Default, Devaluation and Depression: Argentina after 2001

PRELIMINARY DRAFT

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Abstract

The currency board system as it operated in Argentina was very successful in reducing inflation below zero; but, as Krueger and Fisher (2003) ruefully observe, "the combination of a highly dollarized banking system and a rigid exchange rate regime can result in vulnerabilities that are difficult to manage".

The collapse of the currency peg and debt default have been blamed on the progressive loss of competitiveness of the Argentine economy over the decade when its currency was tied to the US dollar, and on growing doubts about long run fiscal sustainability, which together led to a "sudden stop" in the external finance, Gerchunoff and Llach (2003), Mussa(2002), Calvo et al (2002). But this was a 'twin crisis', with the banking system playing a crucial role in precipitating and propagating economic collapse. The 'crowding out' of private borrowers by the public sector had left the banking system heavily exposed to the sovereign's unsustainable debt; and the subsequent bank runs of 2001 - leading to the imposition of the "corralito" in December of that year - meant that the private sector was finally starved of the credit needed to keep business alive, Blejer (2003) and Sturzenegger(2003).

Given the precipitate fall of the peso, it was almost inevitable that, when Eduardo Duhalde was appointed as the new president in 2002, there would be a write-down of bank assets and liabilities in dollars, i.e. some 'pesification' of their balance sheets. But what no one predicted was an *asymmetric* pesification (AP) in which dollar deposits were converted to pesos at the rate of 1:1.4, but dollar loans converted to pesos one to one, an arrangement that rendered the banks insolvent, the only plausible reason for which was the government's desire to privilege the loan customers of the banks, Sturzenegger(2003). (After pressure from the IMF and the resistance of the banks, however, the government issued new bonds to cover the financial losses gap generated by the asymmetric write-down.)

The authors cited above provide us with a graphic history of these events, their causes and dire consequences - nothing less than an Argentine Great Depression, with constant price GDP falling by a greater percentage than in 1931, investment falling by more than a third and a halving of imports (Ministerio de Economía, 2003). Our aim in this paper is to provide a consistent framework of analysis, which includes some but not all of the key features. To capture the adverse impact of high interest rates and devaluation on the on the supply side of the economy via the balance sheet effects on businesses and banks, we adopt the approach developed by Aghion et al (2000, 2001) and adapt it to fit the Argentine experience. We use it to show first how pesification can, in principle, mitigate adverse balance sheet effects[1] ; but how, mishandled, it can plunge the economy into chaos.

Finally, going beyond the positive economics of the macro-model, we offer a simple game theoretic explanation of why the ill-starred initiative of robbing Peter (the banks) to pay Paul (loan customers) was pursued. Lastly we discuss the positive impact of the debt restructuring now under negotiation.

¿Por qué cayó la Argentina en la mayor crisis económica de su historia? ¿Por qué acabó tan catastróficamente un sistema monetario que en el algún momento había despertado los mayores elogios y un apoyo popular que se prolongó hasta su final?[2]

Gerchunoff and Llach (2003)

[1] although the contractual structure was so dollarised that this would have difficult, Heymann (2002).

[2] Why has Argentina collapsed in the worst economic crisis in its history? What brought to such a catastrophic end a monetary system that had attracted great praise and enjoyed popular support until the last moment?

Introduction

In eliminating price inflation, the currency board system operated in Argentina proved extraordinarily successful; but, as Krueger and Fisher (2003) ruefully observe, “the combination of a highly dollarized banking system and a rigid exchange rate regime can result in vulnerabilities that are difficult to manage”.

Blame for the end of the currency peg and debt default has been attributed to the progressive loss of competitiveness of the Argentine economy over the decade when its currency was tied to the US dollar, and on growing doubts about long run fiscal sustainability, which together led to a “sudden stop” in the external finance, Gerchunoff and Llach (2003), Mussa(2002), Calvo et al (2002). But the end of the dollar peg did not simply involve a delayed devaluation; it took the form of a ‘twin crisis’ in which a banking system heavily exposed to the sovereign’s unsustainable debt played a central role in precipitating and propagating economic contraction, Blejer (2003) and Sturzenegger(2003). The insolvency of the entire banking system was, perhaps, the crucial element in accounting for the depth of the collapse.

It was inevitable and appropriate that, when Eduardo Duhalde was appointed as president in 2002 and the peso lost almost half its value in terms of the dollar, there should be a write-down of bank assets and liabilities in dollars, i.e. some ‘pesification’ of their balance sheets. What no one predicted was an *asymmetric* pesification - in which dollar deposits were converted to pesos at the rate of 1 to1.4 and dollar loans converted to pesos one to one – enough to wipe out the capital of the banking system even before taking account of the writedown of bank holdings of sovereign dollar denominated debt. Thanks to this enforced ‘de-dollarisation’, banks which had been long the US dollar suddenly found themselves unhedged, so the fall of the peso rendered them insolvent and brought the financial system to a halt.

If the actual process of pesification was to prove so disastrous, why was it chosen? The only plausible reason for the asymmetry was the government’s desire to privilege the loan customers of the banks, Sturzenegger(2003). (After pressure from the IMF and the resistance of the banks, the government has - belatedly - issued new bonds to recapitalise the banks.)

The authors cited above provide us with a graphic history of these events, their causes and dire consequences, involving nothing less than an Argentine Great

Depression. Our aim in this paper is first to provide an account of the implications of devaluation-with-pesification on bank balance sheets; and then to incorporate this in a consistent framework of analysis, which includes other key features, particularly the severe effects of the falling peso corporate balance sheets. After describing how the enforced pesification of the banks can – and did - lead to insolvency, we therefore turn to 'third generation' macroeconomic models of crisis to show how this can produce a catastrophic collapse of the economy as a whole. To capture the adverse impact of high interest rates and devaluation on the on the supply side of the economy via the balance sheet effects on businesses and banks, we adopt the approach developed by Aghion et al (2000, 2001) and adapt it to fit the Argentine experience. We use it to show first how pesification can, in principle, mitigate adverse balance sheet effects[3] ; but how, mishandled, it can plunge the economy into chaos. Finally, going beyond the positive economics of the macro-model, we offer a simple game theoretic explanation of why the ill-starred initiative of robbing Peter (the banks) to pay Paul (loan customers) was pursued. Lastly we discuss the positive impact of the debt restructuring now under negotiation.

Bankrupting of the banking system

To see how a collapse of the dollar can easily lead to banking collapse, we examine the impact of the rising price of the dollar on the net worth of the banking sector under three assumptions. As a baseline, we note that if there is no interference with bank portfolios - which were long the US dollar in 2001 - bank net worth *rises* as the peso falls. Second, we consider the case of *asymmetric pesification* (AP) with a conversion rate for loans of one to one and for deposits of one dollar to1.4 pesos, then there is a loss of net worth: at s =1.4 for example banks will lose the 0.4/1.4 of the value of their dollar lending to the private sector. Last of all we add the assumption that the *government pesifies* banks holdings of its own dollar debt (at the same rate rate of one-to one enjoyed by loan customers).

Bank net worth in these three cases is given by equations (1) to (3) below,

$N= E (B+X+L-D) + P$ With no interference (1)

[3] although the contractual structure was so dollarised that this would have difficult, Heymann (2002).

N’ = E (B+X)+L-$\overline{S}$ D + P With AP (2)

N’’ = B+E X+L-$\overline{S}$ D + P With AP + Default (3)

using the notation:

N= Net Worth of banks
E = Pesos per dollar
B= Dollar denominated sovereign bonds held by Banks
X= Net external dollar balance for the banks (negative in this case)
L= dollar denominated loans
D= dollar denominated deposits
P=Net peso balance for the banks
$\overline{E}$ = rate of pesification for deposits

These three outcomes are shown as schedules in Figure 1, with the dollar value of the peso plotted on the horizontal axis. With the peso at one-to-one with the dollar, bank net worth is shown initially at R on the vertical axis; and, with banks long the dollar, this increases with the price of the dollar as shown by the schedule N. The effect of AP is to cut the banks net worth by 0.4L, so the Net worth schedule moves down to N’ in the figure. If, in addition, the Government pesifies the banks holdings of its own dollar debt then the banks are exposed to losses as the dollar rises in value and their net worth is shown as the downward-sloping schedule N’’(which intersects with N’ at s=1).

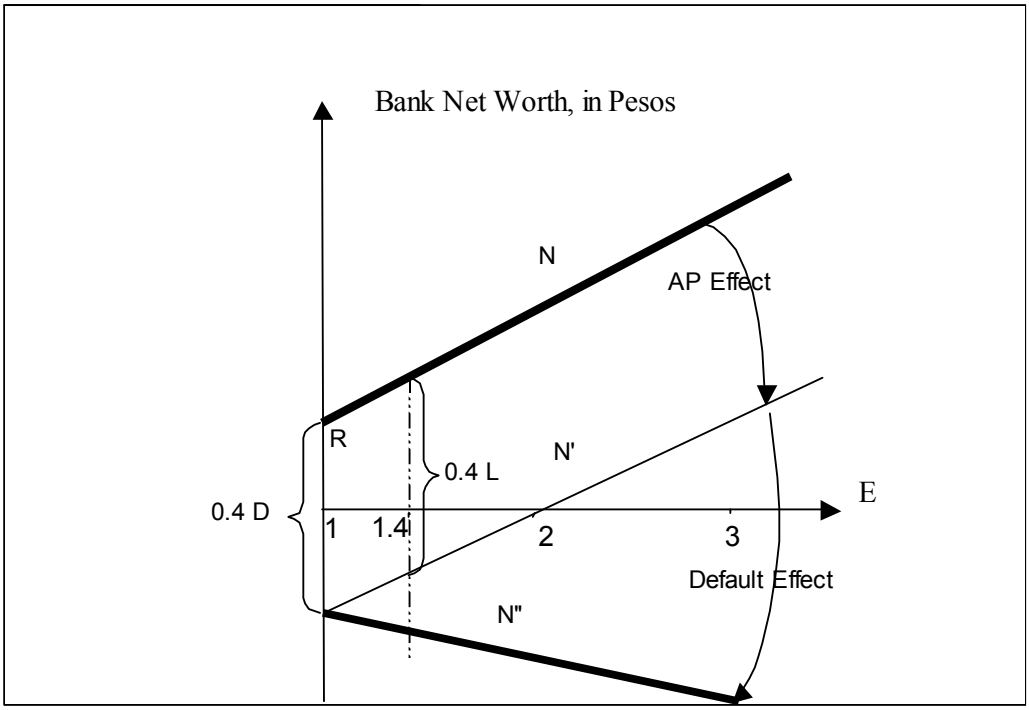

Figure 1. Bankrupting the banks

The potentially devastating impact these measures can have on bank net worth is clear from Figure 1. If the dollar had only risen to 1.4, asymmetric pesification is enough to make banks insolvent, even when the Government honours its bond contracts. If the government defaults on its bonds, net worth takes another hit and falls further; and, if the currency collapses further, the 'twin crises' set in with a vengeance.

To get some idea of the magnitude of the shock to the banking system that the process of pesification posed, consider the consolidated financial statement of December 2001 in Table 1. Note that the banking system had 21% of assets in dollar- denominated government bonds and a negative external dollar imbalance of 8%. Assuming AP (with the conversion for deposits at a dollar = 1.4 pesos and a conversion for loans at the rate of one to one) and that sovereign default decreases the market price of government bonds by 75% (as proposed recently in Dubai), one can compute the shock to bank solvency immediately after the financial collapse in which the dollar doubled in value to 2 pesos. From a healthy position, when capital and reserves of 15 bn pesos constituted 12% of assets, the situation is promptly transformed into one of insolvency as net worth falls by 41.4 bn pesos - a loss of 33% with respect to the 126 bn pesos total of assets in December 2001. How and

why this may trigger a further fall in the peso requires a model of exchange rate determination.

rates.

CONSOLIDATED FINANCIAL STATEMENTS IN bm PESOS

December 2001

		Assets	Liabilities			Assets	Liabilities
	Dollar	26.70	1.50		Dollar	21%	1%
Public	Pesos	3.40	4.50	**Public**	Pesos	3%	4%
	Dollar	39.10	44.10		Dollar	31%	35%
Private	Pesos	15.00	15.90	**Private**	Pesos	12%	13%
Exterior		6.50	16.30	**Exterior**		5%	13%
liquid		9.10		**liquid**		7%	
Loans granted by bcra			4.50	**Loans granted**			4%
Capital, reserves and net income			15.80	**reserves and net income**			12%
Others		26.70	23.90	**Otros**		21%	19%
		126.50	126.50			100%	100%

Gov. Default (loss of 75% against book value….)
AP 1-1.4 Loans at 1:1 and Deposits 1:1.4
Exchange rate 2

After collapse

		Assets	Liabilities	Loss in pesos	Loss in dollars
	Dollar	13.35	2.10	13.95	6.98
Public	Pesos	3.40	4.50		
	Dollar	39.10	61.74	17.64	8.82
Private	Pesos	15.00	15.90		
Exterior		13.00	32.60	9.80	4.90
liquid		9.10			
Loans granted by bcra			4.50		
Capital, reserves and net income			15.80		
Others		26.70	23.90		
		119.65	161.04	41.39	20.70

Table 1. Measuring the shock to bank net worth

Before turning to the analytical details of such a model, it may be as well to ask: why has precedent of Roosevelt in the 1933/4 apparently proved such a poor predictor of economic consequences for Argentina, where the process of pesification has crippled the banking sector and played a crucial role in propagating economic collapse? The action of President Roosevelt in cancelling the Gold Clause to stimulate America in the Great Depression has been adduced as a useful precedent for the pesification of Argentine debt, Hausmann (2001), Kroszner (2002) Miller

(2001); and de *facto* bank and sovereign debt either has been or is being[4] largely pesified. So what went wrong?

By *pesifying public debt* did Argentina make the mistake of going further than the US, as Sturtzenegger (2003,p.49[5]) suggests? Not according to Kroszner (1999) - the source cited by as Sturtzenegger for details of the Supreme Court decision - who says that all four suits to the Court for the restoration of the Gold Clause were rejected, both in respect of public and private debt. That is to say, America downgraded the gold value of public debt too. Presumably US banks in the 1930s also held Government paper: but when it was stripped of the Gold Clause, the banks merely lost an unanticipated capital gain. Likewise, although Argentine bank portfolios in 2001 included some 21% of government paper with a dollar guarantee, action taken by the government (partially) to pesify sovereign debt need not have carried immediate implications for bank solvency. If deposits and loans had been treated symmetrically, Argentine banks would gained from their net position in dollars as the peso fell, leaving some considerable margin for writing down their holdings of government debt[6].

The US Supreme Court decisions in 1933/4 were in fact restricted to long term bonds: *they did not involve bank loans*. But surely private loan customers could also benefit from some relief from the sudden increase in peso cost of dollar debts as the peso fell?True, but as in Argentina over a third of bank liabilities were dollarized, any action to pesify loans would necessarily put bank balance sheets at risk, *unless both were treated symmetrically*. (Dollar deposits were roughly matched by dollar loans, see Table 1.) Indeed there is good reason to believe that the balance sheet effects of symmetric pesification (at a common rate of 1.4 to one, for example) would have been positive, serving "to protect banks from devaluation, inasmuch as to have maintained deposits and loans in dollars would have made it very difficult to recover loans in sufficient volume to honour deposits" Sturtzenegger (2003, p.49).

We conclude that where the Argentine government did go much further than the US in the 1930s was in pesifying bank balance sheets and privileging loan customers (with at a conversion rate of one-to-one, much lower than the 1.4 offered to

[4] At Dubai, the Argentine government proposed a 75% write down of $100b of its sovereig debt, which amounts to approximate pesification.

[5] "Debts of the public sector had to be honoured in gold for it was unacceptably risky for the state, as the interested party, to be able unilaterally to diminish the value of its debts".

depositors) without regard to the resulting insolvency of the banks, a dangerous game of 'robbing Peter to pay Paul' which the government must surely regret (as it has to pay compensation to the banks in any case). Why the government chose to play this game, we try to explain below.

[6] But note that the risk of bankrupting the banks was, apparently, the rock on which plans by Cavallo to pesify government debt foundered.

1. Modifying the framework of Aghion et al.

As a preliminary to analysing development in Argentina in 2001/2002, we first outline the model of Aghion et al (2000), hereafter ABB, and indicate the formal modifications introduced to take account of high ex-ante country spread on sovereign debt, the "crowding-out" of tight fiscal policy in such circumstances and the beneficial impact of pesification on corporate dollar liabilities. We defer to the following section the discussion of the contractionary effect of the asymmetric pesification.

1.1. Outline of Aghion, Bacchetta and Banerjee Model (2000)

The two-period small open economy model proposed by Aghion et al (2000) assumes the following sequence of events in a single period. First, the price is preset according to ex ante PPP condition followed by investment made by firms. Second, there is monetary adjustment following an unanticipated shock. This determines the nominal interest rate and exchange rate for the current period. Third, firms' output and profits are realised. After debt repayment, a fraction of retained earnings will be invested in the next period.

The equilibrium can be determined jointly by the intersection of the so-called IPLM curve and the W curve. As its name suggests, the former is a combination of the Uncovered Interest Parity condition, the LM equation and the PPP condition for the second period. This yields

$$E_1 = \frac{1+i^*}{1+i_1}\frac{M_2^s}{L(Y_2,\bar{i}_2)} \tag{4}$$

where E_1 is the exchange rate for the first period, i^* is the foreign interest rate, i_1 and $\bar{i}_2$ are domestic interest rates for periods 1 and 2, M_2^S and Y_2 are money supply and output in period 2, and $L(Y_2,\bar{i}_2)$ is the money demand function. This IPLM curve is downward sloping in the E_1 and Y_2 space because higher output in the second period increases money demand (i.e., higher L given interest rate in period 2) and so strengthens the exchange rate (note M in period 2 is given).

The W-curve characterises the supply of output. The production function is assumed to be linear in capital stock (which depreciates completely at the end of the period).

The total investment for a given firm consists of last period retained earnings and borrowing (in terms of domestic and foreign currencies and with their fractions given exogenously) which is limited to a given fraction $\mu_t(i_{t-1})$ of the retained earnings. The introduction of $\mu_t(i_{t-1})$, the credit multiplier, (with $\mu_t' < 0$) captures credit market imperfection. The W-curve is specifically given by

$$Y_2 = \sigma\left[1 + \mu_2(i_1)\right](1-\alpha)\left[Y_1 - (1+r_0)D^c - (1+i^*)\frac{E_1}{P_1}(D_1 - D^c)\right] \quad (5)$$

where σ is the productivity parameter, α is the fraction of output consumed in each period, D_1 is the total level of borrowing in period 1, and D^c is its domestic currency component. The so constructed W-curve is a downward sloping straight line in E_1 and Y_2 space because currency depreciation increases firm's debt burden and reduces output. The above formulation also captures explicitly the balance sheet effect of the exchange rate. (Note that Y_2 is set to zero if the right hand side of (5) turns out to be negative.)

The equilibrium is given by the intersection between the IPLM curve and the W-curve. Figure 1 shows one possible equilibrium with the horizontal axis representing the second period output and the vertical the first period nominal exchange rate. In the absence of any shock, the equilibrium is represented by point A. Suppose that there is a large enough unanticipated decline in the productivity σ, shifting the W-curve down to W'. (In the next section we look at the case where this decline in output is due to high interest rates in period 0.) The new W'-curve has no intersection with the original IPLM curve, resulting a collapse in both the output and the exchange rate. To avoid such currency crisis, a tight monetary policy for the current period may be used, which would cause a downward shift of the IPLM curve. Without considering how tight money can affect the W'-curve, such policy may restore output to some extent. However, tight money would increase the current period interest rate and so reduce the credit multiply μ, resulting a further downward shift of the W'-curve. The overall effect of higher interest rate on the output is ambiguous. It depends on the interest sensitivity of the credit multiplier and the proportion of the foreign currency debt in firms' borrowing. Figure 1 shows the case with high interest sensitivity of the credit multiplier and with highly-dollarised debt, so W' moves down more than IPLM', leading to a collapse equilibrium (Point B).

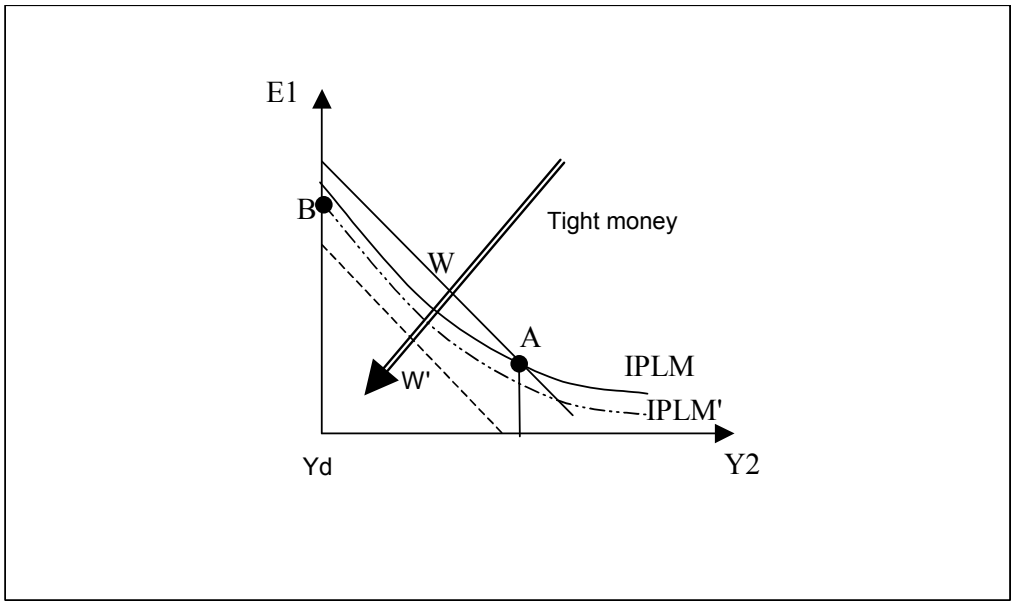

Figure 2 Productivity shock and the effect of tight money

1.2. Extending the ABB (2000) model

To make the model more suitable to describe what happened in Argentina, we follow ABB (2001) to incorporate government debt and impose balance budget condition. In addition, we assume a proportional corporate tax and country risk premium. To capture the post crisis policy, we look at the effect of pesification of corporate liabilities on the output.

a. Corporate Tax

Assuming that corporate tax is levied at a given rate of τ on the firm's realised profits. Introducing taxes reduces the investment in time 1, which in turn affects negatively the output in period 2:

$$Y_2 = \sigma(1+\mu)(1-\alpha-\tau)\left[Y_1 - (1+r_0)D^c - (1+i^*)\frac{E_1}{P_1}(D_1 - D^c)\right] \qquad (6)$$

b. Public debt: (From Aghion et al, 2001)

As in Aghion et al (2001), the consolidated government financing equation can be written as

$$P_t(g_t - t_t) + \left[X^G(1+r_{t-1}) + (1-X^G)(1+i^*)\frac{E_t}{E_{t-1}}\right] d_t^G P_{t-1} = d_{t+1}^G P_t + s_t P_t - E_t \Delta R_t, \quad (7)$$

where g_t is the government expenditure, t_t is taxes, d_t^G is the government debt in period t and X^G is the fraction of its domestic component, d_{t+1}^G is the debt at period t+1, s_t seignorage, P_t is price level in period t.

c. Country risk

To capture the default risk for the dollar debt, we introduce risk premium to both the interest paid by government (π^G) and the interest rate paid by the firm (π^p). In the presence of such risk premium, the government budget constraint becomes

$$(g_t - t_t) + \left[X^G \left(1 + r_{t-1}\right) + (1 - X^G)\left(1 + i^* + \pi^G\right)\frac{E_1}{P_1}\right] d_t^G = d_{t+1}^G + s_t \quad (8)$$

The output in period 2 becomes

$$Y_2 = \sigma\left(1 + \mu\right)\left(1 - \alpha - \tau\right)\left[Y_1 - \left(1 + r_0\right) D^c - \left(1 + i^* + \pi^p\right)\frac{E_1}{P_1}\left(D_1 - D^c\right)\right] \quad (9)$$

d. The impact of pesification on corporate dollar liabilities.

Assume that the pesification (at E=E') of the dollar denominated corporate debt affects only the part that was issue locally, the W-curve is then revised to

$$Y_2 = \sigma\left(1 + \mu(i_1)\right)\left(1 - \alpha - \tau\right)\left[Y_1 - (1 + r_0) D^c - (1 + i^* + \pi_0^p)\left(\frac{E_1}{P_1} D_F^F + \frac{E'}{P_1} D_F^D \right)\right] \quad (10)$$

where D_F^F is the dollar debt issued outside Argentina and D_F^D is that issued domestically.

2. The Argentine crisis

For purposes of analysis, it is convenient to distinguish three half-year periods centred on the political and financial collapse at the end of 2001 namely : Pre-collapse (to September, 2001); Collapse (October 2001 to March 2002); and Depression (from April 2002), referred to as Periods 0, 1 and 2 respectively. The last of these is what we wish to explain: but the seeds of destruction were sown before. So we review the two earlier periods, outlining key events and how they were to set the stage for a profound crisis in which "Argentina passed from being one of the world's fastest growing economies in the 1990s to suffering one of the sharpest recessions of any peace-time capitalist economy since the Second World War" (Gerchunoff and Llach 2003, p.456) – a veritable Great Depression, in which output fell by 20 percent from its peak in 1998, poverty rose to 55% of the population and - in a country famous for the export of food products - children died of hunger.

Period 0: Pre-collapse (Mar 2001/Sep 2001)

In March 2001, after the first bank run, Domingo Cavallo - the architect of the currency peg or '*Convertibilidad*'- was recalled to the post of Minister of Economy in in a move designed to restore investors' confidence. But Argentinean Bonds continued to fall in global markets, and both government and the private sector faced higher borrowing charges of around 12%. So, in a further step to reassure capital markets, Cavallo tried to balance the budget, adopting the Draconian policy of '*Deficit cero*' (zero deficit). Under this policy, however, higher borrowing costs involved running a higher primary surplus, i.e. rising interest rates led to cuts in public expenditure and higher taxes. Confidence was not restored and Argentine sovereign spread rose to 1700bps. in July.

That economic recession led to higher not lower interest rates in the highly indebted Argentine economy, and that recession was met with policies which increased tax and decreased public expenditure are identified by Gerchunoff and Llach (2003,p.456) as two important 'crisis propagation mechanism'. These are incorporated in the model as follows. First, the high sovereign spreads force the government to increase corporate tax to maintain the "zero deficit" commitment with the IMF, as can be seen from the following accounting equation

$$(g_t - t_t) + \left[X^G \left(1 + r_{t-1}\right) + (1 - X^G)\left(1 + i^* + \pi^G\right)\frac{E_1}{P_1} \right] d_t^G = d_{t+1}^G + s_t = FIXED \quad (11)$$

where the first term is the primary deficit and the second term represents the interest payment on public debt. Assuming that the sum of terms is fixed, the only way to adjust to rising interest costs is to run a primary surplus - by raising corporate taxes for example.

Secondly, the high credit risk π_0^p (risk over American companies) plus the high peso interest r_0 also reduce corporate profits available for investment.

Increasing τ, r_0 and π_0^p, will lead to less investment in period 1, ceteris paribus, and so less output in period 2, as can be seen from the W equation:

$$Y_2 = \sigma \left(1 + \mu(i_1)\right)(1 - \alpha - \tau)\left[Y_1 - \left(1 + r_0\right) D^c - \left(1 + i^* + \pi_0^p\right)\frac{E_1}{P_1}\left(D_1 - D^c\right) \right] \quad (12)$$

Period 1: Collapse (Oct 2001/Mar 2002)

The final external trigger for the collapse was the announcement of the IMF in December: the country would not receive the $ 1.3 bn that the government asked for to pay the State debts (Financial Times, Dec.2001). This lack of financial support was followed by the withdrawal restrictions on bank deposits and the rapid spread of various sorts of street demonstrations, lootings to supermarkets, one general strike (Clarin, 14 Dec. 2001) and the increase of the country risk to 50%.

This was a limit for the situation and the 20th of December, the elected president was forced to resign. After this, the country was in a institutionally chaos with 3 successive presidents elected by the Congress only recovering certain political stability at the beginning of January (La Nacion, 2 Jan. 2002) when Eduardo Duhalde was appointed to be the new president. One of his first economic measures was the devaluation of the peso and installed a dual exchange market (one official where 1 dollar worth 1.4 pesos and another free one). Immediately after, the value of the free dollar reached 1.8 pesos. After this, the central bank was allowed to emit new pesos without the backing of dollars (La Nacion, Jan 2002). In this way, the 'Convertibilidad' arrived to an end. There followed a process of 'Pesification' of the whole economy

(Financial Times, 4 Feb. 2002), with the compulsory conversion of all the deposits, transactions and debts to the local currency.

Cavallo's last-ditch attempts to maintain the dollar peg were associated with punishingly high interest rates. With the peg still in place, the IPLM curve is not relevant, its place being taken by the parity peg. But, as in ABB 2000, the high interest rates shift the W-curve downwards, decreasing the output in period 2 (see W' in figure 3).

Faced with such prospect, what would be the policy options Duhalde could choose after he took over the power? To avoid output decline under expected depreciation of the peso, one option is to pesify the firms' foreign currency borrowing in order to avoid credit crunch. This was in effect the policy adopted by FDR in the Great Depression, when he persuaded Congress to cancel the Gold Clause in debt contracts after the US devaluation, as discussed above: devaluation raised the gold price – and the dollar value of gold-denominated debt - by about 70% ; cancelling the Gokept the dollar value unchanged.

First consider the pesification of corporate borrowing which no negative effect on the banking system (e.g. loans and deposits are written down *pari passu* at E'=1). Specifically, let foreign currency borrowing be

$$D_F^F + D_F^D = D_1 - D^c$$

where D_F^F is the dollar debt issued outside Argentina and D_F^D is that issued domestically. With symmetric pesification, the output in the second period then becomes

W'_{SP} :

$$Y_2 = \sigma\left(1+\mu(i_1)\right)(1-\alpha-\tau)\left[Y_1 - (1+r_0)D^c - (1+i^*+\pi_0^p)\left(\frac{E_1}{P_1}D_F^F + \frac{E'}{P_1}D_F^D\right)\right] \quad (13)$$

To illustrate this see Figure 3 where we assume the Argentinean economy is at point A on a peg of one to one with the dollar. Floating the currency and tightening monetary policy will have two effects , as discussed in the previous section: the IPLM curve moves inwards (note it is to the left of A). So too does the W curve, where the equilibrium with symmetric pesification is given by the intersection of the W'_{SP} curve with the IPLM curve, at point C; but without pesification there is a shift to profound

depression at B. The reason that the Roosveltian policy of pesification prevents output from collapsing is that it gives relief to corporations with dollar debts.

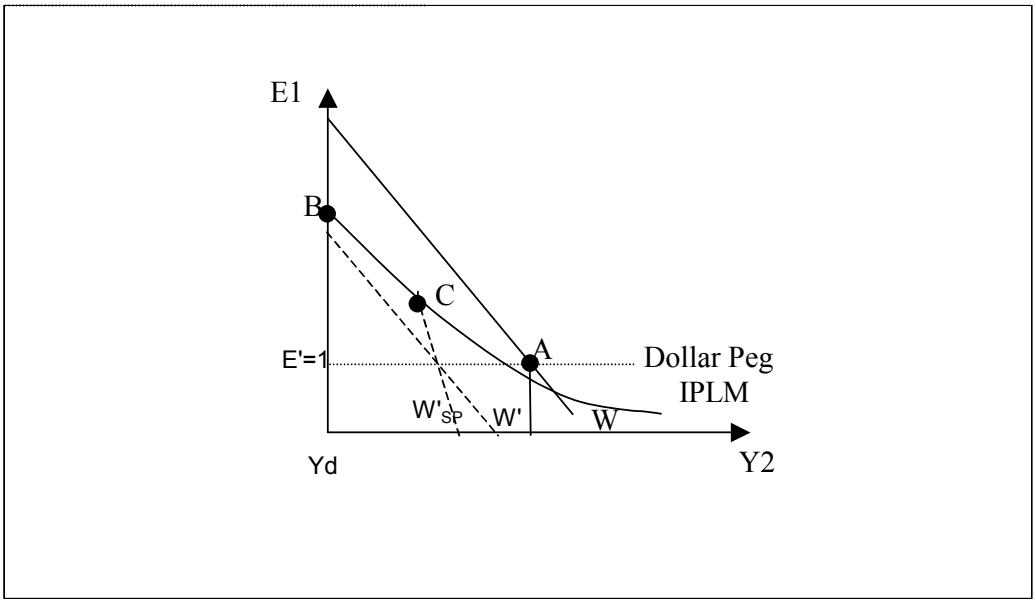

Figure 3. Float and pesify: the Roosevelt solution

Although the pesification of bank loans may have been designed to revive the supply side of the economy, it was part of a package of measures whose effect was to make the banks insolvent: and, as in the United States in the 1930s, crippling the banking system deepened the crisis. In the next section of the paper, we offer a game-theoretic explanation of why the package was adopted. Here we first sketch its main features, then indicate how it exacerbated the crisis.

2.1. Putting it all together

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We have discussed how high real interest rates and high taxes in period 0 could have cut investment in period 1.The tightening of monetary policy in period 1 could also have cut the supply side as will the fall of the currency, though the latter can be somewhat mitigated by 'corporate debt relief' in the form of pesification. Finally however we have seen that the debt relief for corporations was combined with policy actions that made banks bankrupt. If the economy has not yet fallen into a depression this may well be the crowning blow, as the collapse of the banking system leads to a reduction in the credit multiplier (μ), less investment and less output.

This is shown in Figure 4. If the reduction in μ is large enough, the new W''-curve would have no intersection with the IPLM curve, so the currency collapse (point D) becomes the equilibrium. How this disastrous situation could have arisen is discussed in the next section. How can it be reversed?

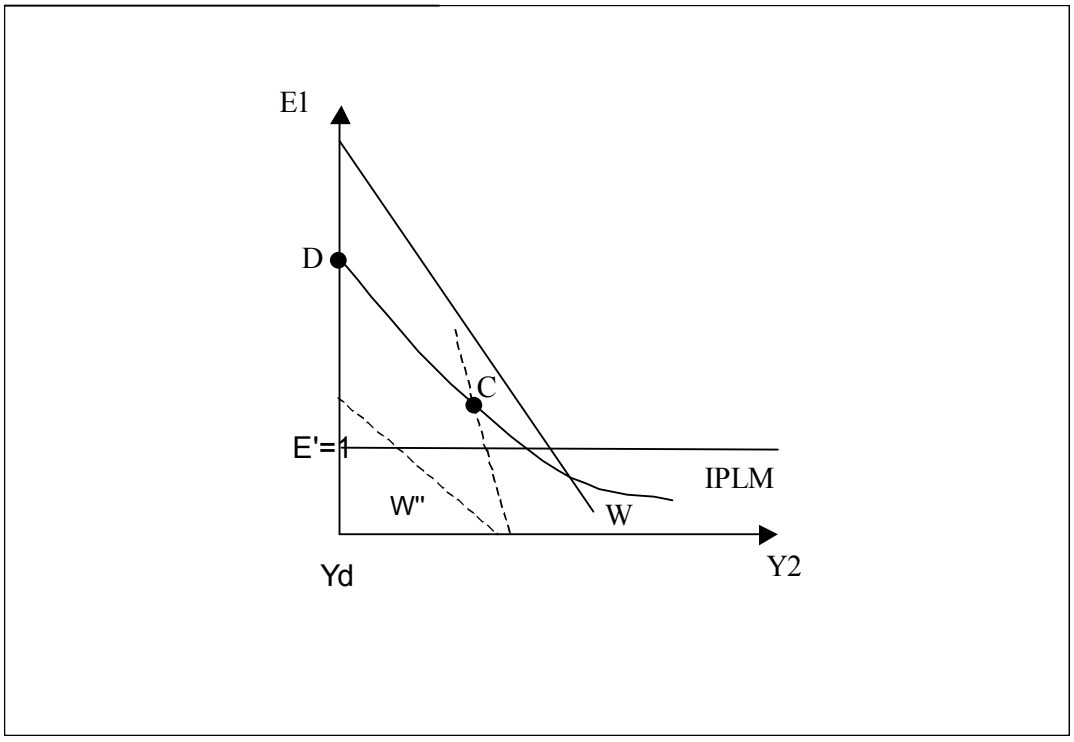

Figure 4. "Nuestra gran depresión"[7]

Given that the default and the policy of AP cannot be reversed, what could the government do to remedy the situation? One option to the government is to restore bank solvency by issuing sovereign bonds, as suggested the IMF. This would increase the credit multiplier and move the equilibrium back to point C in the long run as in Figure 4.

However, there was no immediate and decisive action taken by the Duhalde government to recapitalise the banking system, leaving the country without credit for one year and a half. It is only recently that "the government has issued (or

[7] See Gerchunoff and Llach (2003,p.449-457)

announced) new bonds totalling $27 billion, mainly to compensate banks and savers for the conversion to pesos", (The Economist, 2003).

Capital controls

Argentina did not have capital controls until December 2001, before which substantial outflows occurred. An early imposition of capital controls could have had the effect of reducing the impact of the crisis. The use capital controls to mobilise the foreign assets of domestic citizens, by outflow controls and/or forced repatriation, raises political issues we do not discuss here. We restrict ourselves to indicating in graphical terms how action on the capital account impacts on the exchange rate and output in model being used. Modifying the IPLM curve to

$$E_1 = (1-c)\frac{1+i^*}{1+i_1}\frac{M_2^s}{L(Y_2,\overline{i_2})} \qquad (14)$$

where 0<c<1 indicates the degree of capital controls (see Aghion et al., 2001), we see the effects of imposing capital control in Figure 9. By choosing an appropriate c, one can, in principle, move the IPLM curve down sufficiently to intersect the W''-curve at point D', avoiding the collapse of the output.

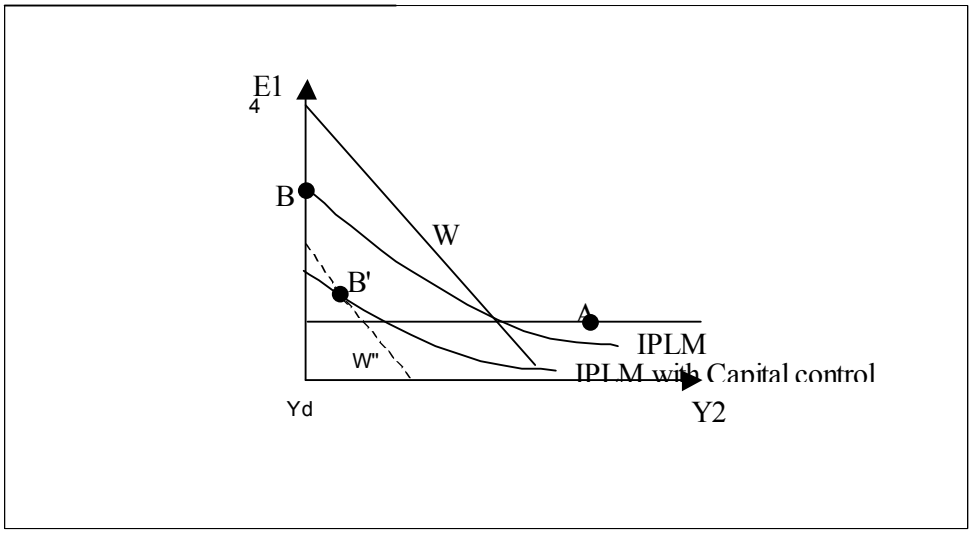

Figure 5 Effect of imposing capital controls.

2.3. Bankrupting the Banks : Policy error, favouritism, or both?

After Mr de la Rua's resignation[8], the country went suffered institutional chaos as Congress elected three successive presidents elected in as many weeks. Some political stability was regained at the beginning of January 2002, however, when Eduardo Duhalde was appointed as the new president. Among the first economic measures, the government he headed devalued the peso and started the process of *'pesification'* of the whole economy. Unexpectedly, the government adopted a differential conversion rate which destroyed banks solvency, as discussed in detail in Section 1 above. We accept the perspective of Sturzenegger(2003,p. 49) that this can only be explained as a political decision to privilege companies that had dollar loans in the local market, without imposing the full costs on those with have dollar deposits in local banks. In this section we argue that the choice of the asymmetric pesification can be explained by the government's desire to benefit particular interest groups (favouritism) in conjunction with mistaken beliefs about bank behaviour (a policy error).

Who were the winners and losers? De la Dehesa (2003) discusses how benefited some "families and companies" and damaged others. The companies that exported and had local costs, those with high dollar debts issued in Argentina and those that had money offshore or dollars "under the mattress" have been the main winners of the pesification. Private banks and companies with external debts in foreign currencies outside the country and wageworkers have been the main losers[9].

Who pays? Foreign banks vs the Government

Clearly the decision to go for asymmetric pesification (AP) rather than symmetric pesification (SP) would cause a large hole in bank balance sheets. Who was to pay? Assuming that the choice is between the government or the banks themselves (many under foreign ownership) Table 2 illustrates the payoffs of each player, where the government chooses between symmetric pesification or the asymmetric pesification, and foreign banks choose whether to accept or resist (and payoffs are normalised to

[8] See Wallin and Druckerman (2001)

[9] To the list of "losers" in this process, we can now add the taxpayer, as the national government has issued US$ 27bm debt to cover the asymmetric pesification process (The Economist, 2003); but that is to get ahead of the story.

zero for the case of SP with cooperation by foreign banks). If the government adopts symmetric pesification, we assume the banks would be inclined to accept, as resisting costs epsilon. If the government decides to pesify asymmetrically, given banks play cooperatively, the government improves its payoffs from to α, which is, effectively, a transfer from the banks, i.e. the government is seeking to gain political ends at the expense of bank shareholders. If the banks resist, however, this triggers economic disaster, with losses of δ for the government and β for the banks ($\beta>>\varepsilon$) which the le banks as they are forced to accept losses; given that banks refuse to corporate, the policy would fail and it would result a substantial reduction in the government payoff to.

Payoff matrix:

Government	**Foreign banks**	
	Accept	Resist
SP	0, 0	0,-ε
AP	□, -□	-□,-□

Note □□□□□

Table 2. The pesification game.

There is no Nash equilibrium in pure strategies assuming simultaneous play. But we assume it is the government that moves first and obtain the extensive form shown in Figure 6. Assuming that the banks estimate that the costs of resisting AP are less than giving in, i.e. $\beta<\alpha$, the banks will resist AP but accept SP. Given these state dependent responses, it is in the government's interest to select SP, thereby avoiding a costly struggle and economic chaos, i.e. the outcome SP, Accept is the Nash equilibrium of the game. Unfortunately this is what did not happen.

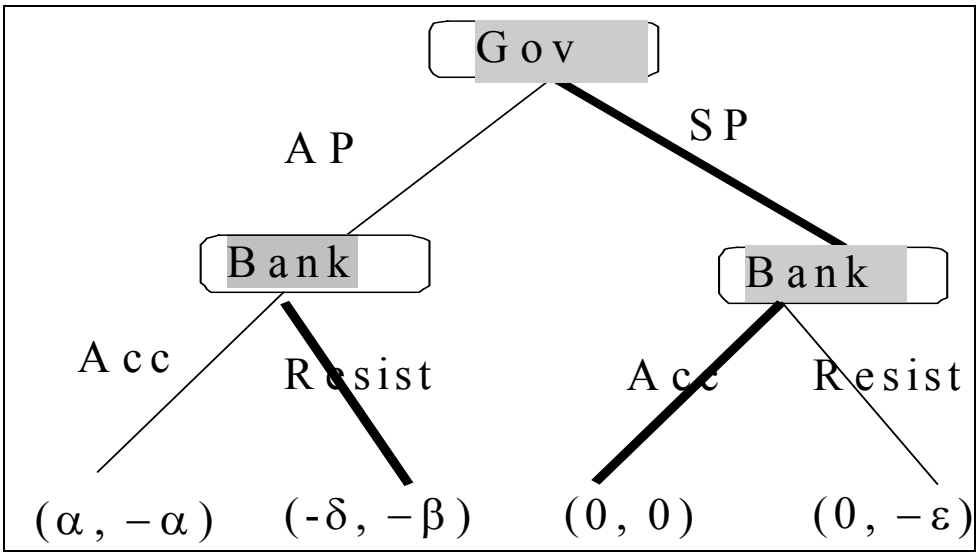

Figure 6. What did not happen.

Duhalde's government may have assumed the only realistic option for the foreign banks was to pay the costs of Asymmetric Pesification (AP) rather than taking the losses of leaving the country, recapitalising their Argentinean branches in order to maintain their worldwide reputation. Formally if the government estimates β by a value $\beta^* > \alpha$ then it will expect the banks to accept AP, and pay up for the necessary recapitalisation in order to stay in business in Argentina. If *Accept* is the dominant strategy for the banks, then it is politically attractive for the Government to adopt AP: foreign banks will pay for transfers to those the government wishes to privilege.

In fact, consultants in London and New York did not believe that resisting the asymmetric pesification by local branches in Argentina would affect their worldwide reputation (The Economist, 2002). (Indeed , the banks may have calculated that they could gain from a further rise of the dollar - assuming they finally were to win some compensation - and the non cooperative strategy of threatening to leave unless given the protection of the *corralon* allowed the banks to wait for a rise in the dollar.)

If, as we suggest, the government made a mistake about bank payoffs (as $\beta<\alpha$), then this strategic error will lead to the disastrous outcome of imposing AP on banks that are willing to resist by playing a long game of attrition rather than pay. In fact the widespread suspension of convertibility was proved very damaging for the economy, the dollar has plunged and, finally, the government is to compensate the banks: i.e. it does look like an error to try to force them to accept losses earlier.

CONCLUSIONS

After the devaluation and default, the government unexpectedly implemented a policy of asymmetric pesification policy which bankrupted the banking system and led to economic disruption. To analyse the enormous plunge of the peso and the deepening recession that accompanied it, we have incorporated the balance sheet effects induced by large currency swings on the supply-side of the economy. Suitably adapted, the framework of Aghion et al (2000) illustrates how high ex ante interest rates can have substantial adverse effect on the supply side and how asymmetric pesification of bank assets can greatly exacerbate the fall of the currency and the depth of the recession. But the level of unused resources implies that, as for the 1930s, one needs to model demand as well as supply.

To explain how such unfortunate policy steps could have been taken we offer a game in which the government mistakenly thought it could play tougher than the foreign banks and get them to pay. This is only a first shot at analysing a very complex political situation; and can surely be improved upon. It would in particular be interesting to explain why *ex ante* the government could not put into play the substantial foreign assets owned by its citizens to recapitalise the banks for example ; or even to act as collateral for external debt[10]; and why ex post the government did not seek to check the inequality increasing effects of devaluation as between those whose assets were kept in Argentina and those whose money was put overseas.

[10] The view that Argentina is a huge net debtor in dollars lies at the heart of the Calvo analysis. However, according to the Economist(2003), Argentineans have more than $100 bn of private assets in dollars outside the bank system. For similar estimartes see also Ministerio de Economía (Begining 2002) $ **108** bn in Clarín 23/7/2002; and Comisión investigadora de fuga de capitales de la Cámara de diputados (End 2001) $ **127 bn.**

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