# Critical Evaluation of the Success of Monetary Policies against Inflation in Turkey After 1980

by

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# ABSTRACT

The most well known view on the relationship between money supply and inflation in contemporary literature is that the increase in money supply in the short-run may affect the real sector but in the long run will affect only the price level. This is the view of Monetarists.

In Chapter 3, monetary policy implementations in Turkey have been analyzed year by year, and the effects of the monetary policy tools against inflation have been observed, analyzed and evaluated.

In Chapter 4, Granger's Causality Analysis is applied to determine a cause-effect relation between the CPI (dependent variable) and the independent variables, M2 money supply, RRR (Required Reserve Ratio) and DR (Discount Rate) consecutively. According to the results of the study, there is bilateral causality between money supply (M2) and the inflation level as it is determined by the Granger's Causality Analysis. As it is observed in this chapter, M2 and RRR affect inflation rate after around 1-year period and DR affects inflation rate after circa 4 years period. In fact, the theory also suggests that among the monetary policy tools, Discount Rate exerts its effect later than the other tools.

In Turkish economy, current inflation rate is the result of accumulation of past experiences. Namely, current inflation rate is determined by recent cost and demand dynamics along with the expectations of agents with a time lag.

One of the major findings of this study is that, according to the Granger-Causality Analysis utilized in the econometric part of this thesis, in Turkish economy, actually the increase in inflation rate leads to increase in money demand that leads to increase in M2 money supply, which is the source of further price increases. If these factors determining the current inflation rate persist in the future, there is no doubt that the future inflation will be no different from the present and the past.

# ÖZET

Enflasyon ile para arzı arasındaki ilişki hakkında ekonomi literatüründe genel yargı şudur; para arzındaki değişiklikler kısa vadede reel sektörü de etkileyebilir fakat uzun vadede, yalnızca fiyatları attırıcı etkisi vardır. Bu, günümüzde de itibar gören Monetarist'lerin görüşüdür. Enflasyon uzun vadede parasal bir olgudur.

3. Ünitede para politikaları uygulamaları yıllar bazında incelenmiş, para arzı öğeleri ile bunların enflasyon ile ilişkileri gözlemlenmiş, irdelenmiş ve değerlendirilmiştir.

4. Ünitede Granger Nedensellik Analizi ile enflasyon (CPI), M2 para arzı, reeskont oranları (DR) ve zorunlu karşılık oranları (RRR) arasında sebep-sonuç ilişkileri test edilmiştir. Sonuç olarak; M2 para arzı ve enflasyon arasında karşılıklı neden-sonuç ilişkisi gözlemlenmiş ve bu Granger Nedensellik Analizi ile de belirlenmiştir. Granger Nedensellik Analizinin sonucuna göre M2 para arzı ve zorunlu karşılık oranları (RRR) enflasyon oranını ortalama 1 yıl sonra etkilerken reeskont oranlarının (DR) enflasyon oranı üzerindeki etkisi yaklaşık olarak 4 yıl sonra görülmektedir. Esasen teori de para politikası araçlarında DR'nin etkisini en geç gösteren değişken olduğu yönündedir.

Türkiye ekonomisi'nde de enflasyon oranı geçmiş tecrübelere dayanan beklentilerin bir sonucudur. Şu andaki enflasyon oranı, enflasyonist beklentilere bağlı olarak oluşan maliyet ve talep artışları ile de açıklanabilir.

Bu tezin en önemli bulgularından biri şudur: çalışmanın ekonometrik bölümünde uygulanan Granger Nedensellik Analizinin sonucuna göre, Türk ekonomisinde aslında enflasyon oranındaki artış para talebini arttırarak para arzının artmasına, para arzındaki

bu artış da fiyat artışlarına sebep olmaktadır. Enflasyonun artmasına sebep olan bu tip beklentilerin gelecekte de devam etmesi halinde, gelecekteki enflasyon oranının bugünkü ve geçmiştekinden çok da farklı olmayacağı düşünülmektedir.

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# List of Abbreviations

**AIC:** Akaike Information Criterion

**C:** Currency

**CPI:** Consumer Price Index

**D/Y:** Debt to National Income

**DD:** Demand Deposits

**DR:** Discount Rate

**e:** Real Exchange Rate

**FX:** Foreign Exchange

**GNP:** Gross National Product

**LM:** Lagrange Multiplier

**M/P:** Real Balances

**M:** Quantity of money

**M1:** Money Supply (Currency in circulation, transactions accounts, travelers checks)

**M2:** Money Supply (M1, demand deposits and time deposits)

**MD:** Money Demand

**OMO:** Open Market Operations

**$P^*$:** Expected Price Level

**P:** Price level

**$P_d$:** Domestic Price Level

**$P_w$:** World Price Level

**E:** Nominal Exchange Rate

**RRR:** Required Reserve Ratio

**SIC:** Schwartz Information Criterion

**u:** Unemployment rate

**V:** Velocity of circulation

**VAR:** Vector Autoregression

**$W_r$:** Real Wage Rate

**Y:** National Income

# 1 INTRODUCTION

Every individual seeks for equilibrium and stabilization in his/her life. Like a single person every nation also seeks for equilibrium and stabilization. Economic stabilization is an important element for a healthy society. There is need to know the fundamental roles of the macro variables of the economy, so that with proper economic policies stabilization can be achieved. According to Monetarism, the main reason for business cycles in an economy is the cycles in the money supply. These business cycles create instability and problems in the economy, which monetary policy has a very important role in achieving stability (Flemming, 1978: 25).

If the stabilization in the economy could not be reached, there will be several problems like inflation, trade deficits, balance of payment problems, etc. However, the most important problem will be the negative psychological outcomes of these undesirable situations (Flemming, 1978: 26).

There are several studies related to the subject of this thesis and the most related ones are cited in Appendix A.

## 1.1 Aim of the Study

The aim of this thesis is to determine extent, proximity in time and direction of the cause and effect relation between monetary policy tools and high and persistent inflation rate in Turkish economy.

In this study, indicator of inflation is taken as changes in CPI. Apart from the two monetary policy tools Discount Rate (DR) and Required Reserve Ratio (RRR), as the indicator of third monetary policy tool, which is Open Market Operations (OMO), M2 (M1, demand deposits and time deposits) is taken. Required Reserve Ratio (RRR) and M2 money supply have faster effects on inflation rate while Discount Rate (DR) has a longer period to this effect as is pointed out by the theory.

According to the literature survey conducted, the various studies on related topics have mostly investigated only correlation ($R^2$) between the inflation rate and the related independent variables. However, not being content with just a correlation, in this thesis a cause and effect relation is investigated between CPI and abovementioned independent variables. To this aim, Granger- Causality Analysis is used.

Inflation is perhaps the most significant economic problem facing Turkey and its origin mainly lies in imbalances and improperly used monetary policies. The main motivation behind this paper is to explore some of the key reasons of Turkish inflation and the relationship between the inflation rate and the monetary policy tools applied in the economy since the year 1980.

## 1.2 Method of the Study

This research is carried out by literature survey from the sources in the Eastern Mediterranean University Library, Bilkent University Library, and Middle East Technical University Library and through the online worldwide web sources. The data used in this study is gathered from CBRT (Central Bank Republic of Turkey) annual bulletins, SSI (State Statistics Institute) bulletins, Treasury Statistics secured by both direct contact and through online web sources of these institutions.

After gathering data and information from these sources, annual figures of monetary policy tools and inflation rate tabulated, analyzed and evaluated. This is followed by the Granger-Causality Analysis to investigate and determine the cause and effect relation between abovementioned variables.

## 1.3 Structure of the Study

In this study, the development of inflation in Turkey with its causes and most importantly the links between the inflation rate and the monetary policy tools are analyzed and critically evaluated, with the hope of forming a basis for new researches in this and related topics.

As mentioned above, main focus of this study is on analyzing monetary policy tools and their implications through inflation. With this aim, in Chapter 2, the related theories about money, monetary policy and inflation is explained. In Chapter 3, the monetary sector of the Turkish Economy will be presented since the year 1980 at which the neo-liberalization started. Year by year, inflation rate and the monetary policy tools (M2 money supply, Required Reserve Ratio (RRR), Discount Rate (DR)) are analyzed with the related events and developments in the economy. Chapter 4 contains the Granger-Causality Analysis to find the cause and effect relationship of these tools with the inflation rate. Evaluation of the findings of Chapter 4 is given immediately at the end of the chapter. Then, in Chapter 5, the conclusion based on the findings in the previous two chapters and the recommendations for a more efficient and effective monetary policy implementations for Turkish economy are given.

# *2 THEORETICAL BACKGROUND*

## 2.1 What is Money?

In this part, the nature and functions of money are examined. “Money is the only commodity that is good for nothing but to be gotten rid off. It will not feed you, cloth you, shelter you, or amuse you unless you spend or invest it. Money is captivating, circulating, and masquerading puzzle” (Tavlas, 1981: 318).

Money is a fascinating aspect of the economy and a crucial element of economics. In the past, money was the means of payment generally accepted in exchange, but it also had the characteristic that it did not pay interest. Thus the sum of currency and demand deposits was the accepted definition of money for a long time. This aggregate is known as M1 (Keyder, 1991: 22).

Money is the means of payment or medium of exchange. Or more informally, money is whatever is generally accepted in exchange. Money is what the state says it is (Abaan, 1997: 8). There is a vast array of financial assets in any economy, from currency to complicated claims on other financial assets. Which part of these assets is called money?

M1, which corresponds roughly to the medium of exchange function of money. That is M1 comprises those claims that can be used directly, instantly, and without restrictions to make payments. These claims are liquid. (An asset is liquid, if it can immediately, conveniently and cheaply be used for making payments.) M1 corresponds most closely to the traditional definition of money as the means of payment. Its components are; currency, transactions accounts (all checkable deposits), travelers checks. M2, includes, in addition, claims that are not instantly liquid withdrawal of time deposits, money market mutual funds may set a minimum on the size of checks drawn on an account. Major components of M2 are; M1, saving deposits and time deposits (Keyder, 1991: 15).

## 2.2 The Demand for Money

“The demand for money is a demand for real balances (M/P). People hold money for its purchasing power, for the amount of goods they can buy with it.” (Keynes, 1936: 201). Keynes’s famous three motives for holding money are as follows:

a. The transactions motive, which is the demand for money arising from the use of money in making regular payments; (Mt = f (Y)).
b. The precautionary motive, which is the demand for money to meet unforeseen contingencies; (Mp = f (Y)).
c. The speculative motive, which arises from uncertainties about the money value of other assets that an individual can hold; (MA = f (i)). Hence, MD = Mt + Mp + MA.

## 2.3 Theories of the Demand for Money

Since 1900s, economists have developed theories underlying the demand for money along different lines. The demand for money theories can be grouped under three main headings:

### 2.3.1 Neo-Classical Quantity Theory

Velocity is assumed to be constant. The Neo-Classical Quantity Theory has two versions. Irving Fisher's (1911) version can be said to be the purely classical quantity theory which asserts that rational individuals, for whom money's sole function is to provide means for transactions purposes, hold a certain proportion, K, of their total planned transactions, T, as real money balances (M/P). Therefore the relevant equation would be M = KPT. This argument represents the "cash balance version" of the Neo-Classical Quantity Theory. In the "transactions version", the velocity of circulation, V, is the reciprocal of K and the resultant equation which is mostly associated with Fisher is, MV = PT (Aydin, 1970: 89).

A. C. Pigou`s version (1917) (Cambridge Approach) however, forms a bridge between the classical quantity theory and the Keynesian money demand theory. Pigou`s version of the quantity theory diverges from Fisher's in four ways (Aydin, 1970: 90):

a. Pigou links the demand for money to peoples` asset holdings: How much money people want to hold as part of their assets, not how much and how fast they want to spend it. Pigou`s equation takes the form of: MD = K. P. w (MD = demand for

money, K = proportion of the public's total nominal assets people desire to hold in the form of money, P = current price of the assets, w = constant money value of total resources and assets held by the public.)

b. Fisher assumed V and T to be independent of the money supply. K and w are affected by changes in the money stock. As money supply increases, marginal utility of the money held decreases.
c. Fisher's approach to the quantity theory takes demand for money in macro terms whereas the Cambridge Approach puts the question in microeconomic terms.
d. Determinants of demand for money in the Cambridge Approach, people hold money because it is a generally acceptable and convenient asset, the constraint on money holding is one's wealth, and there are alternatives to hold money.

### 2.3.2 The Monetarist Approach and the Modern Quantity Theory

In the Monetarist approach, perfect competition is accepted as the basis of analysis. In such a structure, when left to its own accord, prices and wages are flexible and adjust to establish equilibrium at all times. Output response to money supply changes is found to be possible only in the short-run, if the economy is at less than full employment. According to monetarists there is a wide range of alternatives to hold money: financial or real assets. They see all assets other than money as substitute for money (Friedman, 1994: 249).

Velocity is a function of a number of variables, but is found to be fairly stable. Friedman's demand for money theory was a generalization of the older quantity of money. In which the treated money as one among several assets, including bonds,

equities (stocks), and goods. Friedman has emphasized that, in principle, any category of spending on GDP (Gross Domestic Product) could be a substitute for money and might be stimulated by an expansion of the real money supply because he viewed a wider range of assets as being substitutes for money. Friedman viewed monetary policy as having more potent effects on spending (Friedman, 1994: 461).

Friedman's hypotheses are:

a. Money, like any other asset, yields utility, namely, a high degree of liquidity,
b. Money is also subject to diminishing marginal utility,
c. The upper limit to economy's total money holdings is wealth,
d. The opportunity costs of holding money are the rates of return on other assets.

### 2.3.3 Neo-Keynesian Approach

The main assumptions and views of the Neo-Keynesians can be summarized as follows (Keyder, 1991: 52-54):

a. The economy is imperfectly competitive; most firms set their own prices.
b. The economy can reach equilibrium at less than full employment.
c. Prices and wages tend to display a ratchet effect (sticky downward). Hence, they are not flexible enough to clear market.

d. Interest rate channel is very important in the monetary transmission mechanism (the effect of change in M on output).

e. People hold their wealth in only two forms of assets; money and/or bonds.

f. Both monetary and non-monetary forces can generate business cycles. Cycles are not totally a monetary phenomenon.

g. Both monetary and fiscal policy can be used for stabilization purposes.

h. There is mutual interaction between money stock and income. However, they also believe that fluctuations in nominal income can cause fluctuations in the money stock.

i. Neo-Keynesians believe that sustained inflation is possible only iPolicy induced money stock changes can cause fluctuations in the nominal income. n the event of continuing monetary expansion. However, they also accept the importance of short-lived “supply-shock inflations”, generated by sudden shifts in consumption, investment, government or export components of aggregate demand.

## 2.4 The Supply of Money

There is a strong controversy regarding the definition of money supply. There are mainly three approaches to defining money:

### 2.4.1 The Conventional Approach

Money is viewed as a medium of exchange. Whatever serves this purpose is included in the money supply definition. All items that are mentioned in 2.1 (What is money?) section facilitate transactions in the economy and serve as a medium of exchange. If the total supply is kept fairly stable, the value of money is kept relatively stable. This property of money is essential for the continuation of its general acceptance (Trevithick, 1979: 68).

### 2.4.2 The Chicago Approach

This approach associated with Milton Friedman and other University of Chicago economists. Money (M2) is defined more broadly to include depository institutions, time deposits in addition to currency in actual circulation and demand deposits. Time deposits do not serve the medium of exchange function. They are generally held as an "asset". Money in a "time deposit account" becomes the property of the commercial bank and the depositor in return gets an other asset called a "time deposit account", on which he earns an interest. The Chicago definition is based on two criteria (Solow, 1998: 251):

a. Empirical evidence indicates a higher correlation therefore a more stable relationship between income and M2. Thus Chicago theorists hypothesize that a change in money supply would bring about change in nominal income in the process of attaining a new equilibrium between the demand and supply of money.
b. There exists a high degree of substitution between time deposits, demand deposits and currency.

### 2.4.3 The Gurley and Shaw Approach

In this approach, close substitution between currency, demand deposits, credit union shares, and claims against other types of financial intermediaries are emphasized. Therefore, in the money supply definition, this approach includes deposits and claims against all types of financial intermediaries. Gurley suggests that money supply is defined as a weighted sum of currency (C), demand deposits (DD) and their substitutes. Weight of "1" is assigned to C and DD and weights of less than one are assigned to other components (Keyder, 1991: 237).

Therefore, all approaches accept things that serve as a medium of exchange, which is "money". They also stress that assets, which prove to be perfect substitutes to currency and demand deposits, should be included in the narrow definition of the money stock. If the assets property of money is stressed, then "near monies" should also be included in the money supply definition. The money stock thus obtained, becomes the broad definition of money supply (Keyder, 1991: 238).

Depositing and lending the coins start the process of money creation. There are four conditions for money creation in banking system, these are (Maisel, 1982: 28-31):

a. Equivalence of coins and deposits: Paper receipts representing ownership of bank deposits. Checks must be treated as equivalent to payment of gold coins.

b. Redeposit of proceeds from loans: Any consumer or business firm receiving a cash or check payment must deposit it into an account at the same bank.
c. Holding of cash reserves: The bank must hold some fraction of its reserves in the form of cash.
d. Willing borrowers: Someone must be willing to borrow from the bank at an interest rate that covers bank's cost of operation.

## 2.5 The Main Tools of Monetary Policy (The Central Bank's Tools for Changing the Money Supply)

### 2.5.1 Open Market Operations (OMO)

Central Bank can change money supply by purchasing and selling government securities like Treasury Bills and bonds. Central Bank sells bonds to decrease the money supply so interest rates will increase in the market. Conversely Central Bank buys bonds to increase the money supply and interest rates will decrease in the market. Central Bank also carries these transactions on foreign exchange or financial securities. Claims of the Central Bank that accrue as a result of these transactions may be in the form of cash or securities as mentioned above. In the balance sheet these are reported under three subheadings (Nas and Pery, 2000: 176):

a. Cash: This item reflects money claims of the Central Bank resulting from its reverse repurchase agreements drawn on FX or financial paper.

b. Securities: This item reflects Central Bank's claims in the form of securities originating from its reverse repurchase agreements drawn on securities.
c. Other: This item under Open Market Operations` heading reports credits extended to the banks by the Central Bank in connection to Interbank Money Market.

### 2.5.2 Discount Rate (DR)

One of the functions of a Central Bank is to be a "lender of last resort". Central Banks lend to depository institutions including commercial banks, which are financially sound, but have unexpected and immediate needs for additional funds. So Discount Rate is the interest rate that Central Bank charges to depository institutions when they borrow reserves (Emil and Ata, 1998, http://www.treasury.gov.tr).

### 2.5.3 Required Reserve Ratio (RRR)

Central Bank manipulates the legal reserve ratio to influence the ability of commercial banks to lend. Commercial banks are required to keep a certain percentage of their deposits with the Central Bank. This here is viewed a kind of deposit. The reserve requirement system provides the Central Bank with funds that can be used to finance a growth in its assets. Therefore, the reserve requirement tool can easily be used by the Central Bank to raise the necessary funds in the face of an asset increase. However, if such an increase in the Reserve Requirement Ratio is called for, this would reduce the loanable funds in the hands of the commercial banks, thereby shrinking the volume of credits extended, raising the interest rates and thus pushing the economy into a

recession. Thus, even though Central Bank uses this tool in order to influence the size of the credit multiplier; it does not use it with the purpose of creating the funds necessary to finance the growth in its assets (Bach, 1973: 63).

## 2.6 Modern Monetarism

According to Friedman, governments should stop playing God, they can fashion for themselves an employment policy, which is independent of the latent forces of supply and demand within the labor market. Professor Friedman stated simply, his objections to Keynesians that (Kuttner, 1999: 15):

a. The government does not enjoy the elbowroom in implementing its own employment policy that the simple Phillips Curve appears to imply,
b. The most important determinant of aggregate spending is the supply of money,
c. For a constant rate of increase in the supply of money, unemployment will eventually settle down at its natural rate and the rate of inflation will ultimately be equal to the difference between the rate of increase in the supply of money and the rate of growth of output.

Since inflation is the result of past and present attempts by governments to over-utilize the productive capacity of the economy through the issue of new money, cutting the rate of monetary expansion can only reduce inflation. Monetarists imply that

monetary control is the only policy, which will make an appreciable impact on the rate of inflation. On the other side many Keynesians argue that, prices rise for reasons other than the excess demand produced by prior monetary expansion. They maintain that, in economies where the government is pledged to a policy of full employment, the trade union movement may take advantage of this commitment and press forever-higher wage increases (Cizre-Sakallioglu and Yeldan, 1999: 4).

There is nothing in the Keynesian approach to suggest the existence of a direct link between the supply of money and the level of prices. Prices of goods and services change because of changes in demand or supply condition in the market (Kesriyeli, 1999: 29).

“A more simple analysis also indicates that monetary expansion has been associated with accelerating inflation. Specifically, it appears that the rate of inflation is significantly related to the gap between the rate of monetary growth and the rate of growth of real GNP. For example, over the period 1961-1977, there was on average, an increase in the rate of inflation of 0.8 per cent for each one-percentage point increase in the gap between the rate of growth of M2 and real GNP. For the most recent decade for which complete data are available (1968-1977), a similar relationship obtains showing almost a full one per cent increase in the rate of inflation for each rise of one per cent point in the gap between the rate of M2 and real GNP” (Flemming, 1978: 201).

According to Friedman as a monetarist, effect of supply of money on production will be transition in nature; in the long run, economy at potential and rate of money will affect only prices. “Inflation is always and everywhere a monetary phenomenon” (Friedman, 1994: 92).

At the end of increase in money supply, there will be a more rapid increase in the quantity of money than in output. Friedman does not consider price level as a suitable guide for monetary policy (Berument, 2001: 5).

## 2.7 The Role of Money in Macro Models

To predict the impact of a given monetary policy on the different sectors of the economy, as well as on the price level and real output, we need to know the income, wealth and interest elasticities of different sectors. The use of models can increase the predictive power of econometric research, through better representation of the reality. Both in Pure Monetarist and Neo-Keynesian models money is treated as an exogenous variable (Keyder, 1991: 181).

"The monetarist view claims that the major determining factor of total spending is the rate of monetary expansion. Monetarists generally believe that fiscal policy in the absence of accommodative monetary expansion causes crowding-out of private expenditures" (Keyder, 1991: 182).

### 2.7.1 Monetarist Models

There are three models:

#### 2.7.1.1 St. Louis Model (Money Exogenous)

This model is designed to analyze economic stabilization issues within a framework that focuses on the influence of monetary expansion on total spending. The model includes eight endogenous variables so eight equations. Since each endogenous variable for any given period appears only one equation, and is related to endogenous and exogenous variables for earlier periods, the monetarist model here is a “recursive type” model (Kesriyeli and Kocaker, 1999: 18).

#### 2.7.1.2 Aghevli-Khan Model (1978) (Money Endogenous)

Monetarists believe that inflation is a completely monetary phenomenon and accepted the relationship between money and the price level as a one-way causality. However some monetarists stressed the two-way causality between money and inflation. For example, an expansion in the money stock increases the price level, if this affects the government revenues and expenditures, the budget deficit may be larger. When this deficit is financed by monetization then money stock increases again and the whole process repeats itself (Kesriyeli and Kocaker, 1999: 19).

#### 2.7.1.3 Polak Model (Monetary Approach to Balance of Payments)

This model stresses the relationship between domestic credit and the balance of payments, represented by the change in net foreign assets. This model assumes that; a stable demand for money function, explained by income alone, a strictly defined, stable

process through which the money supply is created, exogenously determined domestic credit. If we want to criticize the model, we can say that money demand is more likely to be influenced by other variables, besides income, domestic credit that is treated as an exogenous variable may in fact be influenced by explanatory variables of the demand for money (Nas and Pery, 2000: 180).

### 2.7.2 Neo-Keynesian Model

This model focuses on monetary forces and the channels through which they influence the real economy. The channels of the monetary transmission are; the interest rate, wealth and credit rationing. The monetary expansion initially affects the interest rate, hence the cost of capital. In this model money supply appears as an exogenous variable and interest rates are assumed to be determined by free market sources. Credit rationing comes about as a result of the failure of the interest rates on loans to adjust rapidly enough to clear the market (Nas and Pery, 2000: 177).

## 2.8 Inflation

Inflation is a bad news. Besides distorting prices, it erodes savings, discourages investment, stimulates capital flights (into foreign assets, precious metals or unproductive real estate), restrains growth, makes economic planning a nightmare and in its extreme form, brings out social and political unrest (Beetsma and Bovenberg, 2001: 120).

Inflation is a rise in price level, or a fall in the purchasing power of the monetary unit. There is too much money chasing too few goods. More precisely, inflationary pressure occurs mainly when there is excess total demand for goods and services offered for sale at prevailing prices. Without this situation, substantial inflation will not long continue. Costs especially wages may push upward on prices, even though there is no general excess demand (Bach, 1973: 87).

### 2.8.1 Theories of Inflation

There are different approaches to the analysis of inflation, but two polar extremes, namely the demand-pull and cost-push theories (Flemming, 1978: 203-205).

At one end of the spectrum there is monetarist school of thought, which views inflation exclusively in terms of increases in the supply of money. No major inflation can take place without rapid money growth and rapid money growth will cause rapid inflation. At the end of increase in money supply, there will be more rapid increase in the quantity of money than in output. Friedman does not consider price level as a suitable guide for monetary policy. Monetarists say that, when the supply of money is determined, not by the availability of gold, but by the conduct of the Central Bank in managing the nation's currency. The "excess" issue of money only produces price rises by the Central Bank, probably acting under orders from the government. According to monetarists therefore, inflation can only be brought under control by determined action by the government to restrict increases in the money supply (Kuttner, 1999: 7).

The cost-push school maintains that a satisfactory understanding of the process of inflation cannot be obtained without a through study of the institutional framework within which wages and prices are determined. In particular, they emphasize the dominant role that trade unions have come to play in influencing the rate of wage increase, and hence the overall rate of inflation. Inflation occurs when all of the claims by various groups in society for their “fair” reward add up to more than the economy is capable of producing (Kuttner, 1999: 8).

Keynesian position recognizes the strength of the changes in the supply of money in varying the level of aggregate spending but also recognizes that the power of trade unions may constitute difficulty to fight with inflation, which relies on monetary restriction alone (Trevithick, 1979: 77).

“Demand-pull and cost-push theorists have different arguments for economic actions to be taken to fight with inflation. For example, monetarists advocate a policy of monetary control that is; authorities in charge of the money supply should aim at producing a gradual but determined reduction in the rate of increase in the money supply. They should adopt some target rate of increase in the supply of money roughly in line with the rate of increase in output and should then try to bring down the actual rate of monetary expansion so as to conform to this target figure” (Trevithick, 1979: 78).

We can generate three types of inflation theories with subdivisions within themselves:

#### 2.8.1.1 Pure Monetarist Theories

Expansion of the supply of money at a rate greater than warranted by the growth of real productive potential is a necessary and sufficient condition for the creation of inflation. According to the monetarist view, the rate of price change depends systematically on the prior rate of inflation when the rate of monetary change is given (Ghosh and Phillips, 1998: 13).

#### 2.8.1.2 Internal Theories

It usefully subdivided into two:

a. Wage-push Inflation (Labor market theories): As it is mentioned above, it appeals to the notion of the wage, as the price of the labor, being influenced by excess demand/supply of labor and in turn forming the major part of unit costs. Since labor is a vital element in the production process, a general increase in the wage rate will raise the price of output and the general price level. Thus although the increase in the price level may be immediate result of the higher money wage rate, the ultimate origin of the higher prices lies in the excess demand for labor (Ghosh and Phillips, 1998: 14).

b. Demand-pull Inflation (Excess demand theories): When a country starts running a balance of payment deficits it pays out more of its imports than it receives from abroad in payment for its exports. That country tries to get rid off its balance of payment deficits by increasing its exports, this will lead to a net injection of

effective demand into the economies of the rest of the world. This would produce an expansion in aggregate demand in just the same way as an increase in government spending would do in a closed economy. “If the economies of the rest of the world are at or near full employment, the increase in effective demand will open up an inflationary gap that, by definition, drives the price level upwards” (Trevithick, 1979: 80).

#### 2.8.1.3 External Theories

It can be split into two (Trevithick, 1979: 82):

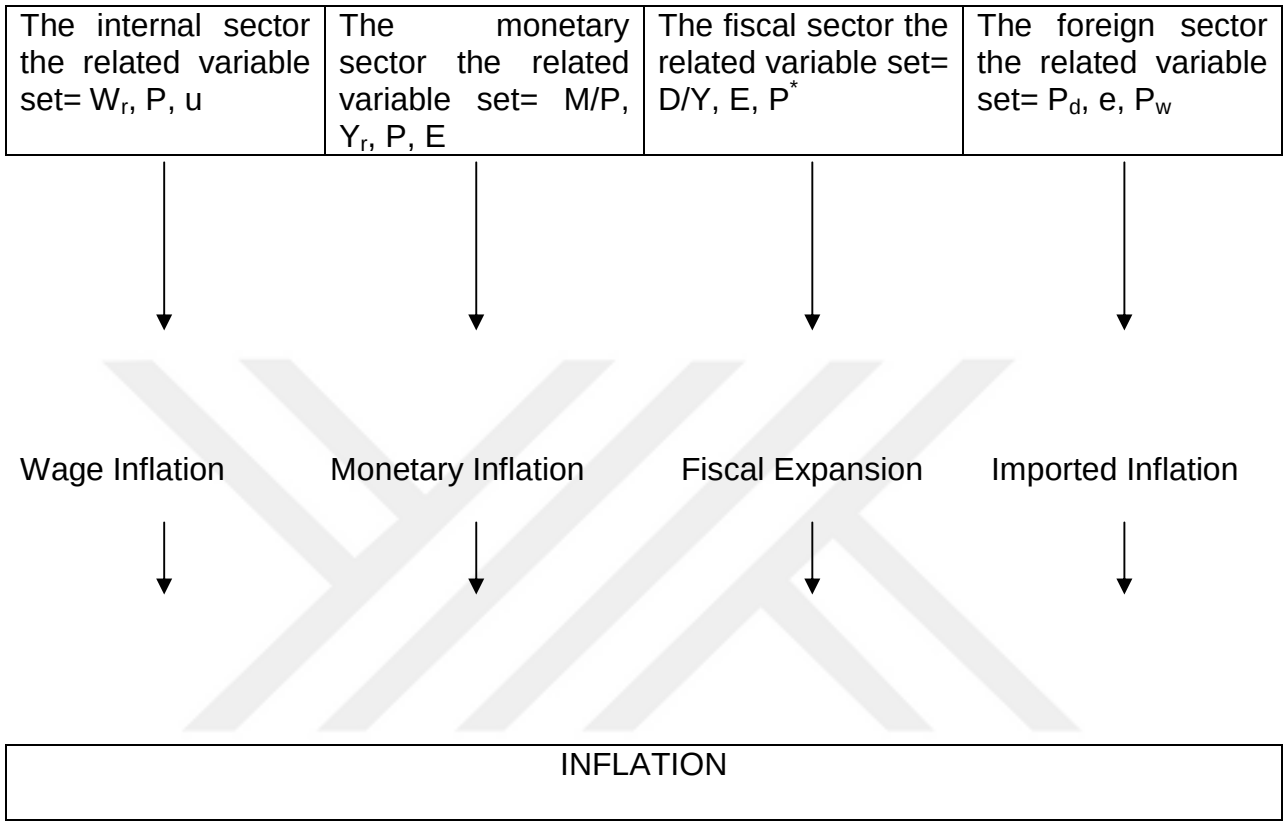
a. Theories involving the transmission of inflation of import prices in foreign currency terms into general domestic inflation.
b. Inflation following from devaluation of the exchange rate, which causes inflation of (home-currency) import cost independently of changes in foreign price level movements (pass-through effect).

However, it is clear that in the real economic world these mechanisms might be interdependent. Therefore, it is difficult to distinguish the outcomes of one theory from the others.

According to pure monetarist view, markets clear instantaneously and changes in inventories of goods or labor reflect changes in expectations about the future path of prices and wages. Since monetarists do not believe the budget deficit has a direct effect

on the inflation rate, the only way for deficits to affect prices through their influence on output will be small.

Figure 2.1: The basic relationships are given in the following theoretical framework:




e=Real Exchange Rate, M/P=Real Balances, P=Price Level, $P^*$=Expected Price Level, $P_d$=Domestic Price Level, $P_w$=World Price Level, E=Nominal Exchange Rate, u=Unemployment Rate, $W_r$=Real Wage Rate, D/Y= Debt to income ratio, $Y_r$= Real income.

### 2.8.2 The Sources of Inflation

There are mainly three sources of inflation:

### 2.8.2.1 The Fiscal or the Seigniorage View

The main argument of the seigniorage view is that, while it is true that “inflation is always and everywhere a monetary phenomenon”, Milton Friedman’s famous dictum, a situation of sustained monetary growth which is not proportional with money demand is generally driven by ongoing fiscal imbalances, and thus inflation is rather “always and everywhere a fiscal phenomenon” (Alper and Ucer, 1998: 21).

“…..allowing monetary policy to accommodate fiscal pressures not only leaves the inflation rate to be determined by the fiscal authority, but -because of the possibility of multiple equilibria- also increase the likelihood that the economy will find itself the operating at an inflation rate higher than it need be” (Fischer, 1981: 382).

### 2.8.2.2 Balance of Payments View

Exchange rate depreciations arising from balance of payments crises are the principal causes of inflation. “Exchange rate depreciations in turn raise the rate of inflation by increasing expectations of inflation, which are then accommodated by the monetary authorities or through a wage indexation mechanism. The latter would occur if the frequency of indexation increase due to inflationary expectations associated with a devaluation. With more frequent wage adjustments, a higher rate of inflation is required to maintain an equilibrium real wage” (Fischer, 1981: 383).

Monetary and exchange rate policies are two equivalent, but mutually exclusive, ways to determine inflation in the long-run. As the economy becomes more open and

exposure to balance of payments volatile flows increase, the link between monetary and exchange rate policies get tighter. As a result, the economy begins to experience the implications of “real exchange rate rule” on inflation dynamics much stronger (Akkaya, 1997: 6).

#### 2.8.2.3 Inertia

It is essential to understand correctly the psychological and institutional background causes of high and chronic inflation phenomena. Inertia has been a good explanation for why it may be difficult to stop inflation. The existence of inflation today is largely explained by the existence of the inflation in the past. Inertia results from prolonged periods of inflation. Sources of inertia as follows (Alper and Ucer, 1998: 22):

a. Accumulation and decumulation of expectations.
b. Institutional arrangements that encourage indexation of labor and financial contracts.
c. Relative price adjustments.

Existence of inertia fundamentally alters the disinflation recipe so that it becomes necessary to support conventional measures of demand control monetary and fiscal policies with measures that take down inertia directly.

# 3 AN OVERVIEW OF THE DEVELOPMENTS IN MONETARY SECTOR IN TURKISH ECONOMY AFTER 1980

## 3.1 Introduction

Inflation is chronic and very high in Turkey since late 1970s. There are several reasons, which increase the inflation rate, and also several outcomes of the high inflation, one of which is the general psychology of the citizens of Turkey having expectations in the direction of increase in inflation (Kesriyeli, 1997: 5).

Since economy affects all the aspects of individual lives, inflation creates an unstable life structure such as decrease in purchasing power of the money, lower life standards especially for the people who earn fixed income. Also inflation creates a deeper difference in social standards among the citizens (Flemming, 1978: 22).

“Inflation expectation is one of the main reasons of the increasing inflation observed in Turkish economy. In a chronic inflationary environment, agents respond more rapidly to the available information in the market” (Kandiller, 1997: 19). What are the deeper reasons and the phases of inflation in Turkey, that caused it to have a chronic nature? In fact, along with the effect of expectations, it has been disclosed in the

recent, April 2002 money report of the Central Bank that an increase in price level is the cause of 2002 money report of the Central Bank that an increase in price level is the cause of increased demand for money in the economy, which necessitates an increase in M2 money supply. This increase in money supply in turn leads to increase in price level (CBRT Report, April 2002). This vicious circle effect is in fact found out in the results of the Granger-Causality Analysis utilized in this study. This perpetual interaction between the money supply and price level may be the basis of the abovementioned chronic nature of inflation in Turkey.

Turkey has undergone a staged liberalization over quite a long period. The 1980 liberalization represents a more fundamental attempt by the government to commit to a more open trade regime and a liberalized financial system. There were several objectives: stabilization of the balance of payments, rationalization of the foreign exchange system, improved efficiency of state enterprises, a boost to the private sector and encouragement of worker remittances and foreign direct investment (Tukel, 1986: 14).

However, along with the abovementioned liberalization efforts, at least to control the ensuing inflation, monetary policies have gained an important role in the economy. Since the control of inflation can be achieved through the control of money stock in the economy, especially monetary policies in a contractionary nature were applied. Independence of the Central Bank from the Treasury was a key priority for Turkey to set proper monetary policies (Ertugrul and Selcuk, 2000: 4). Despite substantive reforms and sophistication in the conduct of monetary and exchange rate policies, inflation has never been the ultimate policy goal of the monetary authorities in Turkey for a long time.

## 3.2 An Overview of 1980-2000 Period

When the tables below (Tables 3.1 and 3.2) are observed, the effects of monetary policy tools (DR, RRR) may be detected to have their full effect on inflation with around 4 years lag for DR and 1 year lag for RRR as were pointed out by AIC (Akaike Information Criterion) and SIC (Schwartz Information Criterion) tests to be the optimum lags in Granger-Causality Analysis, the results of which are fully explained in Chapter 4. Also in line with the aforementioned two tests, M2 affects the inflation rate with around 1-year lag while in turn CPI affects M2 with circa 2-year lag.

### 3.2.1 1980-1988 Period

As can be observed from the five-years background additional statistical data before 1980, the sudden three-digit inflation rate of 1980 can be attributed to circa 80% increase in the increase rate of M2 in 1979. This finding reinforces the results of Granger-Causality Analysis explained in Chapter 4, which gives a mutual casual relation between M2 and inflation with around 1 and 2-year lags consecutively. That is, the increase in CPI, from 16% in 1976 to 22.5% in 1977, caused an increase in M2 after around 2-year lag from 34.4% in 1978 to 61% in 1979. And in turn, the increase in M2 in 1979, almost doubling itself compared to 1978, has caused an increase in inflation rate of 1980 which is also almost double of the previous year.

Table 3.1: Inflation rate, M2 money supply, Discount Rate (DR), Required Reserve Ratio (RRR)

| Years | Inflation Rate (%) | M2 (Billion TL) | M2 (% Change) | DR (%) | RRR (%) |
|---|---|---|---|---|---|
| 1975 | 19 | 147 | 30 | 9 | 20 |
| 1976 | 16 | 181 | 23.1 | 9 | 20 |
| 1977 | 22.5 | 244 | 34.8 | 9 | 20 |
| 1978 | 54 | 328 | 34.4 | 10 | 21 |
| 1979 | 57 | 528 | 61 | 10.75 | 19 |
| 1980 | 107.2 | 924 | 75 | 26 | 30 |
| 1981 | 36.8 | 1710 | 84.95 | 31.5 | 30 |
| 1982 | 27 | 2679 | 56.69 | 32.5 | 30 |
| 1983 | 31.4 | 3477 | 29.79 | 48.5 | 25 |
| 1984 | 48.4 | 5493 | 57.97 | 52 | 25 |
| 1985 | 45 | 8500 | 55.47 | 52 | 19 |
| 1986 | 34.6 | 12173 | 42.55 | 48 | 15 |
| 1987 | 38.6 | 17648 | 44.98 | 45 | 14 |
| 1988 | 73.7 | 27195 | 54.1 | 54 | 14 |
| 1989 | 63.3 | 47140 | 73.34 | 54 | 10 |
| 1990 | 60.3 | 71570 | 51.82 | 50.75 | 9 |
| 1991 | 66 | 117108 | 63.63 | 54.5 | 7.5 |
| 1992 | 70.1 | 190736 | 62.87 | 54.5 | 7.5 |
| 1993 | 66.1 | 282442 | 48.18 | 54.5 | 7.5 |
| 1994 | 106.3 | 630348 | 123.18 | 64 | 8 |
| 1995 | 88 | 1256631 | 99.36 | 57 | 9 |
| 1996 | 80.4 | 2924894 | 132.76 | 57 | 8 |
| 1997 | 85.8 | 5658800 | 93.47 | 75 | 8 |
| 1998 | 84.6 | 11423198 | 101.87 | 75 | 8 |
| 1999 | 64.9 | 21992654 | 92.53 | 65 | 6 |
| 2000 | 39 | 31933334 | 45.2 | 60 | 6 |

Source: CBRT Annual Reports, Treasury Statistics, and SSI.

Table 3.2: % Changes in inflation rate, M2 (%) money supply, DR (%) and RRR (%).

| Years | % Change in Inflation Rate | % Change of change in M2 | % Change in DR | % Change in RRR |
|---|---|---|---|---|
| 1975 | - | - | - | - |
| 1976 | -16 | -23 | 0 | 0 |
| 1977 | 40 | 50.6 | 0 | 0 |
| 1978 | 140 | 1.14 | 11.11 | 0.05 |
| 1979 | 5.5 | 78 | 7.5 | -0.1 |
| 1980 | 88 | 23 | 142 | 0.58 |
| 1981 | -65.67 | 13.26 | 21.15 | 0 |
| 1982 | -26.23 | -33.26 | 3.17 | 0 |
| 1983 | 16.29 | -47.45 | 49.23 | -16.66 |
| 1984 | 54.14 | 94.59 | 7.21 | 0 |
| 1985 | -7.02 | -4.31 | 0 | -24 |
| 1986 | -23.11 | -23.29 | -7.69 | -21.05 |
| 1987 | 11.56 | 5.71 | -6.25 | -6.66 |
| 1988 | 90.93 | 20.27 | 20 | 0 |
| 1989 | -14.11 | 35.58 | 0 | -28.57 |
| 1990 | -4.73 | -29.34 | -6.01 | -10 |
| 1991 | 9.45 | 22.79 | 7.38 | -16.66 |
| 1992 | 6.21 | -1.19 | 0 | 0 |
| 1993 | -5.7 | -23.36 | 0 | 0 |
| 1994 | 60.81 | 155.66 | 17.43 | 6.67 |
| 1995 | -17.21 | -19.33 | -10.93 | 12.5 |
| 1996 | -8.63 | 33.61 | 0 | -11.11 |
| 1997 | 6.71 | -29.59 | 31.57 | 0 |
| 1998 | -1.39 | 8.98 | 0 | 0 |
| 1999 | -23.28 | -9.16 | 13.33 | -25 |
| 2000 | -39.9 | -51.15 | -7.69 | 0 |

Source: Own calculations

As for the effect of DR on CPI, the increase of DR from 10.25% in 1979 to 26% in 1980 gave its inverse effect on inflation rate 4 years later, decreasing it from 107.2% in 1980 to 48.4% in 1984, as has been econometrically determined by Granger-Causality Analysis. Also the inverse effect of increase in RRR, from 19% in 1979 to 30% in 1980, on inflation rate can be seen in 1981 after around 1-year lag, such that inflation rate was 107.2% in 1980 and it decreased to 36.8% in 1981.

In this part, the analysis of the effects of monetary policy tools (DR, RRR, M2) on inflation rate having their lags as mentioned above for the first eight years of the observation period of this study is explained. M2 money supply is taken as one of the independent variables (DR, RRR, M2) and inflation rate is taken as dependent variable in the econometric section of this study.

Turkey has been burdened by high inflation actually since late 1970s. In recent years, this problem became more chronic as inflation rates have steadily increased. Past economic stabilization programmes designed to fight with inflation have never been successfully carried through. Besides expansionary fiscal and monetary policies, low interest rates and wrong exchange rate policies have caused to increase the instability of the economy (Barutca, 2000: 251). “During 1978-1979 Turkish economy had been in a deepening crisis with inflation and balance of payment difficulties. Immediately after that, the government announced a major stabilization programme on 24$^{th}$ January 1980, which included a series of new economic measures that were intended to solve the hyper-inflation, economic stagnation and unmanageable balance of payment deficits” (Alper and Ucer, 1998:8).

As is known from the theory, monetary policy has its effects on the economy in a relatively shorter period compared to fiscal policy. Accordingly, monetary policy tools in Turkish economy have been used for short-term stabilization. These tools affected the inflation rate in around 1 to 4-year periods. Since in our econometric model of Granger-Causality Analysis AIC and SIC gave 1 to 4-year lags as optima, in the Tables 3.1 and 3.2 the values from 1975 onwards are included as a background information to have a healthy analysis of the two decades from 1980 to 2000.

With the economic package of 24$^{th}$ January 1980; government started implementing tight monetary policy. However, inflation rate in this year was as high as 107.2%. Discount Rate (DR) was increased to 31.5% in 1981 with an increase of 21.15% compared to 1980. However Required Reserve Ratio (RRR) was kept at the same level (30%) in 1980. According to the results achieved in Chapter 4, DR would affect inflation rate after circa 4 years period. Actually it happened in this way, inflation rate decreased by 58% from 107.2% in 1980 to 45% in 1985. The increase in M2 money supply was 84.95% in 1981 and it started to decline after this year until 1984. As the Granger-Causality Analysis shows, M2 money supply affects inflation rate after around 1-year lag, and in turn, inflation rate affects M2 money supply approximately after 2 years. In fact, the 5.5% increase in inflation rate, from 54% in 1978 to 57% in 1979, has caused 13.26% increase in the increase of M2 in 1981 after 2 years, from 75% in 1980 to 84.95% in 1981, in turn, the increase in M2 led to increase in inflation rate after around 1 year, from 27% in 1982 to 31.4% in 1983. Similar cause and effect chain relations can be seen between the years 1980-1987. Although little changes in the increase rate of M2 are observed in some years between 1980-1987 period, an absolute decrease in the increase rate of M2 money supply is observed at the end of

this period (1987). Accordingly, inflation rate also decreased by 64% from 107.2% to 38.6% between these years.

“The excess issue of money only produces price rises by the Central Bank, probably acting under orders from the government. According to Monetarists, therefore, inflation can only be brought under control by determined action by the government to restrict increases in the money supply” (Kuttner, 1999: 11).

Required Reserve Ratio (RRR) other monetary policy tool was kept stable between the years 1980-1982. As is known from Chapter 4, RRR has an effect on inflation rate in around 1 year period. Required Reserve Ratio was decreased by 16.66% from 30% to 25% in 1983. Its effect was seen in 1984 after 1-year lag as an increase in inflation rate by 54.14% from 31.4% to 48.4%. RRR was kept stable at 25% until 1984. Although it was decreased by 24% to 19% in 1985, it did not affect inflation rate in an increasing way in 1986. In the year 1986, monetary policy implementations had a turning point, Central Bank started to control the commercial banks` reserves through Open Market Operations (OMO). “Starting Open Market Operations (OMO) became the new way to help the control of quantity of money besides Required Reserve Ratio and Discount Rate” (Kesriyeli, 1997: 10).

Other effects of RRR on inflation rate were seen in 1987 and 1988 such as; it was decreased to 15% in 1986 and inflation rate increased to 38.6% in 1987; it was decreased to 14% in 1987 and was kept at that level until 1988, inflation rate increased to 73.7% in 1988.

“There was persistent increase of inflation at around the time of the 1988 stabilization efforts, which indicates perhaps public’s loss of confidence in the battle against inflation in the face of deteriorating fiscal balances” (Alper and Ucer, 1998: 8). Central Bank liabilities became more liquid and more controllable. Central Bank became more elastic in applying the monetary policy. “The base of the credit policy of the Central Bank was to support the production and export of manufacture and agricultural sectors. So, until the end of the year, Central Bank credits were used to finance the growing sectors rather than to use it as a tool of monetary policy. Hence, Discount Rates were regulated to be a new monetary policy tool instead of being selective credit policy tool” (Barutca, 2000: 165). Since the credits were given to support the abovementioned sectors, the increase in M2 money supply, 54.1% in 1988, has not been inflationary in 1989.

### 3.2.2 1989-1994 Period

Discount Rate was increased by 20% to 54% in 1988, its disinflationary effect was seen in 1992. Inflation rate in 1992 decreased to 70.1%. M2 money supply was increased by 35.58% to 73.34% in 1989, however, it did not affect inflation rate in an increasing way in 1990. Required Reserve Ratio (RRR) was decreased to 10% in 1989. The expected effect of decrease in RRR is increase in inflation rate but actually in 1990 a little decrease in inflation rate is observed. This unexpected decrease of inflation may be explained by increase in the confidence level of the public after the start of implementation of the aforementioned stabilization efforts.

“1990 became another turning point in the history of the Turkish economy such that, in this year Central Bank started to declare its monetary programme to the public (transparency of the Central Bank operations) for the first time. Monetary policies in 1990-1991 were in agreement with the rules for the economic stabilization offered by the Monetarists (rule-based policies)” (Kandiller, 1997: 19). “But soon monetary policies were changed and policies were started to be implemented according to the equilibria in different markets in the economy “(Kesriyeli, 1997: 18). For instance, inflation rate increased by 90.93%, from 38.6% in 1987 to 73.7% in 1988, and it led to an increase in the increase of M2 by 22.79%, from 51.82% in 1990 to 63.63% in 1991, and in turn, it has caused an increase in inflation rate to 70.1% in 1992. The 4.73% decrease in inflation rate in 1990 has caused 1.19% decrease in the increase rate of M2 in 1992. It affected inflation rate after 1 year. Actually, inflation rate decreased from 70.1% in 1992 to 66.1% in 1993.

Until 1994, monetary targets had been mostly achieved by following the new programme, and accordingly stabilization target at the money markets was achieved to a great extend by a decrease in inflation rate as mentioned above. “The Gulf War that started in 1991 and some other political events and early elections made the monetary policy inapplicable. Besides, crisis affected oil prices very badly, oil prices increased very fast and hence, production costs increased also. Increase in production costs caused an increase in the overall price level, which caused also an increase in the inflation rate. This led to depreciation of TL. Economy came to a crisis, high and

continuous inflation rate led to increase in real exchange rate constituted one of the reasons of January 1994 crisis "(Ertuğrul and Selçuk, 2000: 6).

On 5th April 1994, the economic package was declared. This economic package was geared to achieve a fast decrease in inflation rate to achieve stabilization in fiscal sector and exchange rates (Alper and Ucer, 1998: 12). Discount Rate and Required Reserve Ratio was increased to achieve the stabilization in the economy. In fact, Discount Rate was increased by 17.43%, from 54.5% in 1993 to 64% in 1994, and Required Reserve Ratio was increased by 6.67%, from 7.5% in 1993 to 8% in 1994.

### 3.2.3 1995-2000 Period

As was mentioned in Chapter 4, Discount Rate has its full effect on inflation rate around 4 years lag. Thus, the full effect of increase in Discount Rate in 1994 can be seen in the year 1998. Inflation rate decreased to 84.6% in that year. Together with this, Required Reserve Ratio was increased to 8% in 1994. Its full effect on inflation rate was seen after 1-year lag in 1995, in that year inflation rate decreased to 88%. At the following year, RRR was increased again to the 9% level. It has affected inflation rate in 1996, inflation rate decreased to 80.4% in that year.

M2 money supply was regulated to achieve disinflationary efforts of 5th April 1994 economic package. The increase rate of M2 decreased to 99.36% in 1995 as a result of

5.7% decrease in inflation rate, from 70.1% in 1992 to 66.1% in 1993. The decrease in the increase of M2 in 1995 has caused a decrease in inflation rate from 88% in 1995 to 80.4% after 1 year in 1996.

In the middle of 1998, both Turkish economy and world economy went into a recession. The main reason for the recession in Turkey was decrease in domestic demand (Barutca, 2000: 256). “The main functions of the money demand are, growth rate, inflation and interest rates. But this is not the usual case especially if we consider the Turkish economy. The quantity of money that people want to have does not depend mostly on the inflation rate” (Kesriyeli and Kocaker, 1999: 15). Although an increase in M2 money supply is observed in 1998 (101.87%), inflation rate decreased to 64.9% by the end of 1999.

In the year 1999, Central Bank declared its direct inflationary policy to the public. The increase in M2 money supply was decreased to 92.53% in 1999 from 101.87% in 1998 and its disinflationary effect can be seen 1 year later, inflation rate decreased from 64.9% in 1999 to 39% in 2000. Discount Rate was increased from 57% in 1996 to 75% in 1997. This increase in DR has caused a decrease in inflation rate by 39.9%, from 64.9% in 1999 to 39% in 2000.

The government on 9$^{th}$ December 1999, declared the 3-year disinflation programme. The fundamental goals of the programme were; to bring down the consumer price inflation to 25% by the end of 2000, 12% by the end of 2001 and 7% by

the end of 2002. “Through the monetary policy implemented in 1999, the Central Bank aimed at ensuring stability in financial markets. Headline inflation may not represent long-term price movements. Short-term transitory changes in inflation are generally the results of supply shocks. Non-monetary events such as, changing seasonal patterns, seasonal shocks and sector specific shocks may cause transitory noise in short-term price changes and may misrepresent long-term price movements” (CBRT Annual Report, 1999).

The main determinant of the developments in the Turkish economy in 2000 was the “Disinflation Programme” which had been applied since the beginning of the year (CBRT Annual Report, 2000). “At the beginning of the programme, the Required Reserve Ratio for Turkish Lira denominated deposits were reduced from 8% to 6% where the remaining 2% was to be held as free deposits at the Central Bank and subject to the public sector and realized the quarterly net domestic assets targets, which were set as performance criteria in the programme” (Ercel, 2000, http://www.tcmb.gov.tr.).

In the year 2000, monetary policy was similar to the 1999-stabilization programme. But a financial crisis started on 22$^{nd}$ November 2000. Although the target rate of inflation was 25% by the end of 2000, it realized as 39% at the end of that year.

# 4 THE GRANGER-CAUSALITY ANALYSIS CONCERNING THE INTERACTION OF INFLATION AND BASIC MONETARY POLICY TOOLS IN TURKEY

## 4.1 Introduction

The concept of causality adopted in this study is Granger-Causality. The idea lying behind Granger's (1969) notion of causality is simply that if changes in some variable (say x) causes changes in some other variable (say y), changes in x should precede changes in y (Granger, 1969: 425).

The main objective of this study is to find out the nature of causality relationship between monetary policy tools and inflation rate (D (CPI)) in Turkish economy. Those tools are taken as Required Reserve Ratio (RRR), Discount Rate (DR) and M2 money supply, which are the main monetary policy tools. Annual data starting from 1980 until 2000 are taken and the cause and effect relations of changes in the abovementioned monetary policy tools (independent variables) with the inflation rate (dependent variable) of the corresponding years are tested.

In Granger-Causality Analysis, there are four possible outcomes regarding the cause-effect relation of basic monetary policy tools and inflation rate in Turkey. “First, causality may run from the monetary policy tools to inflation rate (CPI); second, it might run in the opposite direction; third, it may run in both directions (implying the existence of feedback system); and fourth, they may turn out to be no evidence of causality in either directions “(Granger, 1969: 427).

## 4.2 “VAR” (Vector Autoregression) Lag Order Selections and “LM” (Lagrange Multiplier) Test

“A Vector Autoregressive Model, or VAR for short, is a time series model used to forecast values of two or more economic variables. Unlike simultaneous equations models, however, the VAR model uses only past regularities and patterns in historical data as a basis for forecasting. No structural model is built. Because no simultaneous equations model is needed, VAR models provide a convenient basis for forecasting within sub regions of the country or at the state level” (Granger, 1969: 322). Suppose $x_t$ and $y_t$ are economic variables whose values we wish to forecast. A VAR model for these variables is given by these equations:

$$y_t = \alpha_0 + \alpha_1 * y_{t-1} + \ldots\ldots\ldots + \alpha_p * y_{t-p} + \beta_1 * x_{t-1} + \ldots\ldots + \beta_p * x_{t-p} + \varepsilon_t \qquad (4.1)$$

$$x_t = \alpha_0 + \alpha_1 * x_{t-1} + \ldots\ldots\ldots + \alpha_p * x_{t-p} + \beta_1 * y_{t-1} + \ldots\ldots + \beta_p * y_{t-p} + u_t \qquad (4.2)$$

“In this model, the current value of a variable $y_{t,}$ is explained by lagged values of itself and lagged values of the variable x, plus a random error $e_{t.}$ Note that the current value of $y_t$ does not depend directly on the current value $x_t$, and thus, the two-equation model 4.1 and 4.2 is not a simultaneous equations model. The random disturbance $e_t$, is assumed to have zero mean, constant variance $\sigma_e^2$, and to be serially uncorrelated. Similarly, the value of $x_t$ is explained by its own lagged values, the lagged values of $y_t$ and the random disturbance $u_t$. The random disturbance $u_t$ is assumed to have mean zero, constant variance $\sigma_u^2$, and to be serially uncorrelated. Each of the variables $x_t$ and $y_t$ is explained by its lagged values, but no other economic variables are involved. Thus the VAR model captures the historical patterns of each variable and its relationship to the other” (Granger, 1969: 323).

“The VAR model specified in equations 4.1 and 4.2 is called a two-dimensional vector autoregressive model of order p; it is denoted by VAR (p). It is called two-dimensional because it contains two variables and more equations; adding more variables and more equations can increase its dimension. It is of order p because it contains lags up to order p. One problem of model specification is selecting the length of lag. As for univariate time-series models and distributed lag models, a variety of criteria are used, including the AIC and SIC criteria. No one method has been found to be best, and there is a possibility of a misspecification when using any method” (Granger, 1969: 324).

Since most of the test procedures are based on regression analysis, it needs estimation to ensure that the series satisfy the required stationary conditions. The Dickey-Fuller test is a more formal test for the existence of a unit root. Applications of the Dickey-Fuller and Augmented Dickey-Fuller unit-root tests to find the required

stationary condition show that (D (CPI) and M2 series are integrated at level 1 (I (1)). Hence, when constructing a VAR (1) model relating to CPI and M2, we assumed that the I (1) nature of the variables made it appropriate to set up a VAR model in first differences. RRR and DR series are at I (0). Accordingly, particular emphasis is placed in all the statistical analysis henceforth. (Augmented Dickey-Fuller Unit Root Tests on D (CPI), DR, RRR and M2 are shown in Appendix B).

In this section (4.2) the procedure and methodology of choosing the lag length is explained. “The Lagrange Multiplier (LM) test begins with the null hypothesis which is given by the restricted model (See equation 4.15). It asks whether a movement in the direction of the alternative hypothesis can significantly improve the explanatory power of the restricted model. The LM test is based on the technique of constrained maximization, in which a Lagrange multiplier is used to provide an estimate of the extent to which the imposition of a constraint alters the maximum-likelihood estimates of a set of parameters. Let $\beta_{UR}$ is the maximum-likelihood estimator of the parameters of the unrestricted model and let $\beta_R$ represent the parameters associated with the restricted model. Then our objective is to maximize ln L ($\beta_{UR}$) subject to the restriction that $\beta_{UR}=\beta_R$. This is equivalent to maximizing

$$\ln L (\beta_{UR}) - \lambda(\beta_{UR}-\beta_R) \qquad (4.3)$$

where $\lambda$ is the Lagrange multiplier. The Lagrange multiplier measures the marginal “valuation” associated with the constraint: the greater is $\lambda$, the greater is the reduction in the maximum value of ln L ($\beta_{UR}$) as the constraint becomes binding. To see this formally, note that one of the first-order conditions for maximization is

$$\partial \ln(L)/\partial \beta_{UR} \qquad (4.4)$$

so that $\lambda$ is the slope of the likelihood function. If the null hypothesis that the restrictions are valid is not rejected, the restricted parameters will be close to the unrestricted parameters and the value of $\lambda$ will be small. The LM test, which is based on the magnitude of $\lambda$, sometimes is called score test ($LM= \lambda(\beta_R`)^2/I(\beta_R`)$, where $\lambda$ and I(), the information matrix, are calculated by differentiation of the log-likelihood function.).

The Lagrange multiplier test can be easily applied to the special case in which one is considering the possibility of adding additional explanatory variables to a regression model. Suppose one has estimated the restricted model:

$$Y= \beta_1 +\beta_2X_2 +.....+\beta_{k-q}X_{k-q} +\varepsilon_R \quad (4.5)$$

And is considering the possibility of adding some or all of q additional variables that are contained in the unrestricted model:

$$Y= \beta_1 +\beta_2X_2 +.....+\beta_{k-q}X_{k-q} +.....+\beta_kX_k +\varepsilon_{UR} \quad (4.6)$$

The Lagrange multiplier test of the hypothesis that each of the additional q variables has a coefficient of 0 is performed by first computing the residuals from the restricted model given by Eq.(4.15). Specifically,

$$\varepsilon`_R= Y-\beta_1`-\beta_2`X_2-...-\beta`_{k-q}X_{k-q} \quad (4.7)$$

Now consider the regression of these residuals on all the explanatory variables in the unrestricted model:

$$\varepsilon`_R= \gamma_1+\gamma_2X_2+...+\gamma_kX_k+u \quad (4.8)$$

If all the additional variables were irrelevant, the coefficients would be zero on the k-q variables that are added when we move from the restricted model to the unrestricted model.

The Lagrange multiplier test is determined on the basis of a test of significance of the regression in Eq. (4.8). Specifically, the LM test statistic, which is given by

LM=NR02 (4.9)

Follows a chi-square distribution with q (the number of restrictions) degrees of freedom. N is the sample size, and R02 is the R2 associated with the regression in Eq (4.8)" (Pindyck and Rubinfeld, 1998:280-282).

Choice of the correct lag length is essential while doing this LM test: In the choice of the relevant lag length Akaike Information Criterion (AIC) and Schwartz Information Criterion (SIC) are both informative. Therefore the abovementioned criterion tests are used for choosing the optimum lag length to be taken in the Granger-Causality Analysis. In this study, the observation period has been taken as 21 years (1980-2000). Research of the relevant studies shows that the maximum lag length to be tested should be 4 with approximately 20 observations, not to lose the important details of the information while testing the hypothesis.

Table 4.1: VAR order selection: Information criteria and LM (Lagrange Multiplier) test for serial correlation.

| | LAG | CPI | DR | RRR | M2 |
|---|---|---|---|---|---|
| AIC | 1 | 0.230177 | -0.462956 | -0.811964* | 0.504675* |
| | 2 | 0.035425* | -0.634415 | -0.785934 | 0.605700 |
| | 3 | 0.122790 | -0.533639 | -0.727775 | 0.722089 |
| | 4 | 0.253434 | -0.739242* | -0.605131 | 0.853656 |
| SIC | 1 | 0.324584 | -0.321346 | -0.763677* | 0.551878* |
| | 2 | 0.177035* | -0.445602 | -0.689360 | 0.700107 |
| | 3 | 0.311603 | -0.297622 | -0.582915 | 0.863699 |
| | 4 | 0.489451 | -0.456022* | -0.411983 | 1.042470 |
| LM-Stat (SC (4)) | 1 | 0.036978 | 0.052726 | 0.606131 | 0.218394 |
| | 2 | 0.038471 | 0.670494 | 0.693090 | 0.279498 |
| | 3 | 0.008677 | 1.200531 | 0.615239 | 1.907026 |
| | 4 | 0.012100 | 0.687729 | 0.751161 | 1.821266 |

| | | | | | |
|---|---|---|---|---|---|
| Probability (msl) | 1 | 0.8475 | 0.8184 | 0.4362 | 0.6403 |
| | 2 | 0.8445 | 0.4129 | 0.4051 | 0.5970 |
| | 3 | 0.9258 | 0.2732 | 0.4328 | 0.1673 |
| | 4 | 0.9124 | 0.4069 | 0.3861 | 0.1772 |

SC (4): Serial Correlation with 4 lags, msl: Marginal Significance Level

*= The minimum value of the corresponding test (Shows the best lag length)

Minimum values of AIC and SIC give us the optimum lag length ("VAR" Lag Order Selections and "LM" Test results are shown in Appendix D). Therefore, 4-lag for DR, 2-lag for CPI, 1-lag for RRR and 1-lag for M2, which are shown in the above table giving the minimum values for both tests, are selected as the optimum lag lengths and to be used in the causality analysis. Since there is no serial correlation in any of the lags, the result achieved is econometrically reliable.

The determinant ($\Omega$) of the residual covariance is computed as (T: number of observations, it is 21 in this analysis; $\varepsilon$: error term; p: the value which determines whether to reject or accept the null-hypothesis by comparing it to the level of significance) (Granger, 1969: 426):

$$|\Omega| = \det \{ (1/ T-p)* \sum \varepsilon_1 * \varepsilon_1' \} \quad (4.10)$$

The log likelihood value (L) is computed assuming a multivariate normal (Gaussian) distribution as:

$$L = - T/2 \{k* (1+\log 2\pi)+\log |\Omega|\} \quad (4.11)$$

And the two information criteria are computed as:

$$AIC = -2L/T + 2n/T \quad (4.12)$$

$$SIC = -2L/T + n \log T/T \quad (4.13)$$

n is the total number of estimated parameters in the VAR.

## 4.3 Granger's Causality Analysis

"The Granger (1969) approach to the question of whether X causes Y is to see how much of the current Y can be explained by past values of Y and then to see whether adding lagged values of X to them can improve the explanation. Y is said to be Granger-caused by X if X helps in the prediction of Y, or equivalently if the coefficients on the lagged Xs are statistically significant. Note that two-way causation is frequently the case; X Granger-causes Y and Y Granger-causes X" (Granger, 1969: 431).

"To evaluate whether each of these two conditions holds, we want to test the null hypothesis that one variable does not help to predict the other. For example, to test the null hypothesis that "X does not cause Y", we regress Y against lagged values of Y and lagged values of X (the unrestricted regression) and then regress Y only against lagged values of Y (the restricted regression). A simple F-test can then be used to determine whether the lagged values of X contribute significantly to the explanatory power of the first regression (F= (N-k) (ESSR-ESSUR)/q (ESSUR), where ESSR and ESSUR are the sums of squared residuals in the restricted and unrestricted regressions, respectively; N is the number of observations; k is the number of estimated parameters in the unrestricted regression; q is the number of parameter restrictions. This statistic is distributed as F (q, N-k)). If they do, we can reject the null hypothesis and conclude that the data are consistent with X causing Y. The null hypothesis that "Y does not cause X" is then tested in the same manner.

To test whether X causes Y, we thus proceed as follows. First, test the null hypothesis " X does not cause Y" by running two regressions:

$$Y= \Sigma^{m}_{I=1} \alpha_I Y_{t-I} + \Sigma^{m}_{I=1} \beta_I X_{t-I} + \varepsilon_t \quad \text{(Unrestricted regression)} \qquad (4.14)$$

$$Y= \Sigma^{m}_{I=1} \alpha_I Y_{t-I} + \varepsilon_t \quad \text{(Restricted regression)} \qquad (4.15)$$

And used the sum of squared residuals from each regression to calculate an F statistic and test whether the group of coefficients $\beta 1, \beta 2, \ldots\ldots, \beta m$ are significantly different from zero. If they are, we can reject the hypothesis that "X does not cause Y". Second, test the null hypothesis "Y does not cause X" by running the same regressions as above, but switching X and Y and testing whether lagged values of Y are significantly different from zero" (Pindyck and Rubinfeld, 1998:243).

In applying Granger's test, the choice of lag length is usually seen as essentially arbitrary. Since the best lag to be chosen 2 for D (CPI), 4 for DR, 1 for RRR, 1 for M2 according to the both tests (AIC and SIC) in Granger's Causality Analysis lag lengths are chosen as mentioned before to have meaningful explanation in the abovementioned three monetary policy tools on the inflation rate of Turkish economy.

The results, which are obtained when Granger's test procedure is applied, are summarized in the following tables. The results reported in the following tables are obtained with the optimum lag lengths which are mentioned before according the results of the above AIC and SIC tests for this study.

Degree of freedom k is 4 (There is 3 independent variables (DR, RRR, M2) including the constant) and number of observations N is 21. For a test at a significance level of 0.05 where we have 3 degrees of freedom (k-1) for the numerator and 17 degrees of freedom for the denominator (N-4), the appropriate F value is found by looking under the 3 degrees of freedom column and proceeding down to the 17 degrees of freedom row; there we find the appropriate F3-17 (F critical) value to be 3.20. This F3-17 value is used in every causality analysis in this test.

Table 4.2: Causality analysis between D(CPI) and DR

$H_{01}$: DR does not Granger Cause D(CPI)

(Reject if F value is greater than 3.20 with 5% significance level)

| LAG | 4 |
|---|---|
| F-TEST | 3.71517 |
| PROBABILITY | 0.07308 |

H02: D (CPI) does not Granger Cause DR

(Reject if F value is greater than 3.20 with 5% significance level)

| LAG | 2 |
|---|---|
| F-TEST | 1.94584 |
| PROBABILITY | 0.18538 |

Table 4.3: Causality analysis between D (CPI) and RRR

H01: RRR does not Granger Cause D (CPI)

(Reject if F value is greater than 3.20 with 5% significance level)

| LAG | 1 |
|---|---|
| F-TEST | 3.56867 |

| | |
|---|---|
| PROBABILITY | 0.08678 |

H02: D (CPI) does not Granger Cause RRR

(Reject if F value is greater than 3.20 with 5% significance level)

| | |
|---|---|
| LAG | 2 |
| F-TEST | 1.93269 |
| PROBABILITY | 0.18723 |

Table 4.4: Causality analysis between D (CPI) and M2

H01: M2 does not Granger Cause D (CPI)

(Reject if F value is greater than 3.20 with 5% significance level)

| | |
|---|---|
| LAG | 1 |
| F-TEST | 5.21007 |
| PROBABILITY | 0.03746 |

H02: D (CPI) does not Granger Cause M2

(Reject if F value is greater than 3.20 with 5% significance level)

| | |
|---|---|
| LAG | 2 |
| F-TEST | 6.03676 |
| PROBABILITY | 0.01534 |

## 4.4 Evaluation of the Findings

The results reported in Table 4.2, show a unilateral causality from DR to D (CPI). $4^{th}$ lag was chosen for DR and $2^{nd}$ lag was chosen for D (CPI) as they are determined by as the optimum lags by AIC and SIC of the “VAR” Lag Order Selections and “LM” tests. The null-hypothesis $H_{01}$:’DR does not Granger Cause D (CPI)’ is rejected according to

the F-test results at a 5% significance level. To test for the possibility that causation also flows in the opposite direction (thereby giving rise to feedback system) the reversed Granger test that is $H_{02}$: 'D (CPI) does not Granger Cause DR' is performed. The result of this test is such that the null-hypothesis is accepted. Taken together, these results would seem to indicate during the two decades period in question, DR causes D (CPI).

The results reported in Table 4.3 suggest there is a causality, which runs from the monetary policy tool (RRR) to inflation rate D (CPI). The 1st lag was chosen for RRR and 2nd lag was chosen for D (CPI) from the result of the VAR test. The first null-hypothesis $H_{01}$: 'RRR does not Granger Cause D (CPI)' is rejected according to the F-test result at a 5% significance level. And the second null-hypothesis $H_{02}$: 'D (CPI) does not Granger Cause RRR ' is accepted means that D (CPI) does not cause RRR.

The results reported in Table 4.4 suggest the existence of feedback system. The 1st lag was chosen for M2 and 2nd lag was chosen for D (CPI) as they are taken from the VAR test results above. The null-hypothesis $H_{01}$: 'M2 does not Granger Cause D (CPI)' and the second null-hypothesis $H_{02}$: 'D (CPI) does not Granger Cause M2' are both rejected at a 5% significance level. Over the period in question, D (CPI) caused M2 while D (CPI) caused by M2.

This chapter has used Turkish data in an investigation of the relationship between the inflation rate D (CPI) and monetary policy tools that are Discount Rate (DR), Required Reserve Ratio (RRR) and the M2 money supply. The results were such

that the relevant lags again were determined by AIC and SIC tests as 4-lag for DR, 1-lag for RRR and 1-lag for M2 for their effects on D (CPI). And as for D (CPI)`s effect on M2 the aforementioned criteria tests give 2-lag for D (CPI) as optimum. Causality analysis of the Granger variety provides evidence of feedback system between inflation rate (CPI) and M2 money supply. And there is a unidirectional causality between Required Reserve Ratio (RRR) and inflation rate D (CPI) from RRR to D (CPI) and between Discount Rate (DR) and inflation rate D (CPI) from DR to D (CPI).

# 5 CONCLUSION AND RECOMMENDATIONS

According to Monetarism, the main reason of economic instability is the up and down floats of the money. Instability of the increase in money supply causes instability in the aggregate demand. To get the stability in the aggregate demand and hence stability in growth, money supply should increase at a stable rate (Ghosh and Phillips, 1994: 12).

In this study, monetary policy developments in Turkey have been analyzed year by year, and the mutual effects of the monetary policy tools (DR, RRR, M2) and inflation (CPI) have been econometrically tested with Granger-Causality Analysis. According to the results of the study, during the observation period in Turkish economy, increase in inflation rate resulted in increases in M2, and in turn, expansion in M2 gave rise to increase in the inflation rate. This has been one of the major findings of this thesis, which has been verified by the econometric analysis conducted by Central Bank of Turkey in April 2002. Also a unilateral causation of DR and RRR on CPI with around 4 and 1-year lags consecutively has been found out.

Latest financial crises of November 2000 and February 2001 showed that it is very important to implement serious monetary programmes because money supply regulations along with interest and exchange rate policies play very important roles in the Turkish financial system. Hence, they should be carefully regulated in order to have

stable and low levels of inflation. Thus, monetary policy gained importance after the abovementioned crises and the governments tried to use the policies according to the Monetarist's rules (i.e. rule-based policies).

Continuous inflation leads to expectations of persistent inflation for the future and as inflation gets accelerated, it causes expectations of higher inflation rate for the coming years. This becomes another problem while fighting with inflation. In Turkey especially after 1980, monetary policies have been used to keep inflation at a stable level, but, never took direct inflation targets; the importance of rule-based monetary policies have gained value but they were applied auxiliary to fiscal policies. Fiscal and corresponding monetary policies in practice could not reach the targets. Higher inflation expectations in Turkish economy was one of the main causes of unsuccessful disinflation programs upto now.

According to Friedman's "Money Demand Theory", money supply should be targeted as much as increase in money demand. In other words, for the monetary targeting to be successful, monetary expansion should be consistent with the macroeconomic targets. There should not be excess money supply. The following targets determine the main features of the last monetary programme (CBRT Annual Report, 2001):

a. Limiting the Net Domestic Assets of the banks, which is the operational target of the Central Bank, through new regulations brought to the banking sector.
b. Dispersion of excessive foreign borrowing obtained from IMF and World Bank, between Central Bank reserves and consolidated budget financing.

However, these targets of the last monetary programme may further increase domestic debt, if they are not applied appropriately.

For those who monitor the latest theoretical studies in economic literature and the country experiences, it comes as no surprise that restoring economic fundamentals alone does not suffice for reaching the abovementioned targets. Central Bank has important tasks for improving the economic expectations. This relates to transparency, according to which a Central Bank should announce the framework of prospective monetary policy, the changes in operational rules and the rationale behind the decisions. Also the Economic and Social Council and the public sector, due to pricing policy of the State Economic Enterprises have important obligations in getting rid of backward indexation habits (CBRT Report, 2002).

Actually along with the increase in the increase rate of money supply more than the required level, the price setting based on past inflation (backward indexation), which as a result of inflationary expectations is also one of the main reasons for inflation to be high in Turkey.

In short, the main causes of chronic inflation in Turkey could be summarized as; excessive monetary expansion, inflation expectations and the accumulation of past experiences which is determined by recent cost and demand dynamics along with the expectations of economic agents with a time lag. If these factors determining the current inflation rate persist in the future, there is no doubt that the future inflation will be no different from the present and the past. Actually, in the recent money report published by Central Bank in April 2002, a deeper evaluation of the causes of chronic inflation has

been done and findings have disclosed that the increase in M2 money supply and inflation rate are in mutually reinforcing chain interaction, which causes the perpetual nature of the chronic inflation in Turkey. The fact that increases in CPI lead to increases in M2 has been one of the major findings of this study, which had been finalized much before the aforementioned report of the Central Bank. To achieve price stability, the Central Bank should evaluate the reasons behind the past and current high inflation and take measures in accordance with the results of this analysis.

As econometrically proven in Granger-Causality Analysis used in this study, among the three monetary policy tools (DR, RRR, M2), RRR and M2 would exert their full effects on inflation rate after a period of approximately one year, while DR exerts its effect after circa four years in Turkish economy. Hence, when decrease in inflation rate is targeted within a short period such as one year, it is recommended for Turkish economic policy-makers to use alterations in RRR and try to effect M2 level in the economy. The change in DR should be resorted to only when longer-term fight against inflation is aimed. Of course, these implementations of the abovementioned monetary policy tools should be utilized in line with a consistent Inflation-Targeting policy, which has been declared to start soon in Turkey.

The findings in this thesis is hoped to give some insight to the Inflation-Targeting policy, which is announced to be adopted towards the end of 2002 as a measure for fighting with the chronic inflation; of course without neglecting the fact that at present there is actually stagflation in Turkish economy, which causes contraction of the economy resulting in unemployment becoming the most important problem after February 2001.

With all these findings, it is hoped that further new studies will be conducted on this and related topics, especially taking into account the cause and effect relation of inflation with other variables from related sciences to economics, such as psychology, sociology and international relations. Thus, creativity in economics can be furthered with new theories, which might be prospective Nobel candidates.

# Appendix A

## *Abstracts of the Related Studies:*

i. Inflation Targeting in Developing Countries: “Macroeconomic policies have many goals like low inflation, high economic growth, balance of payment equilibrium, etc. Since the monetary policy has more flexible framework and exerts its effect with long and variable lags, it has certain advantages over fiscal policy. The issue with the monetary policy is that as it is widely accepted today, the central banks can only control inflation rates in the long run. In 1990s after the failure of monetary and nominal exchange rate targeting to reduce inflation rates, Inflation Targeting (IT) is implemented successfully in some developed countries, which encouraged developing and transition countries fighting against the high inflation rates “(Kadıoğlu, F., Özdemir, N., and Yılmaz, G., The Central Bank of the Republic of Turkey, Research Department, Discussion Paper, September 2000).

ii. Predicting Inflation in Turkey: Leading Indicators Approach: “The purpose of this study is to foresee the turning points of fluctuations of price cycle and inflation in Turkey. Leading indicator approach is applied to a group variable theoretically defined to be potential factors of inflation. Hence, this work suggests applying multiple methods. In this respect, Hodrick-Prescott, Beveridge-Nelson and band-pass methods are utilized and the results are discussed. Empirical results of the analysis show that leading indicators of price cycle and inflation can be achieved. Long-term, strongly inflation correlated indicators are mostly identified by the band-pass filter. The common set of leading indicators derived using suggested detrending methods increases reliability of the results. Using the without

weighting cross-correlation coefficient weighting and factor loading weighting of principal component analysis, composite leading indices are constructed from the leading indicators. Granger-Causality test is used to investigate the contribution of composite leading indicators to the prediction of price cycle and inflation. The results indicate that composite leading indices may help to predict price cycle and inflation "(Uğur, G., M.S Thesis, Dept. of Economics, Bogazici University, June 1999).

iii. Long-run Relationships Among Inflation, Money Growth, Exchange Rates, and Budget Deficit in Turkey: "This study aims to investigate long run relationships among inflation rate, exchange rate, money growth and budget deficits in Turkey using 1987:1-1997:4 quarterly data employing Johansen`s co integration procedure. In the study two significant co integration relations are identified. The first estimate co integration vector is the nominal money supply growth function, which is positively affected from inflation rate and the budget deficits, and negatively affected from exchange rate depreciation. The second significant co integration relation is interpreted as the inflation equation. In this equation money growth, budget deficits and exchange rate depreciation positively affect inflation rate, even though money growth, exchange rate depreciation are also inflationary, the budget deficit is estimated as the most effective factor behind high inflation "(Saygili, M.,M.S Thesis, Bilkent University, December 1998).

iv. A Dynamic Model of Inflation in Turkey: A Co integration Analysis: "In this study, we tried to estimate a proper model for Turkish Economy; inflation is not only a monetary phenomenon but also has an expectational character. By employing quarterly data for the Turkish Economy from the first quarter 1980 until the last quarter of 1992, we obtain a set of stable long run relationships between various economic variables that have a predictive power future movements regarding

some major macroeconomic movements in Turkey. Annual and seasonal unit root properties of the series are investigated. We observed a close relation between increases in credits, international reserves and aggregate demand that forms a loop which creates inflation “(Izmirli, G. B.,M.S Thesis, METU, July 1994).

v. Money and Inflation: International Evidence Based on Co integration Theory: “This study investigates the relationship between money and inflation using co integration tests. For a broad sample of countries, the paper finds that most time series data underlying a typical monetarist model are no stationary, indicating that it is necessary to appropriately transform the data in order to render the confidence tests reliable. Our principal is that money and inflation are related only in countries with high inflation “(Shirvani, H., and Wilbrate, B., International Economic Journal, Volume 8, No: 1, Spring 1994).

# Appendix B

## Consumer Price Index (CPI)

| Year | Index | Inflation Rate (%) |
|---|---|---|
| (1974= 100) | | |
| 1975 | 119 | 19 |
| 1976 | 138 | 16 |
| 1977 | 169 | 22.5 |
| 1978 | 260 | 54 |
| 1979 | 408 | 57 |
| (1979= 100) | | |
| 1980 | 207 | 107 |
| 1981 | 283 | 36.8 |
| 1982 | 360 | 27 |
| 1983 | 473 | 31.4 |
| 1984 | 702 | 48.4 |
| 1985 | 1018 | 45 |
| 1986 | 1370 | 34.6 |
| 1987 | 1899 | 38.6 |
| (1987= 100) | | |
| 1988 | 174 | 73.7 |
| 1989 | 284 | 63.3 |
| 1990 | 455 | 60.3 |
| 1991 | 754 | 66 |
| 1992 | 1283 | 70.1 |
| 1993 | 2131 | 66.1 |
| 1994 | 4396 | 106.3 |
| (1994= 100) | | |
| 1995 | 188 | 88 |
| 1996 | 339 | 80.4 |
| 1997 | 630 | 85.8 |
| 1998 | 1163 | 84.6 |
| 1999 | 1918 | 64.9 |
| 2000 | 2666 | 39 |

Source:Treasury Statistics

# Appendix B

## *Augmented Dickey-Fuller Unit Root Tests*

### i. Augmented Dickey-Fuller Unit Root Test on D(CPI):

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CPI,2)
Method: Least Squares
Sample(adjusted): 1982 2000
Included observations: 19 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(CPI(-1)) | -0.862957 | 0.188926 | -4.567686 | 0.0003 |
| C | 0.006676 | 0.066283 | 0.100715 | 0.9210 |

| | | | |
|---|---|---|---|
| R-squared | 0.551022 | Mean dependent var | 0.029469 |
| Adjusted R-squared | 0.524611 | S.D. dependent var | 0.417853 |
| S.E. of regression | 0.288103 | Akaike info criterion | 0.448303 |
| Sum squared resid | 1.411056 | Schwarz criterion | 0.547718 |
| Log likelihood | -2.258879 | F-statistic | 20.86376 |
| Durbin-Watson stat | 1.936460 | Prob(F-statistic) | 0.000273 |

### ii. Augmented Dickey-Fuller Unit Root Test on DR:

| | | | |
|---|---|---|---|
| ADF Test Statistic | -3.922664 | 1% Critical Value* | -3.8572 |
| | | 5% Critical Value | -3.0400 |
| | | 10% Critical Value | -2.6608 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DR)
Method: Least Squares
Sample(adjusted): 1983 2000
Included observations: 18 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| DR(-1) | -0.530394 | 0.140217 | -3.782664 | 0.0020 |
| D(DR(-1)) | 0.024870 | 0.191109 | 0.130138 | 0.8983 |
| D(DR(-2)) | -0.200096 | 0.194532 | -1.028600 | 0.3211 |
| C | 2.164191 | 0.559998 | 3.864644 | 0.0017 |

| | | | |
|---|---|---|---|
| R-squared | 0.520891 | Mean dependent var | 0.035798 |
| Adjusted R-squared | 0.418225 | S.D. dependent var | 0.145972 |
| S.E. of regression | 0.111339 | Akaike info criterion | -1.359351 |
| Sum squared resid | 0.173548 | Schwarz criterion | -1.161490 |
| Log likelihood | 16.23415 | F-statistic | 5.073645 |
| Durbin-Watson stat | 1.462047 | Prob(F-statistic) | 0.013862 |

### iii. Augmented Dickey-Fuller Unit Root Test on RRR:

| | | | |
|---|---|---|---|
| ADF Test Statistic | -3.056975 | 1% Critical Value* | -2.6889 |
| | | 5% Critical Value | -1.9592 |
| | | 10% Critical Value | -1.6246 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RRR)
Method: Least Squares
Sample(adjusted): 1981 2000
Included observations: 20 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| RRR(-1) | -0.033079 | 0.010821 | -3.056975 | 0.0065 |

| | | | |
|---|---|---|---|
| R-squared | 0.051356 | Mean dependent var | -0.080472 |
| Adjusted R-squared | 0.051356 | S.D. dependent var | 0.128126 |
| S.E. of regression | 0.124793 | Akaike info criterion | -1.275620 |
| Sum squared resid | 0.295891 | Schwarz criterion | -1.225833 |
| Log likelihood | 13.75620 | Durbin-Watson stat | 2.039791 |

### iv. Augmented Dickey-Fuller Unit Root Test on M2:

| | | | |
|---|---|---|---|
| ADF Test Statistic | -5.607242 | 1% Critical Value* | -2.6968 |
| | | 5% Critical Value | -1.9602 |
| | | 10% Critical Value | -1.6251 |

*MacKinnon critical values for rejection of hypothesis of a unit root.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(M2,2)
Method: Least Squares

Sample(adjusted): 1982 2000
Included observations: 19 after adjusting endpoints

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(M2(-1)) | -1.360554 | 0.242642 | -5.607242 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.634147 | Mean dependent var | -0.044264 |
| Adjusted R-squared | 0.634147 | S.D. dependent var | 0.649724 |
| S.E. of regression | 0.392991 | Akaike info criterion | 1.021135 |
| Sum squared resid | 2.779951 | Schwarz criterion | 1.070842 |
| Log likelihood | -8.700779 | Durbin-Watson stat | 1.863515 |

# Appendix C

## "VAR" (Vector Autoregression) Lag Order Selections and "LM" (Lagrange Multiplier) Tests for CPI, DR, RRR and M2:

Two information criteria (AIC, SIC) values in "VAR" Lag Order Selection Tests are computed as (Granger, 1969: 426):

AIC = -2L/T + 2n/T

SIC = -2L/T + n log T/T

(T: number of observations (21 for this study), n: is the total number of estimated parameters in the VAR, L: log likelihood value)

### 1) CPI:

### VAR Lag Order Selection Criteria for CPI:

Endogenous variables: D(CPI(-1),1)
Exogenous variables: C
Date: 11/06/01 Time: 20:22
Sample: 1980 2000
Included observations: 15

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | -0.048070 | NA | 0.067344 | 0.139743 | 0.186946 | 0.139240 |
| 1 | 0.273670 | 0.557684 | 0.073822 | 0.230177 | 0.324584 | 0.229172 |
| 2 | 2.734311 | 3.937025* | 0.060994* | 0.035425* | 0.177035* | 0.033917* |
| 3 | 3.079075 | 0.505653 | 0.067080 | 0.122790 | 0.311603 | 0.120779 |
| 4 | 3.099243 | 0.026892 | 0.077462 | 0.253434 | 0.489451 | 0.250920 |

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

### VAR Residual Serial Correlation LM Tests for CPI:

H0: no serial correlation at lag order h
Date: 11/06/01 Time: 20:26
Sample: 1980 2000
Included observations: 15

| Lags | LM-Stat | Prob |
|---|---|---|
| 1 | 0.036978 | 0.8475 |
| 2 | 0.038471 | 0.8445 |
| 3 | 0.008677 | 0.9258 |
| 4 | 0.012100 | 0.9124 |

Probs from chi-square with 1 df.

## 2) DR:

### VAR Residual Serial Correlation LM Tests for DR:

H0: no serial correlation at lag order h
Date: 11/06/01 Time: 20:37
Sample: 1980 2000
Included observations: 15

| Lags | LM-Stat | Prob |
|---|---|---|
| 1 | 0.052726 | 0.8184 |
| 2 | 0.670494 | 0.4129 |
| 3 | 1.200531 | 0.2732 |
| 4 | 0.687729 | 0.4069 |

Probs from chi-square with 1 df.

### VAR Lag Order Selection Criteria for DR:

Endogenous variables: D(DR(0))
Exogenous variables: C TIME
Date: 11/06/01 Time: 20:38
Sample: 1980 2000
Included observations: 15

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | 5.609540 | NA* | 0.036241 | -0.481272 | -0.386865 | -0.482278 |
| 1 | 6.472172 | 1.380211 | 0.037054 | -0.462956 | -0.321346 | -0.464465 |
| 2 | 8.758116 | 3.352718 | 0.031459 | -0.634415 | -0.445602 | -0.636427 |
| 3 | 9.002291 | 0.325566 | 0.035259 | -0.533639 | -0.297622 | -0.536153 |
| 4 | 11.54432 | 3.050432 | 0.029310* | -0.739242* | -0.456022* | -0.742259* |

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

## 3) RRR:

### VAR Residual Serial Correlation LM Tests for RRR:

H0: no serial correlation at lag order h
Date: 11/06/01 Time: 20:43
Sample: 1980 2000
Included observations: 16

| Lags | LM-Stat | Prob |
|---|---|---|
| 1 | 0.606131 | 0.4362 |
| 2 | 0.693090 | 0.4051 |
| 3 | 0.615239 | 0.4328 |
| 4 | 0.751161 | 0.3861 |

Probs from chi-square with 1 df.

### VAR Lag Order Selection Criteria for RRR:

Endogenous variables: D(RRR(0))
Exogenous variables:
Date: 11/06/01 Time: 20:44
Sample: 1980 2000
Included observations: 16

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 1 | 7.495711 | NA | 0.026000* | -0.811964* | -0.763677* | -0.809491* |
| 2 | 8.287471 | 1.385581 | 0.026716 | -0.785934 | -0.689360 | -0.780989 |
| 3 | 8.822200 | 0.868934 | 0.028406 | -0.727775 | -0.582915 | -0.720357 |
| 4 | 8.841045 | 0.028268 | 0.032316 | -0.605131 | -0.411983 | -0.595240 |

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

## 4) M2:

### VAR Residual Serial Correlation LM Tests for M2:

H0: no serial correlation at lag order h
Date: 11/06/01 Time: 20:46
Sample: 1980 2000
Included observations: 15

| Lags | LM-Stat | Prob |
|---|---|---|
| 1 | 0.218394 | 0.6403 |
| 2 | 0.279498 | 0.5970 |
| 3 | 1.907026 | 0.1673 |
| 4 | 1.821266 | 0.1772 |

Probs from chi-square with 1 df.

### VAR Lag Order Selection Criteria for M2:

Endogenous variables: D(M2(-1))
Exogenous variables:
Date: 11/06/01 Time: 20:47
Sample: 1980 2000
Included observations: 15

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 1 | -2.785061 | NA | 0.097004* | 0.504675* | 0.551878* | 0.504172* |
| 2 | -2.542749 | 0.420007 | 0.107466 | 0.605700 | 0.700107 | 0.604694 |
| 3 | -2.415667 | 0.203332 | 0.121199 | 0.722089 | 0.863699 | 0.720581 |
| 4 | -2.402423 | 0.019424 | 0.139316 | 0.853656 | 1.042470 | 0.851645 |

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

***Source: Eviews 4.0***

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