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Dedollarization in Turkey after decades of dollarization: A myth or reality?

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Abstract

The paper analyzes dollarization in the Turkish economy given the evidence on dedollarization signals. On conducting a Vector Autoregression (VAR) model, the empirical evidence suggests that dollarization has mostly been shaped by macroeconomic imbalances as measured by exchange rate depreciation volatility, inflation volatility and expectations. Furthermore, the generalized impulse response function (IRF) analysis, in addition to the analysis of variance decomposition (VDC) gives support to the notion that dollarization seems to sustain its persistent nature, thus hysteresis still prevails. Hence, unfavorable macroeconomic conditions apparently contribute to dollarization while dollarization itself contains inertia. Furthermore, dedollarization that presumably started after 2001 has lost headway after May 2006. Thus, it seems too early to conclude that dollarization changed its route to dedollarization.

Keywords: Dollarization; VAR; Impulse response; Variance decomposition; Hysteresis; Dedollarization

1. Introduction

Dollarization, since the early 1970s, has been a topic of special interest in the context of developing countries, especially in emerging market economies (EMs). During periods of macroeconomic and political uncertainty, many developing countries experienced a partial replacement of their domestic currencies by a foreign currency either as a store of value, unit of account, or as a medium of exchange.

Dollarization has been analyzed extensively in the previous literature. The earlier works on dollarization demonstrate that dollarization occurs as a result of various factors depending on the structure of the economy. In developed economies, like USA and Canada, dollarization is seen as a counterpart to heavy cross-border trade whereas in Latin American countries, dollarization is usually perceived as a *hedging* strategy against high inflation.

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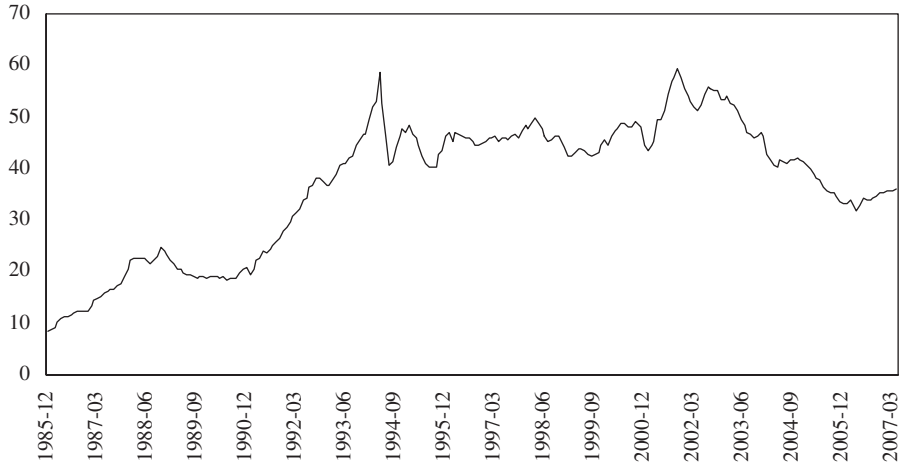

Fig. 1. Dollarization trend in the Turkish economy.

Turkish economy has been experiencing dollarization since the introduction of foreign currency deposits in December 1983. High and volatile rates of inflation, depreciating exchange rate in addition to unsuccessful stabilization efforts, financial crises, and underdeveloped capital markets played a key role in the rising dollarization ratios (Fig. 1).

There are now several studies on the issue of dollarization in the Turkish economy.[2] While some of these studies focus on analyzing the determinants of dollarization [1–5]; others inquire about the *hysteresis* nature of dollarization (ratchet effect), i.e. whether dollarization ratios have reached an *irreversible* stage or not [6,7]. In view of the ample evidence that infer the irreversibility of dollarization due to heavy switching costs, it is thus concluded that dollarization ratios might not decline even after local currency is successfully stabilized. Yet, these studies, which analyze the ratchet effect on dollarization in the Turkish case, confer that, despite high dollarization rate in the Turkish economy, there is still a room for the monetary policy to be effective.

Another line of research on dollarization issue in Turkey shows that dollarization reduces the *seigniorage* and results in higher and more volatile inflation than which is otherwise implied for a given level of budget deficit [8–10]. Consequently, the decline in seigniorage that occurs as the public switches from domestic to foreign money holdings is partially compensated through increases in administered prices, which are translated into higher inflation.

Inspired by the press releases[3] of the Central Bank of the Republic of Turkey (CBRT) declaring conditions of so-called *reverse currency substitution*[4] that justify the enormous reserve buildup despite conducting free float, the recent trend in studying dollarization issue in the Turkish economy has now shifted towards analyzing *dedollarization*—a reversal in the dollarization trend. Coincidentally, dedollarization is also in the agenda of other researchers around the globe. Apparently, dedollarization is perceived as an endogenous outcome of a persistent process of disinflation and stabilization [11]. Furthermore, seminal works such as Ize

[2]Ref. [43] provides an extensive survey on the previous studies on dollarization in the Turkish economy.

[3]Ref. [44] states that conditions of reverse currency substitution warranted foreign exchange intervention on May 11, 2004. Likewise, Ref. [45] also stated the same condition on account for foreign exchange intervention on December 2, 2002. Finally, Ref. [46], dated May 5, 2003 clearly explains the conditions of reverse currency substitution that mitigates buying auctions for foreign exchange.

[4]CBRT officials heavily used ''reverse currency substitution'' terminology in view of the decline in foreign currency denominated assets with respect to M2Y. However, the term is obviously a misnomer. Currency substitution is the situation where foreign currency replaces domestic currency at various extents. However, by naming currency substitution as ''reverse'' it then implies the replacement of foreign currency by domestic currency, which on the other hand does not call for a new terminology. Instead, a more appropriate term would have been ''reversal in the currency substitution'' or ''reversed'' currency substitution in order to describe the situation where people switch their money holding preferences towards domestic money from foreign money. As it happens, reverse currency substitution term was not used widely in the literature, but instead, ''dedollarization'' was prevalently preferred. Thanks to the prefix, the ambiguity was resolved.

and Levy-Yeyati [12,13], Levy-Yeyati [14], and others that follow such as Barajas and Morales [15], Morón and Castro [16], and Ize [17] point out the need for designing policies to fight actively against dollarization, thus finding a way out to dedollarization.

Initial attempts to study dedollarization in Turkey are by Yılmaz [18] and Akıncı and Görmez [19] where the former concentrates on financial dollarization whereas the latter focuses on asset dollarization. Yet, these studies leave a gap for further research by not presenting econometric evidence on the existence and/or sustainability of dedollarization.

Turkey, on the other hand, has been implementing full-fledged inflation targeting (IT) with a commitment to achieve low inflation targets compatible with a sustainable economic growth scheme while also opting for European union (EU) membership and hence European Monetary Union (EMU) membership. Even though, conducting IT is expected to contribute to dedollarization,[5] a likely EMU membership in the future has the potential to exacerbate motives to hold foreign currency from now.[6]

Furthermore, Turkey is frequently exposed to internal risks such as herd investor sentiment, unfavorable risk perceptions about EU accession, delays in structural reforms, banking sector restructuring, and fiscal dominance [20]. Lately, Turkey has also been exposed to external risks such as rising oil and commodity prices, rising global inflation, slower worldwide economic growth, and increased policy rates in the developed economies, which are thus likely to affect capital flow to EMs as well as Turkey. Clearly, these risk factors are likely to affect the course of dollarization.

Among these risk factors, the most relevant one for Turkey is the prospect of decreased capital flow in the face of global liquidity changing its route to developed economies. Turkey on the other hand has largely benefited from favorable global liquidity conditions during 2002–2005. More specifically, during the 2002–2005 period, Turkey experienced high economic growth as well as low levels of inflation rate within "implicit" IT framework designed under IMF conditionality. Furthermore, during this period, both inflation and the primary surplus targets were met which brought confidence.

In the meantime, significant progress was achieved on the EU front such that in December 2004, the European Council declared that Turkey made impressive progress in respecting the political criteria, enough for negotiations on EU membership to start as of October 2005. Hence, the higher confidence and the favorable global liquidity conditions in addition to the IMF anchor as well as the progress on Turkey–EU relations led to massive capital inflow. Capital inflow appreciated the Turkish lira and the stronger lira further helped the disinflation process. The stronger lira also led to a fall in the dollarization ratio and hence, starting from 2002, dollarization ratio—the ratio of foreign exchange denominated deposits to broad money M2Y has declined from as high as 60% to 32% in May 2006. However, the turbulences in May 2006 led dollarization ratio to increase again and as of April 2007, dollarization has reached 37% (Fig. 1).

However, the decline in dollarization is by no means an indication of a further decrease in dollarization. More specifically, decreasing dollarization is an unconvincing evidence for dedollarization and/or sustainability of dedollarization. To give an example, Reinhart et al. [21] report that in 20 developing countries that experienced a significant drop in their dollarized portion of their deposits during 1980–2001, 16 countries experienced rebounds. Furthermore, Galindo and Leiderman [11] define deollarization as a situation in which dollarized bank deposits or loans exceeding 40% are reduced to less than 20% for a period of at least 5 years. Obviously, Turkey does not qualify to be considered as a *dedollarized* economy by these standards.

Furthermore, Turkey encounters a number of policy challenges confronting its monetary authorities in the complex process of preparations for accession to the EU and later to the EMU. As mentioned in Orlowski [22], the fundamental task for the EU/EMU candidates is to gain sustainable stability of their financial systems and, at the same time, to achieve monetary credibility that would guarantee their smooth integration

[5]Ize and Levy-Yeyati [13] and Morón and Castro [16] discuss that the combination of inflation targeting (to the extent that it reduces inflation volatility) with a floating exchange rate (to the extent that it increases real exchange rate depreciation volatility) should foster the use of local currency and discourage the use of foreign currency, since it reduces the risk associated with the former and increases that associated with the latter.

[6]Coricelli [47], Orlowski [22], and Nuti [48] discuss that countries of central Eastern Europe which are candidates for accession to EU face fundamental challenges in the conduct of their monetary policies. More specifically, these countries are characterized by growth rates higher than those of the EU member states along with large current account deficits and an appreciation of the real exchange rate. In such a context, the authors recommend early adoption of the euro.

to the European economy. Therefore, the candidates need to complete disinflation and lay ground for stable financial systems that would not be jeopardized by the ongoing, dramatic structural changes in their economies. Apparently, this has to be accomplished in the presence of the Harrod–Balassa–Samuelson effect[7] contributing to inflation and in the face of possible destabilizing effects of large capital inflows. Apparently, these challenges pose threat to the dedollarization process. Under these circumstances, dollarization/dedollarization remains as a crucial topic to be investigated.

Hence, the aim of this paper is to investigate this topic in the light of this background on the Turkish economy. In inquiring about the existence of dedollarization in the Turkish economy, the paper will utilize an econometric framework based on a theoretical portfolio model. The organization of the paper is as follows: the next section will provide a survey on dollarization en route dedollarization. The following section will discuss country experiences in dedollarization. Consequently, the following section will present empirical evidence on dollarization versus dedollarization debate. Finally, the last section will conclude this paper.

2. A survey on dollarization en route dedollarization

In a typically dollarized economy, dollarization traditionally had implications on the stability of money by causing the monetary policy to be less effective and more complex [21]. In other words, dollarization was considered to be an obstacle that challenged the pursuit of a coherent and independent monetary policy.[8] Even though some dollarization may be warranted as a hedging strategy against exchange rate risk, the widespread view asserts that dollarization exposes the country to currency imbalances, also leading to volatility in the real exchange rate and adverse wealth effects. Hence, these adverse wealth effects consequently limit the effectiveness of monetary policy [23,24].

On account of the limited effectiveness of monetary policy due to dollarization, monetary authorities are less willing to let the exchange rate respond, more willing to increase reserves, and aggressively intervene in the foreign exchange market or adjust short-term interest rates [25]. Volatile interest rates increase the uncertainty and thus the default risk by also lowering credit ratings. Dollarization consequently leads to decreased economic stability, more volatile capital flows and more costly borrowing [26].

In view of these handicaps of dollarization, and due to the fear of floating,[9] a line of research concentrated on the choice of right exchange rate regimes that would insulate an economy from financial crises. In view of the evidence against fixed or "pegged" exchange rate regimes that led to financial crises in Mexico at the end of 1994, Thailand, Indonesia, and Korea in 1997, Russia and Brazil in 1998, Argentina and Turkey in 2000 and 2001; and the fact that EMs without pegged rates, including South Africa, Israel, Mexico, and Turkey have been able to avoid such crises in 1998, many countries have changed their exchange rate regimes during the past decade, moving from crisis-prone "soft pegs"—conventional pegs at adjustable rates—to either "hard pegs"—unconventional pegs with a commitment to never change the par value[10]—or floating regimes. The

[7]The Harrod–Balassa–Samuelson effect is the situation where increasing economic openness induces productivity improvements in the tradable goods sector compared with non-tradable goods sector, leading to rising relative prices of non-tradable goods and ultimately contributing to higher domestic inflation [49–51].

[8]This paper, rather than presenting a comprehensive survey on dollarization, prefers to provide a perspective on how studies on dollarization evolved over time to cover dedollarization issues. Yet, seminal works on currency substitution should not be overlooked. These works include Miles [52], Bordo and Choudri [53], Girton and Roper [54], Ortiz [55], Canzoneri and Diba [56], Thomas [57], Artis [58], Giovannini [59], Giovannini and Turtelboom [60], Guidotti [61], Krueger and Ha [62], McKinnon [63,64], and Calvo and Végh [65,66].

[9]Calvo and Reinhart [67] argue that due to liability dollarization, emerging markets avoid free float; thus, these countries are subject to "fear of floating."

[10]A formal definition of hard peg may be provided as "a pegged exchange rate with a credible commitment never to change the par value, thus subordinating monetary policy to the needs of the exchange market and denying access to devaluation as a policy tool." This definition is borrowed from Alan V. Deardorff, Professor of International Economics at the University of Michigan Ann Arbor, who supplies an extensive international economics glossary, which is available in Ref. [68].

belief that intermediate regimes between hard pegs and free float are unsustainable is known as the "bipolar" view, or two-corner solution [27].[11,12]

The bipolar view led to another line of research that concentrated on the proposal that EMs should completely give up their currencies and adopt an advanced nation's currency as the legal tender [28,29]. This proposal, labeled as "official dollarization,[13]" which is a form[14] of hard peg, was presented as the ultimate way for achieving credibility,[15] growth, and prosperity such that countries that render their currencies would not be exposed to macroeconomic mismanagement.

Even though official dollarization eliminates all scope for an independent monetary policy and also limits the capacity of the domestic monetary authorities to provide the lender-of-last-resort services, it would eliminate the currency mismatch that are particular threats to financial stability. Hence, official dollarization is likely to increase country's access to international capital markets at more favorable terms, thus decreasing both the level and the volatility of the interest rates [30]. Thus, official dollarization would therefore imply higher investment and superior economic performance [31,32].

As opposed to the arguments for official dollarization by the descendents of the view that dollarization would impede the effectiveness of the monetary policy, the center of the debate on dollarization appears to be shifting from a generally passive stance—"learning-to-live-with-it" type of approach, focused on the overall strengthening of prudential norms or the conduct of monetary policy in both currencies—to a more proactive agenda, oriented to control the incentives that favor dollarization and to foster the development of alternative local currency intermediation.

Proactive measures to combat dollarization and hence its persistence are proposed by Levy-Yeyati [14]. The author suggests that any potential scheme for dedollarization should entail a reward and punishment mechanism, carrot-and-stick-approach, increasing the cost of dollar intermediation while expanding the menu of local currency instruments and enhancing their attractiveness. Thus, the author proposes a two-tail approach where prudential regulation should also be revised to address ex-ante the externalities associated with financial dollarization.

The author also adds that any successful dedollarization strategy should be accompanied by sound monetary policies as in Chile and in Israel. Furthermore, the other examples of dedollarization attempts, namely Argentina, Peru, and Uruguay demonstrate that not only sound policies but also a proactive agenda with specific measures aimed at justifying the presence of externalities and enhancing the attractiveness of local currency assets is needed to complement conducive macropolicies.

3. Dedollarization experiences: some selected countries

After reviewing the recent literature on dollarization on the road to dedollarization, this section will discuss cases of dedollarization attempts. Reinhart et al. [21] assert that only a few governments managed to

[11]Corner solution argument is also favored by Tavlas [72]. The author discusses that recent crises experiences imply that even the countries with seemingly sound economic fundamentals are prone to be adversely affected by a currency crisis except for Australia and Hong Kong under floating exchange rate and currency board, respectively. Hence, the author concludes that for a small open economy to be immune from currency collapse, a sound economic policy should be augmented by a corner solution.

[12]An extension to the corner solution argument is brought by Refs. [69–74] which favor monetary union—a form of hard peg. The authors discuss that the experiences of EMU countries provide evidence in favor of the corner solution hypothesis. However, Dellas and Tavlas [74] also state that official dollarization in the Latin American countries is not a feasible option due to the associated potential political costs. Instead, the authors suggest the use of currency board or floating exchange rate accompanied by stronger measures to warrant central bank independence.

[13]As the discussion of the previous section clearly outlines, the term dollarization is used in the context of "official" dollarization by some researchers. However, in the context of the paper, the term dollarization is used to imply *de facto* dollarization (unofficial dollarization) which results from individuals and firms voluntarily choosing to use foreign currency as either a transaction substitute (currency substitution) or a store of value substitute (asset substitution) for the monetary services of domestic currency [75,76].

[14]Another form of a hard peg is a currency board where management of both the exchange rate and the money supply are taken away from the central bank and given to an agency with instructions to back every unit of circulating domestic currency with a specified amount of foreign currency. Examples of hard pegs in practice are Gold Standard, EMU, Ecuador's dollarization, Argentina's convertibility, and the real plan in Brazil [77].

[15]The credibility hypothesis states that the use of exchange rate as a nominal anchor disciplines both the policymakers and private agents [72].

dedollarize their locally issued foreign currency obligations either by amortizing the outstanding debt stock at the original terms and discontinuing the issuance of those securities, or by changing the currency denomination of the debt. As an example to the first strategy, the authors consider Mexico's decision in 1994 crisis to redeem all the dollar denominated *Tesobonos* outstanding and to cease issuing foreign currency denominated bonds thereafter. Argentina's decision in late 2001 to convert the dollar denominated government bonds to domestic currency is a recent example of the second strategy.

Furthermore, the authors also identify cases of large and lasting reversal of deposit dollarization. Accordingly, the authors search for episodes where the ratio of foreign currency deposits to broad money satisfied the following conditions: (i) experienced a decline of at least 20% points; (ii) settled at a level below 20% immediately following the decline; and (iii) remained below 20% until the end of the sample period. Consequently, only 4 of the 85 countries, namely, Israel, Mexico, Pakistan, and Poland met these during the period 1980–2001. In 16 countries, the ratio of foreign currency deposits to broad money declined by more than 20% points during the same period. However, in some of these countries, like in Bulgaria and Lebanon, the deposit dollarization ratio settled at a level considerably higher than 20% following the decline. Furthermore, in 12 out of 16 countries, dollarization ratio fell below the 20% mark initially, but rebounded and increased even further. This pattern was particularly common among the Transition Economies in late 1990s (e.g., Azerbaijan, Belarus, Lithuania, and Russia), but was also prevalent in other countries and periods, like in Bolivia and Peru in the early 1980s, and Egypt in the mid-1990s.

In 3 of the 4 cases that met the above conditions for a large and lasting decline in deposit dollarization, the reversal started as soon as the authorities imposed restrictions on the convertibility of dollar deposits. For example, in 1985, Israeli authorities discouraged opening foreign currency accounts by introducing a 1-year mandatory holding period for all dollarized deposits. In 1982, Mexican government forcedly converted the dollarized deposits to domestic currency at a relatively less favorable rate than was otherwise offered by the market. Pakistani authorities implemented a similar policy in 1998. However, even though Bolivia and Peru adopted similar measures to those of Mexico and Pakistan in the early 1980s, due to extreme macroeconomic instability, both countries had to eventually re-allow holding foreign currency deposits.

Furthermore, even in countries where the restrictions on dollar-denominated deposits have led to a lasting decline in deposit dollarization, these countries had to incur significant costs of *forced* dedollarization. To give an example, forced dedollarization led to doubling in capital flight in Mexico while also leading to a considerable fall in bank credits to the private sector and a poor performance in inflation and growth.[16] The authors conclude that only Israel and Poland appear to be countries with an experience of large and lasting reversals of deposit dollarization, yet at a minimal cost in financial intermediation and/or capital flight as the dedollarization strategy was accompanied by a successful disinflation program based around a strong exchange rate anchor and attractive offers of financial assets with alternative forms of indexation, like in Israel, or very favorable returns, like in Poland, were also included.

Galindo and Leiderman [11] also analyze dedollarization attempts by conducting a survey among central banks of Latin American countries and find that in countries like Argentina, Brazil, Uruguay, Chile, Colombia, Cost Rica, Mexico, Paraguay, Peru, and Venezuela, developing consumer price index (CPI) indexed domestic financial instruments could be a useful policy at a time of high and volatile inflation. The authors also find that the current trend is to develop and deepen the market for non-indexed domestic financial assets, like in Chile and in Peru. Hence, the study concludes that developing these markets is a sounder strategy than CPI indexation from the perspective of successfully dedollarizing the economy.

Morón and Castro [16] discuss the dedollarization experience of Peru. The authors remind that the detrimental effects of financial dollarization are mostly experienced through balance sheet effects, which amplify the impact of adverse external shocks on real variables. Hence, they search for drivers in dollarization, more specifically, the relation between deposit dollarization and loan dollarization.[17] Empirical results suggest

[16]Dornbusch et al. [78] provide a thorough survey on the transmission mechanism explaining how the forced dedollarization led to capital flight. Furthermore, Fernandez-Arias [79] shows that in a theoretical restricted portfolio model, a ban on onshore dollarization leads to some dedollarization, but part of the onshore dollars find their way into increased offshorization. More specifically, banned onshore dollarization leads to sizable offshore deposits but, overall, bank dollarization becomes lower.

[17]Metin-Özcan and Us [80] provide a detailed survey on dollarization terminology. Accordingly, financial dollarization is the dollarization of assets and liabilities in an economy; asset dollarization is the dollarization of assets, and clearly, liability dollarization is

that the causality runs from deposit to loan dollarization, which is in accordance with the intuition that supply considerations dominate if banks are to keep their balance sheets matched. However, the authors find that a regulatory framework that is based on encouraging depositors toward the use of local currency denominated assets may also lead to capital flight. On the other hand, policy recipes in the form of reducing relative volatility of inflation to real depreciation should help discourage depositors to switch to local currency assets. Thus, IT regime is recommended as a useful strategy to combat dollarization.

The experience of Uruguay in dedollarization is discussed in Licandro and Licandro [33] where the authors propose a policy approach based on two foundations: development of markets in national currency to generate a credible alternative to foreign currency and strengthening of the safety net through the regulatory recognition of non-marketable risks. The study underlines the fact that a cooperative action among agencies, which in the case of Uruguay are bank regulator, the pension funds regulator, the insurance companies regulator, and the stock market regulator in addition to the central bank, is essential.

Finally, in another paper by Herrera and Valdés [34], the dedollarization experience of Chile is discussed. As stated by the authors, even though Chilean experience with dedollarization is a success, it cannot be generalized to other countries since many policies that Chile pursued cannot be easily implemented elsewhere. More specifically, some key characteristics of the Chilean dedollarization process have been mostly related to its initial institutional conditions and developments, and some others are connected to specific regulations inherent in Chile. Yet, it should also be underlined that dedollarization in Chile has been a success due to prudent fiscal policy, private and fully funded pension system, and strict capital controls.

4. Empirical analysis

After discussing the country experiences in dedollarization, this section will introduce the econometric model. The empirical analysis in this paper is based on the portfolio approach introduced by Ize and Levy-Yeyati [13]. In view of the fact that dollarization remained high in Latin American countries despite significant stabilization in inflation as well as in other macroeconomic indicators, Ize and Levy-Yeyati [13] used portfolio model to explain such observed hysteresis. The authors argued that domestic residents prefer to denominate contracts in foreign currency when its purchasing power in terms of domestic consumption is stable relative to that of domestic currency. In this setup, expected real exchange rate depreciation volatility relative to inflation volatility is the relevant driving force of dollarization. The authors find that in several of the dollarized South American countries, real exchange rate depreciation volatility has declined as much as or more than inflation volatility. Moreover, they argue that real exchange rate depreciation volatility is anchored by a long-term purchasing power condition, while future inflation is uncertain despite current low levels of inflation.

In the light of the above discussion and the previous work on the analysis of dollarization dynamics in Turkey, one can investigate whether the dollarization process in Turkey is driven by uncertainty in macroeconomic fundamentals. Due to high inflation for more than three decades as well as the boom–bust cycle pattern, Turkish economy has been exposed to high volatility as well ([35,36]). Volatility may thus lead to uncertainty where agents may resort to foreign exchange for hedging purposes as discussed in the earlier sections. Thus, portfolio approach can be adopted in the Turkish case.

4.1. Methodology and searching for appropriate variables

In view of the portfolio approach as well as the volatile character of the economy as mentioned above, the paper will thus model dollarization in relation to volatility. In order to capture volatility in the economy, the paper models output growth volatility, inflation volatility and exchange rate depreciation volatility. Volatility is usually calculated by measuring variance or coefficient of variation. Yet, these calculations do not model the volatility but only provide numerical figures. On the other hand, autoregressive conditional heteroskedasticity (ARCH) models are specifically designed to model and forecast time-varying conditional

(*footnote continued*)
the dollarization of liabilities. A further classification can be made as dollarization of deposits—*referred to as deposit dollarization*—and dollarization of loans—*referred to as loan dollarization.*

Table 1
Unit Root Tests[a]

Variables	Level		
	No intercept	Intercept	Trend and intercept
Dollarization ratio	1.185	−3.474[b]	−2.114
Output growth volatility	−9.211[b]	−9.415[b]	−9.403[b]
Inflation volatility	−0.845	−7.195[c]	−7.320[c]
Exchange rate depreciation volatility	−6.266[b]	−6.272[b]	−6.840[b]
Expected depreciation	−2.573[b]	−6.225[b]	−6.647[b]

[a]Lag length automatically chosen according to Akaike Information Criterion (AIC).
[b]Significant at 1%.
[c]Significant at 10%.

variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent, or exogenous variables. ARCH models were introduced by Engle [37] and generalized as GARCH by Bollerslev [38] and Taylor [39].

Given this brief background on GARCH models, output growth volatility is modeled using the logarithmic difference of the private manufacturing index[18] and some seasonal dummies and it is assumed to follow the GARCH(1,1) process. Similarly, exchange rate depreciation volatility is assumed to follow the GARCH(1,1) process and it is modeled using the logarithmic difference of the spot rate for USD/TRY and a crisis dummy in 1994. Finally, inflation volatility is GARCH (1,1) modeled using the logarithmic difference of the CPI, some seasonal dummies, and a crisis dummy for 1994.

In empirical dollarization models, it is a common practice to include expected depreciation as an explanatory term [40]. Even though, expected depreciation series can be obtained using the Expectations Survey of the CBRT, this series is only available after August 2001 onwards when the CBRT started to conduct this survey. Thus, in order to measure expected depreciation, the paper imposes the restriction that forward transactions of the agents reflect their expectations of the future, thus, it is assumed that forward exchange rate is equal to expected exchange rate. However, forward rate for USD/TRY do not exist as well.

Forward rate can be measured using the Covered Interest Parity condition (also called the Interest Parity condition). Covered Interest Parity can be expressed as

$$f_t = s_t(1 + i)/(1 + i^*),$$

where f_t is the forward exchange rate and s_t the spot exchange rate; i shows the domestic interest rate and i^*represents the foreign interest rate. In order to calculate the forward rate, thus the next month's expected rate for USD/TRY, the paper uses 30-day Eurodollar rate to denote i^* and 1-month time deposit rate for TRY. Apparently, the spot rate for USD/TRY is readily available. Trivially, one can calculate f_t as a proxy for the next month's expected rate for USD/TRY. Finally, dollarization is measured as the ratio of foreign exchange denominated deposits to broad money, M2Y.[19]

4.2. Data source

Our data set covers the period 1985:12–2007:04. The frequency of the data is monthly and data source is publicly available through the CBRT electronic data dissemination system at http://tcmbf40.gov.tr/cbt.html [82]; 30-day Eurodollar rate is available in Ref. [41]. All the series are stationary (Table 1).

[18]Us and Metin-Özcan [81] discuss that due to the unavailability of Turkish Gross Domestic Product (GDP) data at monthly frequency, private manufacturing index can be a proxy.
[19]Dollarization measure in the empirical analysis refers to deposit dollarization of the non-banking sector.

Table 2
p-Values for the Granger Causality Tests[a]

Null hypothesis	Lags									
	1	2	3	4	5	6	7	8	9	10
Expdep → Dolrat	0.12357	0.16420	**0.02399**	**0.00782**	**0.00307**	**0.00986**	**0.01841**	**0.03019**	**0.03438**	**0.03965**
Dolrat → Expdep	0.89946	0.30932	0.16568	**0.05114**	**0.06558**	**0.08154**	0.13830	0.16864	0.23060	0.26335
Exchvol → Dolrat	**1.9E−05**	**0.02642**	**0.05274**	0.13402	0.20358	0.21681	0.26516	0.33516	0.38289	0.28500
Dolrat → Exchvol	0.70272	0.45889	0.24567	0.28156	0.40119	0.41225	0.36077	0.36858	0.47834	0.37847
Infvol → Dolrat	**1.7E−05**	**0.00449**	**0.00397**	**0.01083**	**0.01320**	**0.00030**	**0.00064**	**0.00139**	**0.00092**	**0.00095**
Dolrat → Infvol	0.12571	**0.00349**	**0.00296**	**0.00447**	**0.00095**	**0.00995**	**0.03832**	**0.01134**	**0.01625**	**0.02036**
Outputvol → Dolrat	0.55228	0.42797	0.65111	0.44325	0.57035	0.76405	0.62541	0.69103	0.65538	0.74886
Dolrat → Outputvol	0.78558	0.15898	0.36872	0.31453	0.46093	0.50999	0.38255	0.35706	0.36256	0.41427

[a]A low *p*-value enables one to reject the null hypothesis that the variable *x* does not Granger cause the variable *y*. Bold figures denote *p*-values which are less than 10%.

4.2.1. *Vector Autoregression modeling*

We will proceed by Vector Autoregression (VAR) modeling in order to grasp whether the dollarization process in Turkey has been driven by inflation volatility, output growth volatility, exchange rate depreciation volatility, or expectations of a depreciating TRY. In doing so, VAR model is a useful tool since it is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. Furthermore, VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system.

Before proceeding with the VAR analysis, however, we will analyze the Granger causality between dollarization and inflation volatility, output growth volatility, exchange rate depreciation volatility, and expected depreciation. These variables are denoted by *dolrat*, *infvol*, *outputvol*, *exchvol* and *expdep,* respectively. The pair-wise Granger causality test results suggest that causality is two-way between dollarization and inflation volatility, exchange rate depreciation volatility, and expected depreciation whereas there exists no Granger causality between dollarization and output growth volatility (Table 2).

In the light of the information extracted from the Granger causality tests, output growth volatility is not expected to contribute to modeling dollarization and hence it should be dropped out from analysis ahead. Therefore, our VAR model will include dollarization ratio, inflation volatility, exchange rate depreciation volatility, and expected depreciation as the endogenous terms. The model also includes two exogenous variables (a constant and a dummy for the crisis in 1994). The lag order of the VAR is chosen according to AIC. Accordingly, AIC shows the optimal lag length to be 3 months. The output of the model is provided in Table 1 in the Appendix.[20]

In a VAR model, two useful tools are the analysis of impulse response functions (IRF) and the variance decompositions (VDC), where the former shows the response of one of the endogenous variables to a one-unit shock in one of the variables in the model, and the latter shows the percentage of the expected *k*-step ahead squared prediction of a variable induced by innovations in another variable. However, in a VDC or IRF analysis, one should be cautious about the ordering of the variables. More specifically, the variable, based on the pair-wise Granger causality test that is found to be the most exogenous among others should come first in ordering and vice versa. Otherwise, the results can fundamentally change.

However, Ref. [42] proposes an alternative approach to traditional IRF analysis, which is invariant to VAR ordering. This approach—*referred to as the generalized impulse response analysis*—does not require orthogonalization of shocks. More specifically, the generalized impulse responses from an innovation to

[20]In the light of the fact that the 1985–2001 witnessed period of dollarization and 2002–2007 is presumably the period of dedollarization, we divided our sample to sub-samples with the objective to check the symmetry of the (de)dollarization process. In other words, if the pre-2002 and post-2002 are symmetric, then the coefficient estimates and the impulse responses should not vary between the sub-samples. Although not reported here, the VAR estimation results (available upon request) by sub-samples demonstrate that the impulse responses and the coefficient estimates are quite similar.

the *j*th variable are derived by applying a variable specific Cholesky factor computed with the *j*th variable at the top of the Cholesky ordering.

We also employ this approach to construct order-invariant forecast error VDC. While IRFs trace the effects of a shock to one endogenous variable on to the other variables in the VAR, VDC separates the variation in

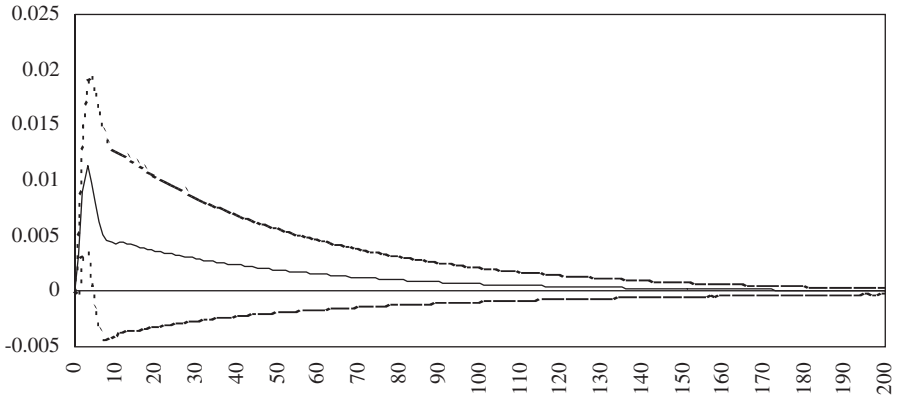

Fig. 2. Generalized impulse response of dollarization to one-unit innovation in inflation volatility (including standard error bands).

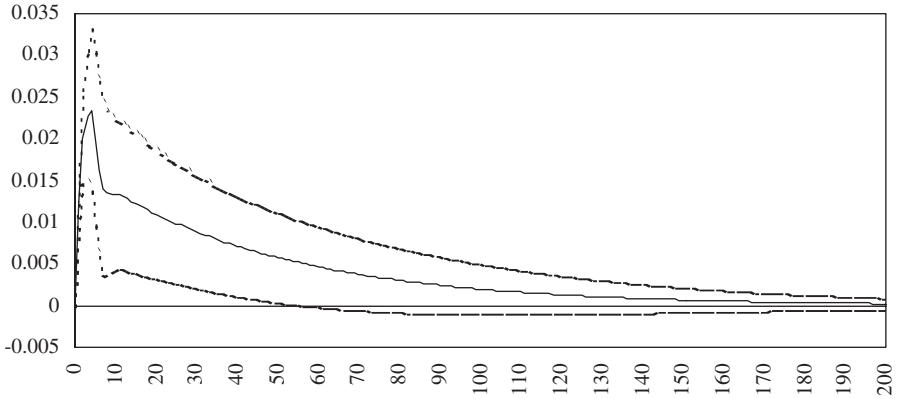

Fig. 3. Generalized impulse response of dollarization to one-unit innovation in exchange rate depreciation volatility (including standard error bands).

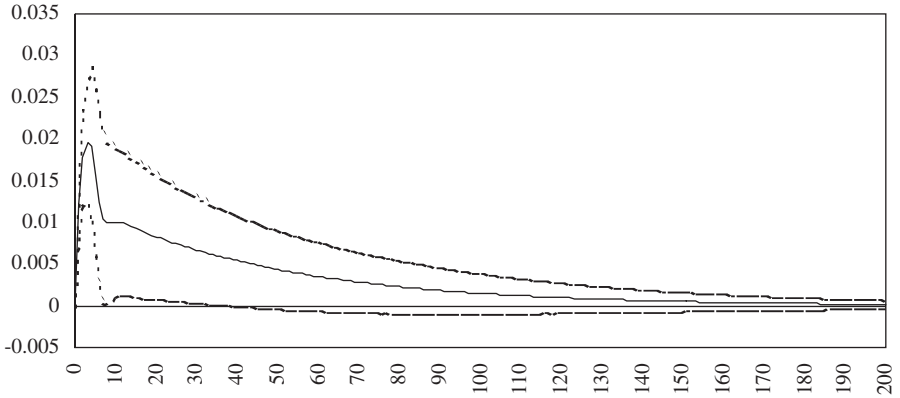

Fig. 4. Generalized impulse response of dollarization to one-unit innovation in expected depreciation (including standard error bands).

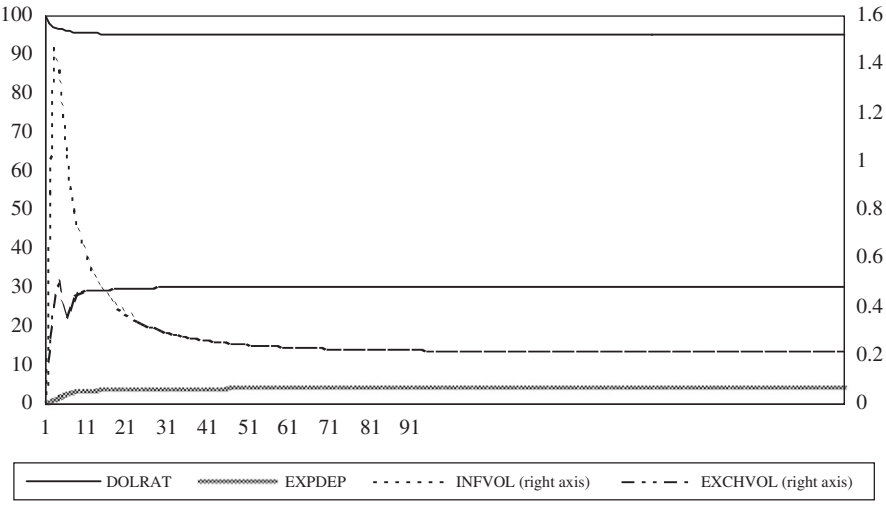

Fig. 5. Variance Decomposition Analysis.

an endogenous variable into the component shocks to the VAR. Thus, the VDC provides information about the relative importance of each random innovation in affecting the variables in the VAR.

Figs. 2–4 in the Appendix plots the generalized impulse responses of the dollarization ratio with respect to innovations in inflation volatility, exchange rate depreciation volatility, and expected depreciation over a horizon of 200 months. The results show that the dollarization ratio increases in response to these innovations. As shown by the dotted lines denoting the ± 2 standard error bands, except for the response of the dollarization to inflation volatility impulse, the impulse responses are also statistically significant.

A further analysis demonstrates that the largest effect on the dollarization comes from innovations in the exchange rate depreciation volatility.[21] Following an initial hike in response to an innovation in exchange rate depreciation volatility, dollarization then starts to decrease and stabilizes though the stabilization takes significantly long. The other innovation, expected depreciation creates a similar impact on dollarization though at a lesser magnitude.

The results from the VDC analysis (Fig. 5) suggest that over a 200-month horizon, more than 90% of the forecast error variance of dollarization can be attributed to shocks in dollarization itself. Inflation volatility shocks and exchange rate depreciation volatility shocks account for less than 1% of the variance of dollarization, while expected depreciation shocks contribute to forecast error variance of dollarization roughly by 4%. The results of the VDC analysis together with the generalized IRF analysis suggest that dollarization is still persistent, lending support to the notion of hysteresis.

5. Concluding remarks

The paper tries to answer whether Turkish economy exhibits signals of dedollarization. Given the strong growth record as well as the success in the disinflation front during the 2002–2005 period, dollarization in the Turkish economy has seemingly declined. However, the results of this study suggest that despite this decline, the persistence character of dollarization still prevails, which therefore suggests that for a significant level of dedollarization to take place, sustainability of the progress in the macroeconomic front is essential. More specifically, given the strong inertial nature of dollarization as well as the heavy impact of volatility created especially by inflation, exchange rate and expectations about exchange rate changes, one should be cautious about concluding that dollarization has finally come to an end. As a matter of fact, dollarization has been on the rise again since May 2006, which also confirms the results of the study.

[21] Although not reported in the paper, dollarization shock has the largest effect on dollarization, which suggests that the autoregressive component of dollarization is very strong, thus dollarization still preserves its inertial nature. Same conclusion is also reached in the analysis by sub-samples.

Furthermore, even though dollarization in the Turkish economy context has been increasingly recognized, there are no current direct policy initiatives to reduce the level of dollarization. Nevertheless, the country experiences show that without taking policy initiatives, persistence of low and stable inflation automatically gives rise to a process of dedollarization, even though this process occurs rather slowly.

However, policymakers can still combat dollarization through prudential regulations. More specifically, country experiences show that banking supervision took a key role in ensuring that commercial banks had fully covered foreign-currency positions with assets equaling liabilities in that denomination. Although, this policy gradually led to dedollarization, it has undoubtedly produced a major fall in the degree of dollarization-induced vulnerability faced by the country, especially in response to adverse shocks.

Therefore, even if there is no direct policy initiative aimed at dedollarizing the financial system, when sound fundamentals are in place, dedollarization will occur endogenously; yet, rather slowly. Nevertheless, the conclusion that Turkey *did* start to dedollarize still seems as a myth rather than a reality.

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Appendix A

VAR results (Table A1).

Table A1
VAR results

	DOLRAT	INFVOL	EXCHVOL	EXPDEP
DOLRAT(−1)	1.341733	0.082648	0.039450	0.185077
	(0.07231)	(0.03860)	(0.08960)	(0.09933)
	[0.5549]	[0.14112]	[0.44029]	[0.86328]
DOLRAT(−2)	−0.329460	−0.073514	−0.200396	−0.446232
	(0.11711)	(0.06251)	(0.14511)	(0.16087)
	[−2.81324]	[−1.17595]	[−1.38099]	[−2.77395]
DOLRAT(−3)	−0.024867	−0.011068	0.158322	0.260487
	(0.07127)	(0.03804)	(0.08831)	(0.09790)
	[−0.34891]	[−0.29093]	[1.79280]	[2.66081]
INFVOL(−1)	0.250132	−0.117898	0.225611	0.277525
	(0.12357)	(0.06596)	(0.15311)	(0.16974)
	[2.02424]	[−1.78737]	[1.47350]	[1.63504]
INFVOL(−2)	0.049158	−0.065435	0.103287	0.214195
	(0.12147)	(0.06484)	(0.15051)	(0.16685)
	[0.40470]	[−1.00917]	[0.68625]	[1.28376]
INFVOL(−3)	−0.132759	−0.095952	0.092088	0.297164
	(0.11746)	(0.06270)	(0.14554)	(0.16134)
	[−1.13028]	[−1.53036]	[0.63273]	[1.84184]
EXCHVOL(−1)	0.281121	0.178496	−0.230288	0.354694
	(0.07152)	(0.03818)	(0.08862)	(0.09824)
	[3.93077]	[4.67550]	[−2.59867]	[3.61053]

Table A1 (*continued*)

	DOLRAT	INFVOL	EXCHVOL	EXPDEP
EXCHVOL(−2)	0.089147	0.126958	−0.316682	−0.060018
	(0.07525)	(0.04017)	(0.09325)	(0.10337)
	[1.18463]	[3.16046]	[−3.39620]	[−0.58062]
EXCHVOL(−3)	0.158760	0.088854	−0.008167	0.120768
	(0.06940)	(0.03705)	(0.08600)	(0.09534)
	[2.28744]	[2.39829]	[−0.09497]	[1.26676]
EXPDEP(−1)	−0.203765	−0.085181	0.193891	0.075641
	(0.05448)	(0.02908)	(0.06750)	(0.07483)
	[−3.74045]	[−2.92923]	[2.87243]	[1.01085]
EXPDEP(−2)	−0.019899	−0.053674	0.046599	0.179946
	(0.05516)	(0.02945)	(0.06835)	(0.07578)
	[−0.36072]	[−1.82272]	[0.68173]	[2.37472]
EXPDEP(−3)	−0.073814	−0.022752	−0.119391	−0.091277
	(0.04407)	(0.02352)	(0.05460)	(0.06053)
	[−1.67504]	[−0.96723]	[−2.18653]	[−1.50792]
C	0.056997	0.010719	0.005469	0.027604
	(0.01615)	(0.00862)	(0.02001)	(0.02218)
	[3.52924]	[1.24342]	[0.27331]	[1.24431]
D1994	0.096427	−0.026629	−0.054780	0.411829
	(0.02805)	(0.01498)	(0.03476)	(0.03854)
	[3.43708]	[−1.77811]	[−1.57584]	[10.6867]
R-squared	0.995411	0.176299	0.112546	0.492488
Adj. *R*-squared	0.995157	0.130733	0.063453	0.464412
Sum sq. resides	0.173257	0.049369	0.266009	0.326906
S.E. equation	0.027153	0.014494	0.033644	0.037297
F-statistic	3920.695	3.869060	2.292507	17.54176
Log likelihood	551.8535	708.1560	498.4733	472.8084
Akaike AIC	−4.320108	−5.575551	−3.891352	−3.685208
Schwarz SC	−4.122340	−5.377782	−3.693584	−3.487440
Mean dependent	3.567087	−0.000885	−0.000854	0.030555
S.D. dependent	0.390155	0.015546	0.034766	0.050964

Standard errors are given in parentheses and *t*-values are given in brackets.

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