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The Price Puzzle in Emerging Markets: Evidence from the Turkish Economy Using "Model Based" Risk Premium Derived from Domestic Fundamentals

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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 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: Risk Premium, Non-Linear State Space Models
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1 Introduction

The important works of Blanchard (2003) and Favero and Giavazzi (2003) clearly show the importance of fiscal discipline and debt dynamics on the performance of inflation targeting for 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, tighter monetary policy actually leads to an increase in the price level. As a result, the "price puzzle" that stems from the misidentification of VAR models for industrialized countries emerges as a structural characteristic for 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. For this purpose, the EMBI spread, prepared by JP Morgan has been used as the risk premium measure in many empirical studies. Intended principally for portfolio management purposes, this spread provides a measure of pure sovereign default risk and is constructed as excess promised returns over United States treasuries.

However, it is still an open question whether the changes in the EMBI spreads are exclusively due to the fiscal performance of the economy. There are several other factors, which lead to significant movements in these spreads. First, as Calvo (2002) argues, the domestic factors appear to be irrelevant in explaining the EMBI spreads once the U.S. corporate spreads are taken into account. His study implies that the main determinant of this spread is "the risk appetite" of the foreign investors. Second, EMBI spreads are highly sensitive to political news. Even in the cases where political developments have temporary effects, sharp changes in the EMBI spreads are observed. Also, the bonds that form the EMBI spread typically have long maturities that do not reflect the government's flow fiscal position, which is another crucial factor. Consequently, it can be argued that EMBI spreads do not only reflect the fiscal side developments but also the external factors and the political news. Therefore, the changes in the EMBI spreads should not be viewed as being derived solely from the domestic fundamentals.

Finally, EMBI spreads are weighted averages that are not based on a structural model. However, as Ferrucci (2003) mentions, the default probability, thus the fiscal performance, depends on many macroeconomic factors such as average maturity of the debt, risk-free interest rate, country's leverage ratio and expected future primary surpluses. Also, there are several studies that analyze the interaction between fiscal policy and exchange rate policy.[1] As a result, it may provide insightful results if the risk premium associated only with the domestic factors could be derived from a structural model, which includes the above factors and is consistent with the overall characteristics of the economy.

Deriving the risk premium from a structural model is not straightforward, especially for developing economies. Since risk is not directly observable, one has to work within an "unobserved components" model, where the standard Kalman Filter emerges as the optimal estimation algorithm. Also, peculiar to emerging markets, one can observe frequent structural changes making it necessary to allow for time-varying relationship between macroeconomic variables. However, in such a case, when the state equation -from which the risk premium series is derived- and the time-varying parameters need to be estimated simultaneously, the procedure will have a non-linear nature, where the standard Kalman Filter is no longer appropriate. The Extended Kalman Filter (EKF henceforth) is one of the most popular estimation techniques for the estimation of such nonlinear systems. This estimation technique serves the purpose of allowing for the unobserved risk premium series to be derived from a system of equations with time-varying parameters.

As the above discussion implies, in the first part of the paper, we propose a methodology to develop a measure of the risk premium from a structural time-varying parameter model that is consistent with the inflation targeting framework that Blanchard (2003) and Favero and Giavazzi (2003) suggest for developing economies. It should be noted that, in this context, "the risk premium" is affected only by the domestic fundamentals and assumed to be independent of either the "appetite for risk" of the foreign investors or the noisy component that is inherent in the EMBI spread. Such an exercise can be criticized for not taking account of the risk perceptions about the future or the incentives of the investors. Our risk premium series may better be called as a "realized risk" that is exclusively derived from the current fiscal structure of

[1] Among these, Reinhart(2002) states that approximately 85% of all the defaults in emerging countries were linked to currency crises, which is a finding that explains the close relationship between the exchange rate and fiscal performance.

the economy. To our knowledge, both the estimation methodology introduced in this paper and the idea of deriving risk premium from such a structural model has not been explored in the literature before. In the second part, we obtain and analyze the impulse response functions to see whether a tighter monetary policy actually leads to an increase in the price level. Thus, we will be able to see whether "the price puzzle" is actually a structural characteristic of an emerging market economy with fiscal problems.

Finally, since the above-mentioned papers stress the importance of fiscal performance on the success of monetary policy, for the application, an emerging market that reflects such characteristics should be chosen. We believe that the Turkish economy stands out as a very good example: After the collapse of the exchange rate-based stabilization program in February 2001, the Turkish economy witnessed its deepest financial crisis along with a huge debt burden. After the detrimental effects of the crisis were over, the Central Bank has started to implement a form of implicit inflation-targeting regime together with intense efforts to lower the debt burden. The Turkish economy seems to incorporate all of the characteristics that we are interested in this study such as a volatile macroeconomic environment with fiscal problems and a form of inflation-targeting framework for the monetary policy.

The following section provides a brief overview of the Turkish economy for the 1999-2003 period with a special emphasis on the debt structure. The structural model is described and the estimation procedure is introduced in the next section. After both the derived risk premium series and the estimated time-varying coefficients are discussed, the simulation results are analyzed. 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]

[2] See Celasun(2002).

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 1998 Russian crisis and the devastating 1999 earthquake, Turkish economy entered an unsustainable economic 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 inflation rate, alleviate the public burden and reduce fiscal sector 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 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 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 duration of indexed domestic debt is long, their coupon payment duration 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 face of any shock, demand for government securities weakens, and expectations of monetization of debt emerges,[5] and default risk rises, putting 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, in

[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).

Turkey, 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 adds to the risk perception in the economy.

Such a structure affects the risk perceptions of the agents, the channel through which an interest rate hike affects inflation may not be as obvious as a conventional channel would imply. This already constitutes an obstacle for the monetary authority. Moreover, 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 expectations of future short-term interest rates. This has not been so for the Turkish case since the beginning of the floating rate regime. Although there are significant signs of improvement, the link is still far from being 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]

3 The Model

This section introduces the system of equations and the 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:

$$R^{CB}_{t+1} = \alpha_{0,t} R^{CB}_{t} + \alpha_{1,t} (\pi_{t} - \pi^{*}_{t}) + \varepsilon^{CB}_{R,t+1} \qquad \textbf{-1-}$$

$$R^{TR}_{t+1} = \beta_{0,t} R^{TR}_{t} + \beta_{1,t} R^{CB}_{t} + \varepsilon^{TR}_{R,t+1} \qquad \textbf{-2-}$$

$$D_{t+1} = \gamma_{0,t} D_{t} + \gamma_{1,t} R^{TR}_{t} + \gamma_{2,t} DEPR_{t} + \varepsilon_{D,t+1} \qquad \textbf{-3-}$$

[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 OXPack routines translated from Gauss programs written by Timo Terasvirta.

[7] For empirical evidence, see Özatay, Şahinbeyoğlu and Emir (2003).

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

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

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

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

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

where π_t is the monthly, CPI-based annualized inflation, π_t^* is the targeted rate of 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 the deviation of the inflation from its target, 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 depicts an inflation specification, where inflation's own lag is used to include inertia and the depreciation rate reflects the pass-through. Also, the output gap derived in Ece et al (2004) is employed to reflect the excess demand pressure on the inflation.

The sixth equation specifies the 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 the real exchange rate appreciation, the output gap and a lag of itself.

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 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 supported by Blanchard (2004) and Favero and Giavazzi (2004) hold.

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 ν_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 and the risk premium series is derived.[8] Also, the time-varying parameters are estimated simultaneously. First, the risk premium series is displayed and compared with the EMBI spread with a special reference to the developments in the Turkish economy for the sample period. Next, estimated time-varying parameters are discussed. Finally, the impulse response results are displayed.

[8] Along with the unobserved series- risk premium- the observed series are also derived. A comparison of the actual series and their estimates is provided in Figure 4.

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 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 found to be 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. It should again be reminded that our risk premium series is derived solely from the domestic fundamentals and reflects the "news effect" or other external factors to the extent that they affect the fiscal dynamics.

Figure 3b shows four phases that can be identified regarding the relationship between the risk premium series and the EMBI spread:

First phase: November 1999 - August 2000. When combined with the devastating effects of the earthquake in August 1999, it was clear that the economic program announced in 1998 would be interrupted. By the end of 1999, there were severe problems about debt sustainability, along with high and persistent inflation. Motivated by these two factors, the 2000 economic program, which relied on a pegged exchange rate regime with fiscal austerity, was announced. By the announcement of the program in December 1999, the estimated risk premium starts to decline though still being above the EMBI series. This is mainly because of the fact that EMBI responds promptly to "news" and as the announcement of the program is perceived as "good news", a sharp decline occurred. However, as we claim, the derived risk premium series responds to news only if it is reflected in the fiscal fundamentals. Hence, both series had a downward trend in this phase, with the estimated risk premium having a slower decline.

Second Phase: August 2000 - April 2001. The optimism at the beginning of the exchange rate based stabilization program was replaced by the perception that the program would fail to achieve its goals of sustainable debt and low inflation. As a result, the EMBI spread reacted sharply to this change in the expectations and exceeded the estimated risk premium series significantly.[9]

Third Phase: April 2001 - April 2002. During this phase the risk premium series is always above the EMBI series because the Treasury undertakes the risk of the fragile banking sector by means of swap operations, which led to a sharp 5As we look at the debt to GDP ratio in this period we observe that the ratio starts to rise sharply in April 2001 which explains why the derived risk premium series starts to rise two to three months after the initial starting point of the crisis. 15 increase in the debt stock, starting from March 2001. Although being above the EMBI series, the risk premium series starts to trend down in July 2001 following the announcement of the May 2001 program. As expected, the EMBI reacts to the announcement of the program in May 2001, before it is actually reflected in the fundamentals of the economy.

Fourth Phase: May 2002 - September 2003. This phase is another example showing that EMBI spread reacts very sharply to "news" irrespective of whether they are actually reflected in the fundamentals or not. At the beginning of May 2002, political instability reached a peak and people doubted that the existing government would be able to continue to be on power and started to speak out possible dates for early elections. The seriously deteriorating health conditions of the Prime Minister can be considered as triggering the loudly spoken opinions for the necessity of "early elections" followed by resignations of key members of the Prime Minister's party. However, despite the political instability, there was a continuous improvement in the fiscal performance of the government that does not seem to have the expected impact on the EMBI spread. Thus, until the elections that took place in late 2002, the EMBI spread appears to be significantly above the risk premium. Following the elections on November 2002, EMBI and the risk premium series start to move in the same direction and no major diversity occurs between the movements of the two series.

The above analysis shows that although the EMBI spread and our "realized" risk premium mainly move in the same direction[10], they diverge during several periods. As we analyze the main reasons behind this divergence, we see that the EMBI spread responds very aggressively

[9] As we look at the debt to GDP ratio in this period, we observe that the ratio starts to rise sharply in April 2001 which explains why the derived risk premium series starts to rise two to three months after the initial starting point of the crisis.

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

once the "news" are taken into account, regardless of their effects on the domestic fundamentals. Thus, the EMBI spread is mainly driven by the changes in the risk perceptions of the investors. However, the "realized" risk premium series does not reflect these "news" unless they affect the domestic fundamentals of the economy. The difference in the two series during the hospitalization of the prime minister is a good example. Despite the improvement in fiscal fundamentals at that time, EMBI spread seems to increase significantly while the "realized risk premium" reflects these improvements.

Finally, it can be argued that if the perceived risks of the investors for the entire emerging markets can be partialled out from the Turkish component of the EMBI spread, then a high correlation with our "realized" risk premium series can be found. However, when we regressed the Turkish component of the EMBI spread on the world component and looked at the correlation between the residuals from that regression and our risk premium series, we observe a coefficient of 0.54. Such a result implies that even if the overall risk in the emerging markets is controlled, the two series contain different information.

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 of the UIP equation, the pass-through parameter in the inflation equation and the parameters in the risk premium equation are analyzed.[11] 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 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 these. 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 interest rate differential and the exchange rate right after the collapse of the

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

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 inherent in fiscal fundamentals is accounted for, 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 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 pass-through is still a crucial factor: a one percent increase in the exchange rate brings about a 0.2 percentage 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 emerging economies. Second, the risk premium emerges as a possible explanation of the deviations in the uncovered interest rate parity condition. Then, all of the variables in the risk premium equation have increasing effects over time, at the

expected direction, highlighting the importance of fiscal discipline. Finally, the parameter estimates seem to be consistent with the scenario that Blanchard (2004) and Favero and Giavazzi (2004) points out for emerging economies. However, to have a clearer picture, an impulse response analysis is further needed.

4.3 Simulation Results

We concentrated on three distinct cases in order to see the propagation of a monetary policy action within the framework of a model introduced in this paper. First, we imposed one percentage point increase in the Central Bank rate on September 2003 after the effects of the financial crisis were over and there were less 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, this leads to a depreciation of the currency after three months. 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, supporting the presence of a "price puzzle". As discussed above, both the unexpected operation of uncovered interest rate parity and the "price puzzle" stems 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 negatively.

Second, as Figure 7 indicates, we imposed a 5-point increase in the risk premium on September 2003. Not surprisingly, the obtained impulse responses for the depreciation rate, inflation rate and the risk premium followed similar paths. In this case there is a depreciation of the currency at the same period as the risk premium increases and the initial appreciation of the currency that is observed in the first case is not observed here. Therefore the transmission of this shock to the inflation rate is much more immediate compared to the first shock defined above.

As a third exercise, we concentrated on July 2001 where the only interest rate increase after the crisis took place.[12]For the purpose of this exercise we reversed the case and tried to find out what would happen if there were a 2.18 percentage points decline in the CB rates on July 2001

[12] The increase was 2.18 percentage points.

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, led to the depreciation of the currency and thus to an increase in the rate of inflation, which was contrary to the expected movement in these variables.

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 importance of both fiscal discipline and debt dynamics on the performance of inflation targeting has been discussed by Blanchard (2004) and Favero and Giavazzi (2004). A key variable in both studies is the risk premium, which, apart from other variables, is also affected by fiscal discipline. Therefore, there is need for an accurate measure of a risk premium, which is derived exclusively from the domestic fundamentals of the economy.

Taking the above discussion as its starting point, this study had two purposes. First, an estimation methodology is introduced for an "unobserved components" model, where the coefficients are also allowed to be time varying. Such a methodology seems to fit well with the characteristics of emerging markets. Second, a "model-based" risk premium series is derived and it is tried to shed light on monetary transmission mechanism in an inflation-targeting economy with fiscal problems.

The Turkish economy stands out as an appropriate case in this context. 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. It also exhibits differences from the EMBI spread, which is conventionally used in the literature as a proxy for risk. Finally, the time-varying parameter estimates and the impulse response analysis indicate that the "price puzzle" can well emerge as a structural characteristic of an emerging market economy with fiscal problems.

Prior to the implementation of a full-fledged inflation-targeting regime, there is need for a better understanding of the underlying monetary transmission mechanism. It also needs to be figured out whether the conjuncture, under which the above-mentioned results are obtained, still engrosses the Turkish economy or not. The results indicate that, a clear break is observed in the

time varying parameters following the crisis in 2001. It is possible to interpret this as a possible change in the dynamics of the macroeconomic variables. Therefore, it is anticipated that the dominating role of the risk premium in the determination of the exchange rates, which has already started to decline within the framework of this model, will decline even further.

APPENDIX I: State Space Representation

The state equation of the model can be written as:

$$\begin{bmatrix} R^{CB}_{t+1} \\ R^{TR}_{t+1} \\ D_{t+1} \\ DEPR_{t+1} \\ \pi_{t+1} \\ y_{t+1} \\ CA_{t+1} \\ \Pr_{t+1} \end{bmatrix}_{8\times 1} = \begin{bmatrix} \alpha_{0,t} & 0 & 0 & 0 & \alpha_{1,t} & 0 & 0 & 0 \\ \beta_{1,t} & \beta_{0,t} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \gamma_{1,t} & \gamma_{0,t} & \gamma_{2,t} & 0 & 0 & 0 & 0 \\ 0 & \varphi_{1,t} & 0 & 0 & 0 & 0 & 0 & \varphi_{0,t} \\ 0 & 0 & 0 & \theta_{1,t} & \theta_{0,t} & \theta_{2,t} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \partial_{0,t} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \mu_{2,t} & \mu_{0,t} & 0 \\ 0 & 0 & \phi_{0,t} & 0 & 0 & 0 & \phi_{2,t} & \phi_{4,t} \end{bmatrix}_{8\times 8} \begin{bmatrix} R^{CB}_{t} \\ R^{TR}_{t} \\ D_{t} \\ DEPR_{t} \\ \pi_{t} \\ y_{t} \\ CA_{t} \\ \Pr_{t} \end{bmatrix}_{8\times 1} + \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & -\alpha_{1,t} \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\varphi_{1,t} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \partial_{1,t} & \partial_{2,t} & 0 \\ 0 & 0 & 0 & \mu_{1,t} & 0 & 0 \\ \phi_{1,t} & \phi_{3,t} & 0 & 0 & 0 & 0 \end{bmatrix}_{8\times 6} \begin{bmatrix} MAT_t \\ PS_t \\ R^{US}_t \\ RER_t \\ R_t \\ \pi^{*}_t \end{bmatrix}_{6\times 1} + \begin{bmatrix} \varepsilon^{CB}_{R_{t+1}} \\ \varepsilon^{TR}_{R_{t+1}} \\ \varepsilon_{D_{t+1}} \\ \varepsilon_{ER_{t+1}} \\ \varepsilon_{\pi_{t+1}} \\ \varepsilon_{y_{t+1}} \\ \varepsilon^{CB}_{CA_{t+1}} \\ \varepsilon_{\Pr_{t+1}} \end{bmatrix}_{8\times 1}$$

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

References

Anderson, B. D. O. and J. B.Moore (1979), “Optimal Filtering”, Prentice Hall.

Bergin P. R. (2004), “How Well Can the New Open Economy Macroeconomics Explain the Exchange Rate and the Current Account?”, NBERWorking Paper, No: 10356.

Blanchard, O. (2004), ”Fiscal Dominance and Inflation Targeting: Lessons from Brazil”, NBER Working Paper, No: 10389.

Central Bank of the Republic of Turkey, Monetary Policy Report, October 2003.

Calvo, G. (2002), “Explaining Sudden Stop, Growth Collapse and BOP Crisis”, 2002 Mundell-Flemming lecture, IMF Sta. Papers.

Celasun, M. (2002), “2001 Krizi, Öncesi ve Sonrasi: Makroekonomik ve Mali Bir Degerlendirme”, unpublished manuscript, Bilkent University Department of Economics.

Chen, G. (1993), “Approximate Kalman Filtering”, World Scientific.

Chui, C. K. and G. Chen (1991), “Kalman Filtering with Real-Time Applications”, Springer Verlag.

Elmendorf, D.W. and Mankiw N.G (1998), "Government Debt” Finance and Economics Discussion Series, Federal Reserve Board, Washington, D.C.

Ece, D., H. Kara, F.Ogunc, U.Ozlale and C.Sagrikaya (2004), “Estimating The Output Gap For The Turkish Economy”, unpublished manuscript, Research Department, The Central Bank of The Republic of Turkey.

Eichengreen, B. and A.Mody (1998), “What Explains Changing Spreads on Emerging-Market debt: Fundamentals or Market Sentiment?”, NBER Working Paper, No: 6408.

Favero, C. and F. Giavazzi (2004), “Inflation Targeting and Debt: Lessons From Brazil”, NBER Working Paper, No: 10390.

Ferrucci, G. (2003), “Empirical Determinants of EmergingMarket Economies’ Sovereign Bond Spreads”, Bank of England Working Paper no: 205.

Ozatay, F., G. Sahinbeyoglu and O. Y. Emir (2004), “High Public Debt and Effects of News on Interest Rates”, Central Bank of The Republic of Turkey Working Paper no: 04/03.

Reinhart, C. M. (2002), “Default, Currency Crises and Sovereign Credit Ratings”, World Bank Economic Review, 16:2, pages 151-170.

Rudebusch, G.D. and L.E.O. Svensson (1998), “Policy Rules for Inflation Targeting”, NBER Working Paper no: 6512.

Rudebusch, G.D. and L.E.O. Svensson (1999), “Eurosystem Monetary Targeting: lessons from U.S. data”, NBER Working Paper no: 7179.

Sargent, Thomas J., and Neil Wallace (1981), "Some Unpleasant Monetarist Arithmetic", Federal Reserv Bank of Minneapolis Quarterly Review.

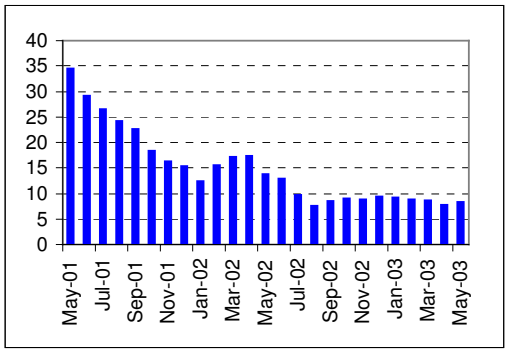
Woodford, Michael (1996), "Control of Public Debt: A Requirements for Price Stability", NBER, Working paper no: 5684.

Woodford, Michael (1998), "Public Debt and Price Level", unpublished manuscript, Princeton University.

Woodford, Michael (2001), "Fiscal Requirements for Price Stability", NBER Working paper no: 8072.

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



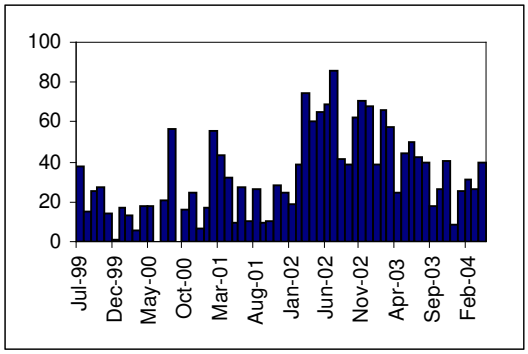
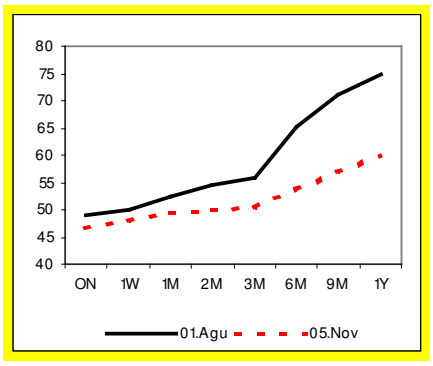
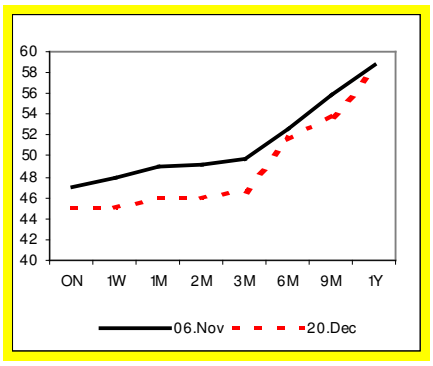


Figure 2: Yield Curves

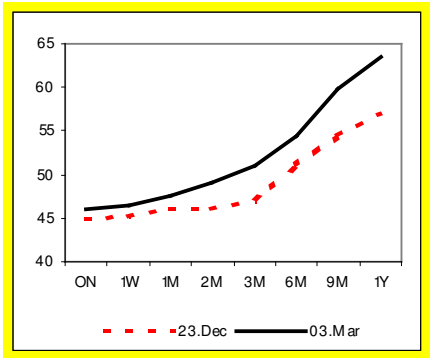
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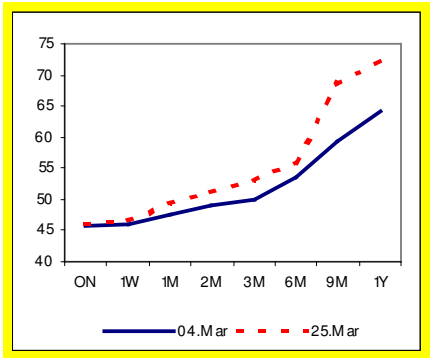
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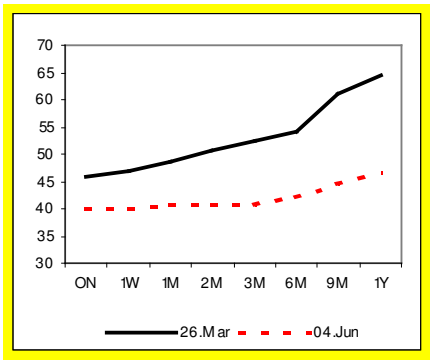
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March 4and 25, 2003



March 26 and June 4, 2003



June 5 and July 31, 2003

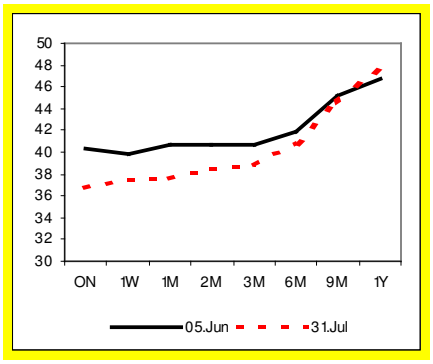
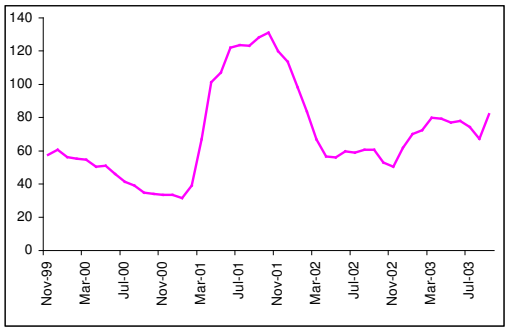


Figure 3: Risk Premium versus EMBI spread

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



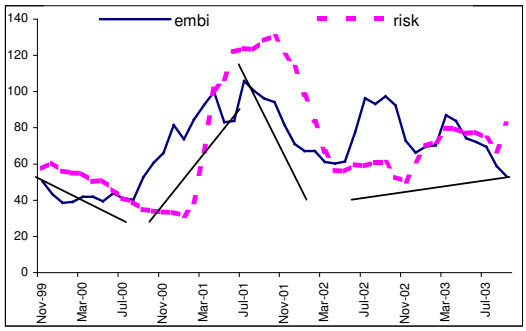
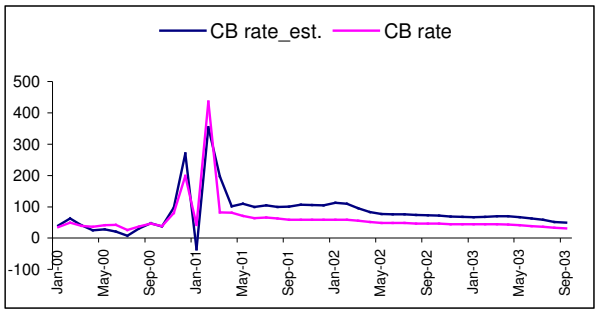
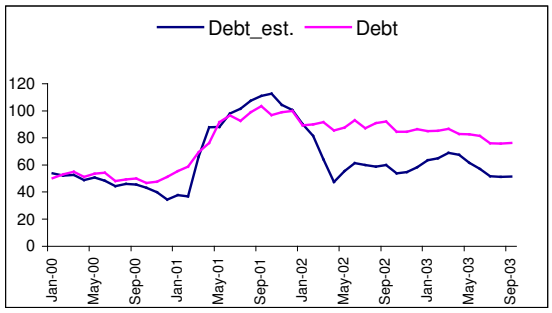


Figure 4: Estimated versus Actual Data

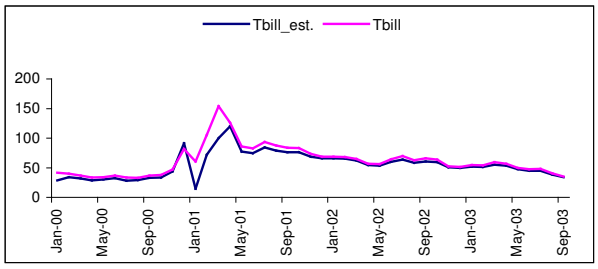
Panel a: Central Bank rate



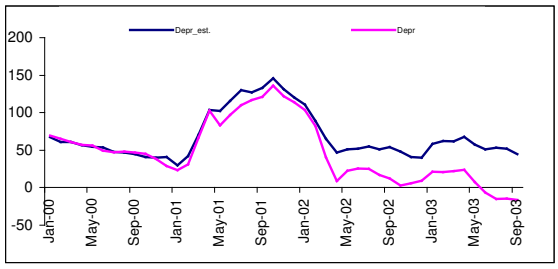
Panel b: Debt/GDP



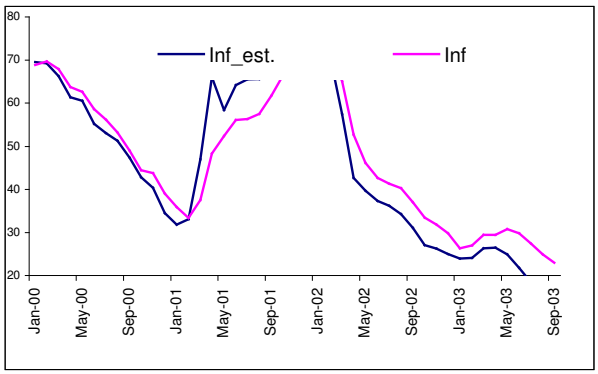
Panel c: T-Bill rate



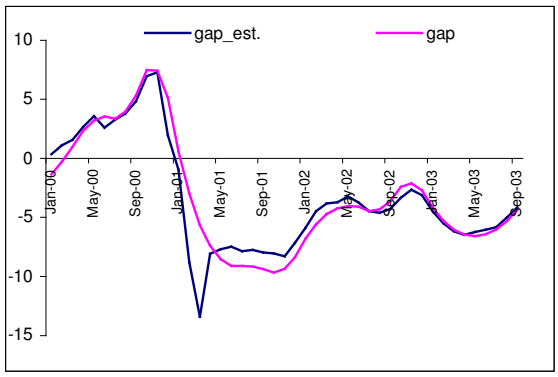
Panel d: Depreciation rate



Panel e: Inflation



Panel f: Output Gap



Panel g: Current Account Deficit/GDP

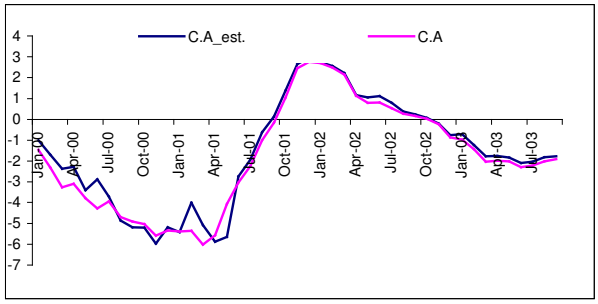
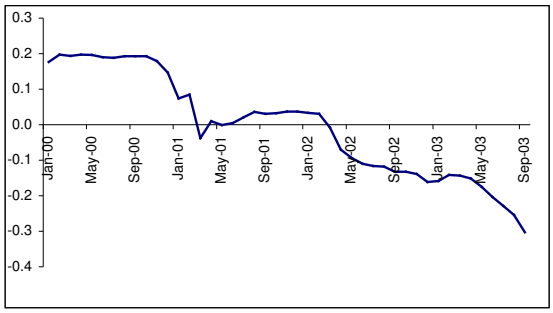
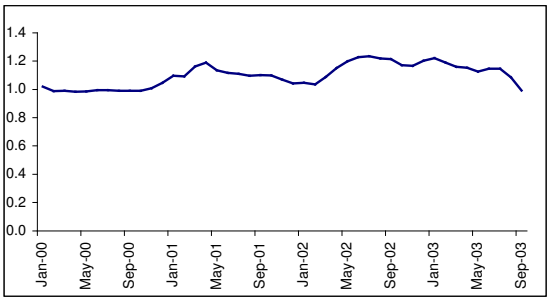


Figure 5: Time Varying Coefficients

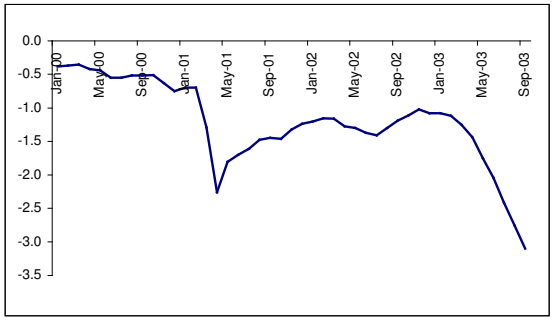
Panel a: Time Varying coefficient of Interest rate differentials in UIP equation



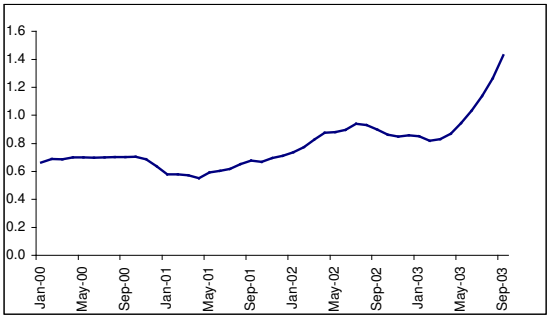
Panel b: Time Varying coefficient of Risk Premium in UIP equation



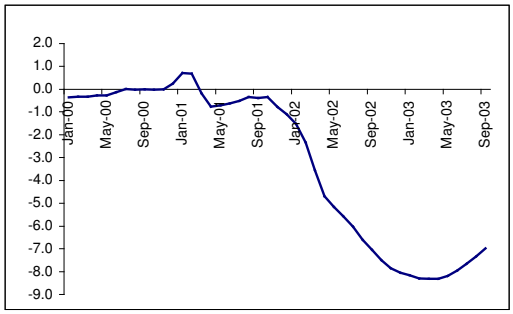
Panel c: Time Varying coefficient of average maturity in Risk Premium equation



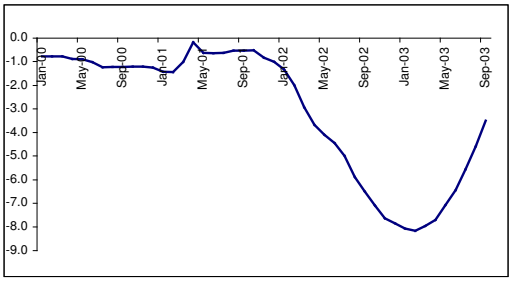
Panel d: Time Varying coefficient of Debt/GDP in Risk Premium equation



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

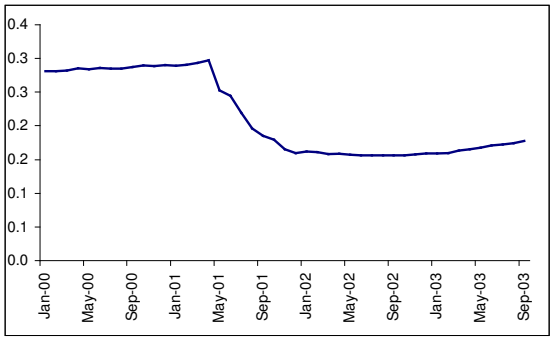


Figure 6: Central Bank Rate increases by 1 percentage point in September 2003 (Shock 1)

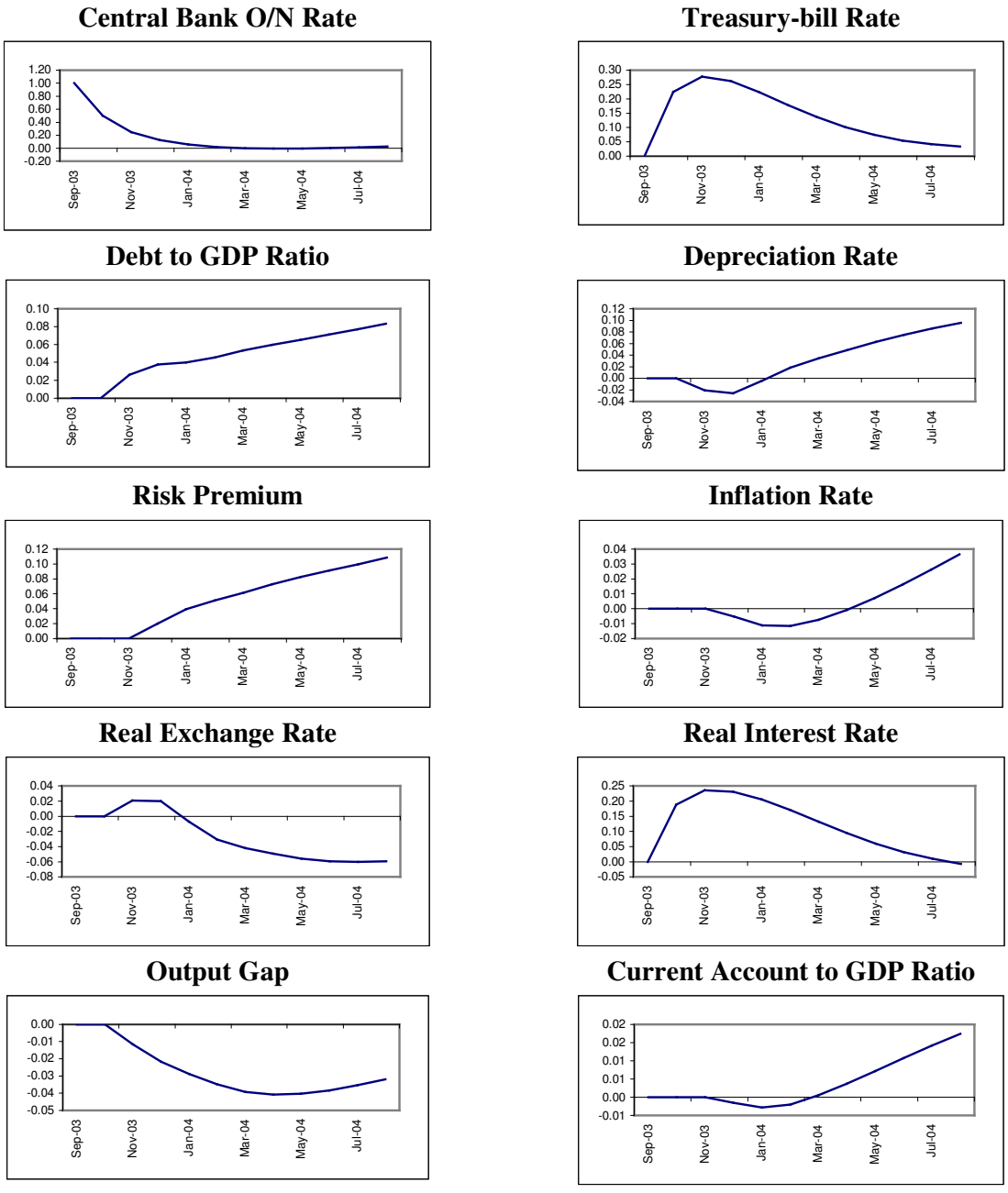


Figure 7: Risk Premium increases by 5 points in September 2003 (Shock 2)

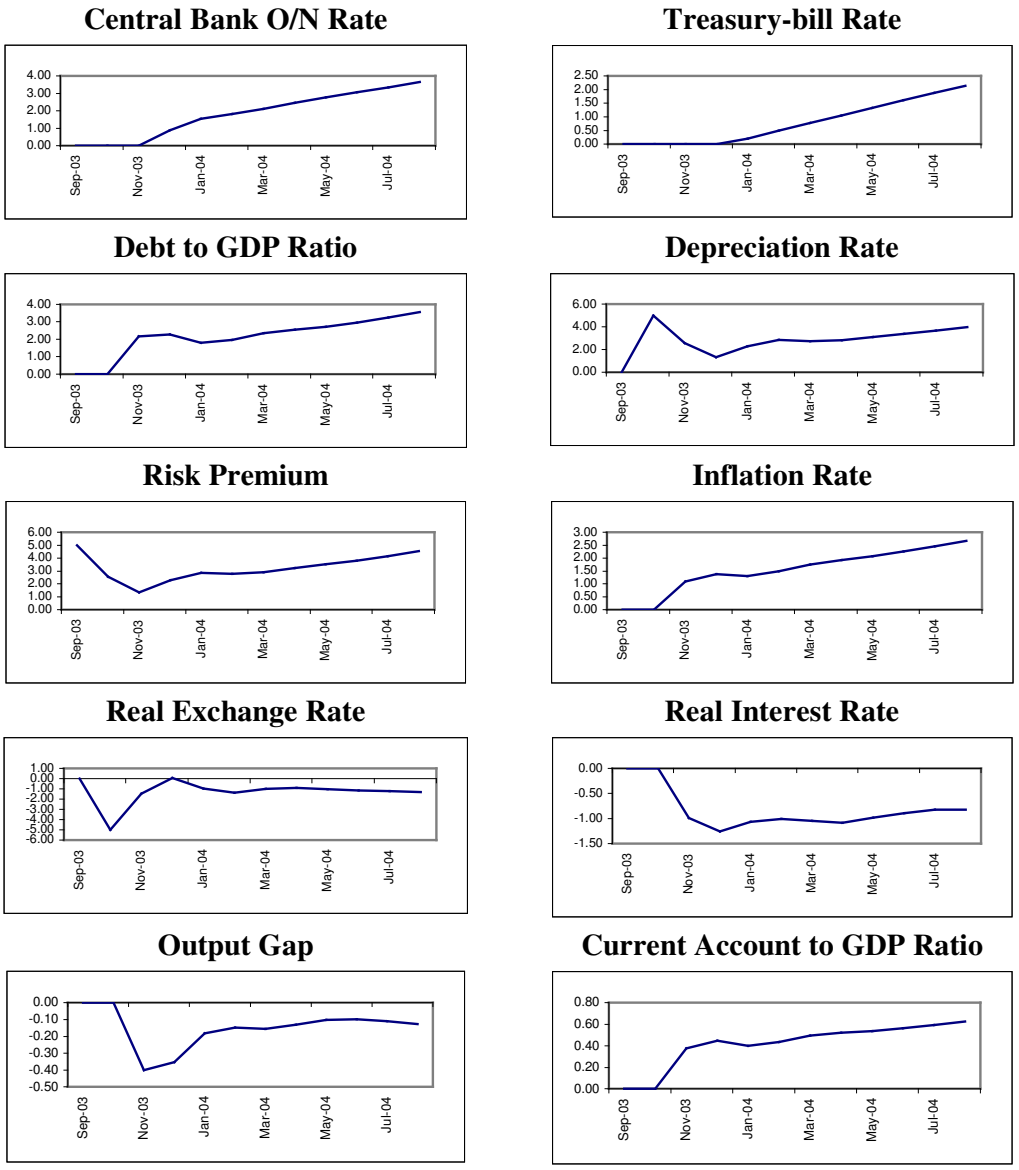


Figure 8: Central Bank rate decreases by 2.18 percentage points in July 2001 (Shock 3)

