DOI: 10.18267/j.pep.261

IMPACT OF MONETARY POLICY ON ECONOMIC INSTABILITY IN TURKEY (1983 – 2003)

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Abstract:
This article aims at revealing the effectiveness of Turkish monetary policy in controlling inflation rate and the stability of exchange rate using the rational expectation framework that incorporates the fiscal role of exchange rate. Based on quarterly data covering the period between 1983: Q4 and 2003: Q4, the analysis affirms that the effort of the Turkish monetary policy at influencing the finance of government fiscal deficit through the determination of the inflation-tax rate, to some extent, affects both the rate of inflation and the real exchange rate, thereby causing volatility in their rates. Moderate evidence emerges that inflation affects volatility of its own rate as well as the rate of real exchange.

Keywords: rational expectations approach, monetary policy, economic instability

JEL Classification: I32, C43, C81

1. Introduction

In the theoretical model the links between high inflation and the joint volatility of the real exchange rate and inflation rate, and some aspects of government's fiscal and exchange rate policies are illustrated in a rational expectation equilibrium framework. Consequently, inflation rate and the real exchange rates are jointly determined by the equilibrium of the model. This is derived from the sunspot equilibria theory in which Woodford (1986), Shigoka (1994) and Drugeon and Wignolle (1996) have demonstrated that macroeconomic instability is related to multiple rational expectation equilibria.

In Turkey, high and fluctuating inflation has been one of the key features of the economy for almost 30 years. Among the major causes of inflation there are persistent public sector deficits, high input prices due to rapid depreciation of the Turkish Lira (TL) and persistent inflationary expectations of economic agents (see Dibooglu and Kibritcioglu, 2001). Many programmes based their anticipations on inflationary trend. Turkish inflation grew from single digit levels in the 1960s and reached its first peak in 1980 at more than 80 %. After reaching a second peak of 125 % in 1994, inflation rate started a downward trend in response to a series of stabilization mea-

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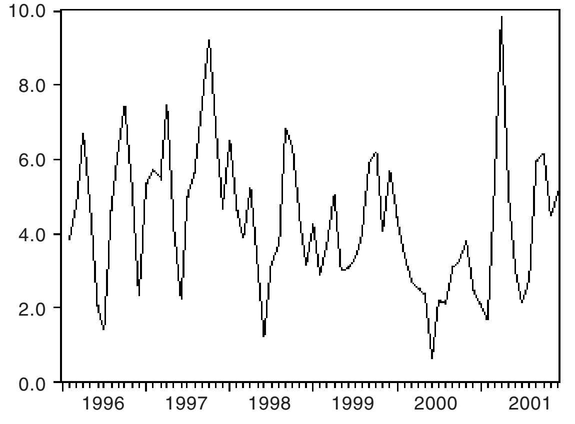
DOI: 10.18267/j.pep.261

sures that were introduced in the same year. Throughout the second half of the 1990s, inflation continued to fluctuate within a 70 to 100 % range. However, after the introduction of the 1999 Disinflation and Fiscal Adjustment Programme and the three-year stand-by agreement signed with the International Monetary Fund (IMF), inflation dropped significantly. Under the three-year stand-by arrangement, the year-end inflation was targeted at 25 % in 2000 and 10 – 12 % by the end of 2001. A combination of internal and external factors starting in the late 1970s was responsible for Turkey's record of high inflation. Throughout the 1960s and the 1970s, Turkey followed an inward-looking growth strategy driven by import substitution policies.

Figure 1
Turkish Inflation (consumer price index in %)



During the earlier stages of this strategy inflation rate was relatively low and the expansionary effects of macro-economic policies were moderate. The public sector, the driving force behind the growth strategy, relied heavily on domestic savings and foreign exchange receipts to meet borrowing requirements. However, as public sector borrowing requirements reached unmanageable levels due to excessive spending during the 1973 – 1974 oil crisis, Turkey resorted to external borrowing and intensified its aggressive short-term borrowing practices. A balance of payments crisis followed and led to the debt crisis of 1978. Rising monetary aggregates exacerbated the inflation situation. This combined with the supply limitations resulting from shortages of imported inputs, caused inflation to accelerate significantly toward the end of the 1970s. In 1980, Turkey introduced drastic measures to stabilize the economy, encourage export promotion, and gradually remove trade barriers and foreign exchange restrictions. The main goals of these measures were to lower inflation from the peak of more than 80 %, to improve the balance of payments, and through further restructuring to transform Turkey into an outward looking export-driven economy. Inflation initially fell to 30 % in 1981, but then it became gradually to rise and fluctuate within a 40 to 70 % range during the rest of the 1980s. Starting in 1988, Turkey began to follow populist measures that caused inflation to accelerate in the following years. As a result of excessive spending, rapid expansion of public sector credits, and expansionary monetary policies motivated by local and general elections, inflation rose significantly in the 1990s. Inflation rate reached its all time high of 125 % in 1994, and Turkey experienced a severe financial crisis. In response to the rising inflation and the widening budget deficits, the government tried to keep interest rates low and switched from domestic borrowing to foreign debt and

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monetization. This policy, which was intended to reduce inflation without giving up economic growth, led instead to higher interest rates, higher deficits, and continued high inflation. The austerity plan introduced in 1994 did eventually succeed in bringing inflation down temporarily, but did not eliminate the macroeconomic imbalances. The year-end inflation after surging to 125 % declined to 72 % in 1995 but rose to almost 100 % again by 1997. Efforts to reduce the interest burden on the budget continued, but that did not prevent the non-interest expenditures from rising. Thus, one primary source of inflation, excessive spending and the resulting budget deficits, remained in effect, and inflation continued to dominate Turkey's macroeconomic environment in the later 1990s.

The present study analyses how effective monetary policy has been in tackling macroeconomic instability in Turkey through a simple monetary model with rational expectation that emphasizes the fiscal role of the real exchange rate. The rest of the article is structured as follows. Section 2 presents the theoretical framework of the rational expectation model and Section 3 presents the empirical results.

2. Rational Expectation Model of Inflation and Exchange Rate Instability

Theoretical framework for linking the relationship between inflation, the instability of real effective exchange rate and inflation rate adopted here draws heavily from Azam (1999, 2001). In the model international price of tradable goods in terms of foreign currency is equal to 1, so that their nominal price in domestic currency is *e*. We also assume that quantity of money in the economy is *M* while the price level is *P*, and that the price level is an increasing (and linearly homogenous) function of *e* and of the price of non-tradable goods which is assumed implicitly in the model. We also define $q = e/P$ as the real exchange rate, which is an increasing function of real exchange rate defined as the ratio of the price of tradable goods to the price of non-tradable goods. In order to incorporate the fiscal role of the real exchange rate, government expenditures and revenues are spilt into two different categories subject to how they are affected by the exchange rate. Here, it is assumed that government expenditures are indexed to the price level *P*, while its revenues (including foreign aid) are indexed to exchange rate. In the model *D* represents an excess of expenditures over revenues indexed to *P* and *F* an excess of revenues over expenditures indexed to *e*. Since the government budgetary policy is usually exogenous of stability objective of monetary policy, this implies that *D* and *F* can be held constant. Consequently, the monetary financing of the overall deficit is given by:

$$dM/dt = pD - eF \tag{1}$$

Equation (1) implies that change in money stock is used to finance fiscal deficits. If we denote the rate of inflation by $\pi = d\ \log p/dt$ and the rate of change in the local currency chosen by government as $\delta = d\ \log e/dt$. Here, we assume that δ is controlled by the government. Since the rational expectation hypothesis assumes private agents to have perfect knowledge about the market, this indicates that they know δ. The real rate of depreciation of the domestic currency is determined by the difference between the rate change chosen by the government and the inflation rate, that is;

$$dq/dt = (\delta - \pi)q \tag{2}$$

If we denote real money balances by *m*, then equation (1) can be re-written as:

$$dm/dt = D - qF - \pi m \tag{3}$$

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We further assume that the demand for real money balances is determined *à la* Cagan (1996) as a function of the expected rate of inflation π^e by the function:

$$m = \lambda(\pi^e),\ \lambda' < 0 \tag{4}$$

Equation (4) holds under the assumption of ration expectation equilibria in which case $\pi^e = \pi$ and $I\, \pi^e\, I << \infty$, $\forall t > 0$, where 0 is the present time period or the initial period.
Substituting equation (4) into (3) yields

$$d\pi/dt = (1/\lambda')dm/dt = (1/\lambda')(D - qF - \pi\lambda(\pi)) \tag{5}$$

This implies that inflation is stabilised as ($d\pi\ /dt = 0$) for all pairs $\{q, \pi\}$ such that:

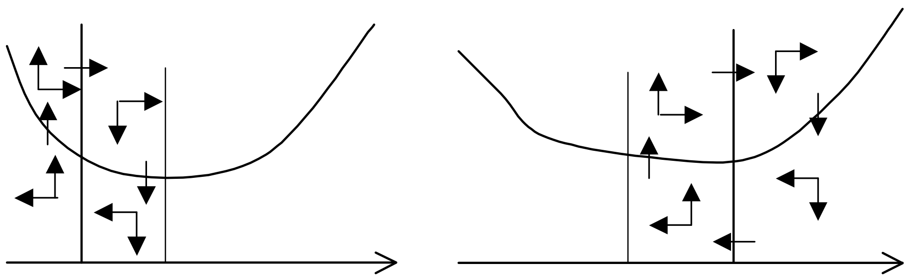
$$D - qF = \pi\lambda(\pi) \tag{6}$$

From equation (6), it can be seen that the inflation financing, i.e. the real seignorage represented by the left hand side of the equation, is a linear decreasing function of q. The negative slope of the function is reinforced by assuming that D and F to be a function of q, in which case it would be assumed that $D' < 0$ and $F' > 0$. This is based on the fact that real depreciation will raise the real value of foreign trade, on which a great deal of taxes are based, therefore raising the level of F, while it reduces the real value of public expenditures on non-traded goods, which determines D. The proceeds of the inflation tax, represented by the right hand side of equation (6) is a non-monotonic concave function of π, according to the inflation-tax Laffer-curve mechanism (see Bruno and Fischer, 1990; Dornbusch and Fischer, 1993). The inflation-tax is maximised as the aggregate maximum of the product of expected and actual inflation rate. This gives the inflation-tax maximising rate as:

$$\pi \max = \arg\max\ (\pi\lambda(\pi)) \tag{7}$$

Figure 2 in part a and b shows that equation (6) is a non-monotonic convex curve labelled as *mm*. This implies that any level of the real exchange rate that is consistent with the existence of a stationary equilibrium – that is located on *mm* – can correspond equally to a low or a high rate of inflation, depending on the side of the curve on which the equilibrium is located. Any movement of the $\{q, \pi\}$ pairs above the mm locus causes inflation rate to increase over time, as indicated by equation (5), while movement of the pairs below the locus decreases inflation. Consequently, a depreciation in the real exchange rate q leads to an increase in fiscal deficit since this will imply an increase in the real value of aid and trade-related taxes. The situation will cause private agents to reduce their real money balances. It is, however,

Figure 2
a) **Inflation – real exchange rate** (δ_L below π^{max}) b) **Inflation – real exchange rate** (δ_H above π^{max})



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important to note that this condition only holds with the rational expectation equilibrium if there is an acceleration in inflation.

Figure 2 (a and b) analyses the combined effect of the exchange rate dynamics contained in equation (2) using phase figures. In the phase figures, the locus of point such that *dq/dt = 0* is denoted *qq*. Figure 2(a) represents the case where the chosen rate of crawl lies below the inflation-tax maximising inflation rate, which denotes a saddle point with a zero-dimensional convergent sub-space. Then as there is no pre-determined variable in the system, the economy jumps instantly at point *E*, and stays there as long as the chosen rate of crawl δ_L is credible. Thus, the real exchange rate and the inflation rate are uniquely determined by the chosen rate of crawl.

However, in case of Figure 2(b) there exists a distinct result with the chosen rate of crawl δ_H which is greater than the inflation-tax maximising rate π^{max}. In this case, the steady-state is stable at point *S*, with a two-dimensional convergent sub-space. According to the phase figure, steady-state S is reachable only through either the north-east, or the south-west, which are positive slope trajectories along the space.

Linearising the system around the stationary point $\{\pi^*, q^*\}$, where $\pi^* = \delta$ yields:

$$\begin{bmatrix} d\pi/dt \\ dq/dt \end{bmatrix} = \begin{bmatrix} -1/\lambda'(\lambda+\pi\lambda') & (-1/\lambda')F \\ -q & 0 \end{bmatrix} \begin{bmatrix} \pi-\pi^* \\ q-q^* \end{bmatrix} \tag{8}$$

The determinant of the Jacobian matrix in equation (8) is always positive, while its trace has the same sign as $\lambda + \pi\lambda'$, which in turn is the same as the sign of the $\pi^{max} - \delta$, because of the assumed inflation-tax Laffer curve. Consequently, the eigenvalues of the matrix are both positive, if the chosen rate of crawl is smaller than the inflation-tax maximising rate of inflation, or they are both negative if the reverse is the case.

From the above, when the chosen rate of crawl is below the inflation-tax maximising rate of inflation, there will be a unique rational expectation equilibrium that determines jointly the rate of inflation and the real exchange rate. Any point other than the stationary point *E* will cause an explosion of the trajectory, and hence violates the convergence condition for rational expectations equilibrium. Therefore, monetary authority embarks on policy that controls the rate of inflation and the real exchange rate through the chosen rate of crawl dictated by the given parameters of the system. On the other hand when the stationary point is *S*, any point inside the phase space belongs to a trajectory that converges eventually to *S*, and therefore conforms to the rational expectations equilibria. This leads to a continuum of rational expectations equilibria. It is essential to note that the difference between the two situations comes from the elasticity of the demand for money with respect to the expected rate of inflation.

In the practical sense, the continuum of the rational expectations equilibria predicts a high volatility for the variables in the system. Since the system has no anchor, the variable of the system becomes extremely unstable and jump from one trajectory to the other based on the response of private agents to information relevant to their expectations (see Blanchard and Fischer, 1989) for an elaborate theoretical exposition in the sunspot model that tries to capture this behaviour).

Given the above, monetary policy aimed at minimising or maximising inflation-tax may lead to instability in the rate of inflation as well as the real exchange rate subject to the inflation tax rate chosen by the monetary authority and the response of private agents to the market information. The policy import of the theory therefore is that inflation causes volatility in its own rate and in the real exchange rate. Further it shows that both inflation and the real exchange rate are jointly determined.

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3. Empirical Results

In the application of the theoretical framework, a search procedure method which allows us to move from general to specific, is employed (see Banerjee et al., 1993). This enables us to arrive at a dynamic relationship between variables of the theoretical system as applied by Azam (2001). We employ quarterly data from 1983:Q4 – 2003:Q4. First, an investigation of the time series properties of the variables is carried out. Using the Augmented Dickey-Fuller (ADF) test, Table 1 shows the unit root test results which indicates that three of the variables in the empirical model are integrated of order zero, I (0), implying that they are stationary at their actual level.

Table 1
Unit Root Test Result

ADF			
Variable	Level	First difference	Order of integration
Consumer price index (CPI)	-1.2346	-3.4567	I (1)
Real inflation rate (RIR)	-2.8745	n.a.	I (0)
Nominal effective exchange rate (NEER)	-2.1299	-4.2687	I (1)
Real value of credit to government (CRGOV)	-4.1498	n.a.	I (0)
Real effective exchange rate (REER)	-1.2937	-3.9423	I (1)
Ratio of central bank's reserves to aggregate domestic credit (RESCR)	-3.1954	n.a.	I (0)

Note: 5% critical value = -2.8933, n.a. = not applicable.

Consumer price index and both nominal effective exchange rate and real effective exchange rate are integrated of order one, I (1), which means that they are only stationary at their first difference. The variable RESCR is used to capture what dictates the type of exchange rate policy measure adopted by government. Second, a test of the existence of long-run relationship among the series of the model equations is performed. The Johansen test shows that comparing the likelihood ratio at 123.43 to the 5% critical value of 69.32 there exists cointegrating vectors of up to 4 in the model (see Table 2), thereby suggesting that the relationship of the model can be used for long-run predictions.

Table 2
Johansen Cointegration Test

Eigenvalue	Likelihood ratio	5 % critical value
0.570	135.142	67.72
0.346	71.258	46.24
0.159	34.249	28.98
0.148	20.020	13.31
0.124	7.272	9.00

DOI: 10.18267/j.pep.261

In the empirical analysis the volatility of REER is examined through equation (9), the result shows that an appreciation in NEER leads to appreciation in REER and *vice versa*. Contrary to the prediction of theory, the result indicates that even with decrease in reserves real exchange rate still depreciates as reflected by the negative sign of the RESCR, the result:

$$\Delta \log REER = \underset{(-0.69)}{-0.02} + \underset{(5.46)}{0.265} \Delta \log NEER - \underset{(-3.68)}{0.211} \log RESCR$$

$$+ \underset{(4.37)}{0.240} \log RESCRDT(-1) - \underset{(-4.72)}{0.034} INF + \underset{(5.77)}{0.342} INF(-1) \qquad (9)$$

$N = 83$, $R^2 = 0.44$, ARCH (2) = 15.6, $F = 11.94$, DW = 1.79

As seen, one year-lagged value of RESCR is positively related to REER, implying that it is actually the past value of the ratio of total reserves to aggregate credit that shows the willingness of the government to depreciate domestic currency. Equation (9) further shows that inflation rate is very significant causal factor of instability in REER, with decrease (increase) in current period inflation rate corresponding to depreciation (appreciation) in REER while increase in one-period lagged value of inflation leads to real depreciation of REER. In the equation Δ represents the first difference operator, white heteroscedasticity-consistent *t* ratios (because of heteroscedasticity problem detected by various tests conducted) are in parentheses and lag operator is denoted as (-1). The result shows that there is no problem of serial correlation. The ARCH test indicates the presence of little auto-regressive conditional heteroscedasticity, but it is not enough to bias the estimates of the model.

In equation (10) we analyse the actual source of instability of REER by testing whether inflation is the main cause volatility in the stochastic process of the relationship in equation (9) by using the GARCH process suggested by Enders (1995). Equation (10) shows that inflation is in fact the major source of volatility of REER in equation (9), in (10) RES2 is the squared term of the residual from (9). Therefore the result is indicative of the fact that the higher is the level of inflation the more will the real exchange rate depreciate.

$$RES^2 = \underset{(0.69)}{0.66} + \underset{(1.78)}{0.001} INF + \underset{(2.44)}{0.332} RES^2 (-1) \qquad (10)$$

$N = 84$, $R^2 = 0.17$, $F = 7.29$, $LM - F = 2.57$

Also, the causal factors of changes in the rate of inflation are examined using a similar approach to that adopted in equation (9). In arriving at equation (11) we embarked on variable deletion test by moving from an over-parameterised to a parsimonious equation. From equation (11) it is clear that variations in inflation rate are significantly determined by all the determinants used. The equation shows that current level of inflation positively related to its past values, level of NEER and the past level of the ratio of reserves to aggregate credits, while it is negatively

$$INF = \underset{(-0.19)}{-0.066} + \underset{(23.63)}{1.023} INF (-1) + \underset{(3.83)}{2.764} \Delta \log NEER - \underset{(-4.67)}{6.563} \Delta \log REER$$

$$- \underset{(-4.99)}{3.755} LRESCRDT + \underset{(4.96)}{3.863} LRESCRDT (-1) + \underset{(2.58)}{0.832} RCRDTGOV \qquad (11)$$

$N = 83$, $R^2 = 0.88$, $F = 116.92$, **DW = 1.27**, LM (2) – $F = 7.79$, ARCH (1) = 5.99

related to REER and the present level of RESCR. This implies that there is a transfer effect of inflation on its yearly rate, and that depreciation in NEER increases the

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rate of inflation while appreciation in REER leads to increases in the rate of inflation. Diagnostic tests applied suggest no estimation problem.

Lastly, we investigate how inflation impact on the volatility of its own rate through changes in periodic values of the CPI. Equation (12) shows that depreciations in both NEER and REER raise the level of CPI, just as increase in credit to government sector also induces high level of CPI. An important result in the equation is significant impact of the past value of CPI on its variation.

$$\begin{aligned}\Delta \log CPI = & -0.332 + \underset{(0.412)}{0.312}\Delta \log NEER + \underset{(2.47)}{0.222}\Delta \log REER(-1) \\ & \quad (0.51) \\ & - \underset{(2.42)}{0.163}\log RESCRDT + \underset{(2.01)}{0.127}\ RECRDTGOV \\ & + \underset{(5.57)}{0.321}\Delta \log CPI(-1)\end{aligned} \tag{12}$$

$N = 83$, $R^2 = 0.49$, **DW = 1.65**, ARCH (1) = 4.11

In order to isolate the actual impact of CPI on the instability of inflation, a GARCH test similar to that of equation (10) is performed. The result of the volatility test shown in equation (13) changes in CPI is positively related to the volatility of the residual of the CPI equation (12).

$$RES^2 = \underset{(-0.78)}{-0.052} + \underset{(5.61)}{0.480}\Delta \log CPI(-1) - \underset{(1.92)}{0.078}\ RES^2(-1) \tag{13}$$

$N = 82$, $R^2 = 0.36$, $F = 4.47$, $LM(2) - F = 2.41$

The results of the different analyses have shown that inflation rate affects changes in real exchange rate and equally affects its own volatility. Also, the effort of the government at using its credit and reserve as monetary tools in checking inflation and the rate of exchange has affected the volatility of the two variables over the years. Thus, it can be concluded that monetary policy, if not well targeted, could yield negative results. This is because private agents' speculative activities may frustrate monetary effort (see Berg and Pattillo, 1999), just as improper inflation targeting could affect real exchange rate volatility (see Amato and Gerlach, 2002) and exchange rate intervention induce inflation (see Galati, 2000).

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This paper has investigated how monetary policy objective of controlling inflation rate and intervention in the financing of fiscal deficits affect the variability of inflation and real exchange rate. The analysis has been conducted using a rational expectation framework that incorporates the fiscal role of exchange rate. The paper has shown that the effort of monetary policy at influencing the finance of government fiscal deficit through the determination of the inflation-tax rate may, to some extent, affect both the rate of inflation and the real exchange rate, thereby causing volatility in their rates. The paper revealed that, in Turkey, inflation, to some extent, affects volatility of its own rate as well as the rate of real exchange.

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