Introduction

There are several historical episodes where certain monies have become international currencies, in the sense that they are used in ordinary domestic transactions in countries other than the one where they are issued.[1] Today, the US dollar plays that role, at least in many countries in Latin America and Eastern Europe. The extent to which the smaller countries in the Latin America have "dollarized" is fairly striking. One notable example (although by far not the most salient) is Costa Rica. In that country, about 61% of the credit issued by the local banking system is denominated in dollars, as well as 53% of its interest bearing liabilities. Even in terms of media of exchange rather than stores of value, 26% of checking account deposits are in dollars, and the (less precise) estimate for cash is at least 33%. These numbers, also, are biased down, as they do not include the fairly extensive use (all in dollars) that local businesses and consumers make of the international banking sector, and of the off-shore subsidiaries of local banks. Furthermore, a casual count reveals that over half of newspaper ads use dollars as the unit of account to post prices, and so do most contracts. Unlike their larger neighbors (except Argentina) the dozen or so smaller Latin American countries, with economies not bigger than $20 billion annual GDP, display similar numbers.

In the last few years, doubt has emerged in these countries regarding whether they should simply go from partial to complete use of foreign currency, and entirely eliminate their local monies. In fact, just in the year 2000 two countries (El Salvador and Ecuador) made the decision to formally dollarize, and the debate has been fairly intense in other places. If this trend continued, the question of this conference (what is the future of Central Banking?) would be answered by a vision of many small countries that do not issue their own currency, a few mid-sized and large countries that do, and a handful of major Central Banks executing international monetary policy.

That is the topic of this paper. The main hypothesis is that, given current trends, it is difficult in the long run for a small, open economy to maintain a Central Bank and an independent currency,

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[1] An international currency is different from a vehicle currency (a medium of exchange in money-for-money interbank transactions), a reserve currency (a store of value for foreign central banks and private agents) or an intervention currency (one used by foreign monetary authorities to affect prices or interest rates). Historical examples of international currencies abound, including some from medieval times using commodity money. Today, the most prevalent international currency is the US dollar, and several estimates reflect that the fraction of greenbacks held outside the US is remarkably large.

and that it is tempting in the short run to accelerate the process and just eliminate the local money right away. Section 2 shows a search theoretic model of money that is helpful to illustrate and formalize some of the long run issues. Section 3 is non-technical, and revises some facts and arguments that have emerged in the context of the debate for quicker dollarization.

This model in Section 2 is a two-country, two-currency search theoretic model, based in Trejos-Wright (2001).[2] In that kind of model, which currency circulates where is determined endogenously, and there are equilibria where one money circulates only in the place where it is issued, while the other is used in both countries, similar to the situation described in the first paragraph. One can ask from the model which regimes constitute equilibria under different parameters, and what are the determinants of the purchasing power of different monies. The very simplified version of that model presented here is used to ask a few questions related to the topic of dollarization. First, we inquire what happens as a small economy becomes increasingly open (a strong trend the world over, do to the significant fall in communication and transportation costs, and in self-imposed trade barriers). In the model, it unavoidably absorbs a large amount of international currency. Then, the real value of the local money supply is reduced in real terms, and so is the amount of seignorage that can be collected by the local monetary authority. At some parameter values, there is more revenue from sharing the seignorage extracted by the international currency, and a high welfare loss from issuing the domestic one. Second, we inquire the outcome of endogenizing policy parameters (the ratio of buyers to sellers, which in this model relates to the real money supply in circulation; and the tax rate on money holdings, which relates to inflation).[3] When each government is given an objective (for instance, maximizing seignorage), in the regimes where there is one or more international currencies, the actions by each one affects the outcome of the other. In fact the Nash equilibrium of that game between them is inefficient: there are policy combinations that yield higher seignorage to both countries

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[2] Matsuyama et.al (1993) extend the basic search theoretic model of money to a two-country, two-currency framework, and study the conditions for international currencies to emerge. Zhou (1996) uses a variation of that model to study money-for-money transactions. In those papers, all objects are indivisible so it is impossible to talk about prices. Trejos-Wright (2001) introduces price determination, using the bargaining approach from Shi (1995) and Trejos-Wright (1995).

[3] In the basic search-money model, like the one used here, things are only kept tractable if one makes assumptions that simplify the distribution of money holders across agents, so that it is always the case that some of them are sellers (carrying no money), and others are buyers (all carrying the same amount of money). This is the main defect of the model, since it is difficult to interpret the parameters acting as money supply and as rate of inflation. Some articles (see, for example, Molico 1997) eliminate these assumptions and thus solve this problem for the one-country model, but the same techniques cannot be applied here.

than in that equilibrium, and in those there is also higher welfare. The best possible outcome can be obtained by issuing a single currency in both countries, that circulates everywhere, with coordinated policies. Alternatively, much can be gained by coordination of policies among monetary authorities, and often that coordination leads to substituting local for international currency.

The smaller countries in Latin America have become significantly more open in the last few years, a trend likely to continue. Their use of US dollars as international currency has also consistently expanded. To the extent that the theoretical ideas described in the previous paragraph apply in reality, one should not be surprised by this; also, one would be led to question whether, in the long run, these nations will be able to sustain their currencies. Furthermore, once an international currency is present, much is to be gained from coordinating policy, and maintaining an independent Central Bank may become costly.

In the local policy debate, the arguments in favor of dollarizing soon have to do with reasons as diverse as interest rate premia, transaction costs, and financial crisis. First, in these countries, there is a significant difference in the ex-post, dollar interest on debt denominated in local currency and in dollars. This premium, associated with the variability of the value of local money, is puzzlingly large. If local currency did not exist, goes the argument, interest rates still would be larger than in the developed world (country risks contain many elements that are independent of the monetary system), but the currency component of the risk and the premium would dissapear. Second, it is argued that transaction costs associated with currency exchange are very large in extremely open economies with inefficient financial service industries. One currency plays the role of money more efficiently than two, and valuable resources can therefore be saved by reducing the need of currency exchange services. Third, speculation about the exchange rate regime is a source of financial stability. It is not doubts about fiscal soundness, or about banking system robustness, but rather about the sustainability of exchange rate regimes, what have started several of the recent runs in these countries. These issues are discussed in Section 3.

If a country does decide to dollarize, there are a variety of matters related to implementation that need to be decided, like the sufficiency of reserves, and the adequate exchange rate. There are also plenty of institutional deficiencies in countries like the ones mentioned here, that become more costly in a dollarized economy. Finally, there are matters of coordination and cooperation with the issuer of the new currency (in this case, the Fed). Those are also topics worthy of study and discussion.

2. The model

Time is continuous and never ends. The world is composed of two countries, labeled 1 and 2. There is a continuum of infinitely lived agents in each country, whose population grows at the same rate $\gamma>0$.

There are many varieties of consumption goods in this economy, all fully divisible but not storable. Each agent produces a specific variety. At any given time, a given agent will want to consume only one particular variety, and derives no utility from consuming others. Agents discount the future, and the rate of time preference is denoted r.

The utility from consuming q units of the right variety is u(q), where $u(0) = 0$, $u'(0) = \infty$, and $u'(q) > 0$, $u''(q) < 0$ $\forall q$; the disutility from producing them is $c(q) = q$. We will assume that there is a value $q° > 0$ such that $u(q°) = q°$. Given one agent desires the variety that a second agent produces, the probability that there is a double coincidence of wants (that the second also desires the variety produced by the first) is denoted y. For simplicity, we shall assume here that y=0.

Each country has a government, which is a monopolistic producer of a national fiat money. Each unit of currency is intrinsically useless and indivisible. Country-k government issues money k by spending one unit each on a fraction M_k of its newborn citizens. This means that the amount of units of currency k in circulation, relative to the amount of agents that are citizens from that country, is also M_k. Agents holding money at any given time are referred to as buyers; those without money are called sellers. No buyer can carry more than one unit of money at a time. For buyers holding a money k, there is the risk, that materializes with arrival rate μ_k, that it will be confiscated by the government of country k, which will then spend it on an seller of the same nationality holding no money in exchange for the maximum amount he is willing to produce, leaving the money distribution constant.[4]

Agents search for potential trading partners. Each agent posts what objects (which money, if he

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[4] Although M_k relates to the amount of money in circulation, one should be careful to interpret it too easily as the "money supply." The reason is that in this model, due to the assumptions that prevent agents from holding amounts of money other than 0 or 1, changes in M_k, along with different quantities of money in circulation, imply as well different distributions of money holdings (different ratios of buyers to sellers), something that is not implied by changes in the money supply in other monetary models. Notice also that the same assumptions make it impossible to introduce actual inflation in the model, so we have to use μ_k (a tax on money holdings, in expected value proportional to the length of time the money is held) as an inflation proxy.

is a buyer, or which variety of consumption good, if he is a seller) is he able to offer, and what objects (monies, for a seller, or other varieties, for a buyer) is he willing to accept in return. The matching process brings together pairs of agents whose postings are compatible. There are infinitessimal but positive fixed costs in matching and bargaining, and this means that no seller posts that he is willing to trade output for a given money if he believes that he will not end up trading with anybody carrying that money.[5]

Once two agents are matched, they bargain over the terms of their exchange. In particular, if a seller meets a buyer wanting his production variety, they enter a bargaining game of alternating offers to determine the amount of output the seller is to produce in exchange for the buyer's cash. The bargaining power of the seller is denoted θ. For simplicity, we assume here that $\theta=0$, so buyers make take-it-or-leave-it offers. This implies that the amount of output that a seller from country k produces in exchange for a unit of money from country j is independent of the nationality of the buyer. We denote it Q_{kj}, so prices are $P_{kj} \equiv 1/ Q_{kj}$.

Search is time consuming, and for a citizen from country j the matching process generates suitable matches with agents from country k at a Poisson rate of arrival α_{jk}. We will assume that $\alpha_{jj} > \alpha_{kj}$ $\forall j,k$, which means that it is easier for a local than for a foreigner to meet other locals. No other form of exchange besides monetary trade is possible: credit will not occur because contracts cannot be enforced, due to the lack of rematch; barter does not occur either, because $y=0$. The fraction of agents from country i who carry currency j will be denoted m_{ij}, and the fraction who are sellers carrying no currency will be denoted $m_{i0} = 1-m_{i1}-m_{i2}$. Also, V_{ij} denotes the expected discounted lifetime utility (*the value function*) for buyers from i holding money j. The value function for a seller from country i will be denoted V_{i0}. It should be noted that since we have assumed that $c(q)=q$, $y=0$ and $\theta=0$, it is easy to show that $V_{ik}=q_{ik}$ and $V_{i0}=0$ $\forall i,k$.

We start with the case where the policy variables M_i and μ_i are exogenous and constant over time, and only look at steady state equilibria where prices don't change and the proportions m_{ij} have converged to their stationary values, which depend on the policies M_i. We will call money k a national currency if it is only traded between buyers and sellers from country k, but not in any

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[5] This last assumption is needed, if one desires all regimes studied here to be subgame perfect Nash equilibria, under $y=\theta=0$. This assumption is not necessary for other values of y or θ, but they make the math unnecessarily complicated for the purposes of this paper. For the general model with arbitrary y and θ, and for the argument why this assumption is needed, see Trejos and Wright (2001).

other matches. We will call money k an international currency if it is traded between all nationality combinations of buyers and sellers. Notice that in this model a currency could be neither national nor international in this sense (for example, it could hold no value and thus never be traded). However, we study only three equilibrium regimes: one where both currencies are national, one where both are international, and one where money 1 is national and money 2 is international.

A stationary equilibrium is a combination of values (Q_{jk}, m_{jk}) that satisfies the right Bellman equations, search conditions and steady state conditions. If money j is a national currency, the Bellman equations associated to it are

(1) $$r\, Q_{kj} = \alpha_{kj}\, m_{j0}\, [u(Q_{jj}) - Q_{kj}] - \mu_j\, Q_{kj} \qquad \text{for } k=1,2$$

the search condition is

(2) $$u(Q_{jj}) \geq Q_{jj} > u(Q_{kj}) \qquad \text{for } k \neq j$$

and the steady state conditions are

(3) $$m_{jj} = M_j, \qquad m_{kj} = 0 \qquad \text{for } k \neq j.$$

If money j is an international currency, its Bellman equations are

(1b) $$r\, Q_{kj} = \alpha_{k1}\, m_{10}\, [u(Q_{1j}) - Q_{kj}] + \alpha_{k2}\, m_{20}\, [u(Q_{2j}) - Q_{kj}] - \mu_j\, Q_{kj} \qquad \text{for } k=1,2$$

the search condition is

(2b) $$\min[u(Q_{1j}), u(Q_{2j})] \geq \max[Q_{1j}, Q_{2j}]$$

and the steady state conditions satisfy

(3b) $$\Delta m_{jj} = \alpha_{jk}\, m_{j0}\, m_{kj} - \alpha_{jk}\, m_{jj}\, m_{k0} + \gamma(M_j - m_{jj}) = 0$$

$$\Delta m_{kj} = \alpha_{kj}\, m_{k0}\, m_{jj} - \alpha_{kj}\, m_{kj}\, m_{j0} - \gamma\, m_{kj} = 0 \qquad \text{for } k \neq j.$$

Before describing new results, we summarize features about the equilibria derived in Trejos and Wright (2001).

- All three regimes mentioned above (the ones with no, one or two international currencies) can be equilibria. For some parameter values, multiple equilibrium regimes exist. However, not all regimes can be equilibria for all parameter values. In particular, the regimes where money j is national cannot satisfy the equilibrium conditions if country k≠j is open enough (that is, if α_{kj} is high). Because the ratio of the populations of countries j and k can be shown to be α_{kj}

/α_{jk}, this also means that international currencies tend to be issued by the larger or more efficient economies. Also, the regimes where money j is international cannot be equilibrium if the two countries are very different (in particular, if α_{11} and α_{22} are very different). A high enough μ_j rules out equilibrium regimes where money j is international, or where money $k \neq j$ is not. Despite the multiplicity of equilibrium regimes, there is some degree of determinacy of prices: within a given regime, for given parameter values, there is only one (Q_{jk}, m_{jk}) combination that satisfies the equilibrium conditions.

- Q_{j1} is higher and Q_{j2} is lower when money 1 is international than when it is not, all other things equal. Also, and more importantly, if the parameters are symmetric (fundamentals in both countries are the same), and the regime where money 1 is national and money 2 is international exists, then $Q_{12} < Q_{22}$ in that regime. In other words, other things being equal, international currencies purchase more at home than abroad. This last result can be interpreted as an explanation of a well known fact: that the US dollar is an outlier in the relationship between national income and deviations from purchasing power parity, as American prices are much lower than those regressions would predict, given what dollars can buy in the international market. In the equilibrium with two international currencies, it can be shown that $Q_{j1} = Q_{j2} = Q_j$ for j=1,2. In other words, both monies are perfect substitutes and, although prices vary across countries, they don't vary across currencies.

We now study in the model new issues, that I will argue below relate to the dollarization issue. Consider first what happens in small economies when they become increasingly open. Assume that country 1 is small relative to country 2 (that is, that $\alpha_{12} > \alpha_{21}$), and compare equilibria as α_{12} varies. Openness relates to α_{12} as this parameter reflects the frequency with which agents from country 1 get an opportunity to trade with citizens from country 2, and associates (within a given regime) with the fraction of total purchases or sales by country 1 agents that are foreign transactions with country 2 agents.

Remember that, as was mentioned above, for high enough α_{12} the regimes where sellers from country 1 do not use money 2 as medium of exchange cannot be equilibria. Notice that it follows from (1) that, within those regimes, Q_{12} is increasing in α_{12} and then, when the later is high, condition (2) cannot be satisfied.

Now, within the regime where money 2 is international and money 1 is national, one can show that

$$(4) \qquad m_{12} = \frac{\alpha_{12}(1-M_1)M_2}{\gamma + \alpha_{12} + \alpha_{21}(1-M_1)}$$

which is increasing (and therefore m_{10} and Q_{11} are decreasing) in α_{12}. This implies that, as the small, "dollarized" economy becomes more open, it will absorb more foreign money, its own local money will become less and less valuable, especially relative to the foreign money (as Q_{22} and Q_{12}/Q_{11} increase in α_{12}).[6]

Consider now the seignorage extracted by issuing money k, which is given by $S_k = \gamma M_k Q_{kk} + \mu_k m_{1k} (1- m_{10}) Q_{1k} + \mu_k m_{2k} (1- m_{20}) Q_{2k}$. It follows that, as α_{12} increases, the seignorage extracted by issuing money 1 becomes lower. Figure 1 shows seignorage collection as a function of α_{12}, in the different regimes. Notice that as the economy 1 becomes more open, seignorage collected by issuing currency 1 lags behind.

Figure 1: Openness and seignorage

Notice also that m_{12} increases in M_2 and decreases in M_1. In other words, in the regime where one money is national and the other one is international, higher amounts of the international currency spread through both countries, and higher amounts of the national currency crowd out from their own country the international currency. This is also true in the regime with two international currencies, where both values m_{j0} fall when either M_k increases. In terms of seignorage, we also find that S_1 is unambiguously higher in the regime where both monies are international (in which, as in equilibrium the two currencies become perfect substitutes, can be

[6] In the more general model where y>0, there is a maximum level of "inflation", call it $\mu^*_1>0$, such that if $\mu_1>\mu^*_1$ then there are no equilibria where money 1 has value, even in country 1. It can be shown that μ^*_1 decreases with α_{12}.

interpreted as a regime where everybody uses the same currency), than in the regime where money 1 is national and money 2 is international, everything else given.

Proceed now to endogenize the policy parameters M_k, setting $\mu_j=0$. Throughout this section, it is assumed that governments take the regime as given, and restrict their choices to policies that allow for the existence of that regime as an equilibrium (i.e., we ignore policies aimed precisely at changing a currency's realm of circulation). Neither will we look at policies where M changes over time, and reduce to comparisons of steady states.

One thing to do is look for Nash equilibria in the interaction between governments, when each government chooses its policy unilaterally, taking as given the decisions of its counterpart, and seeking to maximize the seignorage it collects. We also consider the possibility of international policy coordination, by letting the governments chose the parameters jointly. One way to do this is to assume that seignorage is freely transferable across countries, in which case they maximize $S_1 + S_2$. Alternatively, we can assume seignorage is not transferrable, in which case we use Nash's cooperative bargaining solution, with threat points given by the non-cooperative solution. Then the choice maximises $(S_1 - S^*_1)(S_2 - S^*_2)$, where S^*_j denotes the seignorage that the government j would obtain in the non cooperative Nash equilibrium. As a point of reference, we also derive the non-cooperative Nash equilibrium when each government's objective function is to maximize the welfare of its citizens, $W_j = m_{j1} Q_{j1} + m_{j2} Q_{j2}$.

One result that can be derived analytically is that in the non-cooperative Nash solutions there is inefficiency, in the sense that each government does not take into account the effect it has on the other, and starting from the non-cooperative Nash solution, reducing both M_1 and M_2 marginally increases both S_1 and S_2. To understand the reason, take an increase in M_1. S_2, as a function of M_2, shifts down and to the right; in other words, not only country 2 gets fewer taxes, but also incentives to increase M_2. This leads to a subsequent increase in M_1, and so forth, and the process converges to an allocation where both M's are high and seignorages low, specially in the global regime, where the relationship is strongest. In fact, more taxes may be collected when both governments are trying to maximize welfare (which leads to more restraint in the money creation) than when their goal is seignorage itself. This is true both in the regimes with one or with two international currencies.

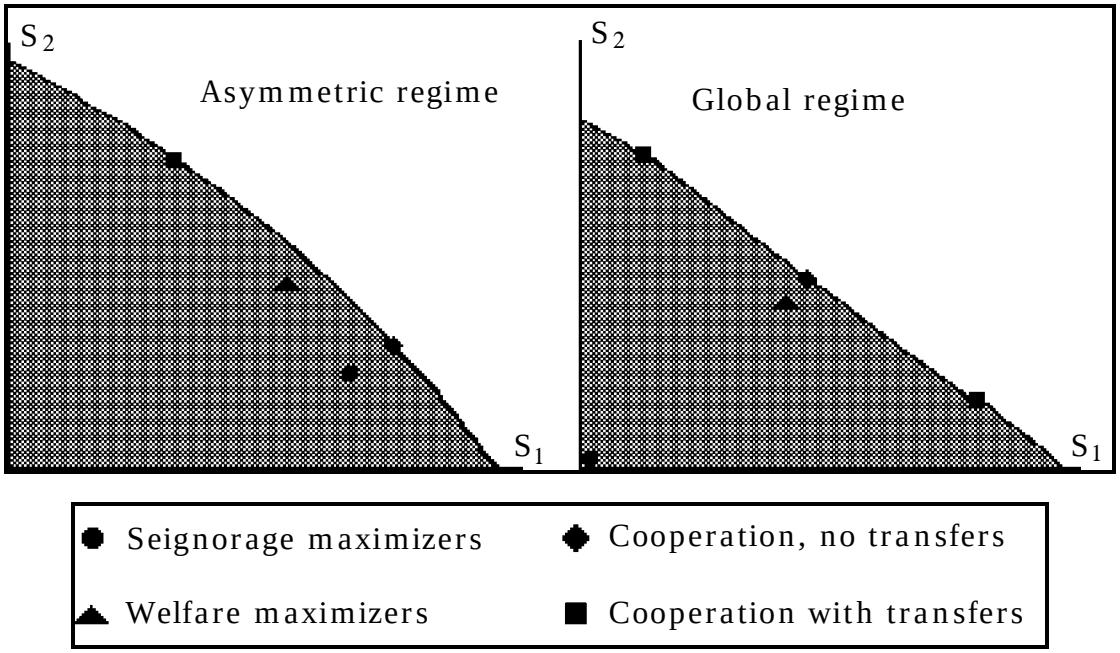
The previous results hold in general. Lets describe now the results from some numerical experiments. First, the feasibility frontier in (S_1, S_2) space for the regime with two international monies contains the one for the equilibrium with one international money; in other words, given

parameters one can obtain (much) more seignorage in the regime where both countries issue international currencies (that end up being perfect substitutes), than in the regime where some agents carry a lesser national currency that is not useful for international transactions. However, although this is true about the combinations of (S_1, S_2) that are feasible, it is also the case that when both monies are international, the inefficiency in the game is largest. Hence, the non-cooperative solution in the regime with two international monies is farther from the frontier, and may be dominated by the non-cooperative solution in the regime with one international money.

Figure 2 illustrates the previous statements. The left panel corresponds to the regime where money 1 is national and money 2 international; the right panel, to the regime where both are international. The shaded areas are the feasible (S_1, S_2) combinations, for alternative values of (M_1, M_2).[7] The cooperative solutions are in the frontier of the feasible set, of course. Notice also that in the regime with one international currency, cooperation and transferable seignorage implies that both countries agree to focus their seignorage collection on money 2, that has higher purchasing power and hence does so more efficiently. Finally, notice that it is possible that each country gets more seignorage in the non-cooperative equilibrium where governments focus on welfare, than when they focus on seignorage itself.

[7] The two panels of the figure are not drawn on the same scale. They are obtained picking symmetric parameters, that is, $\alpha_{11}=\alpha_{22}$ and $\alpha_{12}=\alpha_{21}$. The figures are qualitatively robust to changes in the values of the key parameters.

Figure 2: Feasible combinations of seignorage



With endogenous policies, there is a tendency to excessive issuing of currency, which is stronger when both currencies circulate everywhere. There is, then, a role for cooperation between governments, who by coordinating policies increase their seignorage.

The results so far in this section tell us some things about a very stylized theoretical model. The model, despite its shortcomings, seems appropriate to address the issues that are of interest in this paper, as it has two features that are rare and valuable in this context: monies in this model are primarily media of exchange, not stores of value, and which currencies circulate where is determined endogenously. One hopes then that the model derives some lessons that can be translated to the actual topic of dollarization is Latin America. What are those lessons?

- As a small economy opens, in the sense that trade with foreigners increases as a fraction of total activity, it is unavoidable that foreign currency will circulate locally. The only reason why an agent would not take foreign currency in payment is that he expects it would be difficult or costly to spend it at fair prices (in the model, because you can only spend it on some people; in reality, because you have to trade it at currency markets, that involve transaction costs). If one trades often enough with foreigners that accept foreign money, one has incentives to accept and keep that money, and one must believe that one's compatriots have them as well. Hence, to the extent that communication and transportation costs in

international trade keep falling, more countries will become "dollarized", in the sense that the roles of money in them will increasingly be played by foreign currency.

- The presence of foreign money in one country implies that the local money's ability to capture seignorage is reduced. In the extreme, one can capture more seignorage through monetary union and coordination (using solely an international currency, and finding a way to share the proceeds with its issuer) than by keeping a local currency whose realm of circulation is becoming limited.
- When international currency circulates in a country, monetary policy becomes less effective, at least in the sense that, like in the model, injections of local cash crowd out some foreign cash, and lead to a smaller impact in total liquidity. Because this also implies that policy in one place tends to have effects on another place, and authorities are bound to disregard this cross-effect, there is room for policy coordination, and for inefficiencies if monetary authorities do not coordinate.

3. Dollarization in Latin America

The debate for dollarization in the smaller Latin American countries has been very intense in the last few years. Some of the arguments presented in favour or against of the move are the following:

- High interest rates and short maturities in local currency

The financial systems of these countries tend to have unusually short maturities for assets and liabilities (in some countries, banks do not make any loans longer than three years), and very high interest rates. For example, the other Central American countries have real interest rates that are 60% higher and 8 times more volatile than Panama, a country whose main distinction is that it is dollarized already.

Part of the reason for the high interest rates is independent of the currency in question, and has to do instead with features like poor banking supervision, high levels of country risk, etc. However, part of the reason for these short maturities and high interest rates has to do with high and variable inflation, and very variable nominal exchange rates. This can be perceived through the very large, sustained differences between dollar and "peso" denominated assets, when we compare their ex-post returns expressed on a common currency. This spread is in some countries consistently above 10 percentage points, and must be interpreted as the insurance premium that

assets denominated in pesos pay, for bearing the risks associated with holding a currency with variable value. Relieving agents of those risks, and allowing lower interest rates (which reflect in the quantity of investment) and longer maturities (which reflect in the kind of investment), would be the main purpose of dollarization.

It is a small puzzle why the currency premium is so high in some of these countries, where the data, expost, seems to indicate that the currency "risk" is not that high, yet the premium is sizeable. In Costa Rica, the Central Bank has maintained for almost 18 years the same policy, of updating the exchange rate on a daily basis, at a pace that compensates the inflation differences between the local currency and dollars. During that period, inflation has been very predictable, and unexpected swings in the real exchange rate have not taken place. Despite this stability in the exchange rate regime, for a long past, and the foreseeable future, returns in dollar-denominated assets are consistently 3-5 percentage points lower than equivalent assets (same duration and issuer) denominated in local currency. For a shorter period, El Salvador was another notorious example of a place where the apparent risk seemed much smaller than the currency premium would indicate.

Part of the debate are the fiscal implications of high interest rates, as most of these countries are very indebted locally. In fact, in a few of these countries, it is the Central Bank that owes and honors these debts, which justifies the high inflation rates (to raise the seignorage to service the obligations).

Interest rates do react quite quickly to dollarization. Besides the evidence mentioned above from Panama, we also have the experience of Ecuador. Despite all the other complications and risks (see below), dollar interest rates in Ecuador have fallen significantly since the dollarization announcement.

- Transactions costs

Although mentioned less often, another argument for dollarization has to do with the inherent inefficiency when economies this small and this open issue their own currency. Monies, like languages, pose a coordination game, so one currency plays the role of money much better than two. Unlike the model in section 2, in reality there are accessible financial services that trade currencies, so a peso-holder would not have to miss an opportunity to buy from a foreigner just because he holds the wrong kind of cash. However, those financial services (and the other transactions that are necessary when one deals with multiple currencies) are costly to society.

I know of no reliable measurements about how big is the portion of the financial service sector

that would be made redundant if peso-for-dollar transactions were no longer necessary. However, reliable estimates for Europe (about the savings in switching from many currencies to one euro) reached as much as 0.6% of GDP. For small Latin countries, much more open and much less efficient, I can imagine this number is even larger.

- Financial stability

The financial sector of these countries is particularly unstable and subject to crises. These come from different sources, for example, institutional (solvency problems for banks, for example, and bank runs), fiscal (debt moratoria on the part of governments), or balance of payments (speculation of the sustainability of the exchange rate, and runs against the Central Bank reserves).

This instability can be used to argue both for and against dollarization. On the one hand, banks are more susceptible to runs when there is no lender of last resort to offer deposit insurance and bail them out. According to this line of argument, dollarization would limit the ability of the Central Bank to play that role, so banks would be less stable. On the other hand, in these countries most financial crises start from mismanagement of the exchange rate and reserves, or from speculation against the exchange rate system. Then, once dollarized these economies become more stable, as there is less to speculate about.

It is difficult to know which of these arguments is the most important. For instance, it is not clear that our Central Banks can act as lenders of last resort if they cannot be borrowers of last resort (that is, if they are already too indebted, have limited capacity to collect seignorage, and hold small reserves). Also, the argument about less speculation against the exchange rate regime is difficult to assess, given the experience of the quasi-dollarized Currency Board system in Argentina.

- Controlling inflation

An often heard argument for dollarization is simply that the US dollar has lower inflation rates than local currencies, so these countries have to dollarize for their citizens to enjoy the benefits of low inflation. The simplicity of this argument makes it compelling to politicians, so this is the one that one hears the most often. Of course, it is not obvious that the argument holds water: if these countries dollarized, they would have to make the very same fiscal adjustment necessary to bring their inflation to international standards even if they kept their currency. Nevertheless, there are some ways of arguing that the fight against inflation is significantly aided by dollarization. One has to do with political credibility: even if a government cuts the fiscal deficit

enough to reduce inflation, there is no guarantee that future governments are going to behave in the same way. Then, the argument goes, one may prefer to dollarize the economy, to ensure the sustainability of the fiscal policy that leads to low inflation (because dollarization is politically more costly to reverse than fiscal discipline).[8] A second argument has to do with fiscal adjustment itself: as cutting the deficit is necessary to reduce inflation, dollarization is a cheaper way of doing it, since it leads to lower interest rates immediately, and therefore to lower debt service from the government. Cutting inflation while keeping the currency, then, requires a bigger fiscal sacrifice than cutting inflation through dollarization.[9]

- Macroeconomic policy instruments, seignorage

The argument most often mentioned against dollarization is that, after the local currency ceases to exist, the Central Bank is left without exchange rate instruments, and almost without monetary policy instruments, and therefore shall be much less able to stabilize business cycles. This is certainly a valid point. Moreover, these instruments are going to be determined by the Fed, and American cycles are not perfectly correlated with local ones, so we may end up with procyclical policies and higher short run volatility. Furthermore, as dollar inflation is not zero, local agents shall still "pay" seignorage, but the ones to collect it are to be foreigners.

There are some caveats to this logic. First, business cycles in the smaller economies in Latin America are already fairly correlated to the ones in the US (at least more so than the average Euro economy and Germany), and presumably once they share currency the correlation would increase. Second, for various reasons local policy is already pro-cyclical, and has often been less than brilliant. Third, and most importantly, dollars are already a large fraction of the money supply in these countries, which reduces the ability of local authorities to exercise independent monetary and exchange rate policy, or to extract seignorage. In some of these countries, very open and exposed to relatively large capital flows, the monetary authorities claim to have no control over real exchange rates anyway.

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[8] An argument often made is that the conservative Salvadorean government chose to dollarize, at least in part, to raise the cost of their political adversaries of pursuing expansionary fiscal policies, that could bring back high inflation.

[9] Take for instance the case of Costa Rica. The Central Bank needs to get seignorage for 1.7% of GDP to honor "its share" of public debt. Cutting inflation requires transfering back that debt service to the Treasury, who would pay it, for instance, through higher taxes. On the other hand, the Treasury is already fairly indebted in local currency, and the difference between the interest paid on that debt and on the dollar denominated debt amounts to about 0.4% of GDP. Hence, to relieve the Central Bank debt under dollarization the Treasury needs only a tax increase of 1.3%.

Furthermore, there have been some proposals in the United States (most notably, the IMSA law being discussed in the Senate) to share the seignorage with Latin countries that dollarize. In some countries, the IMSA formula would generate a flow that would be larger than current seignorage receipts. This is also consistent with some of the results from Section 2.

Conclusions

In small and very open economies, the presence and use of international currency is unavoidable. As the use of dollars increases with openess in the future, there may emerge problems with the effectiveness of monetary policy, and with the ability of local authorities to collect seignorage. Also, there may be a role for coordination of monetary policy among countries that are connected by a common international currency. These predictions from the model in Section 2 seem to be confirmed, at least, by the experiences of the smaller Latin American economies that are largely dollarized already.

In those nations, as of late, a debate has emerged about whether they should just do away with their currencies completely, and use the US dollar as their currency. Although there are arguments in both directions, the reasons in favor of that move seem to be compelling, and already a few countries have made the decision to dollarize completely in the short run. Some of those arguments are summarized in section 3.;

If the trend continues, or if the forces moving these nations in this direction extend to larger countries, or to different latitudes, the vision about the future of Central Banking is very different from today. The world could be reduced to only a handful of monetary authorities, with some of them exercising monetary policy internationally, and with strong need for coordination among them.

Unmentioned so far are matters of implementation of dollarization. If a country decides to eliminate its currency: what should be the exchange rate (or does it matter)? Are there sufficient reserves? What institutional arrangements need to be reformed for dollarization to function? What agreements with the issuer of international currency are necessary? These are also important questions, and the experience of the few countries that have dollarized already suggest some answers.