TÜRKİYE CUMHURİYET MERKEZ BANKASI

WORKING PAPER NO: 12/04

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January 2012

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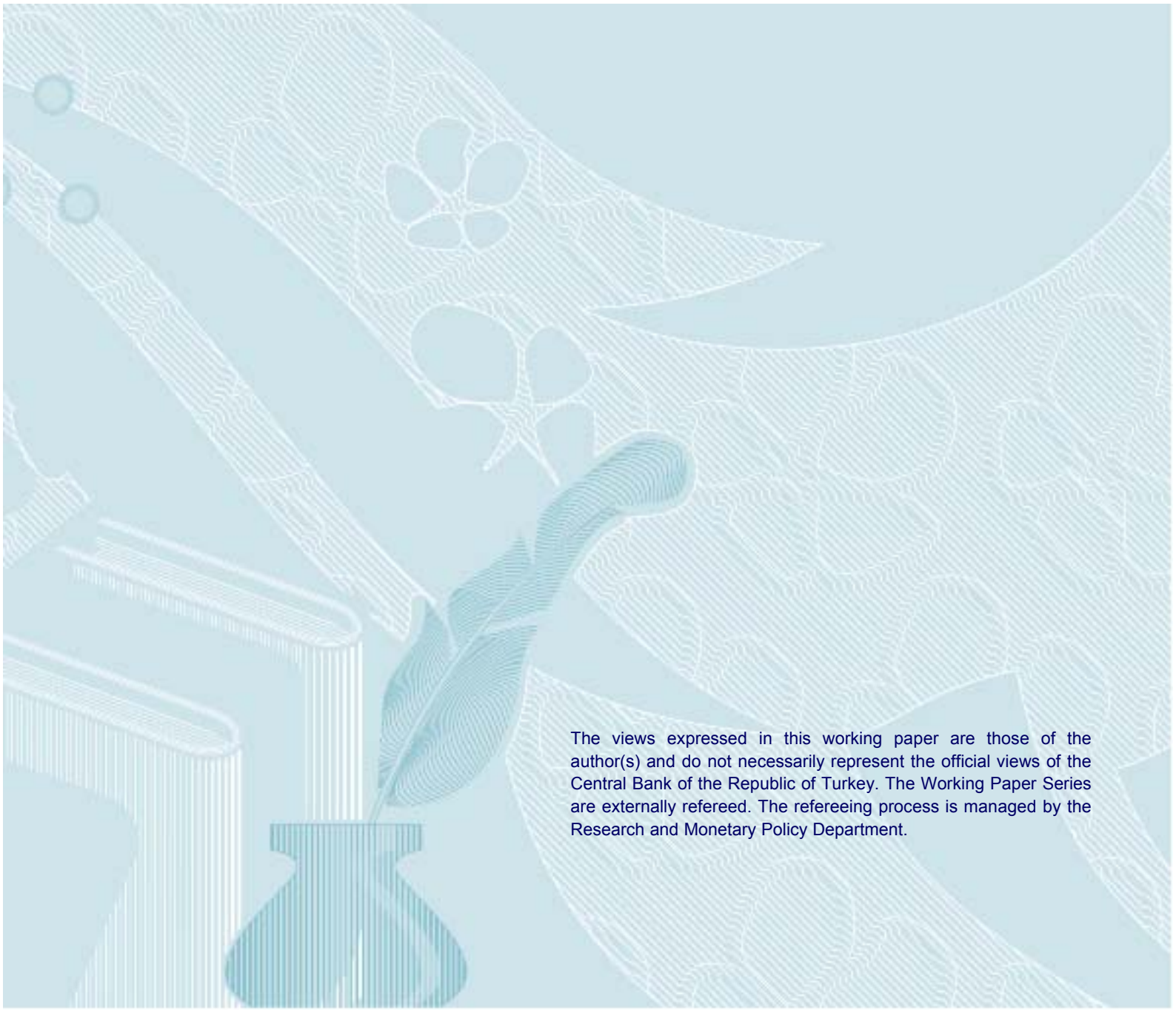

An Empirical Study on Liquidity and Bank Lending

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Abstract

In this study, by using a panel data of Turkish banks, we empirically analyze whether monetary policies that are able to manipulate liquidity positions of banks can affect bank lending. Our results suggest that bank specific liquidity is important in credit supply. Moreover, in determining their lending, banks consider not only their individual liquidity position but also the systemic liquidity. Hence, any monetary policy which can alter liquidity is potentially effective on credit supply.

Keywords: Bank lending channel; Systemic liquidity; Panel data.
JEL classification: C23;E44;E58;G21

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1 Introduction

After the burst of the 2008 global financial crisis, advanced countries have sought the ways of alleviating the effects of the crisis on financial system and macro economy. To this end, fiscal and monetary policy have been utilized to the limits. On the monetary policy front, an unprecedented expansionary stance has been taken for a sustained period of time where FED and ECB flooded the financial system with liquidity by quantitative easing programs. However, expansionary monetary policies have had important consequences beyond the borders of the original country such as sustained large capital inflows towards emerging countries. In an environment where growth differentials between advanced and emerging world were already significantly large, these inflows have heightened the concerns regarding further overheating. At the same time, rapid credit growth fueled by easier access to foreign funds raised financial stability issues.

Under the limitations of existing monetary policy framework, central banks' ability to tackle these issues has been a major concern for both policy makers and researchers. In this respect, there have been numerous changes in the way central banks implement monetary policy recently.[2] For example, Central Bank of Turkey (CBT), being the monetary authority of a typical emerging economy, has resorted to reserve requirements in addition to policy rate in order to achieve multiple purposes. While policy rate and liquidity policy, to some extent, have been aligned to depress the volatility of capital inflows, reserve requirements have been used to slow down the excessive credit growth.[3] Reserve requirements affect the aggregate credit supply by widening the spread between deposit rates and loan rates, and by deteriorating the liquidity positions of banks. Deterioration stems from the fact that higher required reserve ratio locks up a higher amount of bank liquidity within the central bank and, in turn, forces banks to resort borrowing for liquidity. Though the first channel is clear in terms of its qualitative effects and functioning, the effectiveness of the second

[2]Prior to crisis, central banks were enjoying the relatively easier policy framework where price stability was the sole aim of the monetary policy and the policy interest rate was the only tool to be utilized. Macroprudential tools were generally assumed by regulatory and supervisory authorities as financial stability was not seen as a responsibility of central banks. Furthermore, there were no legal framework that would allow cooperation between the central banks and regulatory and supervisory authority.

[3]After the global financial crisis, all emerging countries have used reserve requirements actively, except for Chile, Colombia and Thailand. Alongside the reserve requirements, capital controls have also been utilized by a number of emerging countries to manage the volatility of capital inflows.

channel is disputable as the empirical literature on bank liquidity and bank lending presents mixed results so far.

In this study, we empirically analyze whether monetary policies that are able to manipulate liquidity positions of banks can affect bank lending. Using a panel data of Turkish banks, we study the role of liquidity on bank lending.[4] Our empirical strategy to test these effects involves panel regression analysis where we control for bank fixed effects and treat liquidity measures as endogenous. In line with the earlier studies (see the next section for a detailed literature review), our results suggest that bank liquidity is an important determinant of bank lending in Turkey.

Finally, we consider the effects of systemic (overall) liquidity on new loan issuance. Intuitively, when liquidity conditions are favorable, one would expect the bank spesific liquidity to be less important. A recent survey study on Turkish banking system by Alper et al (2011) does also support this conjecture. According to the survey results, alongside to their own liquidity positions, banks also consider the system wide liquidity position, in particular the degree of dependence of the banking system on Central Bank resources. Our estimations also provide evidence supporting this claim.

In sum, these results provide evidence on the effectiveness of any monetary policy, which can directly impact liquidity, on bank lending. Not to mention, policy rates are also effective in credit growth, however, the effect is homogeneous across banks regardless of bank specific liquidity positions. The paper is structured as follows. In the next section, we review the relevant literature and in section 3 we introduce our econometric model. Section 4 summarizes data and section 5 presents our empirical results. Finally, section 6 concludes the paper.

2 Literature Review

The literature on bank lending channel, which starts with the seminal work of Bernanke and Blinder (1988), is closely related to our work as part of the hypothesis rests on

[4]As described in the bank lending literature, in order this to be a relevant and important question in macroeconomic perspective, a significant portion of the firms and households should be bank dependent, meaning they cannot easily replace the contraction in bank lending by raising other means of financing. That condition is satisfied for the Turkish economy. Banks are at the center of the financial intermediation; commercial paper market is almost absent and foreign borrowing is available to only few large firms.

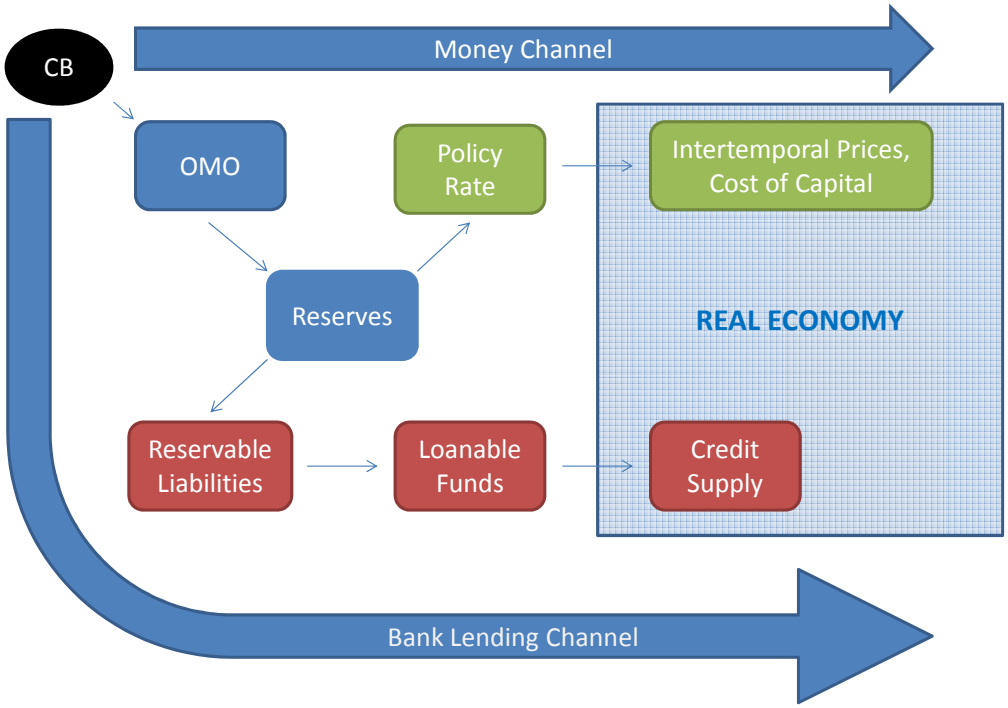
the existence of relation between bank liquidity and bank lending, yet, as will be discussed below, there are important distinctions. By using IS-LM framework they analytically show that monetary policy could have a direct impact on bank lending, which is called as the bank lending channel. Unlike the money channel, where central banks affect market rates through policy rate changes, bank lending channel involves the direct interaction of monetary policy and loan supply. Particularly, when the central bank attempts to increase the policy rate it mops up the bank reserves, where lower reserves mean a reduction in the deposit volume urging banks to shrink their loan portfolio, unless banks are able to offset the drop in loanable funds. If, for some firms, bank loans are not substitutable with other forms of finance, e.g. private bonds, then monetary policy affects the economy not only by the money channel but also via its influence on bank lending.[5]

Numerous papers have attempted to question the existence of the bank lending channel. First attempts used macro data, however due to the fact that money channel and bank lending channel work in the same direction, these studies were criticized for failing to overcome the identification problem. Hence, most studies use micro data following Kashyap and Stein (1995), which utilizes US bank level data for questioning the lending view. The reasoning followed by their work rests on the fact that banks respond monetary tightening asymmetrically depending on their ability to shield from reserve drainage. If there is a separate bank lending channel, one should see the banks, which can offset the effects of tighter liquidity, would have to squeeze their loan portfolio less than the ones which can not. They conjecture that the bank size is closely and positively related to banks' ability to raise nonreservable funds. Their results show that in response to monetary tightening small banks shrink their loan portfolio more compared to large banks, supporting the lending view.

Along with the bank size, several other variables resembling banks' ability to insulate themselves from lending channel have been used in the literature. Banks' capitalizations and liquidity positions are among the most widely used variables. The intuition for the former is that well-capitalized banks can replace the contraction in deposits more easily as they would be perceived as less risky (Kishan and Opiela, 2000). For the latter, liquid banks are supposed to alleviate the need for adjusting loan portfolio by drawing down cash and securities (Gambacorta, 2005, Kashyap and Stein, 2000). Ehrmann et al. (2001) uses an exhaustive list of factors that could be

[5]See Figure 1 for an illustrative view.

Figure 1: Monetary Transmission Mechanism à la Bernanke and Blinder



the source of differential responses to the effects of tight monetary policy functioning through the lending channel.

Empirical evidence investigating the existence of bank lending channel seems to be in favor of bank lending channel. For the Euro area, Ehrmann et al. (2001) finds that banks respond differentially to monetary policy, liquidity positions being the most important factor determining the differences. Altunbaş et al. (2002) also finds out that bank loans respond asymmetrically to monetary stance, however, they find capital strength as the source of the asymmetric reaction of banks. For the US banks, Kashyap and Stein (2000) documents the evidence supporting the lending channel. In their work, the main driver for the asymmetric response of banks is banks' liquidity positions. A relatively recent paper by Cetorelli and Goldberg (2008) find evidence for the lending channel for monetary policy in large banks that are domestically-oriented and without international operations.[6]

[6]There are also studies concluding against the existence of this channel. For the US, Morris and Sellon (1995) concludes that bank lending is not directly constrained by monetary policy actions. Similarly, Favero et al. (1999) finds no evidence for differential response of banks in response to monetary contraction in the Euro area.

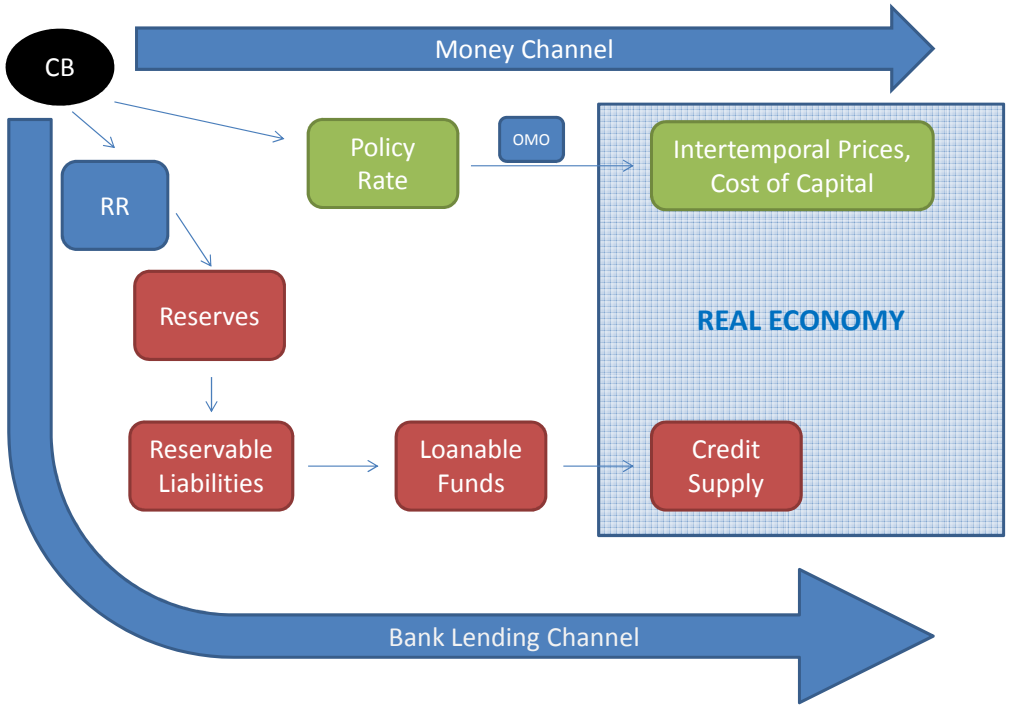
Emerging countries data also give support in favor of the lending view. Matousek and Sarantis (2009) show that bank lending channel is operative in all central and eastern European countries. They find that bank size and liquidity is the most important factors in distinguishing banks' reaction to monetary policy. In another study supporting the bank lending view for Malasia, Zulkey et al. (2010) demonstrates that bank capitalization and bank liquidity are the sources of asymmetric response of banks to monetary policy stance. Takeda et al. (2005) tests the bank lending channel for Brazil by using both interest rates and reserve requirements to resemble monetary policy stance. They find that although banks' reaction do not differ across banks in response to interest rate changes, larger banks are more strongly affected from reserve requirement ratio (which penalizes larger banks more) increases. For Turkish economy, Brooks (2007) finds that liquidity is a significant variable for banks in determining their lending behavior in response to tighter monetary conditions. This empirical work considers bank lending under an inflation targeting framework and analyzes whether bank characteristics result in differential responses to contractionary monetary policy (taking the form of hike in policy rate and direct liquidity withdrawals) in mid 2006. According to her results, banks responses differ significantly and liquidity emerges as the most important variable to affect banks' responses in Turkey for that period.

While empirical studies seem to be dominantly in favor of bank lending channel, especially for emerging economies, some recent papers raise strong objections claiming that bank lending channel could not be operative under inflation targeting regime.[7] This view claims that central banks do not need to adjust the reserves when they decide to change the policy rate. Policy rate is simply announced and liquidity is supplied inelastically from ongoing rate. Hence, the monetary policy operating through interest rates does not directly affect bank's liabilities, as depicted in Figure 2. This line of objection is directed to the first premise of the lending view, namely the direct relation between the policy rate and reserves (and so deposits). As alluded in the introduction part, we study the second link, i.e. our question is whether monetary policy tools (reserve requirements in particular) that directly manipulate banks' liquidity positions can affect bank lending.[8] Most studies concluding in favor of bank

[7]See, for example, Disyatat (2010) and Friedman and Kuttner (2010).

[8]Reserve requirements can directly reduce the banks' liquidity by locking up a fraction of liabilities within the central bank accounts.

Figure 2: Monetary Transmission Mechanism (Alternative View)



lending view states implicitly or explicitly that bank liquidity is crucial. According to a recent survey on Turkish banking system (Alper et al. 2011), both bank liquidity and system wide liquidity are important on bank lending. Hence, if central banks can manipulate banks' liquidity positions under inflation targeting and bank liquidity is important in bank lending, then central banks can steer the economy by affecting credit growth.

3 Model

We investigate the relationship between liquidity and bank lending in Turkey by employing an econometric model similar to that of Ehrmann et al. (2001), which rests on Bernanke and Blinder (1988). In particular, our econometric model evolves from an equilibrium relationship where demand for loans equal to the supply. On the demand side, banks confront a loan schedule that depends on the level of nominal economic activity and the interest rates on their loans. Hence, loan demand depends

on the real GDP, y, the price level, p, and interest rates on loans i^l:

$$L^d_{j,t} = \theta_1 y_t + \theta_2 p_t - \theta_3 i^l_{j,t}. \tag{1}$$

Given the stylized fact that loan demand increases with enhancing economic activity, we expect signs of the coefficients pertaining to real GDP and price level to be positive apriori. On the other hand, demand for loans are expected to decrease with an increase of the interest rates on loans.

On the supply side, loan supply of banks can be written as a function of loanable funds of banks in the economy -where deposits, D, are used as a proxy-, interest rates on loans, i^l, and the overnight monetary policy rate, i:

$$L^s_{j,t} = \mu_j D_{j,t} + \theta_4 i^l_{j,t} - \theta_5 i_t. \tag{2}$$

The first variable on the right hand side of the equation for loan supply pertains to quantitative availability of the money whereas the remaining two variables correspond to the pricing of loans extended. In this regard, insertion of the overnight monetary policy rate can be viewed as the opportunity cost of loans financed by the interbank market.

On the other hand, we let demand for deposits arise from the transactions motive and set deposits equal to money demanded in equilibrium:

$$M = D = -\psi i + \chi. \tag{3}$$

One notable feature of this model is that we allow banks to differ only at their dependencies on their deposits as the source of financing. Specifically, we differentiate banks in terms of the liquidity x_j; the more liquid a bank is, the less it is affected by the level of its deposits:

$$\mu_j = \mu_0 - \mu_1 x_j. \tag{4}$$

In equilibrium, markets clear and by using equations (3) and (4) one can get the following reduced form equation:

$$L_{j,t} = \frac{\theta_1\theta_4 y_t + \theta_2\theta_4 p_t - (\theta_5 + \mu_0\psi)\theta_3 i_t + \mu_1\psi\theta_3 i_t x_j + \mu_0\theta_3\chi - \mu_1\theta_3 x_j}{\theta_3\chi + \theta_4}, \tag{5}$$

which is equivalent to:

$$L_{j,t} = \beta_1 y_t + \beta_2 p_t - \beta_3 i_t + \beta_4 i_t x_j + \beta_5 x_j + \beta_0. \tag{6}$$

This specification allows us to analyze the effects of real GDP, price level, overnight policy rates and bank specific liquidity characteristics on the equilibrium level of loans extended. Signs and significance of the coefficients β_3 and β_5 inform us about the role of monetary policy and bank specific liquidity level on the newly issued loans. On the other hand, the coefficient β_4 denotes the asymmetry across lending behavior, depending on the bank specific liquidity, towards monetary policy changes. Here an important remark is that banks, regardless of their idiosyncratic characteristics, face the same loan interest rate elasticity of demand, θ_3, and have symmetric responses to the changes in real GDP and inflation.

Our model allows for dynamic adjustments in time and due to the non-stationarity in data we use first-differences of variables. On the other hand, first differencing enables us to investigate the bank lending in a more precise way as banks react to a change in monetary policy generally by adjusting the new loans extended. That said, the regression model is as follows;

$$\begin{aligned}\Delta \log(L_{j,t}) = a_j \quad &+ \quad \sum_{k=1}^{m} b_k \Delta \log(L_{j,t-k}) + \sum_{k=0}^{m} c_k \Delta \log(y_{t-k}) + \sum_{k=0}^{m} d_k \pi_{t-k} + \sum_{k=0}^{m} e_k \Delta i_{t-k} \\ &+ \quad \sum_{k=0}^{m} \sum_{p=0}^{n} f_{k,p} x_{j,t-p} \Delta i_{t-k} + \sum_{k=0}^{m} g_k x_{j,t-k} + \sum_{s=1}^{3} h_s DUM_{t,s} + \varepsilon_{j,t}, \end{aligned} \tag{7}$$

where $j = 1, ..., N$ and $t = 1, ..., T$ label bank and time dimension, respectively. N represents the number of banks and m, n denote the number of lags in time. In this notation, $\Delta \log(L_{j,t})$ stands for the percentage growth of loans by bank j at time t. Δi_t is the change in overnight policy rate, $\Delta \log(y_{t-k})$ is the percentage growth of real GDP, π_t is the CPI inflation and x_t denotes the bank specific liquidity characteristics at time t. To avoid a potential endogeneity bias, we instrument possible endogenous variables with their own lags. In particular, we test contemporaneous values of the variables (growth, inflation, policy rate and liquidity) for exogeneity and employ panel IV estimation accordingly. On the other hand, in order to account for seasonal effects we also add quarterly dummies, $DUM_{t,s}$, into the specification above. Finally, the model enables bank fixed effects, denoted by a_j.

As we try to identify the extent to which banks, on average, can count on their liquid assets in extending new loans we use bank specific liquidity characteristics in the model. In addition, we consider systemic liquidity important in new loan issuance. Holding substantial portion of public debt,[9] Turkish banks have quite favorable liquidity positions which enable them to use CBT resources from ongoing rates. Moreover, as Alper et al. (2011) puts it, banks do consider overall liquidity in the banking system when they make their lending decision. However, this does not mean that banks are immune to reserve requirement changes. In practice, central banks may limit the amount of liquidity supplied in ordinary open market operations and may force banks to resort to the standing facilities in case of excess demand.[10] If resorting to standing facilities perceived to be an important signal for bank's financial health, relying excessively on central bank's resources for the liquidity may not be costless as this would increase the probability of utilizing standing facilities. Similarly, if banks are not completely sure that the central bank could rollover the short term debt and possibly quit the existing framework, they again can be reluctant to rely too much on central bank resources. In such a case, banks would not only consider their own liquidity position but also the systemic liquidity; as bonds, which are counted as liquid assets, would not be of critical importance when no agent is in a position to supply liquidity.

4 Data

We use a panel dataset which consists of quarterly averages of monthly balance sheets of Turkish banks for the period 2002Q4 - 2011Q1. Turkish banking sector underwent a comprehensive reform in the aftermath of the devastating 2001 crisis. Our selection of a period beyond 2002Q4 is an attempt to abstract from the structural break took place in the banking sector in 2001. The whole sample includes a panel of 13 commercial banks, which forms 94.7 percent of total loans extended in Turkish Liras (TL) and 95.3 percent of total assets as of 2011Q1.[11] Banks are weighted in estimation according to their total TL assets at the beginning of the observation period. We restrict our

[9] Turkish banks hold 60 percent of total public debt as of 2011Q1.

[10] For example, CBT open market operations are conducted by quantity auctions, where banks only bid for the quantities.

[11] We exclude those banks which have experienced breaks in their balance sheets due to mergers and acquisitions as well as incomplete data in the given period.

Table 1: Descriptive Statistics of Balance Sheets of Banks by Year

	2002(1)	2003	2004	2005	2006	2007	2008	2009	2010	2011(1)
Levels										
Mean Total Assets										
Nominal	7.65	8.71	11.61	15.41	19.96	24.78	30.98	36.40	44.63	52.17
Real	8.71	8.87	10.68	13.09	15.49	17.68	20.01	22.13	25.00	28.47
Mean Paid-in Capital										
Nominal	0.61	0.64	0.74	0.91	1.20	1.58	1.83	2.06	2.28	2.41
Real	0.70	0.65	0.69	0.77	0.93	1.13	1.19	1.26	1.28	1.32
Ratios (as a fraction of Total Assets)										
Securities Portfolio	39.5	39.9	36.6	33.5	29.7	26.7	25.6	28.4	29.5	27.4
Loans	21.5	25.9	38.7	45.8	53.3	57.8	58.9	54.6	56.1	55.8
Equity	23.1	24.6	22.7	19.6	16.0	16.0	15.1	16.7	16.6	15.6
Deposits	47.3	48.3	51.8	53.2	56.8	55.1	54.7	54.8	55.7	55.7

Notes: (1) 2002 figures represent only December values while 2011 figures cover only the first quarter. (2) Nominal figures are in one billion Turkish Liras while real figures are in one billion 2003 Turkish Liras. (3) Ratios are in percentages.

attention to loans in domestic currency, hence all figures are in TL. This is due to the fact that loans in foreign currency are extended only to those with foreign currency denominated income in Turkey. Table 1 summarizes the stylized facts of Turkish banking sector in that period. The share of financial intermediation in Turkish GDP was relatively low in early 2000s, compared to other developing countries. After 2001 crisis, credible and consistent macro policies enhanced macroeconomic stability and accelerated the financial deepening process. Real total assets of the banks are tripled while strict regulations forced banks to increase their capitalization ratios in this period.

In the era prior to structural reforms, banking sector's main function was to finance government's budget deficits. Since then, banks started to perform their conventional functioning of serving as a financial intermediary. This fact is apparent in Table 1; it can be derived that the loan to deposits ratio exhibits an upward trend during the observation period except for the year of 2009, the period when subprime crisis deepened worldwide. On the other hand, government securities portfolio held by banks demonstrates a downward trend except for the years beyond 2009, where liquidity motive was strong.

Our measure of credit growth is the quarter on quarter log differences in total loans which include both commercial and consumer loans denominated in TL. Output growth is calculated as the log differences of seasonally adjusted quarterly nominal GDP. On the other hand, we calculate inflation by taking quarterly percentage change

of seasonally adjusted CPI series.[12]

Liquidity ratio is defined as the share of net liquid assets in total assets. Specifically, our liquidity measure can be written as:

$$liq_{j,t} = \frac{\Omega_{j,t} - \Theta_{j,t}}{TotalAssets_{j,t}}, \tag{8}$$

where total available liquid assets, $\Omega_{j,t}$, is the sum of the following nine items in a bank balance sheet which are cash, receivables from Central Bank, receivables from money market, receivables from banks, securities held for trading (net), securities available for sale (net), securities to be held till the maturity (net), receivables from securities interbank and receivables from reverse repo. It is important here to note that our measure of liquid assets does not include cash held in the central bank for reserve requirement purposes, which is in line with the literature.[13] Then, we subtract liquid liabilities, $\Theta_{i,t}$, which is the sum of the payables to the central bank, payables to money market, payables to securities market, payables to banks and funds from repo transactions. Finally, we divide liquid assets by total assets of the bank to reach our liquidity measure, $liq_{j,t}$.

Our systemic liquidity variable OMO is the quarterly averages of the net of -7 day maturity- open market operations in billion TL. Positive OMO values indicate excess systemic liquidity in the money market. Monetary policy rate, i_t, is the overnight repurchase rate set by CBT on Turkish Lira.[14] Table 2 presents summary statistics of our regressors while Figure 3 depicts time series of selected aggregate variables.

5 Empirical Results

We estimate the model using instrumental variables and up to two lags.[15] The inclusion of lagged values of the dependent variable necessitates the usage of dynamic panel data estimation methods like the difference or system GMM. However, as pointed out by Roodman (2009), when the temporal observations are more numerous than spatial

[12] All macroeconomic data are available on http://evds.tcmb.gov.tr

[13] Our definition of liquidity is similar to Kashyap and Stein (2000). However, they do not include cash in the numerator suspecting that cash is hold for reserve requirement purposes. We account for reserve requirements explicitly and hence include cash holdings in the numerator.

[14] Starting from 2010Q3, 7-day repurchase rate has been chosen as the policy rate of CBT. We therefore apply changes in the current policy rate to i_t series.

[15] Higher order lags turn out to be insignificant.

Table 2: Summary Statistics of Regression Variables by Year

	2003	2004	2005	2006	2007	2008	2009	2010	2011(1)
Growth	1.27	1.77	2.45	1.35	1.24	-1.72	1.01	2.31	1.26
Inflation	4.06	2.33	1.85	2.37	1.98	2.63	1.40	1.82	0.92
Policy Change	-4.39	-1.69	-1.47	0.92	-0.25	-0.04	-2.40	-0.20	-0.63
Liquidity Position	40.43	32.02	27.87	24.37	19.47	17.92	21.38	21.88	20.10
OMO (Net)	8.82	5.92	4.43	9.42	7.86	0.80	-6.41	-10.72	-19.97

Notes: (1) 2011 figures cover only the first quarter. (2) Growth is the mean quarterly difference of the logarithm of seasonally adjusted nominal GDP series. (3) Inflation is the mean quarterly percentage change in seasonally adjusted CPI series. (4) Policy change is the mean quarterly change in average overnight policy rate. (5) Liquidity position is the quarterly average of net liquid assets minus required reserves as a fraction of total assets. (6) OMO is the quarterly averages of the net of -7 day maturity- open market operations in billion Turkish Liras. Positive OMO values indicate excess systemic liquidity in the money market.

(cross-section) observations, dynamic panel bias becomes insignificant and one can use panel IV estimators. Having a panel set with a greater number of temporal units, we estimate the model with panel IV estimators, where we instrument endogenous variables with their own lags. The liquidity variables, both bank specific and systemic liquidity, fail the exogeneity test while it is found that other explanatory variables can be treated as exogenous. This is mainly due to the fact that contemporaneous values of other explanatory variables are found to be insignificant. Exogeneity test statistics are given in Table 3, where we also report Craig-Donald Wald F statistics that tests the null hypothesis of weak instruments.

The first column of Table 3 exhibits results for the model outlined in equation (7). All signs are compatible with our apriori expectations. Specifically, real GDP growth and inflation (both in q-o-q changes) have positive and significant effects on nominal credit growth. The coefficient of inflation statistically equals to 1, which indicates accounting identity arising from the nominal dependent variable.

Our key empirical results are as follows. The direct impact of the short-term policy interest rate changes is negative, significant and acts within two quarters. On the other hand, bank specific liquidity position's direct impact, which is positive and significant, is faster (acts within the same quarter). The latter can be interpreted as the more liquid a bank is, the more it lends. This result suggests that deteriorations in liquidity positions cannot be easily compensated. Hence any monetary policy which can affect bank liquidity[16] may play an important role in credit growth.

[16]There are several ways through which the monetary authority can affect the liquidity position of a typical bank in the system. Adjusting the level of reserve requirements, applying different rates of reserve requirements corresponding to different maturities, changing the haircuts applied to the collateral that banks use to tap central bank's resources can be thought of as the alternative ways which central banks use to alter the liquidity levels of the banks in the system. On the other hand,

Table 3: Credit Growth Estimated by Panel IV Regression

	(1)	(2)	(3)	(4)
$\Delta \log(L_{j,t-1})$	0.384	0.382	0.348	0.326
	(0.075)***	(0.078)***	(0.082)***	(0.084)***
$\Delta \log(y_{t-2})$	0.401	0.398	0.368	0.353
	(0.144)***	(0.145)***	(0.138)***	(0.140)**
π_{t-2}	1.282	1.258	1.061	1.127
	(0.472)***	(0.467)***	(0.490)**	(0.484)**
Δi_{t-2}	-1.029	-0.675	-0.722	-0.735
	(0.400)***	(0.197)***	(0.197)***	(0.200)***
$liq_{j,t}$	0.159	0.146	0.123	0.188
	(0.051)***	(0.048)***	(0.049)**	(0.062)***
$\Delta i_{t-2} * liq_{j,t}$	0.010			
	(0.009)			
SYS_t			0.155	0.465
			(0.075)**	(0.180)***
$SYS_t * liq_{j,t}$				-0.010
				(0.006)*
Seasonal Dummies	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes
Craig-Donald Wald F	1561.6***	3072.5***	655.9***	216.4***
Exogeneity Test Stat.	15.09***	15.37***	15.77***	17.07***
R-squared	0.45	0.45	0.46	0.46

Notes: (1) Dependent variable, $\Delta \log(L_{j,t})$, is the quarterly difference of the logarithm of total Turkish Lira credits. (2) Results are presented for different model specifications. (3) The numbers in parentheses are robust standard errors and (*), (**) and (***) denote significance at 10%, 5% and 1%, respectively. (4) Growth, $\Delta \log(y_t)$, is the quarterly difference of the logarithm of seasonally adjusted nominal GDP series. (5) Inflation, π_t, is the quarterly percentage change in average of seasonally adjusted CPI series. (6) Policy change, Δi_t, is the quarterly change in average overnight policy rate. (7) Liquidity position, $liq_{j,t-1}$, is the quarterly average of net liquid assets minus required reserves as a fraction of total assets. (8) SYS_t is the quarterly average of the net of open market operations divided by price level. Positive SYS_t values indicate excess systemic liquidity in the money market. (9) Craig-Donald Wald F tests the null hypothesis of weak instruments. Exogeneity test statistics are also reported for testing the null hypothesis that the specified endogenous regressors can actually be treated as exogenous. (10) Sample period covers 2002 Q4 to 2011 Q1.

While policy rates and the bank liquidity emerge as statistically significant, results do not provide evidence on the existence of an interaction between those variables as its coefficient is estimated to be insignificant. In other words, estimation results reject the existence of the bank lending view in the traditional sense. But as discussed in detail before, insignificance of the interaction term stems from the fact that inflation targeting central banks do not need to adjust reserves (in other words, directly affect

central bank has also partial control on the systemic liquidity of the whole system. Any activity of the central bank that drains liquidity from the interbank money market alters the systemic liquidity. Changing the monetary base, selling or buying foreign currency in exchange for domestic currency, making interest payments to the Treasury or applying interest on the reserves held at central bank are among the activities that central banks use to affect systemic liquidity.

banks' liquidity positions or loanable funds) when they alter policy rates. The second column of Table 3 presents estimates when we drop the interaction term. We observe no significant change in the estimated coefficients.

Next, we test the empirical importance of systemic liquidity in new loan issuance. In order to represent the systemic liquidity in the interbank money market, we use net open market operations (OMO), performed by the Central Bank. The regressor SYS is the quarterly average of OMO deflated by price level. In this setting, positive SYS values indicate excess systemic liquidity in the money market, where Central Bank draws liquidity from the system. Estimates are given in the third column. We find a positive coefficient, indicating a positive contribution of excess systemic liquidity to loan growth. The fourth column adds the interaction between systemic liquidity and bank specific liquidity. Results reveal that the more the excess systemic liquidity, the less relevant the bank specific liquidity position in bank lending.

6 Conclusion

In this study, we empirically analyze whether monetary policies that are able to manipulate liquidity positions of banks can affect bank lending. In particular, using a panel data of Turkish banks, we study the role of liquidity on bank lending. Our results suggest that bank liquidity is an important determinant of bank lending in Turkey. Moreover, in determining their lending, banks consider not only their individual liquidity position but also that of the whole banking system. Besides, significance of the interaction between systemic liquidity and bank specific liquidity indicates that the more the excess systemic liquidity, the less relevant the bank specific liquidity position in bank lending. On the other hand, interest rate interactions with bank specific liquidity found to be insignificant implying that the original form of bank lending channel (Kashyap and Stein, 1995) is rejected for the Turkish data.

References

[1] Altunbaş, Y., Fazylov, O., Molyneux, P., 2002. Evidence on the bank lending channel in Europe. Journal of Banking and Finance, Elsevier, vol. 26(11), 2093-2110.

[2] Alper, K., Atasoy, H., Karaşahin, R., Mutluer-Kurul, D., 2011. Arzın merkezine seyahat: Bankacılarla yapılan görüşmelerden elde edilen bilgilerle Türk bankacılık sektörünün davranışı (in Turkish). Unpublished manuscript.

[3] Bernanke, B., Blinder, A., 1988. Credit, money, and aggregate demand. American Economic Review, 78 (2), 435-39.

[4] Brooks, P.K., 2007. The bank lending channel of monetary transmission: does it work in Turkey? IMF Working Papers, 07/272, International Monetary Fund.

[5] Cetorelli, N., Goldberg, L.S., 2008. Banking globalization, monetary transmission, and the lending channel. NBER Working Papers 14101, National Bureau of Economic Research, Inc.

[6] Disyatat, P., 2010. The bank lending channel revisited. BIS Working Papers 297, Bank for International Settlements.

[7] Ehrmann, M., Gambacorta, L., Pages, J.M., Sevestre, P., Worms, A., 2001. Financial systems and the role of banks in monetary policy transmission in the Euro area. Working Paper Series 105, European Central Bank.

[8] Favero, C.A., Giavazzi, F., Flabbi, L., 1999. The transmission mechanism of monetary policy in Europe: evidence from banks' balance sheets. NBER Working Papers 7231, National Bureau of Economic Research, Inc.

[9] Friedman, B.M., Kuttner, K.N., 2010. Implementation of monetary policy: how do central banks set interest rates? Handbook of Monetary Economics, in: Benjamin M. Friedman and Michael Woodford (ed.), Handbook of Monetary Economics, edition 1, volume 3, chapter 24, 1345-1438 Elsevier.

[10] Gambacorta, L., 2005. Inside the bank lending channel. European Economic Review, 49(7), 1737-1759.

[11] Kashyap, K., Stein, J.C., 1995. The impact of monetary policy on bank balance sheets. Carnegie-Rochester Conference Series on Public Policy, 42(1), 151-195.

[12] Kashyap, K., Stein, J.C., 2000. What do a million observations on banks say about the transmission of monetary policy? American Economic Review, 90(3), 407-428.

[13] Kishan, R.P., Opiela, T.P., 2000. Bank size, bank capital, and the bank lending channel. Journal of Money, Credit and Banking, 32(1), 121-41.

[14] Matousek, R., Sarantis, N., 2009. The bank lending channel and monetary transmission in Central and Eastern European countries. Journal of Comparative Economics, 37(2), 321-334.

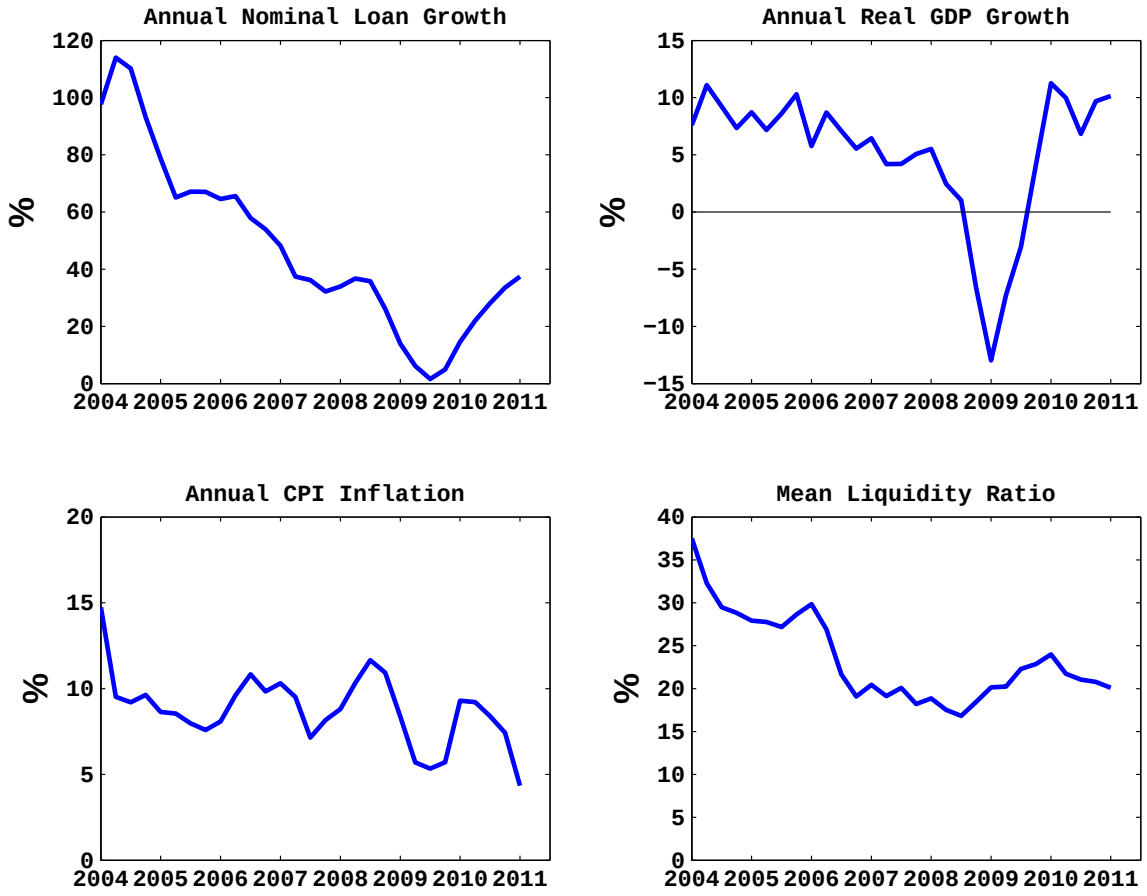
[15] Morris, C.S., Sellon., G.H.Jr., 1995. Bank lending and monetary policy: evidence on a credit channel. Economic Review, Federal Reserve Bank of Kansas City, issue Q II, 59-75.

[16] Roodman, D., 2009. How to do xtabond2: An introduction to difference and system GMM in Stata. Stata Journal, 9(1), 86-136.

[17] Takeda, T., Rocha, F., Nakane., M.I., 2005. The reaction of bank lending to monetary policy in Brazil. Revista Brasileria de Economia, 59(1),

[18] Zulkey, A.K., Ngah, W., Saini, A.W., Bakri, A.K., 2010. Bank lending channel of monetary policy: dynamic panel data evidence from Malaysia. MPRA Paper No. 26157.

Figure 3: Time Series of Selected Aggregate Variables



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