Money, Deficits, Debts and Inflation in Emerging Countries: Evidence from Turkey

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Abstract:

This paper focuses on internal and external factors, which influence the inflation rate in Turkey. The monetary model of inflation rate which was developed by Kia (2006a) was extended and tested on Turkish data. It was found that government debt and deficits along with other factors are important determinants of inflation in Turkey. Furthermore, most sources of inflation in this country are domestic factors.

Keywords: Outstanding debt, deficit, inflation, fiscal and monetary policies, external and internal factors

JEL Codes: E31, E41, E50 and E62
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I. Introduction

The objective of this paper is to investigate empirically the monetary (including real exchange rate) and fiscal (including outstanding public debt, debt management, deficits and government expenditure) as well as other determinants of inflation rate in Turkey. To the best knowledge of the author, except for Kia’s (2006a) work which is on a non-traditional economy, no such study for emerging or developed countries exists. For example, Togan (1987), using a monetary approach to inflation, finds the real income has a positive impact on the inflation rate, while the real interest rate, depending on the estimation technique, may have a positive or a negative impact on the inflation rate in Turkey. Dornbush et al. (1990) and Drazen and Helpman (1990) find that an uncertainty on the time when the deficits are financed creates fluctuation in the inflation rate. Bahmani-Oskooee (1995) finds the world price has a positive impact over the long run on the consumer price in Iran. Özatay (1997) finds that when the fiscal process is not sustainable, the monetary policy cannot be independent and, therefore, because of an unsustainable fiscal policy, price stability in Turkey is very difficult to achieve.

Furthermore, Lim and Papi (1997), using an *ad hoc* general equilibrium model, find the exchange rate and the public deficit have a negative impact on the inflation rate, but the money supply causes a higher inflation rate in Turkey. Pongsaparn (2002), using an *ad hoc* small scale macroeconomic model, tests the impact of macroeconomic variables like domestic and foreign interest rates, real exchange rate, broad money supply and debt-to-GDP ratio on the price level/inflation rate in Turkey. This study finds the
domestic interest rate has a negative impact on the price level, but other variables,
including the outstanding debt per GDP, have a positive impact on the price level in
Turkey.¹ Tekin-Koru and Ozmen (2003) find no support for the linkage between the
budget deficit and inflation through the wealth effect in Turkey. Instead, they found that
deficit financing leads to a higher growth of interest-bearing broad money, but not
currency seigniorage. Us (2004) finds the consumer price index causes monetary base,
but the reverse is not true in Turkey. Arize et al. (2004) find that the inflation in
82 countries responds positively to the volatility of real and nominal exchange rates.
Berument and Kilinc (2004) find shocks in the industrial production of Germany, the
United States and the rest of the world will affect positively the inflation rate in Turkey.
Ashra et al. (2004), using a monetary approach to inflation, investigate a causality
relationship between deficit, money supply and inflation in India. They found no
relationship between the central bank credit to the government and the government
deficit, but found that M3 causes the inflation rate.

El-Sakka and Ghali (2005) find the nominal exchange rate, the nominal interest
rate, the money supply and the world price have a positive impact on the consumer price
index in Egypt but the real income has a negative impact on the level of price.
Kia (2006a) finds, over the long run, a higher exchange rate (lower value of domestic
currency) leads to a higher price in Iran, a higher money supply when it is anticipated
does not lead to a higher price level, but an unanticipated shock in the money supply
results in a permanent rise in the price level. He also finds that the real government
expenditures as well as deficits cause inflation, but if the changes are unanticipated they
cause the opposite effect. Furthermore, a high debt per GDP is deflationary and the foreign financing of the government debt has no price impact when it is anticipated, but it has a positive effect if unanticipated. The foreign interest rate has a deflationary effect in Iran over the long run while imported inflation does not exist in that country.

Rabanal (2007), using a dynamic stochastic general equilibrium model, shows a tight monetary policy in the United States results in a higher inflation rate through a cost of capital. Boschi and Girardi (2007) attempt to find short-run and long-run determinants of the inflation rate in the Euro Area. They found that both demand and supply-side factors, through mark-up process and output gap, affect inflation. Tawadros (2007) uses a monetarist model of inflation to test the neutrality of money in Egypt, Jordan and Morocco and finds that money affects inflation in these countries and not the real income.

Berument (2007), using a VAR model, finds that tight monetary policy reduces income and prices, but results in an appreciation of domestic currency in Turkey. Finally, Williams and Adedeji (2007), using a monetary approach to inflation, find that the inflation rate in the Dominican Republic is affected by money supply, real income, foreign inflation as well as the exchange rate. However, none of these studies incorporates completely the direct impact of the government spending, deficits, the outstanding debt and the government debt management on the inflation rate. As we saw above, some of these studies incorporated one or more public variables while ignoring the rest.

Furthermore, excluding Kia (2006a), no study on estimating the cointegration relationship so far allows the short-run dynamics of the system to be influenced by policy

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1 Both Lim and Papi (1997) and Pongsaparn (2002) provide a survey on empirical studies on inflation in
regime changes as well as other exogenous shocks. As evidenced by Kia (2006b), constant models can have time-varying coefficients if a deeper set of constant parameters characterizes the data generation process. Specifically, the existence of constancy may depend on whether raw coefficients or underlying parameters are evaluated. Kia (2006b) also shows that the estimated long-run relationship can be biased when the appropriate policy regime changes and/or other exogenous shocks are not incorporated in the short-run dynamics of the system. This fact is especially important for the studies on Turkish inflation since the country has witnessed several changes in policy regimes and undergone many other exogenous shocks during the past three decades. For example, in the 1980’s Turkey moved from an import-substitution policy to an export-incentives policy. Some studies, e.g., Lim and Papi (1997), consider this policy regime change a long-run structural break in the estimation of an inflation equation for Turkey. However, as we will see in this paper such a policy change did not generate any structural break in the long-run cointegration relationship.

To fill the gap in this literature, we extended Kia’s (2006a) model and tested it on the Turkish data and the estimation results proved the validity of the extended model, as it is unique in this literature. It should be noted that the model used in this study is different than Kia’s model. The extended model used in this paper is for a country (i.e., Turkey) which is operating under conventional economics. Specifically, our tested model includes the domestic interest rate as well as the real rather than the nominal exchange rate and imposes the restrictions implied by the theoretical model.
Turkey, which relies mostly on agricultural products, experienced severe inflation, up to 106.6% in 1994, when the outstanding debt was 44% of GDP. The outstanding debt reached 99.87% of GDP in 2001 when the inflation rate was 54.4%. The model used in this study is an augmented version of the monetarist model which, unlike the model used in the existing literature, is designed in such a way to incorporate both external and internal factors, which cause inflation in the country. Furthermore, since the model also incorporates government deficits and debt, we could test Sargent and Wallace’s (1986) views that (i) the tighter is the current monetary policy, the higher inflation rate will eventually be, and (ii) that government deficits and debt will eventually be monetized in the long run.

It was found that the model is successful in capturing the impact of fiscal instruments, i.e., deficits, debt and debt management, and of monetary instruments on the inflation rate in Turkey. Furthermore, a policy toward a stronger currency is inflationary and most sources of inflation in Turkey are domestic factors. Finally, Sargent and Wallace’s view on a tight monetary policy leading to higher inflation over the long run is valid. As for fiscal variables in Turkey, it was found that a higher government debt per GDP results in a riskier environment and, therefore, in a higher rate of inflation. However, the reverse is true for the externally government debt financing over the long run. Moreover, there is no imported inflation in Turkey over the long run.

The following section deals with the development of the theoretical model. Section III describes the data and the long-run empirical methodology and results. Section IV is devoted to the short-run dynamic models, which is followed by a section on
analyzing the impact of unanticipated shocks on the inflation rate. The final section provides some concluding remarks.

II. The Model

Considers an economy with a single consumer, representing a large number of identical consumers. The consumer maximizes the utility function (1) subject to budget constraint (2), where

\[ U(c_t, c_t^*, g_t, k_t m_t, m_t^*) = (1 - \alpha)^{-1} \left( c_t^{\alpha_1} c_t^*^{\alpha_2} g_t^{\alpha_3} \right)^{1-\alpha} \]

\[ + \xi (1 - \eta)^{-1} \left[ (m_t/k_t) \eta^1 m_t^{\eta^2} \right]^{1-\eta}, \]  

\[ \tau_t + y_t + (1 + \pi_t)^{-1} m_{t-1} + q_t (1 + \pi_t^*)^{-1} m_{t-1}^* + (1 + \pi_t)^{-1} (1 + R_{t-1}) d_{t-1} + \]

\[ q_t (1 + \pi_t^*)^{-1} (1 + R_{t-1}^*) d_{t-1}^* = c_t + q_t c_t^* + m_t + q_t m_t^* + d_t + q_t d_t^*, \]

(1)  

(2)

where \( \tau_t \) is the real value of any lump-sum transfers/taxes received/paid by consumers, \( q_t \) is the real exchange rate, defined as \( E_t p_t^*/p_t \), \( E_t \) is the nominal market exchange rate (domestic price of foreign currency), \( p_t^* \) and \( p_t \) are the foreign and domestic price levels of foreign and domestic goods, respectively, \( y_t \) is the current real endowment (income) received by the individual, \( m_{t-1}^* \) is the foreign real money holdings at the start of the period, \( d_t \) is the one-period real domestically financed government debt which pays \( R \) rate of return and \( d_t^* \) is the real foreign issued one-period bond which pays a risk-free interest rate \( R_t^* \), where \( d_t \) and \( d_t^* \) are the only two storable financial assets.

It is assumed variable \( k_t \), which summarizes risk associated to holding domestic money, has the following long-run relationship:

\[ \log (k_t) = k_0 \text{defgdp}_t + k_1 \text{debtgdp}_t + k_2 \text{fdgdp}_t. \]

(3)

Variables defgdp, debtgdp and fdgdp are real government deficits per GDP, the government debt outstanding per GDP and the government foreign-financed debt per
GDP, respectively, where it is assumed government debt pays the same interest rate as deposits at the bank (i.e., \( R \)).

Equation (3) is also assumed to be held subject to a short-run dynamics system, which is a function of a set of predetermined short-run (stationary) variables known to individuals. These variables include the growth of money supply, changes in fiscal variables per GDP, the growth in exchange rate, domestic and foreign inflation as well as changes in interest rates. Furthermore, it is assumed that the short-run dynamics of the risk variable \( \log (k) \) includes a set of interventional dummies which account for wars, sanctions, political changes, innovations as well as policy regime changes which influence services of money. Maximizing the utility function (1) subject to equations (2) and (3) and imposing some stability conditions, Kia (2006a) finds the following demand for money relationship:

\[
\log(m_t) = m_{0} + m_{1} i_t + m_{2} \log(y_t) + m_{3} \log(g_t) + m_{4} \log(k_t) + m_{5} \log(q_t) + m_{6} i^*\]

where, \( i^* = \log(R^*/1 + R^*) \), \( i_t = \log(R_t/1 + R_t) \) and, \( m_{0} > 0, m_{1} < 0, m_{2} > 0, m_{3} < 0, m_{4} < 0, m_{5} = ?, m_{6} < 0 \). From the equilibrium condition in the money market we can find the following price relationship:

\[
l_p = \beta_0 + (\beta_1=1) \log M_s + \beta_2 i_t + \beta_3 l_y + \beta_4 l_q + \beta_5 i^*_t + \beta_6 l_t + \beta_7 \log dfgd + \beta_8 debt + \beta_9 fdgd + \beta_{10} trend + u_t
\]

where an \( \log \) before a variable means the logarithm of that variable and \( u \) is a disturbance term assumed to be white noise with zero mean. \( \beta \)s are the parameters to be estimated, where \( \beta_1 = 1, \beta_2 > 0, \beta_3 < 0, \beta_4 = ?, \beta_5 > 0, \beta_6 > 0, \beta_7 > 0, \beta_8 > 0, \beta_9 > 0 \) and \( \beta_{10} > 0 \). It should be noted that Equation (5) is very different from the price equation estimated by
Kia (2006a). He assumed \( i_t \) is zero so as to be able to estimate the equation on Iranian data. Furthermore, Kia substituted for the real exchange rate \( (lq_t) \) its components (i.e., \( E_t \), \( p_t^* / p_t \)) and, therefore, his tested model is a function of the nominal exchange rate as well as the foreign price rather than the real exchange rate.

Consequently, he needed to impose two important restrictions on the coefficients of his model: (i) making the coefficient of the nominal exchange rate and the level of foreign price equal and (ii) the summation of the coefficient of money supply and nominal exchange rate (or foreign price) equal to one. Since these two restrictions make an estimate of the long-run price level unrealistic, he estimated the long-run model without any restriction. However, in our model we only need to impose \( \beta_1 = 1 \).

Furthermore, foreign price in terms of the domestic price (real exchange rate) is a more appropriate determinant of the price level over the long run than its absolute value. Therefore, Equation (5) is a more valid equation for a country like Turkey, where the economy has been operating under a traditional economic system. The next section of this paper is devoted to such estimation.

According to the model, a higher money supply and a higher interest rate (tight monetary policy) increase the price level over the long run. This confirms the theoretical model of Sargent and Wallace’s (1986, p. 160) view that ‘[…] given the time path of fiscal policy and given that government interest-bearing debt can be sold only at a real interest rate exceeding the growth rate \( n \), the tighter is current monetary policy, the higher must the inflation rate be eventually.’ A higher real income results in a higher real demand for money and a lower price level. We cannot determine theoretically the impact of the exchange rate and the foreign price level on the domestic price level. According to
our model, the impact of deficit, government spending, outstanding government debt and
debt financed externally, for a given output level, on the price level is positive.
Consequently, these fiscal variables, according to our theoretical model, are inflationary.
Note that since the real government expenditure is considered a “good” - in fact, a public
good - its level influences the price, while deficits and debt are measures for future taxes
and inflation, and so their proportions to GDP may influence the price level. The
estimation result of the model on Turkish data, which is generated by traditional
economics, is given in the next section.

III. Data, Long-Run Empirical Methodology and Results

(A) Data

The model is tested for Turkey (1970Q1-2003Q3). All observations are quarterly
and the sample period is chosen according to the availability of the data. The sources of
the data, unless specified, are the International Financial Statistics (IFS) online. Some
missing data were taken from the World Development Indicator (WDI) and some from
the State Institute of Statistics of Turkey (SIS) or IMF – Economic and Financial Data
for Turkey. Data series on GDP, government deficits and expenditures as well as debt
financed externally and outstanding government debt are only available yearly. Quarterly
observations were, consequently, interpolated using the statistical process developed by
RATS. This procedure keeps the final value fixed within each full period.

Information on institutional and policy changes in Turkey were taken from The
Middle East and North Africa (2004). \( l_p \) is the logarithm of Consumer Price Index (CPI),
\( l_{Ms} \) is the logarithm of nominal M1, \( i \) is the logarithm of \( (R/(1+R)) \), where \( R \) is the
discount rate at the annual rate, in decimal points. Note that the only reason, as a measure
for the domestic interest rate, the discount rate was chosen is because of its data availability in the sample period. Quarterly data on other more relevant interest rates is only available for a very short part of the sample period. For instance, Treasury Bills rates are available only from 1985Q4.

Variable $y$ is the real GDP, which is the nominal GDP divided by CPI. Variable $g$ is the real (nominal deflated by CPI) government expenditures on goods and services, $q = \frac{E}{p}$ is the real exchange rate, where $E$ is the nominal market exchange rate, which is equal to the domestic currency in terms of $US$. Variable $p^*$ is the foreign price level where, following Kia (2006a) among others, the industrial countries unit value export price index was used as a measure for $p^*$. Foreign rate $i^*$ is the logarithm of $(R^*/1+R^*)$, where, following Kia (2006a), $R^*$ is the LIBOR (3-month London interbank) rate at the annual rate, in decimal points. Variables defgdp, debtgdp and fdgdp are deficits, outstanding debt and foreign debt per GDP, respectively.

(B) Stationarity Tests

To investigate the stationarity property of the variables I used Augmented Dickey-Fuller (ADF) and non-parametric Phillips-Perron’s (PP) tests. Furthermore, the LM unit root test developed by Schmidt and Phillips (1992), (SP, hereafter), was used. This test, in contrast to the Dickey-Fuller test, allows for trend under both the null and the alternative, without introducing any parameters that are irrelevant under either.

I found all variables, except the government expenditure on goods and services are integrated of order one according to all test results (i.e., the level of these variables has a unit root, but their first differences are stationary). The government expenditure on
goods and services, however, was found to be stationary based on all test results. For the sake of brevity, these results are not reported, but are available upon request.

(C) Long-Run Methodology

We analyze a p-dimensional vector autoregressive model with Gaussian errors of the form:

\[ X_t = A_1 X_{t-1} + \ldots + A_k X_{t-k} + \mu + u_t, \quad u_t \sim \text{iid}(0, \Sigma), \quad (6) \]

where \( X_t = [lp_t, lMs_t, i_t, ly_t, lq_t, \text{defgdp}_t, \text{debtgdp}_t, \text{fdgdp}_t] \), \( \mu \) is \( p \times 1 \) constant vector representing a linear trend in the system. The p-dimensional Gaussian \( X_t \) is modeled conditionally on long-run exogenous variable \( i^*_t \) and the short-run set of \( \text{DUM}_t = (Q_1_t, \ldots, Q_4_t, \text{intervention dummies and other regressors that we can consider fixed and non-stochastic}), \) where \( Q \)’s are centered quarterly seasonal dummy variables. Parameters \( A_1, \ldots, A_k, \phi, \) and \( \Sigma \) are assumed to vary without restriction. The error correction form of the model is:

\[ \Delta X_t = \Gamma_1 \Delta X_{t-1} + \ldots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \mu + \phi \text{DUM}_t + u_t, \quad (7) \]

where \( \Delta \) is the first difference notation, the first \( k \) data points \( X_{t-1}, \ldots, X_0 \) are considered fixed and the likelihood function is calculated for given values of these data points. Parameters \( \Gamma_1, \ldots, \Gamma_{k-1} \) and \( \Pi \) are also assumed to vary without restriction. However, the hypotheses of interest are formulated as restriction on \( \Pi \).

Note that the set of dummy variables that constitutes the set of DUM affects only the short-run dynamics of the system. They account for institutional and policy regime changes, which could affect the inflation rate and other variables in the model. For these dummy variables I consider five major policy regime changes that have characterized Turkey (see The Middle East and North Africa, 2004):
(i) In 1984Q4, the government introduced a value-added tax to replace the previous unwieldy system of production taxes. Furthermore, the capital account liberalization started in 1984, when the foreign exchange rate regime was liberalized. Banks were allowed to offer foreign currency-denominated account and non-residents could open lira-denominated accounts in Turkey. Residents could also buy and sell foreign-denominated securities. In other words, capital mobility was allowed. This policy resulted in an appreciation of the Turkish lira [see Pongsaparn (2002) on capital account liberalization].

(ii) In January 1994, two U.S. credit rating agencies downgraded Turkey's credit rating, which resulted in a run of foreign currencies. The value of the lira was officially devalued by 12% against the US dollar; however, the currency continued to plummet. Interest rates rose to 150% - 200% as the government and the Central Bank desperately tried to bring the financial markets under control. In April 1994, the government announced a program of austerity measures to reduce the budget deficit, lower inflation and restore domestic and international confidence in the economy. The program included a freezing of wages, price increases of up to 100% on state monopoly goods, as well as longer-term restructuring measures such as the closure of loss-making state enterprises and an accelerated privatization process.

(iii) In July 1995, the new government approved a raise in the minimum wage and salary increases of 50% for state workers and pensioners. The government stated that the main aspects of its economic program were a commitment to a free-market economy, lower inflation and a steady growth rate, lower taxation for producers, greater efforts to
attract foreign investment, an acceleration in the privatization program and an emphasis on investment in infrastructure projects.

(iv) In January 2000, as part of the anti-inflation program, a new exchange rate substitution policy took effect under which the managed peg used since 1994 was abandoned in favor of a peg set according to a pre-determined devaluation rate (20% in 2000), itself set against a basket of the US dollar and the euro.

(v) In February 2001, following a public clash between the President and the Prime Minister, the financial system went into near-meltdown in Turkey's worst economic crisis in recent years. A massive flight of capital forced the government to float the lira and accept an immediate devaluation of the currency. Consequential consumer price increases sparked widespread protest demonstrations, amidst rumors that another military takeover was imminent. The interest rate rose to the equivalent of 4,000% annually. On February 22, 2001, the government ended the crawling peg with the US dollar and allowed the lira to float freely, with the result that its value fell by 36% over two days. Accordingly, I use the following dummy variables to represent these potential policy regime shifts and exogenous shocks: vtax = 1 from 1984Q4 and = 0, otherwise, fcrisis = 1 for 1994Q2 and = 0, otherwise, pwd = 1 for 1995Q2-1995Q3 and = 0, otherwise, MEX = 1 for 1994Q4-1999Q4 and = 0, otherwise, PEX = 1 for 2000Q1-2000Q4 and = 0, otherwise, flex = 1 since 2001Q1 and = 0, otherwise. One may also argue that, e.g., Lim and Papi (1997), when Turkey moved from an import-substitution policy in the 1980’s to an export-incentives policy, it created a structural break in the long-run inflation relationship. We will show that there is no structural break in our cointegration relationship.
In determining the lag length one should verify if the lag length is sufficient to get white noise residuals. As it was recommended by Hansen and Juselius (1995, p. 26), set \( p=r \) (the unrestricted model) in Equation (6) and test for autocorrelation. In this case the residuals are the OLS-estimates from Model (6). LM tests will be employed to confirm the choice of lag length. The order of cointegration (r) will be determined by using the Trace test developed in Johansen and Juselius (1991). Following Cheung and Lai (1993), the Trace test will be adjusted in order to correct a potential bias possibly generated by a small sample error. Table 1 reports the result of the Trace test as well as the estimated long-run relationships of Equation (5).

Table 1 about here

According to diagnostic tests reported in the table, the lag length 5 was sufficient to ensure that errors are not autocorrelated. According to normality test results, the error is not normally distributed. However, as it was mentioned by Johansen (1995), a departure from normality is not very serious in cointegration tests. Since we allow the short-run dynamics of the system to be affected by the dummy variables included in vector DUM we need to simulate the critical values as well as their associated \( p \)-values for the rank test. CATS in RATS computer package [Version 2, see Dennis (2006)] was used to simulate the critical values. The number of replications is 2500 and the length of random walks is 400.

According to the Trace test result reported in Table 1 we can reject \( r=0 \) at 5% level, while we cannot reject \( r\leq1 \), implying that \( r=1 \). Figure 1 plots the calculated values of the recursive test statistics for the long-run relationship. Note that these statistics are recursive likelihood-ratios normalized by the 5% critical value. Thus, calculated statistics
that exceed unity imply the rejection of the null hypothesis and suggest unstable cointegrating vectors. The broken line curve (BETA_Z) plots the actual disequilibrium as a function of all short-run dynamics including seasonal dummy variables, while the solid line curve (BETA_R) plots the “clean” disequilibrium that corrects for short-run effects. We hold up the first fifteen years for the initial estimation. As the figure shows, the relationship appears stable over the long run when the models are corrected for short-run effects. To investigate if moving from the import-substitution policy to the export-incentives policy in 1983Q4 [see Lim and Papi (1997)] resulted in a structural break in our cointegration relationship I went through the above exercise by allowing a break in 1983Q4. The estimated coefficient was -0.29 with a $t$-statistic of -1.54 which implies there is no structural break as a result of this policy regime shift.

For the sake of robustness, the dynamic OLS (DOLS) test of Stock and Watson (1993) was also used to estimate the above long-run equation (Equation (5)). For the sake of brevity, the bottom panel of Table 1 reports only the estimated result for the price equation (Equation (5)). See the footnote of the table indicated by *** for the formula. The DOLS Wald test result, reported in the table, also indicates the existence of a long-run cointegrated relationship in the space. Comparing the estimated result with the long-run estimated relationship, using MLS procedure we can see that the estimated coefficients of the real income and foreign interest rate are now statistically significant, but with a different sign. Moreover, the estimated coefficient of the real government expenditure is now statistically insignificant, but again has a different sign. All other coefficients have the same sign, but the coefficient of the real exchange rate is
statistically insignificant under DOLS while the estimated coefficient of deficit per GDP is statistically significant under DOLS estimation method.

The estimated coefficients of other variables in DOLS, which only affect the short-run dynamics of the system, for the sake of brevity, are not reported, but are available upon request. The differences between these two long-run estimated results are due to the fact that the DOLS result is less efficient and less reliable than the estimated result of the MLS procedure. Having established that a long-run and stable relationship exists, we will analyze these long-run equations.

**D) Long-Run Relationship**

(i) Monetary policy: According to our theoretical model [Equation (5)], we would expect interest rate to have a positive influence on the price level. Based on our estimation result, the interest rate has a positive and a statistically significant impact on the price level. This means that a tight monetary policy when debt and deficits exist leads to a higher inflation over the long run in Turkey, i.e., Sargent and Wallace’s (1986) view that “[…] the tighter is current monetary policy, the higher must the inflation rate be eventually” cannot be rejected at least for Turkey. This means that, given the time path of fiscal policy and the fact that interest-bearing government debt can be sold only at a real interest rate exceeding the growth rate of the economy, a current tight monetary policy in Turkey results in a higher inflation over the long run. This result confirms Pongsaparn’s (2002) and Baydur and Süslü’s (2004) finding. However, Baydur and Süslü’s analysis is mostly a short-term study, while our finding is a long-run conclusion.

Considering the exchange rate as a monetary instrument, a depreciation of the domestic currency (appreciation of exchange rate) in Turkey leads to a fall in the price
level, as the coefficient of the real exchange rate indicates in the price equation. Note that a higher E in variable q means a depreciation of domestic currency. This result confirms Pongsaparn’s (2002) finding. So far, we found the domestic monetary policy, including the exchange rate policy, could be a major tool to fight inflation over the long run in Turkey. For example, an easy monetary policy which results in a lower interest rate leads to a lower inflation rate over the long run when debt and deficit exist. Furthermore, a depreciation of the domestic currency leads to a higher demand for money (a lower demand for goods and services) resulting in a downward pressure of the price level over the long run.

(ii) Fiscal policy: The long-run estimated coefficient of the log of the real government expenditure is negative and statistically significant. This result implies that over the long-run, a higher government expenditure results in a higher demand for money and, therefore, has a depressing impact on the price level. To the best knowledge of the author, no study has dealt with the impact of the government expenditures on the price level for Turkey and so comparison is not possible. However, Kia (2006a) finds a higher government expenditure in Iran lead to a higher price level over the long run, as the model predicts.

The long-run estimated coefficient of deficits per GDP is positive, but is statistically insignificant. This result confirms our theoretical model. The result is consistent with the finding of Tekin-Koru and Ozmen (2003). The estimated coefficient of the government debt per GDP is positive and statistically significant, confirming the theoretical model. This implies that a higher government debt in Turkey is associated with a riskier environment and higher inflation. This result is consistent with the finding
of Pongsaparn (2002). The estimated coefficient of the externally financed government
debt per GDP is negative and statistically significant. This result implies that a rise in a
foreign financing of debt reduces the risk in holding domestic money and so leads to
lower inflation. However, as we will see later in this paper the situation is different over
the short run.

(iii) External factors: The foreign interest rate has a positive, but statistically
insignificant impact on the price. The estimated long-run coefficient of the real exchange
rate is negative and statistically significant. Noting that we could not determine
theoretically the sign of the real exchange rate in the price equation, the negative impact
of the real exchange rate on price, for a given nominal exchange rate, means a negative
impact of the foreign price on the domestic inflation rate. This means contrary to the case
of Iran [see Bahmani-Oskooee (1995) and Kia (2006a)] and the Dominican Republic [see
Williams and Adedeji (2007)] there is no imported inflation over the long-run in Turkey.
Furthermore, as the nominal exchange rate goes up (Turkish lira depreciates), the price
will fall. This result confirms Pongsaparn’s (2002) finding, but it contradicts Lim and
Papi’s (1997) finding. Finally, the estimated coefficient of the real GDP, contrary to the
model is positive, but statistically insignificant.
IV. Short-Run Dynamic Models of Inflation Rate

In this section we specify the ECM (error correction model) that is implied by our cointegrating vector, estimated in previous section. Following Granger (1986), we should note that if small equilibrium errors can be ignored, while reacting substantially to large ones, the error correcting equation is non linear. All possible kinds of non linear specifications, i.e., squared, cubed and fourth powered of the equilibrium errors (with statistically significant coefficients) as well as the products of those significant equilibrium errors were included.

Note that the error-correction term is a generated variable and its $t$-statistic should be interpreted with caution [Pagan (1984)]. To cope with this problem, I implemented, following Pagan (1984), the instrumental variable estimation technique, where the instruments were first and second lagged values of the error term. Furthermore, to avoid biased results, I allowed for a lag profile of four quarters. And, to ensure parsimonious estimations, I selected the final ECMs on the basis of Hendry’s General-to-Specific approach. Since there are eight endogenous variables in the system, we may have eight error-correction models. However, for the sake of brevity, I only report the parsimonious reduced form and the structural form of ECM for the inflation rate. Other results are available upon request.

Some of these variables were found to have only a marginal model instead of ECM. Specifically, the error-correction term was found to be statistically insignificant in the model for the deficit per GDP (defgdp), the outstanding debt per GDP (debtgdp) and the foreign-financed debt per GDP (fdgdp). In fact, the deficit and the foreign-financed debt per GDP were found to be strongly exogenous. It should be mentioned that for any
cointegrating relationship there should be at least one ECM and in the above model we have five ECMs. Tables 2 and 3 assemble the parsimonious results from the estimating structural and reduced forms of ECM. Other models are available upon request. The structural equation is estimated by the two-stage least squares method by allowing the fitted value of each contemporaneous variable from a parsimonious marginal model [for the definition of marginal model, see Engle, Hendry and Richard (1983), Engle and Hendry (1993) and Kia (2003a and 2003b)] based on four lag values of all variables in the system to serve as its own instruments. To construct overidentified equations, following Johansen and Juselius (1994), I first estimated the correlation coefficients between endogenous variables. Then by imposing a zero restriction on the coefficient of variables in any equation with a correlation coefficient of less than 0.20, in the absolute value term, with the dependent variable, the overidentified structural equations were constructed. The estimated coefficients of the structural equations may not be asymptotically efficient and other estimation methods, e.g., three-stage least squares or full information maximum likelihood estimators are more appropriate, but because of the lack of enough observations I was unable to use these estimators.

In tables 2 and 3, White is White’s (1980) general test for heteroskedasticity, ARCH is five-order Engle’s (1982) test, Godfrey is five-order Godfrey’s (1978) test, REST is Ramsey’s (1969) misspecification test, Normality is Jarque-Bera’s (1987) normality statistic, $L_i$ is Hansen’s (1992) stability test for the null hypothesis that the estimated $i$th coefficient or variance of the error term is constant and $L_c$ is Hansen’s (1992) stability test for the null hypothesis that the estimated coefficients as well as the error variance are jointly constant. None of these diagnostic checks is significant.
According to Hansen’s stability test result, all of the coefficients, individually or jointly, are stable. Both level and interactive combinations of the dummy variables included in the set DUM were tried for the impact of these potential shift events in the models. As it was mentioned in the previous section, DUM also appeared in the short-run dynamics of the system in our cointegration regression.

Tables 2 and 3 about here

According to our estimation results reported in tables 2 and 3, the error-correction term is significant and non-linear, implying that individuals in Turkey may ignore a small deviation from equilibrium, but react drastically to a large deviation. According to the result in Table 2, the growth of the real GDP has an instantaneous impact on the inflation rate. The estimated coefficient of the growth of the real GDP is negative as the theoretical model predicts, but after a quarter, as the estimated coefficient of the lag value indicates, is positive implying that after a quarter a higher income leads to a higher demand for goods and services and causes a higher inflation rate. The latter result can also be seen from the reduced form of the ECM reported in Table 3. This result confirms Pongsaparn’s (2002) finding. As the estimated coefficient of lagged values of the growth of the real government expenditure (Table 3) indicates, the growth of the real government expenditure leads to a higher inflation rate in the country up to two quarters. This positive relationship confirms the theoretical model [Equation (5)].

The estimated coefficient of the change in interest rate is negative after three quarters (tables 2 and 3), but over the long run, as we saw (Table 1), a higher interest rate is associated with a higher price level. Namely, a higher interest rate (a tight monetary policy) reduces the inflation rate after three quarters, but will cause it to go up over the
long run (Table 1). Pongsaparn (2002) also finds a negative relationship between interest rate and inflation over the short-run in Turkey. Furthermore, Telli, et al. (2008), using simulation, find a lower interest rates leads to inflationary pressures on commodity and financial markets in Turkey.

According to the estimated coefficient of the growth of the government expenditure, an increase in the size of the government results in a higher inflation rate in Turkey. As for policy regime or institutional change, according to the estimated coefficient of the dummy variable fcrisis, the financial crisis of 1994 had a positive shock on the inflation rate in Turkey while the anti-inflation program of January 2000 which resulted in banning managed peg exchange rate and allowing the lira to float freely on February 22, 2001 resulted in a lower inflation rate in Turkey, see the estimated coefficient of dummy variables peg and flex, respectively.

As for external factors, according to the estimated coefficient of the foreign rate of interest, in both structural and reduced forms of ECM, after two lags this rate has a positive impact on the inflation rate. Specifically, it seems the inflation in emerging countries is partly due to a higher foreign interest rate as Kia (2006a) also finds a similar result for Iran. Dummy variables Nor1980Q1Q2 and Nor1988Q1, which account for outliers in the data, have positive estimated coefficients. Nor1980Q1Q2 may account for the start of the capital account liberalization in 1980. Nor1988Q1 accounts for the deposit-interest rates liberalization, see Pongsaparn (2002), for these two policy regime changes. The overall conclusion is that the sources of inflation in Turkey are both internal and external factors.
V. Unanticipated Shocks

The estimated coefficients of all ECMs were used to analyze the impact of unanticipated shocks (impulse responses) in domestic factors on the inflation rate. The Choleski factor is used to normalize the system so that the transformed innovation covariance matrix is diagonal. This allows us to consider experiments in which any variable is independently shocked. The conclusions are potentially sensitive to the ordering (or normalization) of the variables. As one would expect, part of a shock in the government expenditures is contemporaneously correlated to a shock in deficits, debt financing and the outstanding debt which by themselves are correlated to a shock in the money supply, the interest rate, the real exchange rate, GDP and the price level.

Consequently, let us propose the ordering of lg, defgdp, debtgdp, fdgdp, lMs, i, lq, ly and lp. By ordering the price level last, the identifying restriction is that the other variables do not respond contemporaneously to a shock to the price level. Note that this ordering is not critical in the analysis as no particular theory or empirical evidence conflicts with the logic of the proposed ordering.

We will run the VAR, with five lags (the lag length of the cointegration equations, see Table 1), in the error-correction form. The impulse response functions reflect the implied response of the levels. The foreign interest rate is included as an exogenous variable. Other deterministic variables include dummy variables which account for policy regime changes or other exogenous shocks. Let us follow Lütkepohl and Reimers (1992) and assume a one-time impulse on a variable is transitory if the variable returns to its previous equilibrium value after some periods. If it settles at a different equilibrium value, the effect is called permanent. Since neither the coefficients of VAR are known
with certainty and nor their responses to shocks, in computing confidence bands, the Monte Carlo simulation is used. The number of Monte Carlo draws is 1000.

In Figure 2, plots A to I depict the impulse responses of the price level to a shock in the real government expenditure, deficits per GDP, debt per GDP, foreign-financed debt per GDP, money supply, domestic interest rate, real exchange rate, real GPP and the price level, respectively. As we can see all responses are within the confidence band.

Figure 2 about here

Note that all plots in Figure 2 show the normalized responses of a shock. The normalization has been done by dividing the response by its innovation variance. This allows all the responses to a shock to be plotted on a single scale. According to Plot (A), a one standard deviation shock to real government expenditures (equal to 0.24 units) induces a contemporaneous fall of about 0.005 units in the price level. The fall in price continues two years before reaching zero at the 9th quarter. Therefore, the impulse is transitory. According to Plot (B), a one standard deviation shock to deficits per GDP (equal to 0.0044 units) induces a contemporaneous increase of 0.001 units in the price level. The price level, then, will fall gradually to -0.06 units at the 24th quarter; therefore, the impulse response is permanent. Consequently, unanticipated fiscal deficits may have a deflationary effect in developing countries, or at least in Turkey.

According to Plot (C), a one standard deviation shock to the outstanding debt per GDP (equal to 0.015 units) induces a contemporaneous increase of 0.008 units in the price level. The rise in price continues to 0.014 units at the 24th quarter; therefore, the impulse is permanent. According to Plot (D), one standard deviation shock to foreign financing per GDP (equal to 0.0016 units) induces a contemporaneous decline of 0.005
units in the price level. The price, however, will increase permanently to 0.015 units at the 24th quarter. Overall, the impulse responses of the price level to a shock on fiscal variables are mixed. Specifically, while a shock to deficits per GDP results in a negative impulse of the price, a shock to outstanding debt and foreign-financed debt results in a continuous increase in the price level in Turkey.

According to Plot (E), a one standard deviation shock to money supply (equal to 0.06 units) induces a contemporaneous increase of 0.003 units in the price level. The price will increase constantly to a level of 0.04 units at the 24th quarter. Consequently, an unanticipated positive shock to the money supply creates a permanent increase in the price level. This result is consistent with Berument’s (2007) finding.

According to Plot (F), a one standard deviation shock to the domestic interest rate (equal to 0.048 units) induces a contemporaneous increase of 0.004 units in the price level. The price then will fall permanently to -0.019 units at the 24th quarter. From the above analysis we can see that the monetary policy is an effective tool to fight inflation in Turkey.

According to Plot (G), a one standard deviation shock to the real exchange rate (equal to 0.045 units) induces a contemporaneous fall of 0.002 units in the price level. The price will fluctuate around zero units up to the 6th quarter before starting to increase by about 0.01 units at the 21st quarter. It will fall thereafter. The impulse impact, therefore, is permanent. Consequently, an unanticipated exchange rate policy which leads to the depreciation of the exchange rate is, therefore, inflationary. In other words, an unanticipated shock in the foreign price relative to the domestic price has a permanent inflationary effect in Turkey.
As Plot (H) shows, a one standard deviation shock to the real GDP (equal to 0.045 units) induces a contemporaneous fall of 0.01 units in the price level. The price will continue to fall permanently to 0.018 units at the 24th quarter. Finally, as Plot (I) shows, a one standard deviation shock to the price level (equal to 0.031 units) induces permanent increases in itself. In sum, the most inflationary induced shocks in Turkey are the outstanding debt and the foreign financing of the debt as well as the positive monetary policy shocks, i.e., a shock to the money supply or the exchange rate.

We analyze variance decompositions for various time horizons in order to investigate whether fiscal, monetary and other shocks have played much of a role in accounting for movements in the price level. Table 4 reports variance decompositions for various time horizons. Each row shows the fraction of the t-step ahead of forecast error variance for the price level that is attributed to shocks to the column variables. According to these results, the real government expenditures, the debt per GDP, the foreign financing per GDP, the domestic interest rate, the real exchange rate and the real GDP shocks account for an insignificant percentage of the price forecast error variance at all horizons. The deficits per GDP and the money supply shocks account for an increasing percentage of the price forecast error variance as the time horizon increases. This result is very similar for Iran which operates under an Islamic system, see Kia (2006a).

For instance, after four quarters, the deficits per GDP shocks account for 7.60% of the price forecast error variance. This rises to 31.24% after three years and to 37.14% after six years. The money supply shocks account for 13.05% after a year, but rises to 15.75% after six years. These results, similar to what was found by Kia, imply that
deficits and money supply shocks play a relatively important role in price fluctuations. However, the major impact of these shocks only occurs with quite a long lag. Interestingly, opposite to what was found by Kia (2006a) for Iran, more than half of the price forecast error variance is due to innovations in itself up to two years, but as the error variance of the deficits and the money supply goes up the price forecast error variance will fall to about 35%. For example, the price forecast error variance is 63.23% at one quarter ahead and falls to 50.71% after two years (not reported in the table). It continues to fall to 35.08% after six years.

VI. Conclusions

Turkey relies heavily on agricultural products and has experienced a period of both high inflation and public debt. I extended and tested the monetary model of inflation rate developed by Kia (2006a) on Turkish data, focusing on internal and external factors, which influence the inflation rate in Turkey. It was found that the monetary policy, including the foreign exchange policy, is an effective tool to fight inflation in Turkey over the long run. Specifically, while a tight monetary policy (a higher interest rate) results in a higher price level over the long run, a weaker currency can help to lower inflation in Turkey. The former effect also confirms Sargent and Wallace’s view that a current tight monetary policy leads to a higher inflation rate over the long run.

In Turkey, over the long run, the increase in the real government expenditures causes the inflation to fall, but the accumulation of debt will raise the inflation rate. Furthermore, it was found that as debt is financed externally, the demand for the domestic currency increases and so the price level falls over the long run. In general, it was found
the major factors affecting inflation in Turkey over the long run are internal rather than external factors.

An increase in the interest rate, while over the long run leads to a higher price level, will reduce the inflation rate over the short run implying a tight monetary policy is effective only over the short run in Turkey. However, it was found that an unanticipated shock to the interest rate has a permanent deflationary effect. Interestingly, while increase in the size of the government, measured by the government expenditures, creates an inflationary environment over the short run, it leads to a deflationary environment over the long run. This is possible when a significant part of the government expenditures is used on infrastructural investment. Furthermore, it was found that an unanticipated shock to the government expenditures has only a short-run effect in this country. However, an unanticipated shock to the deficit and the debt per GDP has a permanent effect.

As for the external determinates of inflation in Turkey, it was found that only over the short run the change in the world interest rate leads to higher inflation. However, an unanticipated change in the foreign price relative to the domestic price (the real exchange rate) results in a permanent inflationary effect. The policy regime changes over the managed exchange rate, similar to the current flexible exchange rate period (since 2001), had a downward pressure on the short-run dynamics of inflation in Turkey. Another domestic shock to inflation was found to be the financial crisis of 1994 which resulted in a higher inflation rate. The overall conclusion is that the sources of inflation in Turkey are mainly internal factors. They arise mostly from the monetary policy.
References


Figure 1: Recursive Likelihood Ratio Tests

Test of known beta eq. to beta(t)

1 is the 5% significance level
Figure 2: Impulse Responses of Domestic Price to a Shock to Other Variables

Plot A
Responses to Real Government Expenditure

Plot B
Responses to Deficits per GDP

Plot C
Responses to Debt per GDP
Figure 2 Continues

Plot D
Responses to Foreign-Financed Debt Per GDP

Plot E
Responses to Real M1

Plot F
Responses to Domestic Interest Rate
Figure 2 Continues

Plot G
Responses to Real Exchange Rate

Plot H
Responses to Real GDP

Plot I
Responses to the Price Level
Table 1*: Long-Run Test Results

Tests of the Cointegration Rank

<table>
<thead>
<tr>
<th>H₀= r</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Diagnostic tests**</th>
<th>p-value</th>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Test for Autocorrelation:</td>
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</tr>
<tr>
<td>Trace</td>
<td>272.70</td>
<td>191.24*</td>
<td>135.88</td>
<td>85.29</td>
<td>60.54</td>
<td>48.24</td>
<td>22.93</td>
<td>11.40</td>
<td>3.08</td>
<td>LM(5)**</td>
<td>0.41</td>
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<td>Trace 95**</td>
<td>257.48</td>
<td>214.59</td>
<td>176.30</td>
<td>141.06</td>
<td>109.89</td>
<td>81.44</td>
<td>57.01</td>
<td>35.47</td>
<td>19.19</td>
<td>LM(1)**</td>
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<td>Test for ARCH:</td>
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<td></td>
<td></td>
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<tr>
<td>Test for Normality:</td>
<td>χ²(1) = 178</td>
<td>0.00</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Lag length = 5</td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>

Test for the Restricted Long-Run Relationship. Restrictions are accepted: χ²(1) = 4.95, p-value = 0.03

<table>
<thead>
<tr>
<th>Normalized</th>
<th>lp</th>
<th>lMs</th>
<th>i</th>
<th>ly</th>
<th>lq</th>
<th>l*</th>
<th>lg</th>
<th>defgdp</th>
<th>debtgdp</th>
<th>fdgdp</th>
<th>constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>lp (t-statistic)</td>
<td>-</td>
<td>Rest. = 1.00</td>
<td>1.19</td>
<td>0.33</td>
<td>-3.32</td>
<td>0.04</td>
<td>-1.55</td>
<td>0.13</td>
<td>1.44</td>
<td>-66.00</td>
<td>47.14</td>
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<td></td>
<td></td>
<td>(6.89)</td>
<td>(1.37)</td>
<td>(-7.76)</td>
<td>(0.37)</td>
<td>(-8.25)</td>
<td>(0.09)</td>
<td>(2.83)</td>
<td>(-9.55)</td>
<td>(7.81)</td>
<td></td>
</tr>
</tbody>
</table>

Stock and Watson’s (1993) Dynamic OLS Results***

Wald statistic = 108.38 (p-value=0.00)

| lp (t-statistic) | - | Rest. = 1.00 | 0.44 | -0.79 | -0.23 | -0.22 | 0.14 | 2.48 | 1.09 | -7.38 | 3.54 |
|                 |   | (5.07) | (-4.76) | (-0.88) | (-4.46) | (1.05) | (3.01) | (4.03) | (1.99) | (0.96) |

a = accept the null of r=1.

(1) The Trace test has been multiplied by the small sample correction factor (N – kp)/N, see Cheung and Lai (1993).

(2) CATS 2 in RATS computer package was used to simulate the critical values. The number of replications was 2500 with a length of random walks of 400.

* The sample period is 1970Q1-2003Q3. lMs is the log of nominal money supply, i and i* are the log[R/(1+R)] and log[R*/(1+R*)], respectively, where R and R* are domestic and foreign interest rates in decimal points, respectively, ly is the log of the real GDP, lq is the log of the real exchange rate, lp is the log of domestic CPI, lg is the log of the real government expenditures on goods and services, defgdp and debtgdp are deficits and outstanding debt per GDP, respectively, and fdgdp is the amount of the foreign-financed debt per GDP.

** LM(i), for i=1, 2 and 5, is ith-order Lagrangian Multiplier test for autocorrelation, respectively [Godfrey (1988)].

*** Stock and Watson’s (1993) test (DOLS) is based on the following regression:

\[ lp = \beta_0 + lMs_t + \beta_2 i_t + \beta_3 ly_t + \beta_4 lq_t + \beta_5 i*_t + \beta_6 lg_t + \beta_7 defgdp_t + \beta_8 debtgdp_t + \beta_9 fdgdp_t + \delta(L) lMs_t + \delta(L) i_t + \delta(L) ly_t + \delta(L) lq_t + \delta(L) i*_t + \delta(L) lg_t + \delta(L) defgdp_t + \delta(L) debtgdp_t + \delta(L) fdgdp_t + DUM_t' \alpha + \epsilon_t \],

where \( \delta(L) \), for i=1 and 2, has two leads and lags.
Table 2*: Error Correction Model for the Inflation Rate
Structural Form

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Δlp</th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>Hansen’s (1992) Li stability test p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
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<td>-0.16</td>
<td>0.05</td>
<td>0.42</td>
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<tr>
<td>Δly_t</td>
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<td>-0.31</td>
<td>0.09</td>
<td>0.63</td>
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<tr>
<td>Δi_t-3</td>
<td>-0.02</td>
<td>-0.02</td>
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<tr>
<td>Δi*_t-2</td>
<td>0.06</td>
<td>0.06</td>
<td>0.03</td>
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<tr>
<td>Δly_t+1</td>
<td>0.22</td>
<td>0.22</td>
<td>0.05</td>
<td>0.64</td>
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<tr>
<td>(ECP)_t-2</td>
<td>0.06</td>
<td>0.06</td>
<td>0.03</td>
<td>0.11</td>
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<tr>
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<td>-0.04</td>
<td>0.02</td>
<td>0.85</td>
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<tr>
<td>Δlp_1</td>
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<td>0.21</td>
<td>0.08</td>
<td>0.83</td>
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<tr>
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<td>-0.14</td>
<td>0.06</td>
<td>0.43</td>
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<td>fcrisis</td>
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<td>flex</td>
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<td>-0.07</td>
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<td>-0.07</td>
<td>0.02</td>
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<tr>
<td>Trend</td>
<td>0.001</td>
<td>0.001</td>
<td>0.0002</td>
<td>0.46</td>
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<tr>
<td>Nor1980Q1Q2</td>
<td>0.14</td>
<td>0.14</td>
<td>0.03</td>
<td>1.00</td>
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<td>Nor1988Q1</td>
<td>0.13</td>
<td>0.13</td>
<td>0.03</td>
<td>0.04</td>
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<tr>
<td>_L_i test on variance</td>
<td>p-value = 0.35</td>
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<tr>
<td>Joint L_c test***</td>
<td>p-value = 0.41</td>
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</table>

\( R^2=0.70, \sigma=0.03, DW=1.66, \) Godfrey(5)=1.34 (significance level=0.24), White=0.99 (significance level=0.99), ARCH(5)=9.75 (significance level=0.08), RESET=0.21 (significance level=0.89) and Normality, Jarque-Bera = 4.34 (significance level=0.11).

* The estimation method is the Ordinary Least Squared. The sample period is 1970Q1-2003Q3. Δ means the first difference, Δlp is the change in the log of CPI and Δly is the change in the log of the real GDP. Δi and Δi* are, respectively, the change in the log\([R/(1+R)]\) and log\([R^*/(1+R^*)]\), where R and R* are, respectively, the nominal domestic and foreign interest rates in decimal points. ECP is the error-correction term. Dummy variable fcrisis is equal to 1 for 1994Q2 and to zero, otherwise. Dummy variable flex is equal to 1 since 2001Q1 and to zero, otherwise. Dummy variable pex is equal to 1 for the period of 2000Q1-2000Q4 and to zero, otherwise. Trend is a linear time trend. Nor1980Q1Q2 is equal to 1 during the first and second quarters of 1980, and to zero, otherwise, and Nor 1988Q1 is equal to 1 in the first quarter of 1988, and to zero, otherwise. These dummy variables were used to eliminate the outliers in the data.
Table 3*: Error Correction Model for the Inflation Rate
Reduced Form

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>Hansen’s (1992) Li stability test p-value</th>
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<tr>
<td>Constant</td>
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<td>0.64</td>
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<tr>
<td>Δiₜ₋₃</td>
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<td>Δlyₜ₋₁</td>
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<tr>
<td>Δi*ₜ₋₂</td>
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<tr>
<td>(ECP)²ₜ₋₂</td>
<td>-0.20</td>
<td>0.05</td>
<td>0.76</td>
</tr>
<tr>
<td>(ECP)³ₜ₋₂</td>
<td>-0.11</td>
<td>0.03</td>
<td>1.00</td>
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<tr>
<td>fcrisis</td>
<td>0.18</td>
<td>0.03</td>
<td>0.14</td>
</tr>
<tr>
<td>flex</td>
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<td>0.02</td>
<td>1.00</td>
</tr>
<tr>
<td>pex</td>
<td>-0.10</td>
<td>0.02</td>
<td>1.00</td>
</tr>
<tr>
<td>Trend</td>
<td>0.002</td>
<td>0.0002</td>
<td>0.71</td>
</tr>
<tr>
<td>Nor1980Q1Q2</td>
<td>0.17</td>
<td>0.02</td>
<td>1.00</td>
</tr>
<tr>
<td>Nor1988Q1</td>
<td>0.13</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Lₜ test on variance</td>
<td>p-value = 0.71</td>
<td></td>
<td></td>
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<tr>
<td>Joint Lₜ test</td>
<td>***</td>
<td>p-value = 0.53</td>
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</table>

R²=0.68, σ=0.03, DW=1.76, Godfrey(5)=1.18 (significance level=0.32), White=96.43 (significance level=0.99), ARCH(5)=4.92 (significance level=0.43), RESET=0.01 (significance level=0.99) and Normality, Jarque-Bera = 3.26 (significance level=0.20).

* The estimation method is the Ordinary Least Squared. The sample period is 1970Q1-2003Q3. Δ means the first difference, Δlp is the change in the log of CPI and Δly is the change in the log of the real GDP. Δi and Δi* are, respectively, the change in the log[R/(1+R)] and log[R*/(1+R*)], where R and R* are, respectively, the nominal domestic and foreign interest rates in decimal points. Δlg is the change in the log of the real government expenditure on goods and services. ECP is the error-correction term. Dummy variable fcrisis is equal to 1 for 1994Q2 and to zero, otherwise. Dummy variable flex is equal to 1 since 2001Q1 and to zero, otherwise. Dummy variable pex is equal to 1 for the period of 2000Q1-2000Q4 and to zero, otherwise. Trend is a linear time trend. Nor1980Q1Q2 is equal to 1 during the first and second quarters of 1980, and to zero, otherwise, and Nor 1988Q1 is equal to 1 in the first quarter of 1988, and to zero, otherwise. These dummy variables were used to eliminate the outliers in the data.
### Table 4* Price Level Variance Decompositions

<table>
<thead>
<tr>
<th>Period (Quarters)</th>
<th>lg</th>
<th>defgdp</th>
<th>debtgdp</th>
<th>fdgdp</th>
<th>lMs</th>
<th>i</th>
<th>lq</th>
<th>ly</th>
<th>lp</th>
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<td>1</td>
<td>4.33</td>
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<td>9.96</td>
<td>3.17</td>
<td>0.95</td>
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<td>15.72</td>
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<td>4</td>
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<td>1.39</td>
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<td>7.63</td>
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<td>0.97</td>
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<td>5.35</td>
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<tr>
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<td>2.76</td>
<td>0.89</td>
<td>15.62</td>
<td>3.18</td>
<td>0.36</td>
<td>4.18</td>
<td>36.02</td>
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<td>0.48</td>
<td>37.14</td>
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<td>1.18</td>
<td>15.75</td>
<td>3.34</td>
<td>0.47</td>
<td>4.01</td>
<td>35.08</td>
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</tbody>
</table>

* See footnote of Table 1 for the mnemonics.