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

Amir Kia*

This paper focuses on internal and external factors, which influence the inflation rate in Turkey. A monetary model of inflation rate was tested on Turkish data. It was found that government debt and deficits along with other factors are important determinants of inflation in Turkey. Furthermore, the inflation in this country is due to both domestic and foreign factors.

Fields of Research: Financial economics, Macroeconomics

1. 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) determinants as well as other sources of inflation during the past three decades in Turkey. To the best knowledge of the author, except for Kia's(2006a) study (which is on a non-traditional economy like Iran, operating under no predetermined interest rate), no such study for emerging or developed countries exists. Furthermore, none of the existing literature (see next section) incorporates completely the direct impact of the government spending, deficits, the outstanding debt and the government debt management on the inflation rate. Excluding Kia (2006)a no study on estimating the co-integration relationship so far allows the short-run dynamics of the system to be influenced by policy 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 (2006)b 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, e.g., in the 1980's Turkey moved from an import-substitution policy to an export-incentives policy. To fill the gap in this literature, we extended Kia's

* Finance and Economics Department, Utah Valley University, Orem, UT 84058-5999, USA, Tel: (801) 863-6898, Fax: (801) 863-7218, E-mail:akia@uvu.edu

(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.
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 the 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. A policy towards a stronger currency is also inflationary. The inflation in Turkey is caused by both domestic and foreign 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 external government debt financing over the long run. Moreover, there is no imported inflation in Turkey over the long run. The next section is devoted to the literature review and is followed by a section on methodology. Section 3 deals with the estimation result and its interpretation. The final section provides some concluding remarks.

2. Literature Review

We divide the literature on developing countries into two categories: those which used the monetary approach to inflation and otherwise. As for the first category, Togan (1987) finds that 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. Ashra *et al.* (2004) 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. Finally, Williams and Adedeji (2007) find that the inflation rate in the Dominican Republic is affected by money supply, real income, foreign inflation as well as the exchange rate.

As for the second category, Bahmani-Oskooee (1995) finds that 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, price stability in Turkey is very difficult to achieve. Furthermore, Lim and Papi (1997) using an *ad hoc* general equilibrium model, find that 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 macro-economic 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.[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 that the consumer price index causes monetary base but the reverse is not true in Turkey. Arize *et al.* (2004) find that inflation in 82 countries responds positively to the volatility of real and nominal exchange rates. Berument and Kilinc (2004) find that shocks in the industrial production of Germany, the United States and the rest of the world will affect positively the inflation rate in Turkey.

El-Sakka and Ghali (2005) find that 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 that, over the long run, a higher exchange rate (lower value of domestic currency) leads to a higher price in Iran and 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.

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. However, none of the studies on developing countries 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.

3. Methodology

From the equilibrium condition in the money market, derived in Kia (2006a) we can find the following price relationship:

$$lp_t = \beta_0 + (\beta_1=1)\, lMs_t + \beta_2\, i_t + \beta_3\, ly_t + \beta_4\, lq_t + \beta_5\, i^*_t + \beta_6\, lg_t + \beta_7\, defgdp_t + \beta_8\, debtgdp_t + \beta_9\, fdgdp_t + \beta_{10}\, trend + u_t, \quad (1)$$

where an l before a variable means the logarithm of that variable, p_t is the price level (CPI), Ms_t is the nominal money supply (M1) and i_t is $\log(R_t/1+ R_t)$ where R_t is the nominal domestic interest rate, in decimal points (discount rate since no other rate is available for the entire period). y_t is the real GDP (nominal GDP deflated by CPI), q_t is the real exchange rate, defined as $E_t\, p_t^*/p_t$ where p_t^* is the foreign price and following Kia(2006a), among others, the industrial countries unit

value export price index was used. E_t is the nominal market exchange rate (domestic price of foreign currency, $US), $i^*_t = \log(R^*_t/1+ R^*_t)$, R^*_t is the nominal foreign interest rate in decimal points (following Kia (2006a) the LIBOR, 3-month London interbank was used). g_t is the real government expenditure on goods and services (nominal deflated by CPI), $defgdp_t$ is deficit per GDP, $debtgdp_t$ is the outstanding debt per GDP, $fdgdp_t$ is the public debt financed externally per GDP and u is a disturbance term assumed to be white noise with zero mean. β'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 (1) 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, which was generated during the period of zero-predetermined interest rate. 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: making the coefficient of the nominal exchange rate and the level of foreign price equal and 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 (1) is a more valid equation for a country like Turkey, where the economy has been operating under the traditional system with predetermined interest rates. The next section of this paper is devoted to such an 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.

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* and some from the State Institute of Statistics of Turkey 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.[2] Information on institutional and policy changes in Turkey were taken from *The Middle East and North Africa,* 2004.

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) 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 also used Zivot and Andrews' (1992) unit-root test which allows for unknown breaks in intercept and slopes. I found all variables 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 ADF and PP test results but, according to Zivot and Andrews' (1992) test result, it has also a unit root with a break at 1989Q3. A graphical demonstration of the series also indicates that the level of this variable is not stationary. For the sake of brevity, these results are not reported, but are available upon request.

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

$$X_t = A_1 X_{t-1} + \ldots + A_k X_{t-k} + \mu + u_t,\ u_t \sim \text{niid}(0, \Sigma), \qquad (2)$$

where X_t = [lp_t, lMs_t, i_t, ly_t, lq_t, lg_t, $defgdp_t$, $debtgdp_t$, $fdgdp_t$], μ is $p \times 1$ constant vector representing a linear trend in the system. The p-dimensional Gaussian X_t is modelled conditionally on long-run exogenous variable i^*_t and the short-run set of DUM_t = ($Q1_t$, …, $Q4_t$, intervention dummies and other regressors that we can consider fixed and non-stochastic), where Q's are centred quarterly seasonal dummy variables. Parameters A_1,…, A_k, ϕ, and Σ are assumed to vary without restriction. The error correction form of the model is:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \ldots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \mu + \phi\, DUM_t + u_t, \qquad (3)$$

where Δ is the first difference notation, the first k data points X_{t-1},…, X_0 are considered fixed and the likelihood function is calculated for given values of

these data points. Parameters $\Gamma_1,...,\Gamma_{k-1}$ and Π are also assumed to vary without restriction. However, the hypotheses of interest are formulated as restriction on Π.

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. 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 favour 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 rumours 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. Lim and Papi (1997) consider the move from an import-substitution policy in the 1980's to an export-incentives policy in Turkey 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 (2) and test for autocorrelation. In this case the residuals are the OLS-estimates from Model (2). 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.

4. Results

Table 1 reports the result of the Trace test as well as the estimated long-run relationships of Equation (1). 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 co-integration 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. The CATS in RATS computer package 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 $r \leq 1$, implying that r=1. I also calculated values of the recursive likelihood-ratios test statistics for the long-run relationship. The relationship appears to be stable over the long run when the models are corrected for short-run effects. For the sake of brevity, this result is not reported, but is available upon request. Furthermore, I investigated 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 co-integration relationship by doing the above exercise, 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.

According to the estimation result, the interest rate, as it was expected theoretically, 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) findings. However, Baydur and Süslü's analysis is mostly a short-term study, while our finding is a long-run conclusion.

Table 1: Long-Run Test Results

Tests of the Cointegration Rank											
H_0= r	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**		
Trace*	272.70	191.24[a]	135.88	85.29	60.54	48.24	22.93	11.40	3.08		
Trace 95	257.48	214.59	176.30	141.06	109.89	81.44	57.01	35.47	19.19		
Diagnostic tests	Test for Autocorrelation: LM(5)**, *p*-value = 0.41, Normality:χ^2= 178, *p*-value =0.0, Lag length = 5										
	Test for ARCH: LM(1)**, *p*-value = 0.10, LM(2)**, *p*-value = 0.01.										
Test for the Restricted Long-Run Relationship. Restrictions are accepted: χ^2(1) = 4.95, *p*-value = 0.03											
Normalized	**lp**	**lMs**	**i**	**ly**	**lq**	**i***	**lg**	**defgdp**	**debtgdp**	**fdgdp**	**constant**
lp(*t*-statistic)	-	Rest. = 1.00	1.19 (6.89)	0.33 (1.37)	-3.32 (-7.76)	0.04 (0.37)	-1.55 (-8.25)	0.13 (0.09)	1.44 (2.83)	-66.00 (-9.55)	47.14 (7.81)

a = accept the null of r=1.

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

** LM(i), for i=1, 2 or 5, is ith-order Lagrangian Multiplier test (Godfrey, 1988).

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. 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.

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 that higher government expenditure in Iran leads to a higher price level over the long run, as the model predicts.

The estimated coefficients of fiscal variables are all statistically significant, except the externally financed government debt per GDP. All of these estimated coefficients confirm the theoretical model. 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.

Let us specify the ECM (error correction model) that is implied by our cointegrating vector, estimated in the previous section. 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. 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, the outstanding debt per GDP and the foreign-financed debt per GDP. In fact, the deficit and the foreign-financed debt per GDP were found to be strongly exogenous. It should be mentioned that for any co-integrating relationship there should be at least one ECM and we have, in fact, five ECMs. For the sake of brevity, I only report the structural ECM model of the inflation rate. Other models are available upon request.

Table 2 assembles the parsimonious results from the estimating of the structural ECM. 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 Kia (2003a and 2003b), based on four lag values of all variables in the system to serve as its own instruments. To construct over-identified 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 over-identified 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 Table 2, White is White's (1980) general test for heteroscedasticity, 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 ith 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 was mentioned in the previous section, DUM also appeared in the short-run dynamics of the system in our cointegration regression.

According to our estimation result reported in Table 2, 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. 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. This result confirms Pongsaparn's (2002) finding. The estimated coefficient of the change in interest rate is negative after three quarters, but over the long run (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. 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 rate leads to inflationary pressures on commodity and financial markets in Turkey.

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 pex and flex, respectively. The estimated coefficient of the foreign rate of interest after two lags 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. 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.

Let us investigate the unanticipated shocks to the system. 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.

Table 2*: Error Correction Model for the Inflation Rate
Structural Form

Dependent Variable	**Δlp**		
Independent Variables	**Coefficients**	**Standard Error**	**Hansen's, 1992, Li stability test *p*-value**
Constant	-0.16	0.05	0.42
Δly_t	-0.31	0.09	0.63
Δi_{t-3}	-0.02	0.01	0.25
Δi^*_{t-2}	0.06	0.03	0.12
Δly_{t-1}	0.22	0.05	0.64
$(ECP)^2_{t-2}$	0.06	0.03	0.11
$(ECP)^3_{t-2}$	-0.04	0.02	0.85
Δlp_{-1}	0.21	0.08	0.83
Δlp_{-2}	-0.14	0.06	0.43
Fcrisis	0.17	0.03	0.14
Flex	-0.07	0.02	0.97
Pex	-0.07	0.02	1.00
Trend	0.001	0.0002	0.46
Nor1980Q1Q2	0.14	0.03	1.00
Nor 1988Q1	0.13	0.03	0.04
L_i test on variance	*p*-value = 0.35		
Joint L_c test	*p*-value = 0.41		
$\bar{R}^2$=0.70, σ=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).			

* 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.

The lag length of five (the lag length of the cointegration equation) was used to run the VAR 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. Since, in computing confidence bands, neither the coefficients of VAR nor their responses to shocks are known with certainty, the Monte Carlo simulation is used. The number of Monte Carlo draws is 1000. For the sake of brevity, plots of the impulse responses are not reported but are available upon request. It was found that all responses are within the confidence band.

There are six noteworthy features of the impulse responses. First, all impulse responses of fiscal variables, except the government expenditure, are permanent. A one standard deviation shock to real government expenditures and foreign-financed debt per GDP results in a contemporaneous fall in the price level but the same shock on deficit and debt per GDP results in an increase in the price level. However, the shock to deficit per GDP results in a fall in the price level permanently, but the shock to debt per GDP and foreign-financed debt per GDP result in an increase in the price level permanently. Second, an unanticipated monetary policy is an effective tool to fight inflation in Turkey, as a one standard deviation negative shock to money supply (positive shock to interest rate) results in a fall in the price level permanently. However, the impact (contemporaneous) effects of these shocks are opposite: it is negative for the money supply and positive for the interest rate. The latter result is consistent with Berument's (2007) finding. Third, an unanticipated shock in the foreign price (in terms of domestic currency) relative to the domestic price has an inflationary effect in Turkey. Specifically, a one standard deviation shock to the real exchange rate induces a contemporaneous fall in the price level. The price will fluctuate around zero until up to the 6^{th} quarter before starting to increase. Fourth, a one standard deviation shock to the real GDP induces a fall in the price level permanently. Fifth, one standard deviation shock to the price level induces permanent increases in itself.

Finally, according to the variance decompositions results, not reported but available upon request, 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. Furthermore, 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 (Kia 2006a).

5. Conclusion

Turkey has experienced a period of both high inflation and public debt. 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 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, the increase in the real government expenditures causes, over the long run, 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. 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 the increase in the size of 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 determinants 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.

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[1]Both Lim and Papi (1997) and Pongsaparn (2002) provide a survey on empirical studies on inflation in Turkey.

[2] The interpolation procedure is through a first order autoregression estimation process of the series. For the process, see Bertsekas (2000). Clearly, in any data collection process, the use of actual data is desirable. However, when data is not available, the second-best solution is their interpolation. For the aggregate data like debt and deficit, the approach used in this paper, among all other available approaches, is the best, as it keeps the last value of the series fixed within each period. Other approaches like Chow and Lin (1971) and Litterman (1983) cannot be used as an alternative because of the unavailability of relevant quarterly series.