Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, Sayı 26, Ocak - Haziran 2005, ss.

AN EMPIRICAL ANALYSIS OF TURKISH INFLATION (1988-2004): SOME NON-MONETARIST ESTIMATIONS

Cem SAATÇİOĞLU*
H. Levent KORAP**

ABSTRACT

The main purpose in this paper is to investigate the determinants of inflationary process in Turkish economy. For this purpose, based on a some potential consequential reasons, a vast literature is tried to be investigated on Turkish inflation, and a model attempt on inflation phenomenon is estimated. The results obtained support the view of cost-push inflation. Also the factors resulting from public sector pricing behavior and also the price inertia phenomenon are estimated as the other main sources of inflationary process under the estimation period 1988-2004, rather than the demand-pull monetary factors.

Key Words: Inflation, Turkish economy, VAR modelling.

INTRODUCTION

One of the main characteristics of Turkish economy for the post-1980 period is the chronic-high inflationary framework which dominates how all the other economic aggregates behave. Contrary to similar developing economies, no success had been achieved against this phenomenon, and also an unstable macroeonomic growth performance accompanied with this process. So a vast literature took place, investigating the potential causes of inflation in Turkish economy. A multi-country comparison of inflation performances would be useful to notice the privileged position of Turkey in this subject within the developing countries,

* Yrd. Doç. Dr., İstanbul Üniversitesi İktisat Fakültesi, İktisat Bölümü.
** Maramara Üniversitesi, Sosyal Bilimler Enstitüsü, İktisat Bölümü.

Makalenin geliş tarihi: Nisan 2005, kabul tarihi: Ağustos 2005

Table 1: Annual Percent Change in Consumer Prices of Some Developing Countries

	1987-96	97	98	99	2000	2001	2002	2003	2004
Turkey	70.9	85.0	83.6	63.5	54.3	53.9	44.8	25.3	10.6
South Africa	12.1	8.6	6.9	5.2	5.4	5.7	9.2	5.8	1.4
Hungary	21.8	18.3	14.3	10.0	9.8	9.2	5.3	4.7	6.8
Chile	15.3	6.1	5.1	3.3	3.8	3.6	2.5	2.8	1.1
Mexico	36.7	20.6	15.9	16.6	9.5	6.4	5.0	4.5	4.7
Bulgaria	63.2	1061.2	18.8	2.6	10.4	7.5	5.8	2.3	6.1
Poland	78.2	14.9	11.8	7.3	10.1	5.5	1.9	0.8	3.5
Romania	76.8	154.8	59.1	45.8	45.7	34.5	22.5	15.3	11.9
Russia	----	14.8	27.7	85.7	20.8	21.5	15.8	13.7	10.9
Brazil	656.6	6.9	3.2	4.9	7.1	6.8	8.4	14.8	6.6
Argentina	193.3	0.5	0.9	-1.2	-0.9	-1.1	25.9	13.4	4.4
Peru	287.4	8.5	7.3	3.5	3.8	2.0	0.2	2.3	3.7

Source: IMF World Economic Outlook (April-2005), Table 11 of Statistical Appendix, pp. 216-219, also cited in Domaç (2004: 1-41).

In our paper, we try to investigate the potential causes of Turkish inflation experience in an empirical way. Thus through a categorization of causes of inflation, the various approaches investigating this phenomenon are tried to be related to the Turkish case, and compared with literature so as to find out the different aspects of Turkish inflation. The next section focuses on literature review and model specification. Section three gives a model attempt considering the categorization in the former section. And the section four concludes.

I. LITERATURE REVIEW AND MODEL SPECIFICATION

For a developing country perspective, the main causes of inflation can be considered in a four branch categorization. The first one, named public finance and pricing behavior, emphasizes the expenditure requirement of public sector over its income generation capacity and the finance of this process by applying the central bank resources, that is, monetization. Pioneered by Phelps (1973), in this approach public sector borrowing requirement (PSBR) can be financed either by seigniorage revenues led by an increase in monetary base or by using domestic and foreign borrowing possibilities. If the monetary authority aims to realize an accommodative monetary policy framework for the purpose of financing public deficits, the growth of monetary base over the demand for these balances by economic agents can cause the public finance requirement to be considered as the main determinant of inflationary process and in a such environment inflation would be a fiscal phenomenon reflecting expenditure pressure on public sector, rather than a monetary case. If the domestic borrowing possibilities are applied to as an other alternative way, an ex-ante increase in monetary base would not be occured, but as Sargent and Wallace (1981) indicate as unpleasant monetarist arithmetic, the more increases in the cost of borrowing thus in the interest structure of the economy as a result of an accumulated debt stock, the harder to finance this debt stock and the more condensed expectations of economic agents for the possibility of monetization by monetary authority. And if this process ends with the case of monetization, the expost increase in monetary base and thus in inflation would be greater than the former case.

Over the Turkish economy Gazioğlu (1986), Anand and Wijnbergen (1989), Rodrik (1990), Ertel and İnsel (1993), Metin-Özcan (1995) and Metin-Özcan (1998) emphasize the importance of monetization for the inflationary environment, while Özatay (1992) and Uygur (1992) give special attention to public sector pricing behavior. O.C. Akçay, Alper and Özmucur (1997) and O.C. Akçay, Alper and Özmucur (2001) find evidence supporting Sargent and Wallace (1981). Koru and Özmen (2003) find seigniorage revenues as a result of an accommodative monetary policy rather than being causes of inflation. Also Özmen (1998) finds a relationship from inflation towards the monetary growth, rather than the opposite direction. Özatay (1996) and Özatay (1999) show that, in an unsustainable fiscal environment, how the monetization of fiscal deficits together with the interventions of controlling the domestic interest rates by monetary authority takes the economy into the 1994 economic crises. Also Celasun, Gelos, and Pratti (2003) find the budged deficits as the main determinant of the formation process of inflation expectations.

The second potential cause for inflation can be considered as the demand determined factors. In this respect, as a sub-division the demand-push factors can also be perceived from a Monetarist or Keynesian economics side. Considering the classical dichotomy assumption between goods and assets markets, Monetarists are of the opinion that the quantity of money and the general price level have a proportionate relationship between each other and the direction of this relationship flows from the changes in monetary balances to the changes in price level, that is, inflation. Under the dichotomy assumption, the stable income-velocity determined by market-based institutional factors gives the quantity of money an exogeneous characteristics which is also under the control of monetary authority. Besides, the general price level has an endogeneous characteristics determined by the changes in the quantity of money. The increase in monetary aggregates does not have any effect upon real aggregates, while reflects to price level directly indicating the demand pressure in the economy. For this approach, the growth of nominal monetary aggregates over the demand for real money balances would be considered as the main causes of changes in price level (Begg, Fischer, and Dornbusch, 1994, 487). Also Friedman (1956) constitutes a more micro-scaled and portfolio-based, well-known New Quantity Theory, while Friedman (1968) indicates the transmission mechanism of a change in monetary aggregates into price level changes in an adaptive expectations based long-run Phillips curve analysis.

On the other side, Keynesians develop an inflationary-gap model in order to explain the inflation phenomenon (Paya, 1998, 375). Up to the point that full-employment income level is attained, a demand pressure caused by a monetary expansion partially reflects to the changes in price level, but also positively influences the production possibilities of the economy. But after this level once attained, monetary expansion completely reflects to the price changes. In this theory, also the diminishing returns encountered with a constant capital stock in the short run and increasing bargaining powers of working classes could cause inflationary pressures from a cost-push side before full-employment (Kalın, 1989: 123).

When we consider the literature level concerning the prominent roles of monetary or demand-push factors on Turkish inflation Fry (1980), Fry (1986) and Togan (1987) show the sensitivity of Turkish inflation to both monetary aggregates and also to interest-structure of the economy. Lim and Papi (1997), Fisunoğlu and Çabuk (1998), Günçavdı, Levent and Ülengin (2000), Günçavdı and Ülengin (2001) find money supply increases as one of the main determinants of inflationary process. Dibooğlu and Kibritçioğlu (2001) also indicate the role of price increases resulted from increases in autonomous aggregate demand-push expenditures, and like Günçavdı and Ülengin (2001), propose the policies based on monetary control and restricting aggregate demand.

The third potential reason for inflationary process in a developing country would be considered as the cost-push factors. In this respect, the foreign exchange shocks or indexation of wages to past inflation and mark-up commoditiy pricing behavior targeting a constant rate of return for the enterprisers identified with Post-Keynesian school of thought, all reflecting to the domestic price level changes are important determinants of inflation. The real exchange rate targeting rule following the devaluations of domestic exchange rate would also strongly reflect to changes in price level. Montiel (1989), Bruno and Fischer (1986) and Dornbusch and Fisher (1993) give various transmission mechanisms leading to the cost-push factors mentioned above which reflect to the inflationary process. Besides, Arestis (1992), Lavoie (1992) and Davidson (1994) approach the inflation phenomenon from a Post-Keynesian point of view emphasizing the price formation under an oligopolistic market structure and considering the class conflicts between different social groups.

From this perspective, Öniş and Özmucur (1990) find a strong impact of devaluations on domestic inflation. On the other side, Rittenberg (1993) finds the direction of causation between exchange rate and price level from price level changes towards exchange rate changes indicating the validity of purchasing power parity (PPP) in Turkish economy. However, Erol and Wijnbergen (1997) find that real exchange rate targeting policy would have only moderate inflationary impacts on the economy. Erol (1997), Agènor and Hoffmaister (1997), Leigh and Rossi (2002) and Ongan (2003) also give evidence indicating the role of the exchange rate devaluations on inflation. B. Akçay (1997) finds the wage increases as an important determinant of inflationary process. Besides, Metin-Özcan, Voyvoda and Yeldan (2000) and Yeldan (2002) indicate the determinant role of competition and income inequality between socio-economic groups, and considering a mark-up based pricing behavior, estimate the downward-rigid pricing tendency of manufacture industry as an important determinant of inflation.

As a last reason of inflation, we can take account of expectation-based price stickiness. But these factor would be a secondary reason securing the perpetuity of past inflation to future, rather than any main reason expressed above. Various indexation mechanisms on nominal monetary aggregates aiming at compensating the real costs of inflation and accommodative monetary policies realized in this manner, as expressed by Calvo ve Végh (1999), would give rise to estimate the past inflation experiences as the main causes of inflation. Özatay (1992), Uygur (1992), Agénor and Hoffmaister (1997), Alper and Üçer (1998), Akyürek (1999), Cizre-Sakallıoğlu and Yeldan (1999), Erlat (2001), CBRT (2002) and Yavuz (2003) indicate the importance of inflationary stickiness and expectations phenomenon on Turkish inflation. Also Akat (2000) strongly opposes to any accomodative monetary and exchange rate policy in this manner and suggests using a nominal anchor to reduce the impact of any factor causing inflationary stickiness.

Through the categorization presented above, we now construct an inflation model comprising all the possible factors from different aspects for Turkish economy. Below is shown such a model formation,

$$P = f\,(\Delta H, \Delta DB, \Delta M, \Delta P_{pub,} \Delta E, \Delta W, INER) \qquad (1)$$

In this functional form, ‘P’ indicates the changes in general price level using consumer price index. ‘ΔH’ represents the changes in the volume of credits the central bank enables to the whole economic system and expresses the sum of credits which are used to both public sector as the credits to the Treasury, public economic institutions and state economic enterprises, and the credits to banking sector as the credits of rediscount, commercial, agricultural and industrial. ‘ΔDB’ indicates the cost which the public sector takes upon itself if the manner of domestic borrowing is applied in financing government expenditure demand and represents the maximum interest rate in the relevant period on government bonds which have a maturity of at most twelve months. ‘ΔM’ indicates the changes in the reserve money aggregate which is the sum of currency issued, required reserves, free deposits of banking sector, fund accounts, and deposits of non-banking sector which might also be considered under the liability and control of monetary authority. ‘ΔP_{pub}’ expresses the change in public sector prices which can be used to finance the expenditure requirement of public sector as a policy instrument and represents the government sector producer price index. ‘ΔE’ indicates the change in prices of assets held in foreigns exchange and represents TL/US$ exchange rate, while 'ΔW' indicates the changes in wages of working classes in the economy, and represents 1997:100 based hourly wage index in manufacture industry. Also the aggregate 'INER' represents the price stickiness phenomenon which explains the changes in price level over itself.

II. AN ATTEMPT OF EMPIRICAL INVESTIGATION

Through the model constructed above, we now try to explore the validity of the factors affecting inflationary process on Turkish economy by using modern econometric estimation techniques. All the data we use are in logarithmic form, except the 'DB' variable which is considered in linear form following the modern literature on this issue. The monthly frequency data are used and the time period for investigation is 1988:01-2004.12. The exception of the year 1987 from the analysis is due to the attainment of the wage data since 1988. All the data used are taken from the electronic data delivery system of Central Bank of Republic of Turkey (CBRT) and are in terms of YTL.

As a next step for our econometric analysis, we investigate the time series properties of the variables used. Granger and Newbold (1974: 111-120) indicate the occurance of the spurious regression problem in the case of using non-stationary time series, causing unreliable correlations within the regression analysis. At first, by using the augmented Dickey-Fuller (ADF) unit root test (Dickey and Fuller, 1979: 427-431) we check for the stationarity condition of our variables by comparing ADF statistics obtained, with the MacKinnon (1996: 601-618) critical values, also possible in Eviews 4.1. For the case of stationarity, we expect that ADF statistics are larger than the MacKinnon critical values in absolute value and that they have a minus sign. Although differencing eliminates trend, we also report the results of unit root tests for the first differences of variables with a linear time trend in the test regression. The results are shown in Table 2 below[1],

Table 2: Unit Root Tests

	constant	constant&trend		constant	constant&trend

P	level	-2.29(1)	2.12(2)	DB	level	-2.75(0)	-2.76(0)
	1.diff.	-8.40(0)*	-8.84(0)*		1.diff.	-12.6(1)*	-12.65(1)*
M	level	-0.86(0)	-0.80(0)	H	level	-2.35(0)	-2.63(0)
	1.diff.	-17.14(0)*	-17.17(0)*		1.diff.	-13.82(0)*	-13.79(0)*
P_{pub}	level	-1.20(1)	-0.49(1)	W	level	-2.74(12)	0.50(12)
	1.diff.	-11.38(0)*	-11.45(0)*		1.diff.	-0.92(11)	-3.68(10)**
E	level	-1.34(1)	-0.31(1)		2.diff.	-9.26(10)*	
	1.diff.	-9.07(0)*	-9.18(0)*				

MacKinnon (1996) critical values

	Constant	Constant&Trend
%1 level	-3.46	-4.00
%5 level	-2.87	-3.43

When we examine the results of the unit root tests, we see that the null hypothesis that there is a unit root cannot be rejected for all the variables with both constant and constant & trend terms in the test equation in the level form. But inversely, for the first differences of all the variables, the null hypothesis of a unit root is rejected at 1% level except the variable ‘W’ for which the null hypothesis is rejected at 5% level by considering a trend effect. As a result, we accept that all the variables contain a unit root, that is, non-stationary in their level forms, but stationary in their first differenced forms, thus enable us testing for cointegration.

We now examine whether the variables used are cointegrated with each other. Engle and Granger (1987: 251-276) indicate that even though economic time series may be non-stationary in their level forms, there may exist some linear combination of these variables that converge to a long run relationship over time. If the series are individually stationary after differencing but a linear combination of their levels is stationary, then the series are said to be cointegrated. That is, they cannot move too far away from each other in a theoretical sense (Dickey, Jansen and Thornton, 1991: 58). For this purpose, we estimate a VAR-based cointegration relationship using the methodology developed in Johansen (1991) and Johansen (1995) in order to specify the long run relationships between the variables. Let us assume a VAR of order p

$$y_t=A_1y_{t-1}+...+A_py_{t-p}+Bx_t+\varepsilon_t \qquad (2)$$

where y_t is a k-vector of non-stationarity I(1) variables, x_t is a d-vector of deterministic variables as constant term, linear trend and centred seasonal dummies which sum to zero over a year (Johansen, 1995: 84), and ε_t is a vector of innovations. We can rewrite this VAR as

$$\Delta y_t=\Pi y_{t-1}+\sum_{i=1} \Gamma_i\Delta y_{t-i} + Bx_t + \varepsilon_t \tag{3}$$

where

$$\Pi=\sum_{i=1}^{p} A_i - I \qquad \Gamma_i = -\sum_{j=i+1}^{p} A_j \tag{4}$$

Granger representation theorem asserts that if the coefficient matrix Π has reduced rank r<k, then there exist kxr matrices α and β each with rank r such that $\Pi=\alpha\beta'$, and $\beta' y_t$ is I(0). r is the number of cointegrating relations (the rank) and each column of β is the cointegrating vector. The elements of *a* are known as the adjustment parameters in the VEC model and measure the speed of adjustment of particular variables with respect to a disturbance in the equilibrium relationship. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π. Also we can express that this method performs better than other estimation methods even when the errors are non-normal distributed or when the dynamics are unknown and the model is over-parametrized by including additional lags (Gonzalo, 1994: 225). We thus first determine the lag length of our unrestricted VAR model, for the maximum lag number selected is 12, by using five lag order selection criterions, that is, sequential modified LR test statistic (LR), final predicton error criterion (FPE), Akaike information criterion (FPE), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). As the lag order selected FPE, AIC and HQ test statistics suggest 2, LR test suggests 4 and SC criterion suggests 1 lag orders. So we consider the lag order 2, to check our econometric model for the cointegration relationship, since lag orders 1 and 4 strongly indicate the serial correlation problem in the VAR framework, but the lag order 2 is appropriate in this respect to carry on our analysis. Below we indicate the VAR lag order selection criteria table in which ´*´ indicates the lag order selected by the relevant criterion,

Table 3: Var Lag Order Selection Criteria

Lag	LR	FPE	AIC	SC	HQ
0	NA	2.04E-08	2.155811	3.818491	2.829208
1	3941.253	3.34E-18	-20.38204	-17.88802*	-19.37194
2	145.0968	2.32E-18*	-20.75636*	-17.43100	-19.40956*
3	66.98745	2.55E-18	-20.67248	-16.51578	-18.98899
4	78.12793*	2.58E-18	-20.68292	-15.69488	-18.66273
5	36.97577	3.42E-18	-20.43108	-14.61170	-18.07418
6	51.97083	4.06E-18	-20.30280	-13.65208	-17.60921
7	55.44038	4.64E-18	-20.22215	-12.74009	-17.19186
8	36.08156	6.17E-18	-20.00749	-11.69409	-16.64050
9	51.63492	7.16E-18	-19.94607	-10.80133	-16.24238
10	64.89597	7.30E-18	-20.03654	-10.06046	-15.99615
11	46.56311	8.77E-18	-19.98714	-9.179725	-15.61008
12	50.20937	1.01E-17	-20.01087	-8.372110	-15.29709

For lag specification 1 we estimate LM(1)=47.04631(0.5527), LM(12)=71.84829(0.0184), and for lag specification 4 we estimate LM(4)=37.84172(0.8765), LM(12)=76.27343(0.0076), and also for lag specification 2 LM(2)=50.51153(0.4136), LM(12)=63.29090(0.0824). The pobability values are indicated in parantheses and probs. are from chi-square with 49 df. Thus when we consider the lag order 2 of AIC statistics for our specification, some 12th order serial correlation problem occurs under the 10% significance level, but if we assume the 5% probability level for meaningness, we can conclude that we do not have to attach importance to serial correlation problem.

As a next step, we estimate the long run cointegrating relationship(s) between the variables by using two likelihood test statistics offered by Johansen and Juselius (1990: 169-210) known as maximum eigenvalue for the null hypothesis of r versus the alternative of r+1 cointegrating relationships, and trace for the null hypothesis of r cointegrating relations against the alternative of k cointegrating relations, for r = 0,1,...,k-1 where k is the number of endogeneous variables. For the trace test, the alternative of k cointegrating relationships corresponds to the case where none of the series has a unit root and a stationary VAR may be specified in terms of the levels of all of the variables. Table 4 reports the results of max-eigen and trace tests with a restricted linear deterministic trend in cointegration equation.

Table 4: Unrestricted Cointegration Rank Test

Sample (adjusted): 1988.4 2004.12
Included observations: 201 after adjusting endpoints
Trend assumption: Linear deterministic trend (restricted)
Series: P M P_{pub} E DB H W
Exogeneous series: DKRIZ DKRIZ2 D_M2 D_M3 D_M4 D_M5 D_M6 D_M7 D_M8 D_M9 D_M10 D_M11 D_M12
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	Max-Eigen Statistic	5 Percent Critical Value
None	0.309945	192.4122*	146.76	74.56783*	49.42
Atmost1	0.170451	117.8444*	114.90	37.56141	43.97
Atmost2	0.125515	80.28297	87.31	26.95805	37.52
Atmost3	0.122345	53.32492	62.99	26.23088	31.46
Atmost4	0.062543	27.09404	42.44	12.98153	25.54
Atmost5	0.049071	14.11251	25.32	10.11357	18.96
Atmost6	0.019899	3.998946	12.25	3.998946	12.25

'*' denotes rejection of hypothesis at the 5% level. Trace test indicates 2 cointegrating relationship, while Max-eigen test indicates 1 cointegrating relationship in the long run variable space. The critical values are taken from Osterwald-Lenum (1992: 461-472), also available from the VAR and COINT procedures in Eviews 4.1. 'DKRIZ' and 'DKRIZ2' are the exogeneous dummy variables representing economic crisis conditions, which take on unity between the periods 1993:10-1994:06 and 2000:10-2001.06 respectively. The variables from D_M2 to D_M12 are the centred (orthogonalized) seasonal dummies which sum to zero over a year (Johansen, 1995: 84) so that linear trend from the dummies disappears and is taken over completely by the constant term and only seasonally varying means remains. For instance, the second month takes the value of 0.916667 while the sum of the remaining eleven months' dummies is –0.916667.

From the Table 4, we consider two potential long run vectors in the cointegrating system. It is not uncommon to find more than one cointegrating relationship in a system with more than two variables using the Johansen procedure. Some researchers in this situation revert back to a system with one cointegrating vector by choosing the vector corresponding to the largest eigenvalue or by choosing the most theoretically plausible cointegrating relationship. Let us follow, here, Dickey, Jansen and Thornton (1991: 61-65). In light of the explanations given above, the objective of cointegration analysis is to find an k by k matrix β', of rank k, such that $\beta' y_t$ decomposes y_t into its stationary and non-stationary components. This is accomplished by obtaining a r by k sub-matrix of β', b', of rank r such that the transformed series $b' y_t$ is stationary. The r rows of β' associated with these stationary series are called cointegrating vectors. The remaining k-r unit root combinations are termed “common trends”. Let us also consider a model with no common trends, so the system is stationary and variable vector never wanders “too far” from its steady-state equilibrium value. If there is one common trend and k-1 cointegrating vectors, however, k-1 of the variables must be solved for in terms of the k^{th}, and the structure of these variables follows a single common trend. Hence, there are k-1 directions where the variance is finite and one direction in which it is infinite. On the other hand, if there is only one cointegrating vector, the k^{th} variable must be solved for in terms of the other k-1 variables. The system can wander off in k-1 independent directions, it is stable in only one direction. The more cointegrating vectors there are, the more stable the system. Hence, all other things the same, it is desirable for an economic system to be stationary in as many directions as possible. Followed by these explanations, below is shown the cointegrating vectors after normalizing on the variable P to obtain economically meaningful estimation results under the assumption of two cointegrating vectors in the long run space,

Table 5: Normalized Cointegrating Vectors on the Variable P

P	M	P_{pub}	E	DB	H	W	TREND	C
-1.00	-0.05	+0.29	+0.39	+0.15	-0.03	+0.16	+0.01	+1.38
-1.00	-0.11	+0.22	+0.45	+0.11	-0.03	+0.15	+0.01	+1.82
χ^2 Statistics for the Significance of Variables under the Assumption of Rank 2								
8.79	3.80	6.44	4.96	21.75	5.27	5.58		
(0.01)	(0.15)	(0.04)	(0.08)	(0.00)	(0.07)	(0.06)		

Above the numbers in parantheses indicating the significance of variables are the probability values of χ^2 statistics asymptotically distributed with degrees of freedom 2, and test the significance of relevant variable against the null hypothesis. The estimation results reveal that all the variables except the monetary variable ‘M’ seems to belong to the cointegrating system. The analyses above considers the 10% significance level to be able to assess and take into consideration as possible as many factors affecting inflationary process. This case, of course, might bring out some consistency problem for the estimation results, but we assume that all the factors above have a potential-ex ante effect on Turkish inflation.

Table 5 indicates that both cointegrating vectors give similar results. Under the assumption of 2 cointegrating vectors, there seems no effect of monetary aggregate (M) on the price level (P) as the classical theory and Monetarists suggest with a strong and positive relationship. In this manner, any contractionary effect on monetary base, which is also insignificant, possibly affects the price level opposite to what classical theory suggests. Rather than a quantity theoretical approach, through the unpleasant monetarist arithmetic of Sargent and Wallace (1981), this case could lead the economy into a stagflationist environment by using the interest structure of economy upwards and thus by constraining the borrowing possibilities of public sector leading to increases in private sector production costs. Especially, O.C. Akçay, Alper and Özmucur (1997) and O.C. Akçay, Alper and Özmucur

(2001) analyse this case in a similar way. CBRT (2002) finds the non-monetary factors as the dominant reasons of inflationary process for Turkish economy as well. The effect of domestic borrowing rate (DB) on general price level supports this finding through an 0.10-0.15% increase in the price level caused by a 1% increase in domestic borrowing rates.

Another possible reason of inflation is assumed to be the pricing behavior of public sector, and the increase in public prices (P_{pub}) by 1% also increases the general price level by 0.20-0.30%, as expected. In this point, under the null hypothesis of weak exogeneity and the assumption of 2 cointegrating vectors, we apply to the weak exogeneity tests in order to determine whether the public prices are exogeneous to our system specification in the sense that indicates a policy instrument and we estimate an LR statistics 7.44 with the possibility of 0.02, thus conclude that this variable indicates an endogeneous characteristics to our system opposed to the findings of Alper and Üçer (1998) and have an accommodative role in the economy rather than a policy instrument characteristics.

As an indicator of cost-pressure on the economy, we consider the effects of foreign exchange rate (E) and wages (W) on inflation, and we found that a 1% increase in exchange rate would increase the price level nearly by 0.40%, and a 1% increase in wages would also increase the price level by 0.15%. These results thus reveal the importance of supple-side and cost-push factors on inflation, similar to the findings of Öniş and Özmucur (1990). As a last variable in our system, the variable (H) representing the potential effects of monetization have been found indicating no effect on inflationary process.

For the dynamic relationships between the variables used, we consider variance decomposition and impulse-response functions in a VAR modelling framework. Impulse-response function indicates the effects of a shock to one endogeneous variable onto the other variables in the VAR, while variance decomposition separates the variation in an endogeneous variable into the component shocks to the VAR. Sims, Stock, and Watson (1990) show that parameters that can be written as coefficients on mean zero, nonintegrated regressors have jointly normal asymptotic distributions and suggest that the common practice of attempting to transform models to stationary form by difference operators whenever it appears likely that the data are integrated is unnecessary. Besides, Maddala (1992: 597) suggests that if a set of unit root variables satisfies a cointegration relation, simple first differencing of all the variables can lead to econometric problems. In the general VAR system with n variables, if all the variables are nonstationary, using an unrestricted VAR in levels is appropriate. Thus following Sims, Stock, and Watson (1990) and Maddala (1992: 597), we carry on our analysis of VARs by using the level data. CBRT (2002) and Bahmani and Domaç (2003) apply to a similar modelling framework. For this purpose, using 1000 Monte Carlo repetitions, the results of variance decomposition analysis based on Cholesky orthogonalization degrees of freedom adjusted for the variable ‘P’ are indicated below. Since the Cholesky decomposition is sensitive to different variable orderings, we check for our results by applying to different variable orderings. We try to place the variables other than the price level in the first ordering in all of the orderings below to give them an exogeneous characteristics such as policy variables as much as possible which enables them to affect changes in price level and we place the price level in the last ordering in three of four orderings in order to give it the maximum effects from the other variables.

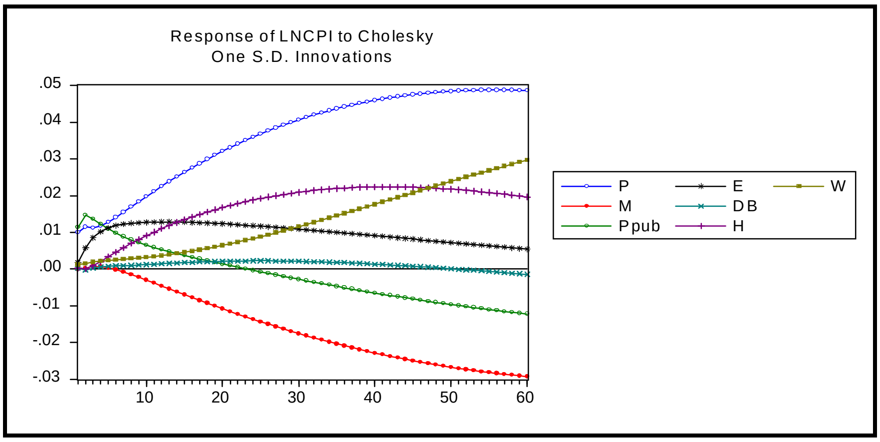
Table 6: Variance Decomposition Analysis of the Changes in Price Level

	Cholesky decomposition (% change) (ordering: E, H, W, DB, M, P_{pub}, P)							Cholesky decomposition (% change) (ordering: DB, W, M, P_{pub}, H, E, P)						
Months	P	M	P_{pub}	E	DB	H	W	P	M	P_{pub}	E	DB	H	W
3	35	0.3	16	48	0.2	0.3	0.1	36	0.1	54	11	0.1	0.1	0.1
6	37	0.6	7.5	52	0.2	1.7	0.4	37	0.1	40	21	0.2	0.1	0.2
12	48	3.1	3.5	37	0.4	6.7	0.6	48	1.3	20	20	0.4	5.9	0.5
24	59	9.8	3.0	15	0.6	12	0.7	59	7.0	5.9	15	0.5	12	1.1
36	61	15	3.0	7.0	0.5	12	1.5	61	12	2.6	9.1	0.3	13	2.2
60	57	22	3.0	2.7	0.3	9.7	4.9	57	20	1.5	4.5	0.1	10	6.0
	Cholesky decomposition (% change) (ordering: P_{pub}, H, P, DB, M, W, E)							Cholesky decomposition (% change) (ordering: M, P_{pub}, E, DB, H, W, P)						
Months	P	M	P_{pub}	E	DB	H	W	P	M	P_{pub}	E	DB	H	W
3	42	0.1	53	5.4	0.1	0.1	0.1	35	0.1	53	11	0.1	0.1	0.7
6	47	0.1	39	12.3	0.3	0.1	0.1	37	0.1	39	21	0.1	1.6	1.1
12	61	0.1	19	12.9	0.4	5.8	0.1	48	0.8	19	23	0.2	7.8	1.3
24	71	5.5	5.3	6.3	0.4	11.4	0.3	59	5.1	5.3	14	0.2	14.5	2.2
36	71	9.3	2.5	3.1	0.2	12.3	1.2	61	9.0	2.5	8.3	0.2	15.4	4.0
60	67	14	2.5	1.2	0.1	10.1	5.2	57	14	2.5	3.9	0.1	12.9	9.8

Examining Table 6 reveals that over a period of 60 months, nearly 60% of the forecast error variance of the variable ‘P’ can be accounted by the shocks over itself, in the sense that indicates the dominant role of price inertia phenomenon on price determination which is aggravated over time. Also, the shocks on public prices (P_{pub}) and exchange rate (E) seem to be the other main reasons explaining the forecast error variance on the price level. Only having considered these main effects, the monetary factors such as variables ‘M’ and ‘H’ begin to affect the changes in price level in a limited way through time. The shocks in public prices affect price level especially for the first twelve months, and over the first six months explain the 40-50% of the forecast error variance on price level. Also the exchange rate shocks explain the 10-20% of the forecast error variance on price level. The variables ‘M’ and ‘H’, over a period of 36 and 60 months respectively, explain nearly 15% changes in forecast error variance on price level. Wages (W) and domestic borrowing rates (DB) have no effect on price level in our dynamic VAR analysis.

We now estimate the impulse-response function for our VAR model, and consider the Cholesky ordering for this purpose as M, P_{pub}, E, DB, H, W, P using 1000 Monte Carlo repetitions.

Graph 1: Impulse Response Analysis of the Changes in Price Level



Our impulse-response analyses suggest that innovations in price level (P) have an increasing effect on itself over the period, and the largest statistically significant effect on price level occurs after 36 months by a 4.4% increase in price level resulted from a 1% standard deviation shock on itself, while disappears after 40 months. The largest statistically significant effect of public price (P_{pub}) shocks on price level occurs after 2 months, and a 1% standard deviation shock on public prices increases price level by 1.4 percent, while disappears after 8 months. The largest statistically significant effect of exchange rate (E) on price level occurs after 13 months, and a 1 standard deviation shock on exchange rate increases price level by 1.3%, while disappears after 16 months. We've found no statistically significant effect of shocks on domestic borrowing rate (DB), reserve money (M), and wages (W) on price level, through the impulse-response analyses. We have also estimated a delayed effect of domestic credit volume (H) which the monetary authority provides to economy, on the price level, and while the statistically significant effect of the variable 'H' occurs between 8-20 months, the largest meaningful effect is seen after 20 months by a 1.7% increase on price level.

Thus using the VARs supports our findings in cointegration analyses that exchange rate changes, in other wors, devaluations of domestic currency and public price shocks resulted from public sector expenditure requirement seem to be the main reasons causing inflationary environment, while the phenomenon 'inflationary inertia' enable this process to settle and perpetuate in the economy.

CONCLUSION

In this paper, we try to investigate the potential causes of chronic-high inflationary environment in Turkish economy for the period 1988-2004 using monthly observations. Under a general categorization of the causes of inflation, using modern econometric estimation techniques enables us to examine the long run equilibrium and short run dynamic interaction process of inflation phenomenon with its potential causes. We thus estimate that the cost-push or supply side factors such as exchange rate changes and public sector expenditure requirement as a demand-side factor seem to be the main causes of inflationary process in Turkish economy, while demand-pull monetary factors have not been found as indicating consequential effects on inflation. Also the price inertia phenomenon which took place through the expectations of past inflation experiences, enables this process to settle and perpetuate in the economy.

NOTES

[1] For the MacKinnon critical values, we consider %1 and %5 level critical values for the null hypothesis of a unit root. The numbers in parantheses are the lags used for the ADF stationary test, and augmented up to a maximum of 12 lags. The choice of the optimum lag for the ADF test was decided on the basis of minimizing the Schwarz Information Criterion (SC). The test statistics and the critical values are from the ADF or UNITROOT procedures in Eviews 4.1. ADF is the augmented Dickey-Fuller test with critical values based on MacKinnon (1996: 601-618). A significant test statistic rejects the null hypothesis in favor of stationarity. '*' and '**' indicate the rejection of the null hypothesis of a unit root for the %1 and %5 levels respectively.

REFERENCES

AGENOR, Pierre Richard and Alexander W. HOFFMAİSTER (1997), "Money, Wages and Inflation in Middle Income Developing Countries**", IMF Working Paper**, 97/174, December.

AKAT, A. Savaş (2000), "The Political Economy of Turkish Inflation", **Journal of International Affairs,** 54/1.

AKÇAY, Belgin (1997), "Rational Expectations Model of Inflation for Turkey", **Dokuz Eylül Üniversitesi İ.İ.B.F. Dergisi,** 12/2, 49-64.

AKÇAY, O. Cevdet, ALPER C. Emre and Süleyman ÖZMUCUR (1997), "Budget Deficit, Money Supply and Inflation: Evidence from Low and High Frequency Data for Turkey**", Boğaziçi University SBE Discussion Paper**, 97/10.

AKÇAY, O.Cevdet, ALPER, C. Emre and Süleyman ÖZMUCUR (2001), "Budget Deficit, Inflation and Debt Sustainability: Evidence from Turkey (1970-2000)", in KİBRİTÇİOĞLU, Aykut,RİTTENBERG, Libby and Faruk Selçuk (eds.), **Inflation and Disinflation in Turkey**, Ashgate Publishing Limited, 77-96.

AKYÜREK, Cem (1999), "An Empirical Analysis of Post-Liberalization Inflation in Turkey", **Yapı Kredi Economic Review**, 10/2, December, 31-53.

ALPER, C. Emre and Murat ÜÇER (1998), "Some Observations on Turkish Inflation: A "Random Walk" Down the Past Decade", **Boğaziçi Journal,** 12/1, 7-38.

ANAND, Ritu and Sweder van WİJNBERGEN (1989), "Inflation and the Financing of Government Expenditure: An Introductory Analysis with an Application to Turkey", **The World Bank Economic Review**, 3/1, 17-38.

ARESTIS, Philip (1992), **The Post-Keynesian Approach to Economics**, Edward Elgar Publishing

BEGG, David, FİSCHER, Stanley and Rudiger DORNBUSCH (1994), **Economics,** Fourth Ed., 1994.

BRUNO, Michael and Stanley FİSCHER (1986), "The Inflationary Process in Israel: Shocks and Accommodation", **NBER Working Paper**, No. 1483.

CALVO, Guillermo A. and Carlos A VEGH (1999), "Inflation Stabilization and BOP Crisis in Developing Countries", **NBER Working Paper**, 6925.

CBRT (2002), **Para Politikası Raporu**, April.

CELASUN, Oya, GELOS R. Gaston and Alessandro PRATTİ (2003), "Would Cold Turkey Work in Turkey?", **IMF Working Paper**, 03/49.

CİZRE SAKALLIOĞLU, Ümit and Erinç YELDAN (1999), “Dynamics of Macroeconomic Disequilibrium and Inflation in Turkey: The State, Politics, and The Markets under a Globalized Developing Economy”, **Bilkent University Department of Economics Working Paper**, 99/10.

DAVIDSON, Paul (1994), **Post Keynesian Macroeconomic Theory**, Edward Elgar Publishing.

DİBOOĞLU, Selahattin and Aykut KİBRİTÇİOĞLU (2001), “Inflation, Output and Stabilization in a High Inflation Economy: Turkey, 1980-2000”, **University of Illinois at Urbana-Champaign, College of Commerce and Business Administration, Office of Research Working Paper**, 01/0112.

DICKEY, David A. and A.Wayne FULLER (1979), “Distribution of the Estimators for Autoregressive Time Series with A Unit Root”, **Journal of American Statistical Association**, Volume 74, Number 366, June, 427-431.

DICKEY, David A., JANSEN, Dennis W. and L. Daniel THORNTON (1991*),* “A Primer on Cointegration with an Application to Money and Income”, **Federal Reserve Bank of St. Louis Review**, March/April, 58-78.

DOMAÇ, İlker (2004), “Explaining and Forcasting Inflation in Turkey”, **World Bank Policy Research Working Paper,** 3287, April.

DORNBUSCH, Rudiger and Stanley FİSCHER (1993), “Moderate Inflation”, **The World Bank Economic Review**, 7/1, 1-44.

ENGLE, Robert F. and C.W.J GRANGER (1987), “Cointegration and Error Correction: Representation, Estimation and Testing”, **Econometrica**, 55/2, March, 251-276.

ERLAT, Haluk (2001), “Long Memory in Turkish Inflation Rates”, **Paper Presented at the 21st Annual Conference of the Middle East Economics Association**, New Orleans, January, 5-7.

EROL, Turan and Sweder van WİJNBERGEN (1997), “Real Exchange Rate Targeting and Inflation in Turkey: An Empirical Analysis with Policy Credibility”, **World Development**, 25/10, 1717-1730.

EROL, Turan (1997), “Nominal Anchors of the Turkish Economy: Evidence from a VAR Model”, **METU Studies in Development**, 24/3, 363-382.

ERSEL, Nesrin and Aysu İNSEL (1993), “Türkiye’de Kronik Enflasyon Süreci ve Antienflasyonist Politikaların Etkinliği 1981-1991”, **ODTÜ Gelişme Dergisi**, 20/3, 299-312.

FİSUNOĞLU, H. Mahir and H. Altan ÇABUK (1998), "Düşük Oranlı ve Sürekli Kur Ayarlamalarının Enflasyon Üzerindeki Etkisi", **ODTÜ Gelişme Dergisi**, 25/2, 297-309.

FRIEDMAN, Milton (1956), "The Quantity Theory of Money – A Restatement", in M. Friedman (ed.), **Studies in the Quantity Theory of Money**, The University of Chicago Press, 3-21.

FRIEDMAN, Milton (1968), "The Role of Monetary Policy", **American Economic Review**, 58, 1-7.

FRY, Maxwell J. (1980), "Money, Interest, Inflation and Growth in Turkey", **Journal of Monetary Economics**, 6, 535-545.

FRY, Maxwel J. (1986), "Turkey's Great Inflation", **METU Studies in Development**, 13/1-2, 117-134.

GAZİOĞLU, Şaziye (1986), "Government Deficits, Consumption and Inflation in Turkey", **METU Studies in Development**, 13/1-2, 117-134.

GONZALO, Jesus (1994), "Five Alternative Methods of Estimating Long - Run Equilibrium Relationships", **Journal of Econometrics**, 60, 203-233.

GRANGER, C.W.J. and Paul NEWBOLD (1974), "Spurious Regressions in Economics", **Journal of Econometrics**, 2/2, 111-120.

GÜNÇAVDI, Öner, LEVENT, Haluk ve Burç ÜLENGİN (2000), "Yüksek ve Değişken Enflasyonun Tahmininde Alternatif Modellerin Karşılaştırılması: Türkiye Örneği", **ODTÜ Gelişme Dergisi**, 27/1-2, 149-171.

GÜNÇAVDI, Öner and Burç ÜLENGİN (2001), "Financial Crisis and Inflationary Dynamics in Turkey**", Istanbul Technical University Faculty of Management Discussion Papers in Management Engineering**, 01/15.

INTERNATİONAL MONETARY FUND (2005), **World Economic Outlook**, April.

JOHANSEN, Søren (1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models", **Econometrica**, 59, 1551-1580.

JOHANSEN, Søren (1995), **Likelihood-based Inference in Cointegrated Vector Autoregressive Models,** Oxford University Press**.**

KALIN, Ahmet S. (1989), **Enflasyon Analitik Bir Yaklaşım**, Filiz Kitabevi, İstanbul.

KORU, Ayça Tekin and Erdal ÖZMEN (2003), “Budget Deficits, Money Growth and Inflation: the Turkish Evidence”, **Applied Economics**, 35/5, 591-596.

LAVOIE, Marc (1992), **Foundations of Post-Keynesian Economic Analysis**, Edward Elgar Publishing.

LEIGH, Daniel and Marco ROSSI (2002), “Exchange Rate Pass-Through in Turkey”, **IMF Working Paper**, 02/204.

LIM, Cheng Hoon and Laura PAPI (1997), “An Econometric Analysis of the Determinants of Inflation in Turkey”, **IMF Working Paper,** 97/170.

MACKINNON, J.G. (1996), “Numerical Distribution Functions for Unit Root and Cointegration Tests”, **Journal of Applied Econometrics**, 11, 601-618.

METİN-ÖZCAN, Kıvılcım (1995), **The Analysis of Inflation: The Case of Turkey (1948 - 1988**), Sermaye Piyasası Kurulu yayını, No. 20.

METİN-ÖZCAN, Kıvılcım (1998), “The Relationship Between Inflation and the Budget Deficit in Turkey”, **Journal of Business** & **Economic Statistics**, 16/4, 412-422.

METİN-ÖZCAN, Kıvılcım, VOYVODA, Ebru and Erinç YELDAN (2000), “On The Patterns of Trade Liberalization, Oligopolistic Concentration and Profitability: Reflections from Post-1980 Turkish Manufacturing”, **Paper Presented at the IVth Annual METU Conference on Economics**, Ankara, September, 2000

MONTIEL, Peter J. (1989), “Empirical Analysis of High-Inflation Episodes in Argentina, Brazil, and Israel”, **IMF Staff Papers**, 36/3, 527-549.

ONGAN, Hakan (2003), “Türkiye’de Enflasyon ve Devalüasyon İlişkisi”, **İ.Ü. İkt. Fak. Mecmuası**, 53/2, 87-100.

ÖNİŞ, Ziya and Süleyman ÖZMUCUR (1990), “Exchange Rates, Inflation and Money Supply in Turkey: Testing the Vicious Circle Hypothesis”, **Journal of Development Economics**, 32/1, 133-154.

ÖZATAY, Fatih (1992), “The Role of Public Sector Prices in Price Dynamics in Turkey”, in H. Ersel (ed.), **Price Dynamics Papers Presented at a Workshop Held in Antalya**, Turkey on May 7-10,1990, Ankara: CBRT, December, 33-69.

ÖZATAY, Fatih (1996), “The Lessons From the 1994 Crisis in Turkey: Public Debt (Mis)management and Confidence Crisis”, **Yapı Kredi Economic Review**, 7/1, 21-38.

ÖZATAY, Fatih (1999), “The 1994 Currency Crisis in Turkey”, Journal of Policy Reform, 3/ 4, 327-352.

PAYA, Merih (1998), **Para Teorisi ve Para Politikası**, Filiz Kitabevi, İstanbul.

PHELPS, Edmund S. (1973), “Inflation and the Theory of Public Finance”, **Swedish Journal of Economics**, 75/1, 67-82.

RITTENBERG, Libby (1993), “Exchange Rate Policy and Price Level Changes: Causality Tests for Turkey in the Post Liberalization Period”, **The Journal of Development Studies**, 29/2, 245-259

RODRIK, Dani (1990), “Premature Libaralization, Incomplete Stabilization: The Özal Decade in Turkey”, **NBER Working Paper**, No. 3300, March.

SARGENT, Thomas J. and Neil WALLACE (1981), “Some Unpleasant Monetarist Arithmetic”, **FRB of Minneapolis Quarterly Review,** 5/3, 1-17.

SIMS, Christopher A., STOCK, James H. and Mark W. WATSON, (1990), “Inference in Linear Time Series Models With Some Unit Roots”, **Econometrica**, 58/1, 113-144.

TOGAN, Sübidey (1987), “The Influence of Money and the Rate of Interest on the Rate of Inflation in a Financially Repressed Economy: The Case of Turkey”, **Applied Economics**, 19, 1585-1601.

UYGUR, Ercan (1992), “Price, Output and Investment Decisions of Firms: An Explanation of Inflation and Growth in Turkish Industry”, in H. Ersel (ed.), **Price Dynamics: Papers Presented at a Workshop Held in Antalya**, Turkey on May 7-10, Ankara: CBRT, December, 1-31.

YAVUZ ÇİL, Nilgün (2003), “Durağanlık ve Koentegrasyon Analizi Çerçevesinde Kamu Açığı ve Finansmanı Açısından Enflasyon Modelinin Tahmini (1982-2001)”, **İ.Ü. İkt. Fak. Mecmuası,** 53/2, 101-117.

YELDAN, Erinç (2002), **Küreselleşme Sürecinde Türkiye Ekonomisi: Bölüşüm, Birikim ve Büyüme,** Altıncı Baskı, İletişim Yayınları, İstanbul.