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THE EFFECT OF BANKING CURRENCY RISK ON THE SUPPLY OF LOANS: A MATHEMATICAL MODEL

Ahmet ŞENGÖNÜL*

(Mersin University, Department of Economics, Çiftlikköyü Campus, Mersin, TURKEY)
sengonul@hotmail.com

Abstract:

This paper presents a mathematical model, which examines how the effect of monetary policy on supply of bank loans depends on currency mismatches in banks' balance sheets. The model explores bank lending channel would be operative when banks, with a low risk perception, finance government through securities by their foreign denominated sources of borrowing, which results in currency risk. In this sense, the importance of the quality of banks' external finance that are supposed to replace lost deposits are also emphasized. In order to highlight these implications of the model for Turkey before the crises in 2000-2001, these assumptions, in particular, are discussed throughout the paper.

Özet:

Bankaların Kur Risklerinin Kredi Arzları Üzerindeki Etkisi: Matematiksel Bir Model

Bu makale, para politikalarının banka kredi arzına olan etkilerinin, bankaların bilançolarındaki para cinsi uyumsuzluğuna ne şekilde bağlı bulunduğunu inceleyen bir matematiksel model sunmaktadır. Model, zayıf bir risk algılamasına sahip bankaların kur riskine neden olan yabancı para cinsinden edinilen dış kaynaklar ile kamu kesimini menkul değerler alımı yoluyla finanse etmesi durumunda, banka ödünç verme kanalının işlerlik kazanabileceğini ortaya çıkarmaktadır. Bu bağlamda, mevduatlardaki azalmanın yerine geçmesi gereken bankaların dış kaynaklarının önemi de vurgulanmaktadır. Bu varsayımlar, modelin, özellikle 2000-2001 krizleri öncesi Türkiye için uygulamalarının önemini vurgulamak için çalışmanın tüm aşamalarında tartışılmıştır.

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Keywords: Bank, currency risk, bank lending channel, Turkey.
Anahtar Sözcükler: Banka, kur riski, banka kredi (ödünç verme) kanalı, Türkiye.

INTRODUCTION

In a fixed or crawling pegged exchange rate regimes, any exchange rate depreciation that often leads to a currency crisis can create solvency problems among banks that are subject to large, unhedged foreign exchange exposures. Macroeconomic shocks, such as an unexpected increase in world interest rates, leading to capital outflows through the banking system lead to a reduction in banks' deposits and capital by weakening of the banking system, due to currency and maturity mismatches. There will also be observed pressures on official reserves, which weaken the central bank's capacity to defend the official exchange rate. Thus, exchange rate depreciation could also lead to a weakening of the banks' positions. In such a period of an increase in the currency risk in banks' balance sheets, holding large and unhedged foreign exchange exposures by banks may also play an essential role in determining the loan supply of banks to the private sector and hence industrial production and economic growth. This may force commercial banks to reduce lending abruptly and liquidate existing loans. The resulting credit crunch may lead to an increased incidence of bankruptcies, a rise in nonperforming loans, and consequently to a banking crisis.

There is a wide literature about the leading factors of the banking and/or currency crisis and the links between them. The researchers mostly focus on the effects of high risk taking by banks in terms of currency risk on banking and possible currency crisis accordingly. For example, Kaminsky and Reinhart (1999:3) linked bank and currency crisis by arguing that while a banking crisis is followed by a currency crisis, fragility of banking system is not an immediate cause of currency crisis. On the other hand, Disyatat (2001:3) discusses the effects of quality and health of balance sheets in terms of net worth and currency risks and presents a model that concludes that higher open positions in foreign currency makes bank balance sheets unhealthy and eventually leads to a contraction in the real economy through the effects of devaluation in the event of currency crisis.

On the other hand, the bank lending hypotheses so far have been analyzed through separating characteristics of banks such as their asset size, liquidity, and on capital equity or capital leverage. By separating banks by their asset size, for example, Kashyap and Stein (1995) use disaggregated data on bank balance sheets for testing the bank lending channel (BLC) of monetary policy transmission. Kashyap and Stein (2000) separate banks by their liquidity strength as a ratio of cash and securities to assets and their asset size and hypothesized that more liquid banks have an easier time protecting their loans as a result of tight monetary policy by allowing to decline their large buffer stocks of cash and securities. In attempting to identify loan supply and the bank

lending channel, Kishan and Opiela (2000:121-141) explore an additional differentiating characteristic that is not tied to a bank's ability to supply loans. They present empirical evidence that the bank capital leverage ratio along with its asset size also could explain the effect of monetary policy on bank loan supply.

To the best of my knowledge, however, these studies have yet to explore how these risk factors of banking and currency crises may have crucial role in either determining the negative growth rates in real income or propagating the effects of shocks "in a bank lending channel framework" before or during the crises period.

Therefore the aim of this paper is to attempt to make a connection between currency risks taken by a fragile banking system and their effects on bank lending via bank lending mechanism of monetary transmission in a simple bank lending model. The theoretical model presented in this paper contributes to the existing credit and bank lending literature by focusing on the importance of the currency risk of banks via net open foreign exchange exposure in their balance sheets in determining the impact of monetary policy on bank loan volumes. Even though there have been some regulations in some developing countries about the indicators of currency risks in balance sheets such as the ratio of net open foreign exchange positions to capital that banks have to obey, the consequences of holding a high rate of this ratio (excessive carrying high foreign exchange risk) as a factor affecting lending volume of these banks has not been analyzed in terms of its effects on real output through the bank lending channel. Thus, the paper will test whether taking excessive currency risk by banks is a separating factor on loans and in turn on the real economy. Thus, taking excessive currency risk characterized by net open position of banks mostly in developing economies, therefore, should have separating effects in explaining the bank lending channel and in formulating monetary policy.

A theoretical model in this paper explores how the bank lending channel may exist under some assumptions. If these assumptions hold, the model also sheds light on whether the sensitivity of lending volume to monetary policy is intensified for the banks (or bank group) with high currency risk in their balance sheets. In order to highlight some implications of the model for the Turkish case, the assumptions of the model presented here, in particular, are also discussed by considering the facts of the Turkish banking system throughout the paper.

I. DISCUSSION

It is fairly argued that the factors leading to banking crisis are also important to understanding the origins of the negative or very low industrial production growth through the monetary transmission mechanism. Even if these factors leading to banking and currency crisis do not affect the supply of loans immediately, they make the supply of loans vulnerable to monetary policy and hence credit crunches during a crisis. As one of the leading factors of banking and currency crisis in economies defending parity to control inflation, currency risks ignored by banks has also had a crucial effect on the supply of loans to the private production sector and on real variables in an economy.

Among the banking risks accumulated in banks' balance sheets, currency risk has a crucial role in leading to banking and currency crises as well as to contractions in output. When banks have some unhealthy balance sheets in terms of having low net worth and high foreign currency exposure, they will be open to currency risk in the event of devaluation that is unexpected domestic currency depreciation. In particular, unhedged foreign currency liabilities or speculative foreign exchange open positions by banks lead to an output contraction in the real economy as seen in the Asian countries during the Asian crisis period. In the wake of a currency crisis, low net worth and high foreign currency open positions (high exposure to currency risks) weakened bank balance sheets and made banks more vulnerable to an output collapse. This collapse in turn led to severe short run contractions of the real economy.

II. THE MODEL

In order to establish how the size of the effect of monetary policy is likely to be affected by banks' net foreign exchange open position as well as their capital structure, I present a simple one period model that is originally modified from Peek and Rosengren (1996: 47-68) and from the model that is used by Kishan and Opiela (2000: 121-141).

It is assumed that a representative bank's balance sheet consists of loans (*LN*), securities (*SEC*), and reserves (*RR*), on the asset side and bank capital (*K*), transactions deposits (*DD*), non-transactions deposits (*TD*), and net open foreign exchange position (*OP*) on the liability side. Prior to the twin crises in 2000 and 2001, almost all of the Turkish banks are assumed to have always foreign exchange liabilities more than foreign exchange assets that yields net foreign exchange open positions, which is formulated as the difference between foreign exchange liability and foreign exchange assets denominated in domestic currency. Therefore, in order to extract net open foreign exchange position from

the total (domestic and foreign currency) items in a bank's balance sheet, all other asset and liability items are also segregated into domestic and foreign currency parts and modeled with only domestic currency items. For example, loans (*LN*) represent only the credits that are being used to domestic creditors in domestic currency. Given the fact of balance sheet constraint, total assets are also assumed to be equal total liabilities. Therefore, a typical bank's balance sheet equation will be as follows

$$RR + SEC + LN = K + DD + TD + OP \quad (1)$$

Among the liabilities of the balance sheet, bank capital (*K*) is assumed to be fixed in the short term. Demand or transactions deposits (*DD*) are assumed to be in inverse relation with the monetary policy indicator, market interest rate, r_M.[1] The coefficient of a_1 is the interest rate elasticity of demand deposit and assumed to be large. This assumption stems from the fact that the opportunity cost of holding demand deposits increases as a response to a general rise in market interest rates. As Peek and Rosengren (1996: 55) argue, "an increase in market interest rates increases the opportunity cost of holding non-interest bearing deposits and causes bank customers to reduce their holdings of such deposits and substitute alternative assets paying market derivative interest rates." Since the bank is in a imperfectly competitive market for demand deposit, how big the sensitivity of demand deposit to market interest rates is and how quickly customers of transaction deposit switch into alternative interest paying assets in response to higher market interest rates mainly depend on the capability of banks to set retail deposit rates on demand deposits such. The less opportunities are for such activities by banks, the higher the magnitude of a_1, the interest rate elasticity of demand deposits. Given the fragility of the Turkish banking sector in which banks prefer to borrow in short-term maturity and lend to the government in relatively longer terms that yields interest rate risk, these banks are heavily dependent on over-night funds. Savers in Turkey prefer to substitutes their demand deposit with REPO since REPO is overnight and it has considerably higher rates than deposit accounts as a response to an increase market interest rate, overnight rates.[2]

On the other hand, within a non-transactions (time) deposits market, a bank is assumed to have market power by raising the amount of non-transaction deposits (*TD*). In doing so, bank offer higher interest rates on the deposit (r_{TD}) above the mean market rate, $\bar{r}_{TD}$. The sensitivity of non-transactions deposit alters to changes in the non-transaction deposit interest rates a typical bank offers therefore is denoted by b_1. Thus,

$$DD = a_0 - a_1 r_M \quad . \tag{2}$$

$$TD = b_0 + b_1 (r_{TD} - \bar{r}_{TD}) \tag{3}$$

On the asset side of the balance sheet, banks are required to hold reserves in the amount of reserve requirement ratio (α) times their demand deposit or transactions deposits, but they hold no excess reserves.

Securities are assumed to be held for buffer stock reasons and formulated as a fixed proportion of transaction deposits (c_1) net of reserves and a fixed proportion of net open foreign exchange position (c_2). Securities hold as a proportion of open position , (c_2 *OP*) stems from the idea that banks invest in profitable domestic currency securities by opening their foreign exchange positions as an alternative motive in addition to the buffer stock motive. This motive is formulated in Equation (7) and appears mainly for investing on some asset side items such as securities and loans for more profit that is included in the profit function in Equation (13) below.

On the other hand, the bank loan market is assumed to be imperfectly competitive that allows a bank to alter its loan volume as long as there is a spread between the loan rate (r_{LN}) and the mean loan market rate $(\bar{r}_{LN})$. When a bank wishes to increase their loan volume, for example, it simply set their loan interest rate below the mean rate. The value of d_1 is the sensitivity of loan demand to a change in the bank's loan interest rate will depend on the opportunities of large and small firms to raise funds alternative to bank loans. It might be assumed to be large or elastic for large firms while it is small or inelastic for small firms, given the uniqueness of bank loans as a source of financing to small firms. That is, the relative magnitudes of this sensitivity for small and large firms may be different in favor of large firms since large firms would have more opportunities to finance themselves with alternative funds such as commercial papers and equities rather than bank loans. For Turkey case, however, most firms should be assumed as having little opportunities to raise funds but bank loans no matter how the size of the firms are. In this case, the (positive) magnitude of d_1 would be small or the sensitivity of loan demand to a change in the bank's loan interest rate would be inelastic.

$$RR = \alpha DD \tag{4}$$

$$SEC = c_0 + c_1 DD - RR + c_2 OP \tag{5}$$

$$LN = d_0 - d_1(r_{LN} - \bar{r}_{LN}) \tag{6}$$

Net foreign exchange open position (*OP*) on the liability side of bank balance sheet that is endogenized and added into the previous models;

$$OP = p_0 + p_1 (r_{sec} - \bar{r}_{sec}) + p_2 (r_{LN} - \bar{r}_{LN}) + p_3 (r_M - \bar{r}_M) \tag{7}$$

where r_{SEC} and $\bar{r}_{SEC}$ are the interest rate on securities that a bank demands and the mean market rate of securities, respectively. A bank is assumed to have two incentives to demand open position. The first incentive is to own more government securities since investing in government bonds is almost always is profitable for banks especially in Turkey.[3] The second incentive is having another funding source to make loans to private firms in the economy. In sum, banks mainly raise their *OP* volume for funding the private and government sector. For an economy in which a central bank reduces foreign currency risk for the banks by adjusting exchange rates according to inflation rates, buying securities such as government bonds and Treasury bills is always profitable since interest on securities is always higher than the mean market rate for securities. This implies that the first incentive mostly is greater than the second one, that is $p_1 > p_2$. In other words, the value of p_1 is the sensitivity of securities demand by banks to a change in the securities interest rate and is assumed to be large, given the uniqueness of securities as a source of financing to budget deficit. Therefore, the first incentive to raise bank's *OP* volume can be characterized by the difference between securities rate that a bank can bid in the government securities auction to invest in securities and the mean market rate of securities.[4] As long as the bank is not able to offer a lower security rate than the mean market rate in the auction, this typical bank will wish to demand more foreign source that in turn increase their *OP* volume. The same logic is true also for the second incentive. The second part of *OP* volume is demanded by a bank in order to provide loans to private firms. As long as the loan interest rate offered by bank is higher than the mean market interest rate, a bank would prefer to get large enough external funds in order to have a market power in offering lower loans rate to increase its loans.

Now consider the third incentive of the banks to open their positions that is represented by the third part of Equation (7), the difference between domestic interest rates, namely inter-bank overnight interest rates, and the mean interest

rate or a specific country's (foreign country) interest rate (namely federal funds rate for the U.S., for example) or average interest rates of some foreign countries. As long as market interest rates are higher than the mean rate, banks are assumed to hold more open position exposures and hence have excess foreign currency risk because this positive difference implies that there exists enough capital inflow so that the price of domestic currency is always overvalued in a fixed exchange rate regime. The expectation of the higher domestic exchange rates makes banks more confidence concerning the predictability of the foreign exchange, i.e., cost of external finance. Therefore, they demand more borrowing in foreign exchange denominated liabilities, which in turns increase their open positions.[5] With a positive difference between domestic nominal interest rates and mean interest rate, banks find themselves in an environment in which interest rates are always higher than the expected nominal depreciation of the domestic currency that could be attributed as a major reason why banks have open position and hence foreign exchange risk in their balance sheets.[6]

The sensitivity of the open position exposures by a bank to a change in the market interest rate, then is measured by the value of p_3. The magnitude of this sensitivity depends on the extent of banks' perception of interest and foreign currency risk given the fact that foreign currency denominated borrowing may not only lead to a currency mismatch but also to a maturity mismatch.

If the difference in the last part in Equation 7 is interpreted as the difference between domestic interest rates and its mean market rate and as long as this difference is being tried to be fixed or less volatile by a central bank's open market operations, banks might feel themselves more confident in terms of interest rate risk they may face and hence will not hesitate to invest in longer term assets (mostly government bond whose maturities are at least one year or longer) through short term financing such as net foreign exchange borrowing, that directly cause the *OP* volume to increase, or domestic denominated sources of borrowing such as demand or inter-bank deposits. Therefore, less volatile behavior of this difference simply causes banks to ignore (or decrease the perception of) the interest rate risk since banks, in this case, may be able to easily forecast their external finance costs when they decide to fund the government through securities.

On the other hand, if this difference is interpreted as the difference between domestic interest rates and the mean interest rate of foreign interest rates, banks tend to ignore the exchange rate risk whenever the policy maker encourages them to expect that domestic currency will depreciate only as much as inflation rate. Therefore, in either case above, the degree of sensitivity of

foreign exchange open positions to a change in the market interest rate (p_3) measures the risk (interest and currency) perception and may be assumed small, given the reasons mention above, causing trivial offsetting effects in the partial derivative of equation 14-17.

The mean market rates for r_{TD}, r_{SEC}, r_{LN} (as in the previous models) and the mean market rate for r_M (foreign *FFR* in my model) are assumed to be directly related to the domestic market interest rate (r_M) with fixed spreads given by e_0, f_0, g_0, and s_0,

$$\bar{r}_{TD} = e_0 + \phi\ r_M \ . \tag{9}$$

$$\bar{r}_{SEC} = f_0 + \phi\ r_M \ . \tag{10}$$

$$\bar{r}_{LN} = g_0 + \phi\ r_M \ . \tag{11}$$

$$\bar{r}_{FF} = s_0 + \phi\ r_M \ . \tag{12}$$

Banks are assumed to maximize profits (π),

$$\pi = (r_{LN} - \theta)LN + r_{SEC}SEC - r_{DD}DD - r_{TD}TD. \tag{13}$$

Total profits are simply the positive difference between banks revenues as interest income on loans (r_{LN} *LN*) net of loan losses (ΦLN) and interest received from securities holdings ($r_{SEC}SEC$), and costs as both interest paid in transactions deposits ($r_{DD}DD$) and interest paid on non-transactions deposits ($r_{TD}TD$).

Using equations (1) to (12) and eliminating *RR*, *DD*, *LN*, *SEC*, *OP*, r_{DD}, and r_{LN}, we maximize profit equation with respect to *TD* and other variables, *LN*, *SEC* and *OP* so that we obtain the first-order conditions to solve for these variables. Testable hypotheses can be derived by taking the derivatives of the *TD*, *LN*, *SEC*, and *OP* equations with respect to market interest rate by assuming c_1, c_2 in Equation 5, and p_3 in Equation 7 are less than 1.

$$\frac{\partial TD}{\partial r_M} = \frac{b_1[a_1(1-c_1) - p_3(1-c_2)]}{b_1 + d_1} > 0 \qquad (14)$$

$$\frac{\partial LN}{\partial r_M} = -\frac{d_1[a_1(1-c_1) - p_3(1-c_2)]}{b_1 + d_1} < 0 \qquad (15)$$

$$\frac{\partial SEC}{\partial r_M} = -[a_1(1-c_1) - p_3(1-c_2)] < 0 \qquad (16)$$

$$\frac{\partial OP}{\partial r_M} = \frac{[a_1(1-c_1) - p_3(1-c_2)]}{(1-c_2)} < 0 \qquad (17)$$

All partial derivatives in equations 14-17 are ambiguous without making additional assumptions concerning the magnitudes of interest rate elasticity of demand deposit (a_1) and sensitivity of foreign exchange open position to a change in the market interest rate (p_3).[7] Given the fact that a_1 is large for Turkish case whose reasons were mentioned above, this requires higher sensitivity of demand deposits to overnight interest rates (i.e., a higher a_1). Therefore, it follows that this elasticity will be large in the Turkish banking system.

On the other hand, as discussed earlier, for countries whose monetary policy leads banks to pursue easy profits on high-yielding government paper via unhedged foreign borrowings *and* causes banks to ignore exchange rate risk by depreciating domestic currency with the inflation rate, the degree of sensitivity of the foreign exchange open position to a change in the market interest rate (p_3) is assumed to be small, which represents a low degree of risk perception of the banks. Given this environment, it is obvious that securities are mostly financed through foreign currency exposure relative to domestic short term financing such as inter-bank borrowing that leads the proportion of securities financed by a bank's open position to be larger than the portion of securities financed by domestic demand deposits ($c_1 < c_2$ in Equation 5).

Given these assumptions about the relative magnitudes of a_1 and p_3, an increase in the federal funds rate increases non-transactions deposits (*TD*) and reduces loans (*LN*) and securities (*SEC*).[8] The effect of the policy on the loans and non-transactions deposits is the same in sign as the effect found in Kishan and Opiela's (2000:125) paper. However, the magnitudes of these effects are smaller when net open positions are added into a bank's balance sheet. This

conclusion basically stems from the fact that banks raise funds through additional foreign borrowing (external finance) that may raise funds to relatively offset the effects of decrease in deposits after contractionary policy but may eventually have unhedged open positions in their balance sheets. Large time deposits increase (*less* relative to the case with no *OP* in bank balance sheet) and loans decreases (*less* relative to the case with no OP in bank balance sheet) in response to contractionary monetary policy.

The model also explores the effect of market interest rates on bank's net open foreign exchange position holdings, and the effect is positive. The magnitude of this positive effect is mainly dependent on the fixed proportion of *OP* in the securities (c_2) that banks hold as well as on the magnitudes of a_1 and p_3. If this proportion (c_2) is large the impact of interest rate changes on the *OP* will be higher. The effect of market interest rate on *OP* maybe will reflect the interest rate and exchange rate risks banks incurred for banks that holds large amount of *OP* to invest on government securities in the environment of higher interest rates.[9]

By following the methodology of Kishan and Opiela (2000:126) in construction of the hypotheses of whether the net effect of asset size and capital structure of a bank on the sensitivity of loans and large time (non-transactions) deposits to a monetary policy that support the bank lending channel, I also explore the net effect of open position volume of a bank on the sensitivity of loans and large time deposits to a policy. This *hypothesis* is $\frac{\partial^2 LN_{it}}{\partial OP_{it}\partial r_t} = \frac{\partial\left(\partial LN_{it}/\partial r_t\right)}{\partial OP_{it}} = \frac{\partial\left(\partial LN_{it}/\partial OP_{it}\right)}{\partial r_t} < 0,$ and basically captures the idea that the negative effect of contractionary monetary policy on lending (negative sensitivity of lending volume to policy) is most pronounced for banks with unhedged large open position. In other words, the lending volume of banks with higher foreign currency exposure will be more responsive to a contractionary monetary policy. While the hypotheses expressed in equation 15, $\partial LN_{it}/\partial r_t < 0$, supports the bank lending channel, the net effect of open position volume on the sensitivity of loans to policy is also important to understand the BLC when we include open position of banks which is mostly observed in developing countries, such as Turkey that eventually experiences banking crisis and credit crunch.

I am assuming that the interest rate sensitivities of *TD*, and *LN* (b_1, and d_1, respectively) are related to size or volume of net open exchange position (*OP*) and capital adequacy. Banks with larger open positions should not have an easier time raising funds through *TD*.

The first and maybe the most important reason that banks try to maintain unhedged foreign exchange open positions is that they are not able to raise funds through non-transactions or time deposits that are relatively more expensive than increasing their external funds through riskless foreign exchange liabilities under the environment limited foreign exchange depreciation and higher interest rates for domestic currency deposits. This assumption may be the case especially for Turkish Banking system as Özatay and Sak (2002:13) argue that open foreign exchange position as a structural feature of the Turkish banking system is related with a long history of high inflation and the inability of domestic banks to borrow long term in their own currency.[10] This requires that domestic borrowing becomes more expensive and difficult, demand for banks' managed liabilities is not elastic and hence the sensitivity of non-transactions deposit changes to the time deposit rates, b_1, gets smaller, especially for banks whose have higher open positions. The reverse is true for banks with better capitalization (Equation 18).

On the other hand, the construction of a link between open position and sensitivity of loans to loan rates is a difficult job since there is yet to say too much about the fact that banks with higher *OP* might prefer offer their loans mostly to the large firms. However, the uniqueness of excessive currency risk taking bank loans to firms may shed light on this relation. The question should be answered here whether the sensitivity of loan demand to loan interest rate (d_1) differs (increases or decreases) depending on the extent of net open position exposure of the banks. If a loan demand is more sensitive to loan interest rates for a bank that has a higher open position, then the relation will be positive or vice versa. If the assumption of that d_1 would be inelastic for firms that are not able to raise funds rather than bank loans is combined with the assumption of that the credit customers of banks with higher *OP* position are mostly bank dependent, the sign of δ_1 will be negative. That is,

$$b_1 = \beta\,(OP,K), \qquad \text{where } \beta_1<0 \text{ and } \beta_2>0. \tag{18}$$

$$d_1 = \delta\,(OP), \qquad \text{where } \delta_1 < 0. \tag{19}$$

Substituting (18) and (19) into (14) and (15) and taking the derivative of (14) and (15) with respect to open position and capital yields,

$$\frac{\partial\left[\frac{\partial LN}{\partial r_M}\right]}{\partial OP} = \frac{[(\beta_2 d_1)][a_1(1-c_1)-p_3(1-c_2)]}{[b_1+d_1]^2} < 0 \qquad (20)$$

$$\frac{\partial\left[\frac{\partial LN}{\partial r_M}\right]}{\partial K} = \frac{[(\beta_2 d_1)][a_1(1-c_1)-p_3(1-c_2)]}{[b_1+d_1]^2} < 0 \qquad (21)$$

The net effect of open position of a bank on the sensitivity of loans and non-transactions deposits to a monetary policy is indeterminate and mainly depends on the signs of both β_1 and δ_1. In other words, the higher degree of sensitivity of loans to monetary policy (or deepening of bank lending channel) depends on the ability of banks to raise funds with higher exposure of net foreign exchange position through TD and the uniqueness of excessive currency risk taking bank loans to firms. Thus, for a bank with higher foreign exchange liabilities relative to foreign exchange assets, the effect of interest rate (or monetary policy) on loans yields more (negative) responsiveness, which means more sensitive to changes in policy. Again, this result is mainly depends on the assumptions about δ_1 and β_1 in the equation 18 and 19. If I assume that the credit customers of banks with higher OP position are large firms instead of small firms and consumers, the sign of δ_1 will be positive because large firms have more substitute sources of borrowing and the demand for bank loans of large firms is more elastic with respect to loan rates. In this case the net effect of open position of a bank on the sensitivity of loans and non-transactions deposits to a monetary policy would be indeterminate and subject to an empirical question. However, in the Turkish case, the demand elasticity of large firms with respect to loan rates may still be inelastic since even most of the large firms have heavy budget constraints and an inability to substitute other sources of borrowing.

On the other hand, the net effect of capital position of a bank on the sensitivity of loans and non-transactions deposits to monetary policy is also positive. This also means that as a bank becomes better capitalized the effect of interest rate changes on bank loans becomes more positive, and thus less sensitive to changes in policy. This result is consistent with the previous studies of Peek and Rosengren (1996:57) and Kishan and Opiela, (2000:126) even though I added in to their model net foreign exchange position. Thus open position and capitalization of a bank has separating effect on loan and *TD* behavior of banks, the hypotheses expressed in equations (15), (20) and (21)

support the bank lending channel that policy affects loans and the size of this effect depends on the size of net open foreign exchange position and capital structure of banks.

In sum, the accumulation of excessive currency risk of banks through open position stemming from borrowing in the international system may be considered as an alternative external finance, which is assumed to make bank lending channel less operative. However, even though banks can replace lost deposits with other sources of funds that is directly unrelated to interest rates, the monetary policy still might affect the supply of loans if these alternative funds leads to accumulate risks in bank's balance sheets. Thus, as well as having these alternative sources of financing, the health or quality of these funds should also importantly matter. Therefore, foreign borrowing and domestic lending that result in net foreign open positions should be considered as alternative external finance sources that also cause banks to face currency risk exposure relevant to this proposition above. Exploring alternative funds through taking currency risk by banks to replace deposit drains, therefore, may not prevent the effects of monetary policy on supply of bank loans through bank lending channel when banks borrow foreign denominated liabilities with lower or no risk perception with respect to interest rate changes while the demand deposit is more sensitive to interest rates ($a_1 > p_3$) and when securities are mostly financed by foreign borrowing (*OP*) rather than domestic borrowing (*DD*) ($c_2 > c_1$). This eventually may also lead to credit crunch in the wake of collapsing fixed exchange regime.

CONCLUSION

When it is assumed that liquidity drains from the banking (financial) system cause credit or bank lending channel to operate, it should go to the roots of this liquidity crushes. For some countries like Turkey, monetary contractions as well as international capital outflows should have a crucial role in determining the liquidity volume in the system. Thus, the relation between monetary policy actions by central bank and the movements in foreign capital movements should be well understood.

As an implication of the theoretical model presented in this study, as long as securities on the asset side of banks' balance sheets are financed by net foreign exchange open position in the form of foreign currency borrowing rather than by domestic borrowing on the liability side of the sheets ($c_1 < c_2$) and sensitivity of demand deposit to market interest rate is higher than the sensitivity of open position demand to market interest rate ($a_1 > p_3$), an increase in interest rates leads to a contraction in bank loans through bank lending

channel of monetary transmission even when including uncovered foreign exchange exposures in banks' balance sheets.[11] Thus bank lending channel and the effects of interest rate on the supply of loans more likely to be observed in a banking system where monetary policy encourages banks to fund government budget deficits as well as in an environment banks ignore of banking risk they face while international lenders do not .

As another implication, the importance of asymmetric structure in perception of banking risks between borrowers and lenders has been emphasized in this paper. Asymmetric information structure between the perception of risks by bankers and international lenders who fund the domestic system, therefore, is also likely to determine whether bank-lending channel works. While commercial banks accumulate risks such as currency and interest rate risk in their balance sheets with a low degree of risk perception, international capital lenders of the domestic banking system might consider the domestic bank system very risky and hence they might have high degree of risk perception. This asymmetry then should lead both to have a vulnerable balance sheets structure for banking crisis and to decrease the supply of bank loans in the system. Thus, if any monetary policy encourages banks to take excessive risks that foreign lenders are aware of while banks, as international borrowers, are not, it will cause a further reduction in loans.

NOTES

[1] For the Turkish Banking System, for example, monetary policy indicator of interest rates may be well represented by interest rate observed in overnight inter-bank transactions-overnight rates.

[2] As Berument (2001:7) argues, "the Repo/Total Demand Deposit rate was 9.54 and the Repo/Total TL Dominated Deposit excluding Repo was 0.47 in 2000:10. Hence, the change in interest rates was more likely to accept repo than other components of M1."

[3] This case was especially effective for Turkish case before the twin crisis in 2000-2001 as indicated "[Turkish] banks became used to easy profits, via unhedged foreign borrowing to finance the purchase of high-yielding government paper, as well as domestic trading in that paper. These activities led to a significant build-up of off-budget positions in the form of open positions and 'repos', which respectively carried high exchange and interest rate risks, as well as a steady crowding out of traditional loans by government securities in the asset portfolio." (OECD, 2001:27-8). The Turkish banks maintained high net open positions in order to capture high-risk premium on government securities, which are mainly denominated in domestic currency (Van Rijckeghem, 1997).

[4] If we assume that securities incentive part of open position is fully realized in terms of security holdings of a bank, then bank's security demand equation will be as follows,

$$SEC = c_0 + c_1\, DD - RR + p_1 (r_{SEC} - \bar{r}_{SEC})$$
$$where \;\; c_2\, OP = p_1 (r_{SEC} - \bar{r}_{SEC})$$

[5] If the country has a fixed or crawling exchange rate regime in which monetary authorities try to defend their exchange rate parity by, for example, adjusting the parity by previous period's inflation rates.

[6] The Former Governor of the Central Bank of the Republic of Turkey, Gazi Ercel, pointed this "As to foreign exchange risk, the difference between the Turkish lira interest rate and the nominal depreciation of the Turkish lira is the major reason why the banks place foreign currency funds in Turkish lira funds or other alternative investment opportunities." See http://www.bis.org/review/r990319b.pdf for his speech in the American Turkish Council meeting in Ankara on 18 March 1999.

[7] Without additional assumptions, the existence of the (opposite) second part in numerator that makes the results ambiguous stems from including open position into the previous models of Peek and Rosengren (1996) and Kishan and Opiela (2000).

[8] This result is contrary to that of Kishan and Opiela (2000: 125). However this contrary does not result of including OP in to their model, rather having a mistake in solving of their model. Their solution is

$$\frac{\partial SEC}{\partial r_{FF}} = -a_1 (c_1 - a) \gtreqless 0 \;\cdot$$ Instead the solution must have been as follows,

$$\frac{\partial SEC}{\partial r_{FF}} = -a_1 (1 - c_1) < 0 \cdot$$

[9] Realization of the expectation of currency depreciation may be observed in the case of growing difference between domestic and foreign interest rates (as indicated in equation 8) in the short term.

[10] See also Goldfajn (2000) for general discussion.

[11] The negative effect is demonstrated in Equation 15.

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