Research and Monetary Policy Department
Working Paper No:07/05

Interest Rate Pass-Through in Turkey

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June 2007

The Central Bank of the Republic of Turkey

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Abstract

We examine the speed and rate of adjustment of lending rates to monetary policy rate for corporate, housing, cash and automobile loans using bank-level micro data. We show that empirical results on unit root, co-integration tests and the estimation of co-integrating vector improve when we allow cross-sectional dependence. We find evidence in favor of central bank control over credit market via short-term interest rates, which is more apparent in the post-credit boom period. Estimation results reveal that while corporate loans are not sensitive to changes in the policy rate, cash and automobile loan rates are responsive to the policy rate. Housing loans, on the other hand, display excessive sensitivity to the policy rate.

* I am grateful to the Banking and Financial Institutions Department for providing data, especially Çiğdem Koğar for assistance. This paper has benefited from comments by Pınar Özlü and Hakan Kara. The views expressed in this paper do not necessarily represent those of the Central Bank of the Republic of Turkey.

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1. Introduction

Inflation targeting has become the main policy objective for most of the central banks in the last decade and the interest rate transmission has attracted much more attention than ever before. Understanding of interest rate channel is crucial to uncover monetary policy transmission mechanism. The study deals with the interest rate pass through, which is defined as the degree and the speed of adjustment of retail bank rates to monetary policy interest rate. The long run co-movement between monetary policy rate and retail bank lending rates is the basis for the analysis.

Interest rate pass through can be examined in two parts as short term and long-term pass through. While high long-term pass through, which is expected to be close to one theoretically, implies more effective interest rate channel, it may also reflect the degree of competition among banks in credit market. Moreover, the speed of changes of lending rates may indicate market players' perception about monetary policy actions whether they are permanent or whether the market anticipates those policy decisions. Thus, interest rate pass-through is important not only for monetary policy, but also for financial system soundness as it includes serious implications for both central bankers and financial supervisors.

The empirical evidence demonstrates that it is uncommon to find complete pass through in bank products in the short run. In fact, in most cases adjustment is not complete even in the long run. Most studies on different countries have found sluggish and incomplete adjustment of lending rates to money market rates. In line with empirical findings indicating incomplete pass through, theoretical explanations have been proposed to explain the incompleteness in retail bank rates, as well. These theoretical explanations, to some extent, explain the interest rate stickiness and incompleteness. This study, however, shows that stickiness and incompleteness vary across loan types. In contrast to the previous studies, we show that when cross-sectional information in the panel dataset is utilized and loan types are differentiated, empirical findings confirm the assertion that bank retail lending rates accommodate to the monetary policy rate. Particularly, our study indicates that loans to corporations and households (housing, cash and automobile) differ in adjustment such that household loan rates are more sensitive to changes in policy rates.

The aim of the study is to shed light on the credit channel via banking sector in Turkey by questioning the interest rate effectiveness of monetary policy via micro data. Using bank level data on interest rates of cash, automobile and housing loans extended to households and corporations, we analyze the transmission of money market interest rates to individual retail bank rates, where money market rate is taken as a proxy of monetary policy rates[1]. Additionally, use of bank specific micro data allows us to reveal the sources of heterogeneity in price setting behavior of banks in different types of loans. From methodological point of view, our study investigates more complicated cointegration relationships in panel data than previous studies in the literature by allowing cross-sectional dependence among banks.

The plan of the rest of the paper is as follows. In section 2, we briefly review the literature. In section 3, we describe our data and the evolution of credit market in Turkish banking sector after 2001 crisis. Section 4 explains the theoretical background of the determination of lending rates. The model is given in section 5. Section 6 presents econometric methodology. Estimation results are given in section 7. Section 8 concludes.

2. Literature Survey

Studies on interest rate pass-through differ according to whether they examine individual or cross-country behavior. While some of the studies in the literature focus on individual countries, others try to understand cross-country differences in interest rate transmission relating possible variations to institutional framework or structural breaks. All studies have an explicit aim, discovering the degree and speed of adjustment of bank rates to changes in money market rates. Most studies cover deposit rates, mortgage rates or bill rates in addition to retail lending rates.

Regarding the cross-country studies, BIS (1994), Borio & Fritz (1994), Cottarelli & Kourelis (1995), Lowe (1994), Mozzami (1999), Mojon (2002), Kleimer and Sander (2000), Donnay and Degryse (2001), Toolsema et al. (2001), Espinosa-Vega and Rebucci (2003), and Bondt (2002) all find out that the dynamics of retail rate adjustment to market interest rate changes are incomplete (i.e. changes in the

[1] Money market rate is used instead of monetary policy rate in all estimations to increase variation in the data, where the former is the weighted average of the latter for all banks studied.

market rates are not reflected to lending rates completely). Second, the degree and speed of pass through are different across particular retail rates. Lastly, there are significant differences across countries, which can be attributed to macroeconomic or other country specific factors (financial structure, banking competition, etc.). For single country cases, Cottarelli et al. (1995) for Italy, Moazzami (1999) for Canada and United States, Winker (1999) for Germany, Manzano and Galmes (1996) for Spain, and Bredin et al (2001) for Ireland are some examples that focus on a particular country and investigate banking system response to monetary policy actions by making use of cointegration methods.

Most of the studies in the literature base their analysis upon the assumption that once the target for policy rate is changed, this will be reflected in the changes in deposit rates, short-term market rates, bill rates and retail banking rates sooner or later. Therefore, there is long run equilibrium among these variables. In other words, these rates and monetary policy rate are cointegrated. Thus, assessing the degree and speed of adjustment of bank lending rates necessitates the use of an empirical methodology examining both short and long run relationship between these variables. In time series context, this is usually carried out with conventional techniques, such as Engle-Granger two-step procedure, Johansen multivariate cointegration methodology or Autoregressive Distributed Lag (ARDL) model of Hendry (1995). Re-parameterization of these approaches as an error-correction mechanism allows one to estimate both short and long run parameters of pass through. As a recent one, Bondt (2002) estimates an aggregate autoregressive distributed lag specification, which is re-parameterized as an error-correction model for the euro area as a whole. In the analysis, he uses deposit and lending rates of different maturities with government bond yields of similar maturities. He finds that pass-through is incomplete for both lending and deposit rates, reaching only 50 percent within a month, but that complete in the end for most of the lending rates.

It is worth mentioning that use of micro data with panel method is very limited in the literature. De Graeve et al. (2004), Sorensen and Werner (2006) and Horvat et al. (2004) are the only current studies. De Graeve et al., for example, analyze the pass through of market conditions to retail bank interest rates in Belgium with a panel of bank deposit and loan rates. They measure the extent of pass-through for each product using panel cointegration approach constructed in Pedroni (1995, 1997) and find out incomplete pass through both for loans and deposit rates.

This paper differs from afore-mentioned studies in several aspects. To the best of author's knowledge, this is the first attempt studying interest rate pass through under the assumptions of cross-sectional dependence and independence separately. This distinction makes it clear that completeness becomes more apparent in certain loan rates if they are allowed to be cross-correlated. Second, the dataset includes individual bank rates from a rapidly developing loan market. Thus the study shows the effect of functioning and growing of loan market to interest rate pass through.

Lastly, a few words need to be mentioned regarding non-stationarity in panel data, which has become a fertile area of both theoretical and applied research recently. Progress in the availability of large panels and combination of information from time series with that of cross-section let econometricians propose several unit root and cointegration tests in panel data. However, until recently, all of these tests suffered from cross-sectional independence assumption. Banerjee et al. (2004) point out that violation of this assumption creates large size distortions in standard panel unit root and cointegration tests. Moreover, this assumption is highly unrealistic in most of the macroeconomic series, where there may exist common driving factors (Stock and Watson, 2002).

Like most of the macroeconomic series, the lending rate series of individual banks are expected to be correlated with each other, a priori. Banks are influenced by several common factors like competition and macroeconomic outlook, thus ignoring cross-correlation may give inaccurate conclusions in pass through studies. As a remedy, we allow for cross-sectional dependence among banks in testing and estimation steps and compare the results with early panel methods.

3. Dataset and Stylized Facts

The data consists of loan rates for individual banks operating in Turkish banking system. Loan types can be classified as corporate, housing, cash and automobile loans. The data set includes all banking groups such as public, private, foreign, investment and development banks. The use of such a dataset, however, precludes using the same cross-sectional observations across each product. Since some bank groups are specialized in certain loan categories, the number of banks for each loan type differs. For example, investment and development banks extend loans only to corporations. Moreover, unavailability of loan rates because of mergers, acquisitions or bailouts is another shortcoming of the dataset. To make panel balanced, we exclude those banks from the analysis. Thus, we have bank level, monthly, balanced panel data covering the period June 2001-September 2005 with cross-sectional dimension 25 for corporate, 18 for housing, 16 for cash and 21 for automobile loans.

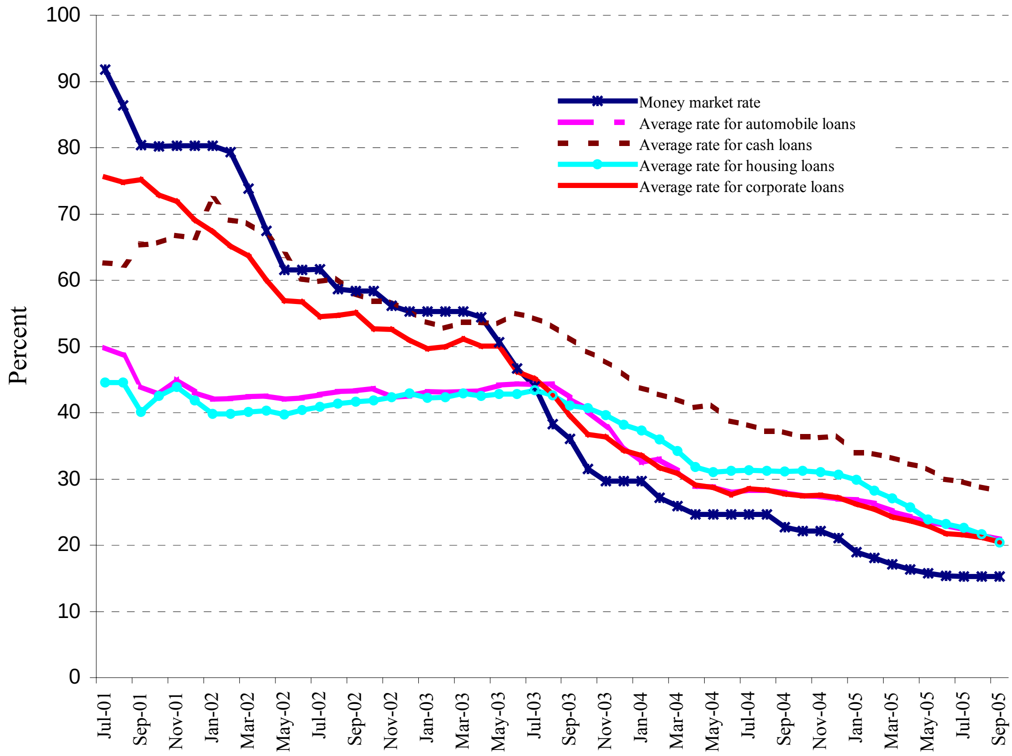
It is a fact that banks are the most important sources of funds for lending in emerging markets. Especially, in bank-based economies such as Turkey, firms and households are wholly dependent on banks' lending facilities for financing their investment and expenditures. However, high debt level, inflation and macroeconomic instability prevented banks from credit supply. First, high debt levels together with high real interest rates changed the portfolio preferences of banks and induced them buying more bonds. Second, since the realization of profit was hard and more risk was attributed to borrowers in high inflation environment, banks stayed liquid by holding bonds. Hence, banks preferred holding government bonds instead of lending and credit base remained low for decades. Moreover, after 2001 financial crisis significant portion of banks became bankrupt. The crisis exacerbated credit conditions and credit base has become even lower.

Nevertheless, due to sound macroeconomic policies in the post-crisis era, credit channel has started to work properly. In the post-crisis period, the aim is to run high primary surplus via tight fiscal policy. Turkey has fulfilled its mission as required by IMF stand-by agreements. So both government-borrowing requirement and interest rates declined significantly. In addition to these developments, E.U. talks further improved the conditions for credit availability by affecting expectations positively.

To explore the effect of monetary policy or money market rate on various lending rates by making use of panel techniques, aggregated figures over crosssections may carry significant information about monetary policy stance, banking profitability and effectiveness of credit channel. Figure 1 shows interest rates movements for the post-crisis period. After the second half of 2003, average credit rates are above the money market rate. This can be a breaking point because it coincides with the beginning of rapid credit expansion and can be interpreted as functioning of loan market. Figure 2 makes this observation more obvious such that it displays credit-to-GNP ratio and the spread between lending rates and the money market rate. Accordingly, when money market rates fall below average credit rate, banks extend loans to private sector. That is to say, credit expansion is launched just after the spread between credit rates and money market rate becomes positive.

Figure 1

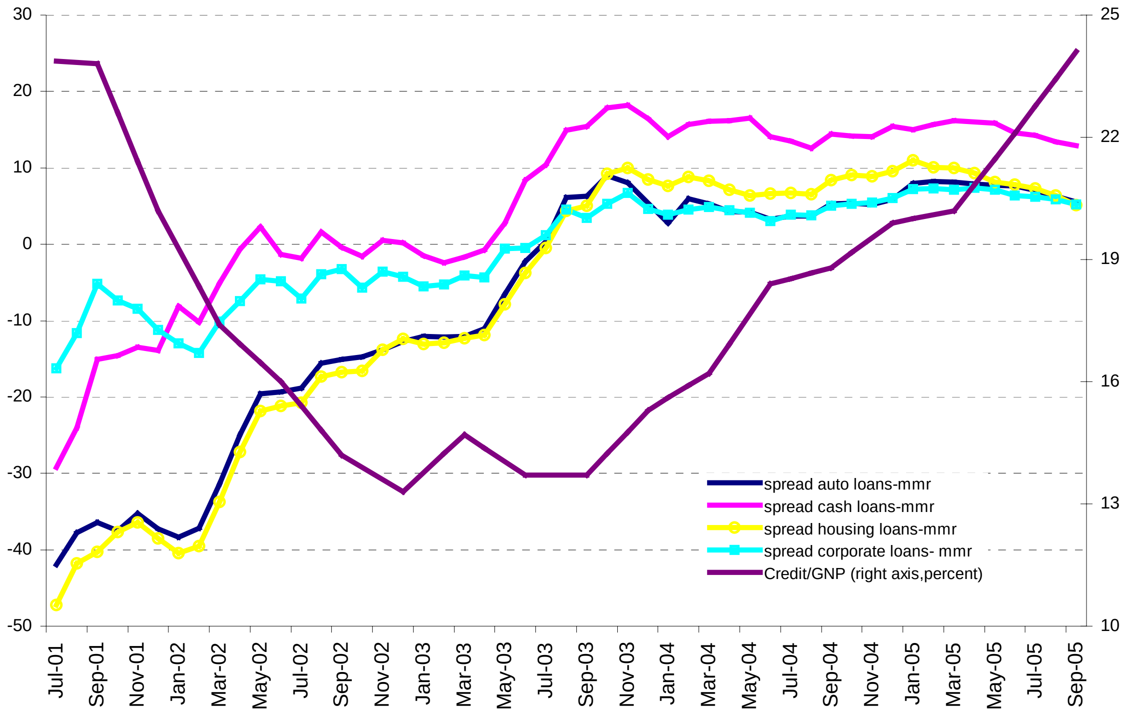
Money Market Rate and Loan Rates



Several explanations can be asserted to interpret the observed coincidence. The gap between money market rate and lending rates may arise since money market rates decrease more rapidly than banks had expected. In this case, rapid credit growth can be attributed to expansionary monetary policy. Conversely, the coincidence may stem from a structural change in the banking system. In this respect, the observation may be conceived as the usual result of starting credit supply. Since banks decide to offer credit to households and corporations, they may keep lending rate above money market rate (mmr) so as to make profit from credit supply. Otherwise, loan market would not be a profitable area for banks. Whether the structural change has any effect on lending rate pass through is analyzed by splitting dataset into two parts via econometric practices in section 5.

Figure 2

Spread and Credit Volume



4. Model of Interest Rate Adjustment

Banks, as financial intermediaries, have a special role in economy collecting funds from depositors or international lenders and channeling them to households and corporations. A bank operates to maximize its expected profit from these financial transactions. Under perfect competition and complete information, equilibrium condition suggests that marginal cost of acquiring additional funds is equal to the price of bank product, the retail-lending rate[2]. In addition, derivative of prices with respect to marginal cost equals one. In this setup, banks set their prices according to

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[2] Pricing behavior of banks can also be examined by focusing on market microstructure. This type of studies assumes that market forces determine lending rate according to the given structure of the market. Although oligopolistic or monopolistic form of credit market has serious implications on pricing behavior, since money market rate is set by central bank, incorporating market structure does not add further information to our approach. Moreover, this paper mainly investigates leading power of central bank over financial markets and to what extent money market rate is the marginal cost of funding for banks. Thus, it is more appropriate to assume pricing with a mark-up and competitive market first, then relaxing perfect competition and symmetric information assumptions. In these cases, adjustment is not complete in the long run.

money market rates and a constant mark-up, μ_0 given in equation 1. (Lowe 1992, De Bondt 2002)

$$lending\ rate = \mu_0 + \mu_1 market\ rate \quad (1)$$

The equation states that money market rate is conceived as the opportunity cost of lending. The adjustment to money market rate is determined by μ_1, which is the long-run pass through that the study aims to discover. The adjustment dynamics change in line with the demand elasticity of loans with respect to the lending rates. Theoretically, the parameter of pass through is envisaged to be one since the derivative of the prices with respect to marginal cost is equal to one under perfect competition. But, as in goods market, any market failures that distorts perfect competition alters the equality of price and marginal cost and removes parameters from anticipated values. In our case, liquidity constraints of borrowers, financial deepening, competition among banks, adjustment and switching costs; all have influence on the elasticity of demand for loans and existence of any of them gives rise to a coefficient less than one. Interestingly, the coefficient of pass through can be more than one, as well. This is the case when asymmetric information is taken into account.

The most famous attempt allowing asymmetric information in credit market is Stiglitz and Weiss (1981). In their seminal paper, they show that expected earnings of banks from loan market are a function of interest rate on loans. This is because probability of default of borrower is increasing with higher interest rates. In this setup, banks cannot increase lending rates even under the case where they face higher marginal cost, i.e. higher money market rate. Any increase in lending rates may result in either adverse selection or moral hazard or both. In this case, higher interest rates may not be profitable for safer projects since it may attract riskier ones (adverse selection). Moreover, even safer projects may fail to pay credit back or borrowers may choose riskier projects because of higher interest rates (moral hazard). Under these circumstances, increase of lending rates may not be optimal for banks. Therefore, instead of lending rate hikes, banks may choose to set interest rates below the equilibrium rate and ration credit supply, restricting the amount of loan. In other words, existence of asymmetric information between borrowers and lenders in credit market may create an upward stickiness in lending rates. Besides, their analysis envisages optimal behavior of banks as restricting the amount of loans.

In banking and finance literature, the subsistence of optimal decisions of banks is attributed to sound risk management practices. Then, the question arises what if banks do not ration credit since their risk management is not strong enough. In this case, interest rate will not be sticky on risky loans and more than one for one adjustment takes place for these riskier loans (De Bondt). Additionally, like most of the emerging market crisis, poor risk management was the most dominant factor explaining crises in Turkey in the last decade. Since rapid credit expansion in Turkey takes place in a relatively short period of time and risk management in Turkish banking system is still immature, the implications of suboptimal choices of banks may be relevant for certain loan types. Thereby, if banks do not ration credit sufficiently, then loans offered by banks in this period may consist of risky loans. That is, estimate of the adjustment parameter higher than one implies risky loan expansion. Otherwise, only possible explanation to more than one adjustment would be such that opportunity cost of lending might be something different from money market rate.

In addition to asymmetric information, switching costs may arise in credit markets and result in inelastic demand for loans with respect to interest rate. Switching costs arise if customers face a cost when they wish to change their banks. Bank-customer history may also create similar results with switching costs in that acquiring credit might be a function of bank-customer relationship. Under both conditions, demand elasticity of loans with respect to the lending rates is low. Firms and households do not change their partners frequently and banks do not need to adjust their rates according to money market rates. That is to say, if switching costs and customer history are significant in financial contracts, pass through in lending rates is incomplete.

Moreover, financial deepening and existence of alternative sources of finance for firms and households may have a direct impact on interest rate pass through. In a deep financial system with rich financial product and sources, loan market becomes more competitive and creditors adjust more completely and quickly to changes in interest rates. Lastly, liquidity constraint of borrowers may be another reason of incomplete adjustment of lending rates. Especially, this may be more relevant in emerging markets because households and firms are more likely to be liquidity constrained. Whereas, households and firms can transfer wealth and income across time and states by well-developed capital markets in developed countries.

Main motivation in this paper is to answer the following questions. First, to what extent lending rates and money market rate move together in the long run. That is to say, how much of the changes in lending rates can be attributed to changes in money market rate in the long-term. Since the money market rate is determined mainly by central bank, the answer also shows the response and the relevance of lending rates to monetary policy decisions. If the money market rate is a good proxy for the opportunity cost of lending, then banks will reflect all changes to lending rates. In this case, changes in those rates are one for one and pass through is said to be complete. The more effective monetary policy rate in credit market, the closer estimate of adjustment parameter to one. Yet, as mentioned before, several attempts for other countries have found incomplete pass through and ascribed the results to factors distorting perfect competition. This means that response of lending rates is to be sluggish if the same factors are valid for Turkey. Thus, we expect the adjustment parameter to be less than or equal to one. If the estimate is greater than one, then either borrowers are risky or the assumption that opportunity cost of lending is money market rate is false. When loan types are distinguished, the results are not unique. Hence, comparing and contrasting the results for different loan types help understand cross-product differences in credit market in response to monetary policy changes.

Secondly, when money market rate changes, an immediate response of banks to this change arises. When banks adjust their lending rates in accordance with market expectations, their instant responses are more sensitive to changes in money market rate. For example, competition in financial system may enforce banks to react very quickly to changes in monetary policy. In fact, not only current but also prospective changes in money market rate matter for banks if the competition is intense in the sector. So, response of bank lending rates to monetary policy decisions within a short period of time is another subject of interest. That is, one needs to estimate the short-term pass through to unveil transmission of credit channel in a relatively short period of time.

Lastly, the speed of adjustment to the long-run trend is another parameter to be discovered. The interpretation of this coefficient is such that effectiveness of monetary policy is associated with high values of estimates of this coefficient. In other words, high speed of adjustment means faster market response and this implies more effective interest rate channel of monetary transmission. Speed of adjustment may be affected by competition among banks in credit market, as well. The higher the competition in the financial system, the higher the speed of adjustment coefficient. Although reverse is not necessarily true, adjustment coefficient enables one to understand the extent of competitiveness in the respective loan market. Moreover, together with short-term pass-through, it enables one to determine average number of months needed to reach the long run (steady-state) value of pass through. A simple calculation exercise allows us to calculate average time horizon of monetary policy to affect lending rates.

5. Econometric Methodology

When dealing with large dynamic panels, there are certain procedures to estimate regression coefficients. These exercises allow one to estimate the parameters such as long-run effects and the speed of adjustment to equilibrium. One of these procedures is dynamic pooled estimation involving traditional fixed or random effect models. Pooled dynamic estimates generated by fixed or random effect models allow the intercepts to vary across banks, but these models impose homogeneity on all other parameters. They depend on the assumption that the slope coefficients and error variances are identical. However, it is shown that conventional pooled dynamic estimates lead to inconsistent results even in large samples (Pesaran and Smith, 1995). This is because large time dimension may create nonstationarity in the data.

Alternatively, instead of pooling the data, it is possible to estimate separate regression equations for each cross-sectional unit and calculate the mean of the parameters across those units. This kind of estimation where panel coefficients were obtained by averaging individual cross-sectional coefficients is called mean group

(MG) estimation. The MG estimator assumes that all of the parameters can differ across units but does not allow for long-run homogeneity.

Pesaran, Shin and Smith (1999) proposed pooled mean group (PMG) estimation, as another alternative to both mean group and pooled estimation. PMG has an intermediate position between the MG and standard fixed effects estimations. In MG estimation both the slopes and the intercepts are allowed to differ across units, yet in fixed effect estimation, the slopes are fixed and the intercepts are allowed to change. In PMG estimation, only the long-run coefficients are constrained to be the same across cross-sectional units, while the short-run coefficients and error variances are allowed to vary.

Furthermore, cross-sectional dependence appears to be a recent but vital issue in dynamic panel estimation. When there is correlation across units, it is necessary to consider the correlation in the estimation. The literature to remedy this problem is still growing. One of the attempts to handle cross sectional dependence is Breitung (2005). His model is the panel analogue of Johansen methodology. He proposes a two-step estimator for the estimation of long run cointegrating vector. In this paper, we utilize all methodologies in the estimation of long run vector. However, we will stick only to pooled mean group estimation to discover short run dynamics. The baseline model is an Autoregressive Distributive Lag ARDL(p,q,…,q) model

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}^{'} X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{2}$$

where x_{it} (kx1) is the vector of explanatory variables for group i, μ_i represents the fixed effects, the coefficients of the lagged dependent variables, λ_{ij}, are scalars and δ_{ij}'s are (kx1) vector coefficients. In our case, y_i and x_i refers to scalar variables of loan rate and money market rate respectively. Time dimension must be large enough so that the model can be estimated for each cross section (individual bank).

The model can be re-parameterized as an error-correction scheme

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i^{'} x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (3)$$

where i=1,2,….,p and j=1,2,….q. This is the model of Pesaran, Shin and Smith (1999) of which we base our estimations. The long run relationship between y_i and x_i is given by the equation

$$y_{it} = \theta_i^{'} x_{it} + \eta_{it} \qquad (4)$$

where $\theta_i^{'} = -(\beta_i^{'} / \phi_i)$ is the long run coefficient. The long run equation is estimated via (3) by pooled fixed effect, mean group estimation, pooled mean group estimation and Breitung two-step procedure, respectively[3].

The parameters of interest are short-term pass through δ_{i0}, long-term pass through θ_i, and speed of adjustment term ϕ_i. In this setup, θ_i shows degree of pass through in the long run, i.e. the extent of changes in money market rate reflected to lending rates in steady-state equilibrium. Similarly, δ_{i0} stands for short-term pass-through, which shows immediate effect of changes in money market rate. Since we use monthly data, it shows alteration within a month. Lastly, ϕ_i, speed of adjustment to the long run equilibrium, displays how fast banks respond to monetary policy actions like interest rate cuts. Average adjustment period is calculated as $(1-\delta_{i0})/\phi_i$ in terms of months.

It is important to note that PMG estimation imposes long-run homogeneity of coefficients, so it is necessary to check for the long run restriction. Pesaran, Shin and Smith (1999) suggest using a joint Hausman test to determine whether common long-run coefficients are applicable to the whole sample. Rejection of the test would suggest that the sample is too heterogeneous to be pooled.

[3] Pesaran (1998) suggest use of de-meaned data to address cross-sectional dependence, however, in our case de-meaning money market rate gives just a matrix of zeros. That's why, results of Breitung's two-step estimator, which allows cross-sectional dependence, is included to alternative estimations.

The error-correction model is well suited to answer the questions regarding short and long run parameters investigated. Availability of large panel data set let us construct panel error-correction framework without concerning about degrees of freedom. Pesaran, Shin and Smith (1999) show that their estimation procedure is valid for stationary and nonstationary series. So, one does not need to test for unit root or cointegration in this approach. Nevertheless, we employ several unit root tests to the data. In case of large N and large T, both cross-sectional and time series properties of the dataset needs to be exploited by the researcher. Moreover, test of cointegration necessitates the variables to be I(1). That is why before estimation step, individual and panel unit root tests are applied to the data to understand the data properties.

Several panel unit root tests have been offered, recently. However, early ones of these tests generally ignore cross-sectional dependence that is common for most of the macroeconomic series. Despite the shortcoming of early unit root tests, they help researchers to develop new tests to deal with dependence across cross-section units. These recent tests try to find out the same question of nonstationarity with early ones but have different approaches to resolution and different implications for empirical research. Therefore, in order to compare results predicated by these tests and to discover what the impact of cross-sectional dependence assumption is on unit root testing, we use more than one unit root tests[4]. The first-generation tests we conduct are Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), Maddala and Wu (1999) and Choi (2001) tests, in order. These tests are designed by assuming no cross-sectional dependence among units. The second-generation tests, allowing cross-sectional dependence, we apply are those of Bai and Ng (2004), Choi (2002), Pesaran (2003), and Chang (2002)[5], respectively.

After panel unit root tests, we conduct cointegration test to check for long run relation. Cointegration test is helpful to understand long run dynamics between variables. Like panel unit root tests, tests for cointegration in panels also suffer from cross-sectional dependence. Westerlund (2006) develops four test statistics in panel error-correction model to test for cointegration, which takes into account cross-

[4] In our study we expect high cross sectional dependence among banks, a priori. This is because competition in the financial sector, macroeconomic stabilization or any other common factors may create dependence among banks in loan market.

[5] For a survey of panel unit root tests, see Breitung and Pesaran (2005) and Hurlin (2004).

sectional dependence, as well. The statistics are designed to test the null hypothesis of no cointegration by inferring whether the error correction term in a conditional error correction model is equal to zero. If the null hypothesis of no error correction is rejected, then the null hypothesis of no cointegration is also rejected. It is indicated that the tests have limiting normal distributions and that they are consistent.

In line with previous literature on interest rate pass through, we choose one lag ARDL model of (2) for each product[6]. Results of unit root and cointegration tests lead us to reparameterize the model as in (3). Since our series are nonstationary and the series move together, long run relationship between two series (loan rate and money market rate) is constructed as in (4). Whether there is a structural break after the beginning of rapid credit expansion in 2003 is inspected by splitting the dataset into two separate panels.

6. Estimation Results

We perform several unit root tests for all types of loans. Results of unit root tests differ as we allow for more heterogeneity and variations in the tests. For all tests, null hypothesis is the nonstationarity of the series. So, high p-values imply unit root in the series. First, we start with the first-generation unit root tests, and then the second-generation unit root tests are utilized.

The first test Levin, Lin and Chu (2002) assume the homogeneity of the coefficient of the lagged dependent variable in the alternative hypothesis and no cross-sectional dependence. Results of this ADF-type test show that the null hypothesis of unit root is rejected for corporate and cash loan rates. Only nonstationary series are housing and automobile loan rates. Results are robust regardless of the choice of bandwidth parameters (Table 1).

The second test Im, Pesaran and Shin (1997, 2003) is again based on cross-sectional independence assumption but allows for heterogeneity in coefficients of lagged dependent variables in the alternative hypothesis. Instead of pooling the data

[6] Alternatively, we use Schwartz and Bayesian information criteria to determine appropriate lag legth, but results do not change significantly.

like Levin, Lin and Chu (2002), they test each unit separately for nonstationarity. Results are more acceptable than the previous test. According to the test, not only housing and automobile loan rates but also cash loan rate can be considered as nonstationary. For corporate loans, some of the statistics do not reject nonstationarity. Yet the statistic based on simulated approximated moments obtained from the original paper rejects nonstationarity of corporate loan rates at 5 percent significance level (Table 2).

The third test is discussed in two different papers with similar approach. Maddala and Wu (1999) and Choi (2001), both of them derive statistics from individual p-values of unit root tests for each cross-sectional unit. They test the same hypothesis as of Im, Pesaran and Shin (1997, 2003). Results are in favor of unit root for all types of loan rates at 5 percent significance level. But for 10 percent type-1 error, nonstationarity of corporate loan rates is rejected (Table 3).

After the first-generation unit root test, the second-generation unit root tests, in which cross-sectional dependence assumption is relaxed, are applied to our dataset. To examine dependence across units, the most influential method in the literature is the factor structure approach. The most comprehensive study in this respect is Bai and Ng (2004). Factor structure is based on the idea of decomposing a variable into two unobserved components, common factor and idiosyncratic error. The former is strongly correlated with many of the series and the latter is largely unit specific. Accordingly, for a series to be nonstationary either the idiosyncratic error or some of the common factors should be nonstationary. Bai and Ng (2004) propose testing common factors and unit specific shocks separately. For the number of common factors equal to one, the statistic they offer is a version of ADF test statistic. For the number of common factors greater than one, their statistics, which are corrected (MQ_c) and filtered test (MQ_f), give the number of independent common stochastic trends. If the number of common independent stochastic trends is equal to zero, then there are N cointegrating vectors for N common factors, and that all common factors are stationary. For idiosyncratic errors, they propose a test statistic defined as in Choi (2001).

Results of Bai and Ng (2004) test are in favor of unit root for all loan types. Idiosyncratic shocks to each loan type are all nonstationary. For corporate loans, the number of common factors is one and its p-value is 0.94 implying nonstationarity. For all other loans, the number of common factors is equal to the number of common independent stochastic trend. Thus for household loans at least two independent nonstationary common factors can be identified in banking sector. These findings are compatible with the recent growth in household loan market. Even though we cannot identify these common factors, the results show that for banking sectors there are common factors in consumer credit market and these factors (like competition, trend in interest rates, disinflation or legal environment) are more significant in this market than in corporate loan market (Table 4).

For robustness purposes, we also conduct three additional tests for nonstationarity. One of them is unit root test in Choi (2002). This test also allows for cross-sectional dependence and has a specification based on error component model. Results of this test are again in favor of unit root. Chang (2002) offers another test that uses instrumental variables to cope with dependence problem. Similarly, results of this test are in line with nonstationarity in the loan rates (Table 5).

The last test we apply is Pesaran (2003). To remedy dependence problem Pesaran proposes cross-sectionally augmented Dickey Fuller test statistic (CADF) by adding cross-section average of lagged levels and first-differences of the individual series to conventional Dickey Fuller or augmented Dickey Fuller regressions. He also proposes a truncated version of CADF (CADF*) to avoid extreme outcomes that may arise in small time dimensions. His test statistics are cross-sectional average of CADF and CADF*. In fact, they are just the cross-sectionally augmented version of the statistics offered by Im, Pesaran and Shin (1997, 2003) denoted as CIPS and CIPS*, respectively. Results should be interpreted according to optimal lag length. For housing and cash loans, nonstationarity of interest rates is not rejected (Table 10). But for corporate and automobile loans it is rejected even at 1 percent significance level.

Finally, in addition to panel unit root statistics, individual unit root test statistics are reported. These statistics are i) standard Augmented Dickey Fuller test statistics, ADF ii) Pesaran (2003) test statistics CADF, and iii) Chang (2002) test statistic, IV-ADF. The last two statistics, CADF and IV-ADF are modified versions of the standard ADF statistic. Similar to ADF, they are constructed to test nonstationarity of individual lending rate series for each bank. Results of ADF and IV-ADF appear to be similar and imply unit root for most of the banks. Yet, results of CADF differ from the former statistics for some banks. Nevertheless, the null of unit root is not rejected for the majority of banks (Table 7-10).

The next step is to test for the existence of long run equilibrium. To control cross-sectional dependence, we employ Westerlund (2006) cointegration test in panel error-correction. The results of cointegration test are also in favor of long run co-movement between chosen variables. The statistics offered are standard normally distributed. Accordingly, the statistic G_τ for housing loans in panel I and II and the statistics for automobile loans in panel II does not support cointegration. Overall, the results strongly reject the null hypothesis of no cointegration. That is, money market rate and loan rates are cointegrated with each other (Table 11). Equilibrium relationship is more apparent after the beginning of credit expansion.

Estimations of adjustment coefficient and short run parameters are carried out by only PMG estimation. For long run cointegrating vector, which denotes long term pass through, all methodologies mentioned in previous section are employed. As discussed above, there may be a structural break after the third quarter of 2003. Also, estimations carried out with whole sample (panel I) suffer from some diagnostics. So, we split data set into two parts to see whether there exists a behavioral change in the adjustment of retail lending rates of banks. In PMG estimations, we also add time trend to capture disinflation period. After estimating the parameters, trend is removed in the alternative estimations of long run equilibrium because trend was insignificant for most loan types in the estimations.

For all types of loans, results of pooled mean group estimations suggest that there is a cointegrating relationship between lending rates and money market rate. While speed of adjustment term is negative and significant for all types of loans, we find that it is higher for corporate loans. Such a finding can be due to the fact that corporate loans are riskier than consumer loans by their nature.

Long run pass through for corporate loans is below one (around 70 percent) in all estimations. In other words, corporate loans adjust incompletely to changes in money market rate. This may be because banks extend loans only to firms about which they have credit record (switching cost). In addition to switching cost, Turkey does not have a deep financial system and firms do not have multiple choices for funding. This makes firms dependent on bank credit and results in inelastic demand for corporate loans. The empirical evidence is in favor of the explanations of incomplete interest rate pass through for corporate loans in all samples.

In contrast to corporate loans, consumer credit market is very competitive in Turkish banking system. Especially after the third quarter of 2003, credit expansion is driven mainly by consumer loans. The most competitive market was housing loan market. Estimates obtained from panel I and II are inconclusive, either the coefficient has opposite sign or it is insignificant. But, estimate of long run pass through for housing loans is higher than one in rapid credit growth period (panel III). This means that housing loans may be extended to risky borrowers. Banks accommodate to market rates by decreasing more than one for each one point cut in money market rate. As discussed, when pass through is more than one, the higher the adjustment of bank lending rates to money market rate, the higher risk associated to the loan type. Estimations suggest that housing loans are more likely to be a risky loan type than other loan types, especially in the second part of the time period. Another explanation may be such that they have alternative sources of funds. For instance, by structured derivatives, they may find external funds with lower interest rates, since interest rates are expected to go down in future. This means that opportunity cost of housing loans is not exactly the money market rate.

Results that are more interesting arise from cash loans and automobile loans. Although estimations with panel I show incomplete pass through for all loans, estimations for rapid credit growth period for cash and automobile loans lead to one-to-one adjustment rate. This means banks set the price of cash and automobile credits according to money market rate. It can be inferred that central bank can steer these loans more easily than other loans by changing monetary policy rate (Table 12, 13, 14).

Alternative estimations carried out for long run equation are in favor of pooled mean group estimation. Especially, results of two-step estimation by Breitung (2002) are very similar to those of pooled mean group estimation because it takes into account the cross-sectional dependence. Like fixed effect estimates, mean group estimation is not a good choice for our case. Turkish banking system composed of banks with different sizes. Pooling those banks or making inference with average figures may result in imperfect conclusions. Nevertheless, it gives similar results to others at least for panel III (Table 15).

Estimates of short run pass through are generally insignificant. Only cash and automobile loan rate adjustment in panel III appear to be significant. This may stem from the fact that banks expect changes in monetary policy rate and adjust immediately to these changes. Despite insignificance of the short run adjustment rates, we utilize these parameters to calculate average mean lag for the purpose of comparison of different loan types. Average mean lag indicates the average number of months needed to reach long run equilibrium. It can be interpreted as the time horizon of monetary policy actions. Accordingly, duration of response of credit rates to money market rate changes has become shorter after the rapid credit expansion. That is, banking sector react more quickly to monetary policy decisions after the third quarter of 2003. Estimates with trend for panel III gives the time needed to influence corporate, housing, cash and automobile loans as 1.2, 2.9, 1.7 and 0.9 months, respectively (Table 16).

7. Concluding Remarks

In this paper, we conduct an empirical analysis of pass through from money market rate to bank lending rates. We compare four loan types composed of consumer and corporate loans in terms of their long-run co-movement with money market rate. Estimation results show that pass through is higher for all types of loans and long run co-movement between rates is more apparent when the loan market is functioning more properly. In determination of corporate loan rates, banks do not consider money market rate as the only factor. They adjust incompletely even in the long run and rapid credit expansion period has little effect on the adjustment of corporate loan rates.

Regarding household loans, pass-through is higher than the corporate loans. However, before rapid credit expansion period, co-movement with money market rate is not clear. After credit boom, lending rate adjustment is full in cash and automobile loans. In this period, banks either engage in risky borrowers in housing credits or they have alternative sources of funds.

To sum up, it can be concluded that central bank has a control over banking rates that shows its effect within a quarter. The monetary policy rate, the unique instrument of inflation targeting, can be used to control credit driven demand.

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Table 1: Levin, Lin and Chu (2002) Unit Root Test

	t_ρ^*	$\hat{\rho}$	t_ρ^{*B}	t_ρ^{*C}
Corporate	-6.4860	-0.0430	-5.5853	-5.3134
	[0.0000]	[0.2248*e^{-4}]	[0.0001*e^{-4}]	[0.0005*e^{-4}]
Housing	2.0202	-0.0026	1.9088	1.8641
	[0.9783]	[0.0000]	[0.9719]	[0.9688]
Cash	-3.006	-0.0097	-3.0662	-3.0111
	[0.0013]	[0.0000]	[0.0011]	[0.0013]
Automobile	-0.1841	-0.0139	0.3746	0.1497
	[0.4270]	[0.0000]	[0.6460]	[0.5595]

Notes: t_ρ^* is the adjusted t-statistic computed with a Bartlett kernel function and a common lag truncation parameter given by $K = 3.21T^{1/3}$ (Levin and Lin, 2002). t_ρ^{*B} is the adjusted t-statistic computed with a Bartlett kernel function and individual bandwidth parameters (Newey and West, 1994). t_ρ^{*C} is the adjusted t-statistic computed with a Quadratic Spectral kernel function and individual bandwidth parameters. $\hat{\rho}$ is the pooled least squares estimator. For all statistics, p-values are given in brackets.

Table 2: Im, Pesaran and Shin (2003) Unit Root Tests

	t_bar_{NT}	Z_{t_bar}	W_{t_bar}	$t\_bar_{NT}^{DF}$	$Z_{t\_bar}^{DF}$
Corporate	-1.7841	-1.4748	-1.7813	-1.6026	-0.4339
		[0.0701]	[0.0374]		[0.3322]
Housing	-0.6130	4.4483	4.2014	-0.6947	4.0506
		[1.0000]	[1.0000]		[1.0000]
Cash	-1.0478	2.1989	1.9276	-0.5350	4.5517
		[0.9861]	[0.9730]		[1.0000]
Automobile	-0.7262	4.2093	3.9757	-0.9296	3.1401
		[1.0000]	[1.0000]		[0.9992]

Notes: t_bar_{NT} is the mean of individual Augmented Dickey Fuller statistics. $t\_bar_{NT}^{DF}$ is the mean of individual Dickey Fuller statistics. Z_{t_bar} is the standardized t_bar_{NT} statistic based on the moments of the Augmented Dickey Fuller statistics. $Z_{t\_bar}^{DF}$ is the standardized $t\_bar_{NT}^{DF}$ statistic based on the moments of the Dickey Fuller distribution. W_{t_bar} is the standardized t_bar_{NT} statistic based on simulated approximated moments (Im, Pesaran and Shin, 2003, table 3). The corresponding p-values are given in brackets.

Table 3: Maddala and Wu (1999) and Choi (2001) Unit Root Tests

	P_{MW}	Z_{MW}
Corporate	63.6229	1.3623
	[0.0933]	[0.0866]
Housing	18.2614	-2.0905
	[0.9939]	[0.9817]
Cash	20.8972	-1.3879
	[0.9339]	[0.9174]
Automobile	16.6274	-2.7684
	[0.9998]	[0.9972]

Notes: P_{MW} is the Fisher's test statistic, Z_{MW} is the Choi (2001) standardized test statistic. p-values are given in brackets.

Table 4: Bai and Ng (2004) Unit Root Tests

		Idiosyncratic Shocks			Common Factors	
					Trends $\hat{r}_1$	
	$\hat{r}$	$Z_{\hat{e}}^{c}$	$P_{\hat{e}}^{c}$	ADF^{c}	MQ_c	MQ_f
Corporate	1	-4.4712	5.2875	-0.0958		
		[1.0000]	[1.0000]	[0.9400]		
Housing	2	-1.2207	25.6423		2	2
		[0.8889]	[0.9000]			
Cash	3	-1.7096	18.3234		3	3
		[0.9563]	[0.9746]			
Automobile	3	-0.9932	32.8972		3	3
		[0.8397]	[0.8417]			

Notes: $\hat{r}$ is the estimated number of common factors, based on BIC. For the idiosyncratic components only pooled unit root test statistics are reported. $P_{\hat{e}}^{c}$ is the Fisher's type statistic based on p-values of the individual ADF tests. $Z_{\hat{e}}^{c}$: the standardized Choi's type statistic. ADF^{c} is the standard ADF t-statistic. p-values are given in brackets. MQ_c: the estimated number of independent stochastic trends in the common factors from the corrected test. MQ_f: the estimated number of independent stochastic trends in the common factors from the filtered test.

Table 5: Choi (2002) Unit Root Test and Chang (2002) Non-Linear IV Unit Root Tests

	P_m	Z	L^*	S_N
Corporate	1.2358	-1.3673	-1.3418	10.8373
	[0.1083]	[0.0858]	[0.0898]	[1.0000]
Housing	-0.2916	2.6287	2.6101	2.3886
	[0.6147]	[0.9957]	[0.9955]	[0.9915]
Cash	-0.5765	0.3001	0.3134	6.7167
	[0.7179]	[0.6180]	[0.6230]	[1.0000]
Automobile	-1.3322	1.9064	1.8220	3.1018
	[0.9086]	[0.9717]	[0.9658]	[0.9990]

Notes: P_m, Z and L^* are Choi (2002) test statistics. p-values are given in brackets. S_N is Chang (2002) test statistic derived from individual IV-ADF for each series. p-values are given in brackets.

Table 6: Pesaran (2003) Unit Root Tests

	p^*	CIPS				CIPS*			
Lag Length p		1	2	3	4	1	2	3	4
Corporate	4	-3.8063	-3.1798	-3.1986	-2.8873	-3.7470	-3.1798	-3.0880	-2.8873
		[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]	[0.010]
Housing	2	-2.4819	-2.0018	-2.1965	-2.3247	-2.3841	-2.0018	-2.1965	-2.3247
		[0.010]	[0.200]	[0.055]	[0.015]	[0.010]	[0.200]	[0.055]	[0.015]
Cash	3	-2.5812	-2.0973	-2.0191	-2.0791	-2.5812	-2.0973	-2.0191	-2.0656
		[0.010]	[0.135]	[0.205]	[0.150]	[0.010]	[0.135]	[0.205]	[0.160]
Automobile	2	-3.0852	-3.2451	-2.2704	-2.4201	-3.0852	-2.6037	-2.2704	-2.4201
		[0.010]	[0.010]	[0.030]	[0.010]	[0.010]	[0.010]	[0.030]	[0.010]

Notes: CIPS and CIPS* are Pesaran (2003) test statistics. p^* is the optimal lag length to decide on critical values. p-values are given in brackets.

Table 7: Individual Unit Root Tests for Corporate Loans

Banks	lag	ADF	p-ADF	CADF	p-CADF	IV ADF	p-IV ADF
1	6	-1.2693	0.6350	-4.2114	0.0100	1.9736	0.9758
2	0	-1.1934	0.6700	-1.7283	0.5350	2.2201	0.9868
3	0	-2.0257	0.2750	-2.4936	0.2150	1.8765	0.9697
4	0	-1.4006	0.5750	-2.7880	0.1300	1.8068	0.9646
5	8	-1.9272	0.3150	-1.4439	0.6550	2.0972	0.9820
6	2	-0.5171	0.8800	-1.4559	0.6500	1.5097	0.9344
7	3	-1.4480	0.5500	-2.2003	0.3200	2.1580	0.9845
8	1	-1.2620	0.6400	-1.0739	0.7800	1.8900	0.9706
9	4	-1.8155	0.3700	-2.6925	0.1550	2.2964	0.9892
10	2	-3.0726	0.0350	-2.1178	0.3550	2.8894	0.9981
11	0	-1.5986	0.4750	-3.1691	0.0650	2.8903	0.9981
12	5	0.0571	0.9600	-1.6394	0.5700	1.5226	0.9361
13	2	-1.6669	0.4450	-3.3445	0.0450	3.1331	0.9991
14	1	-2.6068	0.1000	-3.1732	0.0650	2.7951	0.9974
15	0	-2.2820	0.1800	-2.6006	0.1800	2.5129	0.9940
16	0	-4.4756	0.0100	-2.3458	0.2650	3.3792	0.9996
17	2	-1.9688	0.3000	-4.4623	0.0100	2.4138	0.9921
18	9	-1.6521	0.4450	-4.7150	0.0100	0.7062	0.7600
19	12	-1.2297	0.6500	-5.7261	0.0100	0.7975	0.7874
20	4	-1.2041	0.6650	-4.5241	0.0100	2.6569	0.9961
21	11	-2.4968	0.1250	-3.4383	0.0350	1.6781	0.9533
22	1	-0.1842	0.9350	-3.0271	0.0850	3.2596	0.9994
23	5	-3.5594	0.0100	-0.5952	0.9000	2.7624	0.9971
24	9	-1.2640	0.6350	-3.3058	0.0500	0.6280	0.7350
25	5	-2.5399	0.1150	-3.9091	0.0100	2.3329	0.9902

Notes: ADF is standard Augmented Dickey Fuller test statistic and CADF is Pesaran (2003) test statistic. IV-ADF is Chang (2002) test statistic. p-values are given in next colums.

Table 8: Individual Unit Root Tests for Housing Loans

Banks	lag	ADF	p-ADF	CADF	p-CADF	IV ADF	p-IV ADF
1	1	-1.1430	0.6950	-1.0239	0.8050	2.6515	0.9960
2	2	-1.4664	0.5450	-0.9289	0.8300	2.3972	0.9917
3	0	0.5254	0.9850	-1.5898	0.5900	1.5916	0.9443
4	1	-0.1240	0.9400	-1.9300	0.4350	0.7691	0.7791
5	0	-1.6484	0.4500	-3.4861	0.0300	2.1230	0.9831
6	6	-3.6945	0.0100	-2.4918	0.2150	3.2018	0.9993
7	0	0.2973	0.9750	-3.4859	0.0300	1.0967	0.8636
8	1	-1.8165	0.3700	-1.0144	0.8050	2.3101	0.9896
9	6	-0.9280	0.7700	-2.9255	0.1050	1.1683	0.8786
10	1	-0.4909	0.8850	-1.8905	0.4500	0.5612	0.7127
11	1	-0.2340	0.9250	-1.7569	0.5100	2.0400	0.9793
12	12	-1.0099	0.7350	-2.6657	0.1650	1.5732	0.9422
13	4	-1.3511	0.6000	-2.4594	0.2250	2.3668	0.9910
14	3	-1.6274	0.4600	-2.7181	0.1500	1.5937	0.9445
15	0	-1.6699	0.4400	-0.9441	0.8250	0.0260	0.5104
16	3	-0.3829	0.9050	-0.9946	0.8100	1.3968	0.9188

Notes: ADF is standard Augmented Dickey Fuller test statistic and CADF is Pesaran (2003) test statistic. IV-ADF is Chang (2002) test statistic. p-values are given in next columns.

Table 9: Individual Unit Root Tests for Cash Loans

Banks	lag	ADF	p-ADF	CADF	p-CADF	IV ADF	p-IV ADF
1	3	0.8865	0.9900	-1.8432	0.4750	1.5930	0.9444
2	0	0.1902	0.9700	-1.3796	0.6800	-0.5714	0.2838
3	0	-5.5175	0.0100	-2.2005	0.3200	-1.1020	0.1352
4	0	-1.6317	0.4600	-3.1426	0.0700	0.2363	0.5934
5	1	-0.0758	0.9450	-1.8607	0.4700	0.2812	0.6107
6	6	-1.7302	0.4100	-2.1713	0.3350	1.4342	0.9242
7	0	1.7355	0.9900	-1.6205	0.5800	0.6810	0.7521
8	0	-0.8447	0.7950	-2.4144	0.2450	0.3542	0.6384
9	7	-1.6387	0.4550	-2.1292	0.3500	2.2705	0.9884
10	2	0.5463	0.9850	-0.6942	0.8800	0.8312	0.7971
11	0	-1.7201	0.4150	-2.5508	0.2000	0.9607	0.8316
12	1	-0.3285	0.9150	-0.3323	0.9350	0.5697	0.7155
13	1	-1.1904	0.6750	-1.6416	0.5700	0.1007	0.5401
14	0	-0.2886	0.9200	-1.6068	0.5850	-0.4431	0.3288
15	1	-0.5733	0.8650	-2.6524	0.1650	0.5629	0.7132
16	5	-0.1551	0.9350	-3.9455	0.0100	1.1283	0.8704
17	0	1.3316	0.9900	-1.9079	0.4500	0.9649	0.8327
18	1	-0.0291	0.9500	-1.9384	0.4350	0.2820	0.6110

Notes: ADF is standard Augmented Dickey Fuller test statistics and CADF is Pesaran (2003) test statistic. IV-ADF is Chang (2002) test statistic. p-values are given in next columns.

Table 10: Individual Unit Root Tests for Automobile Loans

Banks	lag	ADF	p-ADF	CADF	p-CADF	IV ADF	p-IV ADF
1	6	-1.2638	0.6350	-1.4272	0.6600	2.1498	0.9842
2	3	-0.5729	0.8700	-19.8304	0.0100	1.3094	0.9048
3	1	0.1729	0.9700	-3.5417	0.0250	0.9198	0.8212
4	0	1.3554	0.9900	-1.8551	0.4700	-0.2908	0.3856
5	0	-2.8965	0.0550	-2.8372	0.1200	-0.1949	0.4227
6	0	-1.7143	0.4150	-2.1745	0.3300	-0.3691	0.3560
7	1	-0.9360	0.7700	-2.3791	0.2550	-0.4877	0.3129
8	6	-1.4974	0.5250	-4.7033	0.0100	1.2834	0.9003
9	1	0.0157	0.9550	-3.1287	0.0700	0.9104	0.8187
10	0	-0.1424	0.9400	-1.4806	0.6400	0.6803	0.7518
11	2	-1.4822	0.5350	-0.9881	0.8050	2.8379	0.9977
12	1	-0.1498	0.9350	-3.0698	0.0800	1.0475	0.8526
13	0	-1.4495	0.5500	-2.4255	0.2400	1.1912	0.8832
14	1	-0.2409	0.9250	-1.6824	0.5550	1.1405	0.8730
15	0	-0.5234	0.8800	-2.4537	0.2300	-0.0983	0.4608
16	0	-0.1909	0.9350	-1.7101	0.5400	0.3394	0.6328
17	0	-0.6619	0.8450	-1.9029	0.4500	0.6501	0.7422
18	1	-0.5833	0.8650	-2.8143	0.1250	0.0787	0.5314
19	5	-0.1403	0.9400	-2.7182	0.1500	0.9291	0.8236
20	3	-1.6074	0.4700	-2.8978	0.1100	-0.1078	0.4571
21	1	-0.7417	0.8250	-2.1257	0.3500	0.2956	0.6162

Notes: ADF is standard Augmented Dickey Fuller test statistic and CADF is Pesaran (2003) test statistic. IV-ADF is Chang (2002) test statistic. p-values are given in next columns.

Table 11: Westerlund (2006) Cointegration Test

	Panel I (2001:07-2005:09)				Panel II (2001:07-2003:07)				Panel III (2003:08-2005:09)			
	Corporate	Housing	Cash	Automobile	Corporate	Housing	Cash	Automobile	Corporate	Housing	Cash	Automobile
G_τ	-8.810	0.154	-6.110	-1.858	-2.468	-0.826	-6.800	-4.159*e14	-3.157	-7.062	-7.450	-10.542
G_α	-15.028	-1.689	-7.051	-2.581	-5.011	-2.524	-6.140	-1.194*e14	-2.046	-4.498	-4.203	-5.920
P_τ	-7.844	-0.728	-3.800	-3.541	-1.973	-6.130	-5.616	-2.169*e15	-3.911	-4.228	-4.342	-13.181
P_α	-14.398	-1.847	-6.225	-4.586	-8.465	-8.374	-6.968	-1.486*e15	-4.795	-4.519	-5.533	-12.705

Notes: G_τ , G_α , P_τ , P_α are Westerlund's (2006) test statistics for testing cointegration in panel error-correction . All statistics are distributed standard normally. Critical values of one-sided tests for 1, 5, 10 percent significance levels are -2.326, -1.645, -1.250, respectively.

Table 12: Pooled mean group estimation results for different loan types

	Panel I (2001:07-2005:09)			
	Corporate	Housing	Cash	Automobile
θ_i	0.726***	-0.219***	0.781***	0.703***
	(0.037)	(0.043)	(0.071)	(0.093)
ϕ_i	-0.435***	-0.255***	-0.280***	-0.199***
	(0.044)	(0.069)	(0.070)	(0.045)
β_i	0.316***	-0.056***	0.218***	0.140***
	(0.032)	(0.015)	(0.055)	(0.032)
δ_{i0}	-0.082	0.087	-0.179	-0.126
	(0.090)	(0.062)	(0.118)	(0.123)
α_i	0.024	-0.207***	0.036	0.059***
	(0.025)	(0.047)	(0.024)	(0.023)
μ_i	3.014***	16.767***	2.647**	-0.593
	(1.020)	(4.311)	(1.182)	(0.712)
Hausman	1.48	0.53	0.34	0.13
	[0.22]	[0.47]	[0.56]	[0.72]
observations	1250	900	800	1050
$\overline{R}^2$	0.532	0.147	0.120	0.197

The Model:

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{i,t-j} + \mu_i + \alpha_i t + \varepsilon_{it}$$

where $\theta_i = -(\beta_i / \phi_i)$ is the long run pass through coefficient. The standard errors are given in parentheses. p-value of the Hausman test statistic is given in brackets where p>0.05 means not rejecting the homogeneity of long run pass through coefficient across units. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

Table 13: Pooled mean group estimation results for different loan types

	Panel II (2001:07-2003:07)			
	Corporate	Housing	Cash	Automobile
θ_i	0.417***	0.002	0.905***	-0.160**
	(0.082)	(0.017)	(0.119)	(0.062)
ϕ_i	-0.562***	-0.439***	-0.398***	-0.314***
	(0.059)	(0.089)	(0.078)	(0.053)
β_i	0.234***	0.001***	0.360***	-0.050***
	(0.025)	(0.000)	(0.071)	(0.008)
δ_{i0}	-0.059	0.097	-0.238	0.009
	(0.111)	(0.082)	(0.159)	(0.149)
α_i	-0.207***	-0.03	0.216	-0.135**
	(0.063)	(0.067)	(0.132)	(0.067)
μ_i	18.790***	18.840***	-2.451	19.151***
	(2.201)	(3.988)	(2.951)	(3.605)
Hausman	0.05	0.00	1.77	1.69
	[0.82]	[0.99]	[0.18]	[0.19]
observations	600	432	384	504
$\overline{R}^2$	0.523	0.103	-0.022	0.432

The Model:

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{i,t-j} + \mu_i + \alpha_i t + \varepsilon_{it}$$

where $\theta_i = -(\beta_i / \phi_i)$ is the long run pass through coefficient. The standard errors are given in parentheses. p-value of the Hausman test statistic is given in brackets where p>0.05 means not rejecting the homogeneity of long run pass through coefficient across units. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

Table 14: Pooled mean group estimation results for different loan types

	Panel III (2003:08-2005:09)			
	Corporate	Housing	Cash	Automobile
θ_i	0.631***	1.588***	1.065***	1.082***
	(0.073)	(0.150)	(0.102)	(0.093)
ϕ_i	-0.651***	-0.290***	-0.469***	-0.429***
	(0.062)	(0.033)	(0.068)	(0.045)
β_i	0.411***	0.461***	0.500***	0.464***
	(0.039)	(0.053)	(0.073)	(0.049)
δ_{i0}	-0.224*	-0.160	-0.215**	-0.638***
	(0.120)	(0.118)	(0.089)	(0.168)
α_i	-0.007	0.138***	0.013	0.152***
	(0.032)	(0.037)	(0.047)	(0.023)
μ_i	7.942***	-4.309***	4.974**	0.430***
	(0.985)	(0.831)	(1.924)	(-3.609)
Hausman	1.28	3.51	1.18	0.41
	[0.26]	[0.06]	[0.28]	[0.52]
observations	625	450	400	525
$\overline{R}^2$	0.601	0.249	0.328	0.347

The Model:

$$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i x_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*'} \Delta x_{i,t-j} + \mu_i + \alpha_i t + \varepsilon_{it}$$

where $\theta_i = -(\beta_i / \phi_i)$ is the long run pass through coefficient. The standard errors are given in parentheses. p-value of the Hausman test statistic is given in brackets where p>0.05 means not rejecting the homogeneity of long run pass through coefficient across units. ***, **, * denote significance at the 1, 5, and 10% level, respectively.

Table 15: Alternative estimation results for long term pass through

	Panel I (2001:07-2005:09)				Panel II (2001:07-2003:07)				Panel III (2003:08-2005:09)			
	Mean Group Estimation	Panel Two Step Estimation	Dynamic Fixed Effect	Static Fixed Effect	Mean Group Estimation	Panel Two Step Estimation	Dynamic Fixed Effect	Static Fixed Effect	Mean Group Estimation	Panel Two Step Estimation	Dynamic Fixed Effect	Static Fixed Effect
corporate	0.693***	0.723***	0.695***	0.730***	0.667***	0.746***	0.699***	0.734***	0.712***	0.764***	0.660***	0.854***
	(0.034)	(0.015)	(0.036)	(0.039)	(0.071)	(0.032)	(0.076)	(0.081)	(0.071)	(0.036)	(0.076)	(0.091)
housing	0.758***	0.364***	0.300***	0.245***	-0.095	-0.050*	-0.050	-0.025	-2.369	1.104***	0.930***	0.967***
	(0.127)	(0.047)	(0.056)	(0.037)	(0.084)	(0.029)	(0.057)	(0.063)	(3.400)	(0.066)	(0.130)	(0.088)
cash	0.630***	0.599***	0.635***	0.542***	0.548***	0.541***	0.541***	0.414***	0.959***	1.100***	0.964***	1.089***
	(0.091)	(0.029)	(0.065)	(0.087)	(0.174)	(0.062)	(0.167)	(0.144)	(0.090)	(0.047)	(0.073)	(0.063)
automobile	0.644***	0.398***	0.334***	0.321***	0.086	-0.008	-0.060	0.019	0.644***	0.753***	0.648***	0.906***
	(0.091)	(0.030)	(0.046)	(0.046)	(0.134)	(0.043)	(0.074)	(0.083)	(0.061)	(0.050)	(0.046)	(0.057)

Notes: The standard errors are given in parentheses. ***, **, * denote significance at the 1, 5, and 10% level, respectively. Trend is not included.

Table 16: Average mean lag for different types of loans (in months)

	Panel I (2001:07-2005:09)	Panel II (2001:07-2003:07)	Panel III (2003:08-2005:09)	Panel I (2001:07-2005:09)	Panel II (2001:07-2003:07)	Panel III (2003:08-2005:09)
		With trend			Without trend	
Corporate	2,11	1,67	1,19	3,06	2,20	1,73
Housing	4,26	2,50	2,90	7,33	3,79	3,23
Cash	2,93	1,91	1,67	3,65	3,45	1,61
Automobile	4,39	3,47	0,84	6,22	4,67	1,06

Notes: Average adjustment lag is calculated according to formula $1-\delta_{i0}/\phi_i$ for each loan type.