

# AN ALTERNATIVE APPROACH TO ANALYZE THE MONETARY TRANSMISSION IN TURKEY: AN EMPIRICAL ANALYSIS ON SPEED OF ADJUSTMENT

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## ABSTRACT

Monetary transmission mechanism has a crucial role on the effectiveness of monetary policy. Changes in policy interest rates impact real variables through the channels of the mechanism and are transmitted to retail banking interest rates with lags that could be summarized in speed of adjustment level. We offer a model to estimate the parameter so called “speed of adjustment” and make a comparative analysis using time varying speed of adjustment for bank loans interest rates to the policy interest rates in the Turkish economy.

**Keywords:** Monetary policy, policy rate, interest rate pass-through, bank loans, Hull-White model, Kalman filter

**Jel Code:**E43, E52, E58

## TÜRKİYE’DE PARASAL AKTARMA ANALİZİNE FARKLI BİR YAKLAŞIM: UYUM HIZI ÜZERİNE AMPİRİK BİR ANALİZ

### ÖZ

Parasal aktarma mekanizmasının para politikasının etkililiği üzerinde hayati rolü vardır. Politika faiz oranındaki değişiklikler reel büyüklüklere bu mekanizmanın kanalları vasıtası ile tesir eder. Bu gecikmeler ile ilgili olarak kullanılan faiz oranı geçişkenliği kavramı, piyasa ve banka faizlerinin politika faizine uyumunun derecesini ve hızını tanımlar. Bu çalışmada uyum hızı parametresinin tahmin edilebileceği bir model önerilerek, Türkiye’de banka kredi faizlerinin politika faizine dinamik uyum hızı karşılaştırmalı olarak analiz edilmektedir.

**Anahtar Kelimeler:** Para politikası, politika faizi, faiz oranı geçişkenliği, banka kredileri, Hull-White modeli, Kalman filtresi

**Jel Kodu:** E43, E52, E58

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## 1. Introduction

In economics, it is accepted by a majority that, at least in the short run, monetary policy can significantly influence the course of the real economy. In recent years we have seen central banks in many countries following a strategy of high interest rates in order to prevent an increase in inflation arising from an overheated economy. We have also witnessed many central banks pursuing a strategy of low interest rates for raising aggregate demand in recession conditions. In order to be successful in such an enterprise, the monetary authorities have to know that from which channels the mechanism work and to what degree it affects.

The mechanism that transmits monetary authority's policy actions to the real sector is called as monetary transmission mechanism. Central bank as the monetary authority wishes this mechanism to allow itself to steer the economy in the desired direction. Monetary transmission mechanism is actually quite complex in point of interaction among the components of monetary ground and the real economy. Bernanke and Gertler (1995) describe this mechanism as a "black box" and they emphasize that it is impossible to estimate precisely what there is in the box.

Recent years, central banks operate to affect economies with short term interest rates as the main policy tool in inflation targeting framework. Changes in the policy interest rates have influence on real variables through the channels of transmission mechanism where explained in the second section of the study. However, changes in the policy interest rates firstly affect financial markets by modifying to market interest rates. Later, banks start to change their interest rates on deposits and credits. This means, changes in the policy interest rates are transmitted to retail banking interest rates with lags. Our main issue in this study, the interest rate pass through what is related to these lags and defined as the degree and the speed of adjustment of market and retail bank rates to the policy interest rates. The degree and the speed of this process is crucial on the effectiveness of monetary transmission mechanism because, it is essential for an inflation targeter central bank to understand how, by how much, and over what period changes in the policy interest rates affect aggregate expenditures and so inflation. From this point of view, the third section of the paper includes the determinants of interest rate pass through and its literature.

The purpose of the study is to offer an alternative tool to study the interest rate pass through for Turkey. For this purpose, we employ a time varying mean reversion model in which the parameter so called "speed of adjustment" could be estimated. We make a comparative analysis on estimated speed of adjustment levels for bank loans to the policy interest rates. The empirical results of the issue are in the fourth section of the study. Finally, in the conclusion part, there is a comment of these results and the study as a whole.

## 2. The Channels of Monetary Transmission

Views in the literature about monetary transmission mechanism working are separated into two main approaches. While Keynesian economics argues that monetary transmission works through interest rates, Monetarism claims that changes in asset prices has another crucial role in the mechanism.

Mishkin (1996) practically describes the various channels through which monetary policy actions impact real variables. The channels of transmission could complement each other and work simul-

taneously. Initially, the interest rate channel of monetary transmission mechanism can be explained by using Keynesian IS-LM model. An expansionary monetary policy leading to a fall in real interest rates, which in turn lowers the cost of capital, causing a rise in investment spending that also includes housing and consumer durable expenditure, thereby leads to an increase in aggregate demand and a rise in output. Here, the first important point is that the real interest rate plays crucial role in the private sector's decisions on expenditure not the nominal interest rate. The second considerable matter is that the real long-term interest rate and not the short-term interest rate is viewed as having the major impact on spending. In such a way that, a policy-induced decrease in the short-term nominal interest rate lowers the short-term real interest rate when the rational expectations are considered. The expectations hypothesis of the term structure, which states that the long-term interest rate is an average of expected future short-term interest rates, suggests that the lower real short-term interest rate leads to a fall in the real long-term interest rate. Firms, finding that their real cost of borrowing over all horizons has decreased, raise their investment expenditures. Likewise, households facing lower real borrowing costs heighten their purchases of homes, automobiles, and other durable goods. In this way, aggregate output and employment rise.

In open economies, additional real effects of a policy-induced decrease in the short term real interest rate come about through the exchange rate channel. In such a way that, when domestic real interest rates fall, domestic currency deposits become less attractive relative to deposits denominated in foreign currencies. This brings about a fall in the value of domestic currency deposits relative to other currency deposits. The rising foreign currency demand leads the depreciation of the domestic currency. Furthermore, the lower value of the domestic currency makes domestic goods cheaper than foreign goods, thereby causing a rise in net exports and hence in aggregate output.

The third response to a monetary policy appears from the changes in equity prices. This channel can be explained by Tobin's  $q$ -theory of investment and Modigliani's life-cycle theory of consumption. Tobin (1969) defines  $q$  as the ratio of market value of firms to the replacement cost of the physical capital. If  $q$  is bigger than 1, this means the market price of firms is high relative to the replacement cost of capital, and so, new plant and equipment capital is cheap relative to the market value of firms. Thus, companies can issue equity and get a high price for it relative to the cost of the new physical capital. Hereby, investment spending will rise because firms can buy a lot of investment goods with only a small issue of equity. According to the monetarist view, when the money supply rises, firms and consumers find more money than they want to hold. In other words, the money supply exceeds the money demand. The monetarists say that the excess money goes to spending and so that stock market is a possible choice to expend. Increasing demand for equities raises their prices eventually. On the other hand, Keynesian approach comes to the same conclusion but from a different way. The price of bonds is inversely related to the long-term interest rate, so a fall in long-term interest rates rises bond prices. A selling wave on bonds brings about a tending to equities, so the prices of equities start to increase. If we combine these views with the fact that higher equity prices lead to a higher  $q$ , ceteris paribus, we can say that a higher investment spending occurs at the end of the expansionary monetary policy. Moreover, higher equity prices open a road to consumption through wealth effects. In Modigliani's (1971) life-cycle model, consumption spending is determined by the lifetime resources of consumers, which is made up of both human capital, physical capital and financial wealth.

When equity prices rise after a monetary expansion, the lifetime resources of households increase. Thus, increasing their financial wealth leads to a rise in consumption and output.

If we suppose housing as equity, the results above are valid for housing market at the same time. A monetary expansion which lowers the real interest rates generally decrease the cost of financing house purchase, and so increase the demand. Increasing house prices bring about both a rising Tobin's  $q$  for real estate market and a rising financial wealth, thereby raising new house production and consumption. Hence, the monetary transmission mechanism also operates through housing price channel.

Two distinct credit channels, the bank lending channel and the balance sheet channel, also allow the effects of monetary policy actions to raise through the real economy. These two channels arise from the presence of asymmetric information problems in credit markets. **Asymmetric information** signifies a situation in which one side involved in transaction with another, has more or superior knowledge and information than the other. Asymmetric information is the source of adverse selection and moral hazard problems. The existence of asymmetric information is one of the major reasons of why the verification and enforcement of financial contracts are so costly. Banks are eminently well suited to solve asymmetric information problems in credit markets and so they are the main actors in lending.

Blinder and Stiglitz (1983) and Bernanke and Blinder (1988) explain the lending view for many banks, particularly small banks, deposits represent the principal source of funds for lending and that for many firms, particularly small firms, bank loans represent the principal source of funds for investment. For why, large firms can directly access the credit markets through stock and bond markets. Again, an expansionary monetary policy, which increases bank reserves and bank deposits, increases the quantity of bank loans available. This increase in loans will cause investment and consumption expenditures to rise. This course shows the bank lending channel from credit channels of transmission mechanism. However, substitutability of bank deposits with other sources of funds (bonds, certificates of deposit etc) orientates banks to easily respond to a decline in bank reserves during a monetary contraction. This is a detractive fact of especially a tightening monetary policy in most economies. Even though it is extraneous, in financialization\*\* process firms are disappeared from the focus of banking sector. Therefore, the decline of the traditional bank lending business which is occurring worldwide means that banks are playing a less important role in credit markets, rendering the bank lending channel less potent (Mishkin, 1996).

On the other hand, the balance sheet channel stresses the potential impact of changes in monetary policy on borrowers' balance sheets and income statements, including variables such as borrowers' net worth, cash flow and liquid assets. Bernanke and Gertler (1995) underline the balance sheet channel through the external finance premium. The external finance premium is a wedge reflecting the difference in the cost of raising capital externally via equity and debt markets versus cost of capital internally available to firms (i.e. by retaining earnings). This premium facing a borrower should depend on borrower's financial position which is actually her net worth –the sum of her liquid assets

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\* this term refers to a pattern of accumulation in which profit making occurs increasingly through financial channels rather than through trade and commodity production (Krippner, 2005)

and marketable collateral. A stronger financial position that means a greater net worth enables a borrower to get into debt less costly, thus she has a low external financial premium. Since borrowers' financial positions affect the external financial premium, fluctuations in the quality of borrowers' balance sheets similarly should affect their investment and spending decisions. For example, an expansionary monetary policy leading to a fall in interest rates strengthens borrowers' balance sheets, because this fall in interest rates brings about a rising on the value of their marketable collaterals and liquid assets. Therefore, the higher net worth of firms decreases the external financial premium and also leads a higher investment spending. Mishkin (1996) approaches the same issue from asymmetric information problems. A rise in net worth of firms decreases adverse selection and moral hazard problems. In this manner, adverse selection and moral hazard problems generally move in the same direction with interest rates. This means lower interest rates decrease adverse selection and moral hazard problems. In short, a change in monetary policy that raises or lowers interest rates tends to change the external finance premium and also both adverse selection and moral hazard problems in the same direction. In fact, decreases in interest rates similarly cause a recovery in household balance sheets because consumers' cash flow is positively affected and their financial positions as well. Thus, this leads an increase in consumers' durable expenditures.

### **3. Determinants of Interest Rate Pass Through and the Literature**

In literature, there is a consensus on the issue that the monetary policy affects the real economy mostly through long-term interest rates. Changes in policy interest rates have influence directly on short term interest rates, while they affect long-term interest rates indirectly through short term interest rates. The connection between short and long term interest rates is determined by the yield curve. It is widely accepted that expectations are a key determinant of the shape of the yield curve. According to the expectations theory, long-term interest rates are obtained as an average of expected future short-term interest rates. Moreover, when changes in policy interest rates affect short-term interest rates, they have also effect on future term interest rate expectations and this interaction is considerable for transmission mechanism. For instance, if the central bank takes actions to raise short-term interest rates and market participants expect the short-term rate to decline gradually back to the starting value in the future, then the long rate will rise less than the short rate. On the other hand, if the central bank takes action to raise the short-term rate and market participants expect that this increase is just the first stage of a longer sequence of increases, then the long rate will rise by more than the short rate (Taylor, 1995).

The changes in policy interest rates are transmitted to retail bank interest rates while they create changes in long-term rates through short-term rates and expectations. Interest rate pass through, as a key component of monetary transmission, describes how changes in central banks' policy rates transmit to longer-term retail interest rates on credits and deposits. If policy and market rates reflect to retail bank rates as rapidly and exactly, this convenience affects the price stability by strengthening the transmission mechanism. In addition, it has contribution on profitability and soundness of banking system and also to financial stability.

The decisions of households and firms related to consume, saving and investment are influenced from the changes in deposit and credit interest rates. Credit rates affect the credit demand of households and firms, as deposit rates are also one of the major determiner of money demand in economy. Therefore, pass through from policy rates to credit and deposit rates is important for central banks in point of affecting the credit and money demand.

According to the theory, it is expected that the changes in policy interest rates are transmitted to market and retail bank interest rates rapidly and fully under perfect information and competition conditions. However, macroeconomic situation and financial characteristic of the economy affect the level and the speed of pass through. Under suitable economic conditions such as rapid and stable economic growth, banks' ability to change deposit and loan interest rates would be easier and faster. Especially during economic recession periods, banks which are not willing to supply loan for use due to the credit risk would not reflect policy interest rate reductions to loan interest rates instantly. Therefore, the present conjuncture is very important for efficiency of the monetary transmission channels. In the same way, financial problems affect the pass through course. If banking sector itself has crucial problems for example relating to the banks' balance sheets, this will break the harmony of the interest rate pass through as a whole.

Most of the studies about the issue show that the level of pass through is higher in long run than short maturities. It is seen that the level and the speed of pass through differ across countries. Cottarelli and Kourelis (1994) e.g. measured the degree of lending rate stickiness in 31 industrial and developing countries by estimating simple dynamic models. They observed the degree of lending rate stickiness by looking at the response of lending rates following a change in money market rates at different time lags. According to this study, it is clear that the degree of stickiness is quite different across countries, particularly in the short run. They argue that, significant differences in the response of lending rates can be observed three and six months after the change in money market rates, while in the long run the adjustment tends to be close to unity for most countries. These differences especially in the short run are based on structural diversities in financial markets of the stated countries by the writers. Borio and Fritz (1995), Donnay and Degryse (2001) and Sander and Kleimeier (2002) confirm that pass through is higher in the long run. Furthermore, all these studies are unanimous about the positive role of competition in the banking system for the pass-through process. In their another study, Sander and Kleimeier (2004) also find that the health of the banking sector is a positive determinant for the pass-through. They point out the distinct structural features of national financial markets as well as macroeconomic factors such as interest-rate volatility, structural inflation and growth as the considerable reasons of the pass-through heterogeneity across euro-zone countries.

Bondt et al (2005) empirically examine the interest rate pass-through at the euro area level. The paper's focus is on the pass-through of official interest rates, approximated by the overnight interest rate, to longer-term market interest rates, which, in turn, are a proxy for the marginal costs for banks to attract deposits or grant loans, and therefore passed through to retail bank interest rates. Empirical results of the study suggest that the pass-through of official interest rates to market interest rates is complete for money market interest rates up to three months, but not for market interest rates with longer maturities. Secondly, the writers show that the immediate pass-through of market interest

rates to retail bank interest rates is incomplete. Finally, the empirical results of the study suggest a quicker retail bank interest rate pass-through process in the euro area since the introduction of the euro.

Gigineishvili (2011) explains the pass-through desintegration among 70 countries from all regions, including low income, emerging and developed countries. The paper exhibits that per capita GDP and inflation have positive effects on pass-through, while market volatility has a negative effect. Among financial market variables exchange rate flexibility, credit quality, overhead costs, and banking competition are regarded to strengthen pass-through, whereas excess banking liquidity to impede it in his paper.

There are several interest rate pass through studies for individual countries in literature. Aydın (2007) e.g. finds that while corporate loans are not sensitive to changes in the policy rate, cash and automobile loan rates are responsive to the Central Bank of Turkey's policy rate. Housing loans, on the other hand, display excessive sensitivity to the policy rate. Özdemir (2009) and Çavuşoğlu (2010) show for the Turkish economy that the pass through from the market rate to deposit and lending rate is complete in the long run, while in the short run lending rate shows more flexibility relative to deposit rate. On the other hand, Hansen and Welz (2011) exhibit the pass-through capability for the Swedish economy during the global financial crisis. According to this study, the pass-through from money market rates to retail rates is found to have been complete, but sluggish, before the crisis. During the turmoil the pass-through from money market to lending rates has been preserved at short maturities, but not at longer maturities. The writers emphasize that lack of access to long-term funding has likely played a role.

In this study, by following a different methodology apart from the pass-through literature, that the impact of the policy rate on different type of bank loans will be discussed by the estimated speed of adjustment parameter for the Turkish economy. Literature has mostly been concentrated on cointegration relation between policy rate and the loan rates. However the response of loan rates to the changes in policy rate could be time varying. In order to see that, we employ a time varying mean reversion model explained in the following chapter and estimate the model with Kalman filter algorithm.

#### 4. Methodology and Empirical Evidence

Consider the following discrete time mean reverting interest rate model that follows Ornstein-Uhlenbeck process (see Hull and White 1990).

$$\Delta r_t = \alpha_t (Pol_t - r_t) \Delta t + \sigma \sqrt{\Delta t} Z_t, \quad Z_t \sim N(0, 1) \quad (1)$$

where  $\alpha_t$  is the time dependent speed of adjustment and alternatively represented as  $\partial \Delta r_t / \partial (Pol_t - r_t)$  is the policy rate set by the Central Bank,  $r_t$  is the loan rate at time  $t$ , and finally  $\sigma$  is the constant diffusion parameter. We rearrange the model (1) in a state space form and estimate it by an ordinary Kalman filter assuming linearity and Gaussian distribution;

$$\begin{aligned} r_{t+1} &= \beta_{0,t} + \beta_{1,t} r_t + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma^2) \\ \beta_{i,t} &= \beta_{i,t-1} + \eta_{i,t} \quad \eta_{i,t} \sim N(0, \delta), \quad i = 0, 1 \end{aligned} \quad (2)$$

Where  $\beta_{0,t} = \alpha_t * Pol_t$  and  $\beta_{1,t} = 1 - \alpha_t$

The Kalman filter is an optimal filter when the model is linear and Gaussian, due to the fact that

Kalman filter obeys the optimal updating rule where the variance is minimized by definition for each step.

The data is obtained from Electronic Data Delivery System from the Central Bank of Turkey and it is weekly and covers the period January 2002-August 2012. The policy rate refers to reverse repo auctions rate. Four models are estimated for corporate, housing, cash and automobile bank loans.

Figure 1 (see appendix for figures) shows the policy interest rates and the four bank loans rates. As we see from Figure 2, the policy rate and bank loan rate differences are obvious. According to the empirical evidence of our study, speed of adjustment measures the sensitivity of change in the loan interest rate to the distance between the loan rate and the policy rate. As we see from Figure 3, the speed of adjustment on corporate rates are generally the highest followed by the speed of adjustment level of the cash rate until 2009. The difference between the two is small between 2004 and 2006. After 2006, the margin gets bigger and a huge difference occurs after 2009 as speed of adjustment level for corporate loans quickly returns back to its original magnitude. Interestingly, after 2009 when inverse repo rate drops down to 1.5%, adjustment level of automobile loans increases more than housing and cash rates. Moreover, adjustment level of housing and cash rates do not likely seek to return back their mean levels reflecting a decrease in the impact of policy rate. The speed of adjustment on corporate rates are higher than the other components of bank loans relatively in the Turkish economy. The low speed of adjustment on housing and cash rates might show the weakness of monetary transmission on these components of credit channel.

## 5. Concluding Remarks

First of all, we examined the mechanism that transmits monetary authority's policy actions to the real sector which called as monetary transmission mechanism. We described the various channels through which monetary policy actions impact real variables. The interest rate channel, the exchange rate channel, equity and housing prices channels, the bank lending and the balance sheet channels were checked over in detail. We emphasized that the channels of transmission could complement each other and work simultaneously.

On the other hand, we know that changes in the policy interest rates firstly affect financial markets by modifying to market interest rates, when/if the transmission mechanism works. Later, banks start to change their interest rates on deposits and credits with lags. The degree and the speed of adjustment of market and retail bank rates to the policy interest rates, in other words, the interest rate pass-through is crucial on the effectiveness of monetary transmission mechanism.

In this study, by following a different methodology apart from the pass-through literature, we observed the impact of the Central Bank of Republic of Turkey (CBRT)'s policy rate on different type of bank loans by the estimated speed of adjustment parameter. This methodology enables us to compare time varying adjustment levels among bank loans, however, it does not manifest much about absolute impact of the policy.

It is found that the speed of adjustment on corporate rates are relatively higher than the other components of bank loans in the Turkish economy. The low speed of adjustment on housing and cash rates might show the weakness of monetary transmission on these components of credit channel. Interests on corporate and housing loans in response to policy rate changes are more sensitive than others. It is clear that the impact of cost of funding on bank loans should be checked alternative to the policy rate.

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Appendix

FIGURE 1: INTEREST RATES

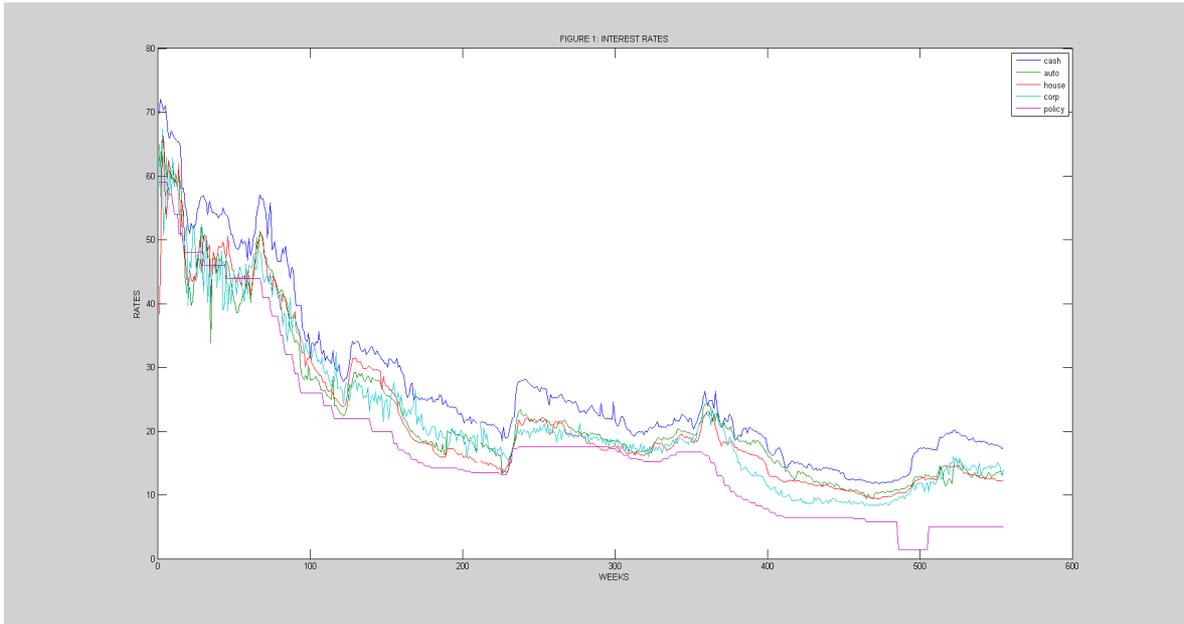


FIGURE 2: POLICY RATE AND LOAN RATE DIFFERENCES

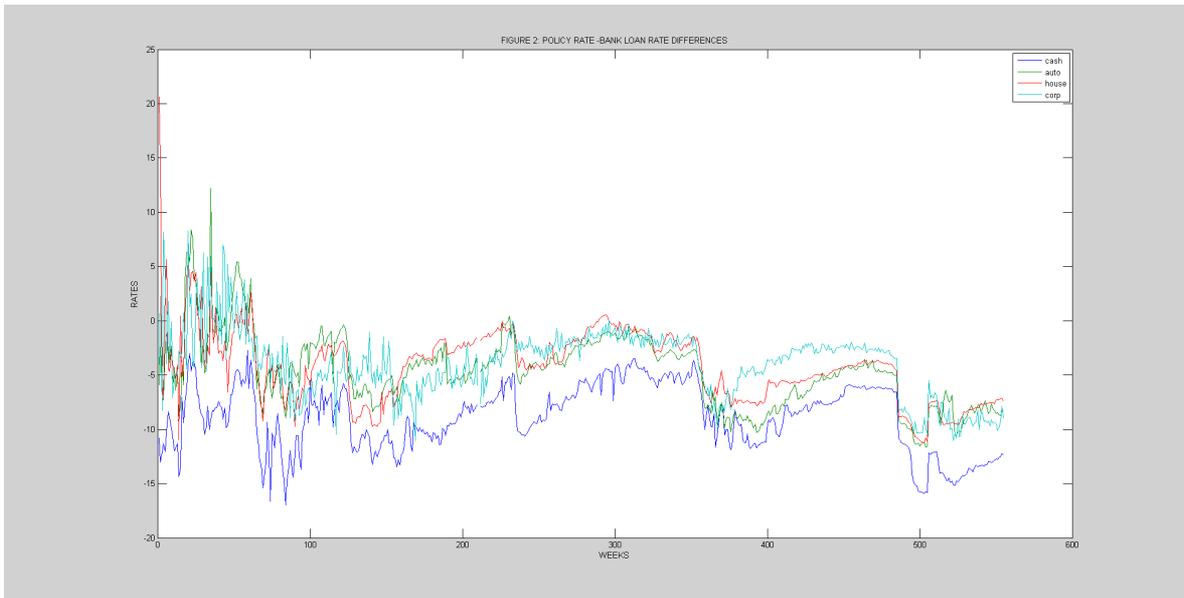


FIGURE 3: SPEED OF ADJUSTMENT FOR BANK LOANS 2004-2012

