# Monetary Transmission

# via the Administered Interest Rates Channel

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## Abstract

This paper examines the dynamics of administered interest rate changes in response to changes in the benchmark money market rate in Singapore. Our results show that the administered rates' adjustment speed differs across both financial institutions and financial products. The financial institutions' administered (lending and deposit) rates, moreover, are more rigid when they are below their equilibrium level than when they are above. Our finding, hence, implies that the speed of monetary transmission is not uniform across all sectors of the economy and that a tightening monetary policy takes a longer time to impact the economy than an expansionary monetary policy.

JEL classification: E43

Key Words: Monetary Policy, Transmission Mechanism, Interest Rates, Asymmetric Adjustment, Price Rigidity

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## Abstract

This paper examines the dynamics of administered interest rate changes in response to changes in the benchmark money market rate in Singapore. Our results show that the administered rates' adjustment speed differs across both financial institutions and financial products. The financial institutions' administered (lending and deposit) rates, moreover, are more rigid when they are below their equilibrium level than when they are above. Our finding, hence, implies that the speed of monetary transmission is not uniform across all sectors of the economy and that a tightening monetary policy takes a longer time to impact the economy than an expansionary monetary policy.

## 1. Introduction

In this paper, we examine the dynamics of administered interest rate changes in response to changes in the benchmark market rates across different financial institutions (namely, commercial banks and finance companies) and across different financial products (namely, saving deposits, time deposits with various maturities, hire-purchase loans, mortgages, and commercial loans).

At the micro-level, such a study can provide us with a better understanding of the administered rate-setting behavior of different financial institutions. Banks have a significant amount of products with embedded options such as the early withdrawal of deposits and prepayment of loans (including mortgages, overdraft, and credit card loans). To value and risk-manage such products, option-adjusted spread (OAS) analysis is typically carried out. Modeling the relationship between the interbank rate and administered (deposit and loan) rates is an essential part of the OAS analysis. Hence, our study has significant implications for the valuation and risk management of option-embedded banking products such as current account deposits, savings deposits, mortgages, mortgage-backed securities, credit-card receivables, etc.

At the macro-level, an important question in the conduct of monetary policy is how fast financial institutions pass through changes in the market intervention rates to their customers. The existence of differential adjustment rates across financial institutions and across financial products, if any, has important implications for the conduct of monetary policy as it implies that the speed of monetary transmission is not uniform across different segments of the banking sector. Further, the adjustment speed can be different depending on whether rates are above or below their long-term equilibrium level. It is well known that monetary policy operates with lags, partly due to the delay by financial institutions in adjusting their administered rates when market rates change. By examining the different adjustment speed of various financial institutions/products and the asymmetric nature of the adjustment speed, our study can shed additional light on how monetary policy is transmitted via changes in financial institutions' administered rates.

There are two possible approaches to study the role of depository institutions in the monetary transmission mechanism. One approach is to examine how monetary policy is transmitted through the bank lending channel. Previous studies on bank lending channel typically analyze how the banks' balance sheet items respond to changes in monetary policy stance, which is usually proxied by changes in the interbank rate. For example, in the event of a liquidity squeeze, some banks may respond by raising new deposits to maintain or even increase their lending level. Others may use their excess capital to maintain their loan supply. Evidence on bank lending channel in the United States shows that monetary policy is transmitted mainly through small banks that are either illiquid or undercapitalized (Kashyap and Stein, 2000; Kishan and Opiela, 2000). Evidence in Europe is rather mixed, i.e. banks in different countries appear to respond differently to protect their loan supply from changes in monetary policy. Altunbas et al. (2002) finds that monetary policy is transmitted mainly through undercapitalized banks in smaller EMU countries, while Kakes and Sturm (2002) find that monetary policy in Germany is transmitted mostly through small banks.

Another approach, which is undertaken in this study, is to examine how monetary policy is transmitted through the administered rates channel. The relationship between the market rate and the administered rates is a complicated one and the evidence presented, thus far, is mixed and inconclusive. Hannan and Berger (1991), for example, examine the deposit rate setting behavior of commercial banks in the United States and find that: (a) firms in more concentrated market exhibit greater price rigidity; (b) larger firms exhibit less price rigidity; and (c) deposit rates are more rigid upwards than downwards.

Scholnick (1996), similarly, finds that deposit rates are more rigid when they are below their equilibrium level than when they are above. His finding on lending rate adjustment, however, is mixed. Heffernan (1997) examines how the lending and deposit rates of four banks and three building societies respond to changes in the base rate set by the Bank of England and finds that (a) there is very little evidence on the asymmetric adjustments in both the deposit and lending rates, (b) there is no systematic difference in the administered rate pricing dynamics of banks and building societies, and (c) the adjustment speed for deposit rates is, on average, roughly the same as that for loan rates.[1]

Our finding, in contrast, shows that the adjustment speed of administered rates in response to changes in the benchmark market rate varies across both financial institutions and financial products and tends to be asymmetric. More specifically, our paper yields three key results. First, we find that the administered rates' adjustment speed differs across financial institutions. Finance companies' deposit rates, in particular, are less rigid than those of commercial banks, but their loan rates are generally more rigid. Second, our result shows that the adjustment speed differs across financial products. Loan rates, in particular, tend to adjust more slowly than deposit rates. Third, we find that both the lending and deposit rates are more rigid when they are below their equilibrium level than when they are above. Our overall finding, hence, implies that the speed of monetary transmission is not uniform across all sectors of the economy and that a tightening monetary policy takes a longer time to impact the economy than an expansionary monetary policy.

[1] Heffernan (1997), however, finds a wide variation in the adjustment speed *within* each type of financial institutions and products.

We, in addition, find that it is not true in general that monetary policy is transmitted mostly through the smaller financial institutions (as is found in the literature on bank lending channel). Our results suggest that financial institutions have the choice of responding via the administered rates channel and/or the bank lending channel. In the loan market, the larger financial institutions (commercial banks) are more likely to respond to a change in monetary policy via the administered rates channel, while the smaller financial institutions (finance companies) are more likely to respond via the bank lending channel.

The remainder of the paper is organized as follows: Section 2 provides some institutional background about Singapore's depository financial institutions. Section 3 examines the conceptual framework for asymmetric price rigidity. Section 4 outlines our methodology. Section 5 discusses the results and the final section concludes the paper.

## 2. Institutional Background

In this paper, we examine the administered rates setting behavior of two types of depository financial institutions in Singapore, namely the commercial banks and finance companies.[2] Commercial banks are the single most important financial institutions in Singapore. They can be further classified into three subgroups based on the type of licence held: full licensed banks, wholesale banks, and offshore banks. Full licensed banks may engage in all types of banking activities. As at March 2002, six of the 22 full licensed banks are locally-incorporated under the umbrella of three domestic banking groups (DBS, UOB, and OCBC). The other full licensed banks are branches of foreign-incorporated banks. Although small in numbers, the domestic banks are very important players in the domestic banking market, controlling over 90% of total deposits from non-bank customers in Singapore (Luckett et al., 1994). As at March 2002, there are 33 wholesale banks and 59 offshore banks, all of which are branches of foreign banks. Wholesale banks' activities are somewhat restricted as they are not allowed to engage in Singapore Dollar retail banking activities. The offshore banks, moreover, are mostly restricted to the offshore (international) banking activities.

Finance companies in Singapore undertake small-scale financing, which includes hired-purchase financing and mortgage loans for housing. They play an important role in the financial system by lending mostly to individuals and small businesses. Table 1 provides a comparison of the asset & liability structure of the commercial banks and finance companies in Singapore. In terms of size, the finance companies are much smaller than the commercial banks. Their major sources of funds are deposits from individuals and institutions, which account for more than 70% of total funding. In contrast, total deposits accounts for only 51% of commercial banks' total funding as at end-2002. Finance companies, moreover, are not allowed to accept demand deposits. The finance companies' major uses of funds are loans, which account for 79% of their total assets as at end-2002. They also place deposits with banks and other institutions. Finance companies are not allowed to make unsecured loans exceeding S$5,000 to any persons or

[2] Merchant banks in Singapore are non-depository financial institutions and, hence, are excluded in this study. There is, furthermore, no available interest rate data on merchant banks.

to deal in foreign currencies, gold or other precious metals or to acquire foreign currency denominated stocks or bonds. The commercial banks, in contrast, have a more diversified portfolio of assets. For example, the banks' total loans, which accounts for only 46% of their total assets, are generally more diversified across different sectors of the economy. The finance companies are nevertheless important players in the financial sector and their role in the financial intermediation process remains significant despite increasing competition from both the commercial banks and non-banking institutions recently.

INSERT TABLE 1 HERE

## 3. Conceptual Framework for Asymmetric Price Rigidities

Evidence of price rigidity has been well documented for a variety of industries in the developed countries. Among the earlier studies, Mills (1927), for example, used the Bureau of Labor Statistics data on prices collected for the construction of consumer price index (CPI) in the USA to examine the rigidities in wholesale prices for a whole range of goods. More recently, Cecchetti (1986) provides evidence on the rigidities in newsstand prices for magazines. Carlton (1986) examines the rigidities in the prices of industrial commodities and concludes that there are significant price rigidities in a number of industries, including the steel, chemical and cement industries. Kashyap (1995) similarly provides evidence of rigidities in the prices of retail catalogs. Peltzman (2000), moreover, finds in a more comprehensive study of 77 consumer and 165 producer goods that the odds are better than two to one that output prices tend to react faster to input price increases than decreases. Hannan and Berger (1991), Scholnick (1996), and Heffernan (1997), furthermore, provide evidence on the rigidities in the deposit rate and loan rate adjustments in the banking industry.

The rigidity in price adjustment may be due to several factors, namely: fixed menu cost, high switching cost, imperfect competition, and asymmetric information. Under the traditional menu costs hypothesis in economics, firms are reluctant to re-quote the prices of their products if changes in those prices are deemed to be very small (in comparison to the advertisement and promotional costs associated with re-pricing the products) and/or temporary in nature. Instead, firms tend to adjust their prices less frequently and by a larger amount when prices move away from the equilibrium level. The expected price rigidity under the menu costs hypothesis, however, is symmetric.[3]

Price rigidity is also affected by the existence of high switching costs. According to Heffernan (1997), uninformed customers are less likely to switch financial products and/or institutions in search of the best price or yield when there are (perceived or real) high switching costs.[4] The rigidity in prices, therefore, may be attributed to the banks' exploitation of consumers' inertia in switching financial products and/or institutions. Heffernan (1993), for example, provides evidence on banks' sophisticated price

[3] For more information on menu costs hypothesis and its economic implications, refer to Blinder (1994), Duta et al. (1999), and Mankiw (1985).
[4] Switching costs, in particular, tend to be high in market segments that require long-term relationship building and repeated transactions.

discrimination practices where the rates on certain banking products were initially offered at bargain or competitive level, but allowed to grow less competitive over time. If banks can price-discriminate to exploit customers' inertia, then rates are expected to be rigid upwards for customer deposits, but rigid downwards for loans.

Rigidities in interest rate adjustments can also be attributed to imperfect competition in the market (Hannan and Berger, 1991). Administered rates, for example, are likely to adjust more slowly in an uncompetitive market. Moreover, because of the collusive price arrangement among banks, rate adjustments in uncompetitive markets can be asymmetric. For example, in the presence of collusive pricing behavior, deposit rates are expected to be rigid upwards, while loan rates are expected to be rigid downwards.

Finally, loan rate adjustment can be sluggish due to the existence of asymmetric information. In Stiglitz and Weiss (1981) model, banks encounter both adverse selection and moral hazard problems when they are required to raise loan rates in response to rising wholesale market interest rates. Adverse selection problem arises because higher loan rates are more likely to attract clienteles that are of higher risk. Moral hazard problem arises because higher loan rates may increase existing borrowers' incentives to undertake high risks and high expected returns projects, in order to compensate for the higher borrowing cost. Increases in loan rates, therefore, may result in greater likelihood of default among existing borrowers. In view of these problems, banks are generally reluctant to raise loan rates significantly over a short period of time. Instead, the banks are more likely to ration the amount of credit extended when there is an upward pressure on loan rates. Loan rates, consequently, are expected to be more rigid upwards under Stiglitz and Weiss (1981) asymmetric information model.

Hence, given the above hypotheses, it is an empirical question as to whether the deposit rates and loan rates are more rigid upwards or downwards. A summary of the predicted price rigidities under the various hypotheses is given in Table 2 below. [5]

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INSERT TABLE 2 HERE

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According to the above hypotheses, it is likely that the rigidity in administered rates vary across different financial institutions and across different products. Variation in the price rigidities of different financial products is possible if financial institutions can selectively price-discriminate on certain products, depending on the relative level of customers' inertia or switching costs. Customer inertia for saving deposit, for example, may be greater than for time deposits. Price rigidities, therefore, are likely to be greater for

[5] Administered price rigidities in certain countries may be attributed to the direct and/or indirect government interventions. As a matter of national policies, governments in certain countries often protect their financial institutions by encouraging downward rigidities in loan rates and/or upward rigidities in deposit rates. Direct government interventions, for example, may be in the form of interest rates regulations, while indirect intervention may be in the form of regulatory moral suasions. At the same time, it is also not unusual for government in certain countries to intervene on behalf of borrowers by encouraging upward rigidity in loan rates or on behalf of consumers by encouraging downward rigidities in deposit rates. Hence, although price rigidities in certain countries may be attributed to government interventions, the expected direction of price rigidities is mixed i.e. depending on the relative political and economic influences of various special-interest groups (financial institutions, borrowers, or consumers). In Singapore, rate setting is seen as the operational decisions of financial institutions and the authority does not regulate both the deposit and lending rates.

products with greater customer inertia. As a result, such financial products will be less responsive to changes in market conditions.

Variation in price rigidities across different financial institutions is also likely if there are significant differences in the price setting behavior of financial institutions. In setting administered prices, some financial institutions may be price leaders, while others may be price followers. In such a price leader-follower paradigm, prices are anticipated to be more rigid for institutions that are of the price-followers type. Rigidities in prices across different institutions, furthermore, may be attributed to the relative inertia of customers, which form the institutions' client base. Institutions that have a higher percentage of inert customers, hence, are more likely to exhibit greater rigidities in administered prices.

Different factors, moreover, are likely to play a different role in the administered rates' (short-term and long-term) adjustment process. Switching cost and menu costs, for example, are more likely to be the primary factors in influencing the short-term adjustment speed whereas imperfect competition and asymmetric information are more likely to be the primary factors in affecting the long-term adjustment process.

## 4. Methodology

In this paper, we examine both the long-run and short-run dynamics of administered rate changes. First, the long-term relationship between the administered rate and the market rate is as follows:

$$y_t = \alpha_0 + \alpha_1 x_t + \varepsilon_t \qquad (1)$$

where $y_t$ represents the endogenous administered (lending or deposit) rates; $x_t$ denotes the corresponding interbank rate (which is assumed to be exogenous); $\varepsilon_t$ is the disturbance term; $\alpha_0$ and $\alpha_1$ are the model parameters. As discussed in Rousseas (1985), $\alpha_0$ measures the constant markup and $\alpha_1$ measures the degree of pass-through in the long term. The long-run adjustment is complete when $\alpha_1$ is equal to one. It is, however, incomplete ($\alpha_1$ is less than one) when markets are not fully competitive and when there are high switching and menu costs and/or asymmetric information.

Second, to examine the short-run dynamics of administered rate changes in response to changes in the market rate, we employed an error-correction methodology that is similarly used in Heffernan (1997) and Scholnick (1996). Using the error-correction model, we can test for differences in the administered rate adjustments when they are above or below their equilibrium level.[6] Finally, the error-correction model also allows us to determine how long it takes for the administered rates to fully adjust to changes in wholesale rates in the market.

Given that most time series data are non-stationary in nature (Granger and Newbold, 1986), the Engle-Granger (1987) cointegration and error-correction procedures can be applied to remove any spurious results. If the two series, $y_t$ and $x_t$, are found to be integrated of order one, I(1), and their linear combination is found to be stationary

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[6] Hannan and Berger (1991), in contrast, used the multinomial logit model to test for asymmetric rigidities in deposit rates.

(integrated or order zero, I(0)), then they are said to be cointegrated. In this case, the following error-correction representation exists:

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 (y_{t-1} - \alpha_0 - \alpha_1 x_{t-1}) + \nu_t \tag{2}$$

where $\Delta$ denotes first difference; $\beta_1$ measures the short-term pass-through rate, and $\nu_t$ is the error term. $\hat{\varepsilon}_{\mathbf{t-1}} = \left(\mathbf{y}_{\mathbf{t-1}} - \alpha_0 - \alpha_1 \mathbf{x}_{\mathbf{t-1}}\right)$, which represents the extent of disequilibrium at time $(t-1)$, is the residual of the long run relationship given by equation (1). $\beta_2$, hence, captures the error correction adjustment speed when the rates are away from their equilibrium level. In the mean reverting case, the sign of $\beta_2$ is expected to be negative.

Following Hendry (1995), the mean adjustment lag of a complete pass-through can be calculated as follows:

$$MAL = (1 - \beta_1) / \beta_2 \tag{3}$$

But, in order to incorporate the possibility of asymmetric adjustments in the administered rates when they are above or below their equilibrium levels, we use an indicator variable, $\lambda$. The indicator variable ($\lambda$) is equal to one if the residual error ($\hat{\varepsilon}_{\mathbf{t-1}} = \mathbf{y}_{\mathbf{t-1}} - \alpha_0 - \alpha_1 \mathbf{x}_{\mathbf{t-1}}$) is positive and 0 otherwise. The asymmetric short-run dynamic equations can, therefore, be written as:

$$\Delta y_t = \delta_1 \Delta x_t + \delta_2 \lambda \hat{\varepsilon}_{t-1} + \delta_3 (1 - \lambda) \hat{\varepsilon}_{t-1} + \eta_t \tag{4}$$

where $\delta_2$ captures the error correction adjustment speed when the rates are above their equilibrium values and $\delta_3$ captures the error correction adjustment speed when the rates are below their equilibrium values. To detect the presence of asymmetric adjustment, we use the standard Wald test to determine if $\delta_2$ is significantly different from $\delta_3$.

As with the symmetric adjustment case, we can define the asymmetric mean adjustment lags of a complete pass-through as follows:

$$ML^{+} = (1-\delta_1)/\delta_2 \qquad (5)$$

$$ML^{-} = (1-\delta_1)/\delta_3 \qquad (6)$$

where $ML^{+}$ represents mean adjustment lag when the administered rates are above their equilibrium value and $ML^{-}$ represents the mean adjustment lag when the administered rates are below their equilibrium value

## 5. Data and Analysis of Results

The monthly series of interest rate data for both the banks and finance companies in Singapore were taken from the *Monthly Statistical Bulletin*, which is regularly published by the Monetary Authority of Singapore (MAS), the de facto central bank of Singapore.[7] The sampling period, which is from January 1983 to December 2002, covers a time span of 20 years. The sample size is, therefore, 240 for each interest rate series.

In our study, the changes in monetary policy stance are proxied by the changes in the benchmark 3-month Singapore interbank offered rate (SIBOR) in the money market. As the de-facto central bank in Singapore, the Monetary Authority of Singapore (MAS) influences interest rate indirectly. As Singapore is a small and open economy, the government adopts a managed float exchange rate regime on a trade-weighted basis. The

[7] The data are freely available from the MAS website: www.mas.gov.sg.

MAS intervenes in the money market in order to maintain the band it has established for the Singapore dollar against the trade-weighted basket of currencies. Any changes in the domestic money market rates, hence, affect both the country's exchange rate and the financial institutions' deposit and loan rates.

For commercial banks, the benchmark lending rate is the prime rate (PRIME) and the referenced deposit rates are: the savings deposit rate (BSaving), the 3-month fixed deposit rate (BFD3), the 6-month fixed deposit rate (BFD6) and the 12-month fixed deposit rate (BFD12). For finance companies, the referenced administered rates are: the 15-year housing loan (HL), the 3-year hire purchase loans on new vehicle (HP), the savings deposit rate (FSaving), the 3-month fixed deposit rate (FFD3), the 6-month fixed deposit rate (FFD6) and the 12-month fixed deposit rate (FFD12).

Table 3 provides the descriptive statistics for the sample data. The deposit rates for both the banks and finance companies are positively related with maturity, indicating an upward sloping yield curve. Finance companies, moreover, tend to offer higher deposit rates than commercial banks. This is consistent with the fact that finance companies tend to rely more heavily on deposits as a source of funding and that finance companies have higher default risk than banks. As there is no deposit insurance scheme in Singapore, finance companies, which are much smaller than banks, have to pay a premium in order to attract deposits. The banks' and finance companies' lending rates are not comparable as they are a function of credit risk as well as funding costs.

INSERT TABLE 3 HERE

Table 4 shows the correlation coefficient among the variables**.** Correlation analysis yields three interesting results. First, in comparison to the loan rates, the deposit rates are, on average, more highly correlated with the SIBOR. Second, the correlation between the SIBOR and deposit rates tends to increase with the maturity of the deposit rates. Third, in comparison to the commercial banks, the finance companies' deposit rates are more highly correlated with the SIBOR, but their loan rates are less correlated with the SIBOR.

INSERT TABLE 4 HERE

In order to determine the dynamics of administered rate changes in response to changes in the benchmark market rate (SIBOR), we first carry out the Granger causality test to determine if changes in the SIBOR cause adjustments in the administered interest rates. Table 5 reports the results of the Granger causality test. As expected, changes in the SIBOR cause all the administered rates to change.

INSERT TABLE 5 HERE

Having determined the dependent and independent variables, we then carry out stationarity and cointegration tests to examine whether the various administered interest rates (lending rate and deposit rate) are cointegrated with the benchmark market rate (SIBOR). If the administered rates are cointegrated with the benchmark market rate, then there is a long-term relationship between the administered rates and the benchmark market rate. In other words, the administered rates are adjusted in response to changes in the benchmark market rate.

Prior to the cointegration tests, however, we must first establish the non-stationarity of the level of interest rate series and the stationarity of the first-differenced interest rate series. Both the Augmented Dickey Fuller (ADF) and Philips Perron (PP) procedures test the null hypothesis of unit root against the alternative hypothesis of stationarity. However, such unit-root tests tend to have low power in distinguishing between the null and the alternative (DeJong et al., 1992). As a consequence, we can also apply the KPSS procedure to test the null hypothesis that the interest rate series are stationary (Kwiatkowski et al., 1992). The results of the stationarity tests on the various interest rate series are summarized in Table 6. For the level of the series, the above three stationarity tests conclusively show that, at 5% level of significance, all the series are unit root non-stationary.[8] The results summarized in Table 6 also show that all the first differenced series are stationary. This implies that all the series have single unit-root. This is exactly the condition necessary for performing the cointegration tests.

[8] An exception is in the case of the finance companies' housing loan rate (HL) where the results are less conclusive because the non-stationarity of the level of the interest rate series is supported by both the ADF and KPSS tests, but not the PP test.

INSERT TABLE 6 HERE

The results of the cointegration tests are reported in Table 7. The ADF test results show that all the administered rates are cointegrated with the SIBOR at 10% significance level, except for the finance companies' hire purchase and housing loan rates. To test for robustness, we also run the Johansen's Trace and Lambda-Max tests, which are considered to be more powerful than the ADF test.[9] The results of the Johansen tests show that that all the administered rates are cointegrated with the SIBOR.

INSERT TABLE 7 HERE

The cointegration test results, hence, show that there is a statistically significant long-term relationship between the benchmark market rate (SIBOR) and the administered interest rates of both the commercial banks and the finance companies. The estimated coefficients of the long-term relationship (Equation 1) are reported in Table 8.

INSERT TABLE 8 HERE

[9] Johansen's tests are considered to be more powerful than the Engle-Granger's ADF test since they do not require an arbitrary assignment of one of the series to be left-hand side series.

The intercept of Equation 1 measures the markup whereas the slope measures the long-term rate of pass-through. As expected, the markup for loan rates is much higher than that of deposit rates. On average, the markup for loan rate is about 5% whereas for deposit rates, it is about less than 1%. As for the degree of pass-through, our results show that the pass-through for both the loans rates and deposit rates are not complete.[10] In the case of loan rates, it is about 50% (except for HP which is about 80%). The reason for the relatively higher pass-through rate on the hire-purchase loans is probably that the hire-purchase market is generally more competitive than the other loan markets as hire-purchase credits are also provided by non-financial institutions (such as the participating merchants themselves).

For deposit rates, their pass-through rate (which is in the range of 70% to 80%) is, on average, higher than that of the loan rates.[11] This is probably due to higher switching costs in the loan market as compared to the deposit market. As a result, it is easier for customer to switch banks when deposit rates are not competitive than when loan rates are not competitive. The relatively lower degree of pass-through for the loan rates, moreover, may be due to adverse selection and moral hazard reasons cited in the Stiglitz-Weiss (1981) asymmetric information model.

[10] The degree of the long-term pass-through is determined by the demand elasticity of deposits and loans to bank administered rates. It is less than one if the demand for loans or deposits is not fully elastic. The degree of the long-term pass-through is also influenced by the degree of market power. Rates in uncompetitive segments of the market adjust incompletely, resulting in a degree of pass-through that is less than one.

[11] The difference in the pass-through rate for the deposit rates and the loan rates is found to be statistically significant using the Wald test. The detailed results of the Wald tests are available from the authors upon request.

The long-term adjustment results also show that the pass-through rate on finance companies' deposit rates is statistically higher than that of the commercial banks.[12] For example, the pass-through rate on finance companies' and banks' saving deposits are, respectively, 84% and 75%. The average pass-through rate on finance companies' and banks' fixed deposits are, respectively, 79% and 72%. This result may be attributed to the fact that finance companies (in comparison to commercial banks) are smaller and riskier and tend to rely more on deposits as a primary source of funding. The finance companies, hence, are required to compete more aggressively for deposits by not only offering higher deposit rates, but also re-adjusting their rates more frequently to changes in the market rates.

Among the deposit rates, the pass-through rate on the finance companies' savings deposit rates is statistically higher than that of its fixed deposit rates. This result may be attributed to competitive reasons where financial institutions tend to compete more for savings deposit, which is less costly and considered as core deposit, than for fixed deposits. We, however, do not find any statistical difference in the pass-through rates among the finance companies' fixed deposit rates of various maturities as well as among the banks' fixed deposit rates.[13]

As the administered rates are found to be cointegrated with the benchmark market rate (SIBOR), the proper short-run dynamics is given by the error-correction model. The results of the symmetric ECM (Equation 2) are reported in Table 9. As expected, all the

[12] The detailed results of the statistical tests are available from the authors upon request.
[13] The detailed results of the (Wald) statistical tests are available from the authors upon request.

estimates of $\beta_2$ are found to be negative and statistically significant. The results show that the administered rates are mean-reverting to long-run equilibrium. In other words, the rates will adjust upwards when they are below the equilibrium level and adjust downwards when the rates are above their equilibrium levels.

INSERT TABLE 9 HERE

It is widely known that market interest rates follow a mean-reverting process, but the short-term adjustment speed is not necessarily the same when the rates are above their equilibrium level as when they are below. The results for the asymmetric ECM (Equation 4) are reported in Table 10. Comparing $\delta_2$ and $\delta_3$, we find that both the banks and finance companies adjust their deposit and loan rates downwards faster than they adjust them upwards. The difference, as indicated by the Wald test, is statistically significant for all the administered rates, with the exception for the 12-month fixed deposit rates and hire-purchase loan rates (HP).

INSERT TABLE 10 HERE

The issue of different adjustment speed is further examined with the estimation of mean adjustment lags (MAL) for both the symmetric and the asymmetric models. The mean adjustment lags of the commercial banks' and finance companies' administered rates are reported in Table 11.

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The results in Table 11 show that the short-run adjustment speed differs across financial products as well as across financial institutions. For example, we find that the short-run adjustment speed for the deposit rates is, on average, faster than that of loan rates.[14] In the case of the commercial banks, their fixed deposit rates' MAL is about 6.6 months, but their prime rates' MAL is about 8.3 months. The MAL for finance companies' fixed deposit rates is about five months, while the MAL for their (HP and HL) loan rates is, on average, about 16 months. This finding is consistent with the earlier long-run adjustment result as well as the correlation result, which shows that, in comparison to the loan rates, the deposit rates are more highly correlated with the SIBOR. The likely reasons for this result, as pointed out earlier, may be the relatively higher switching costs as well as potential adverse selection and moral hazard problems in the loan market.

Among the deposit rates, we find that the mean adjustment lag for both the banks' and finance companies' savings deposit rates is much longer than the mean adjustment lag for the fixed deposit rates. It takes about 13 months for the savings deposit rates to adjust to the long-term equilibrium level, but only about six months for the fixed deposit rates to

[14] The difference in the short-run adjustment speed is statistically significant and may be attributed to differences in both the short-run pass through rate and the error correction adjustment speed. The details of the statistical tests are available from the authors upon request.

do so.[15] The likely reason for this finding may be that the adjustment process in the short-run is more likely to be driven by switching costs consideration. For example, savings deposits are generally held for transaction purposes and, hence, are less sensitive to changes in interest rates. The longer maturity fixed deposits, in contrast, are more sensitive to changes in interest rates as they are mostly held for investment purposes.

The results on short-run adjustments (Table 11) also show that, in comparison to the commercial banks, the finance companies are quicker in adjusting their deposit rates, but slower in adjusting their loan rates.[16] In the case of fixed deposit rates, finance companies' mean adjustment lags are slightly shorter than those of banks. The mean adjustment lags are around five months for finance companies and about six months for commercial banks.[17] The reason for this result again is probably because the finance companies, in comparisons to commercial banks, rely more heavily on deposits as a primary source of funding. But being smaller and riskier, the finance companies have to compete aggressively for deposits. The finance companies, as a consequence, not only offer higher interest rates, but also are quicker in adjusting their deposit rates back to the equilibrium level in response to changes in market interest rates. In general, our finding here is consistent with previous findings on bank lending channel where monetary policy is found to be transmitted mostly through small banks that are either illiquid or

[15] Both the short-run pass through rate and the error correction adjustment speed are found to be statistically different for the saving deposits and the fixed deposits. The details of the statistical tests are available from the authors upon request.

[16] This finding is consistent with the earlier long-run adjustment result as well as the correlation result.

[17] Statistical (Wald) tests show that the difference in the finance companies' and banks' MAL for fixed deposits is mostly attributed to statistical differences in the error correction adjustment speed, rather than the pass through rate in the short-run. The detailed results of the statistical tests are available from the authors upon request.

undercapitalized (Kashyap and Stein, 2000; Kishan and Opiela, 2000; Altunbas et al., 2002; Kakes and Sturm, 2002).

Our result on the dynamics of loan rates, however, shows that the finance companies are, on average, slower than the banks in adjusting their loan rates. For example, the mean adjustment lags for finance companies' hire-purchase loans (HP) and housing loans (HL) are about 12 months and 20 months, respectively. The mean adjustment lag for the banks' prime rate, in contrast, is about eight months.[18] This result may be attributed to the fact that the finance companies' loan customers are subjected to greater switching costs, in comparisons to the banks' loan customers. Customers that borrow from the finance companies, for example, are likely to be riskier because the finance companies (which also lack the economies of scale) often respond to competition from the banks by taking on higher credit risk. The finance companies, as a consequence, tend to charge higher loan rates and, by adverse selection, the finance companies' loan customers are likely to be those retail customers who had been denied credit by the banks. Those who borrow from the finance companies, hence, are somewhat less sensitive to the rates charged by the finance companies.

The above finding, hence, shows that it is not true in general that monetary policy is transmitted mostly through the smaller financial institutions. On the contrary, we find that in the loan market, the larger financial institutions (commercial banks) are quicker in

[18] The difference in the finance companies' and banks' short-run adjustment speed for the loan rates is statistically significant and may be attributed to differences in both the short-run pass through rate and the error correction adjustment speed. The detailed results of the statistical tests are available from the authors upon request.

transmitting the effect of a change in monetary policy via changes in the loan rates. The smaller financial institutions (finance companies), in contrast, are relatively slower in adjusting their loan rates. Instead, as found in previous studies on the bank lending channel, the smaller financial institutions are more likely to adjust their balance sheet items, such the amount of loans outstanding. In other words, in response to a change in monetary stance, financial institutions have a choice of adjusting their administered rates and/or their balance sheet. In the loan market, the larger financial institutions are more likely to respond via the administered rates channel whereas the smaller financial institutions are more likely to respond via the bank lending channel.

Finally, the results in Table 11 show that the mean adjustment lags for all the deposit rates and the lending rates are shorter when the rates are above the long-term equilibrium level than when they are below. For example, the mean adjustment lag for the loan rates, on average, is about 11 months when the rates are above their equilibrium level and is about 18 months when the rates are below. The upward rigidity in the loan rates, in particular, is consistent with the credit rationing hypothesis cited in the Stiglitz and Weiss (1981) asymmetric information model where financial institutions are more reluctant to adjust their loan rates upwards because of the adverse selection and moral hazard problems associated with higher loan rates. Rather than charging borrowers higher rates, banks may be reluctant to lend, resulting in credit rationing and slower loan growth.

There is similarly an upward rigidity in the deposit rates. The mean adjustment lag for the deposits rates, on average, is about six months when the rates are above their equilibrium level and is about 10 months when the rates are below. This finding is consistent with both the switching costs and imperfect competition hypotheses. Customer deposits, for example, are subjected to significant switching costs if they are held primarily for transaction purposes. Financial institutions, as a consequence, are able to exploit deposit customers' inertia by being quicker in reducing the deposit rates when they are above the equilibrium level than in raising the deposit rates when they are below. Furthermore, the existence of imperfect competition in the deposit market, if any, can give rise to collusive pricing practices among the financial institutions. Financial institutions, as a consequence, are likely to reduce deposit rates much faster than they increase the rates when there is imperfect competition in the deposit market.

## 6. Conclusions

There are two possible approaches to study the role of depository financial institutions in the monetary transmission mechanism. One approach is to examine how monetary policy is transmitted through the bank lending channel. Another approach, which is undertaken in this study, is to examine how monetary policy is transmitted through the administered rates channel.

The evidence provided in this paper shows that the adjustment of administered rates in response to changes in market rate tends to be asymmetric and varies across different financial institutions and across different financial products. Adjustments in loan rates, for example, tend to be more sluggish than that of deposit rates. The finance companies, moreover, are quicker in adjusting their deposit rates than the commercial banks, but are slower in adjusting their loan rates. Financial institutions, furthermore, are quicker to decrease both their lending and deposit rates in a falling interest rate environment and are slower to raise their administered rates in a rising interest rate environment. The finding of this paper, hence, has important implications for the conduct of monetary policy as it implies that the speed of monetary transmission is not uniform across all sectors of the economy and that a tightening monetary policy takes a longer time to impact the economy than an expansionary monetary policy.

This paper also provides additional evidence on the relative validity of the various hypotheses (summarized in Table 2) on price rigidities. Our finding on the upward rigidity in the loan rates, for example, is consistent with the prediction of the credit rationing hypothesis cited in the Stiglitz and Weiss (1981) asymmetric information model, but is inconsistent with the predictions of both the imperfect competition and switching costs hypotheses on the dynamics of loan rate adjustments. The imperfect competition and switching costs hypotheses, in contrast, are more applicable in explaining the upward rigidity in the deposit rate adjustments. The menu costs hypothesis, which is applicable in explaining the sluggishness in price adjustments, cannot explain the asymmetric rigidities in either the deposit or loan rates.

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Table 1
Asset and Liability Structure for All Commercial Banks and Finance Companies

| As at December 2002 (S$ millions) | **Commercial Banks** | | **Finance Companies** | |
|---|---|---|---|---|
| Demand deposits | 25,178 | 7% | 0 | 0% |
| Savings deposits | 66,691 | 19% | 223 | 2% |
| Fixed deposits | 87,879 | 25% | 9,612 | 70% |
| *up to 1 month* | *40,078* | *11%* | *n.a.* | |
| *over 1 to 3 months* | *17,589* | *5%* | *n.a.* | |
| *over 3 to 6 months* | *11,804* | *3%* | *n.a.* | |
| *over 6 to 12 months* | *14,310* | *4%* | *n.a.* | |
| *over one year* | *4,099* | *1%* | *n.a.* | |
| Other deposits | 390 | 0% | 21 | 0% |
| **Total Deposits** | **180,138** | **51%** | **9,856** | **72%** |
| Amount due to Banks | 106,060 | 30% | *n.a.* | |
| Other liabilitiess | 36,356 | 10% | 1,755 | 13% |
| Shareholders funds | 30,561 | 9% | 2,111 | 15% |
| **Total Liabilities & Shareholders funds** | **353,115** | **100%** | **13,722** | **100%** |
| | | | | |
| **Total Loans** | **161,283** | **46%** | **10,816** | **79%** |
| *Housing* | *44,719* | *13%* | *1,548* | *11%* |
| *Hire Purchase* | *n.a.* | | *4,034* | *29%* |
| *Other loans & advances* | *116,564* | *33%* | *5,234* | *38%* |
| Amount due from banks | 96,808 | 27% | 1,346 | 10% |
| Other assets | 95,024 | 27% | 1,561 | 11% |
| **Total Assets** | **353,115** | **100%** | **13,722** | **100%** |

Note:

Table 1 shows the consolidated asset and liability structure of all commercial banks and finance companies in Singapore. Finance companies rely mostly on fixed deposits as a source of funds whereas commercial banks can attract demand and savings deposits as well as fixed deposits.

All figures are as at December 2002 (in S$ millions). Offshore banking transactions are not included in the table as banks are required to keep a separate book for tax purpose.

Source: Monthly Statistical Bulletin, December 2002.

Table 2: Summary of Predicted Price Rigidity

| **Hypothesis** | **Symmetric/Asymmetric Price Adjustments** | **Rigidity in Deposit Rates** | **Rigidity in Loan Rates** |
|---|---|---|---|
| Menu costs | Symmetric | Same | Same |
| Imperfect competition | Asymmetric | Rigid upwards | Rigid downwards |
| Switching costs | Asymmetric | Rigid upwards | Rigid downwards |
| Asymmetric information | Asymmetric | n.a. | Rigid upwards |

Table 3
Descriptive Statistics of the Interbank Rate and Administered Interest Rates

| | | Commercial Banks | | | | | Finance Companies | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SIBOR | Lending Rate | Deposit Rates | | | | Lending Rates | | Deposit Rates | | | |
| | 3-month interbank | Prime rate | Savings rate | 3-month Deposit | 6-month Deposit | 12-month Deposit | Hire Purchase | Housing Loan | Savings rate | 3-month Deposit | 6-month Deposit | 12-month Deposit |
| Mean | 0.040 | 0.067 | 0.03 | 0.035 | 0.037 | 0.04 | 0.078 | 0.075 | 0.033 | 0.036 | 0.039 | 0.043 |
| Median | 0.036 | 0.063 | 0.028 | 0.033 | 0.037 | 0.04 | 0.074 | 0.068 | 0.028 | 0.032 | 0.036 | 0.04 |
| Maximum | 0.084 | 0.103 | 0.075 | 0.076 | 0.076 | 0.076 | 0.127 | 0.124 | 0.079 | 0.081 | 0.082 | 0.082 |
| Minimum | 0.008 | 0.053 | 0.004 | 0.008 | 0.011 | 0.013 | 0.051 | 0.061 | 0.005 | 0.007 | 0.01 | 0.013 |
| Std. Dev. | 0.019 | 0.012 | 0.017 | 0.016 | 0.015 | 0.015 | 0.02 | 0.016 | 0.018 | 0.017 | 0.016 | 0.016 |

Table 4
Correlation Coefficient among the Rates

| | PRIME | BSAVING | BFD3 | BFD6 | BFD12 | HP | HL | FSAVING | FFD3 | FFD6 | FFD12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SIBOR | 0.8259 | 0.8443 | 0.8762 | 0.8871 | 0.9027 | 0.7471 | 0.6461 | 0.8597 | 0.9147 | 0.9141 | 0.9181 |
| PRIME | | 0.9370 | 0.9531 | 0.9516 | 0.9391 | 0.8592 | 0.8806 | 0.9185 | 0.9474 | 0.9487 | 0.9332 |
| BSAVING | | | 0.9502 | 0.9470 | 0.9451 | 0.9059 | 0.9036 | 0.9883 | 0.9577 | 0.9559 | 0.9528 |
| BFD3 | | | | 0.9976 | 0.9882 | 0.8716 | 0.8223 | 0.9301 | 0.9888 | 0.9884 | 0.9784 |
| BFD6 | | | | | 0.9950 | 0.8577 | 0.8049 | 0.9300 | 0.9898 | 0.9921 | 0.9850 |
| BFD12 | | | | | | 0.8400 | 0.7845 | 0.9321 | 0.9873 | 0.9922 | 0.9927 |
| HP | | | | | | | 0.9123 | 0.9173 | 0.8885 | 0.8740 | 0.8580 |
| HL | | | | | | | | 0.8883 | 0.8189 | 0.8116 | 0.7941 |
| FSAVING | | | | | | | | | 0.9546 | 0.9512 | 0.9494 |
| FFD3 | | | | | | | | | | 0.9980 | 0.9912 |
| FFD6 | | | | | | | | | | | 0.9959 |

Notes:
PRIME = Prime rate for commercial banks.
BSAVING = Savings rate for banks
BFD3 = 3-month fixed (time) deposit rate for banks
BFD6 = 6-month fixed (time) deposit rate for banks
BFD12 = 12-month fixed (time) deposit rate for banks
HP = Hire-purchase loan rate for finance companies
HL = Housing loan rate for finance companies
FSAVING = Savings rate for finance companies
FFD3 = 3-month fixed deposit rate for finance companies
FFD6 = 6-month fixed deposit rate for finance companies
FFD12 = 12-month fixed deposit rate for finance companies

Table 5
Pair-wise Granger Causality Tests

| Null Hypothesis | F-Statistic | P-value |
|---|---|---|
| SIBOR does not Granger Cause PRIME | 5.48411 | 4.5E-08 |
| SIBOR does not Granger Cause BSAVING | 5.05468 | 2.4E-07 |
| SIBOR does not Granger Cause BFD3 | 5.45097 | 5.1E-08 |
| SIBOR does not Granger Cause BFD6 | 5.68343 | 2.1E-08 |
| SIBOR does not Granger Cause BFD12 | 5.84737 | 1.1E-08 |
| SIBOR does not Granger Cause HP | 5.39272 | 6.4E-08 |
| SIBOR does not Granger Cause HL | 4.00918 | 1.4E-05 |
| SIBOR does not Granger Cause FSAVING | 5.70441 | 1.9E-08 |
| SIBOR does not Granger Cause FFD3 | 6.17682 | 3.1E-09 |
| SIBOR does not Granger Cause FFD6 | 6.74938 | 3.5E-10 |
| SIBOR does not Granger Cause FFD12 | 6.68253 | 4.5E-10 |

Notes:

The table shows that changes in the three-month SIBOR cause all administered interest rates to change (based on pair-wise test).

PRIME = Prime rate for commercial banks.
BSAVING = Savings rate for banks
BFD3 = 3-month fixed (time) deposit rate for banks
BFD6 = 6-month fixed (time) deposit rate for banks
BFD12 = 12-month fixed (time) deposit rate for banks
HP = Hire-purchase loan rate for finance companies
HL = Housing loan rate for finance companies
FSAVING = Savings rate for finance companies
FFD3 = 3-month fixed deposit rate for finance companies
FFD6 = 6-month fixed deposit rate for finance companies
FFD12 = 12-month fixed deposit rate for finance companies

Table 6
Unit Root Tests on level and first differenced Series

| | Critical Values | | | SIBOR | Prime | BFD3 | BFD6 | BFD12 | BSaving | HP | HL | FFD3 | FFD6 | FFD12 | FSaving |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Level** | | | | | | | | | | | | | | | |
| | 1% | 5% | 10% | | | | | | | | | | | | |
| ADF | -3.458 | -2.873 | -2.573 | -2.134 | -2.253 | -1.893 | -1.954 | -1.773 | -1.542 | -2.197 | -2.607 | -1.838 | -1.908 | -1.744 | -1.542 |
| PP | -3.458 | -2.873 | -2.573 | -2.202 | -2.385 | -1.900 | -1.802 | -1.714 | -1.551 | -2.203 | -3.337 | -1.854 | -1.793 | -1.731 | -1.594 |
| KPSS | 0.739 | 0.463 | 0.347 | 1.238 | 0.931 | 1.089 | 1.101 | 1.158 | 1.446 | 1.434 | 1.104 | 1.274 | 1.247 | 1.289 | 1.632 |
| **First-Differenced** | | | | | | | | | | | | | | | |
| | Critical Values | | | SIBOR | Prime | BFD3 | BFD6 | BFD12 | BSaving | HP | HL | FFD3 | FFD6 | FFD12 | FSaving |
| | 1% | 5% | 10% | | | | | | | | | | | | |
| ADF | -3.458 | -2.873 | -2.573 | -14.617 | -8.672 | -8.360 | -8.326 | -8.500 | -8.563 | -9.564 | -6.157 | -8.337 | -8.329 | -8.470 | -8.348 |
| PP | -3.458 | -2.873 | -2.573 | -14.602 | -8.716 | -8.381 | -8.326 | -8.500 | -8.525 | -9.833 | -8.744 | -8.392 | -8.329 | -8.537 | -8.342 |
| KPSS | 0.739 | 0.463 | 0.347 | 0.033 | 0.094 | 0.061 | 0.060 | 0.065 | 0.085 | 0.078 | 0.415 | 0.054 | 0.059 | 0.064 | 0.098 |

Notes:

Both ADF and PP consider unit-root as the null hypothesis whereas KPSS uses stationary as the null hypothesis.

At 5% level of significance, all tests indicate that all the series are unit-root except for the PP test for HL (i.e., we accept the null hypothesis for ADF and PP tests and reject the null hypothesis for KPSS). Therefore, all the series can be considered as unit root series.

The same tests on first-differenced series indicate that all the series are stationary (i.e., we reject the null hypothesis for ADF and PP tests and accept the null hypothesis for KPSS).

Table 7

Cointegration Test

| | ADF | Trace h=0 | Trace h=1 | Lambda Max h=0 | Lambda Max h=1 |
|---|---|---|---|---|---|
| Prime | -3.169 | 29.593 | 5.211 | 24.382 | 5.211 |
| BSaving | -3.197 | 28.178 | 3.799 | 24.380 | 3.799 |
| BFD3 | -3.729 | 29.257 | 4.615 | 24.643 | 4.615 |
| BFD6 | -3.877 | 31.674 | 4.537 | 27.137 | 4.537 |
| BFD12 | -4.197 | 33.303 | 4.007 | 29.296 | 4.007 |
| HP | -2.814 | 26.795 | 4.801 | 21.994 | 4.801 |
| HL | -2.781 | 38.484 | 4.932 | 33.553 | 4.932 |
| FSaving | -3.466 | 33.648 | 3.897 | 29.751 | 3.897 |
| FFD3 | -4.583 | 36.146 | 4.311 | 31.835 | 4.311 |
| FFD6 | -4.569 | 36.115 | 4.249 | 31.866 | 4.249 |
| FFD12 | -4.714 | 34.430 | 3.799 | 30.632 | 3.799 |
| Critical Values | | | | | |
| 1% | -3.9618 | 24.6 | 24.6 | 20.2 | 20.2 |
| 5% | -3.3654 | 19.96 | 19.96 | 15.67 | 15.67 |
| 10% | -3.0657 | 17.58 | 17.58 | 13.75 | 13.75 |

Notes:

The ADF test is based on the residual from the simple regressions of administered rate variables on SIBOR (with constant). According to the ADF tests, HP and HL rates are not cointegrated with the SIBOR at 10% and Prime rate is not cointegrated with SIBOR at 5% (but cointegrated at 10%). However, Johansen's Trace and Lambda-Max tests suggest that they are all cointegrated with the SIBOR. The Johansen's test is considered more powerful than the Engle-Granger's ADF test because the Johansen's test does not require an arbitrary assignment of one of the series to be the left-hand side series.

Table 8
Long-term relationship and the degree of pass-though in the long

$$y_t = \alpha_0 + \alpha_1 x_t + \varepsilon_t$$

| | Markup | Degree of pass-through |
|---|---|---|
| Prime | 0.045 | 0.531 |
| BSAVING | 0.000 | 0.746 |
| BFD3 | 0.005 | 0.733 |
| BFD6 | 0.008 | 0.719 |
| BFD12 | 0.012 | 0.716 |
| HP | 0.045 | 0.805 |
| HL | 0.053 | 0.533 |
| FSAVING | -0.001 | 0.839 |
| FFD3 | 0.004 | 0.806 |
| FFD6 | 0.007 | 0.785 |
| FFD12 | 0.012 | 0.772 |

Markup is measured by the intercept, $\alpha_0$, and the degree of pass-through is measured by the slope, $\alpha_1$.

Table 9
Short-term Dynamics between Administered Interest Rates and Interbank Rate

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 \hat{\varepsilon}_{t-1} + \nu_t$$

| | Beta_1 | T-value | Beta_2 | T-value | Mean lag |
|---|---|---|---|---|---|
| | | Commercial Banks | | | |
| Prime | 0.0969 | 5.330 | -0.1085 | -8.164 | 8.3 |
| BSaving | 0.0957 | 5.868 | -0.0684 | -7.494 | 13.2 |
| BFD3 | 0.1407 | 6.199 | -0.1231 | -8.251 | 7.0 |
| BFD6 | 0.1371 | 6.550 | -0.1307 | -8.822 | 6.6 |
| BFD12 | 0.1390 | 7.152 | -0.1398 | -9.259 | 6.0 |
| | | Finance Companies | | | |
| HP | 0.0453 | 1.563 | -0.0773 | -7.210 | 12.4 |
| HL | 0.0078 | 0.590 | -0.0510 | -9.224 | 19.5 |
| FSaving | 0.0864 | 5.664 | -0.0718 | -8.859 | 12.7 |
| FFD3 | 0.1598 | 7.347 | -0.1739 | -10.751 | 4.8 |
| FFD6 | 0.1498 | 7.236 | -0.1712 | -10.876 | 5.0 |
| FFD12 | 0.1437 | 7.353 | -0.1624 | -10.454 | 5.3 |

$\beta_1$ is the short-term pass-through rate and $\beta_2$ captures the error correction adjustment speed. Mean lag = $\frac{1-\beta_1}{\beta_2}$

Table 10
Asymmetric Adjustment Speed

$$\Delta y_t = \delta_1 \Delta x_t + \delta_2 \lambda \hat{\varepsilon}_{t-1} + \delta_3 (1-\lambda) \hat{\varepsilon}_{t-1} + \eta_t$$

| | delta_1 | T-value | delta_2 | T-value | delta_3 | T-value | Wald | p value | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Commercial Banks | | | | | |
| Prime | 0.0953 | 5.253 | -0.1309 | -6.901 | -0.0873 | -4.739 | 2.721 | 0.0991 | * |
| BSaving | 0.0934 | 5.754 | -0.0866 | -6.879 | -0.0487 | -3.730 | 4.360 | 0.0368 | ** |
| BFD3 | 0.1382 | 6.131 | -0.1561 | -7.358 | -0.0917 | -4.436 | 4.720 | 0.0298 | ** |
| BFD6 | 0.1349 | 6.468 | -0.1584 | -7.631 | -0.1025 | -4.892 | 3.583 | 0.0584 | * |
| BFD12 | 0.1379 | 7.072 | -0.1524 | -7.415 | -0.1250 | -5.595 | 0.809 | 0.3685 | |
| | | | | Finance Companies | | | | | |
| HP | 0.0456 | 1.574 | -0.0901 | -5.885 | -0.0650 | -4.348 | 1.372 | 0.2415 | |
| HL | 0.0064 | 0.493 | -0.0678 | -8.991 | -0.0330 | -4.219 | 10.226 | 0.0014 | *** |
| FSaving | 0.0838 | 5.556 | -0.0938 | -8.318 | -0.0496 | -4.370 | 7.637 | 0.0057 | *** |
| FFD3 | 0.1566 | 7.266 | -0.2154 | -9.315 | -0.1357 | -6.113 | 6.184 | 0.0129 | ** |
| FFD6 | 0.1469 | 7.130 | -0.2043 | -9.098 | -0.1399 | -6.411 | 4.213 | 0.0401 | ** |
| FFD12 | 0.1422 | 7.267 | -0.1818 | -8.389 | -0.1419 | -6.376 | 1.647 | 0.1994 | |

Notes:

The null hypothesis for the Wald test is $H_0 : \delta_2 = \delta_3$, i.e., there is no significant difference in the adjustment speeds when the rates are above and below their equilibrium level.

In almost all cases, we can reject the null hypothesis that there is no significant difference in the adjustment speeds at the 10% confidence level. The only exception is in the case of the 12-month fixed deposit rates for both the banks and finance companies and the finance companies' hire-purchase rate where the Wald test failed to reject the null hypothesis at the 10% confidence level..

* significant at 10%, ** significant at 5% and *** significant at 1%

Table 11
Mean adjustment lags (MAL) in months

| | Symmetric Model | Asymmetric Model | |
|---|---|---|---|
| | | Above the mean | Below the Mean |
| Commercial Banks | | | |
| Prime | 8.3 | 6.9 | 10.4 |
| BSaving | 13.2 | 10.5 | 18.6 |
| BFD3 | 7.0 | 5.5 | 9.4 |
| BFD6 | 6.6 | 5.5 | 8.4 |
| BFD12 | 6.2 | 5.7 | 6.9 |
| Finance Companies | | | |
| HP | 12.4 | 10.6 | 14.7 |
| HL | 19.5 | 14.7 | 30.1 |
| FSaving | 12.7 | 9.8 | 18.5 |
| FFD3 | 4.8 | 3.9 | 6.2 |
| FFD6 | 5.0 | 4.2 | 6.1 |
| FFD12 | 5.3 | 4.7 | 6.0 |