limited number of papers testing the market discipline in the developing and emerging countries. The existence of market discipline in Latin American countries (Argentina, Chile and Mexico) has been proved by Martinez Peria and Scukler (2001). Moreover, Peresetsky (2008) suggests that there is market discipline in the Russian banking system, where depositors demand higher interest rates from

---

<sup>6</sup>According to Calamari's and Gorton's (1991) definition of banking panics, it occurs when bank debt holders at all or many banks in the banking system suddenly demand that banks convert their debt claims into cash

risky banks. This discipline is even stronger than in developed countries. They also find that market discipline weakened after the establishment of deposit insurance.

It is also worth mentioning that, introduction of deposit insurance fund undermines the significance of market discipline. The evidence on efficiency of the implementation of deposit insurance systems in emerging countries is ambiguous. Ioannidou and Penas (2010) highlight that introduction of deposit insurance in Bolivia has diminished the market discipline exercised by large depositors. Prior to the introduction of this system, banks with higher shares of large deposits took on less risk, whereas after the introduction, the effect had vanished. In line with their conclusion, Mondschean and Opiela (1999) and Peresetsky (2008) emphasize that existence of deposit insurance system has weakened depositor discipline in Poland and Russia, respectively. Interestingly, based on the data of 203 banks of Central and Eastern Europe, Kouassi et al. (2011) conclude that even in the presence of an explicit deposit insurance system market discipline can be ensured by interbank deposits. Explicit deposit insurance system encourages monitoring efforts of creditors excluded from insurance and limits banks' risk seeking behaviour.

Another distinct group of studies suggests that macroeconomic indicators should be significant factor to influence the depositors' behaviour in the presence of deposit insurance system. Among them Levy, Yeyati, and Schmukler (2010) emphasized that bank specific characteristics are not the only factor affecting on depositors' behaviour. They analyzed daily data before and after crisis periods and recognized that in some cases macroeconomic factors overshadowed the importance of bank-specific factors in Argentina and Uruguay<sup>7</sup>. Interestingly, the role of macroeconomic data becomes stronger during crisis period. Using evidence from bank run episodes in two emerging economies, authors conclude that macroeconomic factors are significant drivers of depositor behaviour in critical periods of time. In line with their conclusion, Martinez et al. (2001) and Arena (2003) and Dela Torre et al. (2003) also find evidence that traditional indicators of bank fundamentals tend to become less significant and explain smaller part of changes of deposit portfolio and interest rates compared to tranquil times. Moreover, Picorelli (2014) also finds similar evidence for Greece regarding the importance of macroeconomic risk in depositor discipline. Although in the beginning of the crisis banking system did not face liquidity or solvency problems, depositors had started withdrawing their deposits from banks since the end of 2009 in Greece. This phenomenon shows that the macroeconomic shocks affect deposit volume despite the relative "good" indicators of the banks.

---

<sup>7</sup>They used bank-level data: for Argentina 50 banks (85% of total banks assets) and for Uruguay 26 banks (97% of total banks assets).

Inspired by the previous literature this paper concentrates on two issues largely unexplored by the existing literature. In the first place, we empirically analyze the determinants of depositors' behaviour in Azerbaijan and provide a new evidence regarding the importance of macroeconomic shocks on bank deposits.

Further, we contribute to the literature by applying a methodology, which has not been applied before in market discipline literature. We use heterogeneous reduced panel VAR while analysing significance of macroeconomic, alternative investment and bank specific variables in the banking sector of Azerbaijan. Since the data from many banks is used for short time span or is too noisy to conduct reliable investigation using VAR at the individual bank level, we employ a panel methodology that allows individual bank responses to shocks to be heterogeneous. Furthermore, it is important to take into consideration the fact that individual banks are likely to be linked cross-sectionally via common national and regional shocks. To address these issues, we use Chelsky reduced panel VAR methodology developed by Pedroni (2008). This paper could further be developed by applying a new methodology of panel SVAR developed by Pedroni (2013) in the context of structural identification.

### **III. Data**

We assembled a dataset of 21 commercial banks of Azerbaijan which represent more than 80% of the banking sector (40% of GDP). Analysis covers 78 monthly observations starting from 2009 January to June 2015. Furthermore, we interpolate non-available data and cleaned possible outliers. We also implemented a test for stationarity in heterogeneous panel data. The definitions and sources of data, as well as descriptive statistics are given in the tables 1 and 2 in the appendix of the document. To understand the determinants of depositors' behaviour, the paper examines proxies for macroeconomic, bank soundness and alternative investment shocks.

Classic indicators of direct macroeconomic shocks relevant to depositor behaviour are sovereign and currency risks<sup>8</sup>. In the first case, sovereign risk may affect market discipline as it reduces government's capacity of debt repayment. Government debt to GDP in Azerbaijan is low (13.75%, 2014) and almost stable for the period that we used in our regression. Therefore, we do not consider the impact of debt shock on depositors' behaviour in this paper.

In the second case, depositors may react to currency shocks because existence of depositor's guarantee scheme does not hedge depositors from losses coming from exchange rate fluctuations. However, regression analysis based on times series of foreign exchange rates is not applicable for

---

<sup>8</sup> Eduard Levy, Yeyati, Maria Soledad Martinez Peria and Sergio L. Schmukler

countries with fixed exchange rate regime because exchange rate is stable over time (Figure 1). When a country is unable or unwilling devalue its currency, it must have sufficient foreign exchange reserves and should be willing to spend them to sustain a fixed exchange rate. FX reserve of Central Bank of Azerbaijan Republic (CBAR) declined significantly after oil price slumped. CBAR authorities defended local currency by drawing on their substantial foreign exchange reserves (Figure 2). Hence, we include *FX reserves* of the Central Bank of Azerbaijan Republic to investigate relationship between currency risk and deposit portfolio of banks.

Furthermore, we assume that housing market represents an alternative investment opportunity in Azerbaijan, since capital market is underdeveloped. Thus, we use *house price* per kv/m in USD dollar in secondary market in Baku in order to examine relationship between deposits and alternative investment opportunities. If deposits run from banks, the withdrawn funds might flow to real estate market. The relationship between deposits and house prices can evolve in two directions:

- Real estate market and household deposits may have a negative relationship. In particular, when house prices go up, consumers may form an expectation of further growth in real estate market, thus prefer buying a property rather than saving their funds in bank accounts. On the other hand, when house prices fall, people prefer to keep money in deposit accounts rather than invest in real estate, as expectations of profit margins in real estate decrease.
- Real estate prices and deposits may also have a positive relationship, because higher house prices will require the households to save more in order to afford buying a house.

Beside the macroeconomic and alternative investment indicators, we include bank level data to examine market discipline in Azerbaijan. Interest rates paid on deposits, capital adequacy ratio and lag of household time deposits in national currency are used as bank specific variables.

Interest rates are considered to reflect riskiness of banks as depositors require higher compensation from a riskier bank. In our analysis we use bank level data of annualized interest rates on households' time deposit accounts opened during each month.

In addition, the *capital adequacy ratio* is included as an indicator of banks' soundness, which is measured by ratio of total capital to risk weighted assets. We expect that high level of capitalization helps banks to reduce risk and attract more deposits. A bank with higher capital adequacy ratio can absorb greater level of unexpected losses before becoming insolvent. Thus, high capitalization will have a positive effect on bank deposits.

In order to check robustness of our model we use additional bank specific variable– *liquidity*. In general, banks with a large volume of liquid assets are considered to be safer, because, these assets will allow banks to meet unexpected withdrawals by customers. In this sense, we expect that banks with more liquid assets suffer fewer deposit withdrawals because these banks face lower risk apriori. The liquidity ratio is calculated by dividing liquid assets<sup>9</sup> to total asset according to balance sheet of each bank respectively.

However, if Deposit Insurance Fund (DIF) weakens the role of market discipline in Azerbaijan, interest rates, liquidity ratio and capital adequacy ratio will not affect customers' deposits.

Furthermore, we use *households' time deposits* as a proxy for depositors' behaviour. We focus on individuals' time deposits only in national currency, since foreign currency deposits include increased balance which comes from national currency's devaluation.

#### **IV. Methodology**

It is important to take into consideration the fact that individual banks are likely to be linked cross-sectionally via common and national shocks. Therefore, the presence of heterogeneity in dynamics makes conventional dynamic panel methods not appropriate, as they require the dynamics of individual bank responses to be identical among all banks (Pesaran & Smith, 1995). We expect to overcome this problem, by applying Cholesky reduced form panel Vector Autoregressive Model (VAR) following Pedroni (2008) and Pedroni (2013). Before estimating VAR model, first we need to test for cross-sectional dependence in our data.

Cross-sectional dependence relies on various factors, such as the magnitude of the correlations across cross sections and cross-sectional dependence itself. If cross-sectional dependence is caused by the presence of common factors, which are unobserved but uncorrelated with the independent variables, the standard fixed-effects and random-effects estimators are consistent. On the other hand these methods are not efficient, because the estimated standard errors are biased (Hoechle, 2007). If the unobserved components which create interdependencies across cross sections are correlated with the included independent variables, these methods will not work. To solve this problem Pesaran (2006) proposed new approach.

While considering the standard panel-data model

$$y_{it} = \alpha_i + \beta'x_{it} + u_{it}, \quad i = 1, \dots, N \text{ and } t = 1, \dots, T$$

---

<sup>9</sup> Liquid assets include cash and correspondent accounts

$x_{it}$  is a  $K \times 1$  vector of regressors,  $\beta$  is a  $K \times 1$  vector of parameters to be estimated and  $\alpha_i$  represents time-invariant individual parameters. Under the null hypothesis,  $u_{it}$  is guessed to be independent and identically distributed over periods. Under the alternative approach,  $u_{it}$  may be correlated across cross sections; however the assumption of no serial correlation remains (Cheng Hsiao, 2007).

Thus the hypothesis is:

$$H_0: \rho_{ij} = \rho_{ji} = \text{cor}(u_{it}, u_{jt}) = 0 \text{ for } i \neq j$$

The number of possible pairings ( $u_{it}, u_{jt}$ ) rises with  $N$ .

Here  $\rho_{ij}$  is the product-moment correlation coefficient

$$\rho_{ij} = \rho_{ji} = \frac{\sum_{t=1}^T u_{it} u_{jt}}{(\sum_{t=1}^T u_{it}^2)^{\frac{1}{2}} (\sum_{t=1}^T u_{jt}^2)^{\frac{1}{2}}}$$

Pesaran (2004) has suggested two approaches to test cross sectional dependence using the pairwise correlation coefficients of the residuals in the regression equations (Rafael E. De Hoyos, 2006). One is the **LM** test of Breusch and Pagan (1980)

$$\text{LM} = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N (T \hat{\rho}_{ij}^2 - 1)$$

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t=1}^T \hat{u}_{it} \hat{u}_{jt}}{(\sum_{t=1}^T \hat{u}_{it}^2)^{\frac{1}{2}} (\sum_{t=1}^T \hat{u}_{jt}^2)^{\frac{1}{2}}}$$

Here  $\hat{u}_{it}$  is the estimate of  $u_{it}$ . LM is distributed as  $\chi^2$  with  $N(N-1)/2$  degrees of freedom (the null hypothesis of interest). LM statistic is valid for fixed  $N$  as  $T \rightarrow \infty$  and when  $N$  is large and  $T$  is finite this test exhibit significant distortion. In this case, Pesaran has proposed the following alternative, CD test

$$\text{CD} = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N (\hat{\rho}_{ij})$$

Unlike the LM statistic, under a wide range of panel-data models the CD statistic has mean at exactly zero for fixed values of  $T$  and  $N$  (including homogeneous/heterogeneous dynamic models and non-stationary models).

In the next step we apply VAR model to estimate regression. The VAR model is then given by the following system of equations: <sup>10</sup>

$$\Delta z_{it} = \Gamma_{i0} + \sum_{j=1}^n \Gamma_{ij} \Delta z_{it-j} + \pi_{it}$$

$$\Delta z_{it} = (\text{dep}, \text{res}, \text{house}_{pr}, \text{ir}, \text{car})'$$

Where,  $\Delta z_{it-j}$  is a matrix of endogenous variables; log of households time deposit in national currency (dep), log of FX reserves of central bank of Azerbaijan (res), log of average house price per each kv.m in secondary market ( $\text{house}_{pr}$ ), interest rate of individuals' time deposits during the period (ir), and capital adequacy ratio (car);  $\Gamma_{i0}$  is a matrix of constants;  $\pi_{it}$  is a matrix of innovations to: international reserve of central bank of Azerbaijan ( $\pi_{it}^{\text{res}}$ ), house price ( $\pi_{it}^{\text{housepr}}$ ), interest rate ( $\pi_{it}^{\text{ir}}$ ) and capital adequacy ( $\pi_{it}^{\text{cap}}$ ), with  $E(\pi_{it}) = 0$ , and covariance matrix  $E(\pi_{it} \pi_{it}') = \Omega_{\pi}$ . Thus, a vector auto regression is a system in which each variable is expressed as a function of its own lags, as well as lags of each of the other variables.

To get orthogonalized impulse response and variance decomposition we applied Cholesky decomposition (triangularization)  $\Omega_{\pi} = LL'$ , where L is known as the Cholesky decomposition matrix for  $\Omega_{\pi}$ , and then accumulated the impulse responses to see the effects of the shocks on the levels of the variables<sup>11</sup>. This method measures the time profile of the effect of perturbations on the expected future values of variables in a dynamical system. The advantages of using this approach is that, with panel data we can control for factors that could cause omitted variable bias if they are omitted, also we can control unobserved or unmeasured unobserved heterogeneity.

## V. Empirical Results

As some of the information is considered confidential we refer to total rather than individual bank results. The VAR methodology outlined above is used to generate impulse response functions that capture the dynamic effects of macroeconomic, bank specific and alternative investment shocks on deposit portfolio in each bank of our sample. In this section we present results of our estimations to answer two questions: 1) What factors determine depositors' behaviour in Azerbaijan? 2) Does macroeconomic environment overshadow importance of market discipline and investment opportunities alternative to depositing money in banks?.

<sup>10</sup> To choose lag length for reduced form VAR we used Akaike's Information Criteria (AIC).

<sup>11</sup> See Pedroni (2008) and Pedroni (2013) for details on the identification and computation of the impulse response form and the decomposition of shocks into regional versus national in panels.

### **What factors determine depositors' behaviour in Azerbaijan? Impulse response:**

As a result of our analysis we confirm a positive impact of macroeconomic and alternative investment shock on deposit portfolio over a ten months' period. Our finding also shows a wide variation in the impulse responses of the (log) deposit portfolio to bank specific shocks; both interest rate and capital adequacy shock doesn't seem statistically important for depositors' behaviour, thus undermining the role of market discipline in Azerbaijan banking sector.

While analyzing macroeconomic shock for Azerbaijan, firstly, we confirm depositors' positive response to reserve shocks. Figure 3.1 reports the median as well as the 25th and 75th percent quintile response to reserve shocks among 21 banks in our sample.

Specifically, the point estimates for reserve shock reveal that for the median, one unit reserve shock increases deposits by about 2% in the following month, and slowly increases to 6.5% after 10 months. As the median as well as the 25th and 75th percent quintile response to reserve shocks is positive, the result suggests that, the shock hit all banks in the same direction.

Secondly, while analyzing alternative investment shock for Azerbaijan, our main finding is that depositors respond positively to alternative investment shock which is similar to reserve shock. Figure 3.2 reports the median as well as the 25<sup>th</sup> and 75<sup>th</sup> percent quintile response of depositors to house price factor which confirm a positive effect after second lag. The median of the banks' response reveal that one unit house price shock increases individual deposits by about 1% after 10 month, while the initial effect is close to zero in the first month.

Thirdly, besides the macroeconomic and the alternative investment shocks, bank specific factors such as deposit interest rates and capital adequacy shocks are analyzed. Figure 3.3 shows that, consistent with the hypothesis, there is a positive link between interest rate shock and the median of the total response of depositors. Fig.3.3 reports that, in spite of a positive link between interest rate shock and the median of the total response of depositors, there is a wide variation in the 25<sup>th</sup> and the 75<sup>th</sup> percent quintile responses among 21 banks. The 75<sup>th</sup>percent quintile response shows that one unit interest rate shock increases deposits by about 6%, while the 25<sup>th</sup> percent quintile response is very close to zero. This result suggests that, there is likely a subset of banks for which interest rate shock matters.

While analysing depositors' respond to capital adequacy shock, we observe that the response is very close to zero (Fig.3.5). The 25<sup>th</sup> percent quintile response, while negative, is very close to zero and conversely the 75<sup>th</sup> percent quintile response is positive (while remaining small). This implies that, both interest rate and capital adequacy shock does not seem statistically important

for depositors' behaviour and reject existence of market discipline in Azerbaijan. This can be explained by the existence of the Deposit Insurance Fund (DIF) in Azerbaijan. We suggest that, credible deposit insurance system reduces the incentives of depositors to monitor banks and undermines the role of market discipline.

### **Does macroeconomic environment overshadow importance of market discipline and investment opportunities alternative to depositing money in banks?**

Our results so far indicate that explanatory power of macroeconomic shock is higher compared to alternative investment opportunities and bank soundness indicators. We rely to the fact that, the median as well as the 25th and 75th percent quintile response of bank deposits to macroeconomic shock is positive and more consistent across banks compared to alternative investment opportunities and bank specific shocks. Banks seem to be more responsive to macroeconomic shock, as the impulse response function is positive in all months across all quintiles.

In the context of Azerbaijan our paper also highlights the effect of bank specific shock varies, we observe a positive response to deposit interest rates and almost zero response to capital adequacy shock. Thus, we conclude that market discipline is weak in Azerbaijan and market participants adjust their behaviour according to their macroeconomic expectations. Initial response of depositors to the increase in reserve is positive 2% and it cumulatively increases to 6.5% after ten month, implying that, depositors adjust their expectation depending on changes in macroeconomic environment. Depositors would react to currency shocks because existence of depositor' guarantee scheme does not hedge depositors from losses coming from exchange rate fluctuations.

Immediate response of depositors to the increase in house prices is negative, implying that depositors withdraw their funds from deposits and invest in real estate on expectations of higher yields. However, cumulative reaction of depositors to the increase in house prices after one month is positive, as households would need more savings in order to afford a house.

To summarise our central result: Depositors seem to be more responsive to a macroeconomic shock compared to alternative investment and bank specific shocks.

### **VI. Robustness check**

To address possibility of biased results and to check robustness of different variables, we consider alternative specifications by including liquidity ratio and gold price to the regression.

Firstly, we re-estimated the cross section regression after including alternative soundness indicator, liquidity ratio. However, there is still no significant relationship between liquidity and

depositors' behaviour. Therefore, our results are still robust by rejecting existence of market discipline in Azerbaijan.

Secondly, we re-estimated the regression using gold price as another proxy for alternative investment opportunity. However, the results suggest that, depositors do not respond the change in gold price consistently and confirm the role of the real estate investment market for the country. Hence, the paper contributes to existing literature by shedding light on the potential role of real estate market for Azerbaijan economy.

## **VII. Conclusion**

Using heterogeneous Cholesky reduced panel VAR approach, this paper shows that macroeconomic factor – reserve shock is the most important driver of depositors' behaviour compared to alternative investment and bank specific shocks in the period of 2009- 2015 in Azerbaijan banking sector.

Firstly, we have found evidence of depositors' positive respond to macroeconomic shock. The result suggests that, market participants respond to reserve shock consistently, because existence of depositor' guarantee scheme does not hedge depositors from losses coming from exchange rate fluctuations and they adjust their decisions based on changes in macroeconomic environment.

Our findings suggest that house price is a reliable proxy for alternative investment shock in Azerbaijan. Although, in the first month there is evidence of substantial variation in the strength of alternative investment shock across banks, the effect seems to show more consistent result which is positive for the quintiles after the one month,.

Conversely, while analyzing bank specific indicators (interest rate and liquidity ratio) we find that, depositors' response to banks specific factors is low. We conclude that market discipline in Azerbaijan is weakened by existence of Deposit Insurance Fund. To summarize, our results so far indicate that, an explanatory power of macroeconomic risk is higher compared to alternative investment and bank specific indicators and wider than usually considered by the literature.

The main findings of this research also lead to important lessons for the policy debate. As macroeconomic shocks affect market participants significantly, government authorities may think about reducing the potential negative effects of currency shock to the banking sector by stimulating the attraction of national currency deposits. Differentiated required reserve rate, remuneration rate and deposit insurance premia could be applied to prevent the withdrawal of national currency deposits.

## Bibliography

- M S Martinez Peria and Sergio L. Schmukler, 2001, "Do depositors Punish Banks for Bad Behaviour? Market Discipline, Deposit Insurance and Banking Crises", *The Journal of Finance*, Vol. 56 (3), pp. 1029-1051;
- Levy-Yeyati, M. Martinez Peria and S. Schmukler, 2010, "Depositor Behavior under Macroeconomic Risk: Evidence from Bank Runs in Emerging Economies", *Journal of Money, Credit and Banking*, vol. 42, issue 4, pp 585-614
- De la Torre, A., Levy-Yeyati, E., and Schmukler, S., 2003. "Living and Dying with Hard Pegs: The Rise and Fall of Argentina's Currency Board" *Economia*, Spring, pp. 43-107.
- Arena, Marco, 2003, "Bank Fundamentals, Bank Failures, and Market Discipline: An Empirical Analysis for Latin America and Asia during the Nineties." Working Paper, *Inter-American Development Bank and Asian Development Bank*
- Park, Sangkyun, and Stavros Peristiani, 1998, Market discipline by thrift depositors, *Journal of Money, Credit, and Banking* 30, 1, 347-364.
- Ioannidou VP and Penas, MF, 2010, 'Deposit insurance and bank risk-taking: evidence from internal loan ratings' *Journal of Financial Intermediation*, vol 19, no. 1, pp. 95-115
- Thomas S. Mondschean, Timothy P. Opiela, 1999, "Bank Time Deposit Rates and Market Discipline in Poland: The Impact of State Ownership and Deposit Insurance Reform" *Journal of Financial Services Research* May, Volume 15, Issue 3, pp 179-196
- Kouassi T., Distinguin I., Tarazi A., 2011, Bank deposit insurance, moral hazard and market discipline: Evidence from Central and Eastern Europe.
- Julieta L. Picorelli, 2014, "Sovereign Default Risk and Depositor Behavior. The Case of Greece" *Rev. De Economia Politica De Bs. AS.* Ano 8, Vol. 13, 109-144, ISSN 1850-6933
- M Pesaran and Ronald Smith 1995, "Estimating long-run relationships from dynamic heterogeneous panels" *Journal of Econometrics*, vol. 68, issue 1, pages 79-113
- Peter Pedroni, 2013. "Structural Panel VARs," *Econometrics, MDPI, Open Access Journal*, vol. 1(2), pages 180-206, September
- Pesaran, M. H. 2004. "General diagnostic tests for cross section dependence in panels" University of Cambridge, Faculty of Economics, *Cambridge Working Papers in Economics* No. 0435.
- Rafael E. De Hoyos, V. S., 2006, Testing for cross-sectional dependence in panel-data models. *The Stata Journal*, 482-496.
- Hoechle, D., 2007, Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, 281-312.
- Cheng Hsiao, M. H., 2007, Diagnostic Tests of Cross Section Independence for Nonlinear Panel Data Models. *CWPE 0716*.

Breusch, T. S. and A.R. Pagan, 1980, "The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics," *Review of Economic Studies*, 47(1), 239-253.

Pedroni, P., 2008, "A note on the Econometrics of a Panel SVAR," working paper, *Williams College*.

Anatoly Peresetsky, 2008, "Market discipline and deposit insurance in Russia" Discussion Papers 14, Bank of Finland, BOFIT Institute for Economies in Transition

Pesaran, M. H. (2006). Estimation and inference in large heterogenous panels with multifactor error structure. *Econometrica* 74, 967–1012.



**Table 3. Residuals cross-section dependence test**

Residuals Cross-Section Dependence Test	
Test	Statistics
Breusch-Pagan LM	7690.7***
Pesaran scaled LM	365.0***
Bias-corrected scaled LM	364.9***
Pesaran CD	18.1***

**Figures 3. Impulse responses**

Fig: 3.1 Response of time deposits to FX reserves

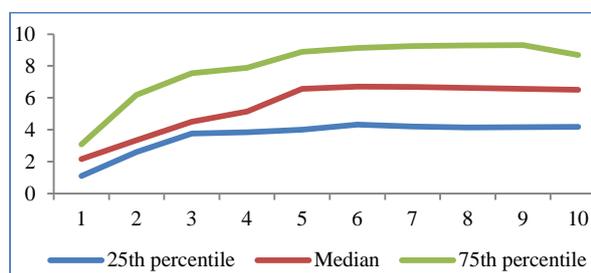


Fig: 3.2 Response of time deposits to house price reserves

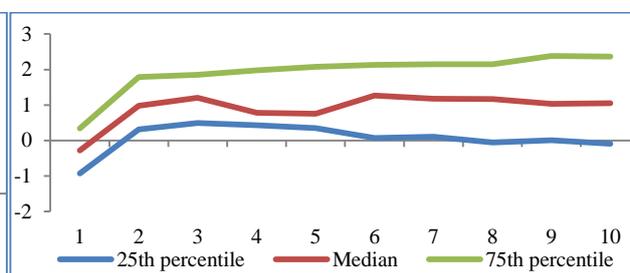


Fig3.3 Response of time deposits to interest rates

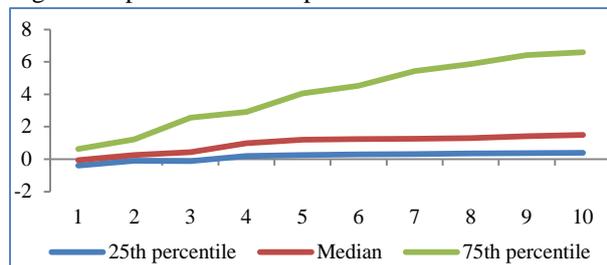


Fig 3.4 Response of time deposits to deposit

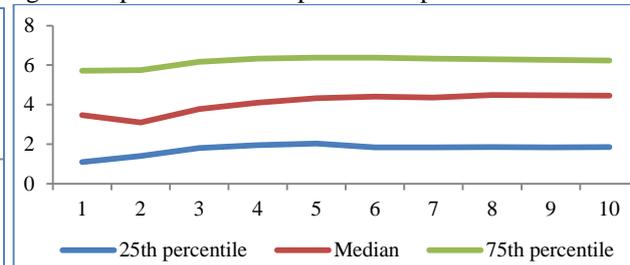


Fig 3.5 Response of time deposits to capital adequacy

