

# **The Hysteresis of Currency Substitution: Currency Risk vs. Network Externalities**

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## **Abstract**

It is widely documented that currency substitution (using foreign money in transactions) increases in periods of high inflation but does not decline once inflation is reduced. The paper uses survey data from Bulgaria, which experienced this phenomenon, to investigate the origins of this ratchet effect. We find that expected devaluation of the domestic currency, while relatively high, does not play a major role in sustaining the dollarization of transactions. Conversely, preferences for the use of foreign money are strongly influenced by people's perception that foreign money is already widely used in the economy.

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# The Hysteresis of Currency Substitution: Currency Risk vs. Network Externalities

## 1. Introduction

It is well established that dollarization<sup>1</sup> increases in times of high inflation as foreign currencies, usually the dollar, substitute for the domestic currency first as a store of value and then, if inflation reaches very high levels, also as medium of exchange. It is also well established, however, that de-dollarization does not occur, at least not fully, when disinflation is achieved. Instead economic agents continue to use foreign money in the financial system and in transactions. This ratchet effect is one of the stylized facts of dollarization (Calvo and Vegh, 1992) and has attracted considerable attention in the literature.

The explanations for the ratchet effect can be grouped into two main categories: 1) *Network externalities*: if economic agents can choose among several currencies for transactions they will prefer the currency that is already widely used in the economy; therefore, if dollarization reaches sufficiently high levels during a period of high inflation it will persist after inflation has declined because the dollar is already entrenched as a means of payment; and 2) *Expected depreciation* of the domestic currency: the less risky currency - the dollar, will be preferred because it preserves value better. In this framework, dollarization persists because of persistent doubts in the future stability of the local currency even if the current exchange rate is stable. The next section elaborates on these arguments.

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<sup>1</sup> The paper uses dollarization to refer to both unofficial dollarization and unofficial euroization.

Although there is substantial academic and policy interest in the hysteresis of currency substitution, the theories outlined above are difficult to validate empirically for lack of data on the use of multiple currencies in transactions.<sup>2</sup> Nonetheless, the literature offers some evidence. In their analysis of the Argentine economy, Kamin and Ericsson (2003) augment the available data on multiple currencies from the financial system with data on the amount of dollars (in cash) circulating in Argentina. The data are obtained from the Currency and Monetary Instruments Reports of the U.S. Treasury Department that document the flow of U.S. currency between the U.S. and foreign countries. Similarly, Feige et al. (2002), Feige et al (2003), and Feige and Dean (2004) use these and additional sources (including survey data, a denomination displacement method, and a money demand method) to generate estimates of dollarization for Latin American and transition economies. These studies provide evidence for hysteresis by showing that a period of financial instability raises the level of dollarization for a long time after the episode of instability has ended. Furthermore, they argue that the network externality effect is the dominant factor explaining the persistence of dollarization.

This paper provides further evidence on the expected depreciation and the network externality hypotheses using survey data from Bulgaria. The survey includes questions designed specifically to investigate these effects on the micro level. Bulgaria is a typical case of the ratchet effect of high inflation on dollarization. It experienced hyperinflation in 1997, which led to the widespread dollarization of financial assets and transactions. It disinflated successfully by implementing a fixed exchange rate regime

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<sup>2</sup> In contrast, financial data from the banking system have been utilized in a number of papers to investigate the use of foreign currencies in the financial system (asset substitution). See Kamin and Ericsson (2003), Ize and Levi-Yeyati (2003), Martinez and Werner (2002), Gruben and Welch (1996), Melvin (1988), and Aghenor and Khan (1996).

along with a currency board and has had single digit inflation for almost 10 years. Yet the euro and the dollar are still widely used for transactions and in the financial system.

The national survey in 2003 studied here helps explain this phenomenon. We find that expected devaluation of the domestic currency contributes to the hysteresis of dollarization but only for residents of small towns and villages. Conversely, preferences for the use of foreign money are strongly influenced by people's perception that foreign money is already widely used in the economy.

The rest of the paper proceeds as follows. The next section discusses the theories of dollarization hysteresis in more detail. Section 3 describes the process of dollarization in Bulgaria. Sections 4 and 5 present the survey data and the empirical estimations, and Section 6 concludes.

## **2. Theories of dollarization hysteresis**

### Purchasing power risk

In Tandon and Wang (2003), Craig and Waller (2004), Camera et al. (2004), and Engineer (2000) transactions between economic agents can be carried out using more than one currency. The models usually have two currencies: the "dollar" which is a stable currency with a low risk of losing purchasing power and the local currency, the "peso," that has a positive probability of losing purchasing power. For example, Craig and Waller (2004) and Camera et al. (2004) model the purchasing power risk as a random government tax on domestic money holdings.

In that set-up, accepting the local currency in transactions is risky because the local currency might lose value before it is exchanged for goods. Therefore, persistent expectations of currency depreciation lead to persistent dollarization of transactions. However, the models generate equilibria where the local currency is not fully displaced by the dollar despite the persistent doubts in its stability. Instead, the two currencies coexist, which matches closely what is observed in developing countries where the local currency and a foreign currency circulate simultaneously.<sup>3</sup>

In the models, the local currency remains a viable medium of exchange because the use of dollars entails a transaction cost. For example, in Engineer (2000) the cost of using dollars is assumed to be proportional to the size of the transaction. The inclusion of transaction costs in his model is motivated by the observation from developing countries that sellers of goods have to verify whether the dollars offered by the buyers of goods are not counterfeit. The risk of accepting counterfeit dollars in exchange for goods can be substantial. Tandon and Wang (2003) also incorporate a proportional transaction cost. In Guidotti and Rodriguez (1992) the cost is not associated with the use of dollars per se but with switching between currencies.<sup>4</sup>

There are two main factors explaining the extent of dollarization in these models: the purchasing power risk associated with using the local currency and the transactions

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<sup>3</sup> Multiple equilibria are possible if beliefs about the value of a currency as store of value and medium of exchange affect its actual use. In Tandon and Wang (2003), a drop in confidence in the local currency lowers money demand. This decreases the inflation tax base and heightens the likelihood of seignorage-induced inflation. In Camera et.al. (2004), an exogenous increase in the perceived value of a currency as medium of exchange raises its actual use as medium of exchange. Tandon and Wang underscore the “importance of institutional innovations (such as currency boards that issue credibly “backed” money) that could result in expectations of greater demand for domestic money by augmenting the confidence in domestic money.”

<sup>4</sup> The two currencies can coexist even in the absence of explicit transaction costs. In Craig and Waller (2004) and Camera et al. (2004) the degree of dollarization is a function of the riskiness of the local currency, the stock of money supplies, and the severity of trade frictions.

cost associated with using dollars. An increase in risk leads to greater dollarization. For a given level of risk, an increase in the transaction cost lowers the level of dollarization. The relationship between incomplete confidence in the local currency and dollarization is explored by Melvin and Fenske (1992) and Clemens and Schwartz (1993) in the context of Bolivia. In a country with a history of exchange rate instability like Bolivia, de-dollarization might not occur because the history of past instability feeds into expectations of future instability.

Despite the intuitive appeal of the hypothesis that the “good” money will drive out the “bad” (risky) money, this might not necessarily be the case. In Tandon and Wang (2003), Craig and Waller (2004), and Engineer (2000) the riskier currency is used less in transactions. However, Camera et al. (2004) show that the opposite is also possible: the “bad” money can drive out the “good” money (as in Gresham’s Law). In their model, while the buyers of goods prefer to dispose of the risky currency, the sellers of goods are reluctant to sell goods in exchange for the risky currency. The prices of goods denominated in the local currency will be higher reflecting the risk assumed by sellers. If the domestic currency prices are high, buyers might prefer to use the “good” currency in transactions and to hold on to the “bad” currency despite the risk of losing purchasing power. According to that view, expected depreciation might decrease rather than increase the use of dollars in transactions.

### Network externalities

Uribe (1997) builds a model economy where a continuum of goods can be purchased using either the domestic currency or a foreign currency. As in other papers, e.g. Tandon and Wang (2003) using dollars to purchase goods involves a transaction cost. In Uribe's model this cost is given by  $\phi(\theta, k)$ , where  $\theta$  denotes the various goods traded in the economy, i.e. different goods might have different transaction costs, and  $k$  reflects the "economy's accumulated experience" in using the foreign currency as a means of payment or as Uribe also refers to it, the "stock of dollarization capital." The cost of transacting in dollars  $\phi(\theta, k)$  decreases in the level of dollarization  $k$  in the economy, i.e. the dollar will be preferred in transactions if it is already widely used.

An increase in exchange rate risk leads to an increase in the use of dollars as medium of exchange. In Uribe's model, if the use of dollar becomes widespread, de-dollarization would not occur automatically after pegging the exchange rate, even if the peg is fully credible, because the transaction cost of using dollars has declined as a result of the increase in dollarization. To compare this to the papers discussed previously, a period of rapid exchange rate depreciation leads to persistent dollarization not because it fuels expectations of future exchange rate depreciation but because it lowers the cost of using foreign money. Of course, these are not competing hypotheses as the two effects can contribute to dollarization hysteresis independently.

The network externality outcome also obtains from first principles in the search theoretical models of money. In Kiyotaki and Wright (1989), an object that has no intrinsic value can emerge as medium of exchange if people expect it to be accepted as a means of payments. The use of the object as medium of exchange essentially becomes a

norm, a social convention. Therefore, if the dollar becomes widely used as a result of a period of financial instability, it will continue to be used after disinflation. Also, the dollar can become widely used simply because economic agents believe that it is useful as medium of exchange. Similarly, multiple equilibria are possible in Craig and Waller (2004) where the increased use of a currency (the “economy’s accumulated experience” with using dollars in Uribe’s model) increases the likelihood that it will be accepted in transactions thereby increasing its appeal as medium of exchange.

The role of network externalities has been supported by experimental studies, e.g., Duffy and Ochs (2002) and Camera et al. (2003). For example, Camera et al. construct three experiments where money and an alternative asset with a positive return (consol) can be used in transactions. In the first experiment where money and the consol are introduced simultaneously, the consol displaced money as medium of exchange as can be expected. In the second experiment money is introduced for several rounds of the game before introducing the consol. The experiment shows that money continues to be used as medium of exchange even after the consol is introduced. Furthermore, Camera et al. find that the habit of using money becomes entrenched even after only a few rounds of the game.<sup>5</sup>

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<sup>5</sup> As in the second experiment, in the third experiment the consol is introduced in later rounds. However, the dividend of the consol is now paid before trade occurs instead of after the trades. The altering of the timing of trade and the dividend payouts between experiments shows that the dividend-paying asset will be hoarded leading to shocks to its supply and to erratic price movements. In this environment money is the preferred medium of exchange.

### Empirical hypotheses

Drawing on the literature, we can formulate the following empirical hypotheses regarding economic agents' preferences over the use of various currencies in transactions:

Hypothesis 1: *The dollar will be preferred by economic agents who believe that dollars are already widely used in the economy.*

Hypothesis 2: *The dollar will be preferred by economic agents who expect the local currency to depreciate.*

We need to make an important qualification to Hypothesis 2. As pointed out earlier, Camera et. al. (2004) explain that while buyers of goods are eager to get rid of the risky currency, sellers of goods are reluctant to accept it as they would assume the currency risk. The survey investigated in this paper asks respondents about their currency preferences from the perspective of sellers. In Camera et. al. (2004), sellers are unwilling to accept the risky currency especially if “trade frictions” are large, i.e. if sellers cannot engage easily in subsequent transactions as buyers. If the sellers can dispose of the risky currency easily, then they are more willing to accept the local currency in exchange for goods. We test this proposition by differentiating between agents who live in rural areas and small towns from those who live in big cities. Arguably, people in more rural areas face more trade frictions. Furthermore, they have less access to banks and other financial institutions where they can convert local currency into foreign currency at a low cost and, thus, reduce their currency risk exposure. Therefore, we can expand Hypothesis 2 as follows: *The dollar will be preferred by economic agents who expect the local currency to depreciate. This effect will be stronger for agents residing in villages and small towns.*

### **3. Financial crisis, stabilization, and dollarization in Bulgaria**

Figure 1 shows the changes in the nominal lev (the local money)/dollar exchange rate and the percent bank deposits denominated in foreign currencies in Bulgaria from 1993 to 2005. The currency composition of bank deposits is used often to measure financial dollarization in the empirical literature. The Bulgarian currency was continuously depreciating since the early years of transition. During the period from 1993 to 1995 the lev depreciated by about 190 percent against the dollar. During that period, approximately 33 percent of bank deposits were in foreign currencies. In 1996 and 1997, the exchange rate went into a free-fall depreciating by more than 800 percent. As could be expected the dollarization of bank deposits increased dramatically along with the sharp depreciation of the lev. By 1998, 86.9 percent of bank deposits were denominated in foreign currencies. With the introduction of the currency board, the exchange rate was fixed and inflation declined to an average of 5.5 percent per year almost instantaneously. Figure 1 shows that the percent foreign currency deposits also declined from their peak in 1998 but they are nonetheless still at about 50 percent of all bank deposits.

Bulgaria introduced a fixed exchange rate regime with a currency board on July 1<sup>st</sup> 1997. A currency board is a “hard” peg in the sense that the size of the foreign exchange reserves held by the central bank is sufficient to cover the monetary base of the country. Furthermore, the central bank is prohibited from financing government expenditures. These rules are clearly spelled out in a special law which also serves to make this regime transparent. Nonetheless, currency boards are not immune from crises as the recent experience in Argentina shows and therefore concerns about devaluation may persist. In Bulgaria, as in Argentina during its currency board period (see Schmukler

and Serven 2002), there has been a persistent spread between local currency interest rates and foreign currency interest rates. The average spread between interest rates on one-year local-currency bank deposits and euro deposits has been about 200 basis points since 2000.

Although the tax system and other payments to and from the government are denominated in the local currency, Bulgarians can legally use foreign currencies to open bank accounts and to settle transactions. However, the evidence on the extent to which foreign moneys are used in transaction is scarce. Feige (2003) provides estimates of the foreign currency holdings in 25 transition economies. Feige estimates that about 41 percent of the currency held in Bulgaria in 2001 was in foreign currencies. This is close to the average percent foreign currency holdings in other transition economies (43.8 percent). It is difficult to determine how much of the foreign currency holdings in Bulgaria and elsewhere in the transition economies are used in transactions and how much are held as store of value because of lack of trust in the banking system but, nonetheless, the estimates suggest a relatively high level of dollarization.<sup>6</sup>

Bulgaria implemented wide-ranging reforms in its financial system along with introducing the currency board. Most banks were privatized, in many cases taken over by major foreign banks. Bulgarians can open bank accounts in various currencies. Currency conversion costs are low.<sup>7</sup> Hence, expected devaluation, while affecting the currency composition of bank deposits, may not necessarily affect the preferences for the use of foreign currencies in transactions. However, although banking services are relatively well

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<sup>6</sup> There is ample anecdotal evidence in line with these estimates. For example, the asking prices of most real estate ads in the leading real estate classified in Bulgaria ([www.imot.bg](http://www.imot.bg)) are in euro.

<sup>7</sup> As an indicator, on the last day of August 2003, the month of the survey, the bid-ask spread of the euro interbank foreign exchange market was only 0.11 percent of the average bid and ask price on that day.

developed, banks do not have the same presence in all localities in the country. Much of the banking activity is concentrated in the large cities which is not uncommon in other transition economies. The EBRD (2002) reports large disparities in the availability of banking services in rural versus urban areas.

#### **4. Survey data**

The survey used in this paper was conducted in August 2003 by a national polling agency using certified professionals.<sup>8</sup> The sample size of about 1000 respondents is representative of the population and is the standard size of national surveys in this country of 8 million citizens. To study preferences over various currencies in transactions, the survey asked respondents in what currency they would prefer to receive payments from a real estate sale, from a vehicle sale, from a real estate rental agreement, and for salaries. Table 1 shows that about 64 percent of respondents prefer the local currency for real estate sales, 26 percent prefer the euro and 10 percent prefer the dollar. Less than one percent of the respondents prefer currencies other than these three. Preferences for the local currency are stronger for wages, rents and vehicle sales compared to real estate sales. For example, 77 percent of the respondents prefer wages in the local currency. The next section explores the determinants of these preferences.

Then the survey posed the following question: *Based on your observations, how frequent are transactions in Bulgaria in which foreign currencies are used instead of the lev?* Respondents could answer that such transactions are very frequent, frequent, not frequent, very rare, or that they are not aware of transactions using foreign currencies.

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<sup>8</sup> The questionnaire and other information about the survey, which is one of a sequence of annual surveys on the transition of the monetary system in Bulgaria since 1997, can be obtained upon request. The questions on preferences over multiple currencies in transactions were asked only in the 2003 survey.

This question is used to test the network externality theory, i.e. whether greater use of foreign currencies in transactions leads to stronger preferences for the use of foreign currencies in transactions. The question gauges how widespread is the use of foreign money in transactions, or at least how widespread is the perception of such use. Table 2 shows that about half of the population is not aware of the use of foreign money in transactions and 21 percent report a frequent or very frequent use. The correlations in Appendix A show that respondents who are younger, male, with more education and higher income, and those who reside in the big cities perceive a wider use of foreign currencies in the economy. This suggests that the perceptions of the use of foreign money are influenced by individuals' personal experiences as most foreign currency transactions are probably carried out in urban environments and involve large ticket items such as real estate and vehicles.

Next, the survey asked respondents what is the likelihood that the currency board would collapse with large devaluation in the next 6 months, 1 year, and 5 years. It is clear from the responses summarized in Table 3 that the currency board is not fully credible. About 17 percent of the respondents believe that the likelihood of devaluation is big or very big, and only about 22 percent believe that the likelihood of devaluation is zero over the following year. We use this question to test the effect of expected devaluation on currency preferences. Furthermore, we use the place of residence of respondents, i.e. large towns including the capital vs. small towns and villages, to differentiate between respondents with respect to the "trading frictions" they face and their access to financial services.

The estimations reported in the next section control for demographic characteristics: education, age, gender, and income.<sup>9</sup> A recent Eurobarometer survey (European Commission 2004) in the 12 new European Union accession countries (Bulgarians were not surveyed) inquired about respondents' preferences regarding the adoption of the euro in their countries. In all countries, older respondents, female respondents, and less educated respondents were on balance less happy about the idea of adopting the euro. These attitudes could be related to the degree of information about the euro as well as people's personal experiences using the euro in domestic transactions and while traveling. Our estimations investigate whether these factors work in the same direction when respondents are given the choice of multiple currencies for domestic transactions instead of being asked about the official adoption of the euro.

## **5. Explaining multiple currency preferences**

To begin the analysis, Table 4 shows the percentage of respondents who prefer the lev for salary payments and in real estate transactions. The responses to the other two types of transactions: rents and vehicle sales, show similar results. The table provides the responses for different subgroups of respondents defined using the survey questions about the use of foreign currencies in the economy, expected devaluation, and demographic characteristics.

The table shows that the perceived use of foreign currencies in transaction influences strongly respondents' preferences. For example, 70.54 percent of the respondents who think that foreign currencies *are not* used widely in the economy prefer

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<sup>9</sup> Income is measured using a question that asks respondents whether they can buy everything they need, only essentials or not even essentials. The response rate to this question was higher than the response rate to an alternative question asking about income in monetary units.

the domestic currency in real estate sales. In comparison, only 40.49 percent of the respondents who think that foreign currencies *are* widely used in transactions prefer the lev. Expected devaluation also influences the stated preferences. Respondents who expect devaluation during the upcoming year prefer foreign currencies more strongly. However, the size of the effect is smaller compared to the effect of network externalities. Looking at the remaining results, the domestic currency is preferred more strongly among older respondents, female respondents, less educated respondents, low income respondents, and respondents in small towns and villages. The effects of age and education are particularly strong, coming close to the size of the effect of network externalities.

#### Empirical estimations

Table 5 explores these relationships in a multivariate framework. We estimate a probit model where the dependent variable is a dummy variable equal to 1 if a respondent prefers the lev, and zero otherwise. The explanatory variables are Network Externality (dummy variable equal to 1 if the reported use of foreign money is frequent or very frequent, and zero otherwise), Expected Devaluation (dummy variable equal to 1 if the likelihood of devaluation is big or very big), an interaction variable of Expected Devaluation with a dummy variable for small towns and villages, and demographic characteristics: age, income, gender, education, and place of residence.

Table 5 reports marginal effects, which can be interpreted as the direct influence on the probability of stating a preference for the lev at the mean of an independent variable. In the case of dummy variables used as independent variables, the reported

coefficient estimate equals the probability of preferring the lev if that dummy variable is one minus the probability of preferring the lev if it is zero.

In line with the evidence from Table 4, Table 5 shows that Network Externalities are a strong influence on currency preferences. In terms of size, the coefficient 0.210 on Network Externality in the first column of results means that the probability of preferring the lev in real estate transactions is 21 percentage points higher for a respondent who believes that foreign currencies are widely used in the economy compared to the remaining respondents. The size of the coefficient on Network Externality is strongest for real estate transactions, then vehicle sales, then rental agreements, and finally salaries. Anecdotal evidence suggests that this matches the ranking of these payments in terms of the actual use of foreign currencies in the economy.

Next, the results show that Expected Devaluation affects currency preferences but only if respondents reside in small towns and villages. The effect is statistically significant (at lower significance levels compared to Network Externality) for all transactions except salaries. In terms of size, the likelihood that a respondent in a small town or a village prefers the domestic currency declines by about 13 percentage points ( $0.026 - 0.158 = -0.132$ ) if the respondent expects devaluation of the lev.

Looking at the demographic characteristics, age is positive and statistically significant in all estimations and the size of the effect is similar across the estimations. Each 10 additional years increase the likelihood of preferring the lev by about 7 percentage points. Similarly, female respondents, less educated respondents, respondents with lower income and those who reside in smaller towns and village also generally prefer the lev. These groups of respondents probably have less direct experience using

foreign currencies, which are typically used in large transactions, and therefore are less willing to accept currencies other than the local money. For the same reason, fewer respondents in those groups would need foreign currencies to make future transactions as the lev is used in most day-to-day transactions.

### Robustness checks

We obtain similar results using other definitions of Network Externality and Expected Devaluation such as several dummies for a very frequent use, frequent use, etc. of foreign currencies and, similarly, for a very big, big, small, etc. likelihood of devaluation.<sup>10</sup> We also estimated the models with expected devaluation over the next six months or five years with similar results. Qualitatively similar results were also obtained with alternative education variables such as distinguishing between primary, high school, and higher education. Estimating the equations with age squared reveals some nonlinearity in the age effect. The positive effect of age on the preferences for the local currency increase substantially when respondents reach about 60 years of age.

Various specifications of the models were also estimated starting with a parsimonious specification including only Network Externality, Expected Devaluation, the interaction of Expected Devaluation with the dummy variable for small towns and villages, and the dummy variable for small towns and villages. Then we added the remaining explanatory variables one at a time. The estimated effects are similar to those reported in Table 5. For example, the coefficient estimate on Network Externality is

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<sup>10</sup> All estimations discussed in this section are available on request. Also, Appendix B investigates the choice between the dollar, the euro, and the lev using a multinomial logit model.

-0.224 in the parsimonious model explaining currency preferences in real estate transactions. This is very close to the coefficient estimate of -0.211 from the full model reported in table 5. Similarly, the coefficient estimate on the interaction variable of Expected Devaluation with small towns and villages is -0.134 in the parsimonious model and -0.158 in Table 5.

The remaining explanatory variables also have similar effects to those reported in Table 5. Although the correlation coefficients of many of the control variables are statistically significant, the sizes of the correlation coefficients are relatively small. For example, according to Appendix A, income and education are positively correlated but the correlation coefficient is only 0.22. Also, age and residence in small towns and villages are positively correlated but the correlation coefficient is only 0.07. Therefore, the estimated effects do not change substantially depending on the empirical specification.

## **6. Conclusion**

The empirical results presented in this paper show that foreign currencies are preferred in transactions if they are already used widely in the economy and, for residents of small towns and villages, if the domestic currency is expected to depreciate. These results confirm theoretical hypotheses developed to explain the hysteresis of dollarization: dollarization increases in times of high inflation but it is not reversed fully if disinflation is achieved. Furthermore, demographic characteristics such as age, gender, and education play an almost equally important role in shaping preferences over multiple currencies. The empirical evidence presented here is important as the literature on

dollarization has focused on financial dollarization almost exclusively using data from the domestic financial systems. Similar data for the analysis of the dollarization of transactions are not readily available, especially on the micro level.

The results suggest that while both network externalities and expected devaluation contribute to the persistence of dollarization, the network externalities effect is more important in statistical significance and in size. These results provide a useful parallel to the literature on financial dollarization where currency risk, defined as persistent expectations of devaluation or, in the Minimum Variance Portfolio approach of Ize and Levi-Yeyati (2003), as the volatility of domestic currency inflation relative to the volatility of the real exchange rate, is of primary importance. In contrast, the dollarization of transactions seems to be driven primarily by network externalities and less so by currency risk. As Ize and Levi-Yeyati show, an increase in real dollarization leads to an increase in financial dollarization but the reverse need not occur. In many countries, financial dollarization is high even though most domestic transactions are carried out using the local currency. Thus, financial dollarization and the dollarization of transactions are driven by relatively different forces. Using measures of financial dollarization to proxy for the dollarization of transactions in the empirical literature has to be done with caution.

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## **Appendix B. The euro versus the dollar**

We also estimated a multinomial logit model where the same independent variables used in the main text explain the choice between the lev, the euro, and the dollar. The advantage of this estimation is that we can determine whether certain factors influence not only the preferences for the domestic currency versus foreign currencies but also whether they determine the preferences among the foreign currencies. These results are reported in Table B1. The analysis includes only the euro, the dollar and the lev since very few respondents preferred currencies other than these three. Furthermore, the table reports results only for real estate transactions as the results for salaries, vehicle sales and rents were similar.

The base outcome used in the estimations is preferences for the euro. Therefore the second column of coefficients resembles the results of Table 5, i.e. the coefficients show if a certain respondent characteristic is associated with stronger or weaker preferences for the lev relative to the euro. The first column of results refers to the choice between the euro and the dollar. A negative coefficient indicates stronger preferences for the euro and a positive coefficient indicates stronger preferences for the dollar. There are three statistically significant coefficients in that column of results. Older respondents generally prefer the dollar over the euro. As the euro is a relatively new phenomenon, the historical stability of the dollar may influence the preferences of older respondent to a greater extent. Next, more educated respondents prefer the euro over the dollar possibly because of greater information, e.g., about the continuing rapid appreciation of the euro during that time. Finally, concerns about devaluation of the lev seem to strengthen preferences for the euro more so than preferences for the dollar which may also be attributed to the continuing weakening of the dollar during that period.

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**Appendix A.**  
**Table A1.**  
**Summary statistics.**

	Leva for real estate sales	Leva for vehicles sales	Leva for rents	Leva for salaries	Frequent or very frequent use of foreign money	Expected devaluati on within 1 year	Age	Higher education	Female	Income	Small towns and villages
Mean	0.64	0.67	0.70	0.77	0.21	0.17	50.07	0.19	0.55	1.72	0.54
Minimum	0	0	0	0	0	0	17	0	0	1	0
Maximum	1	1	1	1	1	1	91	1	1	3	1
SD	0.48	0.47	0.46	0.42	0.41	0.37	18.15	0.39	0.49	0.52	0.49
<i>Correlations</i>											
Real estate											
Vehicles	0.91*										
Rents	0.83*	0.83*									
Salaries	0.65*	0.67*	0.70*								
Foreign money	-0.25*	-0.21*	-0.17*	-0.14*							
Devaluation	-0.03	-0.03	-0.05	-0.06	-0.02						
Age	0.32*	0.30*	0.31*	0.27*	-0.17*	-0.01					
Higher education	-0.17*	-0.17*	-0.15*	-0.07*	0.10*	-0.01	-0.11*				
Female	0.12*	0.11*	0.09*	0.12*	-0.09*	0.01	0.07*	0.06			
Income	-0.18*	-0.14*	-0.16*	-0.11*	0.10*	0.01	-0.18*	0.22*	-0.06*		
Sm. Towns/Vill.	0.19*	0.16*	0.16*	0.08*	-0.18*	-0.01	0.07*	-0.32*	-0.04	-0.15*	

Notes: \* indicates statistical significance at the 5 percent level.

Table B1

Preferences for the domestic currency and the U.S. dollar versus the euro in real estate transactions. Multinomial logit analysis.

	Dependent variable: 1 if a respondent prefers the local currency, 2 for the euro, 3 for the dollar Base outcome is 2 (preferences for the euro)	
	U.S. dollar	Domestic currency
Network Externalities	0.361 (0.261)	-0.830*** (0.195)
Expected devaluation	0.117 (0.441)	0.138 (0.313)
Expected devaluation* Small towns and villages	-1.626** (0.782)	-1.033** (0.425)
Age	0.020*** (0.007)	0.041*** (0.005)
Higher education	-1.158*** (0.332)	-0.812*** (0.207)
Female	-0.119 (0.252)	0.499*** (0.169)
Income	0.129 (0.253)	-0.331 (0.171)
Small towns and villages	-0.075 (0.281)	0.611*** (0.194)
Chi2(16)		223.60
Number of observations		966

Notes: Standard errors are provided in parentheses. \*\*\*(\*\*,\*) indicates statistical significance at the 1(5, 10) percent level.

Figure 1. Exchange rate changes and financial dollarization.  
Bulgaria, 1993-2004

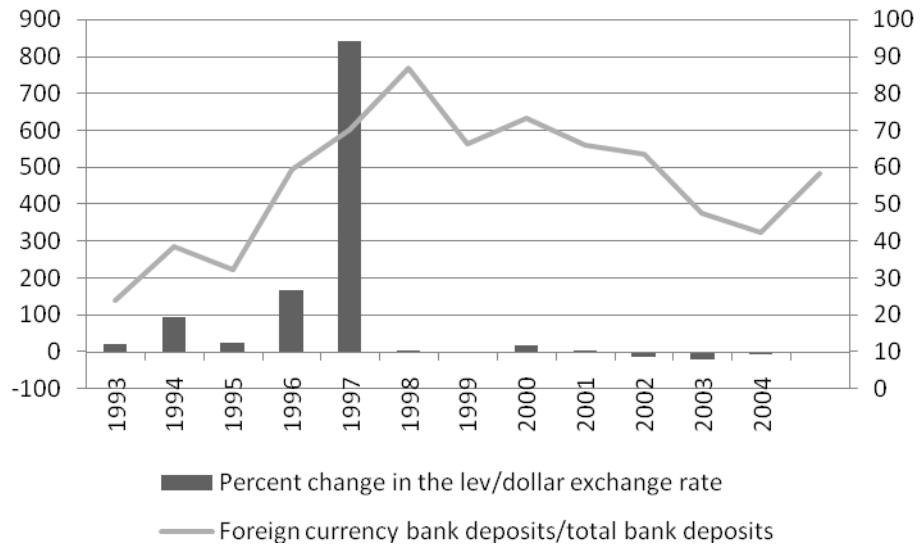


Table 1  
 Preferences over multiple currencies in transactions: Percent of answers in each category

In what currencies would you prefer to receive payments for the following?				
	Salaries	Real estate rent	The sale of a vehicle	The sale of real estate
Local currency	77.22	70.48	67.28	64.25
Euro	17.77	21.65	23.79	25.64
U.S. Dollars	4.60	7.25	8.41	9.60
Other currencies	0.41	0.61	0.51	0.51
Total	100.00	100.00	100.00	100.00

Table 2

The perceived use of foreign currencies in transactions: Percent of answers in each category

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	Based on your observations, how frequent are transactions in Bulgaria in which foreign currencies are used instead of the lev (the domestic currency)?
Not aware of such use	47.8
Very rare use	10.4
Rare use	20.8
Frequent use	16.8
Very frequent use	4.2

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Table 3  
 Expected devaluation: Percent of respondents by type of response

	In your opinion, what is the likelihood that the currency board will collapse with a large devaluation in the next		
	6 months	12 months	5 years
Very big	3.5	3.8	8.9
Big	9.3	12.9	18.9
Small	31.1	31.5	25.7
Very small	17.1	17.0	13.9
None	26.6	21.8	18.2
I don't know	12.4	13.0	14.4
Total	100.0	100.0	100.0

Table 4  
The demand for local currency

	Percent of respondents who prefer to receive the domestic currency	
	For salaries	In real estate sales
Foreign currencies widely used <sup>a</sup>	65.37	40.49
Foreign currencies not widely used	80.36	70.54
	(-14.99) <sup>***</sup>	(-30.05) <sup>***</sup>
High probability of devaluation <sup>b</sup>	71.34	60.98
Low probability of devaluation	77.22	64.91
	(-5.88) <sup>*</sup>	(-3.93)
Female	81.95	69.98
Male	71.53	57.41
	(10.42) <sup>***</sup>	(12.57) <sup>***</sup>
Age > 50	85.63	78.24
Age ≤ 50	67.46	49.46
	(18.17) <sup>***</sup>	(28.78) <sup>***</sup>
Higher education	70.68	46.60
Less than higher education	78.78	68.49
	(-8.10) <sup>**</sup>	(-21.89) <sup>***</sup>
Small towns and villages	80.22	72.76
Large towns and the capital	73.59	53.95
	(6.63) <sup>**</sup>	(18.81) <sup>***</sup>
Low income	83.17	74.92
High income	74.56	59.47
	(8.61) <sup>**</sup>	(15.45) <sup>***</sup>

Notes:

<sup>a</sup>Survey respondents who answered “very frequent” or “frequent” to the following question: Based on your observations, how frequent are transactions in Bulgaria in which foreign currencies are used instead of the lev?

<sup>b</sup>Survey respondents who responded “very big” or “big” to the question: In your opinion, what is the likelihood that the currency board would collapse with large devaluation in the next 1 year.

\*\*\* (\*\*, \*) indicate statistical significance from t-tests at the 1(5, 10) percent level.

Table 5  
The demand for local currency: Probit analysis

	Dependent variable: 1 if a respondent prefers the local currency, 0 otherwise			
	Real estate sales	Vehicle sales	Rent	Salaries
Network externality	-0.211*** (0.041)	-0.161*** (0.040)	-0.110*** (0.038)	-0.088*** (0.034)
Expected devaluation	0.026 (0.059)	-0.039 (0.056)	-0.006 (0.055)	-0.046 (0.053)
Expected devaluation* Small towns and villages	-0.158* (0.093)	-0.188** (0.092)	-0.134* (0.088)	-0.050 (0.075)
Age	0.008*** (0.001)	0.007*** (0.001)	0.007*** (0.001)	0.006*** (0.001)
Higher education	-0.116*** (0.044)	-0.132*** (0.043)	-0.089** (0.040)	-0.035 (0.036)
Female	0.114*** (0.033)	0.101*** (0.031)	0.072** (0.030)	0.087*** (0.027)
Income	-0.078** (0.033)	-0.039 (0.031)	-0.070** (0.030)	-0.034 (0.026)
Small towns and villages	0.138*** (0.037)	0.116*** (0.036)	0.110*** (0.034)	0.037 (0.031)
Chi2(8)	199.28	162.05	152.90	102.95
Number of observations	968	968	967	969

Notes: Standard errors are provided in parentheses. \*\*\*(\*\*,\*) indicate statistical significance at the 1(5, 10) percent level.