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ABSTRACT

This study offers the first empirical microeconomic analysis of the effectiveness of dollar debt and contract redenomination policies to mitigate adverse financial and relative price consequences from a large devaluation. An analysis of Argentina's policy of devaluation with redenomination in 2002, in contrast to Mexico's policy of devaluation without debt redenomination in 1994-1995, shows that devaluation benefited tradables firms, and that dollar debt redenomination in Argentina benefited high-dollar debtors, as shown in these firms' investment behavior, especially non-tradables firms whose revenues in dollar terms were adversely affected by devaluation. That investment behavior contrasts with the experience of Mexican firms in the aftermath of Mexico's large devaluation, in which non-tradables producers with high dollar debt displayed significant relative reductions in investment. Stock return reactions to Argentine debt redenomination indicate large, positive, unanticipated effects on high-dollar debtors from debt redenomination. Energy concession contract redenomination likewise increased investment by high energy users in Argentina, and that benefit was apparent also in positive stock returns of those firms.

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I. Introduction

Argentina's financial crisis of 2001-2002 was one of the most widely anticipated emerging market crises in recent years. The inconsistency between persistent fiscal deficits and recession, on the one hand, and the inflexible currency regime of "convertibility," on the other hand, became increasingly apparent to market observers from 1999 through 2001. By the end of 2001, given the political infeasibility of fiscal reform (a fact illustrated by the brief tenure and abrupt demise of officials who suggested the desirability of fiscal reform), sovereign default and devaluation became inevitable toward the end of 2001.

Argentina's denouement, however, had an unusual and largely unforeseen wrinkle, namely "pesification" – the effective redenomination of dollar-denominated debts enforceable under domestic law and many other dollar-denominated or dollar-indexed contracts. Redenomination of dollar debts implied a substantial reduction of the real debt service burdens of dollar-denominated debtors. It was inspired by the realization that without redenomination Argentina would have to find a way to address massive, economy-wide insolvency of dollar-denominated debtors, as well as a huge relative price increase for energy and transport costs that were fixed by concession contracts in dollar terms.

Although a change in relative prices always has real economic consequences, in a world of perfect capital markets, the reallocation of wealth between creditors and debtors, or the incidence of financial distress, would not matter for real decisions (like investment, employment and consumption). But in the presence of adverse selection, moral hazard, and physical contracting costs, wealth reallocations and financial distress can have powerful effects on firms' and consumers' investment and employment decisions. Hence redenomination policy could have

important effects on investment and consumption as a means of resolving economy-wide financial distress and increasing the net worth, and hence the borrowing capacity, of borrowers.

A superficial look at Argentina's macroeconomic performance suggests that the decision to redenominate debts, and other dollar-denominated or dollar-indexed contracts, during the devaluation of the peso in the beginning of 2002 was successful in reversing the downward trend in economic activity. Figure 1 displays the path of quarterly GDP in Argentina from 1999 to 2005. The beginning of 2002 marked the end of recession and the beginning of a sustained recovery. Of course, this evidence is not conclusive, since it does not establish a clear link between redenomination policy and macroeconomic performance. In particular, the macroeconomic evidence does not disentangle among the three potentially important channels through which Argentina's devaluation with redenomination could have expanded economic activity – namely, (1) a boost to exports (as the result of devaluation alone), (2) a reduction in the relative price of energy costs, and (3) the implicit transfer of wealth to dollar-denominated debtors from debt redenomination alongside devaluation.

This study analyzes the effects of redenomination policy on firms in Argentina in the aftermath of its devaluation of 2002. The study employs firm-level data to examine how the effects of redenomination policy varied across firms depending on their differing levels of dollar-denominated debt and their different sectoral exposures to devaluation risk (i.e., tradables producers versus non-tradables producers). By exploiting the cross-sectional variation in firms' exposure to different consequences of devaluation with redenomination, I am able to distinguish the effects of the three channels through which devaluation with redenomination affected firms' behavior. To provide a standard of comparison for the Argentine firms, I view Argentine firms' experiences in 2002-2003 in the mirror of the experiences of Mexican firms in 1995-1996,

during the aftermath of the Mexican crisis of 1994-1995 (a large devaluation in a highly dollarized economy that occurred without the redenomination of dollar debts).

Section II begins with an analysis of the timing of the Argentine financial crisis. That review shows that: (1) Argentina was in an unusually vulnerable macroeconomic position as the result of the large fraction of domestic debts and transportation and utility concession contracts that were denominated in or indexed to dollars, and the small fraction of its economy devoted to exports; (2) the risk of devaluation was widely understood by market participants long in advance of the crisis and considered substantial by the market by mid 2001. Section III examines the effects of Argentine debt redenomination policy as part of its decision to devalue. Section IV adds to that analysis a consideration of effects of the redenomination of utility concession contracts.[1]

Sections III and IV each analyze the investment decisions of Argentine firms. Those analyses compare the Argentine (2001-2002) and Mexican (1994-1995) devaluation experiences from the perspective of Argentine and Mexican firms' rates of fixed capital investment. Mexico's devaluation policy did not include redenomination of debt and utility contracts, while Argentina's devaluation policy did include redenomination. The comparison of individual firms' investment behavior shows that Argentina's decision to redenominate dollar debt and dollar-indexed utility tariffs in pesos had a salutary effect on the investment decisions of firms, which is isolated within the subset of firms that had high dollar debt and operated in the non-tradables sector. In Section III, I provide estimates of the size of the effect on Argentine firms from the policy of redenominating debt. Section IV extends the analysis of Section III to evaluate the

[1] This study considers only the effects of redenomination policy on utility and debt contracts because one cannot identify other differences across firms related to redenomination policy (e.g., different firms' propensities to use toll roads, whose tariffs were also affected by redenomination policy).

effect of utility tariff redenomination by comparing the investment behavior of high energy consuming Argentine firms to those of other firms. The results reported in Section IV show that high energy consuming Argentine firms invested more in the year after the crisis than other Argentine firms, *ceteris paribus.*

In theory, non-tradable producers with high dollar-denominated debts, and high energy consuming firms, should have benefited from redenomination policy, ceteris paribus, more than other producers. Unlike non-tradables producers, tradable producers' dollar-denominated revenues are not reduced by devaluation. In fact, the investments by high-dollar debt, non-tradables producers in Mexico fell more following devaluation than those of high-dollar debt tradables producers. But in Argentina, as a result of redenomination, there was no difference in investment behavior between highly dollar-indebted tradable and non-tradable producers.

Sections III and IV also contain an analysis of Argentine firms' stock returns during the announcement of devaluation policy. Section III's analysis of stock returns shows that (1) redenomination policy was not anticipated by the market, and (2) the advantage of redenomination in improving the condition of high-dollar debt firms was understood at the time the Argentine government made its decision, and became priced into the market, as is visible in highly positive average stock returns during both of the redenomination event windows. Apparently, the salutary effect of redenomination was understood by the Argentine stock market at the time redenomination policy was announced. Section IV's analysis of stock prices also considers the effect of utility tariff redenomination on stock returns. Holding constant other characteristics (including the effects of debt redenomination), high energy consuming Argentine firms' stock returns reacted positively to redenomination news that signaled lower energy costs.

The results relating to debt redenomination are consistent with the view that debt-deflation shocks related to the combination of dollar-denominated debt and large devaluation can have important adverse short-term consequences for investment. And redenomination policies that reallocate wealth from creditors to debtors, and from energy producers to energy consumers, can have positive short-term macroeconomic consequences. This study does not measure the long-term costs associated with redenomination policy, such as adverse reputational consequences in capital markets. Section V offers some observations about the tradeoffs policymakers face when considering whether to redenominate contracts during a devaluation.

II. Argentina's Crisis and Its Vulnerability to Devaluation

The Predictability of Collapse

In 2000 and 2001, market participants became increasingly concerned about the possibility of an Argentine devaluation. Devaluation became a significant possibility as early as 2000.[2] Figure 2 plots the interest rates on 30-day dollar-denominated and peso-denominated deposits for the years 2000 and 2001. The interest differential between these two deposit interest rates, according to covered interest parity arbitrage, is equal to the forward premium on the peso, and therefore, is a direct measure of the market's perception of devaluation risk.[3] The interest rate differential, plotted in Figures 3A and 3B, contains a combined forecast of devaluation and a risk premium, as follows:[4]

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[2] For a review of the evolving drama from the perspective of markets and policy makers, see Paul Blustein, *And the Money Kept Rolling In* (and Out*): Wall Street, the IMF, and the Bankrupting of Argentina*, Public Affairs, 2005. See also Pedro Pou, "What Lessons Can Be Learned from Recent Financial Crisis? The Argentine Experience," available at http://www.kc.frb.org/Publicat/sympos/1997/pdf/s97pou.pdf.

[3] For a discussion of covered interest parity, see David O. Beim and Charles W. Calomiris, *Emerging Financial Markets,* Irwin-McGraw Hill, 2000, pp. 248-50.

[4] In this discussion, I abstract from the fact that the 30-day deposit interest rate differential understates the extent of devaluation expectations, since the possibility of a redenomination of dollar debts was taken into account by the

$i_P - i_D$ = (perceived probability of devaluation) x (% expected devaluation) + devaluation risk premium

For example, if the peso-denominated interest rate on 30-day deposits is 20% and the dollar-denominated interest rate on 30-day deposits is 12%, that implies an interest differential of 8%. Under the assumption of risk neutrality (where only the first of the two terms above enters into market pricing of devaluation risk), an 8% interest rate differential could imply a 20% chance of a 40% devaluation sometime during the next thirty days. That interest differential would also be consistent with a 40% chance of a 20% devaluation. Under the assumption of risk aversion, some of the interest differential would represent a premium for bearing risk (in excess of simply earning an expected return equal to the riskless return for bearing the risk of devaluation). For example, under risk aversion, an 8% interest rate differential could be consistent with a 2% risk premium and a 20% chance of a 30% devaluation.

While it is not possible to determine the precise combination of (1) the perceived probability of devaluation, (2) the percentage devaluation expected to occur if a devaluation does occur, and (3) the devaluation risk premium, these three components of the interest rate differential tend to be positively related (bad news about fiscal affairs tends to produce increases in all three components). Thus, a rising interest rate differential will tend to be the result of increases in each of the three components.

As Figure 2 shows, the possibility of devaluation, as measured by the deposit interest rate differential, increased substantially in the spring of 2001, and then rose dramatically in the late summer and fall of 2001. The sovereign risk of Argentina followed a similar pattern, as shown in

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market. The perceived possibility of debt redenomination acts to reduce the observed interest rate differential for any given probability of devaluation.

Figures 3A and 3B, which use two similar alternative measures of the sovereign yield spread on Argentina's international bonds. The co-movement of the sovereign debt spread and the deposit interest rate differential reflects the fact that both sovereign default risk and devaluation risk were driven by a common factor, namely an unsustainable fiscal policy.

The peso-dollar deposit interest rate differential declined dramatically at the beginning of December 2001, just before the January 2002 devaluation. That decline does not reflect a decline in the perceived risk of devaluation. Rather, it is an artifact of the so called *corralito* – the policy of restricting the withdrawal of bank deposits, which was accompanied by a dramatic reduction in the interest rate paid on 30-day deposits denominated in both dollars and pesos.

Another indicator of perceived devaluation risk is capital flight. From June through the end of November 2001, as shown in Figure 4, more than $6 billion in dollar-denominated deposits were withdrawn from Argentine banks. Similarly, Argentina's international reserves declined dramatically during 2001, as shown in Figure 5. Capital flight was closely associated with the *corralito*, beginning on December 1, 2001. As shown in Figure 6, capital flight was the last phase of a contraction in capital inflows that had been gaining momentum since 1999, and that had been negative since 2000.

As Figures 2-6 clearly show, market sentiment about devaluation risk and government default risk varied during 2001. Devaluation and default risk were significant as early as December 2000, and remained elevated throughout 2001, but reached very high levels during particular weeks and months of 2001 (e.g., March-April, July, and September-December of 2001).

After the initial devaluation occurred (plotted in Figure 7), and in anticipation of the decision to float the currency (which implied the likelihood of a substantial increase in

devaluation), the government chose to redenominate private dollar debts and transportation and utility tariffs to alleviate the economic harm that otherwise would have resulted from devaluation. On Friday, January 4, 2002, the government announced a plan to end convertibility, take steps to provide debt relief to debtors owing dollar-denominated debts, and eliminate the legislation that had tied public utility and transportation tariffs to the dollar. Convertibility was ended on January 6, 2002, and the executive was empowered to establish a new exchange rate system. Some small dollar debts were converted right away into pesos. On February 3, under Decree 214/02, all dollar-denominated debts were redenominated in anticipation of floating the currency, which occurred on February 11.[5]

The potential financial harm from devaluation without debt contract redenomination, or equivalent measures to reduce the real value of dollar-denominated debts, was a theme of much academic research and policy debate in the wake of the Mexican financial crisis of 1994-1995 and the 1997 Asian financial crises. The Argentine government had observed the consequences of devaluation without debt redenomination in Mexico post-1994 and in East Asia post-1997, and was keenly aware of the severe adverse consequences of not combining devaluation with debt redenomination. Those consequences included massive financial distress of borrowers, and financial gridlock resulting from that inability of firms to repay their debts. Those concerns figured prominently in the discussion of Argentina's policy options at the time it chose to devalue. Several prominent academics (including Nobel Laureate Joseph Stiglitz) argued that devaluation would produce financial distress for borrowers with dollar denominated claims, and

[5] Decree 214/2002 can be found within the website of the Ministry of Economy and Production: http://www.mecon.gov.ar. More specifically, Decree 214/2002 can be found at http://infoleg.mecon.gov.ar/txtnorma/72017.htm.

that a redenomination of debts or some other economy-wide plan to reduce the value of dollar-denominated debt would soften the blow of devaluation.[6]

It bears emphasis that debt, and transportation and utility tariff, redenomination were linked by policy to devaluation. Dollar debts and transportation and utility tariffs were not reduced by a fixed nominal quantity (as in a debt exchange), but rather were redenominated in pesos so that any future reductions in the value of the peso would not result in the deterioration of borrowers' abilities to meet debt service obligations, or energy or toll road users' abilities to pay their energy bills or tolls. Furthermore, recognizing that debt redenomination was not necessary with respect to the financing of exports (as argued above), the government limited debt redenomination in its Decree 410 of March 1, 2002 by excluding foreign trade finance from redenomination.[7]

Observers and policy makers were also aware of examples that illustrated the possibility of macroeconomic improvement via reductions in the real value of debt. A debt exchange that effectively reduced the real value of bank debt had been used to help revive Argentine banks under the Bonex Plan a decade earlier. Debt redenomination alongside devaluation had been

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[6] See also Michael Bordo and Roberto Chang, "Throw Away the Dollar Peg," *Financial Times*, June 7, 2001. For a review of the issues involved in this discussion, see Luis Felipe Cespedes, Roberto Chang, and Andres Velasco, "Balance Sheets and Exchange Rate Policy," National Bureau of Economic Research Working Paper No. 7840, 2000, and "IS-LM-BP in the Pampas," IMF Staff Papers, Vol. 50, Special Issue, 2003, pp. 143-56; Charles W. Calomiris, Daniela Klingebiel, and Luc Laeven, "A Taxonomy of Financial Crisis Restructuring Mechanisms: Cross-Country Experience and Policy Implications,", in *Systemic Financial Distress: Containment and Resolution*, edited by Patrick Honohan and Luc Laeven, Cambridge University Press, 2005, pp. 25-75; Ricardo Hausmann and Andres Velasco, "Hard Money's Soft Underbelly: Understanding the Argentine Crisis," in *Brookings Trade Forum: 2002*, edited by Susan M. Collins and Dani Rodrik; Aaron Tornell, "Policy in an Economy with Balance Sheet Effects," in *Preventing Currency Crises in Emerging Markets*, edited by Sebastian Edwards and Jeffrey A. Frankel, University of Chicago Press, 2002, pp. 705-40; Sebastian Edwards, *Real Exchange Rates, Devaluation, and Adjustment*, MIT Press, 1989; and Paul Krugman and Lance Taylor, "Contractionary Effects of Devaluation," *Journal of International Economics* 8, 1978, pp. 445-56.

[7] Decree 410/2002 can be found within the website of the Ministry of Economy and Production: http://www.mecon.gov.ar. More specifically, Decree 410/2002 can be found at http://infoleg.mecon.gov.ar/txtnorma/72761.htm. It is important to note that, while foreign trade finance, and foreign debts enforced outside Argentina, were not pesified, pesification still had substantial benefits for exporters to the extent that they had borrowed domestically in dollars for purposes other than trade finance.

used to great effect by the United States when it redenominated private sector gold-denominated debts into dollar-denominated debts in 1933. A study by Professor Randall Kroszner, arguing for the salutary effects of that policy choice, was widely circulated before the Argentine crisis.[8] Professor Kroszner was also a member of President Bush's Council of Economic Advisers at the time of the Argentine crisis. Mexico had pursued a similar debt-relief policy of reducing the dollar value of its dollar-denominated bank loans and dollar-denominated deposits in 1982.[9]

One aspect of Argentina's redenomination policy that is outside of the scope of this study is worthy of comment, namely "asymmetric pesification" of bank loans and deposits. While bank loans were subject to redenomination at face value into pesos (and therefore depreciated in dollar terms fully by the amount of exchange rate devaluation), dollar-denominated deposits were converted into pesos at a higher peso value. This policy was an attempt to placate depositors, who complained of the loss of value of their bank deposits. Asymmetric pesification implied a substantial loss to banks, since their liabilities were depreciated in value much less than their assets. To compensate banks for that loss, the government issued bonds to the banks which replaced the lost value from asymmetric pesification. Thus, citizens qua taxpayers paid for the cost of the relative subsidy received by citizens qua depositors. Asymmetric pesification seems to have had little real effects on banks (or their borrowers) and seems best described as a

[8] See Randall Kroszner, "Is It Better to Forgive than to Receive? Repudiation of the Gold Indexation Clause in Long-Term Debt During the Great Depression," University of Chicago, Working Paper, November 1999.

[9] Liliana Rojas-Suarez and Steven R. Weisbrod, *Financial Fragilities in Latin America: The 1980s and 1990s*, IMF Occasional Paper 132, Washington, D.C.: International Monetary Fund, October 1995, pp. 17-18. This article describes how partial redenomination of bank loans and deposits in Mexico was used to shift some of the burden for the bailout of bank borrowers (via loan redenomination) onto bank depositors (via deposit redenomination): "…the government engaged in a policy of reducing the real burden of borrower debt and forcing depositors to absorb some of these losses through a reduction in the real value of deposits. The latter action was achieved through a combination of policies: forced conversion of foreign currency-denominated deposits at unfavorable exchange rates and negative real interest rates on peso-denominated deposits. The real value of loans was reduced through the conversion of foreign currency loans to pesos at an exchange rate that overstated the value of the peso relative to the dollar."

politically expedient way to impose losses on consumers by postponing taxation and making it less visible.

Argentina's Vulnerability to Devaluation

The appeal of redenomination of dollar debts as part of a devaluation policy reflected the fact that the Argentine financial system was one of the most dollarized financial systems in the world on the eve of the Argentine devaluation. Based on an overall financial system dollarization score, derived by Reinhart, Rogoff and Savastano (2003), Argentina was the fourth most dollarized financial system (outside the United States) in the world during the period 1996-2001. Table 1 reports data for the 16 countries identified by Reinhart, Rogoff and Savastano (2003) as having the highest dollarization scores.

The Reinhart, Rogoff and Savastano score (which takes into account the fraction of dollarized deposits, dollar-denominated bonds and external public sector debt) does not fully capture the peculiar vulnerability of Argentine debtors to devaluation (in the absence of dollar debt redenomination). To capture the vulnerability of Argentine private sector borrowers on the eve of devaluation, I construct an alternative measure, based entirely on private borrowing denominated in dollars (relative to total private debt). This measure (corporate debt denominated in dollars – or, CDDD – relative to total domestic private debt), is reported in Table 1 alongside the Reinhart, Rogoff and Savastano dollarization score, and is plotted for the 50 countries identified by Reinhart, Rogoff and Savastano as having "highest" or "high" dollarization scores in Figure 8D.

Table 1 and Figures 8C and 8D show that the dollarization score and the CDDD ratio imply somewhat different rankings of countries. According to the CDDD ratio, Argentine private

sector debt was much more heavily dollarized than those of the other four countries with similar or higher Reinhart, Rogoff and Savastano dollarization scores (Bolivia, Bulgaria, Ecuador, and Uruguay).

But neither the dollarization score nor the CDDD ratio, by itself, can capture a country's debtors' vulnerability to devaluation. First, as discussed in Section IV below, other dollar-denominated or dollar-indexed contracts (i.e., utility tariffs) may add to financial distress in the wake of a devaluation. Furthermore, to the extent that a country's dollar-denominated debt service can be paid by export revenues, borrowers can be insulated from the effects of devaluation. Exporters earn dollar-denominated revenues in external markets, and so are insulated from declines in the domestic demand for their products. That ability to maintain dollar revenues during a devaluation enables tradables producers to continue to service dollar-denominated debt, even after a devaluation. Indeed, the decline in the dollar value of labor and occupancy expenses as the result of devaluation can result in a net advantage to exporters from devaluation, despite high dollar-denominated debt. In contrast, non-exporting firms' revenues do not provide a revenue offset against rising real debt service costs.

Thus, in a highly dollarized country with a small fraction of exports to GDP, devaluation without debt redenomination would have a particularly negative effect on domestic borrowers. In addition, as discussed in Section IV below, a proper measure of a country's financial vulnerability to a devaluation should also take into account the existence of factors such as dollar-indexed transportation and utility concession contracts.

Table 1 and Figures 8A-8D show that Argentina was in a peculiarly vulnerable position from the standpoint of that combined measure of financial vulnerability (the combination of its export-to-GDP ratio and either measure of financial dollarization). There are countries listed in

Table 1, and plotted in Figures 8A, 8B, 8C, and 8D, that have a higher CDDD ratio or dollarization score than Argentina's (Angola, Mozambique, and São Tomé & Príncipe, for example, have higher CDDD ratios than Argentina; Ecuador, Bolivia, and Uruguay have higher dollarization scores), but those countries all have substantially higher export-to-GDP ratios than Argentina. Argentina had the lowest export-to-GDP ratio of the highly dollarized economies shown in Table 1, and ranked fourth and sixth with respect to its financial dollarization (using the Reinhart, Rogoff and Savastano score, or the CDDD ratio, respectively). Clearly, Argentina was one of the most vulnerable economies, if not *the* most vulnerable economy, in the world to the financial and macroeconomic consequences of devaluation (if it were pursued without the redenomination of debts).

III. Effects of Debt Redenomination

I now turn to the questions of whether devaluation with debt redenomination had salutary effects on the investment behavior of debtor firms, and whether redenomination was a positive surprise at the time it was enacted. To test whether devaluation with debt redenomination substantially increased the investments of Argentine firms, and whether the announcement of this policy was a positive surprise to the market, I undertook two empirical analyses.

The first is an analysis of the investment behavior of firms, which measures the extent to which debt redenomination improved the ability of Argentine firms, and especially non-tradables firms, to invest in plant, property and equipment during the two years after devaluation. This study contrasts the relatively favorable experience of non-tradables producers with high preexisting levels of dollar-denominated debt in Argentina after its devaluation with the experience of high-dollar-debt non-tradables producers in Mexico after its devaluation.

By using a "difference in difference" empirical approach – that is, contrasting the lack of a difference in investment behavior between non-tradables high-dollar debtors, and tradables high-dollar debtors, in Argentina, with the substantially lower investment spending of non-tradables high-dollar debtors relative to tradables high-dollar debtors in Mexico – I am able to control not only for differences in the effects of devaluation on firms' revenues, but also for selectivity bias in firms' decisions to issue dollar-denominated debts. In particular, it non-tradables producers that issue dollar-denominated debt may have some superior characteristics relative to other non-tradables producers ex ante (at the time of their debt offerings) that help to explain their willingness to issue dollar-denominated debt despite its risks. Indeed, below I describe some evidence from ex post performance that supports that view. This selectivity bias will tend to understate the effects of debt deflation shocks. Comparing the performance of Argentine and Mexican non-tradables firms with high dollar debt controls somewhat for that selectivity bias, since selectivity bias should apply to both Argentine and Mexican non-tradables firms with high dollar debt.

The second part of the analysis examines the Argentine stock market's reactions to the debt redenomination announcement of February 3, 2002, to determine whether redenomination policy was a surprise and whether the market viewed redenomination as improving the condition of Argentine firms – in particular, whether redenomination was associated with an improvement in the market's view of the prospects of Argentine firms with high preexisting levels of dollar-denominated debt. This event study finds that the announcement of debt redenomination was beneficial and not fully anticipated. The announcement was associated with a positive stock market reaction, on average, and with an especially favorable reaction with respect to the prospects of high-dollar-debt producers.

Both empirical analyses provide support for the view that the combination of devaluation and redenomination of debt in Argentina was a beneficial short-term macroeconomic policy compared to devaluation without the redenomination of debt. The fact that high-dollar-debt non-tradables producers benefited the most from redenomination is consistent with the theory of investment under imperfect capital markets, discussed at length above, which implies that they would have been among the most vulnerable to a devaluation without redenomination. Given Argentina's low proportion of exports and high levels of dollarized debts (shown above in Table 1, and in Figures 8A-8D), the improvement in the performance of high-dollar-debt non-tradables producers likely was of substantial importance to the Argentine recovery from the crisis.

A Comparison of Investment Behavior after the Argentine and Mexican Crises

The effect of financial distress on a firm's economic performance is revealed through that firm's investment decisions. Fixed capital investment is clearly a decision variable of the firm, one that is highly dependent on the availability of financing. Firms that are in financial distress, or even those not in distress that have suffered substantial declines in net worth value as the result of an increase in the value of their debts relative to their assets, will suffer higher costs of financing investment, and consequently may shrink investment spending dramatically.[10]

I compare the investment behavior of firms in Mexico and Argentina in the wake of their devaluations of December 1994-1995 and early 2002, respectively, which are plotted in Figures 7 and 9. I consider differences in firms' investment behavior during periods one and two years after devaluation, and relate those investment behavior differences to the sector in which the

[10] See Ben Bernanke and Mark Gertler, "Financial Fragility and Economic Performance," *Quarterly Journal of Economics* 104, 1989, pp. 878-104; Steve Fazzari, R. Glenn Hubbard, and Bruce Petersen, "Financing Constraints and Corporate Investment," *Brookings Papers on Economic Activity*: 1, 1988, pp. 141-95; and Charles W. Calomiris and R. Glenn Hubbard, "Internal Finance and Investment: Evidence from the Undistributed Profits Tax of 1936-37," *Journal of Business*, 68, 1995, pp. 443-82.

firms operate (tradable or non-tradable) and to the firms' reliance on dollar-denominated debt. Behavioral differences are gauged relative to a simple neoclassical benchmark "accelerator" model, in which investment is a function of sales. As discussed above at length, firms in the non-tradables sector with a heavy reliance on dollar debt will be the most vulnerable to a devaluation without a debt redenomination (the policy choice of Mexico in 1994-95). Non-tradables firms with high dollar debt should demonstrate the greatest reductions in investment, both because their sales growth will be relatively lower after a devaluation, and because their ability to access external finance will be adversely affected by their deteriorating financial condition. Non-tradables producers that have issued less dollar-denominated debt (in Mexico) will experience less deterioration in their financial condition, and thus, less of a decline in their investment. The effect of dollar-denominated debt should be less apparent in the investment behavior of Argentine non-tradables firms with high dollar-denominated debt, since their debts were redenominated. Thus, in theory, one would expect to observe the following three phenomena from a comparative study of Mexican and Argentine firms' investment behavior after their respective devaluations:

> Hypothesis 1: In both countries, firms in the tradables sector, *ceteris paribus*, should exhibit higher investment growth after a devaluation relative to non-tradables producers, since in comparison to non-tradables producers, devaluation reduces their revenues less and affects their financing costs less.
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> Hypothesis 2: Non-tradables firms with high dollar debt, *ceteris paribus*, should exhibit lower investment spending *in Mexico,* compared to low-dollar debt, non-tradables firms *in Mexico*, in the wake of devaluation, since devaluation increases the effective debt burden for high-dollar debt, non-tradables producers.
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> Hypothesis 3: Non-tradables firms with high dollar debt, *ceteris paribus*, should *not* exhibit inferior performance *in Argentina*, compared to low-dollar debt, non-tradables firms *in Argentina*, since debt redenomination removed the effect of an increased debt burden for high-dollar debt, non-tradables borrowers as the result of devaluation.

Table 2 describes the variables used in the study and defines them. Table 3 investigates the three hypotheses from the perspective of raw data on investment expenditures in the first year after a devaluation (as a proportion of the firm's total plant, property and equipment at the end of the prior year). Table 4 is identical to Table 3 but considers the two-year period after a devaluation. Hypothesis 1 is confirmed by Tables 3 and 4. Tradables producers in both Mexico and Argentina tend to invest more after devaluation than non-tradables producers. To be specific, in Argentina, both high-dollar-debt and low-dollar-debt tradables firms invest more after devaluation than firms with similar dollar debt ratios operating in the non-tradables sector, and those differences are statistically significant. For example, high-dollar-debt tradables producers in Argentina had investment ratios of 0.18 in the two years after devaluation (shown in Table 4), while high-dollar-debt non-tradables producers in Argentina displayed investment ratios of only 0.07. The difference between non-tradables and tradables, which is shown in Table 4 as -0.1092, is significant at the 7.8% significance level. In Mexico, the difference between tradables and non-tradables firms is also positive and statistically significant for high-dollar-debt firms, but there is no significant difference across the two sectors within the category of low-dollar-debt firms (and the sign of the effect is reversed).

Hypotheses 2 and 3 are also confirmed in Tables 3 and 4. With respect to Hypothesis 2, in Mexico, high-dollar-debt non-tradables producers display much lower investment rates than low-dollar-debt non-tradables producers. The differences are large, statistically significant, and persistent (they grow in magnitude during the second year after devaluation). With respect to Hypothesis 3, in Argentina, there is no difference among non-tradables producers related to the presence of dollar-denominated debt. Within the category of non-tradables producers, high-

dollar-debt and low-dollar-debt firms behave similarly (particularly in the two-year window results in Table 4) and are not statistically significantly different.

By way of providing additional background on the determinants of investment, Tables 5-8 report data on sales and earnings before interest cost, taxes, depreciation or amortization (EBITDA), broken down into the same categories as in Tables 3 and 4. While these revenues and earnings measures are certainly not independent of financial distress effects, they are measured before taking into account the effects of debt service costs on net earnings. Tables 5 and 6 provide evidence on sales revenue growth and Tables 7 and 8 provide data on earnings (EBITDA) relative to assets. The patterns of difference between tradables and non-tradables producers are similar to those shown in the investment tables. Tradables producers have superior sales and earnings growth to non-tradables producers after devaluation.

One interesting finding is that in both Mexico and Argentina, high-dollar-debt firms (within either sector) tend to have *higher* revenue growth than low-dollar-debt firms after devaluation. In other words, in Mexico, high-dollar-debt non-tradables firms had lower investment growth than low-dollar-debt non-tradables firms *despite* the fact that their revenue growth was *higher*, indicating a very potent effect of dollar-denominated debt in depressing investment rates for non-tradables producers in Mexico. The higher revenue growth of high-dollar-debt firms reflects selection bias; firms with better prospects for growth and earnings tend to be the ones that qualified for access to dollar-denominated debt in the past.[11]

Tables 9 and 10 provide an additional analysis of Hypotheses 2 and 3, using a multiple regression framework. Those Hypotheses predict the presence (in Mexico) and absence (in Argentina) of a high-dollar-debt effect for non-tradables producers, *ceteris paribus*. Tables 9 and

[11] See Sanket Mohapatra, "Exchange Rate Regimes and Corporate Borrowing from International Capital Markets," Working Paper, Columbia University, February 2004.

10 perform a *ceteris paribus* comparison by controlling for differences in sales growth or prior rates of investment (pre-devaluation) at the firm level, for firms in Mexico and Argentina, pre- and post-devaluation. Table 9 reports cross-sectional regression results for two specifications for one-year period comparisons, and Table 10 reports similar regressions for two-year periods. The two regression specifications within each table differ by either including or excluding interactive indicator variables that allow the interaction of the sector (tradable or non-tradable) and the dollar debt level, and that also interact the product of those variables with the country indicator (ARG).

Tables 9 and 10 do *not* provide tests of Hypothesis 1. Note that the main effect of devaluation on the relative performance of tradable producers is their relative growth in dollar-denominated revenues. Since revenue growth is included in the regression, and is thus *controlled for*, there is little residual explanatory role for the TR indicator variable in the regressions. The fact that the TR indicator variable has a weak, and sometimes negative, effect on investment in the regressions, does not imply a rejection of Hypothesis 1; it simply implies that, once one controls for differences in dollar-denominated revenue growth, there is little else about tradables producers, per se, that boosts their investment rates (although, the net effect of the TR indicator is positive, and often statistically significant, for Argentina – that is, the sum of the TR and TRxARG coefficients is positive, and the TRxARG coefficient is often statistically significant).

Tables 9 and 10 provide tests of Hypotheses 2 and 3. With respect to Hypothesis 2, the predictions are that the coefficient on DDA is negative (reflecting the negative effect of higher dollar debt in Mexico for non-tradable producers), and that the coefficient on TRxDDA is offsetting and positive (reflecting the mitigation of the negative effect of dollar debt that comes

from being an exporter). These predictions are supported by the regression results; the coefficients are of the right sign and large, although the levels of statistical significance are not always high, owing to the limited sample size. With respect to Hypothesis 3, the predictions are that the interactions of the DDA and TRxDDA with the ARG indicator should be opposite to those of DDA and TRxDDA. In other words, DDAxARG should be positive (reflecting that the negative effect of higher dollar debt that is present in Mexico is absent in Argentina), and TRxDDAxARG should be negative (reflecting the fact that the relative advantage tradable firms have in avoiding the special burden of dollar debt is also absent in Argentina). These predictions are similarly confirmed.

In summary, an investigation of the investment behavior of firms in Mexico and Argentina, one or two years after their countries' respective devaluations, finds that the predicted effects of devaluation with and without debt redenomination are upheld in the data. In Mexico, where devaluation was not accompanied by dollar debt redenomination, investment was reduced as the result of increased debt burdens for firms with high dollar debt, and this burden was borne primarily by non-tradable firms. In Argentina, where devaluation was accompanied by the redenomination of private dollar-denominated debts, these effects on investment were not apparent.

An Event Study of the Announcement of Debt Redenomination

Having shown that redenomination seems to have improved the financial condition and investment performance of Argentine firms, I ask whether the market anticipated that improvement. The purpose of this event study is to see whether the salutary effects of

redenomination were anticipated in advance, and whether they were understood widely at the time the policy was announced.

The event study measures whether the stock market in Argentina reacted favorably to the announcement, overall, and also whether the abnormal returns of firms that were most likely to benefit from redenomination policy (those with high dollar debt, and those producing in the non-tradable sector) enjoyed the largest relative returns in reaction to the announcement. In Tables 11 and 12, I present results for an event study of redenomination using both raw returns and abnormal returns (returns measured after removing the effects of overall market returns on the returns of individual firms). The results for raw returns are useful for gauging the overall macroeconomic effect of the announcement of redenomination. Both the raw and abnormal returns results are useful for gauging cross-sectional differences.

While there had been an announced intention to redenominate some dollar debts on January 4, and small dollar debts had been redenominated in the first week in January, it was not until later that the government decided to redenominate all dollar debts into pesos. On February 3, all dollar-denominated debts were redenominated in anticipation of floating the currency, which occurred on February 11. Given the ambiguities about redenomination of debt in early January, and the absence of any trading days in the stock market between January 4 and January 17, I chose January 30, 2002 to February 7, 2002 as the event window for debt redenomination. The details of the method for calculating raw and abnormal returns are provided in the notes to Table 11.

Table 11 divides Argentine publicly traded firms into four categories, divided by the level of their dollar debt (high or low) and by whether they are in tradables or non-tradables sectors. The raw and abnormal returns are positive for all four categories of firms during the event

window, indicating a substantial positive returns for each group, which ranges from 1.6% for low-dollar-debt non-tradable firms to 27.6% for high-dollar-debt tradable firms.

The differences in Table 11 between high-dollar-debt firms and low-dollar-debt firms in each sector are large and statistically significant, indicating that firms with large amounts of dollar-denominated debt enjoyed much higher raw and abnormal returns during the event window. This confirms that redenomination was not fully anticipated, and that the market perceived that redenomination would particularly improve the performance of firms with large amounts of dollar debt.

Interestingly, however, within each debt category, tradable producers show substantially higher returns than non-tradable producers. This result seems to contradict economic theory and the empirical results of our investment study above. Shouldn't high-debt non-tradable producers have been expected to receive a greater advantage from redenomination than high-debt tradable firms, since in the event, they actually do seem to have been relatively advantaged by redenomination?

There are two simple potential explanations for the relatively positive effect on tradable producers' returns during the redenomination event window. First, redenomination was understood at the time to be a preamble to floating the currency. Having redenominated transportation and utility tariffs and dollar debts, the government was much more likely to float, and much more likely to permit a substantial devaluation, since the major macroeconomic cost of a large devaluation had been removed by the redenomination of debt contracts. Thus, one of the pieces of "news" embedded in the redenomination announcements was the likelihood of a much greater devaluation than had been previously expected. Obviously, news of a much higher devaluation than previously expected would benefit tradable producers. Thus, any interpretation

of the cross-section of returns during the redenomination event window is complicated by the fact that redenomination was news about *two* things: On the one hand, it was news about tariff and debt relief, which was most advantageous to high-dollar-debt firms, and to high-dollar-debt non-tradable firms, in particular. On the other hand, it was news about the likelihood of a large devaluation, which advantaged tradable firms. This may explain why the cross-section of returns shown in Table 11 shows high relative returns for firms with high debt, and also high relative returns for tradable firms. In other words, even if redenomination, *per se*, was understood to be relatively advantageous to non-tradable firms with high dollar debt, there was more to the redenomination *announcements* than redenomination *per se*.

A second possible interpretation revolves around the effects of the February debt redenomination announcement on the fortunes of utility producers. A large proportion of non-tradables firms were utilities, and many of them were affected adversely by the redenomination of utility tariffs, which had been part of the earlier redenomination announcement in the first week in January 2002. It is possible that the decision to broadly redenominate dollar debt in February was interpreted as a signal of a declining possibility that the government would renegotiate utility tariffs to increase their real amount (as many utility industry representatives hoped). According to that interpretation, the February redenomination announcement may have been bad news for utility companies. This possibility in more detail in Section IV below.

Table 12 provides regression results for the cross-sections of raw and abnormal returns, which confirm the results of Table 11. The higher the dollar debt ratio, the bigger the positive effect on returns during the redenomination window. Holding the level of debt constant, tradable firms experienced higher returns during the event window.

IV. Redenomination of Utility Contracts

Consequences of Utility Tariff Redenomination

Thus far, this study has explored only the effects of devaluation and debt redenomination policies on firms. The redenomination of Argentine utility contracts is another potentially important dimension through which redenomination policy affected macroeconomic performance, and cross-sectional differences in investment and stock market returns.

Not only did market participants perceive a significant risk of collapse as early as 2000, they recognized the possibility of redenomination of contracts as part of the government response to that collapse. The potential redenomination of dollar-indexed transportation and energy tariffs and dollar debts was discussed frequently as a policy to accompany devaluation, as a means of promoting macroeconomic improvement.[12] Indeed, many observers favored reductions in the real costs of energy and transport tariffs from an early date. As early as April 2000, an influential market analyst and the Minister of the Economy were openly suggesting that it would be desirable to renegotiate transport and utility contracts as a means to improve Argentine macroeconomic performance:

> Argentina is "bogged down" on several fronts, according to the influential analyst [Miguel Angel Broda]. The currency board, which pegs the peso to the dollar, and the fact that 85 percent of the foreign debt was incurred in dollars prevent Argentina from resorting to a devaluation to lower costs, he pointed out.
>
> That means the costs in dollars are very high," said Broda, who like [Minister of the Economy] Machinea stressed the need to reduce transport costs and utility rates by renegotiating the contracts under which companies were privatized.[13]

[12] The Argentine economy continued to contract in 2000 and 2001. During 2000, real GDP growth was -0.8%. During 2001, growth in the first two quarters of the year (relative to the same quarters of the previous year) was -2.0% and -0.2%, respectively. In the third and fourth quarters, the decline in GDP accelerated, and the growth in real GDP for the 2001 year as a whole was -0.4%.

[13] "Economy – Argentina: On the Mend, Albeit Slowly, Say Officials", *Inter Press Service*, April 6, 2000.

Similarly, in its October 7, 2000 issue, *The Economist* noted that:

> Businessmen complain that they are hurt by the high tariffs charged by privatized utilities. Next month, the government is throwing open the telecoms market, which should cut tariffs, but it argues that in gas and electricity industries its hands are tied by long-term contracts. Not so, argues Eduardo Basualdo, an economist: the Menem government was lenient in enforcing the utilities' contracts, and Mr. de la Rua could insist on a renegotiation.[14]

Economists, policy makers, and market participants inside and outside Argentina perceived a high risk of a financial crisis and saw high tariffs as a significant drag on the economy as early as the Spring of 2000. Market participants knew that devaluation without redenomination would have substantially increased already high real costs of transportation, energy, and debt service.

Firms and consumers, in general (other than the affected utilities and toll road suppliers) should have benefited (at least in the short term) from the elimination of dollar indexation of transportation and utility tariffs. But some firms and consumers should have benefited more than others. In particular:

> Hypothesis 4: Firms that are heavy users of energy as an input to production, *ceteris paribus*, should have seen the largest benefits from tariff redenomination. In contrast, utilities suppliers whose tariffs were redenominated may have suffered from the policy.[15]

A Comparison of Investment after the Argentine and Mexican Crises

To investigate that hypothesis, I first added two new indicator variables to the previous regression analysis of investment for post-crisis years in Argentina and Mexico, and to the analysis of the cross-section of Argentine stock returns. First, the variable "utility" is an indicator

[14] "Another President Caught in Argentina's Economic Trap," *The Economist,* October 7, 2000.
[15] I say "may have suffered" because it is conceivable that utility companies did not suffer, on net, from redenomination policy, since tariff redenomination increased quantities demanded (by lowering prices) and also increased the likelihood of the payment of utility bills that otherwise may not have been paid at all as the result of their high cost (especially in the volatile political environment of Argentina in 2002).

variable that takes the value 1 if the firm is an Argentine utility producer affected by the redenomination of tariffs in 2002, and otherwise takes the value 0. All of the firms in Table 13 are included in the investment regression analysis, but only some are included in the event studies. A list of the firms is provided in Table 13. Second, the variable "high energy" captures whether an Argentine firm is in an industry that is an intensive user of energy. I define a firm as a high-energy consumer if its 3-digit NAICS code is 322 (Paper), 324 (Petroleum & Coal Products), 325 (Chemicals), or 331 (Primary Metals). These four industries were the top manufacturing consumers of energy in 1998 in the United States, according to the U.S. Department of Energy. To my knowledge, comparable information is not available at the sector level in Argentina.

The results (which are modified versions of Tables 9 and 10) are reported in Tables 14 and 15. Coefficient estimates for most variables in Tables 9 and 10 are quite similar to those in Tables 14 and 15. The utility indicator coefficient is negative in all specifications, but the effects are not statistically significant. The high-energy indicator coefficient is positive in the one-year specification, and significant at the ten percent level, but in the two-year specification, the coefficient is negative, small in magnitude, and statistically insignificant. These results suggest that utility tariff changes had little adverse effect on investment by utility suppliers (during our sample period), but large, positive short-term effects on investment by high energy users. The fact that this effect is not present over the two-year post-crisis window may indicate that the positive effects from tariff redenomination reflected the elimination of the perceived risk of a sharp rise in the real cost of energy for high energy users, rather than a long-term motivation to expand investment relative to sales.

The absence of a *long-run positive* effect on investment relative to sales for high-energy firms in this regression, relative to other firms, should not be misconstrued to imply that the stabilizing effects of tariff redenomination for investment in the year immediately after the crisis were unimportant in the long run. In the counterfactual world of no tariff redenomination, financial distress could have resulted for many high-energy consuming firms, and that would have had significantly negative long-run effects on investment by those firms, and on the economy generally. In other words, the regression coefficient measures the effect of tariff redenomination relative to an implicit benchmark of no change in real tariff costs. In fact, in the absence of tariff redenomination, real tariff costs would have more than tripled. Thus, a zero long-run effect (relative to other firms) may reflect a large positive long-run outcome when properly compared to the counterfactual of what otherwise would have resulted from the tripling of real energy costs and the reductions in investment by high-energy firms that would have been a consequence of that cost increase.

One possible explanation for the lack of an observed negative effect on utility suppliers is that reductions in real energy costs increased demand and reduced default risk (by improving the ability of consumers and firms to pay their bills).

Event Studies of the Announcements of Redenominations

Tariff redenomination occurred in the first week in January, long before the redenomination of all dollar-denominated debts in early February. Thus, I consider two separate event studies of announcement effects. The first event window is designed to address the effect of the initial announcement of utility tariff redenomination. This event window examines stock returns over the period January 2 to January 18. January 2 is two days before the government's

January 4 announcement; January 17 is the first day in which trading occurred after the announcement. The second event study is designed to explore the potential effects of debt redenomination policy on expectations about tariff renegotiation (on the theory that debt redenomination may have been viewed as a negative signal about the government's political propensity for utility tariff renegotiation). It examines the same time frame as Table 12 above (January 30-February 7).

Results for the two event study windows are presented in Tables 16 and 17. The average raw returns in the first event window were 26.4 percent, indicating that the policy announcement was seen as favorable for the sample of firms, overall. For the first event window (Table 16), coefficient signs are consistent with expectations, and are quite large, but the standard errors are even larger. With the exception of the tradables indicator (reflecting the importance of the devaluation aspect of the announcement), none of the other coefficients is statistically significant. While the results are consistent with expectations, the sample size is not large enough to offer conclusive evidence on the effects of tariff changes on the stock returns of suppliers and high-energy users.

For the second event window (Table 17), the high-energy indicator is positive, large, and somewhat statistically significant. The utility indicator is negative, large, and statistically insignificant. These results lend some credence, but not conclusive evidence, in support of the hypothesis that the February debt redenomination decree was perceived as a signal of political propensities that implied a reduced chance that the government would renegotiate to raise tariff rates in the near future (which, in the event, the government was unwilling to do). Overall, the event study results indicate that the market perceived redenomination policy changes as positive

for companies that were heavy users of energy, after controlling for other firm attributes (i.e., indicators for dollar debt and tradables).

V. Conclusion

This study offers the first empirical microeconomic analysis of the effectiveness of dollar debt and contract redenomination policies to mitigate adverse financial and relative price consequences from a large devaluation. An analysis of Argentina's policy of devaluation with redenomination in 2002, in contrast to Mexico's policy of devaluation without debt redenomination in 1994-1995, shows that devaluation benefited tradables firms, and that dollar debt redenomination in Argentina benefited high-dollar debtors, as shown in these firms' investment behavior, especially non-tradables firms whose revenues in dollar terms were adversely affected by devaluation. That investment behavior contrasts with the experience of Mexican firms in the aftermath of Mexico's large devaluation, in which non-tradables producers with high dollar debt displayed significant relative reductions in investment. Stock return reactions to Argentine debt redenomination indicate large, positive, unanticipated effects on high-dollar debtors from debt redenomination. Energy concession contract redenomination likewise increased investment by high energy users in Argentina, and that benefit was apparent also in positive stock returns of those firms.

This evidence for short-term macroeconomic benefits from redenomination, however, does not necessarily imply that redenomination policy in Argentina was socially beneficial, on net, nor does it imply that Argentina's policy should be imitated by other countries facing a need to devalue. When government interferes with preexisting contracts it may damage the reliability of contracting agreements made in the future. The adverse reputational consequences to a

government from redenomination, therefore, must be considered alongside the short-term gains from redenomination. Clearly, redenomination policy should not be used frequently as a countercyclical measure, since doing so would have little short-term benefit (few contracts would exist to be redenominated) and would eliminate the use of beneficial dollar contracting, which can be helpful in spurring investment in emerging market countries by limiting the devaluation risks borne by creditors or investors in privatized utility companies.

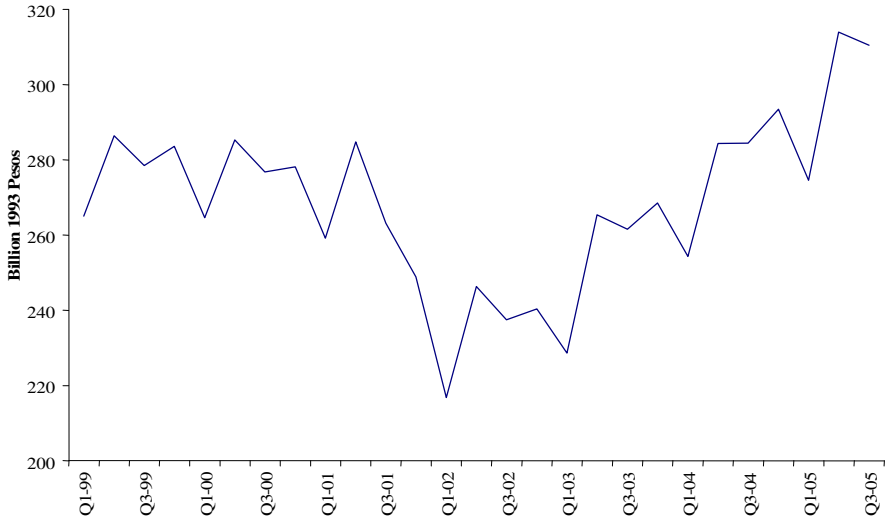
To the extent that redenomination policy leads market participants to expect future ex post changes in contract enforcement, it could be particularly damaging to the economy. Thus, when redenomination policy is employed, it should be accompanied by other policies and credible signals that indicate that its use is exceptional. For example, in Argentina, having redenominated utility contracts into pesos, the government should have moved quickly to renegotiate utility tariffs on a fair basis. If it had done so, that would have substantially mitigated reputational consequences of pesification policy.

Despite the reputational costs of redenomination policy, however, it is likely to be beneficial for some circumstances in some contexts. In the presence of a large devaluation in a highly dollarized financial system, the alternatives to the redenomination of dollar debts for emerging market countries are frequently very unattractive policies, including (a) the economy-wide litigation of creditors' claims on bankrupt borrowers through the legal system, (b) the establishment of government-run asset management companies to dispose of distressed assets, or (c) government subsidies to banks and borrowers to permit them to resolve otherwise unpayable debts. As Calomiris, Klingebiel and Laeven (2005) show in a analysis of various cases of financial crises, emerging market countries suffer from weak legal systems and corrupt political

environments, which make solutions of type (a) and (b) particularly unattractive.[16] And the large moral-hazard costs associated with bailouts, and their undesirable effects on government finances, make solutions of type (c) problematic, as well. Despite the reputational costs of redenomination, compared to available alternatives, in some cases it may offer the speediest and least costly method of resolving the financial distress and macroeconomic decline that results from devaluation in a highly dollarized economy.

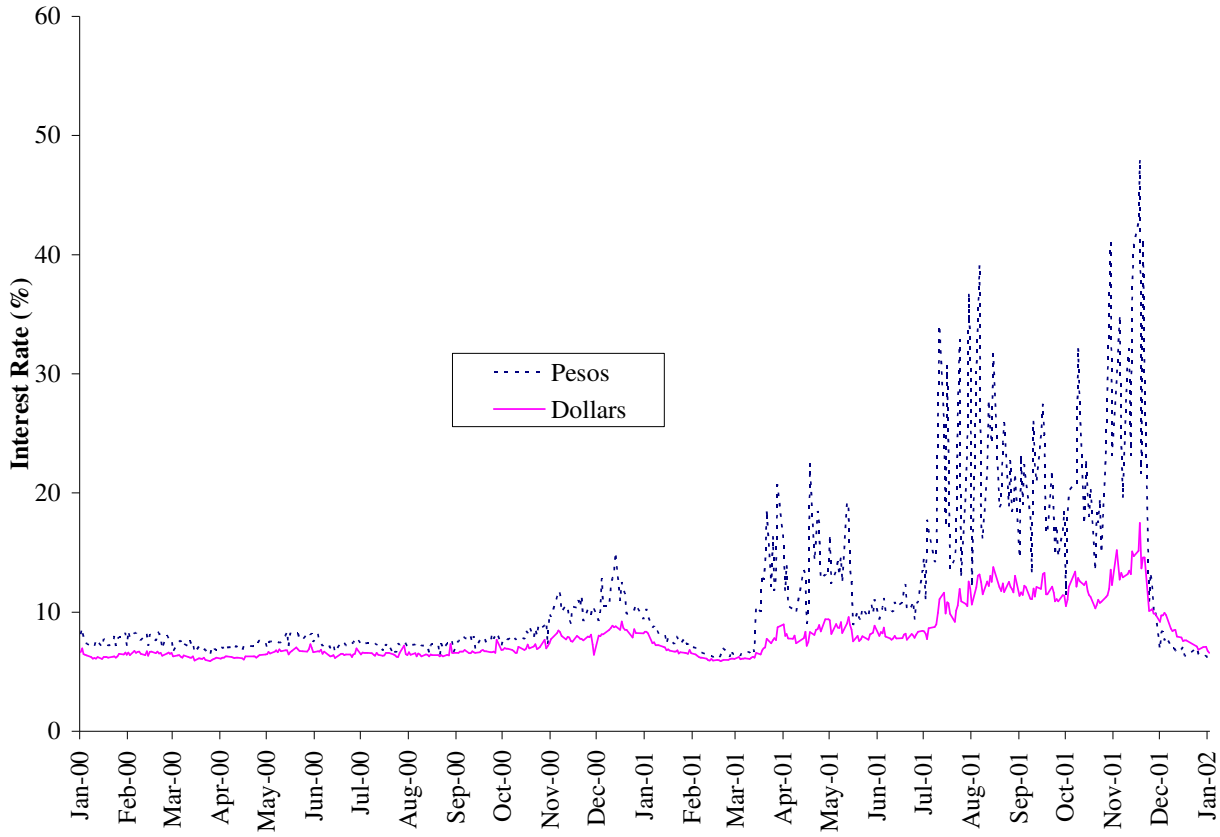
[16] Charles W. Calomiris, Daniela Klingebiel, and Luc Laeven, "A Taxonomy of Financial Crisis Restructuring Mechanisms: Cross-Country Experience and Policy Implications,", in *Systemic Financial Distress: Containment and Resolution*, edited by Patrick Honohan and Luc Laeven, Cambridge University Press, 2005, pp. 25-75.

Figure 1: Argentine Quarterly GDP, 1999-2005



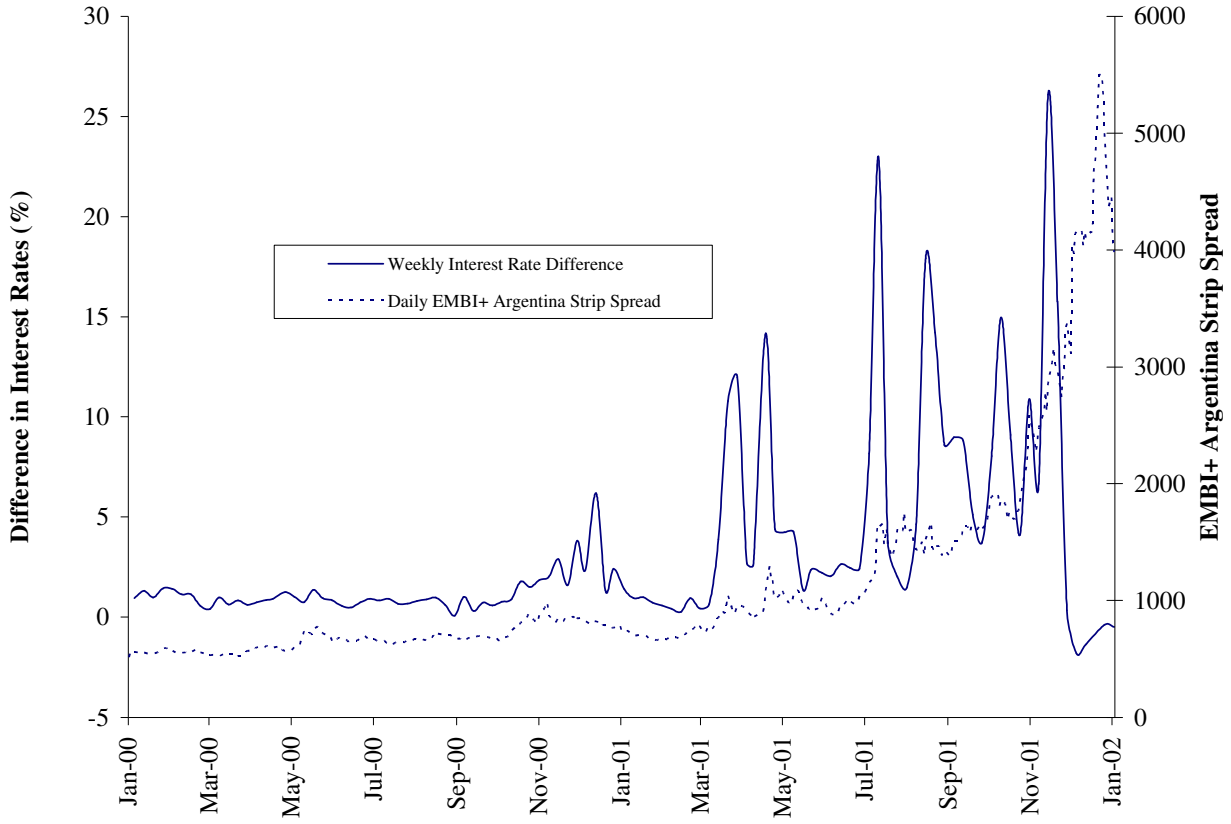
Quarterly GDP (Real 1993 Prices): 1999Q1-2005Q3
Source: Indec (http://www.indec.mecon.ar/nuevaweb/cuadros/17/cuadro8_1.xls)

Figure 2: Interest Rates on 30-Day Time Deposits in Pesos and Dollars



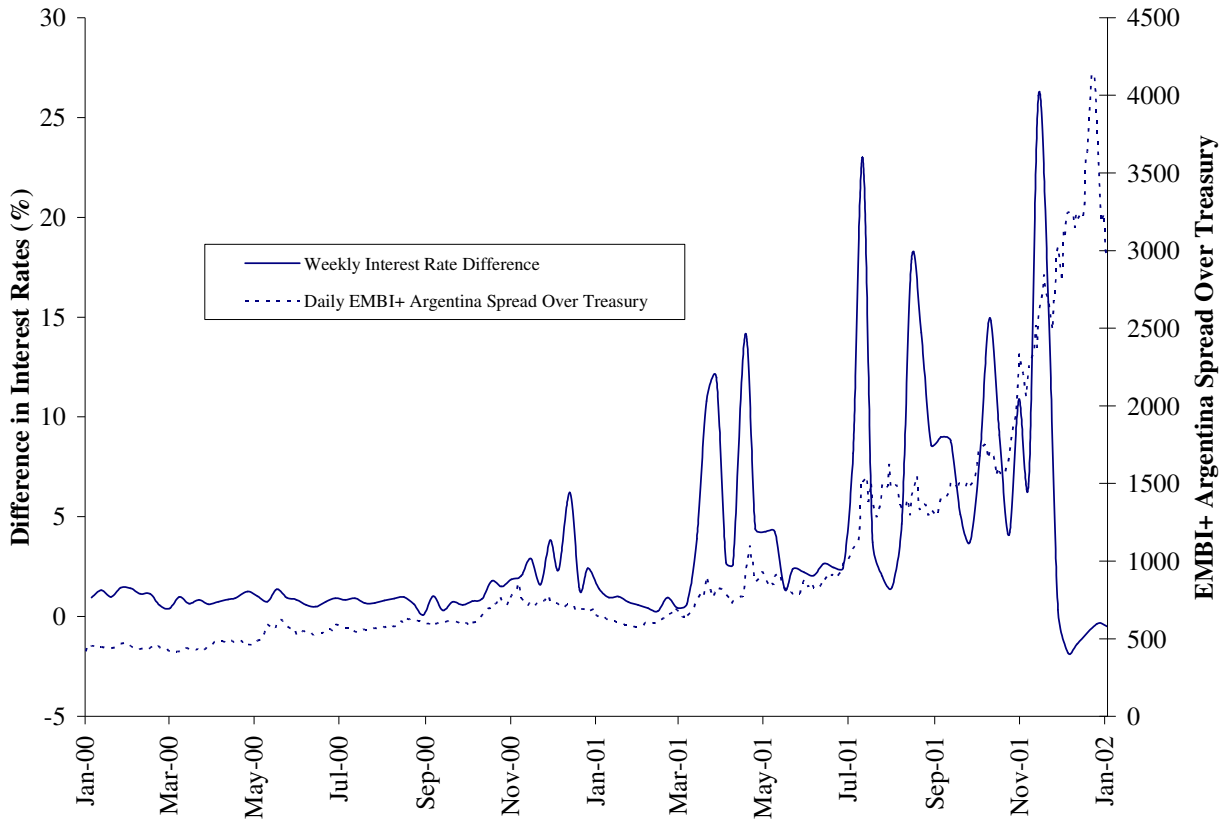
Sources: J.P. Morgan Chase & Co.; Banco Central de la República Argentina, Interest Rates on Deposits (*available at* http://www.bcra.gov.ar/).

Figure 3A: Difference Between Interest Rates on 30-Day Time Deposits in Argentina in Pesos and Dollars vs. EMBI+ Argentina Strip Spread



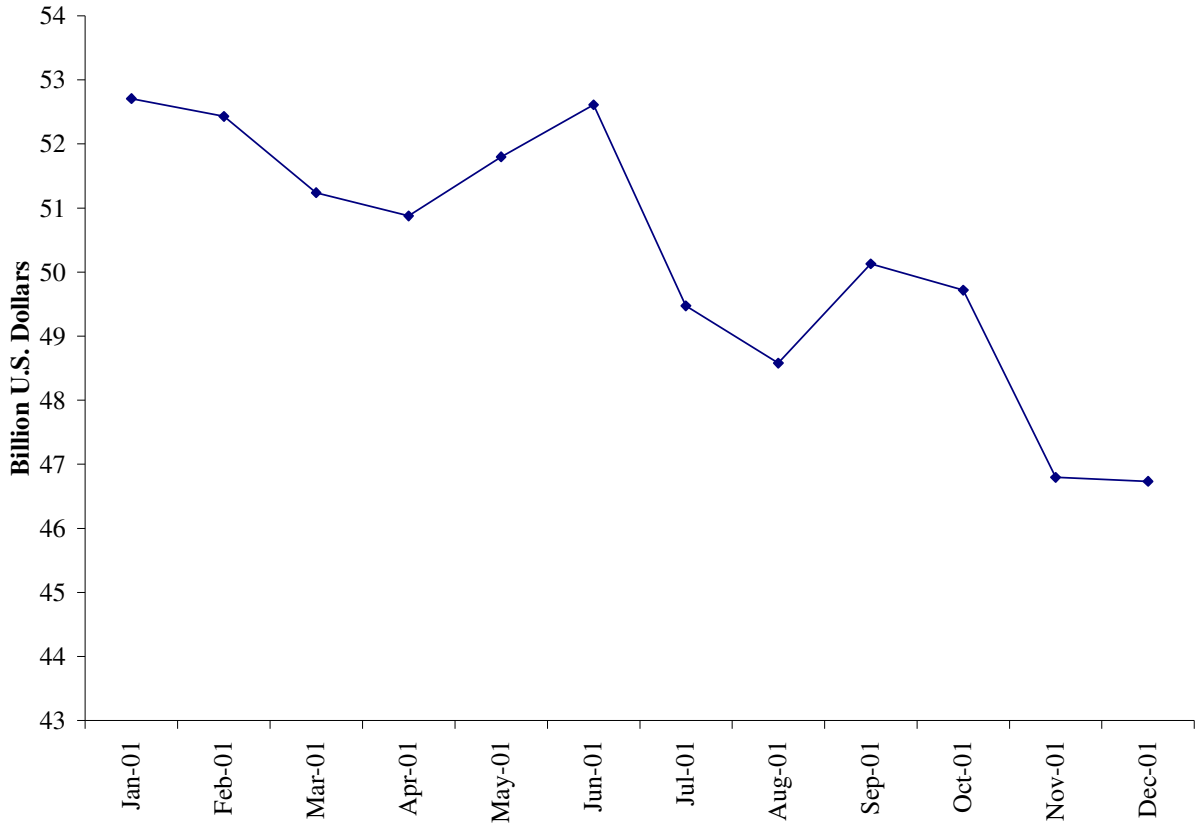
Sources: J.P. Morgan Chase & Co.; Banco Central de la República Argentina, Interest Rates on Deposits (*available at* http://www.bcra.gov.ar/).

Figure 3B: Difference Between Interest Rates on 30-Day Time Deposits in Argentina in Pesos and Dollars vs. EMBI+ Argentina Spread Over Treasury



Sources: J.P. Morgan Chase & Co.; Banco Central de la República Argentina, Interest Rates on Deposits (*available at* http://www.bcra.gov.ar/).

Figure 4: Monthly Dollar Deposits in Argentina, 2001

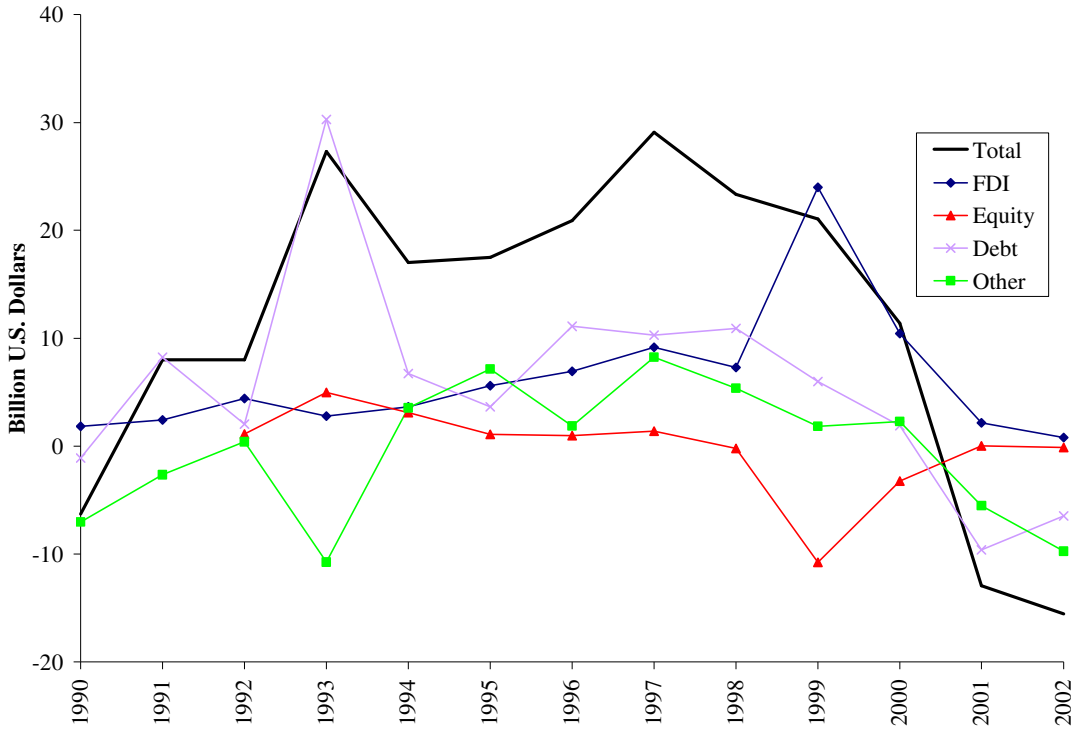


Source: Argentina Ministry of Economy & Production, Macroeconomic Statistics (available at http://www.mecon.gov.ar/peconomica/basehome/infoeco_ing.html).

Figure 5: International Reserves in Argentina, 2001

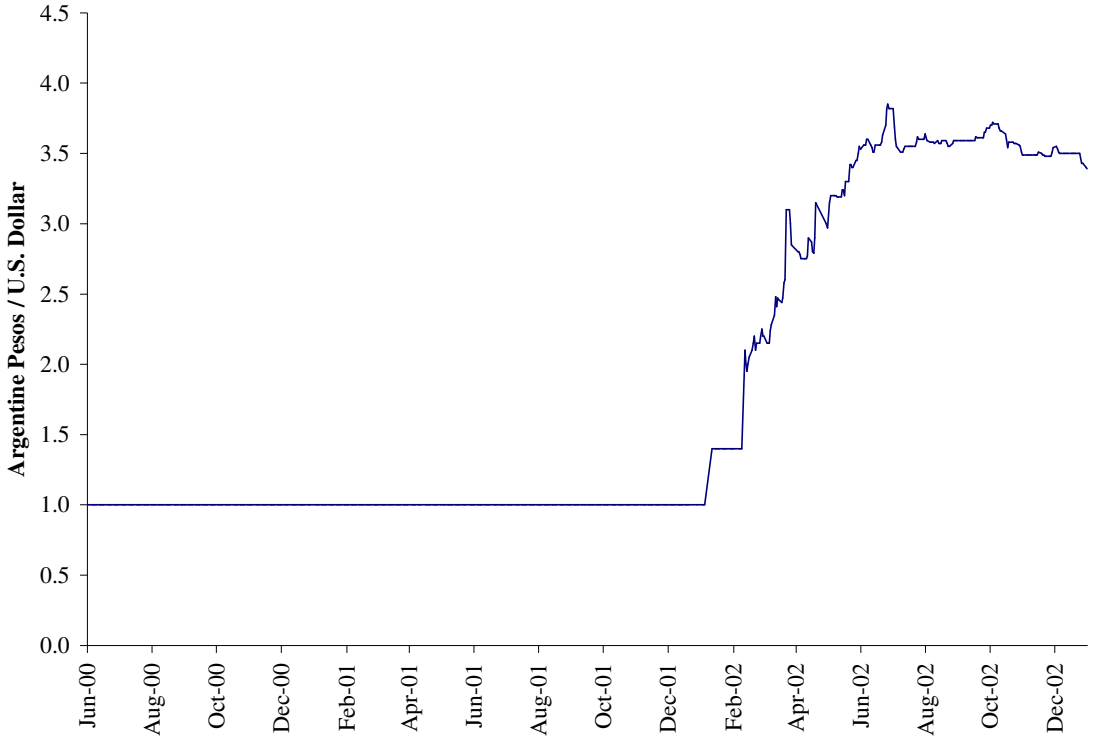
Note: Because of a change in the BCRA's definition of international reserves, data after October 31, 2001 includes public bonds involved in reverse repo-operations. Data before October 31 does not include these bonds.
Source: Banco Central de la República Argentina, International Reserves and BCRA's Financial Liabilities (*available at* http://www.bcra.gov.ar/).

Figure 6: Annual Capital Inflows in Argentina, 1990-2002



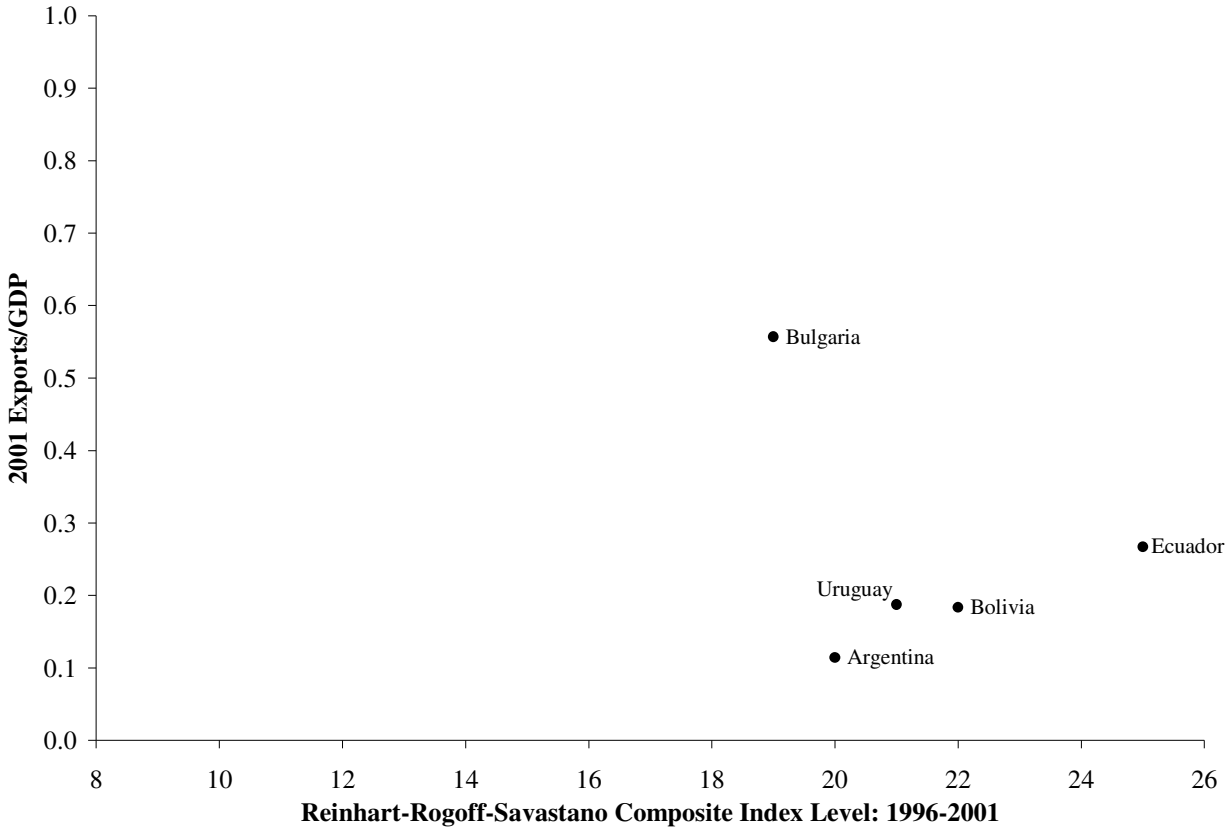
Note: Equity inflow was not available until 1992. I use the following variables from the IMF's International Financial Statistics as components of capital inflows:
1) FDI: line 78bed (Direct Investment in the Reporting Economy, n.i.e.)
2) Equity: line 78bmd (Equity Securities Liabilities)
3) Debt: line 78bnd (Debt Securities Liabilities).
4) Other: line 78bid (Other Investment Liabilities, n.i.e.)
Source: International Monetary Fund, International Financial Statistics, June 2004.

Figure 7: Argentina's Nominal Exchange Rate
June 2000 – December 2002



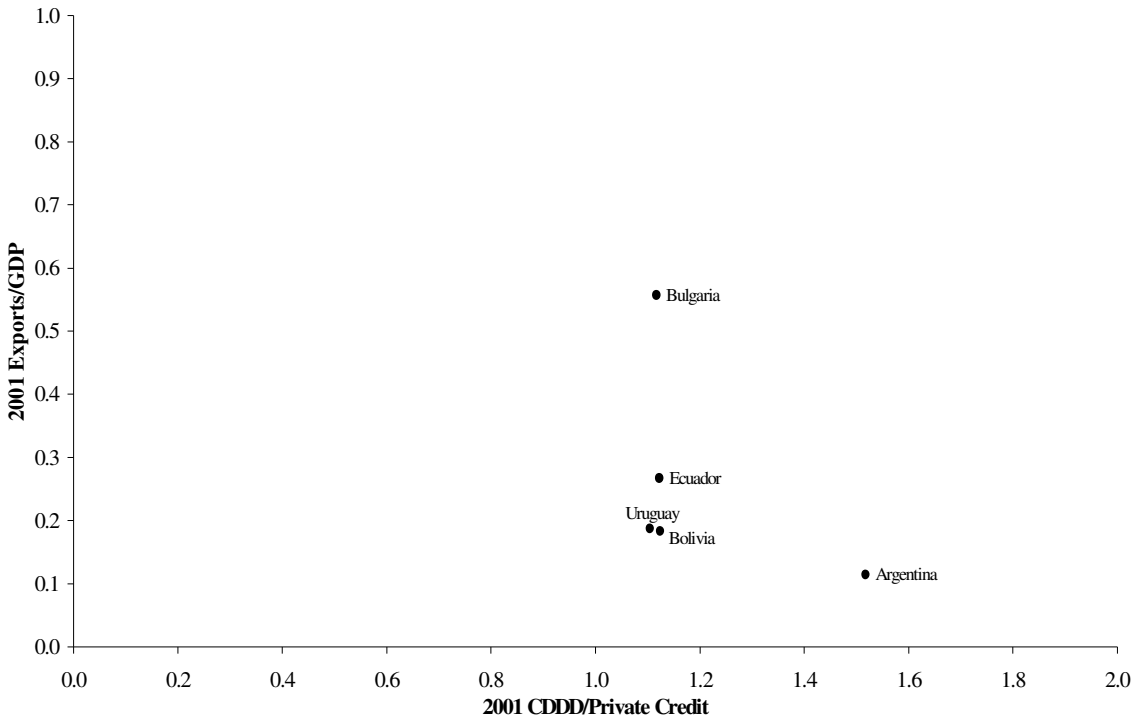
Source: Economatica.

Figure 8A: Reinhart-Rogoff-Savastano Composite Dollarization Index Level vs. Exports-to-GDP Ratio for Reinhart-Rogoff-Savastano's Five Highest Dollarized Countries



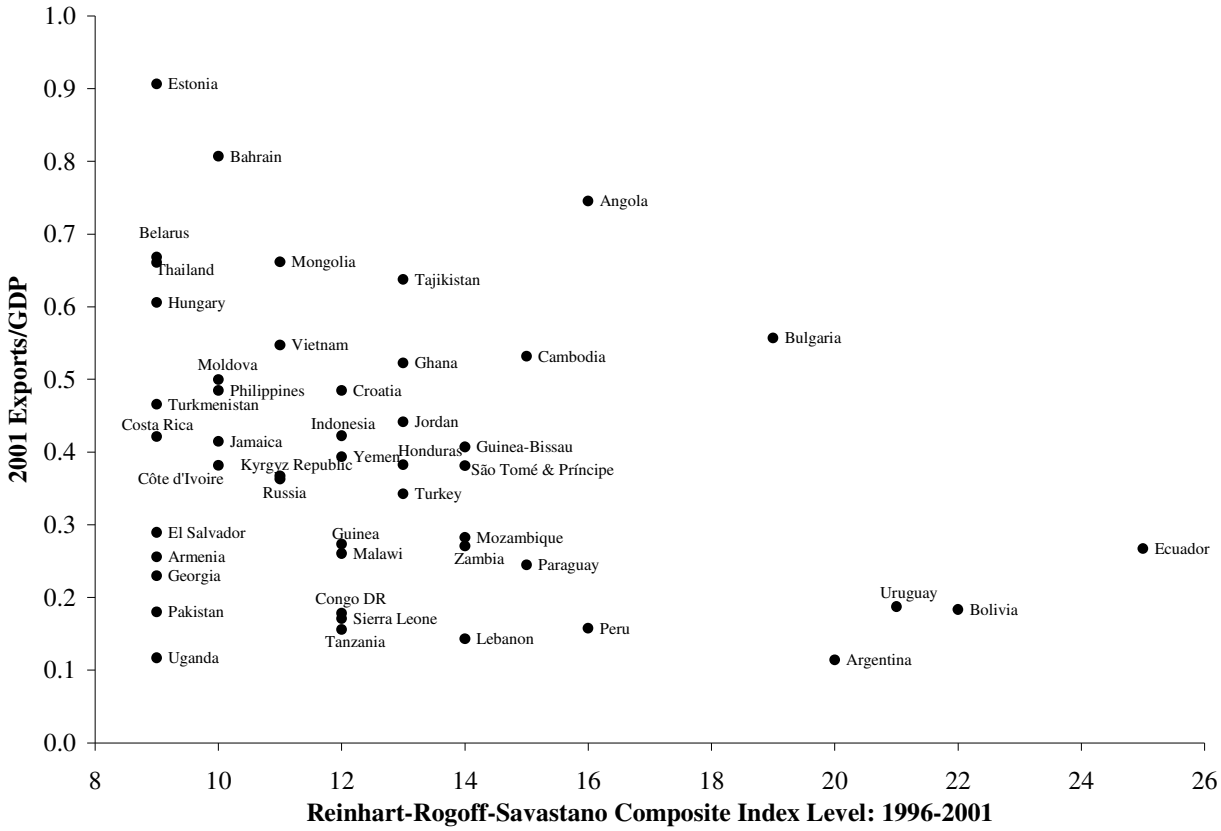
Sources: Carmen M. Reinhart, Kenneth S. Rogoff, & Miguel A. Savastano, Addicted to Dollars, NBER Working Paper 10015, October 2003, at Table 4; World Bank, World Development Indicators Database (*available at* http://devdata.worldbank.org/data-query/).

Figure 8B: CDDD-to-Private Credit Ratio vs. Exports-to-GDP Ratio for Reinhart-Rogoff-Savastano's Five Highest Dollarized Countries



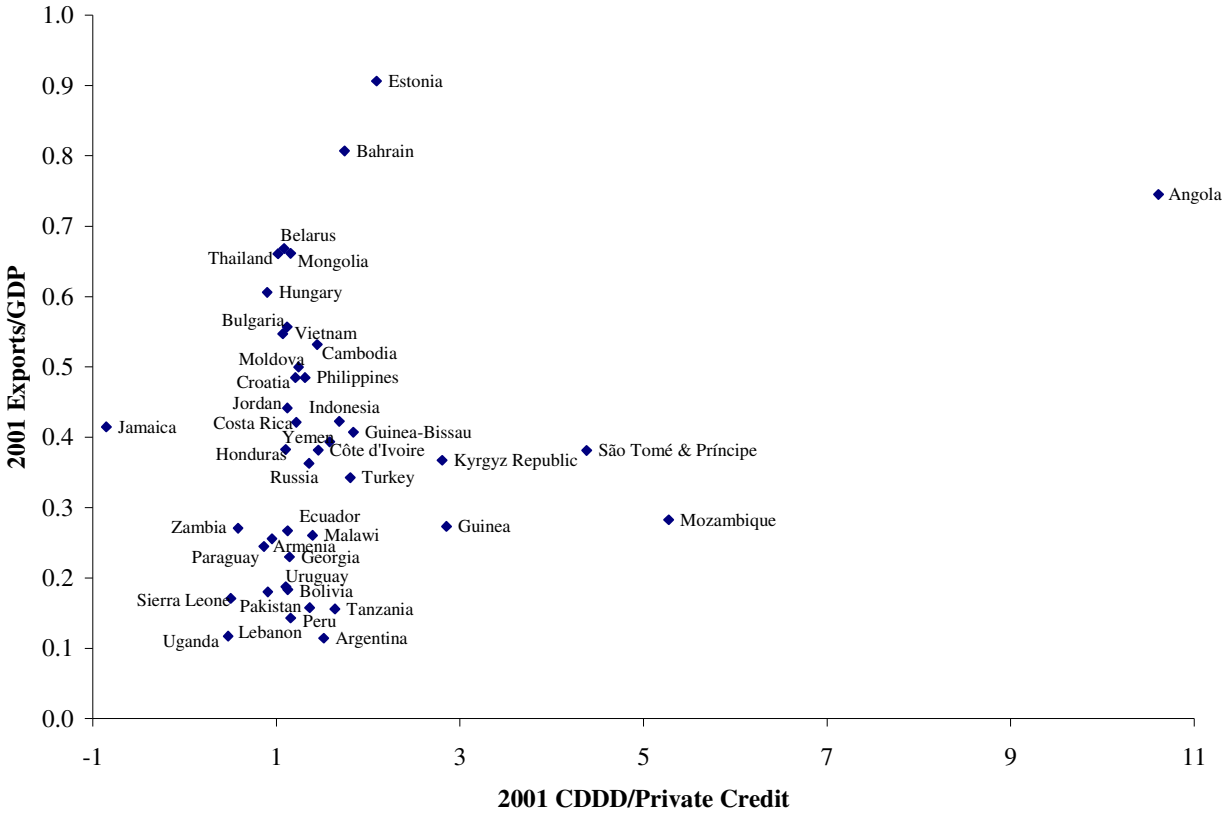
Sources: International Monetary Fund, International Financial Statistics Yearbook (2002); World Bank, World Development Indicators Database (*available at* http://devdata.worldbank.org/data-query/); Bank for International Settlements, Consolidated Banking Statistics (Table 9A) and Securities Statistics (Table 12C) (*available at* http://www.bis.org/statistics/index.htm).

Figure 8C: Reinhart-Rogoff-Savastano Composite Dollarization Index Level vs. Exports-to-GDP Ratio for Reinhart-Rogoff-Savastano's Fifty Highest Dollarized Countries



Note: Lao, Nicaragua, and Bosnia & Herzegovina are excluded from this figure because the World Bank did not have data on these countries' exports-to-GDP ratio in 2001.
Sources: Carmen M. Reinhart, Kenneth S. Rogoff, & Miguel A. Savansto, Addicted to Dollars, NBER Working Paper 10015, October 2003, at Table 4; World Bank, World Development Indicators Database (*available at* http://devdata.worldbank.org/data-query/).

Figure 8D: CDDD-to-Private Credit Ratio vs.
Exports-to-GDP Ratio



Note: Lao, Nicaragua, and Bosnia & Herzegovina are excluded from this figure because the World Bank did not have data on these countries' exports-to-GDP ratio in 2001. In addition, Ghana, Tajikstan, Congo DR, El Salvador, and Turkmenistan are excluded from the graph because the IMF did not have data on these countries' private credit, or because the BIS did not have data on at least one component of CDDD for these countries.

Sources: International Monetary Fund, International Financial Statistics Yearbook (2002); World Bank, World Development Indicators Database (*available at* http://devdata.worldbank.org/data-query/); Bank for International Settlements, Consolidated Banking Statistics (Table 9A) and Securities Statistics (Table 12C) (*available at* http://www.bis.org/statistics/index.htm).

Figure 9: Mexico's Nominal Exchange Rate
June 1994 – December 1996

Source: Economatica.

Table 1: Degrees of Dollarization for Reinhart-Rogoff-Savastano's Sixteen Highest Dollarized Countries

Country	Reinhart-Rogoff-Savastano Composite Index Level: 1996-2001 (Rank)		CDDD / Private Credit: 2001 (Rank)		Exports / GDP: 2001 (Rank)	
Ecuador	25	(1)	1.123	(11)	0.267	(10)
Bolivia	22	(2)	1.124	(10)	0.183	(13)
Uruguay	21	(3)	1.104	(14)	0.187	(12)
Argentina	20	(4)	1.518	(6)	0.114	(16)
Bulgaria	19	(5)	1.117	(12)	0.557	(3)
Lao	17	(6)	1.088	(15)	N/A	N/A
Nicaragua	17	(6)	1.106	(13)	N/A	N/A
Angola	16	(8)	10.611	(1)	0.745	(1)
Peru	16	(8)	1.365	(8)	0.158	(14)
Cambodia	15	(10)	1.445	(7)	0.532	(4)
Paraguay	15	(10)	0.864	(17)	0.245	(11)
Guinea-Bissau	14	(12)	1.839	(4)	0.407	(6)
Lebanon	14	(12)	1.157	(9)	0.143	(15)
Mozambique	14	(12)	5.275	(2)	0.283	(8)
São Tomé & Príncipe	14	(12)	4.381	(3)	0.381	(7)
Zambia	14	(12)	0.583	(18)	0.271	(9)

Note: Corporate Dollar-Denominated Debt (CDDD) is equal to the sum of 1) consolidated claims of reporting foreign banks on the non-bank private sector of individual countries, 2) international debt securities by corporate issuers, and 3) the difference between the nation's total private credit and local currency claims on local residents. Private credit is converted to U.S. dollars using the end-of-2001 exchange rate.

Sources: Carmen M. Reinhart, Kenneth S. Rogoff, and Miguel A. Savastano, Addicted to Dollars, NBER Working Paper 10015, October 2003, at Table 4 (attached as Exhibit D-10); International Monetary Fund, International Financial Statistics Yearbook (2002); World Bank, World Development Indicators Database (*available at* http://devdata.worldbank.org/data-query/); Bank for International Settlements, Consolidated Banking Statistics (Table 9A) and Securities Statistics (Table 12C) (*available at* http://www.bis.org/statistics/index.htm).

Table 2: Description of Variables

Variable	Description
t	Year following devaluation (Argentina: t=2002; Mexico: t=1995). Likewise, I define the year preceding devaluation to be: t-1=2001 for Argentina, and t-1=1994 for Mexico.
S_t	Net revenue in year t, converted to U.S. dollars
SG_t	$\log(S_t) - \log(S_{t-1})$
$SG2y_t$	$\log(S_t + S_{t+1}) - \log(S_{t-1} + S_{t-2})$
I_t	Capital expenditures in year t, converted to U.S. dollars
K_t	Plant, property, and equipment as of December 31 in year t, converted to U.S. dollars
IKR_t	I_t / K_{t-1}
$IKR2y_t$	$(I_t + I_{t+1}) / K_{t-1}$
ARG	Argentina dummy variable: equal to 1 if the firm is Argentine, 0 otherwise
TR	Tradable dummy: equal to 1 if the firm is in a tradable sector, 0 otherwise
A_t	Total assets as of December 31 in year t, converted to U.S. dollars
$EBITDA_t$	Earnings before interest, taxes, depreciation & amortization in year t, converted to U.S. dollars
DDA_{t-1}	Ratio of dollar-denominated liabilities to total assets on December 31 in year t-1
EAR_t	$(EBITDA_t - EBITDA_{t-1}) / A_{t-1}$
$EAR2y_t$	$(EBITDA_t + EBITDA_{t+1} - EBITDA_{t-1} - EBITDA_{t-2}) / A_{t-1}$
KSR_t	K_t / S_t

Note: I convert all financial data to real 1999 U.S. dollars using December-to-December changes in the country's consumer price index and the exchange rate for December 31, 1999. I define a firm as "tradable" if its 2-digit NAICS code is 11 (Agriculture, Forestry, Fishing, and Hunting), 21 (Mining), or 31-33 (Manufacturing). I exclude firms with NAICS codes 52 (Finance and Insurance), 531 (Real Estate), or 55 (Management of Companies and Enterprises) from my analyses. I define all other firms as "non-tradable."

Table 3: Mean Ratio of Capital Expenditures to Plant, Property, and Equipment in the Year Following Devaluation (IKR_T):
Argentina (2002) & Mexico (1995)

	Non-Tradable Firms			Tradable Firms					
Argentina	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0353	11	0.0366	0.0728	13	0.1218	-0.0375	-1.0554	0.1543
Low-Dollar Debt Firms	0.0706	9	0.0804	0.0956	17	0.0996	-0.0250	-0.6929	0.2482
Dif	-0.0353			-0.0227					
T-Stat	-1.2160			-0.5476					
Pr(Dif ≥ 0)	0.1251			0.2946					
	Non-Tradable Firms			Tradable Firms					
Mexico	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0295	7	0.0357	0.0750	23	0.0918	-0.0455	-1.9426	0.0315
Low-Dollar Debt Firms	0.0875	28	0.1173	0.0670	25	0.0571	0.0205	0.8226	0.7922
Dif	-0.0580			0.0080					
T-Stat	-2.2348			0.3594					
Pr(Dif ≥ 0)	0.0163			0.6393					

Note: In my analyses of Economatica data, the term "dollar-denominated" refers to any item denominated in foreign currencies because Economatica does not provide dollar-specific information. Dollar-denominated debt is defined as foreign currency-denominated liabilities of all kinds. I define a firm as a "high-dollar debt" firm if the ratio of its dollar-denominated liabilities to its total assets on December 31 in the year preceding devaluation is greater than or equal to 35 percent. I exclude all firms for which dollar-denominated liabilities were not available for the year preceding devaluation, as well as any firms with dollar-denominated liabilities that exceeded total liabilities. I use consolidated financial data if dollar-denominated liabilities are available on the firm's consolidated balance sheet in the year preceding devaluation; otherwise I use non-consolidated data if dollar-denominated liabilities are available on the firm's non-consolidated balance sheet in the year preceding devaluation. I convert all data to real 1999 U.S. dollars using December-to-December changes in the country's consumer price index and the exchange rate for December 31, 1999. I exclude one outlier Mexican firm from all of my analyses. This firm's value of $SG2y_t$ was -5.37, which implies a revenue decline of 99.5 percent from 1993-94 to 1995-96. T-statistics are calculated assuming unequal variances.
Source: Economatica.

Table 4: Mean Ratio of Capital Expenditures to Plant, Property, and Equipment in the Two Years Following Devaluation ($IKR2Y_T$): Argentina (2002-03) & Mexico (1995-96)

	Non-Tradable Firms			Tradable Firms					
Argentina	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0724	6	0.0959	0.1817	7	0.1579	-0.1092	-1.5305	0.0784
Low-Dollar Debt Firms	0.0644	5	0.0397	0.2155	7	0.1537	-0.1511	-2.4875	0.0207
Dif	0.0080			-0.0339					
T-Stat	0.1862			-0.4069					
Pr(Dif ≥ 0)	0.5712			0.3456					
	Non-Tradable Firms			Tradable Firms					
Mexico	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0711	7	0.0669	0.1460	23	0.1460	-0.0749	-1.8919	0.0356
Low-Dollar Debt Firms	0.1625	28	0.2141	0.1224	25	0.0893	0.0401	0.9075	0.8150
Dif	-0.0914			0.0236					
T-Stat	-1.9155			0.6695					
Pr(Dif ≥ 0)	0.0324			0.7463					

Note: See Note for Table 3.
Source: Economatica.

Table 5: Mean Log Difference in Revenues in the Year Following Devaluation (SG_T): Argentina (2002) & Mexico (1995)

	Non-Tradable Firms			Tradable Firms					
Argentina	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	-0.0494	11	0.2418	0.1642	12	0.6319	-0.2136	-1.0871	0.1474
Low-Dollar Debt Firms	-0.2008	9	0.3560	0.3385	18	0.4697	-0.5394	-3.3234	0.0016
Dif	0.1515			-0.1743					
T-Stat	1.0876			-0.8169					
Pr(Dif ≥ 0)	0.8522			0.2121					
	Non-Tradable Firms			Tradable Firms					
Mexico	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	-0.1994	7	0.3497	-0.1589	23	0.3128	-0.0404	-0.2742	0.3950
Low-Dollar Debt Firms	-0.6014	28	0.3513	-0.2400	25	0.2430	-0.3614	-4.3921	0.0000
Dif	0.4020			0.0811					
T-Stat	2.7181			0.9969					
Pr(Dif ≥ 0)	0.9885			0.8377					

Note: See Note for Table 3.
Source: Economatica.

Table 6: Mean Log Difference in Revenues in the
Two Years Following Devaluation ($SG2Y_T$):
Argentina (2002-03) & Mexico (1995-96)

	Non-Tradable Firms			Tradable Firms					
Argentina	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	-0.1289	11	0.3011	0.1058	12	0.7165	-0.2347	-1.0391	0.1576
Low-Dollar Debt Firms	-0.2238	8	0.1843	0.3936	14	0.3891	-0.6174	-5.0312	0.0000
Dif	0.0948			-0.2878					
T-Stat	0.8488			-1.2433					
Pr(Dif ≥ 0)	0.7960			0.1156					
	Non-Tradable Firms			Tradable Firms					
Mexico	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	-0.1258	7	0.3088	0.0707	22	0.3226	-0.1965	-1.4503	0.0880
Low-Dollar Debt Firms	-0.3949	28	0.3786	0.0002	25	0.2606	-0.3950	-4.4626	0.0000
Dif	0.2691			0.0705					
T-Stat	1.9654			0.8170					
Pr(Dif ≥ 0)	0.9625			0.7906					

Note: See Note for Table 3.
Source: Economatica.

Table 7: Mean Earnings Growth in the Year Following Devaluation (EAR_T): Argentina (2002) & Mexico (1995)

	Non-Tradable Firms			Tradable Firms					
Argentina	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	-0.0237	11	0.0799	0.1067	12	0.2077	-0.1304	-2.0184	0.0313
Low-Dollar Debt Firms	-0.0306	9	0.0351	0.1021	18	0.1701	-0.1327	-3.1765	0.0024
Dif	0.0068			0.0046					
T-Stat	0.2558			0.0637					
Pr(Dif ≥ 0)	0.5991			0.5251					
	Non-Tradable Firms			Tradable Firms					
Mexico	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0127	7	0.0468	0.0106	23	0.0459	0.0021	0.1039	0.5403
Low-Dollar Debt Firms	-0.0512	28	0.0438	-0.0097	25	0.0656	-0.0414	-2.6710	0.0054
Dif	0.0639			0.0204					
T-Stat	3.2715			1.2553					
Pr(Dif ≥ 0)	0.9950			0.8919					

Note: See Note for Table 3.
Source: Economatica.

Table 8: Mean Earnings Growth in the Two Years Following Devaluation ($EAR2Y_T$): Argentina (2002-03) & Mexico (1995-96)

	Non-Tradable Firms			Tradable Firms					
Argentina	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	-0.0197	6	0.1670	0.3452	6	0.3459	-0.3649	-2.3270	0.0259
Low-Dollar Debt Firms	-0.0818	7	0.0380	0.2565	9	0.2914	-0.3384	-3.4453	0.0041
Dif	0.0621			0.0886					
T-Stat	0.8917			0.5172					
Pr(Dif ≥ 0)	0.7949			0.6916					
	Non-Tradable Firms			Tradable Firms					
Mexico	Mean	Firms	Std. Dev	Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0525	7	0.1295	0.0534	22	0.0916	-0.0009	-0.0178	0.4931
Low-Dollar Debt Firms	-0.0668	27	0.0867	0.0273	25	0.1068	-0.0940	-3.4678	0.0006
Dif	0.1192			0.0262					
T-Stat	2.3055			0.9040					
Pr(Dif ≥ 0)	0.9738			0.8146					

Note: See Note for Table 3.
Source: Economatica.

Table 9: OLS Regression Statistics for Ratio of Capital Expenditures to Plant, Property, and Equipment in the Year Following Devaluation (IKR_T):
Argentina (2002) & Mexico (1995)

Independent Variables	Specification 1		Specification 2	
	Coefficient (Std. Error)	T-Stat P>|t|	Coefficient (Std. Error)	T-Stat P>|t|
IKR_{t-1}	0.0523 (0.0170)	3.08 0.003	0.0540 (0.0173)	3.12 0.002
SG_t	0.0156 (0.0199)	0.78 0.437	0.0137 (0.0201)	0.68 0.497
ARG	-0.0313 (0.0361)	-0.87 0.388	-0.0844 (0.0510)	-1.65 0.101
TR	-0.0102 (0.0201)	-0.51 0.613	-0.0382 (0.0313)	-1.22 0.225
DDA_{t-1}	-0.0680 (0.0500)	-1.36 0.176	-0.1449 (0.0809)	-1.79 0.076
TR x ARG	0.0496 (0.0314)	1.58 0.116	0.1327 (0.0626)	2.12 0.036
DDA_{t-1} x ARG	0.0423 (0.0788)	0.54 0.592	0.2192 (0.1346)	1.63 0.106
TR x DDA_{t-1}			0.1242 (0.1029)	1.21 0.230
TR x DDA_{t-1} x ARG			-0.2684 (0.1638)	-1.64 0.104
Constant	0.0790 (0.0212)	3.73 0.000	0.0924 (0.0252)	3.67 0.000
Regression Statistics				
Observations	130		130	
R^2	0.1138		0.1337	
Adjusted R^2	0.0630		0.0687	
Root MSE	0.0833		0.0830	

Note: See Note for Table 3.
Source: Economatica.

Table 10: OLS Regression Statistics for Ratio of Capital Expenditures to Plant, Property, and Equipment in the Two Years Following Devaluation ($IKR2Y_T$): Argentina (2002-03) & Mexico (1995-96)

Independent Variables	Specification 1		Specification 2	
	Coefficient (Std. Error)	T-Stat P>|t|	Coefficient (Std. Error)	T-Stat P>|t|
IKR_{t-1}	0.1788 (0.0384)	4.66 0.000	0.1710 (0.0388)	4.41 0.000
$SG2y_t$	0.0762 (0.0343)	2.22 0.029	0.0774 (0.0345)	2.24 0.027
ARG	-0.0529 (0.0781)	-0.68 0.500	-0.0962 (0.1249)	-0.77 0.443
TR	-0.0321 (0.0316)	-1.01 0.314	-0.0830 (0.0486)	-1.71 0.091
DDA_{t-1}	-0.1464 (0.0759)	-1.93 0.057	-0.2810 (0.1232)	-2.28 0.025
TR x ARG	0.1338 (0.0620)	2.16 0.033	0.2039 (0.1467)	1.39 0.168
DDA_{t-1} x ARG	0.1140 (0.1721)	0.66 0.509	0.2869 (0.3157)	0.91 0.366
TR x DDA_{t-1}			0.2183 (0.1573)	1.39 0.169
TR x DDA_{t-1} x ARG			-0.2702 (0.3768)	-0.72 0.475
Constant	0.1363 (0.0320)	4.26 0.000	0.1657 (0.0385)	4.31 0.000
Regression Statistics				
Observations	104		104	
R^2	0.2931		0.3074	
Adjusted R^2	0.2415		0.2411	
Root MSE	0.1263		0.1263	

Note: See Note for Table 3.
Source: Economatica.

Table 11: Cumulative Raw & Abnormal Returns of Argentine Stocks Over the Five-Day Trading Window Around the Redenomination Announcement:
January 30 – February 7, 2002

Raw Returns	Non-Tradable Firms Mean	Firms	Std. Dev	Tradable Firms Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0941	6	0.0366	0.2757	9	0.1261	-0.1815	-4.0703	0.0011
Low-Dollar Debt Firms	0.0158	3	0.0353	0.1577	11	0.1012	-0.1419	-3.8683	0.0014
Dif	0.0784			0.1180					
T-Stat	3.1004			2.2715					
Pr(Dif ≤ 0)	0.0167			0.0190					
Abnormal Returns	Non-Tradable Firms Mean	Firms	Std. Dev	Tradable Firms Mean	Firms	Std. Dev	Dif	T-Stat	Pr(Dif ≥ 0)
High-Dollar Debt Firms	0.0500	6	0.0878	0.2421	9	0.1510	-0.1921	-3.1088	0.0042
Low-Dollar Debt Firms	0.0105	3	0.0295	0.0617	11	0.1283	-0.0511	-1.2105	0.1247
Dif	0.0395			0.1804					
T-Stat	0.9943			2.8420					
Pr(Dif ≤ 0)	0.1774			0.0059					

Note: See Note for Table 3. The cumulative raw return for stock *i* is equal to:

$$CRR_i = \sum_{t=1}^{5} r_{i,t} ,$$

where $r_{i,t}$ is the daily return for stock *i* on day *t*, defined as the percentage change in closing prices from the previous day, or:

$$r_{i,t} = \frac{p_{i,t} - p_{i,t-1}}{p_{i,t-1}} .$$

Before calculating any returns, I convert all closing stock prices to U.S. dollars using the exchange rate for that day. Not all stocks trade every day. When calculating cumulative raw returns, I set the closing stock price for a day with no trades equal to the most recent closing price preceding that day. I only calculate cumulative raw or abnormal returns for a stock if it traded on at least one day in the first half of the window (January 30-February 1), before the announcement of redenomination of all dollar-denominated debt, and on at least one day in the second half of the window (February 6-7), after the announcement of redenomination of all dollar-denominated debt.

Before calculating cumulative abnormal returns, I estimated regression coefficients for each stock using the market model:

$$wr_{i,t} = \beta_{0,i} + \beta_{1,i} wr_{MERVAL,t} + \varepsilon_{i,t} ,$$

where $wr_{i,t}$ is the weekly return for stock *i* and the $wr_{MERVAL,t}$ is the weekly return of the MERVAL stock index on week *t*. I estimate the market model for each Argentine stock in my sample over the 52 weeks from December 8, 2000, to November 30, 2001. I only calculated $wr_{i,t}$ if the stock traded both in week *t* and in the preceding week *t*-1. The cumulative abnormal return for stock *i* in the event window is defined as:

$$CAR_i = \sum_{t=1}^{5} abr_{i,t} \ ,$$

where $abr_{i,t}$ is the abnormal return on day t, or

$$abr_{i,t} = r_{i,t} - \left(\beta_{0,i} + \left(0.6\beta_{1,i} + 0.4 \right) r_{MERVAL,t} \right).$$

As the abnormal return equation shows, I normalized the beta coefficients to 1 before estimating predicted returns. If a stock did not trade on day t in the event window, though, I set $abr_{i,t}$ equal to 0. I did not estimate cumulative raw or abnormal returns for stocks with fewer than 10 weekly returns in the market model estimation period. T-statistics are estimated assuming unequal variances.

Source: Economatica.

Table 12: OLS Regression Statistics for Cumulative Raw & Abnormal Returns of Argentine Stocks Over the Five-Day Trading Window Around the Redenomination Announcement: January 30 – February 7, 2002

Independent Variables	**Dependent Variable**			
	Cumulative Raw Returns		Cumulative Abnormal Returns	
	Coefficient (Std. Error)	T-Stat P>|t|	Coefficient (Std. Error)	T-Stat P>|t|
TR	0.1561 (0.0409)	3.82 0.001	0.1249 (0.0528)	2.37 0.026
DDA_{t-1}	0.2447 (0.1051)	2.33 0.028	0.3473 (0.1356)	2.56 0.017
Constant	-0.0255 (0.0524)	-0.49 0.631	-0.0959 (0.0676)	-1.42 0.168
Regression Statistics				
Observations	29		29	
R^2	0.4070		0.2912	
Adjusted R^2	0.3613		0.2367	
Root MSE	0.1009		0.1301	

Table 13: Argentine and Mexican Firms in the Investment and Event Study Regression Samples Defined as Utilities (Subject to Redenominated Tariffs) or as High-Energy Consumers

Company Name	Included in Event Study Regression Sample?
Utilities	
Camuzzi Gas Pamp. ORD	No
Distr Gas Cuyana ORD	No
Edenor ORD	No
Edesur ORD	No
Gas Natural BAN ORD	No
Metrogas ORD	Yes
Transener ORD	Yes
Transp Gas Sur ORD	Yes
Transp Gas de Norte ORD	No
High-Energy Consumers	
Acindar ORD	Yes
Aluar ORD	Yes
Atanor ORD	Yes
Massuh ORD	No
Quim Estrella ORD	No
Rosenbusch ORD	Yes
Siderar ORD	Yes
Siderca ORD	Yes
Solvay Indupa ORD	Yes

Note: I define a firm as a high-energy consumer if its 3-digit NAICS code is 322 (Paper), 324 (Petroleum & Coal Products), 325 (Chemicals), or 331 (Primary Metals). These four industries were the top manufacturing consumers of energy in 1998 in the United States according to the U.S. Department of Energy (*see* http://www.eia.doe.gov/emeu/aer/txt/ptb0203.html). I define an Argentine firm as a "utility" for the purposes of the regressions if its 2-digit NAICS code is 22 (Utilities) *and* if it was subject to the tariffs being redenominated into pesos. Two Argentine firms, Central Costanera ORD and Central Puerto ORD, are classified with the Utilities NAICS code in Economatica, but I do not assign them the "utility" dummy variable in the regressions because they were not subject to tariffs that were redenominated into pesos.
Source: Economatica.

Table 14: OLS Regression Statistics for Ratio of Capital Expenditures to Plant, Property, and Equipment in the Year Following Devaluation (IKR_T):
Argentina (2002) & Mexico (1995)

Independent Variables	Specification 1		Specification 2	
	Coefficient (Std. Error)	T-Stat P>|t|	Coefficient (Std. Error)	T-Stat P>|t|
IKR_{t-1}	0.0516 (0.0173)	2.97 0.004	0.0537 (0.0180)	2.99 0.003
SG_t	0.0073 (0.0205)	0.36 0.721	0.0058 (0.0207)	0.28 0.781
ARG	-0.0177 (0.0417)	-0.43 0.671	-0.0710 (0.0597)	-1.19 0.237
TR	-0.0078 (0.0200)	-0.39 0.700	-0.0355 (0.0312)	-1.13 0.259
DDA_{t-1}	-0.0664 (0.0497)	-1.34 0.184	-0.1425 (0.0806)	-1.77 0.080
TR x ARG	0.0209 (0.0376)	0.56 0.579	0.1016 (0.0713)	1.43 0.156
DDA_{t-1} x ARG	0.0421 (0.0793)	0.53 0.596	0.2080 (0.1388)	1.50 0.136
TR x DDA_{t-1}			0.1227 (0.1025)	1.20 0.234
TR x DDA_{t-1} x ARG			-0.2489 (0.1667)	-1.49 0.138
Utility x ARG	-0.0233 (0.0386)	-0.60 0.548	-0.0140 (0.0401)	-0.35 0.727
HighEnergy x ARG	0.0592 (0.0348)	1.70 0.091	0.0581 (0.0348)	1.67 0.097
Constant	0.0747 (0.0214)	3.49 0.001	0.0879 (0.0255)	3.45 0.001
Regression Statistics				
Observations	130		130	
R^2	0.1378		0.1549	
Adjusted R^2	0.0731		0.0761	
Root MSE	0.0828		0.0827	

Note: See Notes for Tables 3 and 13.
Source: Economatica.

Table 15: OLS Regression Statistics for Ratio of Capital Expenditures to Plant, Property, and Equipment in the Two Years Following Devaluation ($IKR2Y_T$): Argentina (2002-03) & Mexico (1995-96)

Independent Variables	Specification 1		Specification 2	
	Coefficient (Std. Error)	T-Stat P>|t|	Coefficient (Std. Error)	T-Stat P>|t|
IKR_{t-1}	0.1778 (0.0388)	4.58 0.000	0.1701 (0.0392)	4.34 0.000
$SG2y_t$	0.0779 (0.0350)	2.23 0.028	0.0797 (0.0353)	2.26 0.026
ARG	-0.0325 (0.0932)	-0.35 0.728	-0.0639 (0.1481)	-0.43 0.667
TR	-0.0327 (0.0320)	-1.02 0.309	-0.0841 (0.0491)	-1.71 0.090
DDA_{t-1}	-0.1466 (0.0766)	-1.91 0.059	-0.2817 (0.1244)	-2.26 0.026
TR x ARG	0.1234 (0.0818)	1.51 0.135	0.1779 (0.1700)	1.05 0.298
DDA_{t-1} x ARG	0.1063 (0.1756)	0.61 0.546	0.2486 (0.3317)	0.75 0.455
TR x DDA_{t-1}			0.2190 (0.1588)	1.38 0.171
TR x DDA_{t-1} x ARG			-0.2275 (0.3920)	-0.58 0.563
Utility x ARG	-0.0358 (0.0817)	-0.44 0.662	-0.0358 (0.0848)	-0.42 0.674
HighEnergy x ARG	-0.0192 (0.0755)	-0.25 0.800	-0.0203 (0.0756)	-0.27 0.789
Constant	0.1373 (0.0324)	4.23 0.000	0.1669 (0.0389)	4.29 0.000
Regression Statistics				
Observations	104		104	
R^2	0.2950		0.3093	
Adjusted R^2	0.2275		0.2267	
Root MSE	0.1274		0.1275	

Note: See Notes for Tables 3 and 13.
Source: Economatica.

Table 16: OLS Regression Statistics for Cumulative Raw & Abnormal Returns of Argentine Stocks Over the Five-Day Trading Window Around the Devaluation Announcement: January 2 – January 18, 2002

	Dependent Variable			
	Cumulative Raw Returns		Cumulative Abnormal Returns	
Independent Variables	Coefficient (Std. Error)	T-Stat P>|t|	Coefficient (Std. Error)	T-Stat P>|t|
TR	0.2857 (0.1584)	1.80 0.086	0.3518 (0.1695)	2.08 0.051
DDA_{t-1}	0.3566 (0.3271)	1.09 0.289	0.2074 (0.3500)	0.59 0.560
Utility	-0.1484 (0.2141)	-0.69 0.496	-0.1158 (0.2291)	-0.51 0.619
HighEnergy	0.1718 (0.1423)	1.21 0.241	0.0873 (0.1522)	0.57 0.573
Constant	-0.0844 (0.1743)	-0.48 0.634	0.0717 (0.1865)	0.38 0.705
Regression Statistics				
Observations	25		25	
R^2	0.3841		0.3475	
Adjusted R^2	0.2610		0.2170	
Root MSE	0.2886		0.3088	

Note: See Note for Table 11. The calculation of returns is the same as in the window around the redenomination announcement. The same restrictions to the sample of firms included in the regression also apply to the devaluation window. The first half of this five-day trading window is January 2-4, and the second half of the window is January 17-18. No Argentine stocks traded from January 5 through January 16.

Table 17: OLS Regression Statistics for Cumulative Raw & Abnormal Returns of Argentine Stocks Over the Five-Day Trading Window Around the Redenomination Announcement: January 30 – February 7, 2002

Independent Variables	**Dependent Variable**			
	Cumulative Raw Returns		Cumulative Abnormal Returns	
	Coefficient (Std. Error)	T-Stat P>|t|	Coefficient (Std. Error)	T-Stat P>|t|
TR	0.1168 (0.0478)	2.44 0.022	0.0659 (0.0622)	1.06 0.300
DDA_{t-1}	0.2597 (0.1031)	2.52 0.019	0.3780 (0.1342)	2.82 0.010
Utility	-0.0237 (0.0699)	-0.34 0.737	-0.0731 (0.0910)	-0.80 0.430
HighEnergy	0.0919 (0.0455)	2.02 0.055	0.1039 (0.0591)	1.76 0.092
Constant	-0.0233 (0.0526)	-0.44 0.662	-0.0832 (0.0685)	-1.21 0.236
Regression Statistics				
Observations	29		29	
R^2	0.4951		0.3860	
Adjusted R^2	0.4109		0.2837	
Root MSE	0.0970		0.1261	