"The behavior of Turkish consumer loan rates, deposit rates and consumer loan premium in post-2001 currency crisis"

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NUMBER OF REFERENCES

0

NUMBER OF FIGURES

0

NUMBER OF TABLES

0

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The behavior of Turkish consumer loan rates, deposit rates and consumer loan premium in post-2001 currency crisis

Abstract

Asymmetries in the Turkish consumer loan-deposit rate spread (consumer loan premium) were documented. Empirical results revealed that the consumer loan premium adjusts to the threshold more slowly when the deposit rates fall relative to the lending rates than when the deposit rates move in the opposite direction. This predatory rate setting behavior is consistent within the observed lending institutions, operating in an opaque, highly concentrated market over the post Turkish currency crisis of the 2000s era. Empirical results also revealed no Granger causality between the consumer loan rate and the deposit rate, indicating that the consumer loan rate is independent of the 1-month deposit rate. Moreover, this finding suggests that the Turkish countercyclical monetary policy does not matter in the short run.

Introduction

The spread between the lending rate banks charge borrowers for consumer loan and the 1-month deposit rate they pay savers is defined henceforth as "consumer loan premium". This premium not only provides interest income to financial intermediaries, but it also influences a country's level of saving and consumption. This consumer loan premium reveals how commercial banks respond to countercyclical monetary policy and hence the effectiveness of central bank's monetary policymaking. Consequently, analysis of this consumer loan premium illuminates and provides insight into banking behavior. Modern economic theory articulates that nominal interest rates can be decomposed to the real rate, risk premium and the inflation expectation premium; hence, the difference between these two nominal rates is the real spread. In this context, the consumer loan premium may be considered as a real measure in nature. Accordingly, this paper examines the behavior of Turkish banks with a focus on their consumer lending-deposit rate setting and the behavior of the consumer loan premium, and in turn, the dynamic interrelationship of the elements that determine them.

From the theoretical perspective of interest rate settings, banks in a free market economy would incorporate all elements of risk and set a risk-free equilibrium spread between the rates paid savers and the rates charged consumer borrowers, i.e., the consumer loan premium. If banks set a loan premium either too high or too low, market forces would force an adjustment back to some equilibrium spread. Monopolistic/oligopolistic concentration thwarts the operation of such free market forces and leads to wider, asymmetric spreads and larger consumer loan premium. Asymmetries in the Turkish financial sector illustrate this process as economic conditions separately influenced the rate charged consumer borrowers and the rate paid savers, which resulted in a consumer loan premium larger than a free market determined spread.

Across the spectrum of changes that took place in Turkey during the last twenty years, discussed below in section 3, the banking industry in that country can be characterized as highly monopolistic and oligopolistic. Economic theory and banking experience suggest that monopolistic and oligopolistic concentration inevitably leads to predatory pricing behavior as indicated by the asymmetric spread between the interest rates charged borrowers and the interest rates paid savers. The focus of this paper explores that theoretic proposition and more specifically probes the question: do asymmetries exist in the Turkish consumer loan/deposit rate spreads, and if such asymmetries are present, how do consumer loan rates and deposit rates respond to these asymmetries? Are the responses independent or dynamically interrelated? The remainder of this study is organized as follows: the following section briefly reviews the literature on asymmetries in lending-deposit rate setting behavior by commercial banks; the next section summarizes the Turkish banking sector; the section that follows describes the data and the descriptive statistics used in the analysis; the next section describes the methodology used and the empirical results; the concluding section provides observations and remarks.

1. A brief literature review

The rationale for theoretically hypothesizing asymmetric responses to the national countercyclical monetary policy can be attributed to the documented asymmetric rate-setting behavior of the commercial banks in the context of rates of return on financial market instruments. Dueker (2000) and Tkacz (2001) have reported asymmetries in the U.S. prime lending rate in the past. Thompson (2006) found asymmetries in the U.S. prime lending-deposit rate spread. Sarno and Thornton (2003) found asymmetries in the U.S.

Treasury securities in their studies. Frost and Bowden (1999) and Scholnick (1999) reported asymmetries in mortgage rates in New Zealand and Canada. Hofmann and Mizen (2004) indicated asymmetric behavior of retail rates in the United Kingdom. Hannan and Berger (1991), and Neumark and Sharpe (1992)) examined various deposit rates for the same behavior. Several studies have found asymmetric cointegration between bank lending and deposit rates. For instance, Nguyen et al. (2008) documented similar asymmetries in Mexican lending and deposit rates. Nguyen and Islam (2010) reported asymmetries in the Thai bank lending and deposit rates. Nguyen et al. (2010) found asymmetries in the Bangladeshi lending deposit rates. Chang and Su (2010) reported nonlinear cointegration between the lending and the deposit rate in ten Eastern European countries. Lately, Haug and Basher (2011) found nonlinear cointegration in the purchasing power parity relationships for Canada, Japan, Switzerland, the UK, Belgium, France, Germany, Italy and the Netherlands.

Three main approaches which help explain the rate-setting behavior of the banking sector: the bank concentration hypothesis, the consumer characteristic hypothesis, and the consumer reaction hypothesis[1]. The bank concentration hypothesis posits that oligopolistic banks raise lending rates quickly in reaction to favorable market forces but are much slower in raising deposit rates. The reverse is the case in declining markets as they react quickly to adjust downward the rates paid depositors and slower to reduce the rates charged borrowers (Neumark and Sharpe, 1992; Hannan and Berger, 1991). The consumer characteristic and consumer reaction hypotheses each posit that a greater proportion of unsophisticated consumers, coupled with higher search and switching costs, which provides bankers with heightened opportunities to adjust rates and widen the spread, thereby increasing the banks' advantage and producing incremental profits (Calem and Mester, 1995; Hutchison, 1995; Rosen, 2002).

Interestingly, the asymmetric adjustment in lending rates may be influenced by a further asymmetry. Banks may be reluctant to raise rates to the full extent allowed by a rising market because to do so could lead to an adverse selection pool of predominantly higher risk loans. Restraint in maximizing lending rates encourages a broader base of loans with an inherent lower detrimental risk pool (Stiglitz and Weiss, 1981).

2. The Turkish banking sector

As argued by Yildiran et al. (2011), decreasing confidence in financial sector, increasing demand for

foreign currency and resulting capital outflows led the IMF-supported exchange rate program of 1999 to collapse. Consequently, banks with high exchange rate risk were adversely affected, resulting in them being acquired by the Savings Deposit Insurance Fund of Turkey and by the mergers and acquisitions. Additionally, during the restructuring program of banking sector, which cost about 36 percent of GDP, the number of banks, branches and employees decreased as a result of mergers, acquisitions and license revocations in the industry until 2004.

As to the history of the Turkish banking sector, Gual (1999) observed that banks have been a target of heavy regulatory interventions for a long time. Moreover, Denizer et al. (2000, p. 4) posited that Turkey has undergone a number of major policy changes in bank regulation over the last 20 years. However, since the 1980s, the government has made a concerted effort to liberalize the banking market in order to increase competition and hence to improve the efficiency of the financial systems. The liberalization program either abolished or relaxed regulations, and the sector responded quickly to these developments. Increased competition forced banks to reduce their costs, which resulted in the closure of unprofitable branches and the reduction of staff. This eventually increased the profitability of the banking system. Denizer et al. (2000, p. 4) articulated that even after such improvements, the question of whether financial reforms improved efficiency remains to be answered.

Additionally, Denizer et al. (2000, p. 4) indicated that until the 1980s, economic policies in Turkey were inward looking, with extensive protection against foreign competition. During this period the share of state in banking, for example, reached to more than 50 percent. Because of entry restrictions prior to 1980, Turkish commercial banks enjoyed an oligopolistic environment and faced almost no competition. As a result these banks were highly profitable. Such profitability may have given overconfidence to commercial banks, which in turn might have prevented a careful analysis of bank performance and managerial ability of their executives. This lack of awareness would have caught these institutions off-guard after the liberalization program (Oral and Yolalan, 1990).

As a part of a structural adjustment program to switch to an outward-oriented growth strategy, the Turkish economy in general and financial system in particular have been significantly opened up and liberalized over the last two decades. The banking-related component of these reforms had two key elements: the elimination of control of interest rates and a significant reduction in directed credit programs, as well as the relaxation of entry barriers into the banking system in order to promote competition and to increase efficiency. There were also measures to develop equity and bond markets. In 1984, Turkish residents were al-

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[1] Scholnick (1999) provides the survey on these three types of explanations for commercial banks' interest rate asymmetries in the literature.

lowed to open foreign currency accounts in banks leading to increase product variety and services.

These were important changes considering the earlier constraints on financial markets. Interest rates had been controlled since the 1940s – a policy in keeping with the state-led development strategy based on import substitution. Rates had been changed five or six times until 1978. The interest rate control policies led banks already in the system to non-price competition through the opening of new branches. Directed credit programs absorbed almost 75 percent of loanable funds. Entry, especially after the early 1960s, was highly restrictive. This situation, coupled with the exit of a large number of banks during the 1960-80 period, resulted in a concentrated market dominated by large private and public banks with extensive branch networks. Among the 42 existing banks in 1980, only four were foreign. Accordingly, the bank-dominated financial sector was uncompetitive and inefficient prior to 1980 with a limited range of products (Denizer, 1997). Moreover, the government strictly controlled the capital account.

What has been remarkable about financial liberalization in Turkey has been the entry of new banks, both domestic and foreign. By 1990 there were 23 foreign banks in the system, meaning 19 new entries, which matches the number of new entries by the Turkish banks. With interest rate deregulation, which allowed banks to engage in price competition, the entry of new banks led to a significant decline in the traditional measures of concentration ratios, suggesting that competition in the sector has improved. These visible changes indicate that there have been major movements towards the free operation of financial

markets. Indeed, by 1998 the Turkish banking sector had minimal policy constraints on domestic and financial market consumer loan (Denizer, Gultekin, and Gultekin, 2000).

3. Data

One of the challenges in empirical studies of developing economies is the lack of desirable data. This study uses weighted averages of 1-month deposit rates and weighted average consumer loan (including personal, vehicle, and housing loans) rates over the period from December 2001 to January 2013. The sample period began after the severe Turkish currency crisis of 2001. The data was collected from the Central Bank of the Republic of Turkey. The weighted average consumer loan rates and weighted averages of 1-month deposit rates are denoted by LR_t and DR_t, respectively. These rates will be referred to as lending rates and deposit rates, respectively. The difference between the lending rate and the deposit rate is defined as the consumer loan premium and is denoted by CP_t.

Figure 1 displays the behavior of the respective lending rates, deposit rates and the consumer loan premium over the sample period. As Figure 1 suggests, the Turkish consumer lending rate and the 1-month deposit rate oscillated around a fairly steep downward trend during the restructuring program of banking sector from 1980 to 2004. The Turkish consumer loan premium was mostly positive over this period. Interestingly, the Turkish consumer lending rate and the 1-month deposit rate oscillated around a fairly moderate downward trend the consumer loan premium was almost always negative over the remainder of the sample period.
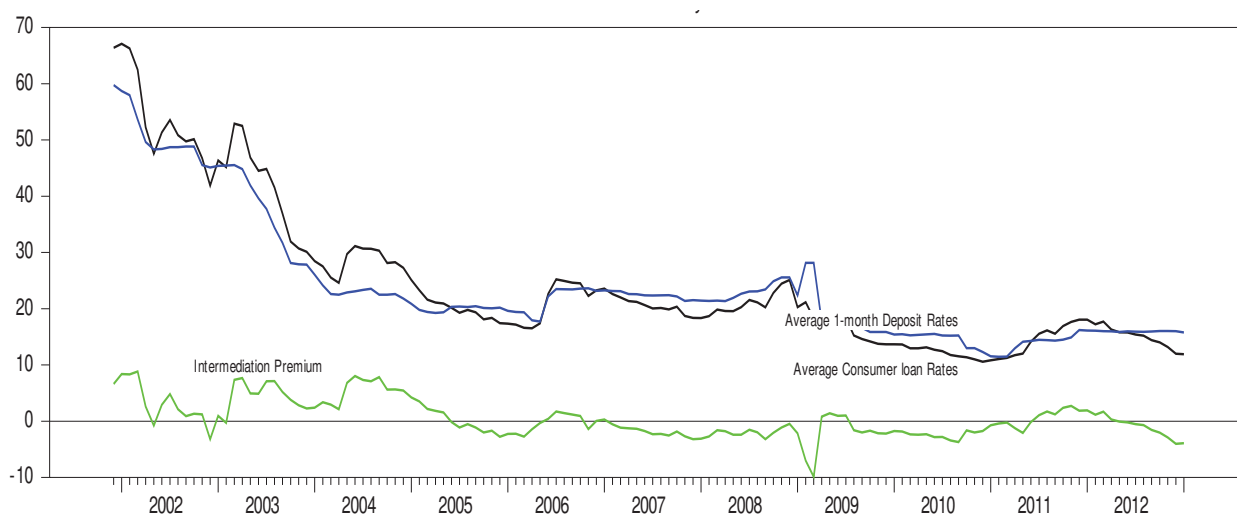

Fig. 1. Turkish consumer loan rate, deposit rate, consumer loan premium (December 2001 to January 2013)

The mean lending rate during the sample period was 24.42 percent, and ranged from 10.58 percent to

67.10 percent with a standard error of 13.16 percent. The mean deposit rate over the same period

was 23.98 percent, and ranged from 11.47 percent to 59.78 percent with a standard error of 11.18 percent. Their correlation was 97.41 percent which is fairly high. The mean consumer loan premium during the sample period was 0.45 percent, and ranged

from -9.87 percent to 8.84 percent with a standard error of 3.40 percent. Moreover, as suggested by Figure 1, it is likely that the Turkish consumer loan premium experienced a structural shift over the sample period.

$$CP_t = \mu + \theta DU + \alpha t + \gamma\, DT + \delta D\,(T_b) + \beta CP_{t-1} + \sum_{i=1}^{k} \psi_i \Delta CP_{t-i} + \upsilon_t, \tag{1}$$

where $DU = 1\ (t > T_b)$ is a post-break constant dummy variable; t is a linear time trend; $DT = 1\ (t > T_b)$ is a post-break slope dummy variable; $D\,(T_b) = 1(t = T_b + 1)$ is the break dummy variable; and ε_t are

white-noise error terms. The null hypothesis of a unit root is stated as $\beta = 1$. The break date, T_b is selected based on the minimum t-statistic for testing $\beta = 1$ (see Perron, 1997, pp. 358-359).

Table 1. Perron's endogenous unit root test, Turkish monthly data (December 2001 to January 2013)

$CP_t = 0.7242 - 1.2750\ DU + 0.0435\ t - 0.0429\ DT + 1.6791\ D\,(T_b) + 0.6023\ CP_{t-1} + \upsilon_t$		
(1.1177) (-1.4539) (1.6142 ***) (-1.5503) (-0.9650) (8.7563*)		
No. of augmented lags: $k = 1$	Break date: January 2005	$t\,(\alpha = 1) = -5.7817^{*}$

Note: Critical values for t-statistics are in parentheses. Critical values are based on $n = 100$ sample for the break-date (Perron, 1997). * and *** indicate significance at 1 and 10 percent levels, respectively.

4. Methodological issues and analytical framework

4.1. Structural break. To search endogenously for the possibility of any structural break in the Turkish consumer loan premium, this study utilized Perron's (1997) endogenous unit root test function with the intercept, slope, and the trend dummy to test the hypothesis that the Turkish consumer loan premium has a unit root.

The estimation results of Perron's endogenous unit root tests are summarized in Table 1. The post-break intercept dummy variable, DU, is negative and the post-break slope dummy variable, DT, is also negative and both are insignificant at any conventional level. The time trend is positive and marginal significant. The empirical results of these tests suggest that the Turkish consumer loan premium followed a stationary trend process with a break date of January 2005, as the consequence of the Turkish government's restructuring program of banking sector, which cost about 36% of GDP. As articulated by Yildiran et al. (2011, p. 3) the program caused the number of banks, branches and employees to decrease as a result of mergers, acquisitions and license revocations in the industry until 2004.

4.2. Nonlinear cointegration. Additionally, as posited by Breitung (2001, p. 331), economic theory suggests in many cases a nonlinear relationship between economic and financial time series. This implies that LR_t and DR_t, may be nonlinearly cointegrated. To discern this possibility, Breitung's nonparametric procedure is applied to test for their nonlinear cointegration.

Breitung's nonparametric testing procedure consists of the cointegration test, known as the rank test for

cointegration, and the nonlinearity test, referred to as the score statistic for a rank test of neglected nonlinear cointegration. Following Breitung (2001), this study defines a ranked series as $R_T\,(LR_t)$, [of LR_t among $LR_1, \dots\ LR_T$] and $R_T\,(DR_t)$, accordingly. Breitung's two-sided rank test statistic, testing for cointegration, denoted by Ξ_T^{*}, is calculated as follows:

$$\Xi_T^{*} = T^{-3} \sum_{i=1}^{T} (r_i^R)^2 / (\sigma_{\Delta r}^2), \tag{2}$$

where T is the sample size, r_i^R is the least squares residual from a regression of $R_T\,(LR_t)$ on $R_T\,(DR_t)$. As pointed out by Haug and Basher (2011, p. 187), $\sigma_{\Delta r}^2$ is the variance of Δr_i^R, which is included to adjust for the potential correlation between the two time series LR_t and DR_t. The critical values for this rank test are given in Table 1 in Breitung (2001, p. 334).

Given the positive result of the rank test, the first step in calculating Breitung's score statistic for a rank test of neglected nonlinear cointegration (testing for nonlinearity) is to regress the Turkish consumer loan rate, LR_t, on a constant, the deposit rate, DR_t, the ranked series of the deposit rate, $R_T\,(DR_t)$, and the disturbance ζ_t.

$$LR_t = \delta_0 + \delta_1 DR_t + R_t^{*}\,(DR_t) + \zeta_t, \tag{3}$$

where $\delta_0 + \delta_1\,DR_t$ is the linear part. Under the null hypothesis, $R_t^{*}(DR_t) = 0$ implying that LR_t and DR_t are linearly cointegrated. Under the alternate hypothesis, $R_t^{*}(DR_t) \neq 0$ implying that LR_t and DR_t are nonlinearly cointegrated. The score test statistic is given by $T R^2$, where R^2 is the coefficient of determination of the least squares regression of ζ_t, under the null hypothesis, on a constant, the ranked series of the deposit rate, $R_T\,(DR_t)$, and a disturbance term. T is again the sample size. As articulated by Breitung (2001, p. 337), under the null hypothesis of

linear cointegration, the score statistic for a rank test of neglected nonlinear cointegration is asymptoti- cally Chi-square distributed with one degree of freedom.

Table 2. Unit root and tests of asymmetry, Turkish monthly data (December 2001 to January 2013)

ρ_1	ρ_2	τ	$H_0: \rho_1 = \rho_2 = 0$	$H_0: \rho_1 = \rho_2$	aic	sic
-0.2326*	-1.1417*	1.6830	$\Phi_\mu = 22.6790$*	$F = 21.1812$*	0.9634	1.0726
$Q_{LB(12)} = 11.2490$ [0.5077]		ln L = -245.8822		$F_{(4,127)} = 13.8859$		D.W. = 1.9553

Notes: The null hypothesis of a unit root, $H_0: \rho_1 = \rho_2 = 0$, uses the critical values from Enders and Siklos (2001, p. 170, Table 1 for four lagged changes and $n = 100$). * Indicates 1 percent level of significance. The null hypothesis of symmetry, $H_0: \rho_1 = \rho_2$, uses the standard F distribution τ is the threshold value determined via the Chan (1993) method. $Q_{LB(12)}$ denotes the Ljung-Box Q-statistic with 12 lags.

5. Threshold autoregressive (TAR) model

If the results of Breitung's nonparametric tests are positive, this study follows Thompson (2006) to regress the spread, CP_t, on a constant, a linear trend and an intercept dummy (with values of zero prior to January 2005 and values of one for January 2005 and thereafter) to formally examine the Turkish lending, deposit rates and their consumer loan premium (the estimation results are reported in Appendix). The saved residuals from the above estimated model, denoted by $\hat{\varepsilon}_t$, are then used to estimate the following TAR model:

$$\Delta\hat{\varepsilon}_t = I_t\rho_1\hat{\varepsilon}_{t-1} + (1-I_t)\rho_2\hat{\varepsilon}_{t-1} + \sum_{i=1}^{p}\alpha_i\Delta\hat{\varepsilon}_{t-p} + \hat{u}_t, \quad (4)$$

where, $\hat{u}_t \sim i.i.\ d\ (0, \sigma^2)$ and the lagged values of $\Delta\hat{\varepsilon}_t$ are meant to yield uncorrelated residuals. As defined by Enders and Granger (1998), the Heaviside indicator function for the TAR specification is given as:

$$I_t = \begin{cases} 1 & \text{if } \hat{\varepsilon}_{t-1} \geq \tau \\ 0 & \text{if } \hat{\varepsilon}_{t-1} < \tau \end{cases}. \quad (5)$$

The threshold autoregressive (TAR) model allows the degree of autoregressive decay to depend on the state of the consumer loan premium, i.e. the "deepness" of cycles. The estimated TAR model empirically reveals if the consumer loan premium tends to revert back to the long run position faster when the premium is above or below the threshold. Therefore, the TAR model indicates whether troughs or peaks persist more when shocks or countercyclical monetary policy actions push the consumer loan premium out of its long-run equilibrium path. In this model's specification, the null hypothesis that the consumer loan premium contains a unit root can be expressed as, $\rho_1 = \rho_2 = 0$ while the hypothesis that the premium is stationary with symmetric adjustments can be stated as $\rho_1 = \rho_2$.

6. Results of the cointegration test with asymmetric adjustment

Empirical calculations indicate that Breitung's nonparametric rank tests and score test are 0.000035, which fails to reject the null hypothesis of cointe-

gration, and 0.724096 which fails to reject the null hypothesis of linear cointegration, respectively. These test results reveal that the Turkish consumer loan and deposit rates are linearly cointegrated at all conventional levels of significance. Additionally, the estimation results of the TAR model are summarized in Table 2.

An analysis of the overall estimation results indicates that the estimation results are devoid of serial correlation and have good predicting power as evidenced by the Ljung-Box statistics and the overall F-statistic, respectively. The calculated statistic Φ_μ = 22.6790 indicates that the null hypothesis of no co-integration, $\rho_1 = \rho_2 = 0$, should be rejected at the 1 percent significant level, confirming that the Turkish consumer loan premium is stationary[1].

The estimation results further reveal that both ρ_1 and ρ_2 are statistically significant at 1 percent level. In fact, the point estimates suggest that the Turkish consumer loan premium tends to decay at the rate of $|\rho_1|$ = 0.2326, for $\hat{\varepsilon}_{t-1}$ above the threshold, τ = -1.6830, and at the rate of $|\rho_2|$ = 1.1417 for $\hat{\varepsilon}_{t-1}$ below the threshold. Additionally, the empirical results also reveal that, based on the partial $F = 21.1822$, the null hypothesis of symmetry, $\rho_1 = \rho_2$, should be rejected at any conventional significant level, indicating statistically that adjustments around the threshold value of the Turkish consumer loan premium are asymmetric.

More specifically, given the finding of $|\rho_2| > |\rho_1|$, the adjustment of the Turkish consumer loan premium toward the long-run equilibrium tends to persist more when the premium is widening than when it is narrowing. These findings reveal that Turkish lending institutions adjust their lending rates differently to rising versus declining deposit rates. These findings can also be interpreted to show that these institutions react differently to expansionary monetary policy than to contractionary. Given $|\rho_2| > |\rho_1|$, the adjustment toward the long run

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[1] As shown by Petrucelli and Woolford (1984), the necessary and sufficient condition for the basis to be stationary is: $\rho_1 < 0$, $\rho_2 < 0$ and $(1+\rho_1)(1+\rho_2) < 1$.

equilibrium tends to persist more when the Turkish consumer loan premium is widening than when the spread is narrowing. This result parallels those reported by Thompson (2006) for the U.S. and supports the hypothesis that banks adjust their lending rates differently to rising versus declining market rates. Therefore, the finding of $|\rho_2| > |\rho_1|$ seems to suggest the predatory pricing behavior of the Turkish lending institutions which is consistent with the market concentration and consumer characteristic hypotheses, as well as the observed monopolistic/oligopolistic nature of the Turkish banking sector.

7. Results of the asymmetric error-correction model

Given the results of the above asymmetric cointegration tests, an Asymmetric Threshold Autoregressive Vector Error-Correction (TAR-VEC) model is estimated to further investigate the asymmetric short-run dynamics with respect to the Turkish consumer loan (LR_t) and deposit (DR_t) rates. The estimation results of this model can be used to study the nature of the Granger causality between the Turkish consumer loan and deposit rates. The empirically determined nature of the Granger causality will help to evaluate empirically whether and how the Turkish consumer loan and the deposit rates respond to changes in consumer loan premium, induced by external economic shocks or countercyclical policy measures. Additionally the following TAR-VEC model differs from the conventional error-correction models by allowing asymmetric adjustments toward the long-run equilibrium.

$$\Delta LR_t = \alpha_0 + \rho_1 I_t \hat{\varepsilon}_{t-1} + \rho_2 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{11}(L) \Delta LR_{t-i} + A_{12}(L) \Delta DR_{t-i} + u_{1t}, \tag{6}$$

$$\Delta DR_t = \tilde{\alpha}_0 + \tilde{\rho}_1 I_t \hat{\varepsilon}_{t-1} + \tilde{\rho}_2 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{21}(L) \Delta LR_{t-i} + A_{22}(L) \Delta DR_{t-i} + u_{2t}, \tag{7}$$

where $u_{1,2t} \sim i.i.d\ (0,\ \sigma^2)$ and the Heaviside indicator function is set in accord with (5). This model specification recognizes the fact that the Turkish consumer loan and deposit rates may respond differently, depending on whether the consumer loan premium is widening or narrowing (i.e., expansionary or contractionary monetary policy or economic shock).

Table 3 summarized the estimation results for the TAR-VEC model specified by equations (5), (6), and (7), using the Turkish consumer loan and deposit rates. In reporting the estimation results, $A_{ij}(L)$ represents the first-order polynomials in the lag operator L. The F_{ij} represents the calculated F-statistic with the p-value in squared brackets, testing the null hypothesis that allcoefficients of A_{ij} are equal to zero. The t-statistics are reported with "*" and "***" indicating the 1 percent and 10 percent significance levels, respectively. $Q_{(12)}$ is the Ljung-Box statistic and its significance is in squared brackets, testing for the first twelve of the residual autocorrelations to be jointly equal to zero. ln L is the log likelihood. The overall, F-statistics with "*", indicates the significant level of 1 percent.

An analysis of the overall empirical results indicates that the estimated equations (6) and (7) are absent of serial correlation and have good predicting power as evidenced by the Ljung-Box statistics and the overall F-statistic, respectively. As to the long-run adjustment, the estimation results of equation (6) of the TAR-VEC model reveal that ρ_2 is statistically significant at 10 percent level, while ρ_1 is significant at 1 percent level. This finding indicates that when introducing the short-run dynamic adjustment to the model, the Turkish consumer loan rates respond to the narrowing and the widening of the consumer loan premium. This empirical result suggests that in setting their lending rates, Turkish lending institutions respond to contractionary and expansionary monetary policy in the long-run. With regard to the long-term adjustment of the 1-month deposit rates, the estimation results of equation (7) show that both $\tilde{\rho}_1$ and $\tilde{\rho}_2$ are significant at 1 percent and 10 percent levels, respectively. These findings suggest that in setting deposit rates, Turkish lending institutions respond not only to the narrowing but also to the widening of the consumer loan premium. This finding suggests that Turkish lending institutions respond to contractionary and expansionary monetary policy in setting their deposit rates in the long run.

Table 3. Turkish lending and deposit rates, monthly data (December 2001 to January 2013)

$\Delta LR_t= 0.0968.$-.$0.2258\ I_t\ \hat{\varepsilon}_{t-1}\ + 0.2238\ (1 - I_t)\ \hat{\varepsilon}_{t-1} + A_{11}(L) \Delta LR_{t-i} + A_{12}(L) \Delta DR_{t-i} + u_{1t}$		
(-0.5777) (-2.3071*) (-1.7448***) F_{11}= 5.5401 [0.005] F_{21}= 0.3689 [0.6923]		
$Q_{(12)}$ = 14.8320 [0.2507]	ln L = -217.9712	$F_{(6,112)}$-statistic = 3.9085*
$\Delta DR_t= 0.0327.$-.$0.1552\ I_t\ \hat{\varepsilon}_{t-1}\ +0.22885\ (1 - I_t)\ \hat{\varepsilon}_{t-1} + A_{21}(L) \Delta LR_{t-i} + A_{21}(L) \Delta DR_{t-i} + u_{2t}$		
(0.0326) (-1.9118***) (3.1914*) F_{21} = 2.0634 [0.1086] F_{22}= 4.7356 [0.0105]		
$Q_{(12)}$ = 7.3870 [0.8310]	ln L = -216.1432	$F_{(7,122)}$- statistic = 5.3358*

Note: * and *** indicate 1 percent and 10 percent levels of significance, respectively.

In addition to estimating the long-run equilibrium relationship and asymmetric adjustment, the estimated TAR-VEC model also allows for determinations of the Granger causality between the Turkish consumer loan rates and deposit rates. The partial F-statistic in equation (6) reveals that the consumer loan rate responds only to its own lagged changes but not the lagged changes in the deposit rates. Additionally, the estimation results also indicate that the Turkish deposit rate responds to its own lagged changes but not the lagged changes of the consumer loan rates. These findings suggest that the Turkish consumer loan rate and the 1-month deposit rate are independent in the short run. Economically, this exogeneity indicates that the Turkish countercyclical monetary policy does not matter in consumer loan market in the short run over the sample period, despite the concerted effort from the central bank to improve the banking sector.

Concluding remark and policy implications

This study estimated the threshold autoregressive (TAR) model developed by Enders and Siklos (2001) to investigate the behavior the Turkish consumer loan rate, 1-month deposit rate and the consumer loan premium.

First, following Perron's (1997) procedure, an endogenous unit root test function with the intercept, slope, and trend were specified and estimated to test the hypothesis that the Turkish consumer loan premium has a unit root. The empirical results of these tests suggest that the Turkish consumer loan premium followed a stationary trend process with a break date of January 2005, as the consequence of the Turkish government's restructuring program of banking sector, which cost about 36% of GDP. As

articulated by Yildiran et al. (2011, p. 3) the program caused the number of banks, branches and employees to decrease as a result of mergers, acquisitions and license revocations in the industry until 2004. Additionally, that Breitung's nonparametric rank test and score test indicate that the Turkish consumer loan and 1-month deposit rates are linearly cointegrated.

Second, the finding of $|\rho_2| > |\rho_1|$ indicates that the adjustments of the Turkish consumer loan premium *toward* the long-run equilibrium are asymmetric and tend to rise faster when countercyclical monetary policy or shocks which cause deposit rate to increase and fall slower when the deposit is declining. These findings can also be interpreted to demonstrate that banks react more slowly to expansionary than to contractionary monetary policy. The finding of $|\rho_2| > |\rho_1|$ seems to support the articulation by the consumer characteristic and market concentration hypotheses which underlie commercial bank interest rate asymmetries. This finding also reveals the predatory pricing behavior of Turkish financial institutions operating in a very concentrated market.

Finally, the empirical estimation of the TAR-VEC model reveals no Granger-causality between the Turkish consumer rates and the 1-month deposit rates in the short run. The finding of no Granger causality is important since it reveals that Turkish commercial banks do not respond to countercyclical monetary policy by changing the 1-month deposit rates even though the monetary policy makers try to utilize the policy to influence the financial market conditions. This finding is surprising given the Turkish banking reforms initiated to increase the level of competition in the banking sector.

References

1. Breitung, J. (2001). "Rank Tests for Nonlinear Cointegration", *Journal of Business and Economic Statistics*, 19, pp. 331-340.
2. Caprio, G., Klingebiel, D. (2003). *Episodes of Systemic and Borderline Financial Crises*, World Bank, Mimeo.
3. Chan, K.S. (1993). "Consistency and Limiting Distribution of the Least Squares Estimator of a Threshold Autoregressive Model", *Annals of Statistics*, 21 (1), pp. 520-533.
4. Chang, H.L. and Su, C.W. (2010). "The Lending-Deposit Rate Relationship in Eastern European Countries: Evidence from the Rank Test for Nonlinear Cointegration", *Czech Journal of Economics and Finance*, 60 (6), pp. 534-544.
5. Denizer, C. (1997). The effects of financial liberalization and new bank entry on market structure and competition in Turkey, Policy Research, Working paper, WPS 1839.
6. Denizer, C., Gultekin, B. and Gultekin, M. (2000). Distorted Incentives and Financial Structure in Turkey, paper presented at the Financial Structure and Economic Development Conference, in February 10-11, 2000 at the World Bank, Washington, D.C.
7. Denizer, C.A., Dinc, M. and Tarimcilar, M. (2000). Measuring Banking Efficiency in the Pre- and Post-Liberalization Environment: Evidence from the Turkish Banking System, November, 2000. World Bank Policy Research Working Paper No. 2476. Available at SSRN: http://ssrn.com/abstract=632546.
8. Dueker, M.J. (2000). "Are Prime Rate Changes Asymmetric?" Federal Reserve Bank of St. Louis Economic Review, September/October, pp. 33-40.
9. Enders, W. and Granger, C.W.J. (1998). "Unit Root Tests and Asymmetric Adjustment with an Example Using the Term Structure of Interest Rates", *Journal of Business and Economic Statistics*, 16 (3), pp. 304-311.
10. Enders, W. and Siklos, P. (2001). "Co-integration and Threshold Adjustment", *Journal of Business & Economic Statistics*, 19 (2), pp. 166-176.

11. Engle, R.F. and Granger, C.W.J. (1987). "Co-integration and Error Correction: Representation, Estimation and Testing", *Econometrica*, 55, pp. 251-276.
12. Frost, D. and Bowden, R. (1999). "An Asymmetry Generator for Error-Correction Mechanisms, with Application to Bank Mortgage-Rate Dynamics", *Journal of Business & Economic Statistics*, 17 (2), pp. 253- 263.
13. Gual, J. (1999). Deregulation, Integration and Market Structure in European Banking, *Journal of Japanese and International Economies*, 13, pp. 372-396.
14. Hannan, T.H. and Berger, A.N. (1991). "The Rigidity of Prices: Evidence from the Banking Industry", *American Economic Review*, 81 (4), pp. 938-945.
15. Haug, A.A. and Basher, S.E. (2011). "Linear or nonlinear Cointegration in the Purchasing Power Parity Relationship?" *Applied Economics*, 43, pp. 185-196.
16. Hofmann, B. and Mizen, P. (2004). "Interest Rate Pass-Through and Monetary Transmission: Evidence from Individual Financial Institutions' Retail Rates", *Economica*, 71, pp. 99-123.
17. Hutchison, D.E. (1995). "Retail Bank Deposit Pricing: An Intertemporal Asset Pricing Approach", *Journal of Money*, *Credit*, *and Banking*, 27, pp. 217-231.
18. Neumark, D. and Sharpe, S. (1992). "Market Structure and the Nature of Price Rigidity: Evidence from the Market for Consumer Deposits", *Quarterly Journal of Economics*, 107 (2), pp. 657- 680.
19. Nguyen, C.V. and Islam, A.M. (2010). "Asymmetries in the Thai Lending-Deposit Rate Spread: An Econometric Analysis", *Applied Economic Letters*, 17 (13), pp. 1229-1236.
20. Nguyen, C.V., Islam, A.M. and Ali, M.M. (2010). "Bangladeshi Lending-Deposit Rate Spread: An Econometric Analysis", *Global Economy and Finance Journal*, 3 (2), pp. 238-246.
21. Nguyen, C.V., Pointer, L., and Smith, C. (2008). "The Asymmetric Behavior of the Mexican Banking Interest Rate Margin", *Journal of Business and Economics Perspectives*, 34 (2), Fall/Winter, pp. 57-67.
22. Oral M. and Yolalan, R. (1990). An Empirical Study on Measuring Operating Efficiency and Profitability of Bank Branches, *European Journal of Operation Research*, 46 (3), pp. 282-294.
23. Perron, P. (1997). "Further Evidence on Breaking Trend Functions in Macroeconomic Variables", *Journal of Econometrics*, 80 (2), pp. 355-385.
24. Petrucelli, J. and Woolford, S. (1984). "A Threshold AR (1) Model", *Journal of Applied Probability*, 21, pp. 270-286.
25. Rosen, R.J. (2002). "What Goes Up Must Come Down? Asymmetries and Persistence in Bank Deposit Rates", *Journal of Financial Services Research*, 21 (3), pp. 173-193.
26. Sarno, L. and Thornton, D.L. (2003). "The Dynamic Relationship Between the Federal Funds Rate and the Treasury Bill Rate: An Empirical Investigation, *Journal of Banking and Finance*, 27, pp. 1079-1110.
27. Sellon, G.H. (2002). "The Changing U.S. Financial System: Some Implications for the Monetary Transmission Mechanism", *Federal Reserve Bank of Kansas City Economic Review*, First Quarter, pp. 5-35.
28. Scholnick, B. (1999). "Interest Rate Asymmetries in Long-Term Loan and Deposit Markets", *Journal of Financial Services Research*, 16, pp. 5-26.
29. Stiglitz, J.E. and Weiss, A. (1981). "Credit Rationing in Markets with Imperfect Information", *American Economic Review*, 71 (3), pp. 393-410.
30. Thompson, M.A. (2006). "Asymmetric Adjustment in the Prime Lending-Deposit Rate Spread", *Review of Financial Economics*, 15 (4), pp. 323-329.
31. Tkacz, G. (2001). "Endogenous Thresholds and Tests of Asymmetry in U.S. Prime Rate Movements", *Economics Letters*, 73, pp. 207-211.
32. Yildiran, L., Akin, G.G., Aysan, A.F. and İleri, S. (2011). "Demand, Competition and Welfare Analysis in the Turkish Banking Sector (September 16, 2011)". Available at SSRN: http://ssrn.com/abstract=1928631 or http://dx.doi.org/10.2139/ssrn.1928631.

Appendix

Table 4. Estimation results, Turkish monthly data (December 2001 to January 2013)

$CP_t = 4.3976 - 5.5146 \; Dummy_t + \varepsilon_t$		
(11.7187*) (-12.4382*)		
ln L = -301.5126, R^2 = 0.5361	*DW* statistic[a] = 0.6573	$F_{(1,132)}$ = 154.7092*

Notes: * Indicates significance at 1 percent level. [a] As articulated by Enders and Siklos (2001, p. 166), in this type of model specification, ε_t may be contemporaneously correlated.