On the Link between Dollarization and Inflation: Evidence from Turkey*

by

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Abstract

This paper investigates the role of dollarization in the dynamics of inflation in Turkey. Descriptive analysis suggests that, in addition to high inflation and economic instability, institutional factors also played an important role in the evolution of dollarization in Turkey. The empirical findings corroborate the importance of dollarization in the dynamics of inflation. The results suggest that shocks to dollarization initially lead to a decline in the monetary base as the public switches from domestic to foreign money holdings. However, the monetary base increases later on to generate the required inflation tax for a given budget deficit. The findings also indicate that the fiscal authority tries to compensate part of the decline in inflation tax through raising administered prices. As expected, the exchange rate responds positively to shocks to dollarization owing to the high elasticity of substitution between domestic and foreign currency.

***Keywords*:** Dollarization; currency substitution; inflation.

JEL classification: E3; E5; F41.

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I. Introduction

High and volatile inflation has been one of the salient features of the Turkish economy since the 1970s. Evolution of inflation in Turkey differs from other high inflation episodes in one important respect. Contrary to many other high inflation episodes, high persistent inflation in Turkey never spiraled into hyperinflation. This, coupled with macroeconomic instability and failed stabilization efforts, in turn, led to one of the highest dollarized economies where, by the end of 2001, foreign currency deposits accounted for roughly 60 percent of total deposits (Table 1).

The high level of foreign currency deposits in Turkey raises questions concerning the design, implementation and effectiveness of monetary, fiscal, and exchange rate policies. Existing studies[1] show that dollarization: (i) reduces the yield of the inflation tax and results in higher and more volatile inflation, for a given level of budget deficit (Nicholas 1974, Rojas-Suarez 1992);[2] (ii) reduces the monetary authorities' control over domestic liquidity both by increasing the component over which little direct influence can be exerted and by rendering money demand less stable (IMF 2000); (iii) affects the choice of exchange rate regime (Berg and Borensztein 2000);[3] and (iv) increases the exposure of the banking system to additional risks on account of uncovered foreign liabilities.[4]

Although the phenomenon of dollarization raises many questions, investigations of policy alternatives offer few clear-cut solutions. The lack of simple policy answers is attributed to, inter alia, two factors.[5] First, the analytical work in this area has not been able to produce clear guidance in many important issues. Second, at the empirical level the absence

[1] See Calvo and Vegh (1992) for a comprehensive review of the relevant literature.
[2] In the presence of a high elasticity of substitution, dollarization is also likely to render the exchange rate extremely volatile in response to policy changes and credibility problems (McNelis and Asilis 1992).
[3] More specifically, Berg and Borensztein (2000) show that a high degree of currency substitution argues for a more fixed exchange rate regime, while asset substitution may imply either more rigid or more flexible regimes may be appropriate.
[4] It is also argued that a nominal devaluation will drastically increase the burden faced by debtors and can generate a wave of corporate bankruptcies. This may, in turn, result in a banking crisis, as banks see their stock of non-performing loans rise. Calvo (1999) also supports this conjecture and claims that "liability-dollarized economies are highly vulnerable to a devaluation".
[5] See Calvo and Vegh (1992) for more on this.

of data on the stock of foreign currency circulating in the economy has emerged as a serious hindrance. As a consequence, empirical studies can only investigate the importance of dollarization (foreign currency as a store of value) but not necessarily currency substitution (foreign currency as a medium of exchange).

The distinction between medium of exchange substitutability and store of value substitutability is also important in assessing the stages of the dollarization process. In this respect, casual evidence suggests that in high-inflation countries foreign currency is used initially as a store of value or unit of account, and only later as a medium exchange. As such, currency substitution can be viewed as the last stage of the dollarization process.[6]

Table 1: Evolution of the Dollarization in Selected Countries[a]

	Argentina	Croatia	Czech Republic	Mexico	Peru	Poland	Romania	Russia	Slovakia	Turkey
1990	47.2	-	-	13	48.7	-	3.6	-	-	25.5
1991	48.1	-	-	13.6	65.1	-	4.7	-	-	33.6
1992	47.1	-	-	11.1	66.8	-	20.4	-	-	38.6
1993	52.2	-	8.9	12.7	66.4	29.6	37.9	39.9	12.5	44.3
1994	55.5	59.3	7.8	18.9	67.2	33.9	27.9	39.2	14.2	51.7
1995	57.4	66.6	5.9	19.6	65	25.1	27.6	28.3	12.5	53.0
1996	56.4	67.6	6.7	20.1	68	20.9	28.4	27.4	11.4	48.5
1997	57.2	68.9	12.7	14.2	58.9	20.7	33.4	24.6	11.8	50.4
1998	58.2	73.7	12.7	17.1	58.5	17.7	37.3	51.2	16.4	46.7
1999	62.3	71.6	13.3	17.2	49.3	17.6	43.2	48.8	15.9	45.9
2000	-	73	13.3	17	48.5	16.5	47	48.5	16.3	45.3
2001	-	73	13.5		47	17.9	49.3	46.8	16.4	57.6

Source: CBRT and Honohan and Shi (2002) a: FX deposits as a percentage of total deposits (end-year).

Although several studies have investigated the dynamics of inflation in Turkey, to the best of our knowledge, existing empirical work has not explored the role of dollarization in the inflation process. This paper attempts to fill this void in the literature on Turkey by empirically investigating the importance of dollarization in the dynamics of inflation. The investigation also attempts to provide a brief descriptive analysis of the main macroeconomic and institutional factors affecting the evolution of the dollarization process in Turkey.

[6] Throughout this paper, Turkey's experience of increasing holdings of foreign currency deposits is being referred to as dollarization.

The principal conclusions that emerge from our study corroborate the importance of dollarization in the dynamics of inflation in Turkey. The empirical findings suggest that shocks to dollarization lead to a decline in the monetary base as the public switches from domestic to foreign money holdings. However, the monetary base increases after 5 months to generate the required inflation tax for a given budget deficit. The results also indicate that the fiscal authority tries to compensate part of the decline in inflation tax through raising administered prices. As expected, the exchange rate responds positively to shocks to dollarization owing to the high elasticity of substitution between domestic and foreign currency.

The remainder of the paper is organized as follows. Section 2 provides a brief description of the main macroeconomic and institutional factors affecting the dollarization process in Turkey. Section 3 discusses the dynamics of inflation in Turkey and presents the empirical results. Section 4 concludes the paper.

2. A Cursory Look at the Evolution of Dollarization in Turkey

Dollarization reflects economic agents' efforts to protect the value of their wealth and income, in the context of deteriorating financial conditions, that have an adverse effect on the expected return of domestic money holdings relative to those on foreign balance, as well as in response to changes in institutional, political and external factors that influence expectations regarding the liquidity of domestic versus foreign currency denominated assets.

In this respect, the following subsections will highlight the key macroeconomic and institutional factors that contributed to the steady rise in dollarization in the Turkish economy since the mid-1980s.

2.1 Macroeconomic Factors Affecting the Dollarization Process

Since the introduction of foreign currency deposits in Turkey in December 1983, dollarization has increased significantly, owing to high and volatile rates of inflation and a depreciating exchange rate (Figures 1 and 2). In addition to these factors, unsuccessful stabilization efforts, financial crises, and under-developed capital markets played an important role in the rise in dollarization.

Particularly, in the aftermath of the 1994 financial crisis that resulted in a substantial devaluation of the Turkish lira, economic agents became more concerned with unexpected increases in inflation and devaluations as evidenced by the prominent shift in their portfolio composition. The collapse of the exchange rate based stabilization program in February 2001 further promoted this upward trend in dollarization.

Figure 1

Deposit Dollarization and Exchange Rate Volatility (percentage)

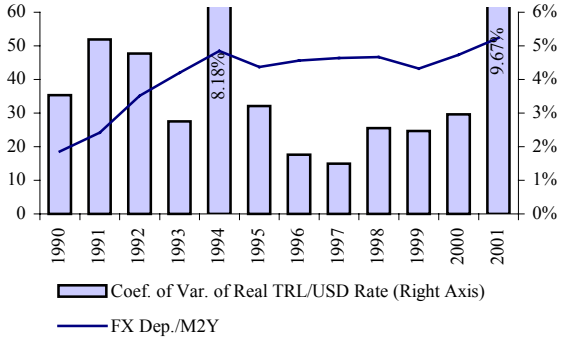
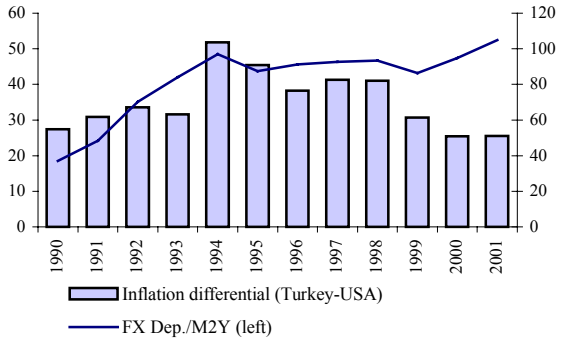


Figure 2

Deposit Dollarization and Inflation Rate Differential (percentage)



The share of FX deposits in broad money supply (M2Y)—one of the most widely used indicators of dollarization—reached its peak of 59.5 percent in October 2001, from 12.8 percent in 1986.[7] During the 2000 exchange rate based stabilization program, however, there was a reduction in FX deposits both in USD terms and as a share of M2Y, reflecting economic agents' confidence in the program. Nonetheless, the process of de-dollarization

[7] M2Y = M2 + FX Deposits, where M1= Currency in Circulation + Demand Deposits and M2= M1 + Time Deposits

was short-lived. The collapse of the exchange-rate-based stabilization program in February 2001 led to a surge in foreign currency deposits, which continued to rise, reaching roughly 58 percent of all deposits by the end-December 2001. [8]

If we include the Turkish residents (non-banking) deposits abroad—using the data reported by the BIS—as part of foreign currency holdings of the private sector, this new ratio, which increased from 16.7 percent in 1986 to 63.8 in 2001, shows a similar pattern with a slightly steeper upward trend compared to FX/M2Y (Figure 3).

Figure 3

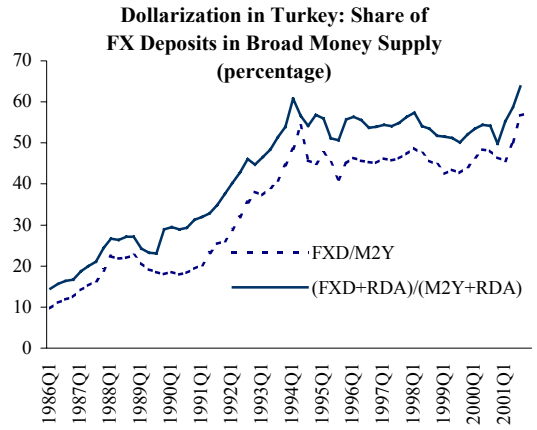
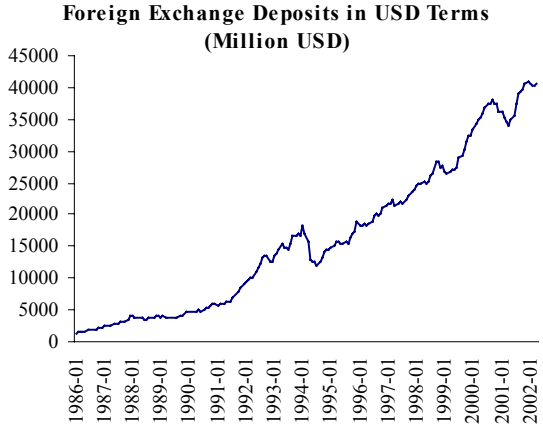


Figure 4



The increasing share of foreign exchange credits in total credits emerges as an additional indicator of the rise in dollarization. This ratio would also capture the financial system's exposure to systemic risk in the case of large devaluations. Although there was a shift in the composition of loans in favor of foreign exchange loans after the 1994 financial crisis, the share of foreign currency lending in the total declined noticeably during the exchange-rate-based stabilization program in 2000 (Figure 5). The decline in FX lending, however, coincided with the sharp increase in banks' open positions. This observation, in turn, corroborates the notion that pegged exchange rates provide implicit guarantees for those

[8] In USD terms, FX deposits rose to USD 40.8 billion.

looking to borrow in foreign currency, thereby giving rise to a moral hazard problem (Eichengreen and Hausmann 1999).

Figure 5

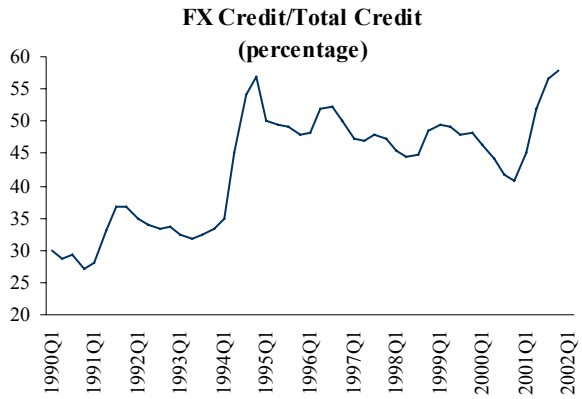
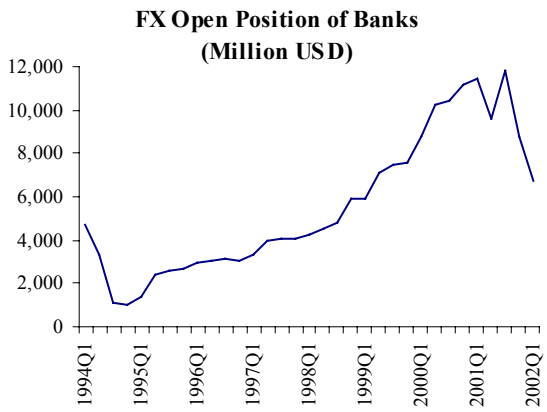
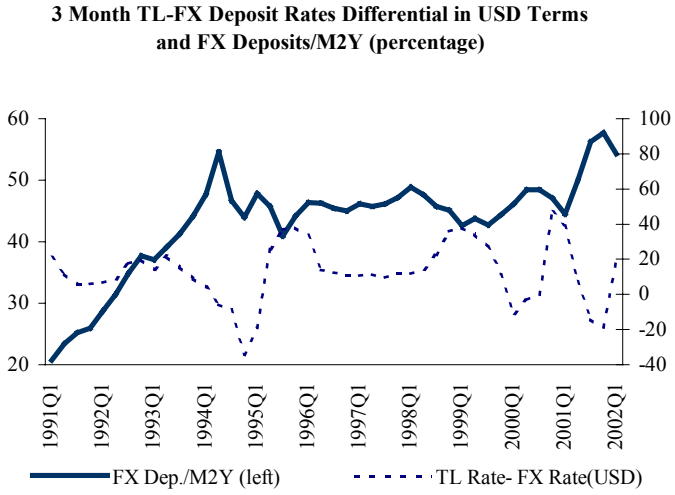


Figure 6



Casual evidence suggests that the excess return on Turkish lira deposits over foreign currency deposits also played an important role in the dollarization process. A quick glance at the FX/M2Y ratio and the difference between the interest rate on Turkish lira deposits and FX deposits corrected for changes in the exchange rate indicates that the periods of high dollarization tend to be associated with negative excess returns on Turkish lira deposits (Figure 7).

Figure 7



Changes in the composition of deposits can also shed some light on the evolution of the function of domestic money over time. An interesting observation in this respect is the sharp decline in TL denominated time deposits with 6-12 months maturity (Table 2). TL deposits with 1-3 months maturity, however, display a noticeable upward trend during the time under consideration. In the case of foreign currency deposits, this pattern appears to be much less prominent. This observation, in turn, confirms the decline in the use of TL at the level of store of value.

Table 2. Composition of Bank Deposits (percentages)

	Turkish Lira Deposits			Foreign Exchange Deposits		
		Time Deposits			Time Deposits	
	Demand Deposits	1-3 months	6-12 months	Demand Deposits	1-3 months	6-12 months
1990	36.5	46.2	53.8	24.3	46.6	53.4
1991	31.6	47.1	52.9	21.7	44.5	55.5
1992	33.1	49.0	51.0	23.4	46.0	54.0
1993	36.6	51.2	48.8	26.6	47.6	52.4
1994	27.3	53.4	46.6	28.8	49.1	50.9
1995	21.4	54.9	45.1	29.1	48.5	51.5
1996	27.0	56.4	43.6	26.9	48.7	51.3
1997	23.3	58.1	41.9	23.3	48.3	51.7
1998	17.4	60.2	39.8	21.3	49.3	50.7
1999	17.2	61.5	38.5	17.7	49.9	50.1
2000	20.6	62.4	37.6	15.4	51.7	48.3
2001	19.9	62.9	37.1	18.2	51.9	48.1

Source: CBRT

In recent years, particularly in the aftermath of the February 2001 crisis, the share of government securities in foreign currency or indexed to foreign currency in the total has increased substantially (Figure 8). The share of government securities denominated in foreign currency or indexed to foreign currency in total domestic debt rose to 36 percent in 2001 from 8 percent in 2000. This development, in turn, not only makes the fiscal position more sensitive to exchange rate changes, but also further increases the degree of dollarization in the economy.

Figure 8
The Share of FX linked/ denominated Debt Instruments in Total Domestic Debt Stock

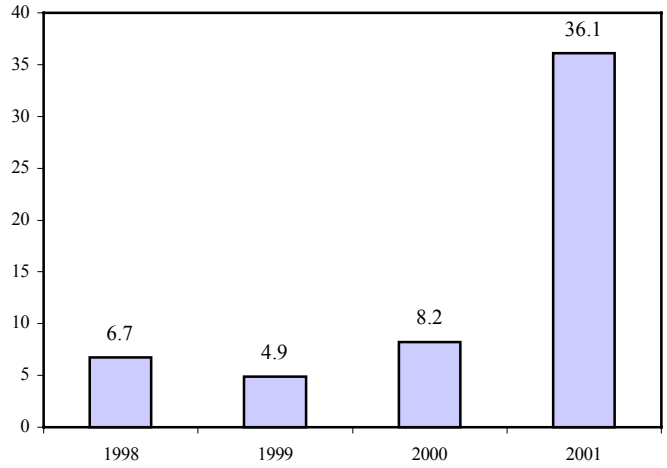
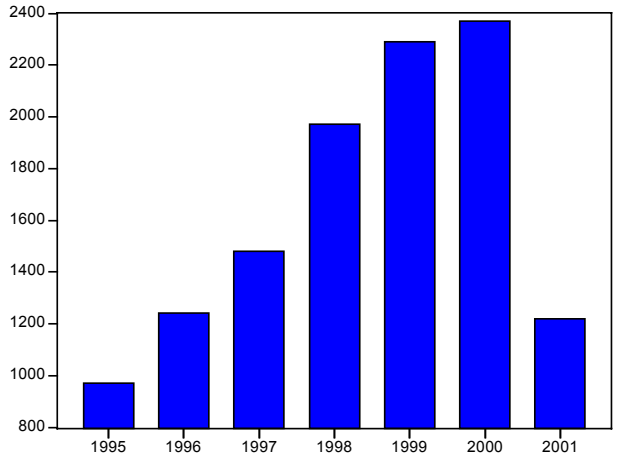


Figure 9
FX Funds Raised by Special Finance Houses (million USD)



Finally, evidence suggests that Special Finance Houses (SFHs)—a form of non-bank financial institutions—also played an important role in the dollarization process in Turkey. Between 1995 and 2000 foreign exchange funds raised by special finance houses displayed a steep upward trend (Figure 9).[9] In 2001, the Bank Restructuring and Supervision Agency closed the largest special finance house, which led to a decline in funds raised by SFHs by USD 1 billon.

2.2 Institutional Factors Affecting the Dollarization Process

In addition to the macroeconomic environment, institutional factors and agents' expectations of future political developments play a crucial role in the process of dollarization. Evidence suggests that dollarization is likely to proceed more rapidly in countries with poorly developed capital markets and limited outlets for domestic investments, in economies where there are formalized and secure channels for holding foreign currency—i.e., foreign currency bank deposits—and where there are fewer regulations on the types of

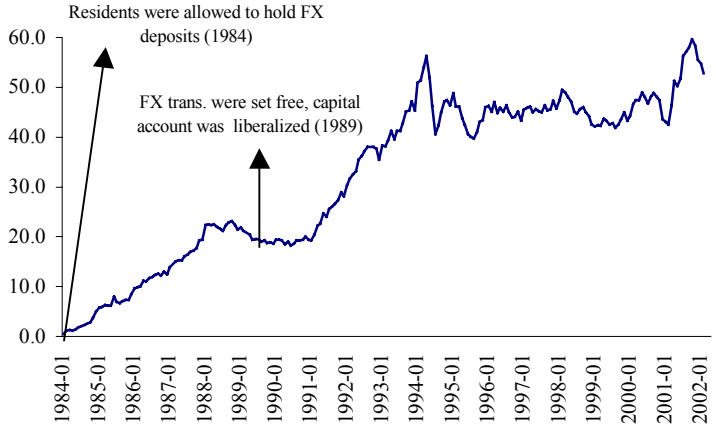
[9] Institutions engaged in Islamic banking constitute a significant portion of special financial houses. Clients of these institutions tend to hold their savings in foreign currency in lieu of TL denominated interest earning deposits or other interest earning instruments.

transactions that can legally be financed. Moreover, the greater the uncertainty regarding future political developments, the greater the agents' incentive to hold foreign currency.

In this context, Turkey's experience with the dollarization process was not significantly different from other dollarization episodes.[10] The noticeable increase in foreign currency deposits since the mid-1980s took place in the context of the liberalization of the financial system and the emergence of new financial instruments along with the capital account liberalization (Box 1). The degree of dollarization in Turkey appears to have increased especially after: (i) residents were allowed to hold FX deposits; (ii) transactions in FX were set free; and (iii) the liberalization of the capital account in 1989.

Figure 10

FX Deposits/M2Y (percentage)



In addition to the above-mentioned institutional factors, policy decisions regarding *reserve requirements*, *withholding tax rates*, and *resource utilization deductions* also played an important role in the process of dollarization in Turkey.

[10] See Savastano (1992) for the role of institutional factors in the process of dollarization in the case of Bolivia, Mexico, Peru, and Uruguay.

Box: 1 The Financial Liberalization in Turkey

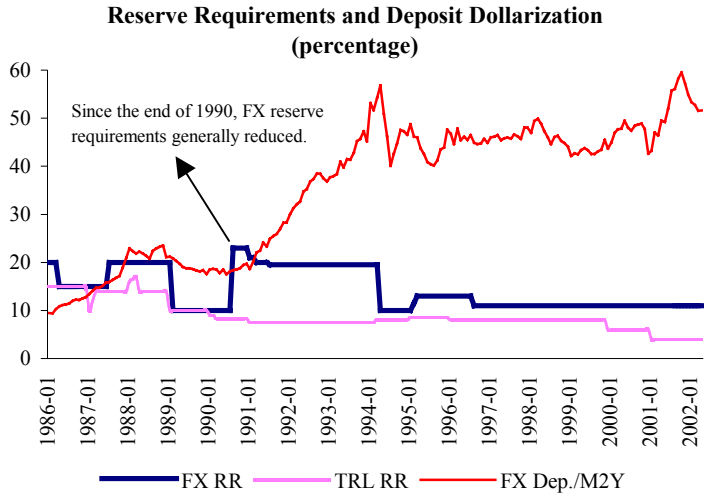
Turkish experience of financial liberalization began along with the structural adjustment program initiated in 1980, under the auspices of the World Bank and the International Monetary Fund. At the beginning of the stabilization program, interest rate ceilings on loans and deposits were lifted. In the credit market, the Central Bank's control over commercial banks was simplified with a revision of the liquidity and reserve requirement system for deposits. An interbank money market for short-term borrowing facilities was enacted in 1986. In 1987, the Central Bank diversified its monetary policy instruments by starting open market operations. In order to regulate and supervise the capital market, a regulatory body (the Capital Market Board) was established. The Istanbul Stock Exchange was reopened in 1986.

The liberalization of the exchange rate regime began in 1981. To this end, the practice of setting and announcing nominal foreign currency rates daily by the Central Bank began in May 1981. With the passage of Decree no. 30 in July 1984, the second step in the liberalization of the foreign exchange regime took place. The most important provisions of the Decree no. 30 were: (i) allowing foreign residents to invest in Turkish lira denominated securities, and repatriate profits freely; (ii) letting the Turkish citizens to have foreign currency denominated deposits with the domestic banks; and (iii) allowing the domestic banks to extend FX loans and borrow from international financial markets.

The final step in liberalizing the FX regime and international capital movements occurred with the passage of the Decree no. 32 (on the Law of Protection of the Value of the Turkish Lira) in August 1989, and Decree amending Decree no. 32 in February 1990. The latter two Decrees completed, to a large extent, the liberalization of the FX regime and international capital movements: (i)commercial banks, Islamic Financial Institutions and authorized foreign currency brokers were allowed to determine freely the FX rates in their transactions; (ii) limitations on the amount of FX denominated assets to be owned by the private domestic investors were lifted; and (iii) limitations on the domestic banks' borrowing from international financial markets were lifted. Furthermore, foreign residents were allowed to buy or sell company stocks (quoted on the Istanbul Stock Exchange) and government securities. The restrictions over the transfer of profits abroad by foreign investors were also abolished.

Central Bank imposed *reserve requirements for foreign exchange deposits* in end-1985. During the period 1985-1990, the reserve requirement ratio on FX deposits varied between 15 to 25 percent. By 1996, this ratio declined to 11 percent and remained at that level thereafter. It is argued that imposition of a high reserve requirement on foreign currency deposits can be considered as a policy tool to discourage the use of foreign currencies. In the context of the Turkish experience, it appears that the downward trend in FX reserve requirement ratios after the 1990s coincides with the steady rise in dollarization. However, the fact that the reserve requirement ratios on FX deposits were generally kept higher than those on domestic currency deposits (Figure 11), not surprisingly, suggests that this policy alone cannot be an effective policy tool in discouraging the use of foreign currency.

Figure 11



The withholding tax rates on interest income from FX deposits, which stayed at 10 percent between 1988 and 1996, were increased gradually in the 1997-2001 period. In 2001, the tax rate for FX deposits with less than one-year maturity and more than one-year maturity, increased to 18 percent and 16 percent, respectively.[11] As a result of the high premium on the TL denominated deposits, the nominal interest income obtained from TL deposits is greater than that of foreign exchange deposits. Therefore, holding foreign exchange deposits instead of Turkish lira deposits would lead to a lower amount of withholding tax.[12] In addition, changes in the principal of the foreign currency deposit in terms of TL, which often arises from the appreciation of the foreign currency, are not subject to taxation. This, in turn, renders TL deposits less attractive compared to foreign exchange deposits.

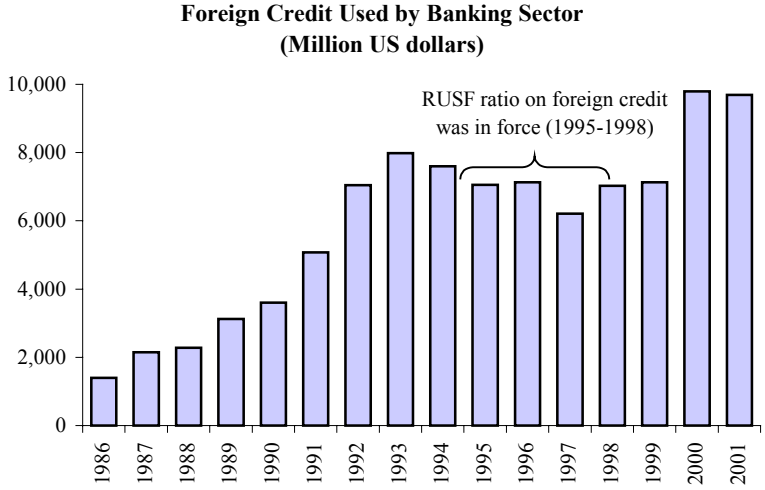
The *Resource Utilization Support Fund (RUSF) deduction*, which was introduced in 1985, initially applied to foreign exchange loans extended by banks. The RUSF deduction applies to lending rates and the borrowers pay the deductions. However, the RUSF deduction concerning the foreign credits used by the banks and residents from abroad applies to the quantity of the loan. Casual evidence suggests that the RUSF deductions were somehow

[11] Tax rates on TL and FX deposit rates did not differ significantly since 1988.

[12] For example, let us assume that the exchange rate is 1TL=1USD and the respective interest rates on the TL and USD denominated deposits are 50 percent and 4 percent. In the case of a TL100 deposit, assuming that the withholding tax rate is 20 percent, the amount of withholding tax will be TL10. In the case of a USD 100 deposit, assuming that the exchange rate depreciates (1TL= 0.5 USD) and that the withholding tax rate is 20 percent, the amount of withholding tax will be TL 1.6.

effective in rendering banks' foreign exchange borrowings from abroad less attractive (Figure 11).

Figure 11



3. The Dynamics of Inflation in Turkey

The Turkish economy has been undergoing high and chronic inflation since the 1970s. Indeed, starting from the 1970s, the inflation rate displayed an upward trend and reached its peak of 120 percent in 1994 in the aftermath of an exchange market crisis.[13] The evolution of inflation in Turkey can be divided into three sub-periods: (i) the period during which price developments were influenced by the financial liberalization and the deteriorating current account outlook (1989-1993); (ii) the 1994 currency crisis and worsening debt dynamics (1995-1999); and (iii) the exchange-rate based stabilization program and its collapse (2000-2001).

Between 1989 and 1993, prior to the 1994 crisis, inflation rate hovered around 60 percent. After the 1994 crisis, the inflation rate moved to an upper plateau in the 80 percent

[13] For a more extensive discussion of the studies on inflation in Turkey see Hoon and Papi (1997) and references therein. See also Akat (2000) for an overview of the political economy of inflation in Turkey.

range. Inflation began to move towards the 60 percent range at the outset of 1998 due mainly to the fiscal retrenchment along with the sharp contraction in economic activity.[14]

Table 3. Evolution of the Inflation Rate in Selected Emerging Market Economies[a]

	1981-1990	1991-1995	1996-2000	2000	2001
Turkey	46.3	79.3	74.1	54.9	54.4
Israel	118.3	12.9	6.4	1.1	2.9
South Africa	14.7	11.3	6.5	4.5	5.7
Korea	6.4	6.2	4.0	2.3	4.1
Malaysia	3.2	4.3	3.1	1.3	1.4
Thailand	4.4	4.8	4.3	1.5	1.7
Hungary	10.9	25.4	15.1	9.7	9.2
Chile	20.4	13.9	5.2	3.8	3.6
Mexico	69.1	18.0	19.4	9.5	6.4

a: IMF WEO (2002) and the CBRT.

In an attempt to stabilize the Turkish economy plagued by the chronic high inflation and real interest rates as well as deteriorating debt dynamics, the authorities launched an exchange rate based stabilization program in January 2000. The program also included some heterodox measures in the context of public prices and new rent regulations in the housing sector in line with the targeted inflation rate with an objective to reduce consumer price inflation to 25 percent by the end of 2000.

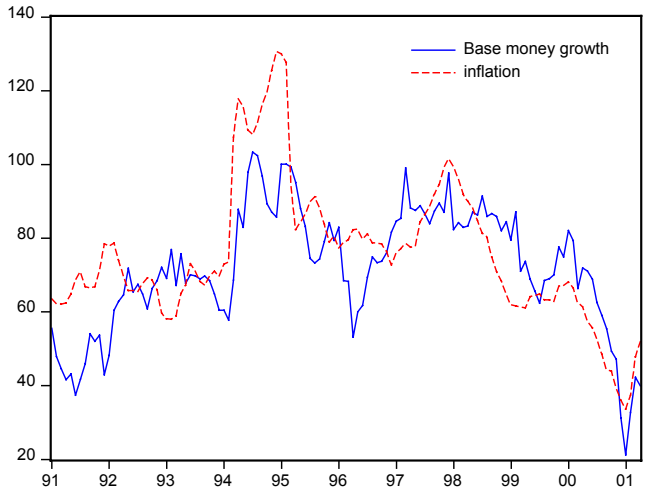
Although there was some success in reducing inflation—the CPI inflation declined to 33.4 percent on an annual basis by February 2001—weaknesses in the banking system, the severe terms of trade shock along with the deterioration of the macroeconomic vulnerabilities all contributed to the collapse of the program. As a result, a floating exchange rate regime was adopted on February 22, 2001.

In high inflationary countries like Turkey the question of why prices increase lies at the heart of the debate over which policies should be adopted to stabilize the price level. The notion that inflation is ultimately a monetary phenomenon is widely accepted. There is strong

[14] See the Inflation Report published by the Central Bank of Turkey (CBRT) in July 2000 for more on this.

evidence that in the medium and long term, there exists a very close correlation between the rate of growth of monetary aggregates and inflation, after changes in output and velocity are taken into consideration. This correlation has been corroborated both in the international[15] and Turkish experiences (Figure 12).

Figure 12
Base Money Growth and Inflation



At first blush, the above discussion might suggest that it would be relatively straightforward for the central bank to eliminate inflation in light of its influence on the behavior of monetary aggregates, the monetary base in particular. Needless to say, however, the close correlation between money and prices does not reveal anything about the direction of causality.[16]

In this respect, consistent with the experience of other countries with high-inflation episodes—i.e., Mexico and Brazil—recent empirical evidence on Turkey suggests that exogenous movements to monetary base have not been a cause of inflationary pressures in

[15] See for instance Lucas (1996).

[16] In fact, the results of Granger Causality tests show that the causality runs from prices to base money (Monetary Policy Report published by the CBRT in April 2002).

Turkey.[17] The empirical findings show that that inflationary pressures in Turkey have their origin in the following factors: (i) the presence of external shocks which engender sharp exchange rate depreciations; (ii) changes in public sector prices; and (iii) inflationary inertia.[18]

3.1 Empirical Analysis and Results

In spite of the high level of dollarization in Turkey, to the best of our knowledge, there has not been any empirical study investigating the effects of dollarization on the dynamics of inflation.[19] Evidence suggests that the presence of high dollarization could affect the inflationary dynamics through several channels. More specifically, it is argued that dollarization: (i) aggravates the resulting inflation rate for a given fiscal deficit (Nicholas 1974 and Rojas-Suarez 1992);[20] (ii) increases the volatility of inflation for a given budget deficit (McNelis and Asilis 1992); (iii) coupled with a high degree of currency substitution renders the exchange rate not only more volatile, but also more responsive to credibility issues (Akçay et. al. 1997).

It should be noted that the above highlighted channels do not suggest that dollarization is the cause of inflation. By contrast, dollarization is usually an endogenous response of economic agents to economic instability and high inflation. As a consequence, the presence of dollarization should be viewed as a channel through which fiscal and monetary policies influence the evolution of inflation.

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[17] See the Monetary Policy Report published by the CBRT in April 2002. Existing studies, see for instance, Lim and Papi (1997), Sakallıoğlu and Yeldan (1999), Özcan et. al. (2001), tend to agree upon the importance of the inertia and the exchange rate. However, there seems to be a disagreement over the importance of monetary variables.

[18] The above underscored indirect transmission channel through which shocks to exchange rates and public prices can influence inflation expectations in Turkey can be illustrated by the following example. Let us assume that the central bank faces an exogenous shock in the form of unanticipated adjustments to public sector goods prices that are not compatible with the central bank's inflation target. In turn, this will generate a higher CPI, thereby raising nominal demand for money. If the central bank increases the supply of base money to match the increase in demand, the central bank would have accommodated the rise in money demand engendered by an exogenous shock to prices caused by the increase in public prices. Under normal circumstances, this would be described as once for all adjustment in the price level, which should not create further problems for the central bank. However, given Turkey's history of high inflation, the dynamics triggered by the increase in public prices are complicated as the public might revise their inflationary expectations upwards, which would lead to increases in wages and non-tradeable goods prices, and thus bringing about inflation and monetary base growth.

[19] Selçuk (2001), Akçay et. al. (1997), and Selçuk 1997) investigated different aspects of the consequences of dollarization in Turkey.

[20] This channel becomes more prominent as the inflation rate rises since economic agents adjust their portfolio more swiftly.

This section—drawing upon the dynamics outlined in the previous section—investigates the importance of dollarization in the dynamics of inflation in Turkey.[21] To this end, we employ a vector autoregression (VAR) model that incorporates, as its endogenous variables: *CPI (P), base money (MB), exchange rate (EX), dollarization ratio (FX/M2Y) and public sector prices (PSP)*.[22]

We follow a recent paper by Peseran and Shin (1998), which proposes an alternative approach to widely used orthogonalized impulse response analysis. Unlike the traditional impulse response analysis, this approach—*referred to as generalized impulse response analysis*—does not require orthogonalization of shocks and is invariant to the ordering of the variables in the VAR. We also employ this approach to construct order-invariant forecast error variance decompositions.

More specifically, the generalized impulse responses are invariant to the re-ordering of the variables, but this is not the case with the orthogonalized ones. Typically, there are many alternative re-parameterizations that could be employed to compute orthogonalized impulse responses, and there is no clear guidance as to which one of these possible parameterizations should be used. In contrast, the generalized impulse responses are unique and fully take account of the historical patterns of correlations observed amongst the different shocks.[23]

We begin our empirical investigation by testing for the order of the VAR using several information criteria. Based on the overall results of these tests reported in Table 4, the optimal lag length was determined to be 2.

[21] It should be noted that our approach is quite similar to the one outlined in the Monetary Policy Report of the CBRT issued in April 2002 and to the ones employed for other comparable emerging market economies (see, for instance, Carstens and Werner (1999) as a reference for the Mexican experience).

[22] All data are obtained from the Central Bank of Turkey and the State Institute of Statistics.

[23] For instance, structural VAR (SVAR) approach attempts to identify the impulse responses by imposing a priori restrictions on the covariance matrix of the structural errors and the contemporaneous and/or long-run impulse responses to themselves. The restrictions include requiring certain shocks to have zero long-run impacts, or by assuming contemporaneous effects of certain other shocks to be zero on certain variables. Under this approach, it is assumed that the structural (or economic) errors are uncorrelated, which may not be reasonable in many macro-econometric applications of SVAR methodology. In addition, while this approach can be used in very small systems, the number of restrictions required grows rapidly with the number of endogenous variables in the system, making it non-feasible in larger systems.

Table 4. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	242.201205	NA	1.89E-08	-3.593958	-3.484761	-3.549585
1	1303.516111	2026.147000	2.87E-15	-19.295700	-18.640520	-19.02946
2	1371.332110	124.329300	1.50E-15*	-19.94443*	-18.74326*	-19.45633*
3	1395.634845	42.713900	1.52E-15	-19.933860	-18.186710	-19.2239
4	1420.030646	41.02930*	1.55E-15	-19.924710	-17.631570	-18.99288
5	1438.129579	29.067980	1.74E-15	-19.820150	-16.981020	-18.66646
6	1452.873953	22.563360	2.07E-15	-19.664760	-16.279650	-18.2892
7	1471.959696	27.761080	2.33E-15	-19.575150	-15.644050	-17.97773
8	1492.309845	28.058540	2.59E-15	-19.504690	-15.027620	-17.68542
9	1511.344635	24.802910	2.97E-15	-19.414310	-14.391250	-17.37317
10	1534.83607	28.83039	3.22E-15	-19.39146	-13.82241	-17.12845
11	1558.70655	27.48723	3.53E-15	-19.37434	-13.25931	-16.88947
12	1582.09375	25.15895	3.97E-15	-19.34991	-12.68889	-16.64317

Note: * 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.

The VARs are estimated using monthly data from January 1990 through December 2001. The estimated VAR coefficients are not in themselves very interesting and thus are omitted. Instead, we focus on the impulse responses and the variance decompositions.[24]

Figure 13 plots the impulse responses of CPI (P) monetary base (MB), the exchange rate (EX), public prices (PSP), and the dollarization ratio (FX/M2Y) with respect to innovations in FX/M2Y over a horizon of 36 months.[25] Standard errors are calculated by the Monte Carlo method, with 1,000 repetitions (of ± 2 standard deviations).[26]

[24] In the estimations, we included two dummy variables to account for the impact of the 1994 and 2001 crises. The VAR stability condition check suggests that the model satisfies the stability condition. Also, we included a linear time trend in the estimations. The results of this exercise suggest that the empirical findings are not sensitive to the inclusion of a linear time trend.

[25] There is an issue of whether the variables in a VAR need to be stationary. Sims (1980) and others recommend against differencing even if the variables contain unit roots. He contends that the goal of a VAR analysis is to determine the interrelationships among the variables, not to determine estimates. The main argument against differencing is that it "throws away" information concerning the co-movements in the data. Following the argument put forth above, variables are not differenced. By not imposing co-integrating relations, the estimation avoids a long-run identification problem, which may be in principle difficult to solve, with no loss of information on the long-run properties of the system, incurring some loss due to the reduced efficiency of estimation but at no cost in terms of consistency of estimators. See Sims et al. (1990) for more on this.

[26] Monte Carlo standard errors are computed as follows. At each repetition, a random sample from the asymptotic distribution of the VAR coefficients is drawn. The asymptotic distribution of the VAR coefficients is given in Hamilton (1994). From these simulated coefficients, the impulse response functions are computed. After repeating this process 1000 times, the 95% confidence interval, by the percentile method, is constructed. The standard errors reported are the standard deviations of the simulated impulse responses across 1,000 replications.

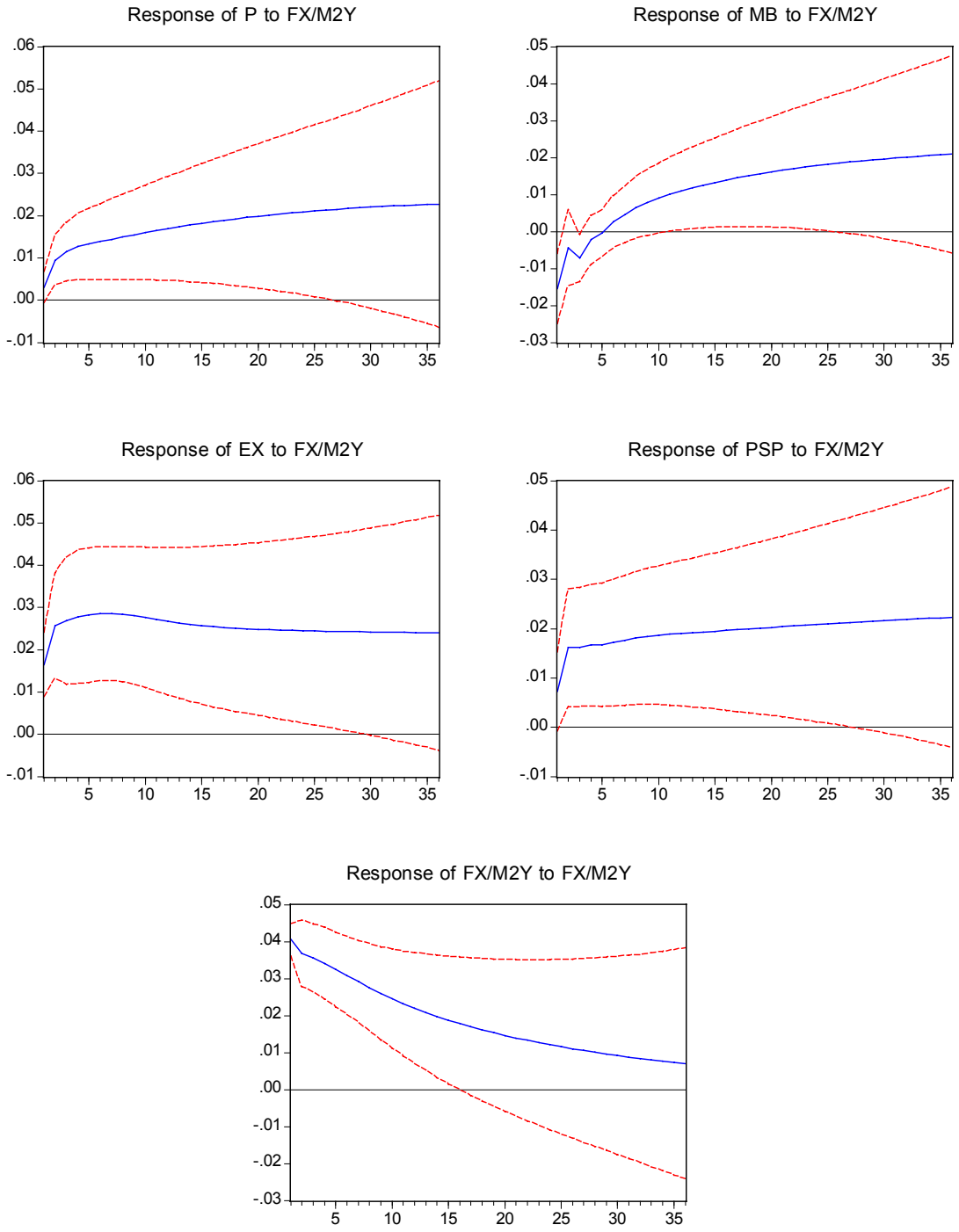
Impulse responses suggest that shocks in FX/M2Y have a positive impact on P, EX, and PSP.[27] While innovations in FX/M2Y have a negative effect on MB for the first 5 months, they affect MB positively thereafter. Shocks to dollarization ratio (FX/M2Y) have a positive and statistically significant impact on P in the first 29 months. The largest statistically significant impact on P occurs after 29 months: *a 1 percent standard deviation shock to FX/M2Y increases P by around 2 percent.*

The effect of FX/M2Y shock has the largest statistically significant impact on PSP after 17 months: *a 1 percent standard deviation shock to FX/M2Y increases PSP by around 2 percent*. After 17 months, the effect of the FX/M2Y impulse on PSP becomes statistically insignificant. Shocks to FX/M2Y have a positive and statistically significant impact on EX in the first 22 months and thereafter they are statistically insignificant. The largest statistically significant impact takes place after 7 months: *a 1 percent standard deviation shock to FX/M2Y increases EX by around 2.9 percent.*

The results also indicate that shocks to FX/M2Y have a negative and statistically significant effect on MB after 1 month and 3 months. The effect of the FX/M2Y impulse on MB turns positive and statistically significant after 8 months and remains so until 33 months, after which they become statistically insignificant. The largest statistically significant impact takes place after 33 months: *a 1 percent standard deviation shock to FX/M2Y increases MB by around 2 percent.*

[27] Since the variables are in logs, the impulse responses have the interpretation of cumulative growth rates relative to base.

Figure 13: Response to Generalized One S.D. Innovations ± 2 S.E.



The results from variance decompositions[28] suggest that, over a 36-month horizon, 38.3 percent of the forecast error variance of P can be accounted by shocks to FX/M2Y.[29]

[28] The forecast error variance decomposition indicates the proportion of the movements in a sequence due to its "own" shocks versus shocks to the other variables. The overall results of this exercise are reported in the Appendix.

FX/M2Y shocks contribute roughly 34 percent, 44 percent, and 30 percent of the forecast error variances of PSP, EX, and MB respectively over a 36-month horizon. The results also indicate that FX/M2Y explains nearly 61 percent of its forecast error variance, lending support to notion of the hysteresis also observed in other countries (Guidotti and Rodriguez 1992).

All in all, the response of the variables involved in the inflation dynamics in Turkey to shocks to FX/M2Y appears to confirm the results of the previous studies. In response to innovations in FX/M2Y, MB declines initially as the public switches from domestic to foreign money holdings. However, the monetary base increases after 5 months to generate the required inflation tax for a given budget deficit.

The increase in PSP in response to FX/M2Y shocks suggests that the fiscal authority tries to compensate part of the decline in inflation tax through raising administered prices. As expected, the exchange rate responds positively to shocks to dollarization owing to high elasticity of substitution—a finding in line with the previous studies (Selçuk 1997 and Akçay et. al. 1997).

4. Conclusion

This paper aimed to accomplish two goals. First, it intended to provide a brief description of the main macroeconomic and institutional factors affecting the evolution of the dollarization process in Turkey. Second, it aimed to empirically investigate the importance of dollarization in the dynamics of inflation.

The results from the descriptive analysis suggest that, in addition to high inflation and economic instability, institutional factors also played an important role in the evolution of dollarization in Turkey. More specifically, the liberalization of the financial system and the

[29] The findings also suggest that P explains over 60 percent of its forecast error variance—a finding highlighting the importance of the inertia in inflation.

emergence of new financial instruments as well as capital account liberalization contributed to the upward trend in foreign currency deposits since the mid-1980s. In addition, policy decisions pertaining to reserve requirements, withholding tax rates, and resource utilization deductions appear to have played some role in affecting the dollarization process.

In an attempt to empirically investigate the importance of dollarization in the dynamics of inflation in Turkey, the paper employed a recent technique introduced by Peseran and Shin (1998), referred to as *generalized impulse response analysis.* Unlike the traditional impulse response analysis, this approach does not require orthogonalization of shocks and is invariant to the ordering of the variables in the vector autoregression (VAR).

The empirical results underscore the importance of dollarization in the dynamics of inflation in Turkey. The findings are consistent with the view that shocks to dollarization lead to an increase in the monetary base to produce the required inflation tax for a given budget deficit. Moreover, the results imply that the decline in inflation tax, which occurs as the public switches from domestic to foreign money holdings, is in part compensated by increases in administered prices. In line with the results of the previous studies, the findings also highlight that the exchange rate responds positively to dollarization shocks owing to the high elasticity of substitution.

The fact that an increase in dollarization affects the evolution of inflation adversely suggests that the decline in dollarization would have a favorable impact on the dynamics of inflation. In light of the experience of other countries with dollarization, however, it is clear that this general policy implication does not translate into simple policy prescriptions. Evidence suggests that dollarization displays irreversibility (hysteresis), i.e. dollarization ratios do not decline even after the local currencies have been successfully stabilized and financial markets have deepened due to switching costs and long-lasting memories.[30] In

[30] See Broda and Levy-Yeyati (2001), Guidotti and Rodriguez (1992), Dornbusch and Reynoso (1989), and Dornbusch et. al. (1990) for more on this.

addition, it is argued that hysteresis can take place even when the memory of past macroeconomic imbalances diminishes, if the expected volatility of inflation remains high in relation to that of the real exchange rate.[31]

In this regard, inflation targeting emerges as an interesting policy option. This policy framework could be considered to limit dollarization since it would amount to a higher exchange rate volatility relative to price volatility.[32] Indeed, evidence suggests that inflation-targeting countries experienced a decline in the pass-through from the exchange rate to prices.[33] This, in turn, implies that there may be scope for increasing the volatility of the real exchange rate without raising that of inflation, which could render inflation targeting as a promising policy framework for limiting dollarization. This proposition, in turn, calls for a comparative investigation of the experiences of inflation targeters and non-inflation targeters with dollarization.

[31] See, for instance, Ize and Levy Yeyati (1998).

[32] Ize and Levy Yeyati (1998), drawing upon minimum variance portfolio equlibria, shows that for a given variance of inflation, an increase in the variance of the rate of depreciation reduces dollarization since it limits the hedging benefits of dollar assets.

[33] See Corbo et. al. (2001) for an assessment of inflation targeting.

Appendix: Generalized Forecast Error Variance Decompositions

Table A1: Percentage of the Variance of Prices Explained by

Months	Prices	Base Money	Exchange Rate	Public Prices	FX/M2Y
6	0.7628	0.0282	0.5743	0.3255	0.1643
12	0.7068	0.0309	0.5610	0.2801	0.2207
24	0.6591	0.0299	0.5050	0.2718	0.3180
36	0.6213	0.0274	0.4599	0.2877	0.3884

Table A2: Percentage of the Variance of Base Money Explained by

Months	Prices	Base Money	Exchange Rate	Public Prices	FX/M2Y
6	0.1872	0.7728	0.1332	0.1383	0.0667
12	0.4274	0.4573	0.2997	0.1786	0.0955
24	0.5381	0.2431	0.3832	0.1958	0.2008
36	0.5529	0.1694	0.3859	0.2243	0.2942

Table A3: Percentage of the Variance of Exchange Rate Explained by

Months	Prices	Base Money	Exchange Rate	Public Prices	FX/M2Y
6	0.2319	0.0016	0.8431	0.1481	0.2472
12	0.3151	0.0013	0.7803	0.1674	0.3132
24	0.3756	0.0038	0.6788	0.2112	0.3920
36	0.3962	0.0058	0.6046	0.2449	0.4361

Table A4: Percentage of the Variance of Public Prices Explained by

Months	Prices	Base Money	Exchange Rate	Public Prices	FX/M2Y
6	0.3857	0.0051	0.8385	0.6819	0.1432
12	0.4522	0.0045	0.8516	0.5919	0.1961
24	0.5115	0.0080	0.7691	0.5021	0.2773
36	0.5244	0.0108	0.6819	0.4606	0.3406

Table A5: Percentage of the Variance of FX/M2Y Explained by

Months	Prices	Base Money	Exchange Rate	Public Prices	FX/M2Y
6	0.0231	0.0543	0.1026	0.0342	0.9456
12	0.0165	0.0392	0.0625	0.0636	0.8062
24	0.0108	0.0284	0.0409	0.1013	0.6505
36	0.0097	0.0260	0.0363	0.1198	0.6081

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