CENTRAL BANK OF THE REPUBLIC OF TURKEY

Is 'Price Puzzle' Actually A Structural Characteristic Of The Emerging Markets? Evidence From The Turkish Economy [*]

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January 2005

Abstract

The recent studies by Blanchard (2004) and Favero and Giavazzi (2004) imply that a tight monetary policy consistent with an inflation-targeting framework in emerging market economies could actually increase the price level due to the lack of fiscal discipline and the associated high risk premium. We extend their arguments in two ways. First, we introduce a semi structural model with time varying parameters, where the risk premium is 'unobserved' and it is derived within the system. Such an approach fits better with the volatile nature of the emerging market economies by allowing us to track down the time-varying effects of macroeconomic dynamics on both risk premium and other related variables. Second, we obtain the impulse response functions and analyze the implications of a tight monetary policy on the risk premium. Taking the Turkish economy as our reference point, we find that the arguments of Blanchard (2004) and Favero and Giavazzi (2004) seem to be valid.

Keywords: Monetary Policy, Non-Linear State Space Models, Extended Kalman Filter
JEL Codes: C32, C63, E30

[*] We would like to thank Fabio Canova, Refet Gurkaynak, Jurgen Von Hagen, Hakan Kara, Fethi Ogunc and Levent Ozbek for their kind help and suggestions. The usual disclaimer applies.

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1. INTRODUCTION

The recent works by Blanchard (2004) and Favero and Giavazzi (2004) clearly show the importance of fiscal discipline and debt dynamics on the performance of inflation targeting for the emerging markets. In an environment, where the domestic public debt is high and the average maturity is short, concerns on debt sustainability increase the risk premium significantly. Such a case poses a problem for the monetary policy: a tighter policy associated with higher real interest rates would increase the debt service burden and could actually lead to capital outflows and eventually a depreciation of the domestic currency by increasing the probability of default. Then, given the high degree of exchange rate pass-through, which is another feature of the emerging markets, the depreciation of the domestic currency, in fact, increases the price level. As a result, the "price puzzle", which stems from the misidentification of VAR models in the literature, can actually emerge as a structural characteristic of the emerging market economies.

The argument above relies heavily on the operation of uncovered interest rate parity condition in an unconventional way, which is caused by the increased risk premium. Thus, developing an accurate measure of risk that reflects especially the fiscal performance of the economy emerges as a critical issue. As recently mentioned by Ferrucci (2003), this risk premium is also sensitive to other macroeconomic factors as well. [1]

As the above discussion suggests, there may be important gains from further investigating the arguments of Blanchard (2004) and Favero and Giavazzi (2004) by giving a special emphasis to the role of the macroeconomic dynamics on the default risk. This paper actually extends these two studies in that direction: First, we treat the 'default risk premium' as an unobserved variable and derive it from a system of equations with time varying parameters. In that sense, we obtain a 'model consistent' risk premium from a system, which is designed to reflect the characteristics of an inflation-targeting emerging market economy with fiscal problems. A time-varying parameter framework is preferred since it will better fit with the volatile macroeconomic environment and the frequent structural changes in the emerging markets. Such a methodology also allows us to track down the time-varying effects of macroeconomic dynamics on both the risk premium and the other related variables. Second, we generate the impulse response functions and analyze the implications of the monetary policy on the risk

[1] There are several studies that analyze the interaction between the default risk and the macroeconomic variables. As an example, Reinhart (2002) states that approximately 85% of all the defaults in emerging countries were linked to currency crises, which explains the close relationship between the exchange rate and fiscal performance.

premium. Thus, it is possible to test whether the "price puzzle" can actually be a structural characteristic of an emerging market economy with fiscal problems.

As it will be clearer later on, another contribution of this paper lies in the estimation methodology. Since the unobserved 'risk premium' and the time-varying parameters need to be simultaneously estimated, the state space representation of the model will have a non-linear characteristic, where the standard Kalman Filter fails to be appropriate. Then, the extended Kalman filter (EKF), which is designed for the estimation of such nonlinear systems, is employed.

Finally, for the application, an emerging market that reflects the above mentioned characteristics should be chosen. As the next section shows, the Turkish economy seems to incorporate all of these characteristics such as a volatile macroeconomic environment with fiscal problems and a form of inflation-targeting framework for the monetary policy.

Following this discussion about the Turkish economy, the model and the estimation procedure are presented. Then, the parameter estimates and the impulse response results are displayed. The final section concludes.

2. THE TURKISH ECONOMY: 1999-2003

In the late 1990's, the incomplete financial and institutional infrastructure discouraged foreign direct investment and necessitated the use of debt-related financial instruments to close the Turkish financing gap. Also, a fragile banking system together with high real interest rate costs due to the increased domestic borrowing of the fiscal sector shaped the structure of the Turkish economy. The monetary policy, on the other hand, was mainly accommodating the fiscal side, as a means of stabilizing the financial gaps.[2]

Imbalances arising from public budget limitations, namely budget deficit and its financing method, put direct and, through expectations, indirect pressure on the economy, which accumulated through the end of 1990s. Following the 1998 Russian crisis and the devastating 1999 earthquake, the Turkish economy entered an unsustainable path by the end of 1999. At the end of the year, inflation rate was 68.8 percent, year-on-year, and fiscal sector borrowing requirement including duty losses reached 28.9 percent, doubling the 1990-1999 average. Domestic debt stock to GDP ratio almost tripled the 1990-1999 average and increased to 42,6 percent. This forced the policy makers to introduce a new policy framework and take the economy back to a sustainable track. Hence, "2000-2002 Program" was introduced to decrease

[2] See Celasun(2002).

inflation rate, alleviate the public burden and reduce the debt stock to a sustainable level. A program of structural reforms, including privatization of public enterprises, has also supported it.

Due to the reluctance in structural reforms and the lack of supervision and regulation in the banking sector, initial credibility gain, which concealed the accrued fragilities of the economy for a while, started to erode after the first half of the year. Nominal interest rates started to rise and the first turmoil in November 2000 was successfully eased by the Central Bank intervention in the money market. However, uncertainties regarding the commitment to the economic program aggravated the deterioration of expectations after November. The exchange rate based stabilization experience of Turkey for over a year was abandoned with the severe crisis on 22 February 2001. Central Bank was forced to quit the exchange rate peg and started to implement floating exchange rate regime.

A new economic program for strengthening the Turkish economy was announced on May 2001. This program intended for a structural transformation in the economy and therefore placed heavy emphasis on the implementation of the key structural reforms in public finance and banking sector as well as on the implementation of prudent fiscal and monetary policies with a view to place the Turkish economy on a sustainable growth path. To this end, the Central Bank, with the overriding objective of achieving and maintaining price stability, has been implementing implicit inflation targeting as the monetary policy framework since May 2001. In other words, the Central Bank has been using overnight interest rates as the policy instrument in a forward-looking manner to achieve the inflation targets, jointly set by the Government. Furthermore, control over the overnight rates has been strengthened with the floating exchange rate regime and short-term interest rates became the main policy instrument of the monetary program. Following the adoption of floating exchange rate regime, Central Bank was successful in bringing down the inflation. CPI inflation undershot the inflation targets two years in a row. The year-end inflation in 2002 was 29,7 percent, below the year-end target of 35 percent and it was 18,4 percent in 2003, below the target of 20 percent, which was a historic low in the last 20 years.

However, consistent with the fiscal theory of price level, both the high level of debt and its structure has been hindering the effectiveness of the monetary policy. The debt stock consists mostly of short-term debt, which is indexed to inflation and financial assets to a great extent. This structure, in turn, makes debt stock management as the center of attention and raises frequent arguments on debt sustainability. The fragile debt structure leads to excess sensitivity of expectations on political uncertainty and therefore, diminishes the effectiveness of economic policies.

Short-term debt stock, irrespective of being indexed or not, constitutes a large fraction of the total debt. The portion of short-term non-indexed debt in the domestic debt stock is still relatively high. While the maturity on indexed domestic debt is long, their coupon payment maturity is too short, 3 to 6 months, which adds on to the short-term debt stock[3] (Figure 1). Taking such a structure into consideration, short-term financing requirement of treasury becomes quite intense.[4] This, in turn, requires high debt service and leads to increased vulnerability of domestic debt stock, which then quite frequently raises sustainability issues. Therefore, in the case of any negative shock, the demand for government securities weakens, the expectations about monetization of debt emerges,[5] and the default risk rises, which all put upward pressure on exchange rate and interest rates. Consequently, inflation expectations worsen. To sum up, irrespective of the current or future values of short-term rates of the central bank, an exogenous confidence shock may trigger adverse expectations about the sustainability of domestic debt stock and thus dominate inflation expectations.

Yield curves analysis supports these observations as well. Perception of risk alters significantly as maturity changes. While the yield curves are flatter in short-term maturities, it becomes considerably steep as maturities lengthen (Figure 2). During the period in consideration, 3 months is the break point where slope of the yield curve starts to accelerate. In other words, for the Turkish economy, the risk premium is rather high after 3 months. In addition, debt to GDP ratio after the February 2001 crisis has been above the threshold level of 58.8 percent[6], which further adds to the risk perception in the economy.

There is at least one more challenge which needs to be addressed: the relationship between the CBRT interest rate and the market interest rates--interest rates that is relevant for the agents' consumption and investment decisions. Under the assumption of a stable risk premium, market rates are supposed to be driven by the expectations of future short-term interest rates. However, this has not been the case for the Turkish economy since the beginning of the floating rate regime. Although there are significant signs of improvement, the link is still far from being

[3] See, Monetary Policy Report of CBRT, October, 2003.
[4] High interest rates are a characteristic of a country with high debt service. See Elmendorf and Mankiw (1998).
[5] See, Sargent and Wallace (1981), Woodford (1995,1996 and 2001).
[6] The threshold value is estimated by LSTAR (Logistic Smooth Transition Autoregressive) model. Estimation of the LSTAR model has been conducted using Ivar Petterson's STR2 compiled OXPac routines translated from Gauss programs written by Timo Terasvirta.

clear due to considerable amount of variation and noise in the market rates potentially stemming from the fragility of debt stock and external uncertainties.[7]

As a result, our message from the above discussion is clear. The debt structure and the fiscal stance constitute a clear obstacle for the monetary authority. Moreover, a tight monetary policy could actually worsen this scenario by increasing the already high risk premium in the economy, providing support for the arguments put forth by Blanchard (2004) and Favero and Giavazzi (2004). In that sense, the Turkish economy stands out as a good example.

3. THE MODEL

In this section, we introduce our model and the estimation methodology. Consistent with Blanchard (2004) and Favero and Giavazzi (2004), as long as there are concerns about the debt sustainability, the uncovered interest parity condition can operate in an unconventional fashion: increases in interest rates as part of a tight monetary policy further increase the probability of default and thus lead to increased risk premium required by the investors. Such a case can result in capital outflows and a possible currency depreciation, which further worsens the scenario especially when there is a high degree of pass-through from exchange rate to prices.

The following system of equations captures these factors in a reduced form model:

$$R_{t+1}^{CB} = \alpha_{0,t} R_t^{CB} + \alpha_{1,t}(\pi_t - \pi_t^{*}) + \varepsilon_{R_{t+1}}^{CB} \qquad \textbf{-1-}$$

$$R_{t+1}^{TR} = \beta_{0,t} R_t^{TR} + \beta_{1,t} R_t^{CB} + \varepsilon_{R_{t+1}}^{TR} \qquad \textbf{-2-}$$

$$D_{t+1} = \gamma_{0,t} D_t + \gamma_{1,t} R_t^{TR} + \gamma_{2,t} DEPR_t + \varepsilon_{D_{t+1}} \qquad \textbf{-3-}$$

$$DEPR_{t+1} = \varphi_{0,t} \Pr_t + \varphi_{1,t}\left(R_t^{TR} - R_t^{US}\right) + \varepsilon_{ER_{t+1}} \qquad \textbf{-4-}$$

$$\pi_{t+1} = \theta_{0,t} \pi_t + \theta_{1,t} DEPR_t + \theta_{2,t} y_t + \varepsilon_{\pi_{t+1}} \qquad \textbf{-5-}$$

$$y_{t+1} = \partial_{0,t} y_t + \partial_{1,t} RER_t + \partial_{2,t} R_t + \varepsilon_{y_{t+1}} \qquad \textbf{-6-}$$

$$CA_{t+1} = \mu_{0,t} CA_t + \mu_{1,t} RER_t + \mu_{2,t} y_t + \varepsilon_{CA,t+1} \qquad \textbf{-7-}$$

$$\Pr_{t+1} = \phi_{0,t} D_t + \varphi_{1,t} MAT_t + \varphi_{2,t} CA_t + \varphi_{3,t} PS_t + \varphi_{4,t} \Pr_t + \varepsilon_{\Pr_{t+1}} \qquad \textbf{-8-}$$

[7] For empirical evidence, see Özatay et al (2004).

where π_t is the monthly, CPI-based annualized inflation, $DEPR_t$ is the annualized depreciation rate of the domestic currency (TL/USD), R_t^{TR} is the treasury bill secondary market rate, R_t^{US} is the U.S. federal funds rate, R_t^{CB} is the central bank overnight target rate, D_t is the total consolidated debt stock ratio to GDP, y_t is the output gap, R_t is the real interest rate, RER_t is the percentage change in the real exchange rate, $\Pr_t$ is the unobserved risk premium, MAT_t is the average maturity of domestic borrowing, CA_t is the current account deficit ratio to GDP, PS_t is the primary surplus ratio to GDP.

The first equation is a standard, Taylor rule type, policy rate equation that depicts the relationship between the central bank policy rate and the rate of inflation, where the central bank reacts to a change in the inflation by changing its policy rate. In order to refrain from a possible autocorrelation and to capture "interest rate smoothing" incentive by the central bank, the lagged value of the overnight rate is also added. The sign of the coefficient on inflation is not unambiguous, however: If the arguments of Blanchard (2004) and Favero and Giavazzi (2004) hold, it is possible to observe some kind of a "price puzzle", where increases in interest rates are associated with higher inflation.

The second equation imposes a very simple relationship between the secondary market Treasury bill rate and the Central Bank policy rate, indicating that a movement in the policy rate of the Central Bank would have an impact on longer-term rates.

The third equation attempts to summarize the debt dynamics of the Turkish economy: it states that the domestic debt to GDP ratio of the economy depends on its own lag, the Treasury bill rate and the depreciation rate. While an increase in the Treasury bill rate raises the current period's cost of debt financing, the depreciation of the currency increases the debt burden of the foreign exchange denominated debt. As a result, these two factors should affect the debt stock to GDP ratio negatively.

The fourth equation is the key equation in the model, which reflects the ideas put forth by Blanchard (2004) and Favero and Giavazzi (2004). The depreciation rate is expressed as a combination of the risk premium and the interest rate differential. Consistent with the conventional uncovered interest rate parity condition, an increase in the interest rate differential causes an appreciation and vice versa. However, if there is an increase in the perceived risk, then, through capital outflows, the currency may depreciate. As a result, the overall effect on the exchange rate depends on whether the risk premium channel or the conventional uncovered interest rate parity condition dominates.

The fifth equation is a multivariate inflation specification, where inflation's own lag is used to include inertia and the depreciation rate reflects the pass-through. The output gap measure is adopted from Ece et al (2004) to reflect the excess demand pressure on the inflation.

The sixth equation specifies the above-mentioned output gap as a function of its lagged value, the real exchange rate and the real interest rate. The relationship between the output gap and the real exchange rate is evidently discussed in Ece et al (2004). Here, it is more important to note that the monetary policy affects the inflation through the impact of the real interest rates on the aggregate demand, as proposed in Rudebusch and Svensson (1998, 1999).

The seventh equation identifies the current account balance as a function of its lagged value as well as the real exchange rate and the output gap. Appreciation of the exchange rate and positive output gap are expected to generate a current account deficit.

The eighth equation is written down to identify the possible components of the risk premium associated with the fiscal side fundamentals. It is assumed that, other than its own lag, the risk premium is affected by the average maturity of domestic borrowing and the ratios of debt stock, the current account deficit and the primary surplus to GDP. The debt to GDP ratio is constructed using the consolidated debt stock, both foreign and domestic. The average maturity is included to capture the risk perception of the people lending to the Treasury to finance its deficit. It is also a very important indicator of the fiscal flow position. Due to the fact that most of the foreign investors view current account deficits as important signals of currency crisis, this variable is also added in the regressor matrix for the risk premium series. Also, Reinhart (2002) reports a very close link between currency crisis and defaults for the emerging markets, which provides support for such a specification. Lastly, the primary surplus variable is used as a proxy for the fiscal discipline criteria. This variable also incorporates extra information as a measure of the credibility, especially in the presence of IMF stand-by agreements.

It is quite possible that the above system of equations can be criticized on the grounds of lacking a fully structured model. However, these reduced form equations can easily be derived from a model, which shares the same spirit with Blanchard (2004).

Finally, it should be mentioned that all of the coefficients in the model are assumed to be time varying, which reflects the characteristics of a volatile macroeconomic environment. By observing the time path of the coefficients and the impulse response functions, one can detect whether the arguments of Blanchard (2004) and Favero and Giavazzi (2004) are valid for the Turkish economy.

3.1 Estimation Procedure

This part introduces the state space representation of the model and the non-linearity, which necessitates the employment of the extended Kalman filter.

As the state space representation of the model in Appendix 1 shows, the state equation is time dependent due to the time-varying parameters to be estimated. Therefore, our state space model, which consists of the state equation and the observation equation, will be as:

$$x_{t+1} = \Phi_t(x_t) + \psi_t(z_t) + G_t(\omega_t)\xi_t \qquad \textbf{-9-}$$

$$y_t = H_t(x_t) + \eta_t \qquad \textbf{-10-}$$

The above form is an example for a non-linear state space model, where Φ_t, ψ_t and H_t are vector-valued functions, ω_t and η_t are uncorrelated zero mean white noise sequences with covariance matrix Q_t and R_t, respectively. Note that both the time-varying parameter vector, Φ_t and the state vector, x_t, are presented in the state equation together in multiplicative form. Since these two vectors are to be estimated simultaneously, the state equation will have a non-linear feature, where the extended Kalman filter should be used.

3.2 Applying EKF

Note that $\Omega_t = \begin{bmatrix} \alpha_{0,t}, \alpha_{1,t}, \beta_{o,t}, \beta_{1,t}, \gamma_{0,t}, \gamma_{1,t}, \gamma_{2,t}, \varphi_{0,t}, \varphi_{1,t}, \theta_{0,t}, \theta_{1,t}, \theta_{2,t}, \\ \partial_{0,t}, \partial_{1,t}, \partial_{2,t}, \mu_{0,t}, \mu_{1,t}, \mu_{2,t}, \phi_{0,t}, \phi_{1,t}, \phi_{2,t}, \phi_{3,t}, \phi_{4,t} \end{bmatrix}$ is the parameter vector to be estimated.

It is convenient to assume that the parameters follow random walk:

$$\Omega_{t+1} = \Omega_t + \varsigma_t \qquad \textbf{-11-}$$

where ς_t is any zero-mean white noise sequence uncorrelated with v_t and with pre-assigned positive definite variances $Var(\varsigma_t) = S_t$. If we treat the above equations as the new state vector and combine them, we will have a non-linear state space model as:

$$\begin{bmatrix} x_{t+1} \\ \Omega_{t+1} \end{bmatrix} = \begin{bmatrix} \Phi_t(\Omega_t)x_t \\ \Omega_t \end{bmatrix} + \begin{bmatrix} \Psi_t(\Omega_t)K_t + G_t(\Omega_t)\omega_t \\ \varsigma_t \end{bmatrix} \qquad \textbf{-12-}$$

$$y_t = \begin{bmatrix} H_t(\Omega_t) & 0 \end{bmatrix} \begin{bmatrix} x_t \\ \Omega_t \end{bmatrix} + \eta_t \qquad \textbf{-13-}$$

The non-linearity can also be seen in equation 12. Then, EKF procedure can be applied to estimate the state vector, which contains Ω_t as one of its components. That is, Ω_t is estimated optimally. This procedure is called adaptive system identification, as noted in Anderson and Moore (1979). Both the extended Kalman filter algorithm and its application in non-linear state space models are discussed in Chui and Chen (1993) and Chen (1993) in detail. Also, appendix 2 presents the updating equations of the extended Kalman filter.

4. RESULTS

After the parameter vector is added to the state space model, the extended Kalman filter is executed. As a result, the 'model consistent' risk premium and the time varying parameter estimates are obtained.[8] In this section, first, the risk premium series is briefly interpreted. Next, the estimated time-varying parameters are discussed. Finally, the impulse response results are displayed.

4.1 Risk Premium

Figure 3a presents the derived risk premium series. It can be seen that, right after the exchange rate-based stabilization program took place in the late 1999, the risk premium series seems to decline. However, with the collapse of the program, we observe a sharp increase, which reaches a peak during the third quarter of 2001. This period also witnessed the most significant concerns about the sustainability of debt and the debt to GDP ratio reached its maximum. However, these concerns were partly eliminated and the first half of 2002 witnessed a dramatic improvement in the risk premium series. After no significant change is observed in late 2002, the risk premium series again seems to pick up slightly from the beginning of 2003.

As expected, the risk premium series is highly correlated (0.76) with the debt to GDP ratio. The upward trend in the debt to GDP ratio - following the major economic crisis in 2001- is very well captured. Moreover, the relatively smoother trend after July 2002 is also reflected.

Next, the risk premium series is compared with the EMBI spread in Figure 3b. Intended principally for portfolio management purposes, this spread provides a measure of pure sovereign default risk and it is constructed as excess promised returns over United States treasuries. As figure 3b shows, the two series mainly move in the same direction especially at the end of the sample period, which provides further support for our results[9].

4.2 Time-Varying Parameter Estimates

As stated previously, one of the main advantages of setting the problem in an extended Kalman filter framework is obtaining time-varying parameter estimates. Since there are too many parameters to be interpreted, we will focus only on the key ones that are of major interest. In this context, the parameters in the UIP equation and the risk premium equation, as

[8] The variables in the state equations are also estimated . A comparison of the actual series with their estimates is provided in Figure 4.

[9] The correlation between the two series is around 0.55.

well as the pass-through parameter in the inflation equation are analyzed.[10] The plots of these time-varying parameters for January 2000-September 2003 period are given in figure 5.

Before analyzing the parameters in the UIP equation, it is worth mentioning again that the link between exchange rate and interest rate differential is not straightforward, especially for the emerging markets. As recently stated in Bergin (2004), the literature on New Open Economy Macroeconomics identifies these deviations from uncovered interest rate parity and argues that monetary policy actions fail to explain them. Therefore, our specification can also be viewed as an attempt to incorporate fiscal fundamentals into uncovered interest rate parity condition. When the time path of the parameters are observed, we detect a structural break in the relationship between the interest rate differential and the exchange rate right after the collapse of the exchange rate-based stabilization program. Such a finding also provides support for our choice of time-varying parameter framework. Starting from March 2001, where the exchange rate has been allowed to float freely, the expected negative link between the interest rates and the depreciation rate of the domestic currency has been established once again. The coefficient of the risk premium in the UIP equation for the January 2000-September 2001 period is observed to be positive and it follows quite a steady path. Such a finding supports the views of Blanchard (2004) and Favero and Giavazzi (2004) about the operation of the uncovered interest rate parity condition. Therefore, once the risk premium inherent in fiscal fundamentals is controlled, a negative relation between interest rate differential and exchange rate can be detected.

On the other hand, it is observed that the magnitude of all of the parameters in the risk premium equation increase in two to three months following the February 2001 crisis. The coefficient of the debt to GDP ratio is always positive and starts to increase right after the crisis, which is exactly what we would expect. Being consistent with this increase, the average maturity of borrowing also declines since people start to worry about the sustainability of debt. It can be seen that the average maturity has increasingly negative effect on the risk premium. We also find that while current account deficit increases the risk, the generated primary surplus as a requirement of the agreement with IMF seems to have a positive impact.

Finally, the estimates for the pass- through coefficient in the inflation specification need to be interpreted. A sharp decline in the pass-through coefficient is observed exactly after the end of the exchange rate-based stabilization program, which also validates our methodology. More interestingly, it supports the views that the degree of pass-through has declined with the

[10] The other estimated parameters are available upon request.

improvement in the inflation in the post-crisis period. Such a finding suggests that the "indexation" behavior of the agents, -which relate the changes in the exchange rate to the expectations about the price level-, has significantly decreased. However, it should be mentioned that the pass-through is still a crucial factor: a one percent increase in the exchange rate brings about a 0.3 percent increase in the CPI.

There are important conclusions to be drawn from these estimated parameters. First, regarding the methodology, the parameters significantly vary over time, which necessitates employing a time-varying parameter framework for the emerging market economies. Second, the changes in the risk premium emerge as a possible explanation of the deviations in the uncovered interest rate parity condition. Third, all of the variables in the risk premium equation have increasing effects over time, at the expected direction, highlighting the importance of the fiscal discipline. Finally, the parameter estimates seem to be consistent with the scenario that Blanchard (2004) and Favero and Giavazzi (2004) point out for emerging markets. However, to have a clearer picture, an impulse response analysis is further needed.

4.3 Impulse Response Analysis

We concentrated on three distinct cases in order to see the propagation of a monetary policy action within the model. First, we imposed one percentage point increase in the Central Bank rate on September 2003, when the effects of the financial crisis were relatively less and there were fewer concerns about the debt sustainability. As Figure 6 shows, an increase in the overnight rate initially leads an appreciation of the currency through the Uncovered Interest Parity condition. However, as the risk premium increases in three months, depreciation in the Turkish Lira is observed. Such a finding casts doubt on the operation of the uncovered interest rate parity condition in the conventional way. More importantly, the impulse response of the inflation rate clearly shows that although there is a slight decrease in the initial periods, the inflation rate starts to pick up, consistent with Blanchard (2004) and Favero and Giavazzi (2004). Based on their arguments, both the unexpected operation of the uncovered interest rate parity and the increase in the inflation rate stem from the existence of the "risk premium" channel. Therefore, it is not surprising to see that an increase in the interest rate leads to an increase in the risk premium- as it leads initially to an increase in the debt stock- thereby affecting both the exchange rate and the inflation rate negatively.

Second, as Figure 7 indicates, we imposed a 5-point increase on the risk premium for the same period. Not surprisingly, the obtained impulse responses for the depreciation rate, inflation rate and the risk premium followed similar paths. In this case, however, there is a depreciation of the currency at the same period as the risk premium increases and the initial appreciation of the currency, which was observed in the first exercise, does not take place here. Consequently, the transmission of this shock to the inflation rate is much more immediate compared to our first example.

As a third exercise, we concentrated on the period July 2001, where the only interest rate increase after the crisis took place.[11] For the purpose of this study, we reversed the case and tried to find out what would happen if there was a 2.18 percentage point decline in the CB rate on July 2001 instead of an increase. It is observed in Figure 8 that the final result is a decline in the rate of inflation. However, the mentioned increase in the CB rate on July 2001, actually led to the depreciation of the currency and thus to an increase in the inflation rate.

As a result, the impulse response analysis clearly shows that the arguments put forth by Blanchard (2004) and Favero and Giavazzi (2004) seem to be valid also for the Turkish economy in the post-crisis period.

5. CONCLUSION

The important works of Blanchard (2004) and Favero and Giavazzi (2004) clearly show the role of the debt dynamics on the performance of inflation targeting. These studies imply that the presence of a 'risk premium' channel could actually cause the price level to increase when the central bank follows a tight monetary policy.

In this study, we extend their arguments by giving more emphasis to the role of the macroeconomic dynamics on the default risk. First, we derive a 'model consistent' risk premium from a system of equations with time varying parameters. Such an approach both reflects the volatile nature of the emerging market economies and allows us to track down the time-varying effects of macroeconomic dynamics on the risk premium. Second, we obtain the relevant impulse responses and analyze the implications of the monetary policy.

Taking the Turkish economy as our reference point, the results show that the derived risk premium series seems to be consistent with the path that the Turkish economy followed for the sample period. More importantly, the time-varying parameter estimates and the impulse response analysis indicate that the "price puzzle" in the VAR literature can well emerge as a structural characteristic of an emerging market economy with fiscal problems.

[11] The increase was 2.18 percentage points.

APPENDIX I: State Space Representation

The state equation of the model can be written as:

$$
\begin{bmatrix} R^{CB}_{t+1} \\ R^{TR}_{t+1} \\ D_{t+1} \\ DEPR_{t+1} \\ \pi_{t+1} \\ y_{t+1} \\ CA_{t+1} \\ \Pr_{t+1} \end{bmatrix}_{8\times 1}
=
\begin{bmatrix}
\alpha_{0,t} & 0 & 0 & 0 & \alpha_{1,t} & 0 & 0 & 0 \\
\beta_{1,t} & \beta_{0,t} & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & \gamma_{1,t} & \gamma_{0,t} & \gamma_{2,t} & 0 & 0 & 0 & 0 \\
0 & \varphi_{1,t} & 0 & 0 & 0 & 0 & 0 & \varphi_{0,t} \\
0 & 0 & 0 & \theta_{1,t} & \theta_{0,t} & \theta_{2,t} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \partial_{0,t} & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & \mu_{2,t} & \mu_{0,t} & 0 \\
0 & 0 & \phi_{0,t} & 0 & 0 & 0 & \phi_{2,t} & \phi_{4,t}
\end{bmatrix}_{8\times 8}
\begin{bmatrix} R^{CB}_{t} \\ R^{TR}_{t} \\ D_{t} \\ DEPR_{t} \\ \pi_{t} \\ y_{t} \\ CA_{t} \\ \Pr_{t} \end{bmatrix}_{8\times 1}
+
\begin{bmatrix}
0 & 0 & 0 & 0 & 0 & -\alpha_{1,t} \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & -\varphi_{1,t} & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & \partial_{1,t} & \partial_{2,t} & 0 \\
0 & 0 & 0 & \mu_{1,t} & 0 & 0 \\
\phi_{1,t} & \phi_{3,t} & 0 & 0 & 0 & 0
\end{bmatrix}_{8\times 6}
\begin{bmatrix} MAT_{t} \\ PS_{t} \\ R^{US}_{t} \\ RER_{t} \\ R^{*}_{t} \\ \pi_{t} \end{bmatrix}_{6\times 1}
+
\begin{bmatrix} \varepsilon_{R^{CB}_{t+1}} \\ \varepsilon_{R^{TR}_{t+1}} \\ \varepsilon_{D_{t+1}} \\ \varepsilon_{ER_{t+1}} \\ \varepsilon_{\pi_{t+1}} \\ \varepsilon_{y_{t+1}} \\ \varepsilon_{CA^{CB}_{t+1}} \\ \varepsilon_{\Pr_{t+1}} \end{bmatrix}_{8\times 1}
$$

On the other hand, the observation equation takes the form:

$$
\begin{bmatrix} R^{CB}_{t} \\ R^{TR}_{t} \\ D_{t} \\ DEPR_{t} \\ \pi_{t} \\ y_{t} \\ CA_{t} \end{bmatrix}_{7\times 1}
=
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0
\end{bmatrix}_{7\times 8}
\begin{bmatrix} R^{CB}_{t} \\ R^{TR}_{t} \\ D_{t} \\ DEPR_{t} \\ \pi_{t} \\ y_{t} \\ CA_{t} \\ \Pr_{t} \end{bmatrix}_{8\times 1}
$$

APPENDIX II: The Extended Kalman Filter

As it is shown in Chui and Chen (1991) and Chen (1993), for k=1,2,..., we have the updating equations as:

$$P_{k/k-1} = AP_{k-1}A' + H_{k-1}(\hat{x}_{k-1})Q_{k-1}H'_{k-1}(\hat{x}_{k-1})$$

$$\hat{x}_{k/k-1} = f_{k-1}(\hat{x}_{k-1})$$

$$K_k = P_{k/k-1}B\left[BP_{k/k-1}B' + R_k\right]^{-1}$$

$$P_k = \left[I - K_k B\right]P_{k/k-1}$$

$$\hat{x}_{k/k} = \hat{x}_{k/k-1} + K_k\left[y_k - g_k(\hat{x}_{k/k} - 1)\right]$$

where $A = \left[\dfrac{\partial f_{k-1}}{\partial x_{k-1}}(\hat{x}_{k-1})\right]$ and $B = \left[\dfrac{\partial g_k}{\partial x_k}(\hat{x}_{k/k-1})\right]$, respectively.

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Figure 1: Structure of Debt Stock

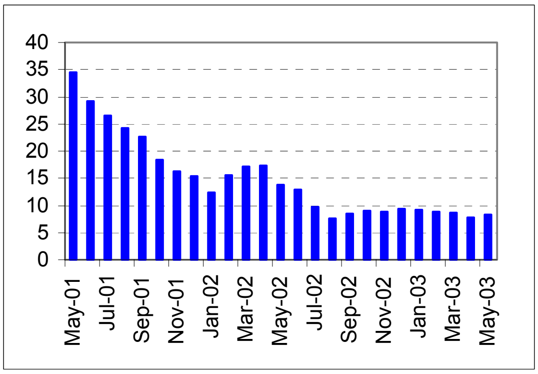
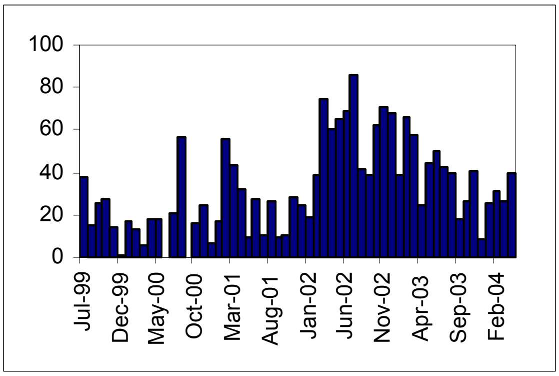
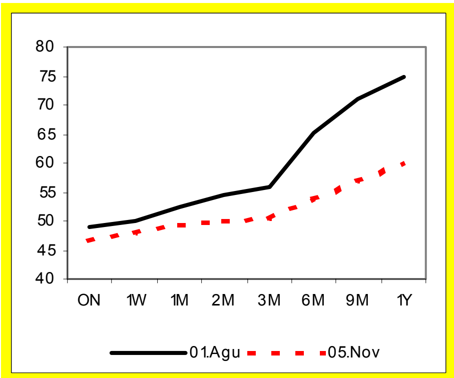
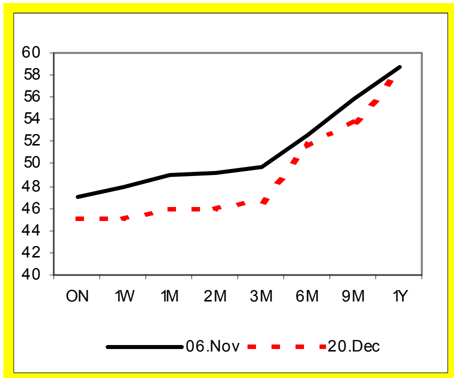
Panel a: Share of Coupon Payments of 2-year Maturity Debt Instruments in Total Cask Debt Stock	Panel b: Share of short-term debt in total cash stock
	

Figure 2: Yield Curves

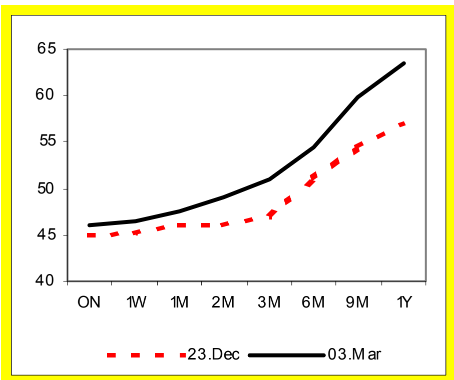
August 1 and November 5, 2002



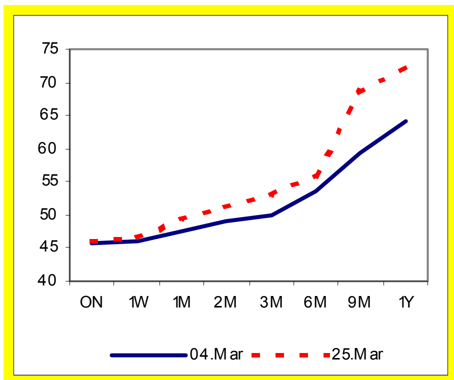
November 6 and December 20, 2002



December 23, 2002 and March 3, 2003



March 4 and 25, 2003



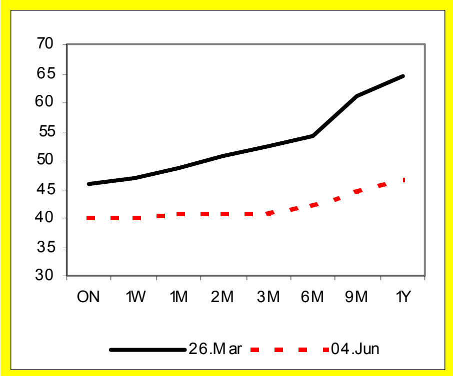
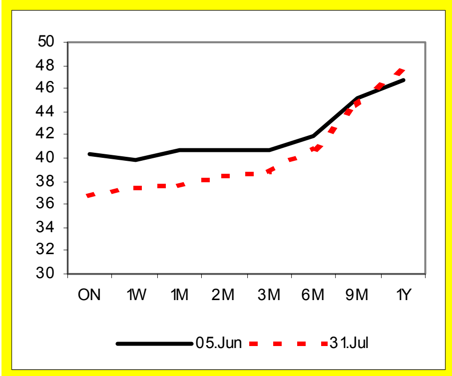
March 26 and June 4, 2003	June 5 and July 31, 2003
	

Figure 3: Risk Premium versus EMBI spread

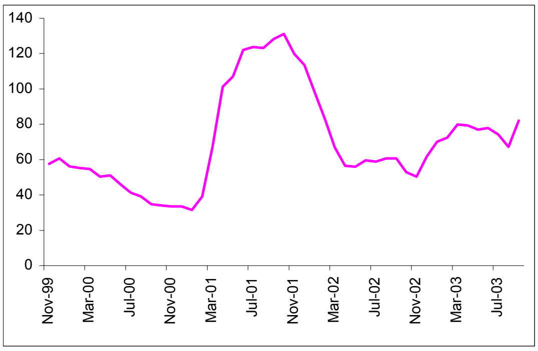
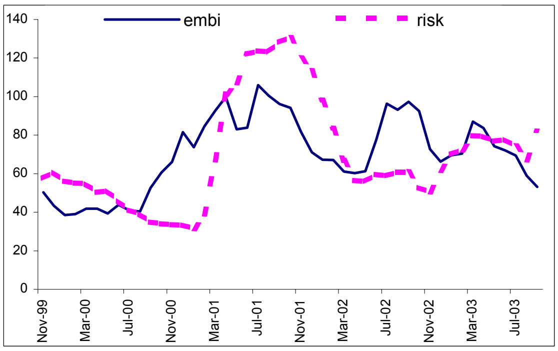
Panel a: The derived risk premium	Panel b: The derived risk premium and the EMBI spread
	

Figure 4: Estimated versus Actual Data

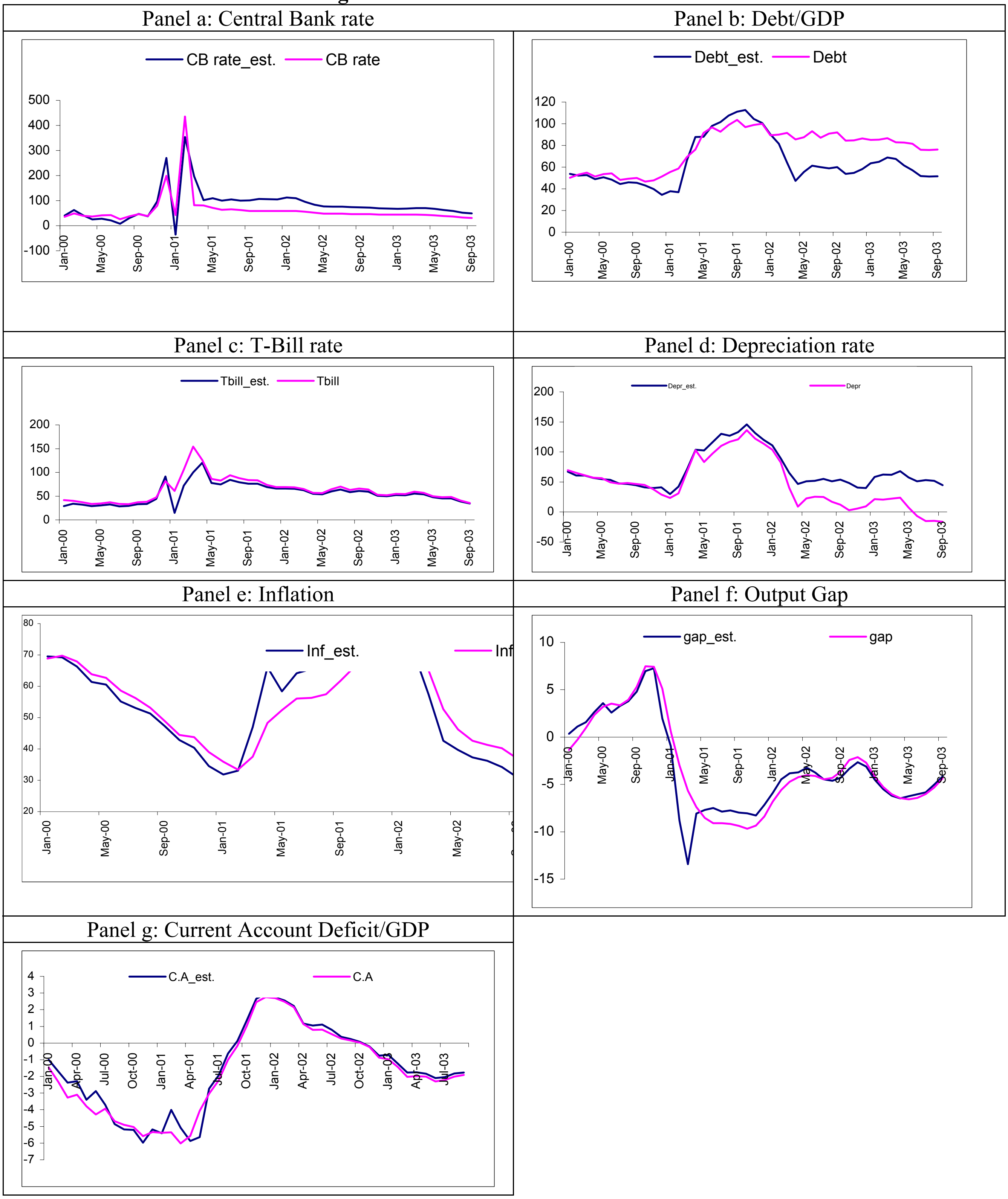
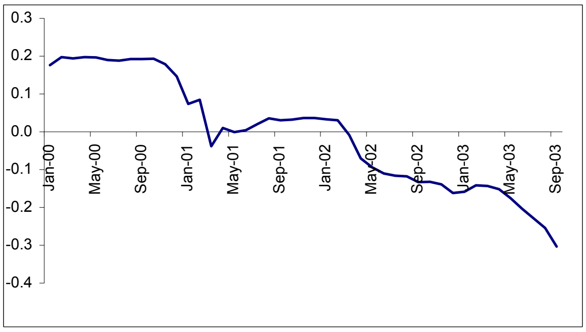
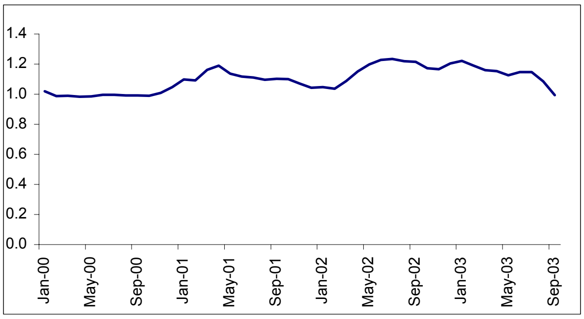


Figure 5: Time Varying Coefficients

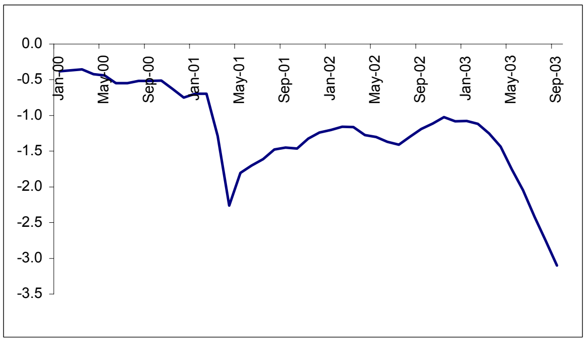
Panel a: Time Varying coefficient of Interest rate differentials in UIP equation



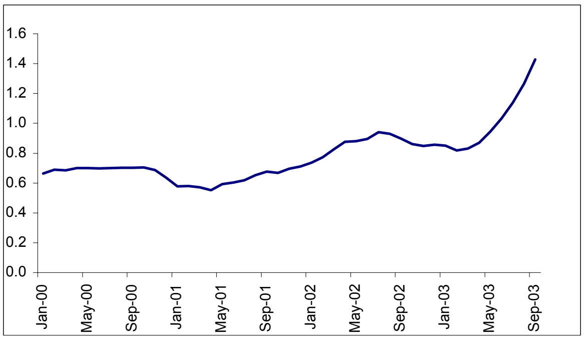
Panel b: Time Varying coefficient of Risk Premium in UIP equation



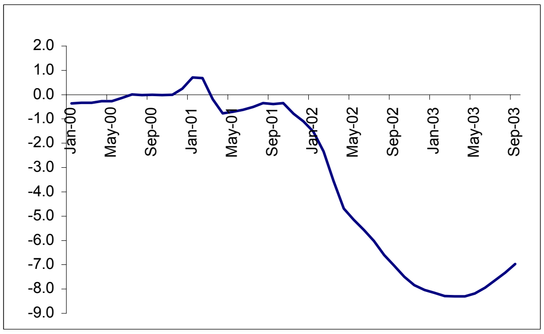
Panel c: Time Varying coefficient of average maturity in Risk Premium equation



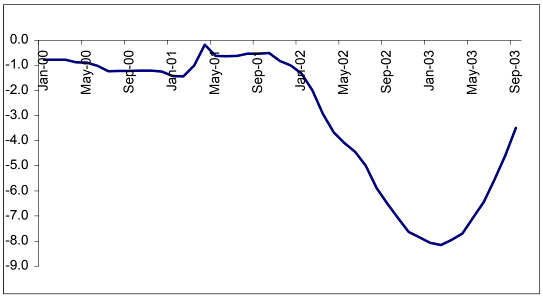
Panel d: Time Varying coefficient of Debt/GDP in Risk Premium equation



Panel e: Time Varying coefficient of Current Account deficit/GDP in Risk Premium equation



Panel f: Time Varying coefficient of Primary Surplus/GDP in Risk Premium equation



Panel g: Time Varying pass-through coefficient

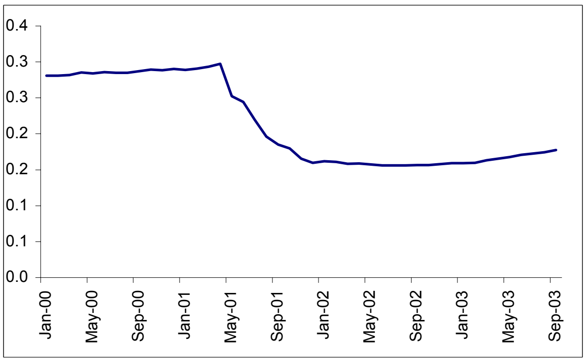
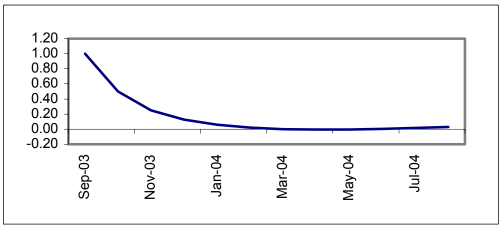
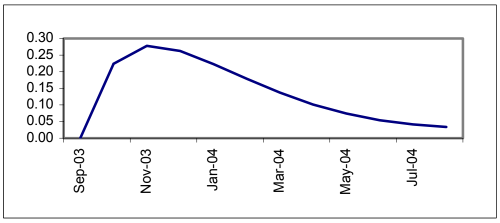


Figure 6: Central Bank Rate increases by 1 percentage point in September 2003 (Shock 1)

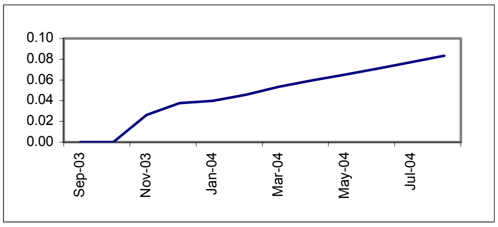
Central Bank O/N Rate



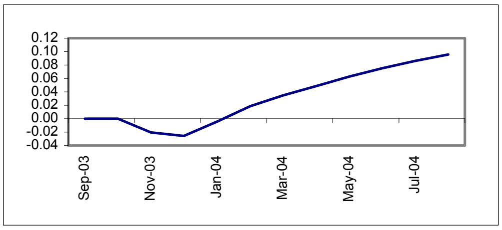
Treasury-bill Rate



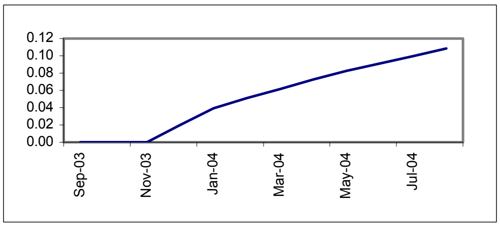
Debt to GDP Ratio



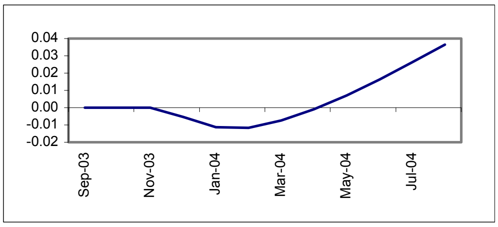
Depreciation Rate



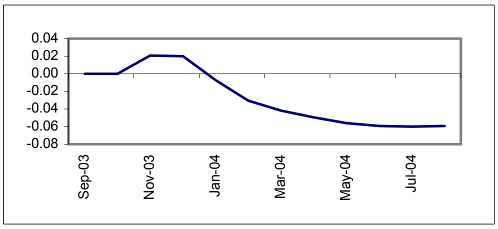
Risk Premium



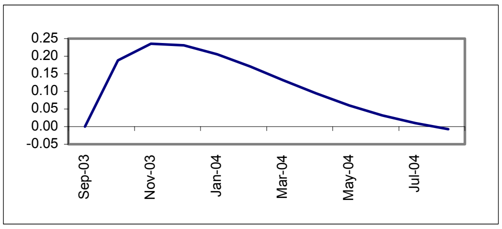
Inflation Rate



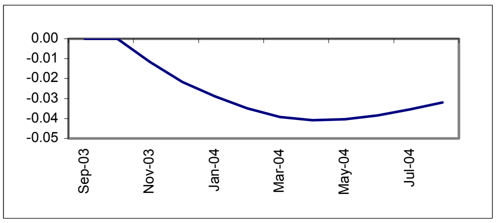
Real Exchange Rate



Real Interest Rate



Output Gap



Current Account to GDP Ratio

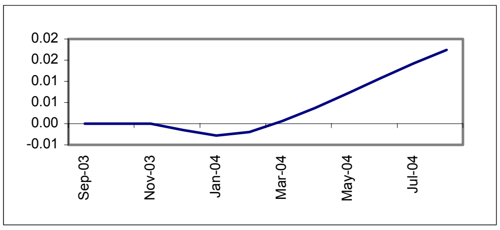


Figure 7: Risk Premium increases by 5 points in September 2003 (Shock 2)

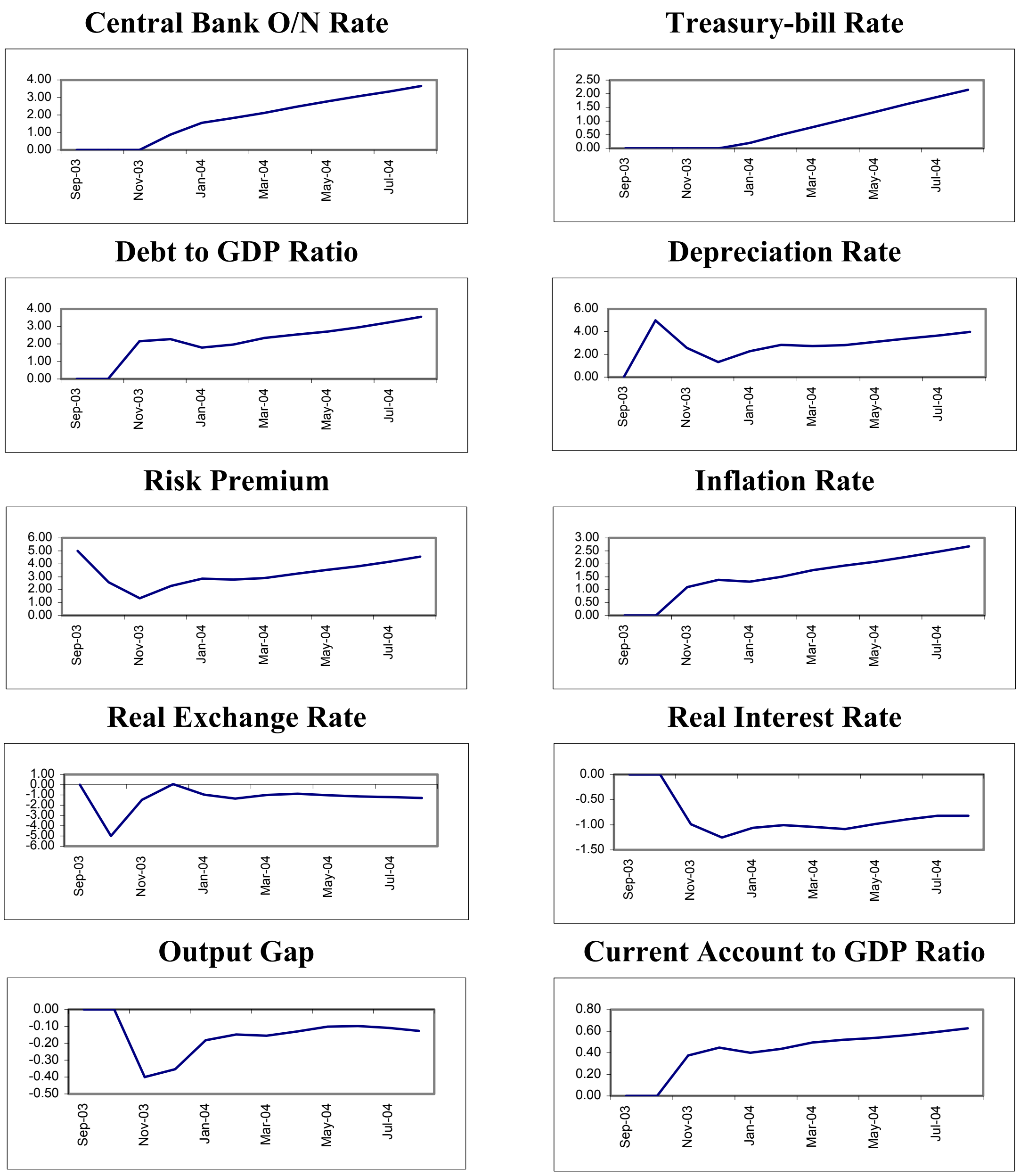


Figure 8: Central Bank rate decreases by 2.18 percentage points in July 2001 (Shock 3)