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Dollarization in Transition Economies: New Evidence from Georgia

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Abstract

This paper provides new evidence for dollarization in Georgia during the period from 1996 to 2007 using implications of dynamic money-in-utility-function models. Partial effects of foreign and domestic inflation, exchange rate, and foreign and domestic currency deposits' interest rates on dollarization are considered. The US dollar is a strong substitute for domestic currency and has a significant share in producing domestic liquidity services. The actual dollarization in Georgia is persistent and larger than partial effects models predict.

Abstrakt

Tato práce předkládá za použití modelu peněz v užitkové funkci nové důkazy o dolarizaci v Gruzii v letech 1996 až 2007. Analýza bere v potaz částečné efekty zahraniční a domácí inflace, výměnných kurzů a úrokových sazeb vkladů v domácí i zahraniční měně. Americký dolar je velkým substitutem domácí měny a má také významné zastoupení v poskytování domácí likvidity. Současná dolarizace v Gruzii je přetrvávající a větší, než modely částečných efektů předpovídají.

Keywords: Dollarization, Georgia, Money-in-utility-function

JEL classification: C51, E41, F31

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1 Introduction

The phenomenon of dollarization¹ was a very popular topic in the academic literature in the 1970s and 1980s. Following stabilization policies in Latin America it became silent. Recently, this issue has gained increasing attention mostly due to the high degree of dollarization in a number of former Soviet market economies. In these economies, large amounts of the US dollar are held by the public. De-dollarization has not occurred in these countries despite recent progress in macroeconomic stabilization. Georgia is one of these economies, in which moderate inflation and stability of the exchange rate do not provide enough incentives to switch to the domestic currency, the lari.

It is well known that dollarization influences monetary independence of a country. Significant dollarization leads to decreasing control over the exchange rate, to reducing the results of inflation stabilization and monetary policies, and to stimulating the growth of the shadow sector of an economy. Thus, dollarization should be taken into account by authorities in determining the exchange rate regime, in conducting policies, and in intervening on the foreign exchange market. This paper studies the significance and degree of dollarization in Georgia, and addresses the issue of the persistence in the use of the US dollars.²

A large stream of literature focuses on the study of dollarization using various approaches. The demand for domestic currency with respect to foreign currency is usually empirically analyzed based on a theoretical model's implications. Several

¹The paper uses dollarization to refer to the unofficial process when the national currency, as means of circulation and wealth accumulation, is substituted with a more stable foreign currency or several currencies (Calvo & Vegh, 1996).

²In Georgia, the US dollar has the largest share (85-90%) in total foreign currency holdings.

categories of theoretical models can be identified. The first type are sequential portfolio balance models (Miles, 1978). In these models agents choose an optimal mix of monetary and non-monetary assets, and then decide how much of each currency to hold. The elasticity of currency substitution is then estimated as a parameter in the demand for foreign to domestic currency equation. The classical optimization model (Thomas, 1985) implies that the ratio of domestic to foreign money is negatively related to the domestic nominal interest rate and positively to the foreign nominal interest rate. Another type of model is a two-period portfolio balance model, in which agents allocate wealth among domestic and foreign money and bonds (for example, Cuddington, 1983). The demand for domestic real money balances is as a function of domestic real income, interest rates on domestic and foreign bonds, and the expected rate of depreciation.

Recent models of dollarization deal with the agent's dynamic optimization. These models usually follow the money-in-utility-function (MIUF, Sidrauski, 1967) approach. Based on the first order conditions for MIUF model optimization, the demand for foreign currency is estimated rather than an *ad hoc* money demand function. The parameters of consumer preferences are jointly or separately estimated by the generalized method of moments (GMM, Hansen, 1982). Imrohroglu (1994) estimates currency substitution between the Canadian and the US dollars. Selcuk (1997) applies the same model for the Turkish case. Friedman and Verbet-sky (2001) consider dollarization in Russia. Mulligan and Nijse (2001) examine currency substitution in Bulgaria, Hungary, Poland, and Romania. A study on Bolivia can be found in Cuddington, Garcia, and Westbrook (2002). Selcuk (2003)

provides empirical evidence for the Czech Republic, Hungary, Israel, Jordan, Poland, and Slovak Republic.

Models with ratchet effect of dollarization usually assume that the reaction of the money demand is asymmetric to the key explanatory variables. In empirical studies, this effect is captured by adding past maximum of inflation rate as an explanatory variable. The main finding of these studies is known as a hysteresis: the elasticity of money demand is higher when inflation rises than when inflation is falling. In theoretical models, this asymmetry results from costs of consideration of households. These can be costs of learning, developing, or applying financial innovation strategies. In these models, only a highly significant decline in inflation or domestic currency appreciation can provide enough incentives to switch to domestic money. Uribe (1997) builds a cash-in-advance model with a network externality with money as a medium of exchange. There are transaction costs for using foreign currency. The positive network externality reduces the transaction costs of foreign currency.

This paper uses the implications of a dynamic money-in-utility-function model to investigate the phenomenon of dollarization in the context of the Georgian transition economy. First, significance of dollarization is addressed. The model is used to estimate the elasticity of currency substitution between the US dollar and the lari as well as their shares in the production of money services. In the model, both currencies are useful in reducing transaction costs. Money services are produced using CES technology with two currencies as inputs. Influence of dollarization learning on the elasticity of currency substitution is studied. This aims to capture not just

the role of the fundamentals but all possible factors that influenced the dollarization process in the past. Second, the MIUF framework is used to study dynamics of dollarization. Evolution of actual dollarization is compared to the model's optimal dollarization level.

The results show that excessive dollarization is of significant importance in Georgia. The GMM estimates indicate that the US dollar is a good substitute for the domestic currency in terms of reduction of transaction costs. Foreign money balances have 0.57-0.8 significant share in producing liquidity services. The model predicts that the optimal dollarization should be smaller and should decrease with the progress in macroeconomic stabilization. However, despite recent improvements in macroeconomic fundamentals, dollarization remains high and is persistent in Georgia. As the US dollar is shown to be a good substitute for the lari, the only way to reduce excessive dollarization is to ensure sufficiently long periods of low inflation and exchange rate stability.

The paper is structured as follows. Section 2 presents the economy model. Section 3 describes the data. Empirical findings are presented in Section 4. The dynamics of dollarization is studied in Section 5. Section 6 concludes.

2 Benchmark Model

The economy consists of infinitely lived identical agents. At the beginning of each period, each agent decides how much to consume $c_t = \frac{C_t}{NP_t}$, how much to hold in the form of domestic real balances $m_t = \frac{M_t}{NP_t}$ and foreign real balances $m_t^* = \frac{M_t^*}{NP_t^*}$ (domestic and foreign personal accounts and demand deposits), and how much to save in certificates of deposits (domestic and foreign term deposits) $cd_t = \frac{CD_t}{NP_t}$ and $cd_t^* = \frac{CD_t^*}{NP_t^*}$ that earn nominal interest rates i_t and i_t^* . Each individual receives an exogenous endowment $\frac{Y_t}{NP_t}$. Variable P_t is the price of the consumption good in terms of the domestic currency, P_t^* is foreign price, N is population that is constant over time $N_t = N_{t-1}$.

Each household maximizes the discounted utility stream $\sum_{t=0}^{\infty} \beta^t U(c_t, m_t, m_t^*)$, with discount factor $\beta < 1$. The utility function is a reduced form of a more complex problem, in which households can shop more efficiently and increase leisure time by holding more money.

Household's budget constraint is given as

$$\frac{C_t}{NP_t} + \frac{M_t}{NP_t} + \frac{M_t^*}{NP_t^*} + \frac{CD_t}{NP_t} + \frac{CD_t^*}{NP_t^*} = \frac{M_{t-1}}{NP_t} + \frac{M_{t-1}^*}{NP_t^*} + (1+i_t) \frac{CD_{t-1}}{NP_t} + (1+i_t^*) \frac{CD_{t-1}^*}{NP_t^*} + \frac{Y_t}{NP_t}.$$

In real per capita terms the budget constraint is

$$c_t + m_t + m_t^* + cd_t + cd_t^* = m_{t-1} \frac{P_{t-1}}{P_t} + m_{t-1}^* \frac{P_{t-1}^*}{P_t^*} + (1+i_t) \frac{P_{t-1}}{P_t} cd_{t-1} + (1+i_t^*) \frac{P_{t-1}^*}{P_t^*} cd_{t-1}^* + y_t.$$

The FOCs for the problem are

$$U_c(t) = \beta(1 + i_{t+1}) \frac{P_t}{P_{t+1}} U_c(t+1) \quad (2.1)$$

$$U_c(t) = \beta(1 + i_{t+1}^*) \frac{P_t^*}{P_{t+1}^*} U_c(t+1) \quad (2.2)$$

$$U_c(t) = U_m(t) + \beta \frac{P_t}{P_{t+1}} U_c(t+1), \quad (2.3)$$

$$U_c(t) = U_{m^*}(t) + \beta \frac{P_t^*}{P_{t+1}^*} U_c(t+1). \quad (2.4)$$

The term $U_x(t)$ denotes the marginal utility of x at time t . Marginal utilities $U_m(t)$ and $U_{m^*}(t)$ show a transaction cost reducing role of the real money balances at period t in domestic and foreign currencies, respectively. In Eq. 2.3 and Eq. 2.4, the marginal utility of holding one unit of real money balances plus the discounted next period marginal utility afforded by the real balances at time t are balanced by the marginal utility loss at time t .

The utility function follows Kydland and Prescott (1982) non-separable in consumption and money services:

$$U(c_t, \Psi_t) = \frac{(c_t^\gamma \Psi_t^{1-\gamma})^{1-\sigma} - 1}{1-\sigma}.$$

This function is a constant relative risk aversion in the consumption and money services function. The parameter $\sigma > 0$ is the coefficient of relative risk aversion, and $\frac{1}{\sigma}$ is the elasticity of intertemporal substitution; γ reflects the transaction requirement of money in a broad sense. This form of the utility function reflects the motive for holding money: to reduce transaction costs in implementing efficient consumption plans. It highlights the link between the liquidity services and efficient consumption.

The additive in consumption and the money services utility function, in contrast, would break this linkage.

The liquidity services function is the CES function as in Imrohorglu (1994)

$$\Psi_t(m_t, m_t^*) = [(1 - \varphi)m_t^{-\rho} + \varphi(m_t^*)^{-\rho}]^{-\frac{1}{\rho}}.$$

This functional form separates the elasticity of currency substitution $\frac{1}{1 + \rho}$ from the share of foreign currency in the production of domestic liquidity services $\varphi \in (0, 1)$.

With these functional forms the marginal utilities are given by

$$U_c = \gamma c_t^{a-1} [(1 - \varphi)m_t^{-\rho} + \varphi(m_t^*)^{-\rho}]^b,$$

$$U_m = (1 - \varphi)(1 - \gamma)c_t^a [(1 - \varphi)m_t^{-\rho} + \varphi(m_t^*)^{-\rho}]^{b-1} m_t^{-\rho-1},$$

$$U_{m^*} = \varphi(1 - \gamma)c_t^a [(1 - \varphi)m_t^{-\rho} + \varphi(m_t^*)^{-\rho}]^{b-1} (m_t^*)^{-\rho-1},$$

where $a = \gamma(1 - \sigma)$, $b = \frac{(1-\gamma)(1-\sigma)}{-\rho}$.

2.1 Three Model Specifications

Partial effects on the degree of dollarization (domestic to foreign money ratio) are studied: the effect of inflation differential (foreign and domestic), of the changes in the exchange rate, and of the interest rate differential (foreign and domestic currency deposits interest rates). These three different model specifications allow us to look at dollarization under alternative assumptions.

In the first model specification that will be referred to as the inflation model

1, there are no saving opportunities and inflation is defined as $\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$ and $\pi_t^* = \frac{P_t^* - P_{t-1}^*}{P_{t-1}^*}$. First order conditions of the problem (Eq. 2.3 and Eq. 2.4)

become

$$\begin{aligned} \gamma c_t^{a-1} [(1-\varphi)m_t^{-\rho} + \varphi m_t^{*- \rho}]^b &= (1-\varphi)(1-\gamma)c_t^a [(1-\varphi)m_t^{-\rho} + \varphi m_t^{*- \rho}]^{b-1} m_t^{-\rho-1} + \\ &+ \beta\gamma \frac{1}{(1+\pi_{t+1})} c_{t+1}^{a-1} [(1-\varphi)m_{t+1}^{-\rho} + \varphi m_{t+1}^{*- \rho}]^b, \end{aligned} \quad (2.3.1)$$

$$\begin{aligned} \gamma c_t^{a-1} [(1-\varphi)m_t^{-\rho} + \varphi m_t^{*- \rho}]^b &= \varphi(1-\gamma)c_t^a [(1-\varphi)m_t^{-\rho} + \varphi m_t^{*- \rho}]^{b-1} m_t^{*- \rho-1} + \\ &+ \beta\gamma \frac{1}{(1+\pi_{t+1}^*)} c_{t+1}^{a-1} [(1-\varphi)m_{t+1}^{-\rho} + \varphi m_{t+1}^{*- \rho}]^b. \end{aligned} \quad (2.4.1)$$

These equations are rearranged in such a way that the variables enter the modified equations as ratios and one minus growth rate form indicating the lack of significant trends.³

$$\begin{aligned} \beta\gamma \frac{1}{(1+\pi_{t+1})} \left(\frac{c_{t+1}}{c_t}\right)^{a-1} \left[\frac{(1-\varphi)\left(\frac{m_{t+1}}{m_t^*}\right)^{-\rho} + \varphi}{(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} + \varphi}\right]^b \left(\frac{m_{t+1}^*}{m_t^*}\right)^{-\rho b} &= \quad (2.3.1a) \\ = \gamma - (1-\varphi)(1-\gamma) \left(\frac{m_t}{m_t^*}\right)^{-\rho} \left[(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} + \varphi\right]^{-1} \frac{c_t}{m_t}, \end{aligned}$$

$$\begin{aligned} \beta\gamma \frac{1}{(1+\pi_{t+1}^*)} \left(\frac{c_{t+1}}{c_t}\right)^{a-1} \left[\frac{(1-\varphi)\left(\frac{m_{t+1}}{m_t^*}\right)^{-\rho} + \varphi}{(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} + \varphi}\right]^b \left(\frac{m_{t+1}^*}{m_t^*}\right)^{-\rho b} &= \quad (2.4.1a) \\ = \gamma - \varphi(1-\gamma) \left[(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} + \varphi\right]^{-1} \frac{c_t}{m_t^*}. \end{aligned}$$

³This stationarity issue is important for estimation.

From these, the optimality condition that will be used in GMM estimation for this inflation model 1 with the share parameter φ is

$$\begin{aligned}
& (\pi_{t+1}^* - \pi_{t+1})\gamma = \\
& = (1-\gamma)[(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} + \varphi]^{-1} \left\{ (1+\pi_{t+1}^*)\varphi \frac{c_t}{m_t^*} - (1+\pi_{t+1})(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} \frac{c_t}{m_t} \right\}.
\end{aligned} \tag{Model 1.1}$$

The optimal money ratio in the economy at the period t is

$$\frac{m_t}{m_t^*} = \left(\frac{\varphi(1-\gamma)\frac{c_t}{m_t^*} - \gamma\varphi\left(1 - \frac{(1+\pi_{t+1})}{(1+\pi_{t+1}^*)}\right)}{(1-\varphi)(1-\gamma)\frac{c_t}{m_t} + (1-\varphi)\gamma\left(1 - \frac{(1+\pi_{t+1})}{(1+\pi_{t+1}^*)}\right)} \right)^{-1/\rho}. \tag{Model 1.1}$$

The money ratio in the period t is a function of the consumption-money ratios $\frac{c_t}{m_t^*}$, $\frac{c_t}{m_t}$, and domestic and foreign inflation in the next period π_{t+1} , π_{t+1}^* . The parameters are the share of foreign currency in the production of domestic liquidity services φ , the transaction requirement of money in broad sense parameter γ , and ρ that implies the elasticity of currency substitution $\frac{1}{1+\rho}$.

Optimality condition for the exchange rate model 2 is obtained in similar way using Eq. 2.3 and Eq. 2.4 as for the model 1.1 using purchasing power parity condition $P_t = e_t P_t^*$. The optimality condition is

$$\begin{aligned}
& \gamma\left(1 - \frac{e_{t+1}}{e_t}\right) = \\
& [(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} + \varphi]^{-1} (1-\gamma) \left\{ \varphi \frac{c_t}{m_t^*} - \frac{e_{t+1}}{e_t} (1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} \frac{c_t}{m_t} \right\}.
\end{aligned} \tag{Model 2.1}$$

The optimal money ratio for the model 2.1 at the period t is

$$\frac{m_t}{m_t^*} = \left(\frac{\varphi(1-\gamma)\frac{c_t}{m_t^*} - \gamma\varphi(1 - \frac{e_{t+1}}{e_t})}{(1-\varphi)(1-\gamma)\frac{c_t}{m_t} + (1-\varphi)\gamma(1 - \frac{e_{t+1}}{e_t})} \right)^{-1/\rho}. \quad (\text{Model 2.1})$$

In this case, money ratio depends on the depreciation rate $\frac{e_{t+1}}{e_t}$ in addition to consumption-money ratios and parameters.

In contrast to models 1 and 2, the interest rates model 3 divides money into current accounts and demand deposits (more liquid money) m_t and m_t^* , and certificates of deposits (term deposits) cd_t and cd_t^* that earn interest rates. From Eq. 2.1 and Eq. 2.2

$$\frac{e_{t+1}}{e_t} = \frac{1 + i_{t+1}}{1 + i_{t+1}^*}.$$

The optimality condition for the interest rate model 3 is

$$\gamma\left(1 - \frac{1 + i_{t+1}}{1 + i_{t+1}^*}\right) = \quad (\text{Model 3.1})$$

$$\left[(1-\varphi)\left(\frac{m_t}{m_t^*}\right)^{-\rho} + \varphi \right]^{-1} (1-\gamma) \left\{ \varphi \frac{c_t}{m_t^*} - \frac{1 + i_{t+1}}{1 + i_{t+1}^*} (1-\varphi) \left(\frac{m_t}{m_t^*}\right)^{-\rho} \frac{c_t}{m_t} \right\},$$

and the optimal money ratio at the period t is now a function of consumption-money ratios, parameters, and foreign and domestic next period interest rates i_{t+1} and i_{t+1}^* :

$$\frac{m_t}{m_t^*} = \left(\frac{\varphi(1-\gamma)\frac{c_t}{m_t^*} - \gamma\varphi\left(1 - \frac{1 + i_{t+1}}{1 + i_{t+1}^*}\right)}{(1-\varphi)(1-\gamma)\frac{c_t}{m_t} + (1-\varphi)\gamma\left(1 - \frac{1 + i_{t+1}}{1 + i_{t+1}^*}\right)} \right)^{-1/\rho}. \quad (\text{Model 3.1})$$

2.2 Modified Versions of the Models

In the first version of each model, the share of foreign currency in domestic liquidity services φ is a fixed parameter. In modified two versions, the assumption of the fixed parameter is relaxed.

For the second version, assume that the share of foreign currency in the production of domestic liquidity services φ changes over time. The agents make decisions over consumption and money holdings knowing lagged dollarization share in the economy in the previous period $DR_t = \frac{m_{t-1}^*}{m_{t-1}^* + m_{t-1}}$. This is the share of foreign currency in the production of money services. Using the actual data on dollarization shares DR_t is calculated using dollarization ratios. For example, version 2 of the inflation model 1 is

$$\gamma \left(1 - \frac{(1 + \pi_{t+1})}{(1 + \pi_{t+1}^*)}\right) =$$

$$[(1 - DR_t) \left(\frac{m_t}{m_t^*}\right)^{-\rho} + DR_t]^{-1} (1 - \gamma) \left\{ DR_t \frac{c_t}{m_t^*} + \frac{(1 + \pi_{t+1})}{(1 + \pi_{t+1}^*)} (1 - DR_t) \left(\frac{m_t}{m_t^*}\right)^{-\rho} \frac{c_t}{m_t} \right\}.$$

(Model 1.2)

In the third version, individuals act as econometricians by learning share of foreign currency in the production of money services using previous period's data on dollarization shares. This is aimed to capture inertia in the agents' foreign currency holdings. Knowledge is accumulated through the use of foreign currency by domestic agents in previous periods. A proxy for such knowledge at time t is fitted value of dollarization ratio obtained by regression on its lags. The idea behind this proxy is that knowledge of foreign currency is proportional to the amounts of

foreign currency previously used.⁴ That is, dollarization in the economy persists because agents constantly utilize accumulated knowledge on the foreign currency use. Each individual runs regression

$$DR_t = \alpha + DR_{t-1}\lambda_1 + \dots + DR_{t-p}\lambda_p + \varepsilon_t,$$

with p being number of lags. One-step-ahead forecast $\widehat{DR}_{t/t-1}$ is obtained OLS estimation under general assumptions. Fitted values are the share of foreign currency in the money services.

$$\begin{aligned} \gamma \left(1 - \frac{(1 + \pi_{t+1})}{(1 + \pi_{t+1}^*)}\right) = \\ [(1 - \widehat{DR}_t) \left(\frac{m_t}{m_t^*}\right)^{-\rho} + \widehat{DR}_t]^{-1} (1 - \gamma) \left\{ \widehat{DR}_t \frac{c_t}{m_t^*} + \frac{(1 + \pi_{t+1})}{(1 + \pi_{t+1}^*)} (1 - \widehat{DR}_t) \left(\frac{m_t}{m_t^*}\right)^{-\rho} \frac{c_t}{m_t} \right\}. \end{aligned}$$

(Model 1.3)

Modified versions for the exchange rate and the interest rate models are expressed in a similar way.

3 Data

The sample period considered in this paper is January 1996 - November 2007 with monthly frequency observations. Foreign nominal money balances are measured by the sum of the foreign currency denominated personal accounts and demand deposits held in Georgian banks by nonofficial, nonbank residents. The domestic nominal money balances are measured as the sum of the lari denominated personal accounts and demand deposits in local banks. As a proxy for consumption

⁴It is assumed that knowledge accumulates equally from all foreign deposits.

seasonally adjusted pure energy consumption is used.⁵ This series are taken from the Georgian electricity distribution company Telasi's statistics. Both foreign and domestic money balances and consumption are converted to real per capita terms by dividing by population and domestic prices. The domestic prices are seasonally adjusted consumer price index. The civilian population is obtained from the World Population record. Seasonally adjusted observations on the GEL/USD exchange rate are used.⁶ The interest rates are domestic and foreign currency denominated term deposits' interest rates. All these series are taken from the National Bank of Georgia statistical bulletins. Foreign price index is the US consumer price index obtained from the Federal Reserve Bank of St. Louis.

Figure 1 shows total dollarization share (foreign currencies share), inflation and depreciation rates for the Georgian economy for the period 1996-2007. The dollarization share is calculated as real per capita sum of the foreign currency denominated personal accounts and demand deposits over the sum of the domestic and foreign currency deposits. The increases/decreases of the share can be partly explained by the lari appreciation/depreciation and inflation rate. However, the ratios remain high despite low inflation and depreciation rates.

Figure 2 shows the shares of the US dollar and Euro in the total dollarization share in the economy in recent years. These are the main foreign currencies in the total ratio. The shares of other currencies deposits (RUB, GBP and CHF) are less than 1%. The US dollar holdings are significantly larger in amount comparatively

⁵Monthly consumption of goods and services and the share of electricity consumption by households data are not available for Georgia. Quarterly goods and services consumption is correlated with electricity consumption series and have similar trends.

⁶Weighted average of the GEL/USD and the GEL/EUR exchange rates is close to the GEL/USD exchange rate as the US dollar has the main share in the total ratio.

to the Euro.

Table 1 provides summary statistics, and the stationarity and structural break tests for the ratios $\frac{e_{t+1}}{e_t}$, $\frac{1 + \pi_t}{1 + \pi_t^*}$, $\frac{1 + i_t}{1 + i_t^*}$, $\frac{m_t}{m_t^*}$, $\frac{m_t^*}{m_t^* + m_t}$, $\frac{c_t}{m_t}$, and $\frac{c_t}{m_t^*}$.

4 Evidence on Dollarization: Empirical Findings

The estimation results for the models 1, 2 and 3 and their versions are obtained using the GMM procedure robust to conditional heteroscedasticity and autocorrelation. Alternative instrument sets are used to check the sensitivity of results to the choice of instruments. The results for the following instrument sets for the three models are presented: ⁷

$$\begin{aligned} I_{t1} &= \left\{ 1, \frac{1 + \pi_{t-1}}{1 + \pi_{t-1}^*}, \frac{1 + \pi_{t-2}}{1 + \pi_{t-2}^*}, \frac{m_{t-1}}{m_{t-1}^*}, \frac{m_{t-2}}{m_{t-2}^*}, \frac{c_{t-1}}{m_{t-1}}, \frac{c_{t-2}}{m_{t-2}}, \frac{c_{t-1}}{m_{t-1}^*}, \frac{c_{t-2}}{m_{t-2}^*} \right\}, \\ I_{t2} &= \left\{ 1, \frac{e_t}{e_{t-1}}, \frac{e_{t-1}}{e_{t-2}}, \frac{m_{t-1}}{m_{t-1}^*}, \frac{m_{t-2}}{m_{t-2}^*}, \frac{c_{t-1}}{m_{t-1}}, \frac{c_{t-2}}{m_{t-2}}, \frac{c_{t-1}}{m_{t-1}^*}, \frac{c_{t-2}}{m_{t-2}^*} \right\}, \\ I_{t3} &= \left\{ 1, \frac{1 + i_{t-1}}{1 + i_{t-1}^*}, \frac{1 + i_{t-2}}{1 + i_{t-2}^*}, \frac{m_{t-1}}{m_{t-1}^*}, \frac{m_{t-2}}{m_{t-2}^*}, \frac{c_{t-1}}{m_{t-1}}, \frac{c_{t-2}}{m_{t-2}}, \frac{c_{t-1}}{m_{t-1}^*}, \frac{c_{t-2}}{m_{t-2}^*} \right\}. \end{aligned}$$

The results are given in Tables 2, 3, 4. In each case, the number of orthogonality conditions is greater than the number of parameters. The validity of these overidentifying restrictions is tested using the J-statistics. The test null hypothesis is that the restrictions are satisfied, and the test statistic is distributed asymptotically as χ^2 with degrees of freedom equal to the number of overidentifying restrictions (Hansen, 1982). The Hansen J-statistics are insignificant for all models, thus not rejecting their validity.

In all the models, foreign money balances have significant share φ in producing liquidity services. The economic significance of the role of the US dollar is big since

⁷The estimation using different instrument sets (number of lags) gives similar results.

the share estimates range between 0.57 and 0.8. The mean of the actual dollarization share (0.716) and of the forecasted values of the dollarization share (0.699) are close to the estimate of φ . The estimate of the transaction requirement of money in broad sense parameter γ is positively significant and is less than one but is very small in magnitude.

The estimates of ρ imply the elasticity of currency substitution ranging between 1.6 and 5.3 in the model 1 with inflation. Increase in domestic over foreign inflation leads to substitution of the domestic for the foreign currency. In the model 2 with exchange rates, the elasticity is between 1.017 and 11 indicating that the demand for the US dollar is responsive to the fluctuations in the exchange rate. The elasticity of currency substitution drops significantly in second and third versions of the model. Keeping φ constant (first version of the model) increases elasticity of currency substitution. The hypothesis $1/(1 + \rho) = 1$ is rejected at any significance level in favor of $1/(1 + \rho) > 1$. In the model 3 with interest rates, the elasticity is between 2.3 and 4.9 but is not significant in the benchmark 3.1 model.

To summarize, monthly Georgian data gives support to models' overidentifying restrictions. The estimate of the elasticity of currency substitution is more than one, between 1.017 and 11, depending on the model's specification. The US dollar is a good substitute for the lari with the motive for holding money being to reduce transaction costs in purchasing consumption goods. The data supports the money-in-the-utility-function model specification with the transactions cost-reducing role for money. The estimate of the share parameter for foreign real money balance in producing money services is significant and is economically big.

5 Dynamics of Dollarization

The optimality conditions of the three versions of the three models are used to calculate the model predicted domestic to foreign money ratios. The optimal money ratio in the economy at period t is a function of economy parameters and consumption-money ratios. In the model 1, the money ratio is also a function of domestic and foreign inflation. In the second and third models, the ratio depends on the changes in the exchange rate and interest rates, respectively. The actual values of the ratio are compared to the optimal values using the parameters ranges for Georgia $\varphi = [0.57, 0.8]$, $\gamma = [6.58E - 04, 0.1]$, $\rho = [-7.33E - 03, -1.09]$.⁸

The optimal money ratios capture the major movements in the actual data (Figures 3, 4, 5 for models 1, 2, 3 respectively). However, the volatility of the optimal values is higher than in the actual data. The models predict less dollarization in the economy and even de-dollarization in some periods starting from 1999. The spike in the model 1 predictions in 2003 is caused by the structural break in the inflation series that is not reflected in the actual data. Versions 2 and 3 result in higher dollarization that is closer to actual data. Figure 4 shows results of the model with the exchange rate. The big spike in the predicted money ratio is driven by the exchange rate break after the Russian crisis. Inclusion of the learning aspect increases the gap between the model's and actual ratios predicting even lower dollarization. The gap between the actual and optimal values of the model 3 is smaller. This model predicts significant de-dollarization in the end of the sample period.

⁸Other factors fixed, when share of foreign currency in liquidity services φ falls the model predicts lower dollarization in the economy. Dollarization falls with transaction requirement of money γ and with less elastic demand for currency $\frac{1}{1+\rho}$.

To summarize, the simple basic models predict that the amount of foreign money holdings should significantly decrease with the progress in macroeconomic stabilization. However, given recent improvements in macroeconomic fundamentals, dollarization is persistent in Georgia. The positive changes in inflation, in the exchange rate, and in interest rates do not provide enough incentives to significantly reduce the US dollar holdings or completely switch to the domestic currency. One explanation for this phenomenon is hysteresis or inertia effect: once switched to foreign currency as a response to macroeconomic instability, there is hedging against future uncertainty even with rapid macroeconomic improvement. An alternative explanation for excessive dollarization is portfolio diversification motives. The agents hold foreign currency in the form of currency deposits and cash as alternative to savings in the form of domestic currency.

As dollarization is costly, policies can be pursued to provide incentives to reduce foreign currency holdings. The simple model predicts that significant exchange rate and domestic inflation stabilization as well as increase in interest rate on the domestic currency deposits reduce dollarization in the economy. If the local currency depreciates and there is high inflation each period the model predicts high dollarization close to actual. According to the model, increase of interest rate on the domestic currency deposits provides additional incentive to switch to domestic currency.

There is an important trade-off between the costs of dollarization and the costs of policy measures used to reduce it. Since dollarization among other things reflects portfolio choices of agents, reducing risk hedging options may negatively affect welfare. Also, the method of increasing interest rates on domestic currency deposits

may result in excessive inflation. Extreme and undesirable measures to reduce dollarization are capital controls and the restriction of foreign currency deposits. These measures were adopted in Bolivia and in Mexico in 1982, and in Peru in 1985. As a result, capital flight and growth in the shadow sector of the economy were stimulated.

The key policy to reduce dollarization in the long run is to restore confidence in macroeconomic stability. As the US dollar is a good substitute for the lari, changes in domestic inflation over foreign inflation or in the exchange rate lead to switching between currencies. Given the observed ratchet effect, only the inflation and the exchange rate stabilization policies will eventually reduce dollarization. For now, dollarization is present, should be taken into account, and can not be completely removed in the near future.

6 Conclusions

This paper presents new evidence for dollarization in the highly dollarized CIS-7 Georgian economy based on a money-in-utility-function model. First, the economic and statistical significance of dollarization is studied based on implications of the model. The elasticity of substitution between the US dollar and the lari and their shares in producing money services are estimated using the GMM procedure. The impact of learning behavior on the elasticity of currency substitution is studied. Second, the paper studies the optimal and actual dynamics of dollarization.

The main empirical findings reveal that dollarization is of first-order importance in Georgia. The US dollar provides a good substitute for domestic currency when

money is held to reduce transaction costs. The implied elasticity of currency substitution is significantly greater than one. Foreign currency has significant 0.57-0.8 share in producing liquidity money services. When behavioral aspects are introduced, the demand for the foreign currency becomes less responsive to the fluctuations in the exchange rate due to learning adjustment.

The empirical results of this paper can be compared with findings for other countries based on implications of similar dynamic equilibrium models. Bufman and Leiderman (1991) get the elasticity of currency substitution for Israel greater than one but the share of foreign currency is less than 0.5. Selcuk (2003) finds that elasticity in the Czech Republic is 1.72, in Israel 1.78, in Poland 5, in the Slovak Republic 1.28, and in Turkey 1.4. Foreign balances have a significant share in producing liquidity services: in Turkey (0.53), in Poland (0.50), in the Czech Republic (0.42) and in Israel (0.39). Fiedman and Verbetsky (2001) report the elasticity of currency substitution in Russian between 2 and 3, and estimate of share of the US dollar in liquidity services below 0.5. In a low inflation economy like Canada the US dollar is not a good substitute of domestic currency and, moreover, the share of foreign currency in domestic liquidity services is very small (Imrohorouglu, 1994). Dollarization plays significant role in transition economies like Russia, Czech and Slovak Republics, Poland, Georgia but is insignificant in the developed economies like Canada. Moreover, the share of the US dollar in producing liquidity services is higher in Georgia than in other transition and developed countries.

The benchmark simple model predicts that the amount of foreign money holdings should significantly decrease with the progress in macroeconomic stabilization.

Exchange rate and domestic inflation stabilization as well as increase in interest rate on the domestic currency deposits should reduce dollarization in the economy. However, dollarization remains persistent and excessive in Georgia. One explanation for this phenomenon is hysteresis or inertia effect: once switched to foreign currency as a response to macroeconomic instability, there is hedging against future uncertainty even with a rapid macroeconomic improvement. An alternative explanation for excessive dollarization is portfolio diversification motives. The agents hold foreign currency in the form of currency deposits and cash as alternative to savings in the form of domestic currency.

Policy measures to reduce dollarization to its optimal level include methods of paying attractive interest rates on deposits, capital controls, prohibition of foreign currency deposits, and the exchange rate and inflation stabilization. The first three methods are usually ineffective and should be exercised with extreme caution. As the US dollar is a good substitute for the lari, changes in domestic inflation over foreign inflation or in the exchange rate will eventually lead to substitution between currencies. Given the observed persistence, long-term inflation and the exchange rates stabilization policies seem to be the only measure that will eventually reduce dollarization.

References

- Adam, C., Goujon, M., Guillaumont Jeanneney, S. (2004). The Transactions Demand for Money in the Presence of Currency Substitution: Evidence from Vietnam. *Applied Economics*, 36, 1461-1470.
- Aslamazishvili, N. & Kakulia, M. (2004). Dollarization in Georgia: Size of the Problem, Factors and the Ways of Solutions. *Banki*, 3, 13-24.
- Brodsky, B. (1997). Dollarization and Monetary Policy in Russia. *Review of Economies in Transition*, 6, 49 – 62.
- Bufman, G. & Leiderman, L. (1993). Currency Substitution under Non-expected Utility: Some Empirical Evidence. *Journal of Money, Credit, and Banking*, 25, 320 – 325.
- Calvo, G. & Vegh, C. (1996). From Currency Substitution to Dollarization and Beyond: Analytical and Policy Issues. G. Vegh ed. *Money, Exchange Rates and Outputs*, Cambridge: MIT Press.
- Cuddington, J. (1983) Currency Substitution, Capital Mobility and the Demand for Domestic Money. *Journal of International Money and Finance*, 2, 111 – 133.
- Cuddington, J., Garcia R-M., Westbrook, D. (2002). A Micro-foundations Model of Dollarization with Network Externalities and Portfolio Choice: The Case of Bolivia (mimeo). Department of Economics of Georgetown University.

- Friedman, A., & Verbetsky, A. (2001). Currency Substitution in Russia. Economic Education and Research Consortium Working Paper Series, 01/05.
- Hansen, L. (1982). Large Sample Properties of Generalized Method of Moments Estimators. *Econometrica* 50, 1029 – 1054.
- Hansen, L. & Singleton, K. (1982). Generalized Instrumental Variables of Nonlinear Rational Expectations Models. *Econometrica*, 50, 1269 – 1285.
- Havrylyshyn, O., Beddies, C. (2003). Dollarisation in the Former Soviet Union: From Hysteria to Hysteresis. *Comparative Economic Studies*, 45, 329-357.
- Imrohorglu, S. (1994). GMM Estimates of Currency Substitution between the Canadian Dollar and the U.S. Dollar. *Journal of Money, Credit and Banking*, 26, 792 – 807.
- Miles, M. (1978). Currency Substitution, Flexible Exchange Rates, and Monetary Independence. *American Economic Review*, 68, 428 – 436.
- Mongardini, J. & Mueller, J. (1999). Effects in Currency Substitution: An Application to the Kyrgyz Republic. IMF Working Paper 99/102.
- Mulligan, R. & Nijse, E. (2001). Shortage and Currency Substitution in Transition Economies: Bulgaria, Hungary, Poland and Romania. *International Advances in Economic Research*, 7, 275-95.
- Selcuk, F. (2003). Currency Substitution: New Evidence from Emerging Economies. *Economics Letters*, 78, 219-224.

- Selcuk, F. (1997). GMM Estimation of Currency Substitution in a High-Inflation Economy. *Applied Economics Letters*, 4, 225-228.
- Sidrauski, M. (1967). Rational Choice and Tatters of Growth in a Monetary Economy. *American Economic Review*, 2, 534-544.
- Thomas, L. (1985). Portfolio Theory and Currency Substitution. *Journal of Money, Credit and Banking*, 17, 347-357.
- Uribe, M. (1997). Hysteresis in a Simple Model of Currency Substitution. *Journal of Monetary Economics*, 40, 1299-1303.

Table 1. Data statistics

	$\frac{e_{t+1}}{e_t}$	$\frac{1 + \pi_t}{1 + \pi_t^*}$	$\frac{1 + i_t}{1 + i_t^*}$	$\frac{c_t}{m_t}$	$\frac{c_t}{m_t^*}$	$\frac{m_t}{m_t^*}$	$\frac{m_t^*}{m_t^* + m_t}$
Obs	142	142	142	142	142	142	142
Mean	0.995	1.505	0.975	0.008	0.009	0.671	0.716
Median	1	1.370	0.986	0.008	0.002	0.275	0.784
Maximum	1.211	13.627	1.053	0.022	0.191	8.579	0.886
Minimum	0.949	-1.247	0.874	0.001	0.000	0.128	0.104
Std. Dev.	0.029	1.716	0.034	0.006	0.023	1.208	0.185
Skewness	4.554	3.662	-0.389	0.319	5.006	3.878	-1.801
Kurtosis	29.100	21.956	-0.245	-1.068	31.032	17.013	2.559
UR/break tests result ^a	broken trend stationary	broken trend stationary	stationary	stationary	stationary	stationary	stationary

^aThe decision is based on the results of ADF, PP, KPSS, Vogelsang and Perron tests at 5% significance level.

Table 2. Estimation results for the model 1

parameter	inflation model 1.1	inflation model 1.2	inflation model 1.3
φ	0.566***(0.099)	-	-
γ	6.41E-04**(3.37E-04)	1.08E-03**(5.61E-04)	2.91E-03***(6.66E-04)
ρ	-1.464**(0.767)	-0.811**(0.382)	-1.618*** (0.329)
$ 1/(1 + \rho) $	2.153	5.300	1.617
J	6.949(0.542)	5.291(0.808)	14.302(0.074)

Sample: 01/01/1996-01/11/2007; estimation method: GMM; * =significance at 10%; ** =significance at 1%; *** =significance at 1%.

Table 3. Estimation results for the model 2

parameter	exchange rate model 2.1	exchange rate model 2.2	exchange rate model 2.3
φ	0.591***(0.161)	-	-
γ	1.06E-03*(5.74E-04)	0.068***(0.024)	6.58E-04***(1.76E-04)
ρ	-1.091***(0.466)	-0.017***(8.52E-03)	-1.647***(0.833)
$ 1/(1 + \rho) $	10.980	1.017(0.00) ^a	1.545
J	12.293(0.504)	7.322(0.885)	4.929(0.977)

Sample: 01/01/1996-01/11/2007; estimation method: GMM; * = significance at 10%, ** = significance at 1%, *** = significance at 1%.
^a p-values of the equality to unity test are in parenthesis.

Table 4. Estimation results for the model 3

parameter	interest rates model 3.1	interest rates model 3.2	interest rates model 3.3
φ	0.800***(0.253)	-	-
γ	9.44E-04***(3.26E-04)	1.40E-03***(3.80E-04)	3.68E-03***(8.06E-04)
ρ	-2.49509(2.232)	-0.797*(.531)	-1.426****(0.459)
$ 1/(1 + \rho) $	-	4.916	2.346
J	4.776(0.853)	3.106(0.96)	15.622(0.058)

Sample: 01/01/1996-01/11/2007; estimation method: GMM; * = significance at 10%, ** = significance at 1%, *** = significance at 1%.

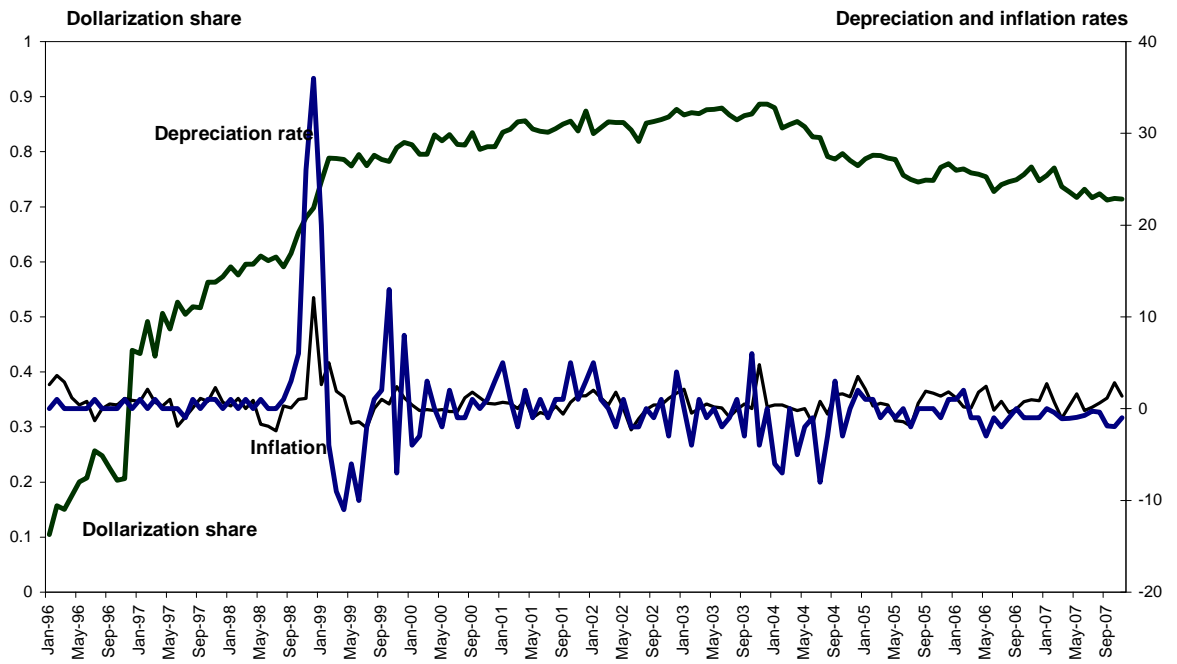


Figure 1: Dollarization share, depreciation, and inflation in Georgia , 1996-2007

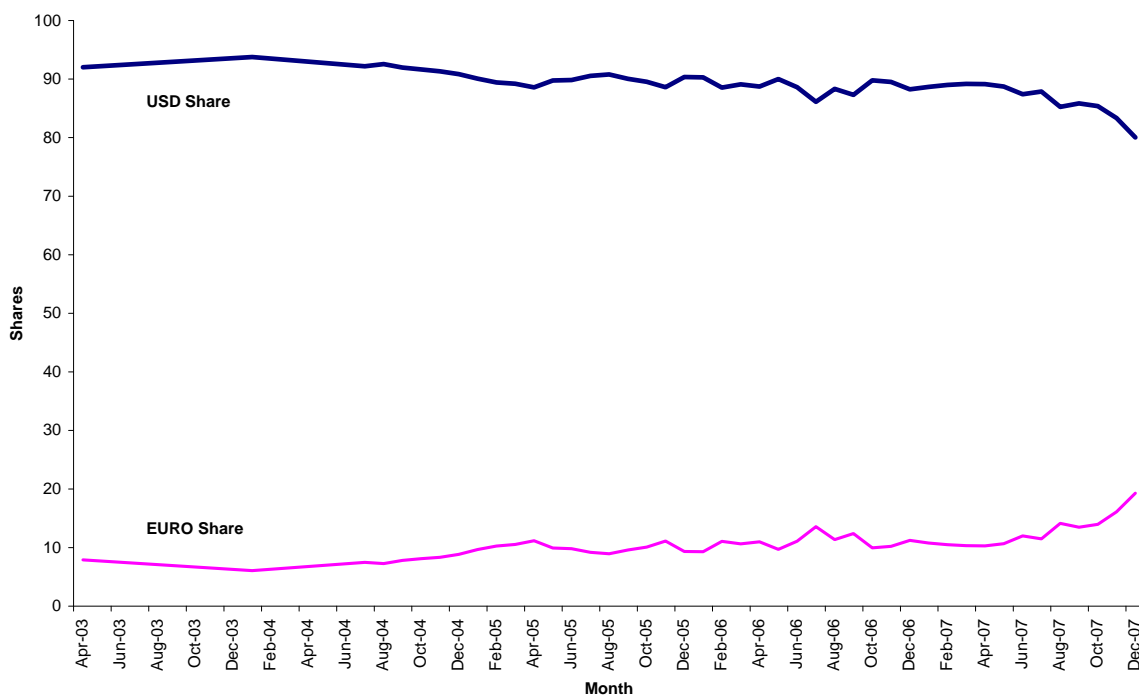


Figure 2: USD and EURO Shares in Dollarization Ratio in Georgia, 2003-2007

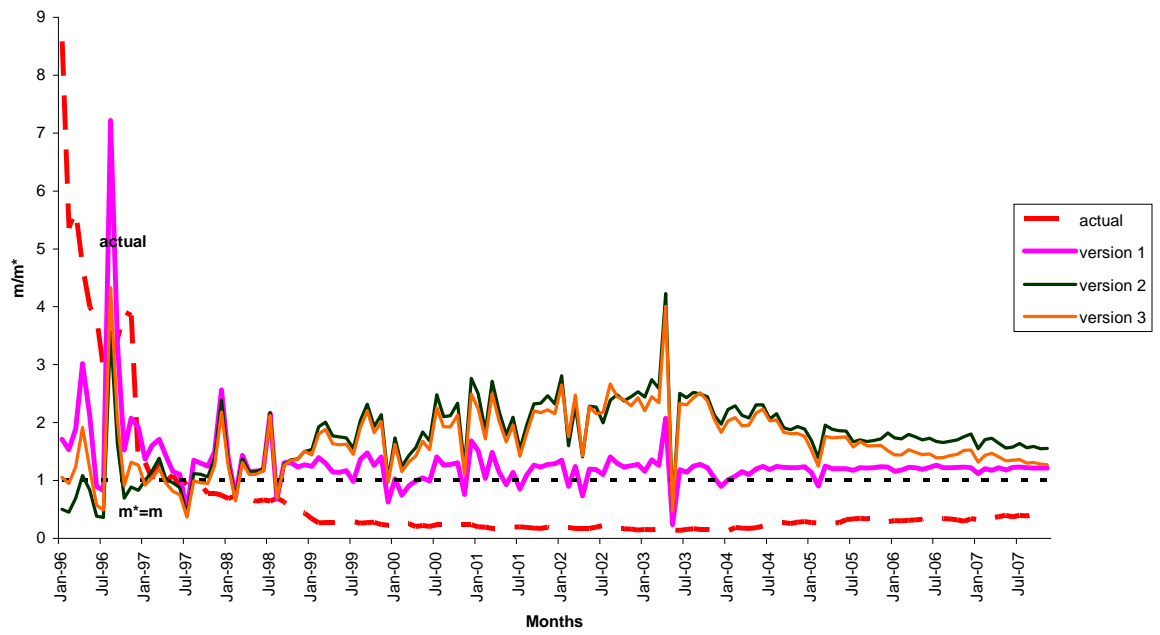


Figure 3: Money ratio: actual and inflaion model 1

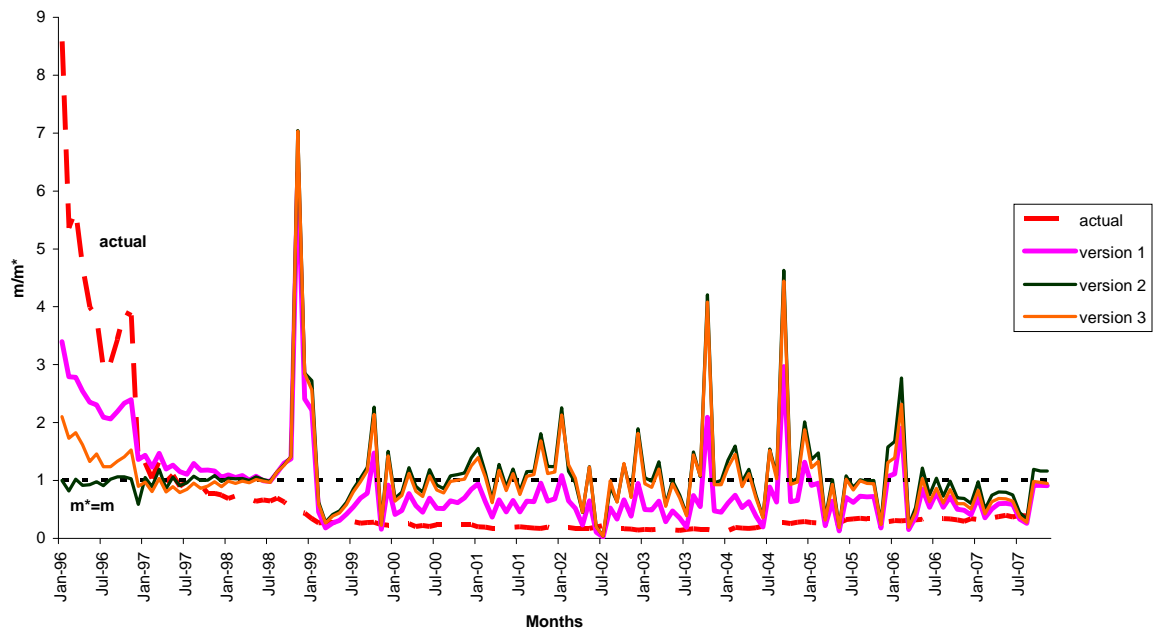


Figure 4: Money ratio: actual and exchange rate model 2

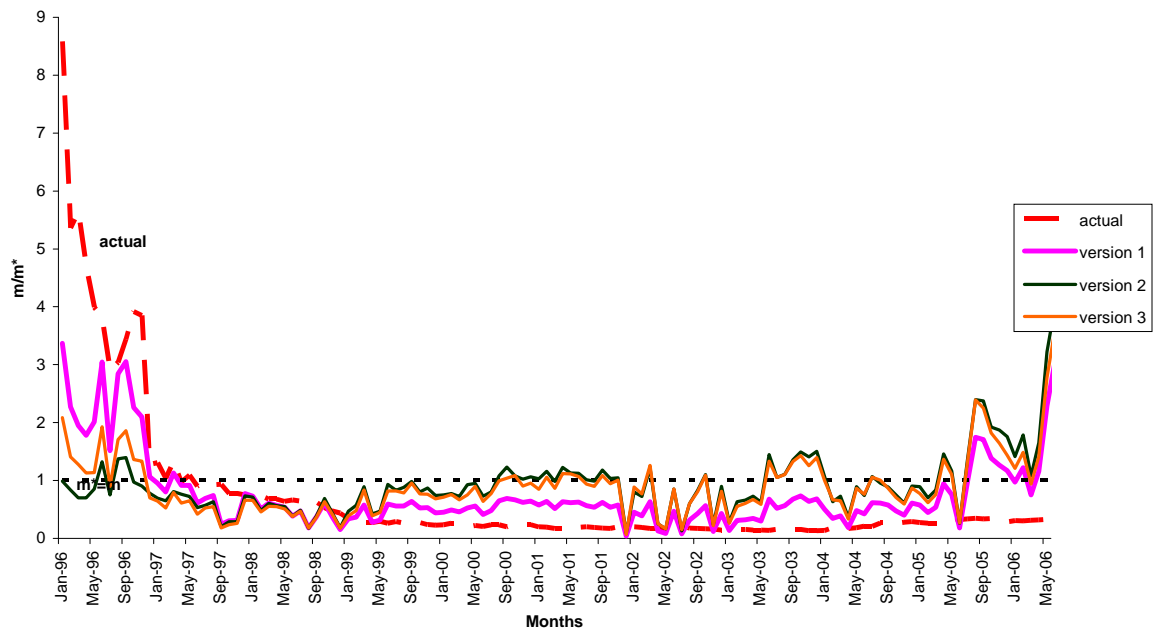


Figure 5: Money ratio: actual and interest rates model 3

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