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AN INTEGRATED ANALYSIS OF TURKISH INFLATION†

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I. INTRODUCTION

Turkey, in its recent economic history, experienced three relatively high inflationary periods, namely, 1954–59, 1977–80 and 1984 onwards. Inflation has been a striking characteristic of the Turkish economy since 1977. It reached its zenith point with an annual rate of 100 percent in 1979/80. The introduction of mixed stabilization and liberalization policies in January 1980 resulted in a temporary recession, but helped to cut the annual inflation from three digits to 25 percent by the end of 1983. However, inflation rose to 40 percent from 1984 and settled down at the 50 percent level during the second half of the 1980's. The reason for inflation is well known: excessive growth of the money supply. It grew uncontrollably to cover the budgetary deficits of public bodies, namely State Economic Enterprises (SEEs), which relied on Central Bank Credit.

The principal aim of this paper is to examine the inflationary process in Turkey covering the period of 1950–88.[1] The approach is based on analysing the inflation rate in an open economy by distinguishing between (i) pure monetarist theories, (ii) internal theories (labour market theories and excess demand explanations) and (iii) external theories, including the role of imported inflation (see Surrey, 1989). Additionally, the effects of fiscal expansion can be considered as a factor of determining inflation as part of the adjustment process due to the public sector budget deficit. Inflation is also determined by excess demands,[2] which may originate in the monetary, government, goods, external and labour sectors of the economy. Theoretic-

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[1]See Fry (1980, 1986), Togan (1987), Onis and Ozmucur (1990) for work on inflation dynamics in Turkey.

[2]The idea is that the excess demand in each sector of the economy leads to inflation is certainly not new. The origins of this theory, a theory has not changed much in more than 200 years, is David Hume. See his *Essays: Moral, Political and Literary* (p. 318).

ally, the partial impacts of these excess demands in each sector will determine inflation. Empirically, however, it is not always easy to find good proxies to describe these excess demands. The concept of cointegration, which identifies a stable long-run relationship among the variables of the related set, might provide a measure of the excess demand. The variables are in the form of deviations from long-run steady-state relations — known as Error Correction Mechanisms (ECM) — which are derived from the sectoral relationships of the economy since the concept of cointegration is isomorphic to error correction. Indeed, Engle and Granger (1987) showed the equivalence between a cointegration relation; defined as a stationary combination of nonstationary variables, and the ECM determined by *a priori* economic argument. Bearing in mind these definitions, excess demand in any market as measured by the deviation from the long-run equilibrium (ECM) is allowed potentially to affect inflation. Pursuing this economic structure, in the remainder of this paper Turkish inflation will be investigated empirically using multivariate cointegration analysis.[3]

The organization of the paper is as follows. Section II proposes an inflation model which approximates the Turkish economy. Individual sectoral analyses of Turkish inflation are examined in Section III. The results of the previous Section III are used to implement a disequilibrium analysis in Section IV. Section V concludes.

II. THE MODEL

In this section, we present a model in which the partial impacts of the monetary, government, external and labour sectors of the economy on the Turkish inflation are examined.

First, we will discover how inflation is generated by taking a slightly roundabout route. The starting point for our model is the demand for money function. Agents wish to hold nominal money (M) in proportion to their nominal income (Y) in a static equilibrium state. However, they hold less money as interest rates (R) and inflation (Δp) increase. So

$$M = KY(1+R)^{\alpha}(1+\Delta p)^{\beta} \tag{1}$$

where α, $\beta < 0$ and K are constant. The lower case letters denote logs of corresponding capitals and Δ denotes the first difference of the related variable. Therefore, in terms of Friedman's model, a stable demand for money function confronts an exogenously controlled supply with equilibrium achieved by adjustment in the price level. The key requirement is a money demand equation with nominal money being exogenous, and that claim can

[3]Recently, empirical research has been carried out concerning cointegration as suggested by Johansen (1988) (see Johansen and Juselius (1990, 1991), and Juselius (1991, 1992) for empirical applications.

be tested.[4] If the monetary authority wishes to slow the inflation trend it has to deliver a lower trend growth rate for the money supply. Therefore, anti-inflation policy is simple to design and execute.

Second, if our understanding of fiscal policy is to be illuminated by the link between deficits and inflation, one must seek this connection not only in the impact of inflation on public finances but also in the effect of money creation on inflation. To model the public sector of the economy, we use the logic of the public finance approach to inflation. In a closed economy, it is assumed that all debt takes the form of non-interest bearing money. Any primary public sector deficit must be financed by printing money. On this basis the public sector budget identity will be

$$(G-T)/Y=\Delta H/Y \tag{2}$$

where G stands for public expenditures, T stands for public sector revenues, Y stands for nominal income and H denotes base money. In a steady state growing economy, by using simple arithmetic

$$\Delta(H/Y)=(H/Y)[(\Delta H/H)-(\Delta Y/Y)]=(\Delta H/Y)-(H/Y)(\Delta p+g) \tag{3}$$

where Δp and g are inflation and the growth rate of real income, respectively. It is assumed that the long-run income elasticity of demand for money is unity. Then the simplified budget constraint can be determined as

$$\Delta(H/Y)=(G-T)/Y-(H/Y)(\Delta p+g) \tag{4}$$

As a fraction of nominal income, $G-T$ must be financed either by inflation tax $H(\Delta p)$ or the real seigniorage Hg which accumulates to the government when income and money demand increases and the corresponding supply of money is provided; if not, it must be financed by increasing the real money stock at a rate which exceeds that justified by money demand given inflation and real income growth. Solving (4) for inflation we obtain

$$\Delta p=c+\gamma(((G-T)/H)-g) \tag{5}$$

In (5), c represents the constant term which can be interpreted as the inertial inflation rate and γ is expected to equal one.[5] The justification behind this reverse equation (5)[6] is that fiscal expansion is inflationary; any increase in the budget deficit, however caused, is likely to be inflationary even if it is only partly monetized.

Following from this, a model regarding the determination of inflation in an open economy context is considered. If there is a long-run tendency for

[4]For the Turkish data, this claim was tested in Metin (1992, Ch. 5, pp. 142–45). It was evident that inflation, the level of real income and the interest rate are weakly exogenous for the parameters of the money demand function.

[5]See Phelps (1973), Begg (1987), Anand and van Wijnbergen (1989) and Rodrik (1990).

[6]The direction of the causality between the public sector deficits and inflation is examined in Metin (1994) by employing an econometric model which tests the exogeneity and endogeneity status of the variables.

domestic prices to follow foreign prices measured in a common currency, then this occurrence can be well represented by Purchasing Power Parity (PPP). The PPP specification can be written as

$$p_D = e + p_W \tag{6}$$

where p_D, p_W, e represent the logarithm of domestic and world prices and the exchange rate respectively. Consequently, price equalization between countries depends on the exchange rate regime in operation. The 'Law of One Price' also applies to financial assets in the form of Uncovered Interest Rate Parity (UIP). The UIP relationship can be defined as

$$r_D = \Delta e + r_W \tag{7}$$

where r_D and r_W represent the logarithm of the domestic and the world nominal interest rates and Δe is the expected change in the exchange rate.

Finally, domestic wage inflation, which is related to excess demand in the economy, can be modelled. If producers follow mark-up pricing, then nominal wage (W) claims above the productivity level are reflected in prices. So, for the unions, the long-run nominal wage is associated with the price level, unemployment (U) and labour productivity (Lp) while the wage which concerns producers is related to the level of producer prices and the productivity level. Therefore the 'wedge' between the workers' cost of living and the prices received by manufacturing firms should also be considered.[7] In wich case, the real wage (W_r) relationship is summarized as

$$W_r = -\alpha\Delta p + Lp - \beta U + \tau Wed \tag{8}$$

where the wedge is denoted by (Wed). Then (8) is reparameterized using labour productivity adjustment:

$$W_r - Lp = -\alpha\Delta p - \beta U + \tau Wed \tag{9}$$

It means that real wages increase in proportion to labour productivity. Therefore, productivity adjusted real wages are determined negatively by the level of unemployment and inflation, positively by a wedge. It can also be interpreted as an unemployment equation as given below

$$U = \lambda[(W_r - Lp) - \alpha\Delta p - \tau Wed]\,(\lambda = 1/\beta) \tag{10}$$

It is clear from the above analysis that there are many explanations for inflation. Alternatively expressed, each of the sectoral theories captures a part, but not all of the story. Moreover, in time each may be of differing importance. An econometric structure which embodies all of the disequilibria, contains the conditional expectation of current inflation given two information sets

[7]See Nickell (1982, 1984), Layard and Nickell (1986), Hall (1986, 1989), Hall and Henry (1987), Jenkinson (1986), Beckerman and Jenkinson (1986a, b), Clements and Mizon (1991) and Juselius (1991) for theory and empirical applications.

$$E(\Delta p | I_1, I_2) \tag{11}$$

$$I_1 = \{\text{ECM} - W_{t-i}, \text{ECM} - M_{t-i}, \text{ECM} - \text{PPP}_{t-i}, \text{ECM} - \text{UIP}_{t-i}, \text{ECM} - \text{def}_{t-i}\}$$

$$I_2 = \{\Delta p_{t-i}, \Delta((G-T)/Y)_{t-i}, ((G-T)/H)_{t-i}, g_{t-i}, \Delta p_{W t-i}, UY_{t-i}, Q\}$$

where $i = 1, 2$. I_1 includes the basic variables of interest, ECMs which are derived from the sectoral relationships of the economy. I_2 represents a linear function of variables which includes the short-run effects arising from the changes in the related variables through the channels of transmission mechanisms.

The variables in the model are constructed as follows. ECM − M is the cointegration relationship among (M/P), (Y/P), R. It shows that an inflationary monetary policy — the monetary growth in excess of the growth in real productive factors — affects the inflation rate. ECM − def is the cointegration relationship among $(G-T)/H$, (H/Y), g, Δp. It shows that $(G-T)$ must be financed by increasing the real money stock. ECM − PPP and ECM − UIP are obtained from the cointegration relationships of $(p_D - p_W - e)$ and $(r_D - r_W - \Delta e)$ respectively. The effects of disequilibrium in the goods and capital market on inflation are represented by the ECM-PPP and the ECM − UIP. UY (the residual obtained from the regression of nominal income on a constant and trend) represents the excess demand for goods. When aggregate demand is above the full employment level, nominal wages are bid up and this will put an upward pressure on prices. To represent this effect, ECM − W is defined as the cointegration relationship among W_t, U, Lp, Δp, Wed. Q contains the set of variables which includes constant, seasonal and intervention dummies. All variables are derived in Section III. First, the inflation rate is regressed on the variables in I_1 and I_2[8] and then the parsimonious model is obtained after some sequential reductions. As a whole, therefore, the structural model of the inflationary process will be constructed in the context summarized above and examined empirically in the remainder of this paper.

III. LONG-RUN SECTORAL ANALYSIS OF INFLATION

The aim of this section is to analyse the long-run inflation determination in each sector of the Turkish economy using cointegration analysis and to produce some proxies to represent each sector's excess demand which will be used in the disequilibrium analysis in Section IV.

[8]A more general model where all the ECMs interact to allow non-linear reactions was too complicated to estimate from the small data sample available.

1. *Monetary Inflation (Quarterly)*

This section analyses the inflationary effects of the Turkish monetary policy over 1949(4)–1987(4).[9] In order to test for cointegration the maximum likelihood procedure developed in Johansen (1988) and Johansen and Juselius (1990) is used. Test statistics are reported in Table 1. Looking at both the trace and the maximum eigenvalue statistics leads us to accept definitely one and possibly two cointegrating relationships and two unit roots. Interpreting the evidence, from the first row of the standardized eigenvectors, one cointegrating combination seems to represent a real money demand relationship as, (1, 10.0, −2.86, 0.10). Thus,

$$(m1-p) = -100\Delta p + 2.86(y-p) - 0.10r$$

could well be a long-run solution for real money balances except perhaps for the high real income elasticity coefficient, which is about 2.9. This is well defined if there is indeed only one cointegration relationship. The second potential cointegration vector can be obtained from the renormalization of the first and the second rows of a standardized eigenvector matrix as $\Delta p = 0.6(y-p) + 0.1r$. This suggests that inflation is stationary around the real income and interest rates. The adjustment coefficients, which are often called loadings, show that the main effect of the first cointegrating vector (long-run demand for money) is on $(m1-p)$; however, there is almost no effect on the other variables. This is a strong indication of the weak exogeneity of these variables for the long-run parameters of the demand for money function. In the second column of loadings, a feedback appeared from inflation on interest rate despite the fact that they do not seem to be cointegrated beyond the excess demand effect. Overall, in the Turkish economy, real money demand is determined by inflation, interest rates and income.

2. *Public Sector Inflation (Annual)*

In this subsection, we examine the cointegration relationship among four variables, namely, base money over income, (H/Y), the growth rate of real income, g, inflation and the deficit over base money $(G-T)/H$.[10] According

[9] M1 is nominal money (narrow, definition: currency in circulation plus demand deposits), P is the GNP price deflator, Y is constant price GNP and R is the Central Bank Nominal Discount Rate. The main series are taken from the IMF *International Financial Statistics* — several monthly issues — and are quarterly, seasonally unadjusted. Since Turkish GNP and the GNP deflator are only available as a yearly base, we generated them quarterly using the method suggested by Fernandez (1981) (see Metin (1992, pp. 132–35) for the details).

[10] The data on central government expenditures and revenues are based on Ministry of Finance sources. GNP and the price level — consumer price index — are obtained from *International Financial Statistics*. Base money is based on Central Bank resources. The central government deficit does not include the SEEs deficit. Since reliable statistics about SEEs deficits are available after the second half of the 1970's the central government deficit is therefore used as a proxy for the total deficit.

TABLE I

Monetary Sector Analysis

*Johansen Tests for the Number of Cointegrating Vectors**

Eigenvalues: 0.025, 0.053, 0.141, 0.309

		Max	*Trace*
Null	*Alternative*	*Score (0.95)*	*Score (0.95)*
$r=0$	$r\geq 1$	56.75 (27.34)	92.59 (48.41)
$r\leq 1$	$r\geq 2$	23.41 (21.27)	35.84 (31.25)
$r\leq 2$	$r\geq 3$	8.44 (14.59)	12.43 (17.84)
$r\leq 3$	$r=4$	3.99 (8.083)	3.99 (8.083)

*The order of the VAR is 4. We have included a constant term and trend in the VAR. r denotes number of cointegration vectors. The 'Trace' and the 'Max' statistics are defined in Johansen and Juselius (1990). The critical values are taken from Table A2 in Johansen and Juselius (1990).

Standardized eigenvectors

Variable	$m1-p$	Δp	$y-p$	r
$m1-p$	1.000	10.047	−2.867	0.102
Δp	−0.163	1.000	1.408	0.104

Standardized loadings

Variable	$m1-p$	Δp
$m1-p$	−0.141	−0.130
Δp	−0.016	0.044
$y-p$	0.008	−0.126
r	0.046	0.141

to the values of both trace and maximum eigenvalue statistics in Table 2, there is one cointegrating relationship and three unit roots.

The first row of standardized eigenvectors can only be interpreted as an inflation equation rather than as a deficit over base money or as base money over income relationship, because none of the last two yielded a target relationship with the correct signs for the parameters. The cointegration relationship as given below, highlights the important determinants of the inflation rate.

$$\Delta p = 2.7(G-T)/H - 2.5g + 1.1(h-y)$$
$$\approx 2.7(((G-T)/H)-g)+(h-y)$$

TABLE 2
Public Sector Deficit Analysis
*Johansen Tests for the Number of Cointegrating Vectors**

Eigenvalues: 0.051, 0.218, 0.437, 0.518

		Max	*Trace*
Null	*Alternative*	*Score (0.95)*	*Score (0.95)*
$r=0$	$r\geq 1$	26.32 (27.34)	57.80 (48.41)
$r\leq 1$	$r\geq 2$	20.72 (21.27)	31.48 (31.25)
$r\leq 2$	$r\geq 3$	8.85 (14.59)	10.75 (17.84)
$r\leq 3$	$r=4$	1.90 (8.08)	1.90 (8.08)

*The order of the VAR is 2. We have included a constant term and trend in the VAR.

Standardized eigenvectors

Variable	Δp	$(h-y)$	g	$G-T/H$
Row 1	1.0	−1.124	2.451	−2.703

Standardized loadings

Variable	*Col. 1*
Δp	0.129
$(h-y)$	−0.168
g	0.136
$G-T/H$	−0.264

Firstly, the deficit explains much of Turkish inflation for the sample period. On the basis of the cointegration relationship, we cannot reject the positive relationship between inflation and the public sector deficit (as a percentage of H). Secondly, inflation is determined by the monetization of the economy and more specifically the ratio of base money to income.

3. *Inflation in an International Context (Annual)*

We now turn our empirical consideration to exchange rate behaviour and inflation, built around the PPP and the UIP — observed interest rate differen-

tials.[11] The sample period is 1950–87, covering three devaluations, and which shifted from a fixed to a floating regime in 1980.[12]

It is expected that there is a cointegrating vector, including all five variables namely, p_D, p_W, e, r_D and r_W in which the hypothesis that the coefficients of variables are 1, −1, −1, 1 and −1 respectively. According to the trace and the maximum eigenvalue statistics, definitely one, and possibly two, cointegrating vectors were obtained in Table 3. The first eigenvector is close to PPP regarding the sign of parameters. However, in terms of the size of the variables, it does not satisfy the target relationship which is summarized as (1, −1, −1). Unfortunately, we could not find any evidence on observed interest rate differentials in the first two rows of standardized eigenvectors; even the linear combinations of them could not provide a meaningful parameter set. To sum up, the PPP relationship was only derived as being, $p_D = 0.6p_W + 0.7e$. Having no evidence on the interest rate differentials can be explained by a policy change in the interest rate adjustments during the early 1980's.

4. *Inflation in the Labour Sector (Annual)*

This subsection examines real wage and price determination in Turkey over the period 1963–88. The set of variables modelled in the system is: W_r is the real wage defined as the difference between the logarithm of the nominal wage and the logarithm of the manufacturing wholesale price index; the labour productivity is defined as $Lp = ym - memp$, where ym is the logarithm of real manufacturing industries' output and $memp$ is the logarithm of the number of employees in the manufacturing industry. U is the total number of officially recorded unemployed workers. The wedge is represented as the difference between the logarithm of the consumer price index and the logarithm of manufacturing industries' wholesale price index. Therefore, the variable set contains real wage, inflation, a wedge, labour productivity and the unemployment level.[13]

According to both maximum eigenvalue and the trace statistics given in Table 4, two cointegrating relationships were obtained. Renormalization of the first and the second rows of a standardized eigenvector matrix yielded below given relationship

$$U = 0.5\,W_r - 0.75\,Lp + 0.76\Delta p + 0.23\,wed$$

[11] See Johansen and Juselius (1991) and Juselius (1991) for related empirical works.

[12] The data can be summarized as: P_D is Turkish consumer price index (1980 = 100), P_W is industrial countries' consumer price index (1980 = 100). Traditionally, the main trade partners of Turkey are OECD countries, including EC countries, the US, Japan and the other industrialized countries. Therefore, industrialized countries have been chosen to represent the foreign influence. e is the exchange rate measured as TL over the US dollar (1980 = 100), r_D is the Turkish time deposit rate (annual), r_W is the US treasury bond rate. The series are taken from *International Financial Statistics* — several issues.

[13] The data is obtained from Bulutay (1990) and Uygur (1990).

TABLE 3
Exchange Rate Analysis
*Johansen Tests for the Number of Cointegrating Vectors**

Eigenvalues: 0.042, 0.196, 0.363, 0.470, 0.605

		Max	*Trace*
Null	*Alternative*	*Score (0.95)*	*Score (0.95)*
$r=0$	$r\geq 1$	35.34 (33.26)	86.62 (69.97)
$r\leq 1$	$r\geq 2$	24.13 (27.34)	51.28 (48.41)
$r\leq 2$	$r\geq 3$	17.18 (21.27)	27.14 (31.25)
$r\leq 3$	$r\geq 4$	8.29 (14.59)	9.96 (17.84)
$r\leq 4$	$r=5$	1.66 (8.083)	1.66 (8.083)

*The order of the VAR is 2. A constant and a trend are allowed to enter the VAR unrestrictedly, in order to model a linear trend in the levels of the price variables.

Standardized eigenvectors

Variable	p_D	p_W	e	r_D	r_W
Row 1	1.000	−0.628	−0.697	−0.477	5.346
Row 2	0.273	1.000	−0.757	−0.705	−7.465

Standardized loadings

Variable	*Col. 1*	*Col. 2*
p_D	−0.147	−0.359
p_W	0.020	−0.011
e	−0.694	−0.333
r_D	0.041	−0.008
r_W	0.040	−0.028

It suggests that unemployment is determined positively by real wages and inflation and negatively by labour productivity. In addition, the wedge has some positive effects on the unemployment level.

IV. DISEQUILIBRIUM DETERMINATION OF TURKISH INFLATION

Now we draw together the preceding analyses to examine the disequilibrium effects on prices in Turkey. Recalling the model which is given in Section II (see equation (11)) the structural model of the inflationary process was constructed. Here we used ECMs — each represents its sectoral excess

TABLE 4
Labour Sector Analysis
*Johansen Tests for the Number of Cointegrating Vectors**

Eigenvalues: 0.039, 0.266, 0.459, 0.730, 0.912

		Max.	*Trace*	*Scaled trace*
Null	*Alter-native*	*Score (0.95)*	*Score (0.95)*	*Score*
$r=0$	$r\geq 1$	56.06 (33.26)	108.43 (69.97)	84.85
$r\leq 1$	$r\geq 2$	30.14 (27.34)	52.36 (48.41)	40.97
$r\leq 2$	$r\geq 3$	14.16 (21.27)	22.21 (31.25)	17.38
$r\leq 3$	$r\geq 4$	7.12 (14.59)	8.05 (17.84)	6.30
$r\leq 4$	$r=5$	0.92 (8.083)	0.92 (8.083)	0.07

*The order of the VAR is 2. We have included a constant term and trend in the VAR. Given the short length of the data and the large number of variables, the trace test is scaled by $T-k$. T is the number of observations and k the number of coefficients. This yielded only one significant cointegrating vector

Standardized eigenvectors

Variable	*U*	W_t	*Lp*	Δp	*wed*
Row 1	1.00	−1.00	−11.071	−1.885	6.130
Row 2	−3.263	1.00	−10.321	−1.083	6.632

Standardized loadings

Variable	*Col. 1*	*Col. 2*
U	0.168	−0.070
W_t	0.019	0.048
Lp	−0.018	−0.044
Δp	0.176	−0.043
wed	0.101	−0.005

demands — which were derived in the previous Section III in addition to some short-run variables. Figures 1–5 show ECM − M, ECM − PPP and ECM − UIP, the growth rate of price level and $(G-T)/H$ respectively.

A parsimonious model was obtained after several sequential simplifications of model (1).[14] The final outcome is given in model (2).[15]

[14]We should inform the reader of several points: (i) The ECM-M in model (1) differs from the cointegration vector in Section III.1, since yearly data was used for the whole analysis, and so we reproduced ECM-M annually. (ii) The data analysis suggested that $(G-T)/H$ was prefer-

Fig. 1. The estimated excess money

In terms of diagnostic test statistics, the estimated model (2) performed satisfactorily. There was no indication of residual autocorrelation (see $AR_{1-2}F=0.55$), and the normality of the residuals was accepted (once D55 was included).[16] $ARCH_1F(1, 26)=2.77$ did not reject homoscedasticity of residuals. However, the RESET test suggested a possible non-linearity in the model. This is not surprising since many of the disequilibria are likely to interact: e.g. a given deficit may cause higher inflation when the excess demand for goods is larger. The standard error of the equation was 0.06. This is a good prediction for Turkish inflation, which has shown substantial

able to the residuals (ECM − def). (iii) Regrettably, a reliable data series for the labour sector is only available after 1960; therefore, ECM − W has not been taken into account in the following analysis due to the limited data length. Using the data from 1960 to 1987, model (1) including ECM − W was also estimated, but the results did not suggest any significant effects from the labour market on Turkish inflation.

[15]One cannot expect any ECMs which are weakly exogenous for the parameters of the model (2). Weak exogeneity suggests that all the cointegrating vectors enter only the conditional model. Cointegrating exogeneity (Hunter, 1990, 1992) implies that long-run relations are block triangular, therefore it means no long-term feedback of inflation onto related ECMs. Weak exogeneity is also not necessary here since an efficient analysis is impossible due to data limitations (see Engle *et al.*, 1983).

[16]The model in equation (2) basically suffered from a major outlier in 1955 which was not explained by the variables in the information set, and did not correspond to any obvious historical events. Thus, we created a dummy (D55) to pick this up.

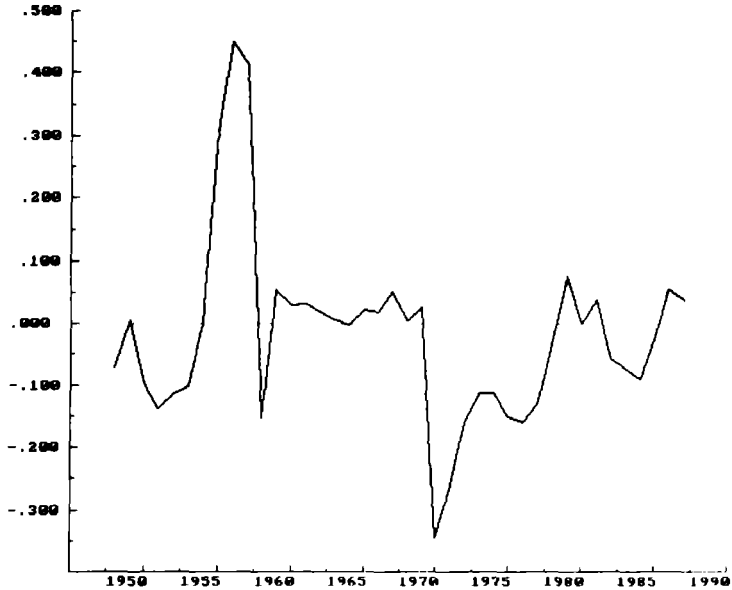

Fig. 2. The deviations from the purchasing power parity

Fig. 3. The deviations from the interest rate differentials

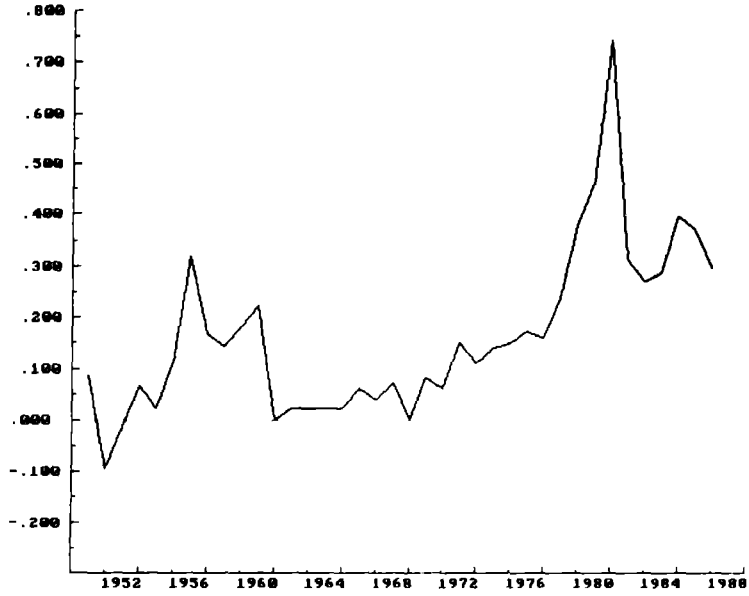

Fig. 4. The growth rate of prices

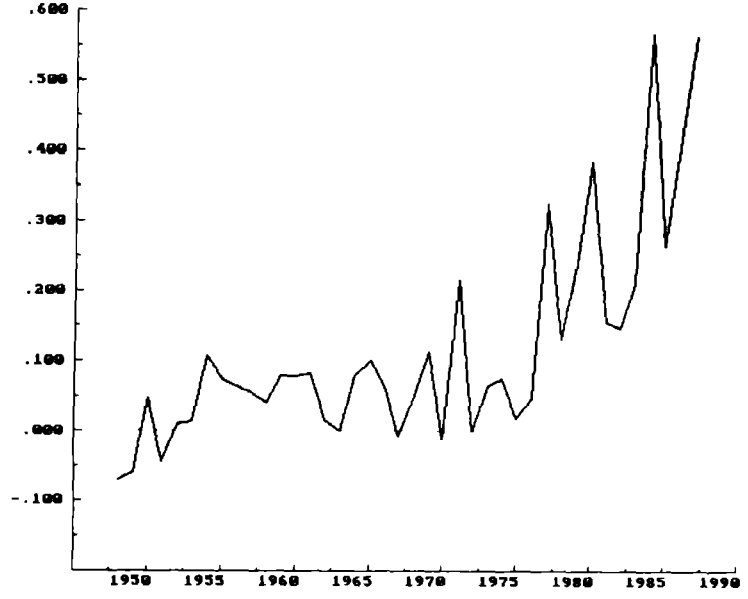

Fig. 5. $(G-T)/H$

TABLE 5
Modelling the Turkish Inflation by OLS, 1950–86

Dependent variable is Δp

Variable	*Model (1)* *Coef. (std. err.)*	*Model (2)* *Coef. (std. err.)*
Constant	−0.175 (0.276)	−0.064 (0.039)
Δp_{-1}	−0.001 (0.178)	
UY	−0.027 (0.389)	
UY_{-1}	0.130 (0.289)	
$ECM - PPP_{-1}$	0.127 (0.079)	0.074 (0.044)
ECM − UIP	−0.102 (0.089)	
$ECM - UIP_{-1}$	−0.141 (0.080)	
ECM − M	0.278 (0.217)	
$ECM - M_{-1}$	−0.328 (0.238)	
$(G-T)/H$	1.298 (0.318)	1.111 (0.135)
$\Delta((G-T)/Y)$	−4.702 (1.63)	−3.901 (0.670)
Δp_W	1.504 (0.655)	1.663 (0.362)
ΔECM − M		0.229 (0.099)
(ECM − UIP)/2		−0.272 (0.093)
D55		0.257 (0.020)
g		−0.234 (0.166)
R^2	0.8405	0.8973
σ	0.0793	0.0601
F_{df}	$11.98_{(11,25)}$	$30.58_{(8,28)}$
DW	2.046	2.072
Normality $\chi^2_{(2)}$	6.0	1.33
AR_{1-2}, F_{df}	$0.47_{(2,23)}$	$0.55_{(2,26)}$
$ARCH_1$, F_{df}	$0.20_{(1,23)}$	$2.77_{(1,26)}$
RESET, F_{df}	$2.11_{(1,24)}$	$3.74_{(1,27)}$

Notes: $F_{AR_{i-j}}$ is a test for ith or jth order autocorrelation suggested by Harvey (1981). $F_{ARCH_{i-1}}$ is the ARCH test (AutoRegressive Conditional Heteroscedasticity due to Engle (1982). F_{RESET} is Ramsey's (1969) test.

increases in the sample period, in particular in the late 1970's with three-digit inflation and most of the 1980's with over 40 percent per annum. Furthermore, testing for constant parameters of model (2) showed no predictive failure over a subset of seven observation. In fact, forecast $\chi^2(7)/7 = 1.66$ and the Chow test $F(7, 22) = 1.55$ showed no misprediction of the model.

A crucial feature of model (2) is that the lagged dependent variable did not matter, so it was eliminated from the model at an early stage of the simplification process. Inflation transpires to have much less inertia than might have been anticipated: the ECMs explain its behaviour and reveal relatively rapid

reactions. Excess demand for goods as measured by UY had no effect on inflation. However, the growth rate of real income appeared with a negative coefficient (-0.23), although it was not statistically significant (omitted variable F test $F(1, 27) = 0.796$). ECM − M was included but not significant in levels. The effect of excess money (ECM − M) only enters as a change, and suggests that there is no long-run effect, given the other explanatory variables. Therefore, monetary expansion increases short-run inflation.

External transmission effects, which come from the disequilibrium between the goods and assets markets, appear in two ways. Firstly, the coefficient of the ECM − PPP_{t-1} is 0.07 and is significant at the 10 percent level. Economic theory suggests that PPP falls should lead to more inflation. However, in this case, a negative correlation between PPP and Turkish inflation was not found. During the sample period, $(p_D - p_W)$ went up dramatically but the exchange rate fell even further. Therefore, PPP fell substantially and this led Turkish inflation to rise relative to world inflation. In addition, an imported inflation effect on Turkish inflation appeared in the highly significant coefficient of Δp_W. The parameter of Δp_W should not be greater than one; however, here it appeared as 1.663. For the overall benefit of the model (2) we retained it. Secondly, an additional effect arising from a disequilibrium in the asset market emerged in the coefficient of (ECM − UIP)/2 which is averaged as, $1/2(\text{ECM} - \text{UIP}_t + \text{ECM} - \text{UIP}_{t-1})$, is -0.27 and is highly significant.

The most important determinant of inflation appears in the central government deficit per unit of base money, measured by $(G-T)/H$ and $\Delta((G-T)/Y$. The former appeared with almost a unit coefficient and affected inflation directly with a highly significant parameter. Fiscal expansion is indeed inflationary in Turkey. When $\Delta(G-T)/Y$ was included in the model, it improved the sign and size of the parameters of the other variables.[17] Economically, this suggests that public sector deficit increases result in a short-run increase in nominal income which in turn lowers inflation. But in the following stage, the resulting demand pressure leads to an increase in inflation which persists while the deficit continues. This supports the view that an excessive deficit of the public sector to a large extent was the main source of persistent high inflation. Therefore, there is a strong relation between the public sector deficit and the inability to bring inflation down.

V. CONCLUDING REMARKS

This paper aimed at analysing inflation in a general framework of sectoral relationships rather than a specific and delineated single sector analysis. In

[17]To consider the effect of the public sector on inflation we tried several forms of deficit scaling, namely, $(G-T)/H$, $(G-T)/Y$, $((G-T)/H-g)$ and finally ECM − def in the modelling. Eventually, inclusion of $(G-T)/H$ and $\Delta((G-T)/Y$ provided a better result than the others and helped to obtain a correct sign and an interpretable size of the other parameters of the model.

this sense, it highlights the relative importance of sectors which contribute to inflation. By conducting a disequilibrium analysis, it was found that fiscal expansion dominated the determination of inflation. The excess demand for money affected inflation positively but only in the short-run. Imported inflation and the excess demand for assets in capital markets had some effect on consumer price inflation while there was no significant effect from the excess demand for goods. A key policy implication is that inflation could be reduced rapidly by eliminating the fiscal deficit.

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