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Financial Dollarization and Dedollarization

Latin American banks and firms tend to earn pesos and borrow in dollars. When widespread across the domestic economy, this kind of currency mismatch is asking for trouble: real exchange rate depreciation, often associated with the loss of access to external financing, becomes a source of systemic risk.

The crises unleashed by widespread liability dollarization involve firms, banks, and the government. Real depreciation chokes nontradables firms en masse, disrupting the real economy, leading to the demise of viable firms, and ultimately engulfing most nonexporting sectors. The banking sector suffers a systemic crisis, either directly from currency risk in its own balance sheet or, more commonly, from the increased credit risk of its dollar loans and often of the government bonds it holds in its portfolio. The public sector is also choked financially as dollarized public debt balloons and becomes unsustainable. It is then forced to resort to contractionary fiscal and monetary policies at a time of deep recession and systemic financial failures. Government, instead of being part of the solution, becomes part of the problem.

Why is dollar financing so prevalent? Dollarized external debt (the so-called original sin) is the source of the countries' aggregate dollar liability position. It has traditionally been blamed for the widespread currency mismatch within the domestic economy, but an equally important contributor to the dollarization of liabilities, and arguably a more tractable policy problem, is the dollarization of domestic savings. The domestic intermediation of dollarized savings by residents amounts to dollarized liabilities within the domestic economy. Liability dollarization and domestic asset dollarization have to be analyzed together to understand overall financial dollarization.

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Academics and policymakers agree that widespread liability dollarization can be a problem, but there is little agreement on the solution or whether a policy that discourages financial dollarization is feasible. Pessimists contend that markets deliver high financial dollarization for a number of solid reasons, including past inflation and financial repression. They point to the existence of very few successful dedollarization experiences (such as Chile and Israel) and a good number of dedollarization failures or outright disasters (like Bolivia and Peru in the 1980s). Optimists, on the other hand, argue that low inflation and exchange rate flexibility throughout Latin America, together with the credibility of inflation-targeting regimes in many countries, represent an auspicious break with the past. They add that successful dedollarization may be rare, but it has seldom been attempted seriously; dedollarization fiascos were conducted under very adverse conditions and do not constitute proof that decisive policies are destined to fail.

This paper offers an analytic survey of the issue of financial dollarization and concludes with a policy proposal for dedollarization. The analytic survey (the next four sections) lays out what is known about financial dollarization in a unified analytic framework. It also examines the empirical arguments of dedollarization put forth by pessimists and optimists. The first of these sections reviews the policy concern with financial dollarization and the risks of dedollarization attempts. The second analyzes the factors that may warrant high financial dollarization as a useful adaptation of the financial system. The third makes the case for a policy to reduce excessive financial dollarization, and the fourth discusses different experiences with dedollarization policies in developing countries. The final section proposes a dedollarization strategy grounded in the theory and evidence analyzed in the previous sections. This strategy relies on displacing financial dollarization through attractive peso substitutes for dollar debt. The policy agenda centers on fostering domestic savings in local currency (as opposed to redressing original sin, which is a much harder nut to crack) and envisages a facilitating role for multilateral development banks.

Macroeconomic Concerns with Financial Dollarization and Dedollarization

Financial dollarization is widespread in many developing countries by all measures.[1] The typical country in Latin America (measured as the simple

1. The term *financial dollarization* refers to the denomination of domestic agents' assets and liabilities in a currency other than the country's national currency; the term is thus not limited to the U.S. dollar. Similarly, I use the term peso to refer generically to the local currency.

average across countries) has a bank financial dollarization of around 40 percent (either in deposits or loans) and a dollar public debt share of 75 percent; these ratios are almost twice as high as in other emerging countries. Bank financial dollarization increased after the 1998 Russian crisis, while the degree of dollarization in public debt has slowly receded.[2] Reinhart, Rogoff, and Savastano construct financial dollarization indexes based on the share of dollar bank deposits in broad money, the share of dollarized domestic public debt, and external debt as a proportion of national income.[3] Financial dollarization in Latin American countries appears extremely high on every count, especially concerning domestic financial dollarization (see table 1).

The Problems of Financial Dollarization

Financial dollarization is socially costly. Economists have traditionally been concerned with the effectiveness of monetary policy in the context of high financial dollarization. Recent crises, however, have pushed the risk of crisis and prudential concerns to the forefront. The empirical evidence strongly supports these concerns, especially the evidence presented in de Nicoló, Honohan, and Ize, Reinhart, Rogoff, and Savastano, and Levy Yeyati.[4] A summary of the main empirical findings follows.

First, financial dollarization substantially contributes to financial fragility and the risk of systemic crisis. Widespread currency mismatches, largely unmitigated by hedging derivatives whose markets are fairly underdeveloped for most local currencies, increase the solvency risk of debtors (including the public sector) and, consequently, of the banking system, even if it is currency matched. Liquidity risk in the banking sector is further increased by the central bank's reduced ability to perform as a lender of last resort in foreign currency. A systemic crisis may also result from fiscal risk owing to dollar public debts, which are quite high in a good number of countries. De Nicoló, Honohan, and Ize provide strong evidence concerning solvency and liquidity effects on banks.[5] Levy Yeyati shows that exchange rate changes increase the propensity to suffer systemic banking crisis only in the presence of high

2. Galindo and Leiderman (2005).

3. Reinhart, Rogoff, and Savastano (2003).

4. De Nicoló, Honohan, and Ize (2003); Reinhart, Rogoff, and Savastano (2003); Levy Yeyati (2006).

5. De Nicoló, Honohan, and Ize (2003). See also Gulde and others (2004); Goldstein and Turner (2003); IMF (2005).

TABLE 1. Financial Dollarization in Developing Countries[a]

	Index			
	Foreign currency bank deposits[b]	*Foreign currency domestic public debt*[c]	*External debt*[d]	*Composite*[e]
Country	*(1)*	*(2)*	*(3)*	*(4)*
Ecuador	70	90	90	250
Bolivia	80	70	70	220
Uruguay	90	90	40	220
Argentina	60	90	50	200
Nicaragua	70	0	100	170
Peru	60	40	60	160
Paraguay	50	60	40	150
Honduras	30	0	100	130
Jamaica	40	0	70	110
Guyana	0	0	100	100
Costa Rica	40	20	30	90
El Salvador	20	30	30	80
St. Kitts and Nevis	30	0	50	80
Brazil	0	30	40	70
Guatemala	0	40	30	70
Chile	10	10	50	70
Belize	0	0	70	70
Haiti	30	0	30	60
Trinidad and Tobago	20	0	40	60
Venezuela	10	0	50	60
Dominica	0	0	60	60
Grenada	0	0	60	60
St. Vincent and the Grenadines	0	0	60	60
Colombia	0	10	40	50
Mexico	10	0	40	50
St. Lucia	0	0	40	40
Dominican Republic	0	0	30	30
Mean, Latin America and the Caribbean	26.7	21.5	54.4	102.6
Mean, other nonindustrial economies	17.4	1.9	63.1	82.4
75th percentile, Latin America and the Caribbean	45	35	65	140
75th percentile, other nonindustrial economies	30	0	90	100

Source: Reinhart, Rogoff, and Savastano (2003) and author's calculations

a. Average for 1996–2001. Percentages are rounded to the closest ten (and truncated at 100). The full sample encompasses ninety non-industrial economies that issued a national currency during all or part of the period 1996–2001. See Reinhart, Rogoff, and Savastano (2003, appendix 1, short sample) for a complete list.

b. Percentage of broad money.

c. Percentage of domestic public debt.

d. Percentage of gross national income.

e. Sum of first three columns.

financial dollarization.[6] Calvo, Izquierdo, and Mejía find that liability dollarization is a predictor of sudden stops in capital inflows, which is an indirect indication of the systemic fragility it induces.[7]

Second, financial dollarization complicates macroeconomic policy and prevents countercyclical policies. The selection of exchange rate regime becomes more complex and risky. The link between fear of floating and liability dollarization is well established—that is, fear of a real exchange depreciation stemming from currency mismatches that may bring insolvency and financial crisis.[8] Reinhart, Rogoff, and Savastano empirically confirm this link.[9] This is not to say, however, that this link is justified: Chang and Velasco question whether fixed exchange rate regimes offer effective protection and show market evidence on risk spreads to back their skepticism.[10] What is beyond doubt is that dollarized public debt complicates fiscal sustainability when real exchange rate depreciation takes place during economic downturns. Furthermore, large external debt, and liability dollarization in general, induces a contractionary bias to real depreciation. Financial dollarization severely limits the scope of countercyclical monetary and fiscal policy, and in extreme cases it makes optimal policy procyclical. Furthermore, the monetary transmission based on peso rates is weakened by the prevalence of dollar rates.[11]

Third, financial dollarization has an overall negative effect on output volatility. To the extent that financial dollarization contributes to crises and complicates countercyclical policies, a negative effect on output volatility is to be expected. This prediction is confirmed by the econometric analysis in Levy Yeyati and agrees with the evidence in Reinhart, Rogoff, and Savastano concerning the association between their overall dollarization index and output volatility.[12] This effect is also confirmed by microeconomic evidence for a number of Latin American countries, which shows the destabilizing effect of liability dollarization in a good fraction of firms in terms of profits and investment, possibly leading to contractionary devaluations.[13]

6. Levy Yeyati (2006).
7. Calvo, Izquierdo, and Mejía (2004).
8. See Calvo and Reinhart (2002); Levy Yeyati, Sturzenegger, and Reggio (2002).
9. Reinhart, Rogoff, and Savastano (2003).
10. Chang and Velasco (2000).
11. Baliño, Bennet, and Borensztein (1999).
12. Levy Yeyati (2006); Reinhart, Rogoff, and Savastano (2003).
13. Depreciations are expansionary with low levels of dollarization and contractionary with high levels of dollarization. See Galindo, Panizza, and Schiantarelli (2003) and references contained therein.

Finally, financial dollarization appears to have some negative effects on the inflation level and volatility. By and large, cross-country evidence shows that the higher the degree of dollarization, the higher and more variable the inflation rate (notwithstanding the widespread improvements in inflation performance over the past decade as financial dollarization increased). These effects do not appear to be strong, however. Furthermore, financial dollarization does not appear to have complicated disinflation policies. Reinhart, Rogoff, and Savastano provide information and a complete noneconometric analysis of financial dollarization and monetary policy; Levy Yeyati presents some econometric evidence pointing in this direction.[14]

The Potential Benefits of Financial Dollarization

At the same time, there is a widespread premise that financial dollarization contributes to deeper financial systems (by providing a high-quality credit instrument) and, hence, the growth level. This premise translates into a fear of artificially impeding financial dollarization—that is, of dedollarizing—because of the risk that financial disintermediation will lead to lower investment and long-run growth. Surprisingly, recent econometric evidence is mixed and suggests that impediments to financial dollarization need not have adverse effects if carried out with adequate policies under the right circumstances. The following two empirical findings stand out.

First, financial dollarization contributes to financial depth only under high inflation. Financial dollarization is a coping strategy that allows market agents to agree on credit contracts; in the absence of such instruments, many of these contracts may not be carried out. A reasonable presumption is that part of these savings would be frustrated or would be invested abroad, legally or illegally, which would result in financial disintermediation and a smaller domestic financial system. However, Nicoló, Honohan, and Ize established the important econometric finding that financial dollarization does not significantly contribute to financial depth except under circumstances of high inflation.[15] They confirm this finding using a variety of econometric methods to control for endogeneity bias that would result from adverse unknown conditions causing both higher financial dollarization and less intermediation. Levy Yeyati also obtains this key finding with his own financial dollarization measures and a specification using a dollarization restrictions index as an instru-

14. Reinhart, Rogoff, and Savastano (2003); Levy Yeyati (2006).
15. De Nicoló, Honohan, and Ize (2003).

ment.[16] His work confirms that the negative effects of impeding dollarization with restrictions depend on inflation circumstances.

Second, financial dollarization does not appear to contribute to faster average growth. This finding results from Levy Yeyati's econometric analysis of the issue, based on a Barro-type regression enlarged with financial dollarization; it is also consistent with the simple association analysis in Reinhart, Rogoff, and Savastano.[17] This result can be explained in part because, as noted, financial dollarization does not necessarily improve financial depth and in part because the increased output volatility associated with financial dollarization may in itself depress average growth.[18] Nevertheless, the fact that Levy Yeyati controls for investment opens the possibility that financial dollarization contributes to faster growth through larger investment based on better access to credit, which is precisely the fear of the dedollarization pessimists. It is advisable to be cautious at this point with this preliminary finding and conclude that there is no evidence that financial dollarization contributes to faster long-run growth.

All in all, this macroeconomic literature suggests that financial dollarization creates a number of stability problems and delivers few growth benefits, except in special cases. A consensus is therefore emerging that policy should be aimed at reducing financial dollarization if remedies can be found for a smooth transition.

Warranted Financial Dollarization

For all its problems, financial dollarization may play a useful role under the circumstances faced by highly dollarized countries. It may be well justified in these cases, in that it is preferable to a less dollarized alternative. This section analyzes how economic fundamentals warrant some degree of financial dollarization and their relevance in accounting for observed financial dollarization.

What Financial Dollarization?

The central concern of financial dollarization has to do with dollar assets and liabilities in the residents' balance sheets. It focuses on residents' asset

16. Levy Yeyati (2006).
17. Reinhart, Rogoff, and Savastano (2003).
18. Ramey and Ramey (1995).

substitution, as opposed to currency substitution; its concern is not inflation but insolvency, not flows but stocks. In this context, I start by distinguishing among alternative concepts of financial dollarization that I use throughout the paper.

Liability dollarization encompasses residents' liabilities denominated in foreign currency (L^*). Liability dollarization is the most interesting concept to analyze in relation to the consequences of financial dollarization, to the extent that it entails a currency mismatch between assets and liabilities that would give rise to a negative balance sheet effect in the case of real depreciation—say, among firms in the nontradables sector or (most) public sectors. The degree of liability dollarization (l) in this concept is measured as a share of total debt liabilities (L), whether in the aggregate (more on this later) or for specific economic sectors (such as nontradables private firms' debt or public debt)

$$l = \frac{L^*}{L}.$$

The existence of domestic currency derivatives markets to help allocate opposing currency hedging demands or capacities would clearly reduce the problem of currency mismatch for any given overall dollarization, l. Specifically, it would facilitate the process through which tradables sectors absorb exchange rate risk from nontradables sectors' borrowing without engaging in unnecessary borrowing and lending operations, which would help to reduce effective liability dollarization in nontradables sectors and increase it in tradables sectors. Liability dollarization would ideally be measured net of currency hedges and considered only when it entails a currency mismatch; this crude liability dollarization index, l, is best interpreted as a proxy of an ideal measure.

Liability dollarization may originate in dollar claims held by residents or foreigners. The analysis of this lending side is key to understanding the drivers of financial dollarization and designing dedollarization policies. Domestic financial dollarization encompasses dollar claims held by residents (D^*). The degree of domestic financial dollarization, d, is measured as a share of total debt assets, D, held by residents (the remainder of which is debt assets in pesos). In turn, debt assets, D, can be claims against other residents or can be held abroad (that is, flight capital, amounting to a fraction, f, of total debt assets, D, held in dollars)

$$d = \frac{D^*}{D},$$

where fD corresponds to the country's debt assets abroad (held in dollars).

Alternatively, external financial dollarization refers to dollar claims (against residents) held by foreigners (E^*). The degree of external financial dollarization, e, is measured as a share of total external debt, E,

$$e = \frac{E^*}{E}.$$

Equating borrowing and lending in the country (total and in each currency), I derive identity relations linking the various concepts described above:

(1a) $$L = (1 - f)D + E = D + (E - fD).$$

In other words, total borrowing equals lending from residents plus lending from foreigners, which also equals domestic savings plus net external debt,

(1b) $$L^* = (D^* - fD) + E^* = D^* + (E^* - fD).$$

That is, dollar borrowing equals domestic dollar lending plus external dollar lending, which also equals domestic dollar savings plus net dollar external debt,

(1c) $$L - L^* = (D - D^*) + (E - E^*).$$

That is, peso borrowing equals domestic peso lending plus external peso lending:

(2) $$\begin{aligned}(1 - l) &= (1 - d)\left(\frac{D}{L}\right) + (1 - e)\left(\frac{E}{L}\right) \\ &= (1 - d)\left(\frac{D}{L}\right) + (1 - e)\left[1 - (1 - f)\left(\frac{D}{L}\right)\right].\end{aligned}$$

As long as D/L remains constant—that is, the macroeconomic relation between (accumulated debt-intermediated) domestic savings and investment borrowing is stable—liability dollarization, l, increases with domestic financial dollarization, d, and external financial dollarization, e. This paper mainly focuses on policies concerning d; Eichengreen, Hausmann, and Panizza propose policies to redress original sin and focus on e.[19] The two initiatives are clearly complementary in reducing liability dollarization, although I argue

19. Eichengreen, Hausmann, and Panizza (2002).

that as a policy matter, it is advantageous to first concentrate the effort on the domestic front.

Other definitions of country currency mismatch can be framed as particular concepts of liability dollarization associated with particular forms of aggregation. In fact, if the whole country is aggregated for the purpose of computing liability dollarization, thus netting out the dollar assets and liabilities of residents, then liability dollarization would amount to $E^* - fD$, the net dollar debt position of the country. This is Goldstein and Turner's country currency mismatch definition, in which all the dollar claims of residents are netted out from their dollar liabilities.[20] Definitions inspired by original sin refer to the (gross) dollar debt liability position, E^*, netting out residents' domestic dollar liabilities but not their assets abroad.[21] In contrast, the definition of liability dollarization, l, in this paper aggregates domestic debtors without any netting out. Theory and experience suggest that any individual or sectoral currency mismatch is a potential concern and that netting out is therefore not a good methodological approach to the policy issues of liability dollarization in countries where domestic financial dollarization is significant.[22]

In line with the original sin hypothesis, according to which developing countries do not obtain external financing in pesos, I assume that $e = 1$ and, therefore, $E^* = E$ (all external debt is in dollars).[23] Under this assumption, capital flight, f (also assumed to be in dollars), becomes irrelevant:

$$(1 - l) = (1 - d)\left(\frac{D}{L}\right). \tag{3}$$

As to macroeconomic changes in D/L, for any given degree of domestic financial dollarization, liability dollarization decreases with domestic savings and increases with domestic investment borrowing. This macroeconomic ratio is a measure of the country's reliance on foreign savings (from 1a):

$$\frac{D}{L} = 1 - \frac{(E - fD)}{L}.$$

20. Goldstein and Turner (2003).

21. Eichengreen and Hausmann (1999).

22. The recent Argentinean crisis exemplifies how difficult it is to "pesify" dollar debts at the expense of domestic dollar lenders (bank depositors).

23. The original sin assumption in this paper is that all foreign debt is contracted in dollars, irrespective of whether foreign peso debt is not offered at all or simply appears too expensive to borrowers.

Because of original sin, the higher the reliance on net foreign savings, $E - fD$, to finance domestic investment, L, the higher the liability dollarization. An important case to analyze is the case in which aggregate domestic savings, D, are constant but net external financing is subject to variations, affecting either debt capital inflows, E (external debt), or debt capital outflows as measured by the offshore savings propensity, f (capital flight). For example, a sudden stop of capital inflows would lead to lower liability dollarization at the cost of lower aggregate domestic liabilities, L, backing investment (equation 1a). In the case of perfect financial integration, an increase in offshore savings, f, would not lead to financial disintermediation because it would be perfectly offset by external debt.[24]

Both domestic and foreign sources of liability dollarization are important in most countries, although their relative importance varies. Table 2 shows countries ordered by their degree of overall financial dollarization (measured as liability dollarization as share of GDP, L^*) and the contribution of domestic and external savings based on equation 1b. It considers two bounds for the contribution of domestic dollar savings in line with the two formulations of equation 1b: a lower bound in which the external source is proxied by gross external savings, thus ignoring the indirect contribution of domestic savings abroad provoking an external borrowing offset, and an upper bound in which foreign savings are proxied by net external savings, thus assuming that domestic savings abroad induce borrowing from abroad for the same amount (consistent with a constant net debt position discussed above).[25] The domestic contribution to financial dollarization is clearly as important as the external contribution. It is actually more important in a number of high financial dollarization countries, especially those with large unreported capital outflows. Furthermore, the degree of domestic financial dollarization appears significantly more amenable to policy treatment and easier to crack than the degree

24. To facilitate comparisons, I interpret the above macroeconomic aggregates as shares of GDP, so that, for example, L^* is total dollar liabilities as a share of GDP. In that case, L^* itself is a measure of the degree of financial dollarization, which is arguably better than l as a measure of systemic currency mismatch because it incorporates the degree of debt leverage of debtors. This measure can also be expressed in terms of the same parameters, with similar implications for the relevance of d given L and D:

$$L^* = dD + e(L - D) - (1 - e) fD = dD + (L - D),$$

when $e = 1$ (original sin).

25. This upper bound is actually underestimated because the estimate of this net position does not include errors and omissions or other debt assets abroad that are not included in reported offshore deposits.

TABLE 2. Asset Sources of Liabilities Dollarization, as a Percentage of GDP[a]

Country	Domestic dollar lending (D* – fD) (1)	External lending (E*) (2)	Domestic dollar saving (D*) (3)	Net foreign savings (E* – fD) (4)	Liability dollarization[b] (L*) (5)	Domestic liability dollarization[c] (%)	
						Minimum (6a)	Maximum (6b))
Nicaragua	51	228	84	195	279	0.18	0.30
Uruguay	46	47	91	2	93	0.49	0.98
Croatia	42	45	74	13	88	0.49	0.85
Philippines	16	68	31	53	84	0.19	0.37
Indonesia	11	67	20	57	77	0.14	0.26
Argentina	17	58	26	50	76	0.23	0.34
Jamaica	9	59	36	32	68	0.13	0.53
Turkey	14	53	25	41	67	0.21	0.38
Moldova	8	56	20	43	64	0.12	0.32
Peru	17	38	31	24	55	0.31	0.57
Egypt	17	33	38	13	51	0.34	0.75
Bulgaria	16	31	35	12	47	0.33	0.75
Malaysia	4	43	18	28	46	0.08	0.39
Chile	5	41	26	20	46	0.10	0.56
Hungary	8	36	16	28	44	0.18	0.36
Thailand	1	43	15	30	44	0.03	0.33
Slovak Republic	11	27	20	17	37	0.28	0.53
Lithuania	9	23	16	16	32	0.29	0.51
Dominican Republic	7	25	18	14	32	0.21	0.55
Guatemala	0	31	15	16	32	0.01	0.48
Latvia	10	20	21	9	30	0.33	0.69
Czech Republic	8	20	32	–4	28	0.29	1.13
Estonia	7	19	20	6	26	0.28	0.77
Romania	5	21	11	15	26	0.18	0.42
Kazakhstan	7	18	12	14	26	0.29	0.47
Poland	7	18	18	7	25	0.30	0.71
South Africa	4	18	18	4	22	0.16	0.81
Mexico	2	19	12	9	21	0.09	0.57
Venezuela	0	18	24	–5	18	0.00	1.30

Source: Levy Yeyati (2004) and author's calculations.

a. Year-end 2001. Sample covers nonindustrial economies, excluding offshore centers.

b. Equals the sum of columns 1 and 2 and the sum of columns 3 and 4.

c. Minimum (6a) equals column 1 divided by column 5; maximum (6b) equals column 3 divided by column 5.

of external financial dollarization; this is arguably a precondition in terms of sequencing, for reasons explained later. This paper, centered on domestic financial dollarization, thus addresses a key direct contributing factor to liability dollarization in countries with high financial dollarization, which is also the first node in the critical path for a comprehensive solution to high financial dollarization.

What Drives Domestic Financial Dollarization?

This section gives a brief and selective account of what is known about the (warranted) drivers of financial dollarization that may give it a useful financial role and justify its consequences. It thus serves as background for the policy analysis in the remainder of the paper.[26]

Domestic financial dollarization is widely viewed as a coping strategy on the part of agents to obtain insurance against surprise changes to peso prices, which make real returns of peso nominal debt very risky. To the extent that the main fear is of a surprise inflationary surge such as many developing countries have experienced in the past, one can interpret this fear as domestic lenders being eager to defend the real value of their savings from dilution by inflation.[27] In summary, domestic financial dollarization is a market adaptation to cope with low-quality currencies.

The high and volatile inflation that has been observed in many developing countries over the years, including episodes of hyperinflation, jibes well with the widespread development of financial dollarization, as financial globalization established itself with a strong footing and increasingly facilitated dollarization by offering opportunities to save abroad. Over the past decade, however, Latin America has seen a remarkable reduction in inflation, while financial dollarization has tended, if anything, to increase. This raises the question of whether financial dollarization is reversible. What matters is the expectation about future inflation (strictly speaking, surprise changes in inflation), rather than current or past inflation. One way to reconcile this apparent anomaly of high financial dollarization under low inflation is to consider that despite the reduction in observed inflation rates, currencies and monetary policies lack credibility: bad memories are not easily forgotten, and it takes a long time for credibility-building policies and institutions to become effective.[28] This hysteresis view of the persistence of financial dollarization does not bode well for the prospects of dedollarization based on monetary discipline.[29] Even the best attempt would be blocked by lack of credibility.

26. For more detail, see the excellent review in Levy Yeyati (2004) and references contained therein.

27. This approach calls for a policy analysis of different forms of defense, of which financial dollarization may be just one; I return to this issue in the last section.

28. See Savastano (1996). Another way to explain the evidence is to consider the costs of switching back to local currency instruments as a result of network externalities, although this argument appears more relevant for currency substitution than for asset substitution (Guidotti and Rodríguez, 1992).

29. See, for example, Reinhart, Rogoff, and Savastano (2003).

I take a more optimistic view derived from the portfolio approach introduced by Ize and Levy Yeyati, from which this section draws heavily.[30] This portfolio optimization approach allows translating the identities in the previous section into behavioral equations, from which implications can be examined. While the next section returns to the drivers of financial dollarization and explores some of the proximate causes, it is useful at this point to outline the basic portfolio model.

I start with the case of domestic lenders (say, depositors) and borrowers (say, firms) choosing between contracting in pesos or dollars for the repayment of a given loan. These choices entail different real return profiles: a peso loan delivers a real return of r_p and a dollar loan a real return of r_d. Let P be the debt repayment for one unit loan from borrower to lender. They choose the fraction, d, of dollars (and $1 - d$ of pesos) of their debt financing portfolio, so that

$$P = (1 - d)r_p + dr_d.$$

Since they are domestic agents, they discount nominal payoffs with the domestic price index, so that returns are subject to currency or price risks: peso loans are subject to inflation risk (uncertain inflation) and dollar loans are subject to exchange rate risk (uncertain real exchange rate). From the point of view of the depositor, returns on peso claims are diminished by inflation and returns on dollar claims are enhanced by real depreciation. In addition to these price risks, all returns are subject to credit or default risk—that is, the uncertainty concerning the fraction of the contractual obligation to be recovered on account of the possibility that the borrower may fail to honor the contract with the lender (this failure amounts to a transfer from lender to borrower, which for the moment is assumed to be costless to the contracting parties). Expected inflation, exchange rate depreciation, and default loss are factored in contractual terms to offset their effect on expected real returns, but the deviations of their realizations from their expected values (that is, surprise inflation, real depreciation, and default) make returns risky. Let e_i represent unexpected inflation, e_x unexpected real appreciation, and e_d unexpected default loss:

$$r_p = E(r_p) - e_i - e_d \text{ and}$$

$$r_d = E(r_d) - e_x - e_d,$$

30. Ize and Levy Yeyati (2003).

where $V[e_i] = V_{ii}$ (inflation risk), $V[e_x] = V_{xx}$ (real exchange rate risk), and $V[e_d] = V_{dd}$ (default or credit risk). Price risks, inflation, and real exchange rate appreciation are possibly correlated with each other according to covariance V_{ix}. Notice that unexpected nominal exchange rate appreciation, e_n, and nominal exchange rate risk, V_{nn}, correspond to

$$e_n = e_i - e_x \text{ and}$$
$$V_{nn} = V_{ii} + V_{xx} - 2V_{ix}.$$

If unexpected inflation and real exchange rate depreciation are positively correlated ($V_{ix} < 0$), then peso and dollar claims hedge each other's returns (and the nominal exchange rate is very volatile: $V_{nn} > V_{ii} + V_{xx}$). At the other extreme, $V_{ix} > 0$ takes its maximum value in the case of a fully credible fixed exchange rate ($V_{nn} = 0$). For simplicity, I assume that both price risks are uncorrelated with default risk ($V_{id} = V_{xd} = 0$).[31]

Lenders (depositors) are risk averse and are concerned with the return volatility of their asset portfolio ($a > 0$ is the coefficient of risk aversion). For simplicity, borrowers (firms) are assumed to be risk neutral. In this basic model, the currency composition of loan repayment, *d,* is determined for lenders by

$$\max_d E(P) - aV(P) \tag{4a}$$

and for borrowers by

$$\max_d - E(P). \tag{4b}$$

Joint maximization efficiency, adding up objective functions 4a and 4b, determines dollarization, *d,* such that the variance of the portfolio is minimized:

$$\min_d V(P). \tag{5}$$

Private efficiency leads to choosing the dollar fraction ratio, d^*, that minimizes the variance of payment (see the appendix):

$$d^* = \frac{V_{ii} - V_{ix}}{V_{nn}} = \frac{V_{ii}}{V_{ii} + V_{xx}} \text{ if price risks are uncorrelated.} \tag{6}$$

31. Given the association between default and real exchange rate depreciation, a more realistic assumption would be $V_{xd} < V_{id}$ (developed in the appendix). The key results do not depend on this simplification.

The main intuition of the equilibrium result is that what matters for financial dollarization is not just inflation risk, but the relative risk between inflation and real exchange rates: financial dollarization may coexist with low inflation risk if real exchange rate risk is also low (under the assumptions, default risk is irrelevant for financial dollarization).[32] The decline in inflation volatility need not lead to a decline in financial dollarization if there is a concomitant decline in real exchange rate volatility. Exchange-rate-based stabilization in Latin America in the 1990s illustrates this case. More generally, fear of floating associated with high financial dollarization appears to be behind the steeper decline of real exchange volatility than of inflation volatility, which led to an increase in latent dollarization, d^*, and which partly explains the persistence of observed financial dollarization. This more elaborate explanation of the observed trends assigns better prospects to a dedollarization strategy based on monetary discipline (say, inflation targeting) combined with flexible exchange rates.

Could this portfolio analysis be applied to foreign lenders to explain original sin (that is, a corner solution of $d^* = 1$)? Eichengreen and Hausmann forcefully contend that other factors, such as country size (which determines the currency's value for international diversification purposes), are more important and explain why countries with strong monetary and fiscal policy like Chile also suffer from original sin.[33] However, the portfolio approach offers an additional explanation: because foreign savers would discount with a different factor (their own foreign consumption basket), they are not as aligned as domestic savers concerning the borrowers' appreciation of the relative volatility of the real returns of lending instruments.[34] This misalignment with foreigners induces home bias, as noted by Thomas.[35] From the perspective of foreigners' real returns, dollar lending would not contain price risk ($V'_{xx} = V'_{ix} = 0$, abstracting from surprise international dollar inflation), and peso lending would contain both inflation risk and the exchange rate risk involved in the conversion of

32. The hedging value between peso and dollar claims (a negative V_{ix}) is also important. It would pull dollarization toward 50 percent, so it would have an ambiguous effect depending on which type of claim is more risky.

33. Eichengreen and Hausmann (1999).

34. The effect of expected real exchange rate changes on expected returns is also asymmetric: it affects foreigners' expected real returns on peso lending and residents' expected real returns on dollar borrowing, thus opening a gap between expected payments between lender and borrower in equations 4a and 4b. Expected real depreciation (appreciation) would favor foreigners lending in pesos (dollars). To simplify, in the text I assume that the real exchange rate is in equilibrium (expected real depreciation is zero).

35. Thomas (1985).

the peso deflator into the dollar deflator ($V'_{ii} = V_{ii} + V_{xx}$). Equation 6 would hold mutatis mutandis; optimal foreign financial dollarization would, in fact, be 100 percent; and original sin would be the natural result of this home bias.

For completeness, I extend the simple portfolio model above to the portfolio consideration of other incomes of lenders and borrowers to see how this broader framework may alter basic dollarization, d^*, in equation 6 and lead to "safe haven" dollarization, $d^{*\prime} > d^*$. Let I be other lenders' income sources (from nonfinancial assets) per unit lent (for a total of $I + P$) and S be borrowers' net revenue sources (net nonfinancial assets) per unit borrowed (for a net revenue of $S - P$), everything in real terms. In this more complete model, equations 4a (for lenders) and 4b (for borrowers) are

$$(4'a) \qquad \max_d E(I) + E(P) - a\left[V(I) + V(P) + 2\,\mathrm{cov}(I,P)\right] \text{ and}$$

$$(4'b) \qquad \max_d E(S) - E(P).$$

Incomes S and I are exogenous and thus are not affected by the decisions on currency mix. Consequently, joint contracting efficiency now amounts to

$$(5') \qquad \min_d V(P) + 2\,\mathrm{cov}(I,P),$$

instead of $\min V(P)$, as in equation 5.

Assuming that lenders' nonfinancial income, I (say, real wages), is negatively correlated with nominal exchange rate depreciation ($V_{In} < 0$), which is certainly the case in currency crises, it is easy to check that a more dollarized debt contract would be a hedge for the lender: $\mathrm{cov}_d(I, P) < 0$.[36] This additional factor leads to even higher dollarization, $d^{*\prime}$ (see the appendix). This is broadly consistent with the finding in de Nicoló, Honohan, and Ize on their version of the safe haven effect, reflected in the coefficient of their GDP hedging variable:[37]

$$(6') \qquad d^{*\prime} = \frac{V_{ii} - V_{ix} - 2V_{In}}{V_{nn}} = d^* - \frac{2V_{In}}{V_{nn}} > d^*,$$

when $V_{In} < 0$.

Finally, borrowers' risk aversion and costly default (both of which I have assumed away so far) may also be relevant factors in the determination of warranted financial dollarization. Their likely effect, however, is to moderate

36. This is emphasized in Ize and Parrado (2002) and Rajan (2004).
37. De Nicoló, Honohan, and Ize (2003).

financial dollarization (see the appendix). Borrowers' risk aversion is neutral in the simple portfolio model because their risk evaluation is aligned with that of lenders and would call for less liability dollarization as a hedge against a fall in real profits or equity values—that is, $\text{cov}_d(S, -P) > 0$. This is consistent with the microeconomic evidence in Galindo, Panizza, and Schiantarelli on the significance of (partial) hedging via the currency composition of the stock of debt.[38] Costly default would also call for less liability dollarization to the extent that default risk is higher for a dollar loan than for a peso loan.[39]

Financial Dollarization and International Lending

Finally, this section reconsiders the same simple portfolio model in a financially open economy (but subject to original sin). Now domestic lenders have a choice of offshore investment (in dollars) not subject to country risk. Its return, r_f, is thus only subject to exchange rate risk, with variance V_{xx}. The portfolio problem entails three choices: onshore peso, onshore dollar, and offshore dollar. Let d denote the fraction of dollar claims in the portfolio as before (now the sum of onshore and offshore dollar claims) and f the fraction of offshore claims in the portfolio:

$$P = (1 - d)r_p + (d - f)r_d + fr_f,$$

with $d \geq f$, so that no short positions exist.

Borrowers, in turn, have a choice of borrowing from foreign lenders (also in dollars). Foreign lenders are not explicitly modeled, but they are assumed to add a risk premium, k, to their alternative return at home, on account of country default risk (or any other motivation behind home bias). Let r denote the (exogenous) expected real cost of foreign financing for a domestic borrower (inclusive of risk premium, k). Nonarbitrage implies that the expected return of offshore investment (for a domestic lender) is $r - k$: $E(r_f) = r - k$. To simplify, I continue to assume that borrowing firms are risk neutral. Then borrowers always pay r in expected value to all lenders, domestic and foreign: $E(r_p) = E(r_d) = r$. Therefore,

$$\begin{aligned} r_p &= r - e_i - e_d; \\ r_d &= r - e_x - e_d; \text{ and} \\ r_f &= (r - k) - e_x. \end{aligned}$$

38. Galindo, Panizza, and Schiantarelli (2003).

39. These effects are ambiguous, however. Jeanne (2002) constructs a special model in which costly default induces dollarization because of a large peso premium; the same result could presumably be obtained under similar assumptions in the case of risk-averse firms.

The domestic lenders' portfolio problem to determine dollarization, d^*, and offshore savings, f^*, thus becomes

$$(7)\quad \max_{d,f} = E(P) - aV(P) = r - fk - aV\left[(1-d)r_p + (d-f)r_d + fr_f\right].$$

It can be checked that optimal dollarization, d^*, is the same value that minimized the variance of payments previously (see the appendix). This is the key result in Ize and Levy Yeyati, that is, the previous result continues to hold for the degree of dollarization, d^*, of total deposits, but part of them are made offshore.[40] Again, the degree of domestic financial dollarization is warranted given the circumstances. This portfolio model has been empirically tested by these authors to explain domestic financial dollarization using historical variances and covariances to proxy expected volatilities for the computation of d^* as the explanatory variable. This variable is always found relevant and substantial in regression analysis. However, observed domestic financial dollarization systematically exceeds d^*, an issue to which I return.

As to offshore savings, the optimal fraction of total deposits made offshore is f^*, which depends on country default risk (see the appendix):[41]

$$(8)\quad f^* = 1 - \frac{k}{2aV_{dd}}.$$

Finally, liability dollarization is affected not only by domestic financial dollarization, *d,* but also by the financing of debt financial intermediation, as measured by the ratio *D/L* (domestic savings to investment, here taken as constant to simplify notation); see equations 2 and 3. Domestic investment, *L,* can be assumed to be a decreasing function of real cost of capital, $r : L = L(r)$, $L' < 0$. The portfolio models above take domestic savings, *D,* as given. Presumably, however, domestic savings depend on the value of objective function 7: $D = D[r - kf^* - aV(P^*)]$, $D' > 0$. This assumption is consistent with Cowan, Kamil, and Izquierdo, who find that the variance of the currency mix negatively affects financial development.[42] Therefore, an increase in international interest rates, *r,* would push *D* up and *L* down, reducing liability dollarization (as well as investment and external debt).[43] If this increase is

40. Ize and Levy Yeyati (2003).

41. The above results for d^* and f^* hold for an interior solution in which there are onshore dollar deposits—that is, $d^* > f^*$. Given the high demand for domestic dollar savings in countries with high financial dollarization, this appears to be the most interesting case. I return to this to review the implications of the alternative case of a corner solution.

42. Cowan, Kamil, and Izquierdo (2004).

43. This result makes use of the envelope theorem applied to f^* and P^*.

due to an exogenous increase in the country risk premium, *k,* then domestic savings would increase by less (the capital flight option is not enhanced), but the qualitative results are the same. In particular, a sudden stop (that is, rationing of external debt, *E,* at a lower level) can be modeled in this way. As long as these external shocks are exogenous and are not dependent on domestic portfolio choices, the resulting financial dollarization is warranted. I return to this issue in the next section.

The above portfolio model leaves out some potentially important factors.[44] In particular, other portfolio choices, such as the choice of maturity, ought to be studied alongside the dollarization decision. For example, a short-maturity peso loan provides a natural substitute to a dollar loan, since it represents an alternative form of protection against surprise inflation. Evidence from the Inter-American Development Bank shows that dollarization is prevalent in long-maturity bank loans and deposits, which clearly confirms this conjecture.[45] Short-maturity financing, with all its attendant price and rollover risks, could be expected to expand if dollar deposits were banned. De la Torre and Schmukler rightly emphasize this issue as a potential pitfall of a narrow dedollarization strategy.[46] Equity financing offers another hedge against surprise inflation, and it is therefore also a substitute for dollar financing, without the obvious downside of short-term debt. Empirical work on this link between dollar debt and equity financing is sorely missing.

Excessive Dollarization: Dedollarization as a Policy Objective

The empirical analysis of the macroeconomic consequences of financial dollarization in the first section points to important costs in terms of financial instability and growth volatility that do not appear to be offset by any clear advantage in terms of average growth. A consensus is visibly emerging around the idea that some degree of dedollarization is a valid policy objective. However, if the only basis for analysis is a set of empirical regularities, it is easy to end up attacking symptoms or to miss the incidental costs associated with

44. For example, the relevance of the asymmetry of stochastic distributions for inflation, exchange rate, and default risk (that is, skewness due to events such as potential hyperinflation bursts, peso problems, and sudden stops) and of asymmetric behavior to large downside risk owing to imperfections is muted by preferences toward risk that can be summarized by the variance of returns as in the portfolio model above, but it may merit a value-at-risk approach.

45. IDB (2004).

46. De la Torre and Schmukler (2003).

the benefits of dedollarizing. This section analyzes the conditions under which financial dollarization is excessive and dedollarization is welfare improving, as well as the corresponding policy instruments that would be required to achieve dedollarization.

Financial dedollarization would be straightforward to obtain using strong antidollarization policies (namely, financial policies that discriminate against dollar debt), but at the peril of financial disintermediation and mounting external debt. Would such an antidollarization policy stance be welfare improving? To the extent that financial dollarization is warranted—that is, to the extent that observed financial dollarization is the equilibrium resulting from the portfolio models of the previous section—it would not be: private returns determining market portfolio allocations are also social returns. However, if market distortions are causing a gap between social and private returns, then the resulting financial dollarization is no longer warranted. If bilateral private dollar contracting imposes costs to third parties, then social returns to dollar claims warranting financial dollarization are lower than private returns. This leads to excessive financial dollarization, for which antidollarization policies may be useful.

I open this section discussing these issues. Nevertheless, dedollarization policy is not exhausted in dealing with market distortions leading to financial dollarization in excess of the warranted level. Warranted financial dollarization is only constrained optimal because it is constrained by missing financial markets and weak institutions. If these constraints are subject to welfare-improving policies on fundamentals, then even warranted financial dollarization is excessive. At the end of the section, I turn to the issue of optimal financial dollarization.

Antidollarization Policy: The Perils of Shrinking Credit and Mounting External Debt

This section describes how antidollarization policy alters the above model, producing lower dollarization possibly accompanied by financial disintermediation and external indebtedness. In what follows, I focus on a policy of taxing, or banning, onshore dollar deposits and leave similar tax schemes on external financing or overall dollar lending to the appendix. Some of the qualitative implications emerging from this augmented model of impediments to onshore dollar savings are confirmed econometrically by de Nicoló, Honohan, and Ize, who control for administrative restrictions on domestic dollar deposits and test their effects.[47] If financial dollarization is warranted, antidollarization

47. De Nicoló, Honohan, and Ize (2003).

policies will be effective but counterproductive. If financial dollarization is excessive, an appropriate dedollarization policy may improve social welfare.

Consider a tax, *t,* on onshore dollar deposits (to simplify, I assume they are payable up front, so that their real value is not subject to uncertainty and return volatilities are not affected). This tax imposes a wedge between the expected returns of the domestic lender and borrower. Since the borrower's expected borrowing cost, *r,* is still pinned down by external debt, the after-tax expected return on onshore dollar lending is $r - t$.[48] The portfolio problem then becomes

$$\max_{d,f} E(P) - aV(P) = r - dt - f(k - t) - aV(P), \tag{9}$$

$$d(t) = d^* - \frac{t}{2aV_{nn}} < d^*, \text{ and} \tag{10}$$

$$f(t) = f^* + \frac{t}{2aV_{dd}} > f^*. \tag{11}$$

The tax on onshore dollar deposits reduces domestic financial dollarization (since peso savings are now more attractive than dollar savings) but increases offshore savings (since the tradeoff between onshore and offshore dollar savings has tilted in favor of untaxed offshore deposits). The sensitivity of dollarization to the disincentive, *t,* increases as risk aversion, *a,* falls and the peso and the dollar become closer substitutes, as measured by the variance of the nominal exchange rate, V_{nn}.[49] Dollar savings are difficult to dislodge when they are not close substitutes to peso savings, because they provide important insurance to peso savings.

By design, the model excludes credit reduction since the effective cost of borrowing remains *r,* which sustains overall domestic financing, *L.* Domestic savings, *D,* could be hurt by lower after-tax returns on onshore dollar deposits, but this effect could be offset by a budget-neutral subsidy on peso deposits refunding the tax revenue to domestic savers. The effects on overall savings can thus also be disregarded, and I focus on the portfolio effects in equations 10 and 11.[50]

48. I assume that offshore dollar lending cannot be effectively taxed.

49. This sensitivity measure corresponds to the concavity of the variance of payment. The flatter the variance, the easier it is to dedollarize.

50. In fact, d would decline further in the presence of the budget-neutral subsidy, $s = t(d - f)/(1 - d)$.

The downside of this intervention is that external debt rises: absorption remains, but capital flight increases.[51] The flipside of this result is that credit would shrink if foreign savings are not available because of an external credit constraint or if mounting debt imposes additional costs (that is, an increase in r). In this case, credit reduction could be avoided if impediments to offshore savings can be jointly used. The bottom line is that selective taxation of onshore dollar deposits may be useful for reducing dollarization, but it works best either with easy access to external debt inflows or with impediments to offshore domestic outflows.

The previous antidollarization intervention assumes that a fraction of dollarized domestic savings is lent onshore, that is, $d > f$. Offshore savings set a floor on dollarization, which is reached when onshore dollar deposits are zero, that is, when $d = f$ (saving offshore is the only way to save in dollars). In the case of a tax on onshore resident dollar deposits, that limit is reached under a prohibitive tax or a ban on onshore dollar savings. Such a ban would yield the following minimum dollarization level (equal to the new offshore savings level):

$$d^{**} = f^{**} = \frac{V_{ii} - V_{ix} + f^{*} V_{dd}}{V_{nn} + V_{dd}}. \tag{12}$$

It can be checked that $f^{*} < f^{**} = d^{**} < d^{*}$ (under the maintained assumption that the basic portfolio model entails positive onshore dollar savings, $d^{*} > f^{*}$).

A ban on onshore domestic dollarization leads to some dedollarization. Part of the onshore dollars do not migrate to pesos, however, but rather find their way into increased offshore savings. Onshore dollar deposits ($d^{*} - f^{*}$) are partly converted to peso deposits ($d^{*} - d^{**}$) and partly to offshore dollar deposits ($f^{**} - f^{*}$). The IMF confirms this theoretical result, showing that countries with banned onshore dollarization feature relatively lower overall bank dollarization but sizable offshore deposits.[52]

The Case for Excessive Dollarization: Market and Policy Distortions

The empirical evidence on the relevance of warranted dollarization, d^{*}, for explaining observed financial dollarization is solid. This is especially so when credibility is taken into account to adjust measured historical volatilities to

51. Other tax schemes encompassing foreign borrowing would moderate the increase in external debt at the cost of lower investment.

52. IMF (2005).

estimate the level of expected volatilities that should be included in a theoretically sound measure of d^*. In fact, half of the cross-country variation in de Nicoló, Honohan, and Ize is explained by institutional and regulatory variables—as well as the macroeconomic environment, which I interpret as a credibility correction term that may simply be adjusting d^* for measurement error.[53] Even with this fix, the evidence on observed dollarization across countries leaves room for more complex theories explaining higher observed financial dollarization, including market distortions leading to excessive dollarization.[54] Unfortunately, little empirical work has been carried out to identify the factors behind these deviations, so considerable uncertainty surrounds the sources of excessive financial dollarization and the corresponding policy remedies.

Distortions in the returns perceived by lenders and borrowers should be removed or compensated with tax-like wedges. In what follows, I distinguish between market externalities and policy externalities. In both cases, I argue that dollar financing implies costs that are external to the contracting parties, which can be internalized with a Pigouvian tax wedge, t, of the kind posited previously to remove excessive dollarization, although in extreme cases shock treatment may be necessary. Once the distortion is identified, antidollarization policy is warranted.

MARKET DISTORTIONS. High financial dollarization leads to systemic financial fragility both because it is powerful (real exchange rate depreciations can be substantial, especially in this era of international financial turmoil and sudden stops) and because it is widespread across agents (which are then hit at once). Recent crises have clearly illustrated the potential for aggregate economic collapse when financial and real networks among firms and banks are systemically disrupted.[55] It is this coordination mechanism that has substantially increased the risk of liquidity crisis in highly dollarized economies, as the ripple effect of a solvency shock on balance sheets quickly becomes a sufficient precondition for a self-validating liquidity run. Even in the unlikely case that peso default risk is higher than dollar default risk for individual firms (as in Jeanne), at a systemic level dollar default risk is likely to predominate because of the default correlation that large real depreciations induce.[56] The failure of contracting private agents to internalize their contribution to aggregate financial dollarization and the consequent systemic inef-

53. De Nicoló, Honohan, and Ize (2003).
54. Ize and Levy Yeyati (2005); Castro and Morón (2004b).
55. Calvo and Fernández-Arias (1998).
56. Jeanne (2002).

ficiency costs are arguably the most important reasons for excessive financial dollarization in the market. This issue receives very little attention in the dedollarization debate, however: most of the enquiry focuses on policy failures that induce excessive financial dollarization.

The risk of systemic crisis produced by aggregate financial dollarization as a vehicle for a systemic shock and a coordinating device is not internalized by private agents in our simple portfolio model.[57] A related aspect of market externalities associated with financial dollarization involves the risk of turbulence and disruption in international financial markets, or the risk of a sudden stop. To highlight the specific aggregate and foreign characteristics of this risk, I model this risk in terms of aggregate foreign debt stock, E^*: the higher this stock, the more likely it is that there would be a financial disruption leading to output losses throughout the economy.[58] This problem has been studied by Fernández-Arias and Lombardo and, more recently, by Wright.[59] The appendix models these market externalities and discusses the corresponding optimal taxes.

Finally, papers by Chamon and by Broda and Levy Yeyati raise the intriguing possibility that dollar financing displaces peso financing because of a coordination failure among creditors to share partial bankruptcy payments.[60] Limited liability implies that in a state of default, partial payments are shared according to a rationing rule. According to bankruptcy law, each creditor class receiving partial payment shares receipts according to the total due to each creditor. Since (nominal) depreciation inflates dollar values in pesos and since surprise nominal depreciation is associated with macroeconomic crisis and firms' default, dollar financing would have an advantage over peso financing in default states.[61] Dollar financing holds an undue advantage in equilibrium, leading to excess dollarization: part of the cost is implicitly absorbed by the debtor's peso lenders (an externality), because a switch from peso to dollar lending at going rates provides a rent to dollar lenders in that the sunk peso lending carries lower default payments after the switch.

57. In Aghion, Bacchetta, and Banerjee (2001), a self-fulfilling currency and banking crisis obtains through the dynamics of incomplete pass-through once financial dollarization reaches a critical level. This social bankruptcy cost could be present even in models of firm default dollarization, as in Ize and Powell (2005), which would then justify prudential banking regulation that penalizes dollar loans.

58. See Tirole (2002) for an elaboration in terms of dual agency theory.

59. Fernández-Arias and Lombardo (2002); Wright (2004).

60. Chamon (2001); Broda and Levy Yeyati (2006).

61. This distortion tends to disappear with inefficient bankruptcy procedures, which would tend to uniformly dissipate the value of all claims.

The excess dollarization produced by this market failure is exacerbated by the feedback between the degree of liability dollarization and the risk of default: the more dollarized a firm's debt, the tighter the association between depreciation and default and, therefore, the stronger the disadvantage for peso lenders. The available evidence suggests that this effect may be substantial. Microeconomic data indicate that, all things equal, highly leveraged firms (a proxy for risky firms) hold a higher share of dollarized liabilities.[62] Macroeconomic data point to the same conclusion: liability dollarization significantly increases with total liabilities (as a share of GDP), according to an estimating equation ($l = 0.50 + 0.27L$).

POLICY DISTORTIONS AND MORAL HAZARD. The literature mainly focuses on policy failures as opposed to market failures, with the implication that government is the problem causing excess financial dollarization.[63] For example, arbitrage across currencies in financial intermediation costs may unduly favor dollar intermediation. The costs of intermediating local currency may be higher due to deficiencies in the payment system or monetary management that leads to higher or more expensive liquid reserves in local currency. Unremunerated (or inadequately remunerated) reserves also represent a regulatory disadvantage for peso intermediation in the context of inflation.[64] Unequal competition with less regulated off-shore banks, which operate in dollars, also promotes currency regulatory arbitrage favoring financial dollarization. Some analysts also argue that currency-blind safety nets, such as deposit insurance or lender-of-last-resort policies, grant an undue advantage to dollar instruments, for the same reasons as in the case of partial bankruptcy recovery.[65] Specifically, because payment events are associated with depreciation, the face value of dollar debts captures a larger share of the insurance.

Finally, a large literature explores how free public insurance, whether explicit or implicit, causes moral hazard. In general, moral hazard favors excessive risk taking by the parties that stand to benefit from the insurance, as a way to capture the expected wealth transfer. While banks are generally currency matched, they are still exposed to exchange rate risk through credit risk (of mismatched borrowers). Given that the real value of dollar claims is countercyclical in developing countries, free insurance is better captured by

62. See, for example, Galiani, Levy Yeyati, and Schargrodsky (2003).

63. See Ize and Powell (2005) for an excellent analysis of most of the cases reviewed in this subsection (except liquidity issues), in the context of an integrated formal banking model.

64. Catão and Terrones (2000).

65. See Broda and Levy Yeyati (2006).

contracting in dollars.[66] Dollar liquidity is costly, so the central bank's ability to provide liquidity support is also a source of moral hazard.[67] Furthermore, once financial dollarization advances beyond some threshold, dollar borrowing becomes privately less risky because some form of financial rescue can be expected in the case of devaluation.[68] This is a good example of the negative feedback mechanisms that amplify excess dollarization effects: high financial dollarization entails implicit insurance as a response to systemic risk, which in turn makes bank dollar intermediation even more attractive.

De la Torre and Schmukler further suggest that dollar pegs represent an implicit guarantee to borrowers in case the peg is broken.[69] Fixed exchange rate regimes encourage excessive financial dollarization by insisting on currency-blind regulation to derive credibility for the sustainability of the peg. Argentina in 2001 is a good example of ex post rescues of dollar debtors and, probably, of ex ante distortions in favor of financial dollarization.[70]

Moral hazard also acts in reverse, from financial dollarization to public incentives to pursue certain policies that fit a highly dollarized economy but that may be suboptimal overall. The detrimental effect of aggregate financial dollarization constraining public policies ex post is similar to an externality. Anticipation of the constraints that financial dollarization may impose on policies ex post could justify discouraging financial dollarization in the first place.[71] This linkage between financial dollarization and exchange rate policy is a key example of a perverse feedback mechanism that may lead to excessive financial dollarization (relative to a precommitted optimal policy). High financial dollarization induces fear of floating as an ex post optimal policy response, which in turn reinforces the incentives to pursue financial dollarization for portfolio reasons (that is, low exchange rate risk), and so on.[72]

66. McKinnon and Pill (1997); Schneider and Tornell (2000).

67. Dooley (2000).

68. Burnside, Eichenbaum, and Rebelo (2001).

69. De la Torre and Schmukler (2003).

70. On the latter, see the microeconomic evidence in Galiani, Levy Yeyati, and Schargrodsky (2003).

71. In contrast with the traditional time-inconsistency problem, which creates incentives to dilute nominal peso debt, dual-agency distortions (by which governments may want to help debtors with dollar liabilities through confiscatory measures in the case of real depreciation) make the case for less financial dollarization. See de la Torre and Schmukler (2003) for an interesting analysis of systemic risks in emerging market debt contracting.

72. Following the same logic, flexible exchange rate regimes would induce an inflationary bias as a way to dilute the debts of debtors in difficulties. This is the private sector generalization of the inflationary bias of public debt in Calvo and Guidotti (1989), in the context of dual-agency theory.

In contrast, a credible commitment to a flexible exchange rate regime would encourage less financial dollarization and could be better overall.[73] This two-directional causality makes it clear that dedollarization policies depend on the maintenance of floating exchange rate policies, which in turn may be risky if financial dollarization is not quickly and successfully reduced.

The mutually reinforcing influences of financial dollarization and exchange rate policy may be strong enough to produce multiple equilibria. Observed high financial dollarization and an inflexible exchange rate policy may be a bad equilibrium within a set that includes a better equilibrium combining low financial dollarization and flexible exchange rates. In this case, observed financial dollarization would be excessive and would merit policy intervention to dedollarize and dislodge the bad equilibrium.[74] This is a vague but optimistic theory of high financial dollarization: In theory, equilibrium selection is simply a matter of coordination (in principle, bad luck), so the policy effort may be confined to facilitating coordination without necessarily requiring any change in fundamentals or credibility.

The Case for Excessive Dollarization: Weak Policy Framework and Missing Markets

Financial dollarization may be warranted and free from distortions, yet still be part of a weak financial system in the absence of a sufficiently fertile contractual environment for agents to arrive at better private and social outcomes. Warranted financial dollarization is only constrained efficient. Remedies to lift these constraints include the provision of market infrastructure to make the environment functional, such as the provision of missing markets, and, more generally, the reform of policies and institutions underlying financial market returns. To the extent that these reforms are cost effective from a social viewpoint, warranted dollarization is excessive, not optimal, and calls for policy intervention on the constraints.

Warranted financial dollarization, $d^* = V_{ii}/(V_{ii} + V_{xx})$ in equation 6, contains the key proximate factors needed to achieve dedollarization, namely, reducing the expected volatility of (unexpected) inflation relative to that of the real exchange rate. The safe haven motivation in equation 6′ highlights the relevance of moderating the expected negative association between nominal depreciation and nonfinancial real income, V_{In}. The next section addresses

73. Chang and Velasco (2005) discuss a general equilibrium portfolio model with these characteristics.

74. Chamon and Hausmann (2003); Ize and Powell (2005).

macroeconomic financial policies and supporting institutions that may be able to produce these changes in expectations.

The reduction of country default risk would appear to be another candidate for facilitating dedollarization, but in this portfolio model it does not have any effect on warranted financial dollarization.[75] However, this irrelevance of country risk is at variance with the evidence from Levy Yeyati, who finds that a reduction in country risk is beneficial.[76] Some modifications to the stochastic assumptions on returns could account for this discrepancy. The derived warranted financial dollarization holds under the assumption that price risks are equally associated with country risk ($V_{id} = V_{xd}$); if country risk is negatively correlated with nominal exchange rate risk, as appears likely ($V_{id} > V_{xd}$), then country risk reduction would be dedollarizing (see the appendix).

Alternatively, the financial dollarization level, d^*, that the simple portfolio model in equation 7 yields may fail to reflect the full impact of default risk. In fact, if the maintained assumption that $f^* \leq d^*$ does not hold, then the derived warranted financial dollarization, d^*, is no longer valid and a reduction in country risk would also help dedollarization. If $f^* > d^*$, warranted dollarization is found as a corner solution with no onshore dollar deposits ($f = d$), as found in equation 12 for the case of a ban:

$$d^{**} = f^{**} = \frac{\left(V_{ii} - V_{ix} + f^* V_{dd}\right)}{\left(V_{nn} + V_{dd}\right)},$$

where ($d^{**} > d^*$). In this case, dollarization is driven by a high propensity to save offshore to escape country risk. While this is counterfactual with high domestic financial dollarization in the aggregate, it may apply to segments of very risk-averse domestic asset holders eager to eliminate country risk by saving offshore despite price risks (a large a leads to $f^* > d^*$), to the point of giving up the minimum variance dollar portfolio of equation 6. In this case, lower country risk, V_{dd}, is dedollarizing because it would reduce dollarization d^{**} (approaching d^*); see the appendix.

As noted by Levy Yeyati, the missing risk-free peso market in the simple portfolio model of equation 7 (that is, peso lending takes place only onshore and is therefore subject to country default risk) becomes relevant for financial

75. It appears relevant for offshore financing, f^*, in equation 7, but only in a ceteris paribus sense, keeping the risk premium, k, constant. If foreigners' risk premium, k, is proportional to country risk, V_{dd} (as would be obtained under the class of preferences of the simple portfolio model), then benchmark offshore financing, f^*, would also be invariant to changes in country risk.

76. Levy Yeyati (2004).

dollarization only in this case of corner portfolios of risk-averse savers.[77] In the basic model with an interior solution, a risk-free offshore peso market with a fair expected return of $r - k$ would be useless because offshore peso savings would fully crowd out onshore peso savings. This is so because the return in the missing market can be replicated by the return in the onshore peso market plus switching a dollar claim from onshore to offshore (which eliminates default risk by lowering expected return by k). However, in the case of the corner solution, $d^{**} = f^{**}$, that obtains under the assumption that $f^* > d^*$, there is no onshore dollar claim to switch and the missing market is not redundant. The availability of the risk-free peso market would allow the replication of the interior portfolio solution, and dollarization would fall to d^* (see the appendix).

To assess the relevance of this dedollarizing result for liability dollarization, it is important to notice that the simple relation between d and l in equation 3 is no longer valid in this case: liability dollarization, l, may actually increase as dollarization (as measured by d) decreases. This is so because the increase in peso savings ($d^{**} - d^*$) takes the form of offshore deposits; in fact, overall offshore savings actually increase by more—as much as ($f^* - f^{**}$) > ($d^{**} - d^*$)—and onshore peso deposits therefore actually decline by the same amount. The reduction in domestic financial dollarization, d, has a beneficial impact on liability dollarization, l, only to the extent that a sufficiently large portion of the offshore peso savings are recirculated as peso lending from abroad—that is, as long as part of external debt inflows, E, are dedollarized in the process (see the appendix). This is consistent with Eichengreen, Hausmann, and Panizza, who advocate the separation of country and price risk as a device for addressing original sin.[78]

The development of some key missing markets—namely, inflation-indexed peso debt—may conceivably entail significant reductions in warranted financial dollarization in all cases. Dollar terms amount to a form of indexation that protects residents' savings from peso inflation, at the cost of exposure to real appreciation; it trades exchange rate risk for inflation risk. The most direct way to address the demand for inflation protection would be to create inflation-indexed instruments that provide a synthetic strong local currency for the purpose of storing value. The return profile of an onshore inflation-indexed peso deposit, or real peso deposit, r_r is as follows:

$$r_r = r - e_d.$$

77. Levy Yeyati (2004).

78. Eichengreen, Hausmann, and Panizza (2003). The development of currency derivatives markets would have a similar effect to the extent that it attracts a class of agents who are willing

These real deposits would contain no inflation risk and would therefore be safer than nominal peso deposits. They would also be superior to onshore dollar deposits, since they are not subject to price risk. The only risk they would contain is default (country risk), so they would only face direct competition from offshore dollar deposits, which are free from country risk. All domestic financial dollarization would therefore be offshore, as in the case of a ban on domestic dollar deposits ($d = f$) in equation 12, which resulted in dollarization d^{**}. The following equation presents the dollarization, d^{***}, resulting from the introduction of onshore inflation-indexed deposits in the simple portfolio model (see the appendix):[79]

$$d^{***} = \frac{f^* V_{dd}}{V_{xx}\left(1 - \rho_{ix}^2\right) + V_{dd}} \qquad \text{if } V_{ix} < 0, \text{ and} \tag{13}$$

$$d^{***} = \frac{f^* V_{dd}}{V_{xx} + V_{dd}} \qquad \text{if } V_{ix} \geq 0.$$

The dedollarization power of inflation-indexed deposits appears enormous. The resulting dollarization (and move toward offshore saving) is smaller than under a total ban on domestic dollar debt ($d^{***} = f^{***} < f^* < d^{**} = f^{**} < d^*$); see the appendix. These claims would be safer than any nominal claim for domestic lending, whether in pesos or dollars (though they would still be subject to country risk).[80] In a more sophisticated model, it would also achieve the desirable objective of breaking the link between real returns and changes in circumstances or perceptions on the evolution of future prices that would affect the expected return profiles of other instruments. If inflation-indexed debt is also available offshore, domestic financial dollarization would

to take currency risk (say, exporters), but who are deterred from doing so because it is bundled with country risk, which they are unwilling to take.

79. Dollarization in equation 13 is not obtained by just replacing onshore (nominal) peso deposits by onshore inflation-indexed deposits in equation 12 (substituting $V_{ii} = V_{ix} = 0$ and $V_{nn} = V_{xx}$). As long as nominal peso deposits retain portfolio value to hedge (offshore) dollar deposits, that is, if $V_{ix} < 0$, inflation-indexed or real deposits do not dominate nominal peso deposits (unless dollarization is fully eliminated). In fact, $N = d^{***}\ (-V_{ix}/V_{ii})$ (see appendix). The hedging value of dollar deposits implicit in $V_{ix} < 0$ pushes up dollarization, d^{***}; the closer the correlation between price risks as measured by $-\rho_{ix}$ (that is, the more complementary they are), the higher dollarization. (If $V_{ix} \geq 0$, then there is no hedging value, and $N = 0$).

80. Empirically, Ize and Levy Yeyati (2003) note that actual financial dollarization was far below d^* in the countries in their sample in which indexed peso instruments provided a good alternative to nominal peso instruments.

be eliminated: dollar holdings would be dominated by inflation-indexed peso holdings both onshore and offshore![81]

The development of markets that are currently missing could also help alleviate the adverse consequences of financial dollarization, or the fear of sudden stops.[82] Domestic currency derivatives markets would expand peso markets by separating price risk from credit flows, thereby eliminating the need to actually borrow or to engage in borrowing and onlending with the attendant credit risk to those who are willing to absorb the exchange rate risk from dollar liabilities (such as exporters). These markets would thus allow a better allocation of inflation risk among residents.[83] Contracts contingent on external shocks can also serve the purpose of hedging against liability dollarization, without the burden of mistrust or moral hazard to the extent that the contingency is exogenous.

Lessons from Dedollarization Experiences

The two main reviews of dedollarization experiences are by Reinhart, Rogoff, and Savastano and Galindo and Leiderman.[84] Reinhart, Rogoff, and Savastano suggest that recent proposals for dedollarization ignore history and thus should not be taken seriously. This section attempts to extract the lessons from success and failure in light of the previous analysis.

Financial dollarization is undoubtedly pervasive and persistent. According to Reinhart, Rogoff, and Savastano, as of year-end 2001, about thirty-five developing countries had bank dollar deposits of over 20 percent of broad money, including nine in Latin America.[85] In the previous twenty years (1982–2001), twenty developing countries saw their bank dollar deposit ratio decline substantially (at least 20 percentage points, to a level below 20 percent), but it rebounded in sixteen of the twenty countries.[86] This does not

81. Nominal peso deposits would also disappear because there are no dollar claims to hedge.

82. Caballero, Cowan, and Kearns (2005).

83. They would also reduce the ex ante incentives for excessive financial dollarization in Caballero and Krishnamurthy (2003).

84. Reinhart, Rogoff, and Savastano (2003); Galindo and Leiderman (2005).

85. Reinhart, Rogoff, and Savastano (2003). The nine Latin American countries were Argentina, Bolivia, Costa Rica, Ecuador, Jamaica, Nicaragua, Paraguay, Peru, and Uruguay. Since then, Argentina has largely dedollarized.

86. A few countries recently saw substantial reductions in financial dollarization after recovering from high inflation, including Bosnia, Egypt, Slovenia, and Poland. Even in these cases, however, dollar deposits remained substantial. A number of transition economies (such as Albania, Armenia, Czech Republic, Estonia, Georgia, Lithuania, Mongolia, Mozambique, and Yemen) saw financial dollarization fall after stabilization, but it then increased again.

imply that the failure rate is 80 percent, because the twenty cases of significant reductions in financial dollarization were not necessarily the result of policy attempts to achieve a dedollarization objective. Nevertheless, only in the other four cases was the gain sustained, thus qualifying as dedollarization experiences under the Reinhart, Rogoff, and Savastano definition (Israel, Mexico, Pakistan, and Poland). Alternatively, Galindo and Leiderman define dedollarization as a situation in which bank dollar deposits or loans exceeding 40 percent are reduced to less than 20 percent for a period of at least five years.[87] Under this definition, only Chile, Israel, and Poland dedollarized.[88] More recently, Argentina has emerged from its crisis with a dedollarized banking system.

I now turn to the three main lessons that emerge from successful and failed experiences of financial dedollarization and the avoidance of financial dollarization. These lessons concern the role of prudential financial policies, the development of dollar substitutes, and the importance of favorable conditions for launching policy packages.

Antidollarization Prudential Policies: Necessary but Risky

Most dedollarization experiences have included some shock treatment to bank dollar deposits and loans. Chile converted bank dollar loans, which were mostly financed by capital inflows, to inflation-indexed loans in a market-friendly way, using a generous fiscal package designed to solve the 1982 banking crisis, which was precisely produced by liability dollarization.[89] Others delivered shocks not with carrots, but with sticks. Israel imposed a mandatory holding period for dollar deposits valued at administrated rates (an implicit tax). Argentina, Mexico, and Pakistan forcibly converted dollar deposits to local currency, inflicting capital losses in the conversion.

The evidence from countries that have avoided the surge of dollarization or the redollarization of bank deposits also points to consistent prudential antidollarization regulation. Israeli banks are required to actively hedge currency risks or impose higher collateral in the case of dollar lending to the nontradables

87. Galindo and Leiderman (2005).

88. The differences between the two sets are easily explained: Chile's high dollarization was not in bank deposits, but in loans (not considered in Reinhart, Rogoff, and Savastano, 2003); Mexico's initial level of dollarization did not reach 40 percent; and Pakistan's dedollarization took place less than five years ago.

89. This is reminiscent of the recent pesification of dollar debts in Argentina, but with the twist of attaching inflation indexation. Argentina actually considered this proposal at the time for all dollar contracts.

sector. Successes in Latin America have also been accompanied by strong prudential financial policies favoring local currency lending, such as legal restrictions on dollar bank deposits: examples include Chile (prohibition on lending to borrowers in the nontradables sector), Mexico (quantitative limitations on lending and prohibition on the holding of dollar deposits by households), Brazil (prohibition on dollar lending except the onlending of foreign credit and prohibition on dollar deposits), and Colombia and Venezuela (ban or strong legal restrictions on dollar deposits).

Dollar repression, however, is more often associated with failure than success. For example, Bolivia and Peru prohibited bank dollar deposits in the early 1980s, only to suffer extreme macroeconomic instability, financial disintermediation, and capital flight that led them to allow dollar deposits again; they remain very highly dollarized to this day. Venezuela does not suffer from financial dollarization in banking owing to regulatory prohibitions, but it faces massive capital flight and bouts of financial instability.[90] Even in countries where the experience of banning onshore dollar bank deposits can be considered satisfactory, like Brazil, Colombia, and Mexico, the degree of offshore dollar bank deposits is substantial, which reduces domestic financial intermediation and contributes to increasing external debt.[91] Repressed dollar deposits also lead to a shorter duration of local currency deposits and loans (through nominal rate instruments at short maturities or floating rate instruments that allow frequent repricing) as a way of recovering some of the protection against surprise inflation that dollar instruments offered.[92] This form of repressed dollarization avoids exchange rate risk at the cost of interest rate risk and roll-over risk, which share some of the harmful characteristics of exchange rate risk.

These experiences suggest that a strong prudential policy discouraging dollarization is necessary, but it is insufficient and often risky. The key question is how to complement this policy in order to contain the financial risks and make it work within a successful policy package, to which I now turn.

Dollar Substitutes: Key for Success but Hard to Produce

The existence of an indexed local-currency instrument that provides an attractive dollar substitute for hedging surprise inflation, which can be used as a

90. Mexico suffered dearly, and pressures for dollarization subsided only in the 1990s.

91. See Galindo and Leiderman (2005). See also IMF (2005) for details on the strict regulations on dollar financial transactions in these countries and the extent to which repressed dollarization onshore is partly reflected in dollarization offshore.

92. It also leads to the dollarization of nonbank lending such as domestic public debt. Brazil is a clear example of these trends.

carrot to sway repressed dollar depositors to local-currency deposits, is a key feature of the most successful experiences. Israel offered indexed local-currency assets from the start of dedollarization. Mexico created an inflation-indexed unit of account in the 1990s, which is offered by banks.[93] Chile introduced inflation-indexed peso instruments decades ago (the *Unidad de Fomento,* or UF). Other Latin American countries, such as Brazil and Colombia, also inherited indexed instruments designed to protect savings from inflationary erosion during past macroeconomic instability; these instruments allowed the countries to better cope with the trend toward financial dollarization. In fact, Brazil's benchmark SELIC overnight interest rate now plays a key role in the government's public debt dedollarizing strategy to match its increased exchange rate flexibility.[94] By contrast, Venezuela, for example, has not instituted any such financial innovation.[95]

The particularly successful case of Chile reveals a combination of policy sticks and carrots (and favorable preconditions) that allowed the country to dedollarize and then build a solid financial system around indexation for twenty years. The key was embracing inflation indexation in policymaking. The monetary authority not only encouraged its use in financial markets, but also engineered the banking crisis resolution with the objective of switching to indexed instruments and designing the entire macroeconomic framework around indexation (for example, exchange rate and monetary policy in real terms).[96] Chile has also been able to develop other markets that support peso financing over time. For example, the forward foreign exchange market and the local bond markets started to develop after flotation, which eliminated the implicit incentive for dollarization of the 1990s.[97]

Nevertheless, the establishment of inflation-indexed financing is difficult. Within Latin America, inflation-indexed bank deposits are only substantial in

93. Poland did not create indexed instruments, but the prospect of joining the euro currency union provided a strong monetary anchor.

94. Nevertheless, this interest rate indexation has its own fiscal risks stemming from large interest rate risk.

95. Argentina has recently created an inflation index used in debt stock restructurings, but the index has not yet been made available for bank deposits and other debt financing flows; its future use remains uncertain.

96. After maintaining low levels of inflation for a long time, Chile is making efforts to substitute indexed instruments for nominal instruments and is finding that the indexed instruments have strong demand, especially at longer maturities. This suggests that indexation remains fundamental as a tool in a dedollarization strategy even in the case of solid advances in inflation control.

97. See Herrera and Valdés (2005). Israel, the other clearly successful case, has also actively pursued the development of financial derivatives markets and made efforts to deepen local-currency bond markets.

Chile.[98] Indexation has failed to take root in a number of countries that have tried to incorporate this innovation (such as Argentina and Uruguay), despite the presence of inflationary concerns.[99] Credibility appears to be a key factor; even Brazil and Chile had difficulties securing the necessary credibility of indexation (Brazil privatized the agency computing the inflation index because of concerns about manipulation; in Chile, the consumer price index was manipulated in the 1970s and 1980s). Another obstacle is lack of confidence that the indexation would survive high inflation.[100] Introducing indexation also faces the usual difficulties in setting up new financial markets, such as imbalances between demand for assets and liabilities and the lack of development of secondary markets.

What does it take to develop strong inflation-indexed markets? The successful experiences of Chile and Israel in developing inflation-indexed instruments throughout the economy were based on the credibility of monetary and fiscal policies. Low inflation reduces the ability to tweak the inflation index, while low public debt reduces the incentive to do so, which lends credibility to the index itself.[101] The early importance of long-term institutional investors with a natural demand for inflation-indexed assets, such as pension funds, was also crucial to the development of this market in Chile; in the case of life insurance companies, demand is not only natural, but mandated by regulation.

The Importance of Favorable Economic Conditions

Reasonable access to foreign financing to offset a potential temporary surge in capital outflows is also important for containing the risks of a strong prudential antidollarization policy. Effective temporary controls on capital outflows could achieve the same goal. Chile's long experience and legal tradition with dual exchange rate capital controls was key to limiting offshore dollarization before capital inflows were ample in the 1990s, although it is difficult to imagine successfully repeating that experience today with liberalized cap-

98. Inflation-indexed deposits are marginally significant in Argentina after pesification. Inflation-indexed loans are also significant in Mexico and Colombia.

99. See Shiller (1998) for an analysis.

100. Argentina underwent arbitrary deindexation in the 1970s and a change of index base following the recent crisis, although pesified dollar-indexed claims fared even worse.

101. A related concern is that because of inevitable lags, hyperinflation would still dilute inflation indexation, thus weakening its attractiveness. This concern appears academic, however, since in such an extreme situation any form of indexation or contracting would also be at risk, including dollar indexation (witness Argentina's pesification of dollar contracts).

ital accounts.[102] The most disastrous cases of failed dedollarization are characterized by periods of instability, capital flight, and lack of access to external financing. Shock treatment of dollar deposits appears extremely risky under those circumstances.

Conditions of favorable and improving returns on peso claims relative to dollar claims facilitated the transition in a number of successful cases. Monetary policy induced a favorable evolution of relative real returns at the beginning of the transition in Israel and Poland, where dedollarization started with a successful exchange-rate-based disinflation program that tilted ex post real returns against dollar deposits. Mexico's dedollarization took hold after 1988, as the process of real exchange rate appreciation made peso instruments more attractive to depositors fearful of the traditionally weak peso.

Is Dedollarization Feasible?

If the fight against excess financial dollarization is feasible, why haven't most countries in that situation attempted to change it? One key answer is that the staggering costs of high financial dollarization have only recently been revealed, so more policy action can probably be expected in the future.[103] Furthermore, the conditions for successfully substituting peso instruments for dollar instruments have only come within the reach of policy now that exchange rates are more flexible and inflation levels have fallen. In fact, recent trends indicate that a number of countries are currently embarking on dedollarization (for example, Argentina, Colombia, Peru, and Uruguay) and that financial dollarization is slowly receding. The dedollarization objective is clearly revealed in the structure of public debt of major countries: Mexico has been paying down foreign (dollar) public debt since the tequila crisis; Brazil has dramatically reduced dollar and dollar-indexed liabilities (debt and guarantees) in exchange for local-currency debt, at a substantial cost; and Argentina has also drastically reduced its share of public dollar debt by offering a relatively expensive conversion option for inflation-indexed bonds. A number of countries are issuing inflation-indexed public debt, including Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Peru, and Uruguay.

Nevertheless, the timidity of dedollarization strategies even today suggests that dedollarization policy, like all investments, imposes up-front costs

102. Herrera and Valdes (2005).

103. Herrera and Valdes (2005) conclude that learning from the dollarization-driven crises of the early 1960s and 1980s helped policymakers and market agents to converge in the healthy financial system developed afterward in Chile.

but delivers benefits only in the future; it may be too costly or too risky to launch in bad economic situations and too unappealing to short-sighted politicians in good economic situations.[104] The implication is that domestic institutions or outside influence, such as conditionality by multilateral organizations, will be important for offsetting this bias toward the status quo.

Financial Dedollarization Strategy

Based on the theory and evidence reviewed in the previous sections, I propose a dedollarization strategy that addresses externalities leading to excessive financial dollarization by setting the right incentives, for both markets and policies, and promotes markets and institutions that may improve the contracting environment, resulting in reduced warranted financial dollarization. The former involves policies to constrain and alter private incentives to discourage the choice of financial dollarization under current circumstances, while the latter encompasses policies to change those circumstances by promoting attractive substitutes of financial dollarization.[105] It does so in a coordinated fashion once favorable conditions for success are present.

The strategic approach aims to compete with the dollar, as opposed to bringing down the dollar. Under this strategy, markets for dollar substitutes, which are currently missing, are the main characters, and antidollarization policies are the supporting cast. This approach is based on the potential benefits and risks that each track offers. Antidollarization policies alone cannot achieve success, and they pose a number of severe risks. The development of dollar substitutes potentially offers enormous benefits, including greater scope for safely implementing antidollarization policies.

Antidollarization Policy: Aligning Private Incentives and Prudential Regulation

The safest and most effective way to align private incentives with social returns is to eliminate the source of the distortion. This clean approach to excessive financial dollarization is generally infeasible, however, and policy needs to aim at compensating distortions. Using legal reform to address the distor-

104. A crisis that calls for restructuring may offer an ideal opportunity to convert dollar claims: it was fully exploited by Chile in the 1980s, but it may have been partially lost in Argentina's recent crisis.

105. See Licandro and Licandro (2002, 2003) for an application of this dual approach to Uruguay.

tions created by currency-blind bankruptcy law appears to be a case in which a rather direct approach is feasible. As discussed earlier, dollar financing has an opportunistic advantage under bankruptcy law because its relative value is likely to increase under default. Reform would introduce the conversion of dollar claims to pesos for the purpose of allocating bankruptcy liquidation or restructuring debt according to a formula that eliminates the ex ante advantage and restores currency neutrality (and efficiency) to the financing currency choice on this account.[106] Similarly, one way to deal with currency disparities resulting from moral hazard in banking would be to specify a penalized conversion formula for dollar claims for the purpose of granting official help.[107] This proposed approach to curtailing excessive financial dollarization must be formally stipulated ex ante, not introduced ex post as a surprise resolution mechanism.[108]

More generally, the existence of a special crisis regime, in which contracts (in this case, dollar contracts) are altered in prespecified ways, parallels the automatic debt rollover triggers and collective action clauses being proposed for international bonds, which would enable or facilitate contingent debt restructuring.[109] If the ill effects of high liability dollarization are mostly felt in cases of real exchange depreciation and crisis, then it may make sense to build in escape clauses that apply in that contingency. Such an approach would retain most of the inflation protection advantages that make dollar lending attractive to savers while moderating most of the extreme private and social costs involved in dollar borrowing. It may therefore be more efficient than traditional blunt antidollarization penalties in prudential regulation, to which I now turn.

Aligning private incentives requires currency-sensitive prudential financial regulation. Currency-specific capital requirements, in the spirit of a value-at-risk approach, would eliminate the financial dollarization bias induced by moral hazard. If moral hazard is an important distortion, then dollar lending to nontradables firms ought to be subject to higher requirements than peso lending, such as higher capital and liquidity requirements, and dollar deposits

106. The similarity with Argentina's surprise pesification of dollar claims is misleading because in this proposal the conversion rule would be known ex ante, at the time of contracting.

107. This discriminatory approach at crisis time could also be applied to both the currency of denomination and maturity in order to protect the core of the banking system when official resources are insufficient in a systemic crisis. This was done in the recent Uruguayan banking crisis, in which sight deposits were fully insured and long-term dollar deposits were reprogrammed for banks that needed help.

108. See also the circuit-breaker proposal for managing liquidity risks under financial dollarization in Ize, Kiguel, and Levy Yeyati (2006).

109. On automatic debt rollover triggers, see Buiter and Sibert (1999).

should carry higher deposit insurance and liquidity provision premiums than peso deposits. Alternatively, requirements could take the form of quantity ceilings on dollar lending. Financial dollarization driven by moral hazard calls for safeguards that limit the expectation of implicit guarantees and bailouts, particularly with regard to dollar borrowing. The prodollar bias of currency-blind deposit insurance can be addressed with currency-sensitive insurance coverage or premiums. Currency-specific liquidity requirements may further level the playing field, by taking into account the differential risks of liquidity crises and the fact that it is more costly for the central bank to hold adequate reserves to cover dollar deposits; otherwise financial dollarization is excessive.[110] All these policy interventions can be summarized in equation 9, where intermediated onshore dollar deposits are penalized on account of these distortions.

Most suggestions in the literature concerning prudential currency-sensitive antidollarization financial regulation refer to the banking system, which is at the core of financial dollarization and of the policy externalities. However, the market externalities emphasized earlier relate to dollar borrowing by nontradables firms, not necessarily bank deposits or bank lending. The corresponding implications for prudential regulation ought to extend to the internalization of the social cost of liability dollarization of nontradables firms, beyond the implications for bank risk or the systemic credit risk of the banking system. Furthermore, the optimal policy often requires taking into account the leverage and financial risks of firms, not only the nature of their revenue. If some of the externalities identified are substantial, this approach calls for a rethinking of the limits of bank prudential regulation to serve objectives of macrofinancial stability beyond banking discipline and banking system risk.

The extent of excessive financial dollarization stemming from market and policy distortions is unclear. Ideal prudential financial policy could very well leave a high level of warranted financial dollarization, thus failing to make a significant dent in financial dollarization and its associated problems even if perfectly implemented. Furthermore, even if the externalities addressed by prudential policy are correctly identified, antidollarization policy of this kind involves very significant risks of turning counterproductive. For both reasons, the proposed dedollarization strategy does not rely on antidollarization policies and is cautious about its use.

One pitfall of an antidollarization focus is the risk of going beyond the elimination of excessive financial dollarization. Policies intended to alter

110. Ize, Kiguel, and Levy Yeyati (2006).

incentives or constrain financial choices to correct mispricing stemming from externalities may easily go awry. Little is known about the size of the interventions required to address the most important externalities, so these policies carry a significant risk that authorities will continue to increase the dose of the treatment until the desired result is obtained, in terms of a substantial reduction in financial dollarization. In fact, Levy Yeyati makes the case that quantities, rather than prices, may be the most suitable policy instrument given the nature of the problem, so policy may take the form of substantial (and arbitrary) quantitative ceilings of financial dollarization from the start.[111] If excessive financial dollarization is mainly due to poor fundamentals underlying high warranted financial dollarization, then an antidollarization policy that would not stop until financial dollarization was brought down significantly would go too far, be counterproductive, and lead to capital flight and financial disintermediation.[112] This theoretical risk is reminiscent of many of the failed dedollarization experiences.

The other major risk of antidollarization policy involves risk displacement or fighting symptoms: agents may favor other harmful forms of debt financing as an unintended consequence of narrowly fighting financial dollarization. Financial dollarization is only one manifestation of financial adaptation to a weak peso; short duration of peso contracts (through either short maturity or floating rates) is another protective device against surprise inflation, and it is likely to be seen as a preferred alternative to dollar savings.[113] Policies that specifically address excessive financial dollarization will likely produce shrinking financial duration and heighten the attendant financial fragility risks, which are cousins of the risks associated with financial dollarization.[114] Similarly, bank regulation may cause financing to migrate to unregulated institutions. Sound currency-sensitive bank regulation needs to take into account this substitution for harmful dollar alternatives.

111. Levy Yeyati (2004).

112. It is tempting to refer to successful experiences of prudential regulation without taking into account that good regulation crucially depends on the availability of suitable substitutes for dollar financing. Chile's prohibition of bank dollar lending to nontradables firms may be appropriate for Chile given the availability of long-term UF financing; in this case, the ban would remove a small level of latent financial dollarization that would arguably be excessive. It would be inappropriate, however, for a banking system without suitable peso alternatives, where a ban would remove far more than excessive financial dollarization and would mean a collapse of financing, especially long-term, to the nontradables sector.

113. De la Torre and Schmukler (2003).

114. The positive correlation between dollarization and maturity confirms this prediction. Repressed financial dollarization in Brazil also attests to this prediction.

Dedollarization by Substitution: Market Development and Supporting Institutions

The development of dollar substitutes within a framework of competing with dollarization can moderate risk displacement and the deleterious effects of going overboard with antidollarization policy by providing a good alternative to harmful dollar substitutes and financial disintermediation. The development of attractive substitutes would give traction to marginal antidollarization incentives. A substitution approach based on better fundamentals to back local-currency financing and the development of healthy peso instruments, such as inflation-indexed instruments, is a broad remedy that would not only erode financial dollarization, but also compete favorably with other risky adaptations, such as short-duration financing.

As shown in both the theoretical analysis and the dedollarization experiences, the key missing market for dedollarization is the inflation-indexed peso market. Even in this idealized context, this new market may not eliminate financial dollarization altogether because of original sin: from the perspective of foreigners, inflation-indexed peso terms are better than nominal peso terms, but they still carry exchange rate risk and therefore do not dominate nominal dollar terms.[115] Most of the externalities analyzed earlier would also apply in this new market, albeit to a lesser extent (for example, the dollar would retain bankruptcy advantages on account of real depreciation, instead of nominal). Additionally, inflation-indexation would not be the best indexation scheme in a more complex portfolio model. Some form of GDP indexation may theoretically be better for balancing the borrowers' matching of revenues and the lenders' desire to hedge nonfinancial income, as in equation 5′.[116] Nevertheless, it would clearly go a very long way in reducing financial dollarization.

Three players stand out as key to jump-starting this missing market. First is the banking system: banking regulation plays an important role in favoring the market's development in banking while ensuring the matching of bank assets and liabilities. Second, institutional investors, such as pension funds and life insurance companies, have a natural demand for long-term inflation-indexed claims because their liabilities are indexed similarly; regulation can

115. Nevertheless, it is a step in the right direction and may be a first step in addressing original sin, consistent with the proposal in Eichengreen, Hausmann, and Panizza (2002).

116. Multiple inflation indexes to cater to agents' preferences and the hedging properties of GDP indexation would be particularly useful, but they have practical drawbacks (Shiller, 1998; Borensztein and Mauro, 2002).

strengthen this natural demand. Finally, the government can issue inflation-indexed debt in the context of an active public debt management policy.

Regardless of how it is jump-started, low liquidity will probably be a weak point of this market, especially at the beginning. This and the existence of switching costs, possibly associated with the complexity of a synthetic instrument, imply that public policy may need to subsidize the initial development phase, either directly or through regulation. An initial temporary subsidy may be critical to compensate for the coordination failure that is bound to exist until markets are fully established. Even then, experience shows that developing this market is difficult.[117] The key factor that may derail the whole enterprise is lack of trust in the computation and enforcement of the index—in part because of the complexity of the process, but in large measure because of concerns with moral hazard on the part of the authority. Institutional reform to ensure the integrity of the index, such that any deviation would be verified as a breach of contract (like any other undue alteration to financial contracts), appears critical for success.

Another suitable substitute for dollar debt financing—and one that is often forgotten—is equity financing. Domestic savings channeled through debt claims have been taken as given in the portfolio models above, but leverage is a variable subject to policy influence. In fact, equity financing is another natural protection against inflation risk. An aggressive dedollarization strategy ought to include incentives on the margin for promoting vehicles of equity financing. Foreign equity investment (foreign direct investment, as well as portfolio investment) is another relevant aspect of a dedollarization strategy, and fostering it is, perhaps, the first step in addressing the problem of original sin when viewed in this broader perspective.[118]

The establishment of a risk-free peso market would allow the separation of default and inflation risk, which are currently bundled together in the onshore peso market. This development will have traction and lead to lower warranted financial dollarization only if there are savers who might be willing to hold peso claims (absorb inflation risk), but who are unable to handle country credit risk to the extent that all their dollar claims are offshore. This may very well be relevant in countries with a high default risk and in the case of extremely risk-averse savers and of institutional investors mandated to avoid risks by regulation, such as pension funds.

117. See Shiller (1998).
118. See Fernández-Arias and Hausmann (2001).

Multilateral development banks may be able to provide such separation through risk-free loans based on intermediation in pesos.[119] Their ability to issue investment-grade local-currency instruments and be a counterparty in the currency swap market, both in nominal pesos and in inflation-indexed pesos, would complete markets and may be effective in creating a local currency claim that can substitute for dollar claims. However, these institutions are intermediaries with full currency matching, and they would therefore need to raise peso funding. If original sin persists, as it should theoretically, and this funding is in local markets, countries with difficult access to external financing may lose the share traditionally secured by these institutions. Countries with a high default risk thus may not be the best candidates for this market.

All public policies need to support the development of these new markets. Prudential financial regulation plays a critical role in supporting the development of dollar substitutes, in harmony with the rest of the effort. Dollar substitutes, such as inflation-indexed instruments and equity-like financing (or leverage considerations), need to be incorporated in a coherent prudential regulation. Public debt management can also play a fundamental role in fostering these new markets. The government is a large player that can issue inflation-indexed debt and make it attractive for domestic institutions and the public at large.[120] It can join efforts with multilateral development banks to develop new peso markets by borrowing from these institutions in these new markets. It can also contribute to the technical aspects of these markets, for example, by building a reference yield curve to help private long-term debt markets and liquid derivatives markets.

In addition to these direct contributions to the development of peso markets, public debt management can provide an indirect contribution by dedollarizing public debt to ensure fiscal sustainability (in the usual case in which public sector balance and net worth is linked to nontradables).[121] Fiscal soundness is the basis for other supporting policies. For example, controlled inflation is key for nominal peso markets and is also likely to benefit inflation-indexed peso markets by reducing the temptation to manipulate the index. The credibility of the index must be backed by a stable monetary and fiscal position, and strong supporting institutions must be specifically established to ensure independence in the production of the index and outside oversight. In

119. Levy Yeyati (2004).

120. At the same time, by acquiring a direct interest in the index, it detracts from its credibility, which will need to be strengthened by other means.

121. See Hausmann (2003) for a public debt management proposal along these lines.

this regard, indexation to exogenous variables such as commodity prices would be much easier to implement, but it would be less useful as a dollar substitute.

A flexible exchange rate coupled with an inflation anchor, as in inflation-targeting regimes, is the ideal setting for supporting peso instruments as substitutes for dollar instruments. A flexible exchange rate in this context implies real volatility, which discourages dollar financing.[122] Furthermore, by avoiding protracted real exchange rate overvaluation, it eliminates the peso problem and reduces the hedging value of dollar claims vis-à-vis nonfinancial incomes in crisis situations. More generally, Caballero and Krishnamurthy show how indexing inflation targeting and foreign exchange interventions to negative external shocks (that is, committing to a countercyclical monetary policy) may also diminish incentives for financial dollarization.[123] The realization of the large costs associated with financial dollarization calls for a reassessment of the benefits of investing in policies and institutions that strengthen the local currency. Inflation targeting, the independence of the central bank, the credibility of the inflation index, and the strength of fiscal institutions to back all of the above are policy concerns that belong to a policy objective of dedollarization and may pass the political cost-benefit test once the gains from this objective are realized.

Favorable Conditions for Launching

Despite the risks involved in antidollarization prudential policies, they are likely to be needed in conjunction with the policy package to develop inflation-indexed and other new peso markets. These market and institutional development initiatives have large set-up costs, and any help to push them past the first hump is important. A case can be made for going beyond the appropriate incentives to eliminate excessive financial dollarization above warranted dollarization under current market conditions in order to impel the switch to dollar substitutes as a way of diffusing set-up costs, although such a move has to be carefully weighed against the risk of instability.

If it were not for the enormous financial disintermediation cost of failure, shock treatment of dollarization, including forced conversions, would be recommendable to save transition costs to the new low financial dollarization equilibrium and ensure that the critical mass needed to dislodge dollarization

122. See Claessens, Klingebiel, and Schmukler (2003) for an analysis of its relevance for the currency composition of government bonds.

123. Caballero and Krishnamurthy (2004).

in cases of multiple equilibria is obtained.[124] The evidence on shock treatment is mixed: it was an element in some successful experiences, but it was also an element in some of the disasters. While it remains a judgment call, it appears that shock treatment may be reasonably used as a device to speed up a sure transition to a much lower warranted financial dollarization, as long as its catalytic role is well understood.[125] Shock treatment seems too risky, however, if prospects are unclear or if a blunt policy intervention may constitute a signal of market unfriendliness. In any event, the authorities must be able to impede capital flight to dampen temporary instability in the transition and have good access to foreign financing to back financial intermediation if the attempt to reduce domestic financial dollarization is not sufficiently successful and triggers capital flight.

This coordinated policy effort should be launched when circumstances are most conducive to success. Favorable conditions include a low expected relative real return of domestic dollar savings (for example, expected real appreciation) to sweeten the exit from dollar assets and macroeconomic stability to lend credibility to the peso substitutes. Current circumstances appear right for this. Furthermore, the current tendency for real exchange rate appreciation following dramatic peg adjustments in some countries and the tendency for real depreciation of the U.S. dollar (the currency of denomination of most foreign-currency debt) are facilitating this transition because it dilutes dollar debts and relieves fear of floating.

Concluding Remarks

Liability dollarization is a major source of financial fragility, especially in countries with high domestic financial dollarization. Domestic financial dollarization is largely explained by a portfolio decision to protect savings from inflation risk and to hedge the loss of nonfinancial income during economic downturns. This mistrust of domestic currency warrants high financial dollarization. Observed financial dollarization is even larger, however, as a result of market and policy failures that allow agents not to face the full social

124. The theoretical case of a bad equilibrium is easier, not harder, than the case of a unique equilibrium, because dedollarization may not require effort. The case for policy effort here is based on a large payoff, not low policy effectiveness.

125. Argentina exemplifies an interesting case in which shock treatment was the unintended result of crisis resolution. If a coherent policy is designed around this new initial condition, the structural change may be a silver lining of the crisis.

costs of dollar debt. Consequently, the case for dedollarization policy is clear. Such a policy must accomplish two objectives: to align private incentives with the social costs of financial dollarization to eliminate the resulting excessive dollarization; and to develop better peso markets to reduce warranted financial dollarization to safe levels.

The dedollarization record shows that while success is hard to attain, it is possible. Three main lessons emerge. First, antidollarization policy must be prudential. Second, a reasonably attractive peso substitute for dollar claims must be made available—namely, inflation-indexed debt as long as there is fear of inflation. Finally, favorable economic conditions are important to entice agents to make the currency switch and to back temporary financial instability. Success requires an integral policy package: attractive peso substitutes for dollar savings and favorable economic conditions are critical for mitigating the risk of financial disintermediation associated with antidollarization policies.

I have derived a dedollarization strategy based on theory and evidence. The proposal involves antidollarization policies to redress market and policy distortions, expanding traditional prudential bank regulation. It is mostly aimed at changing fundamentals and markets, however, rather than imposing mandatory policies. The proposed strategy relies on the development of safer peso markets to displace dollar markets. Dedollarization is possible, and current conditions are conducive to a successful launching. It should be tried, and soon.

Technical Appendix

This appendix contains the formal derivations of the conclusions stated in the text, as well as extensions of the cases analyzed in it. Section titles cross-reference the corresponding sections in the text.

What Drives Domestic Financial Dollarization?

(a) The optimal dollarization portfolio in a simple closed economy model is as follows:

$$r_p = E\left(r_p\right) - e_i - e_d;$$

$$r_d = E\left(r_d\right) - e_x - e_d;$$

$$P = \left(1 - d\right) r_p + d r_d;$$

$$\Rightarrow P - E(P) = -(1-d)e_i - de_x - e_d.$$

$$\min_d V(P) = (1-d)^2 V_{ii} + d^2 V_{xx} + V_{dd} + 2(1-d)dV_{ix} + 2(1-d)V_{id} + 2dV_{xd}.$$

First-order condition: $V'(P) = 0$,

$$\Rightarrow d^* = \frac{V_{ii} - V_{ix} + (V_{id} - V_{xd})}{V_{nn}} = \frac{V_{ii} - V_{ix}}{V_{nn}} \quad \text{if } V_{id} = V_{xd}.$$

Second-order condition: $V''(P) = V_{ii} + V_{xx} - 2V_{ix} = V_{nn} > 0$.

(b) If income hedging is considered, financial dollarization needs to be adjusted:

$$\operatorname{cov}(I,P) = V_{IP} = -(1-d)V_{Ii} - dV_{Ix} - V_{Id}.$$

First-order condition: $V'(P) + 2(V_{Ii} - V_{Ix}) = V'(P) + 2V_{In} = 0$;

$$\Rightarrow d^{*\prime} = \frac{V_{ii} - V_{ix} - (I_{Ii} - V_{Ix})}{V_{nn}} = \frac{V_{ii} - V_{ix} - V_{In}}{V_{nn}}.$$

(c) If borrowers are also risk averse with coefficient $b > 0$, then

$$\max_d (I) + E(P) - a\left[V(I) + V(P) + 2\operatorname{cov}(I,P)\right];$$

$$\max_d E(S) - E(P) - b\left[V(S) + V(P) - 2\operatorname{cov}(S,P)\right].$$

Joint efficiency leads to

$$\Rightarrow \min_d V(P) + 2\lambda V_{IP} - 2(1-\lambda)V_{SP},$$

where $\lambda = a/(a+b)$ and the first-order condition is $V'(P) + 2\lambda V_{In} - 2(1-\lambda)V_{Sn} = 0$. If $V_{Sn} = -V_{In}$, then $d^{*\prime\prime} = d^{*\prime}$ (neutral borrowers' risk aversion). If $V_{Sn} < -V_{In}$, then $d^{*\prime\prime} < d^{*\prime}$ (less dollarization). For example, $S = G - I$ (that is, net revenue equals gross revenue minus wages). If $V_{Gn} < 0$, then $V_{Sn} = V_{Gn} - V_{In} < -V_{In}$.

(d) If default is costly to the contracting parties, including efficiency costs that may occur in near-default situations, then this would introduce a wedge between the costs incurred by the borrower and the benefits enjoyed by the lender. For simplicity, I return to the simplest portfolio model in which income covariances are ignored and borrowers are risk neutral (results would be strengthened otherwise). In this model, the cost wedge can be represented as an additional expected payment cost, *w,* incurred by the borrower. The new equilibrium conditions are as follows:

$$\max_d E(P) - aV(P) \text{ and}$$
$$\max_d - E(P) - w(d).$$

Joint maximization efficiency yields

$$\min_d V(P) + \frac{1}{a} w(d).$$

It is possible to construct models in which peso debt is riskier than dollar debt from the perspective of the firm's solvency. However, as justified before for the assumption $\text{cov}_d(S, -P) > 0$, the relevant case appears to be that dollar debt is riskier than peso debt. In that case, $w'(d) > 0$ and equilibrium dollarization would be moderated ($\tilde{d} < d^*$) as a way for the parties to avoid default costs.

Financial Dollarization and International Lending

If dollar offshore savings are considered in the simple portfolio model (assumed free of default risk), then domestic financial dollarization d includes both onshore and offshore dollar savings. Being f the coefficient of offshore savings, $d \geq f$, they are jointly determined as follows:

$$r_f = (r - k) - e_x;$$
$$P = (1 - d) r_p + (d - f) r_d + f r_f;$$
$$P - E(P) = -(1 - d) e_i - d e_x - (1 - f) e_d;$$
$$V(P) = (1 - d)^2 V_{ii} + d^2 V_{xx} + (1 - f)^2 V_{dd} + 2(1 - d) d V_{ix} + 2(1 - f)(1 - d) V_{id} + 2d(1 - f) V_{xd}.$$

Then,

$$\min_{d,f} r - fk - aV(P)$$

which yields the following conditions:

First-order condition (d): $V'_d(P) = 0 \Rightarrow d^* = \dfrac{V_{ii} - V_{ix} + (1 - f^*)(V_{id} - V_{xd})}{V_{nn}};$

Second-order condition (d): $V_{nn} > 0$;
First-order condition (f): $-k - aV'_f(P) = 0$,

$$\Rightarrow f^* = 1 - \frac{(k/2a) + V_{id} - d^*(V_{id} - V_{xd})}{V_{dd}};$$

Second-order condition (f): $V_{dd} > 0$.

Thus,

$$d^* = \frac{V_{ii} - V_{ix}}{V_{nn}}, \text{ if } V_{id} = V_{xd}; \text{ and}$$

$$f^* = 1 - \frac{k}{2aV_{dd}}, \text{ if } V_{id} = V_{xd} = 0.$$

The above interior solution holds under the maintained assumption that $d^* \geq f^*$ (consistent with nonnegative onshore dollar savings). If alternatively $d^* < f^*$, then a corner solution obtains $d^{**} = f^{**}$. (See the analysis of this corner solution below, in the section on banning onshore dollar deposit.)

Antidollarization Policy: The Perils of Shrinking Credit and Mounting External Debt

Penalties against dollar savings and dollar financing would reduce financial dollarization at the cost of less total financing or higher external debt (or both).

TAX *T* ON ONSHORE DOLLAR DEPOSITS

$$\max_{d,f} r - dt - f(k - t) - aV[P].$$

First-order condition (d): $-t - aV'_d(P) = 0$,

$$\Rightarrow d(t) = d^* - \frac{t}{2aV_{nn}} < d^*.$$

First-order condition (f): $t - k - aV'_f(P) = 0$,

$$\Rightarrow f(t) = f^* + \frac{t}{2aV_{dd}} > f^*.$$

In this case, the expected real cost of foreign financing, r, is not altered and, therefore, overall financing, L, remains. However, offshore deposits increase, and with them capital inflows from abroad.

BAN ON ONSHORE DOLLAR DEPOSITS. A ban on onshore dollar deposits amounts to imposing the constraint $d = f$:

$$V(P) = (1 - d)^2 V_{ii} + d^2 V_{xx} + (1 - d)^2 V_{dd} + 2(1 - d)dV_{ix}.$$

First-order condition: $-k - aV'(P) = 0$,

$$\Rightarrow d^{**} = \frac{V_{ii} - V_{ix} + V_{dd} - \left(k/2a\right)}{V_{nn} + V_{dd}} = \frac{V_{ii} - V_{ix} + f^{*}V_{dd}}{V_{nn} + V_{dd}} = f^{**}.$$

Under the maintained assumption that $d^{*} > f^{*}$, which is the case in which there would be onshore dollar deposits of $d^{*} - f^{*} > 0$ in the absence of the ban, then

$$f^{*} < f^{**} = d^{**} < d^{*}.$$

Note that if $a,b,c,d > 0$ and $(a/b) > (c/d)$, then $(a/b) > [(a + c)/(b + d)] > (c/d)$. Let $d^{**} = (a + c)/(b + d)$, where $a = V_{ii} - V_{ix}$, $b = f^{*}V_{dd}$, $c = V_{nn}$, and $d = V_{dd}$. Then $(a/b) = d^{*}$ and $(c/d) = f^{*}$.

Alternatively, if $d^{*} < f^{*}$, then the corner solution of $d^{**} = f^{**}$ (obtained above in the section on financial dollarization and international lending) is such that $d^{*} < d^{**} = f^{**} < f^{*}$, because then $(a/b) = f^{*}$ and $(c/d) = d^{*}$.

The Case for Excessive Dollarization: Market and Policy Distortions

A firm's revenues decrease when the rest of the firms suffer financially. Therefore, the higher aggregate financial dollarization, the more each firm's revenues decline under a real depreciation, all things equal. That is, a revenue penalty is associated with aggregate liability dollarization, which can be expressed as $\phi = \phi(\bar{d})$, $\phi' > 0$, where $(\bar{d})$ is aggregate domestic financial dollarization. This assumption can be accommodated into welfare equation 7:

$$(7') \max_{d,f} E(P) - aV(P) = r - \phi(\bar{d}) - fk - aV\left[(1-d)r_p + (d-f)r_d + fr_f\right]$$

Private contracting does not internalize the penalty and yields equilibrium portfolio, according to equation 7. Central planners, however, would internalize this endogenous welfare loss and consider equation 7′ in the determination of the socially optimal portfolio; they would therefore moderate dollarization to protect the economy from recession. In the case of a foreign borrowing externality, $\phi = \phi(E)$, $\phi' > 0$, they would moderate foreign borrowing. A suitable instrument would be a Pigouvian tax wedge, $t = \phi'$, similar to one used to discourage domestic savings dollarization imposed on the relevant base.

The Case for Excessive Dollarization: Weak Policy Framework and Missing Markets

What would happen with financial dollarization if default risk, V_{dd}, were reduced?

$$d^{*} = \frac{V_{ii} - V_{ix} + \left(V_{id} - V_{xd}\right)}{V_{nn}}.$$

Let

$$e_i = \alpha e_d + \varepsilon_i,\ \mathrm{cov}\left(e_d, \varepsilon_i\right) = 0;$$

$$e_x = \beta e_d + \varepsilon_x,\ \mathrm{cov}\left(e_d, \varepsilon_x\right) = 0.$$

Then,

$$V_{id} = \alpha V_{dd},$$

$$V_{xd} = \beta V_{dd}, \text{ and}$$

$$V_{id} - V_{xd} = \left(\alpha - \beta\right) V_{dd}.$$

If $V_{id} > V_{xd}$, then $\alpha > \beta$ and $\dfrac{\partial d^*}{\partial V_{dd}} > 0$.

Alternatively, if $f^* > d^*$, then

$$d^{**} = \frac{V_{ii} + f^* V_{dd}}{V_{ii} + V_{xx} + V_{dd}}, \text{ and}$$

$$\frac{\partial d^{**}}{\partial V_{dd}} = \frac{V_{nn}}{\left(V_{nn} + V_{dd}\right)^2}\left(f^* + \frac{\partial f^*}{\partial V_{dd}} - d^*\right) > 0,$$

because $\dfrac{\partial f^*}{\partial V_{dd}} = 0$.

In fact, if foreign portfolio share (of defaultable external debt) is λ and foreigners are risk averse with coefficient c, then

$$\max_{\lambda} r - (1 - \lambda) k - c\lambda^2 V_{dd}$$

leads to

$$\lambda^* = \frac{k}{2cV_{dd}}.$$

For a given λ, k/V_{dd} is constant, as is f^*.

MISSING MARKETS: THE OFFSHORE PESO MARKET. Consider a new, default-free, peso market receiving a fraction, f', of domestic savings:

$$r_p' = (r - k) - e_i;$$

$$P = (1 - d - f')r_p + f'r'_p + (d - f + f')r_d + (f - f')r_f$$
$$= -(1 - d)e_i - (1 - f)e_d - de_x.$$

This is identical to the original portfolio problem except that it is unconstrained by offshore savings being a floor to dollarization, because $f > d$ is feasible with an offshore peso market (the difference can be accommodated with $f' > 0$). Dollarization is therefore d^*. In the normal, unconstrained case, this means no change. The only case in which this would amount to a reduction of financial dollarization is that in which the optimal portfolio was constrained at d^{**} ($> d^*$) under the initial situation because $f^* < d^*$.

The effect on liability dollarization may be counterproductive, however, depending on the extent to which savings in the offshore peso market are channeled to domestic peso financing. In the normal, unconstrained portfolio case, liability dollarization would worsen unless all peso savings were applied domestically, which means that all offshore peso savings, f', whose optimal level is undetermined, are re-lent domestically from abroad. In the case of a constrained portfolio, offshore peso savings are determined: $f' = f^* - d^*$ (since all dollar savings are offshore). If all of them are re-lent domestically, then peso financing increases by the full amount, $d^{**} - d^*$. If nothing is re-lent domestically, then peso financing decreases by $f^* - f^{**}$.

MISSING MARKETS: INFLATION-INDEXED PESO DEPOSITS. With an onshore real peso market, the onshore dollar market would be fully substituted, and domestic financial dollarization (and liability dollarization) would decline:

$$r_r = r - e_d,$$

$$P = (1 - d - N)r_r + Nr_p + (d - f)r_d + fr_f,$$

$$P - E(P) = -Ne_i - de_x - (1 - f)e_d, \text{ and}$$

$$V(P) = N^2V_{ii} + d^2V_{xx} + (1 - f)^2 V_{dd} + 2NdV_{ix},$$

with the following first-order conditions:
First-order condition (d): $V'_d(P) = 2(dV_{xx} + NV_{ix}) = 0$,
First-order condition (N): $V'_n(P) = 2(NV_{ii} + dV_{ix}) = 0$,
First-order condition (f): $-k - aV'_f(P) = -k + 2aV_{dd}(1 - f) = 0$.

For an interior solution, $f = f^*$, $N = d = 0$, which is incompatible because $d < f$. Consider then the corner solution with $d = f$:

$$V(P) = N^2V_{ii} + d^2V_{xx} + (1 - d)^2 V_{dd} + 2NdV_{ix}.$$

First-order condition (d): $-k - aV'_d(P) = -k - 2a(dV_{xx} + dV_{dd} - V_{dd} + NV_{ix}) = 0$ and
First-order condition (N): $V'_n(P) = 2(NV_{ii} + dV_{ix}) = 0$,
$\Rightarrow$ first-order condition (d): $-k - 2a(dV_{xx} + dV_{dd} - V_{dd} + NV_{ix}) = 0$,

$$\Rightarrow d^{***} = \frac{f^* V_{dd} - N^* V_{ix}}{V_{xx} + V_{dd}} = f^{***}.$$

—If $V_{ix} \geq 0$, then $N^* = 0$ (corner) and $d^{***} = f^* V_{dd}/(V_{xx} + V_{dd}) > f^* < d^*$.

—If V_{ix}, then $N^* = -d^{***}V_{ix}/V_{ii}$ and $d^{***} = f^* V_{dd}/[V_{xx}(1 - \rho_{ix}^2) + V_{dd}] < f^* < d^*$.

MISSING MARKETS: INFLATION-INDEXED OFFSHORE PESO MARKET. With an additional offshore real peso market, domestic financial dollarization would be eliminated altogether:

$$r'_r = r - k;$$

$$r_r = r - e_d;$$

$$P = (1 - d - f')r_r + f'r'_r + (d - f + f')r_d + (f - f')r_f = -de_x - (1 - f)e_d;$$

$$V[P] = d^2 V_{xx} + (1 - f)^2 V_{dd}.$$

First-order condition (d): $2dV_{xx} = 0 \Rightarrow d' = 0$;
First-order condition (f): $-k + 2a(f - 1)V_{dd} = 0 \Rightarrow f' = f^*$.