Delay in Debt Swaps: Growth and Sustainability

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Abstract

We explore how prospects of economic recovery and the constraints imposed by sustainability can cause delay in bargaining, particularly when there is asymmetric information between debtor and creditor. Motivation for this analysis is the time taken to arrange the Argentine debt swap concluded in 2005.

In the first section, a simple two-period model of bargaining with symmetric information is used to show that 'efficient delay' can occur when growth prospects exceed the rate of discount and there are no contingent contracts, as in Merlo and Wilson (1998).

Given the concern for sustainability during the Argentine negotiations, however, the game is changed to reflect the view of a more Cautious debtor for whom no settlement is worthwhile unless it is sustainable. If this condition is binding in the first period, it may delay agreement that would otherwise have taken place: but this requires a high level of discounting.

Allowing for two types of debtor and for asymmetric information increases the likelihood of delay, however, as it can act as costly signal by the Cautious debtor in a separating equilibrium. Was the Argentine offer at Dubai deliberately set low enough so as to ensure prompt rejection; to a subsequent reappraisal of the debtor's type; and to a final settlement that respected concern for sustainability? We cite anecdotal evidence on the Argentine negotiation position that it is consistent with this signalling interpretation.

Keywords: Bargaining, delay, growth and sustainability, asymmetric information.

JEL: F34, C78

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Introduction.

To analyse debt restructuring, Bulow and Rogoff (1989) applied the alternating-offers bargaining approach of Rubinstein (1982), assuming the sovereign debtor and creditor bargain over a 'pie' defined by the welfare gains from trade. This application has its attractions; and has been extended to include a role for the International Financial Institutions and other participants, Bhattacharya and Detragiache (1994). But a key prediction is that Pareto efficient settlement will be reached without significant delay: yet several of the sovereign bond restructurings involving international investors from 1998 to 2005 have been characterised by protracted negotiation, as indicated in Table 1.

Sovereign State	Restructuring negotiations	Default?	"Delay" - after default	Face value	Haircut
Russia	11/ 1998 – 7/ 2000 **20 months**	Yes 1/ 1999	**18 months**	$ 29.1	69%
Ukraine	1/2000-4/ 2000 **3 months**	Yes	**3 months**	$ 2.6	40%
Pakistan	2/1999 – 12/ 1999 **10 months**	No	**---**	$0.6	30%
Ecuador	8/ 1999 – 8/ 2000 **12 months**	Yes	**12 months**	$6.5	60%
Argentina	9/ 2003 – 4/ 2005 **19 months**	Yes 12/ 2001	**40 months**	$79.7	67%
Uruguay	4/2003 –5/ 2003 **1 month**	No	**---**	$3.8	26%

Sources: Sturzenegger and Zettlemeyer (2005) Tables 14 and 15;Roubini and Setser (2004b) TableA.3

Table 1 Sovereign Debt Restructurings 1998-2005

Default by Ecuador, for example, took a year to resolve and led to a 60% 'haircut' (write-down of face-value). The defaults by Russia and Argentina, which involved the largest amounts of debt and resulted in the largest haircuts, each took more than a year and a half of negotiation. In this paper, we focus on reasons for delay in bargaining, with special reference to the case of Argentina[1].

[1] Note that the delay between default and restructuring (40 months) in Table 1 is a lot longer than the period of negotiation (19 months): this is because the interim administration appointed in early 2002

In the first section, a simple two-period model of bargaining is used to show that delay can occur when growth prospects exceed the rate of discount. As in the framework of Merlo and Wilson (1998), the pie follows a stochastic process and, in the absence of contingent contracts, settlement may well be delayed until the economy recovers. (Differing views about recovery, between 'Bulls' who expect growth to exceed the discount rate and 'Bears' who do not, can lead to delay in a signalling equilibrium as discussed in Appendix A.)

The need to attain sustainability played a key role in the Argentine debt negotiations (as discussed in detail in Appendix B). How could this affect bargaining? The game is changed to reflect the Cautious debtor's view that no settlement is worthwhile unless it is sustainable: specifically, preferences are defined such that payoffs below a critical level give no utility. This results in an unequivocal increase in the debtor's bargaining power; and agreement that would otherwise have taken place may be delayed. But this requires a high discount rate.

In what follows we illustrate how asymmetric information about the debtor's type increases the likelihood of delay. Delay can act as costly signal by a Cautious debtor who wishes to distinguish himself from an Optimist (who has no sustainability concerns) -- signalling his type to secure an improvement in continuation game payoffs. Could this have been the negotiating strategy that led to the longest delay -- and largest write-down -- in recent sovereign debt restructuring? We cite anecdotal evidence describing the Argentine negotiation position which is broadly consistent with this signalling interpretation.

We indicate in an appendix how recovery prospects and concern for sustainability delay can lead to successive periods delay in a multiple-period model.

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regarded debt restructuring as outside its competence, so negotiations did not commence until President Kirchner was elected in mid-2003 with a mandate to negotiate, Bruno (2004,p.162).

Section 1 Growth and delay in bargaining

(a) No private information

We use a two period model, where creditor and debtor bargain over the division of resources available for restructuring (referred to as a pie). There are two possible sizes of the pie available in the second period, and a common discount factor $\delta < 1$; but no contingent contracts can be written. In this setting we find that delay will arise when the expected increase in the pie exceeds the interest rate. The same feature arises in Merlo and Wilson (1998), although their infinite horizon analysis makes the analysis much less straightforward[2].

The bargaining game is specified as follows. Let π denote the size of the pie that is to be divided between the debtor and creditor. It's value in the initial period is π_L: in the subsequent period it can either remain the same (with probability p) or increase to a higher level π_H (with probability 1-p) where these prospects (depression or recovery) and probabilities are common knowledge. The debtor makes the offer in the first period; but each party has equal probability of making an offer (being the proposer) in the subsequent period.

In the final period, bargaining takes the form of an ultimatum game, where the proposer takes all. Breakdown payoffs are zero for both players. (It is assumed that offers matching breakdown payoffs will be accepted.) Table 2 illustrates the payoffs, with the debtor's payoff first, depending on the state of the economy and who makes the offer.

[2] As an illustration of their approach, they cite the delay in restructuring Latin American debt in the 1980s.

	Depression (p)	Recovery (1-p)
Debtor' s Offer (1/2)	π_L , 0	π_H , 0
Creditor's Offer (1/2)	0, π_L	0, π_H

Table 2 Final period payoffs (probabilities shown in parentheses)

Moving to the first period, we calculate the continuation values for each player. Let the expected size of the pie be denoted $E\pi$, where $E\pi = p\pi_L + (1-p)\pi_H$. Bearing in mind that the choice of proposer in the second period depends on the toss of a coin and that there is a common discount factor δ, the continuation value is the same for each player, namely $\delta E\pi/2$.

In the first period, with debtor as proposer, these continuation values limit the offers that can be made. The current pie can be shared between debtor or creditor; but doing so means giving up on the prospect for economic growth. Thus it is a primitive endogenous growth model, like that of Merlo and Wilson (1998). Figure 1 depicts the situation, with debtor payoffs on the horizontal payoff creditor's on the vertical axis. Pareto-efficient current settlements lie on the downward-sloping line labelled "current pie", the boundary of the set of feasible settlements. Future growth prospects, summarized by the expected continuation values, lie on the upward-sloping 45 degree line, a reflection of the ex-ante symmetry of bargaining power in the second period. These continuation values lie outside the "current pie" if expected growth of the economy, $Eg = (E\pi - \pi_L)/ \pi_L$, exceeds the time rate of discount , defined as $r = (1-\delta)/\delta$: and inside if growth prospects fall short.

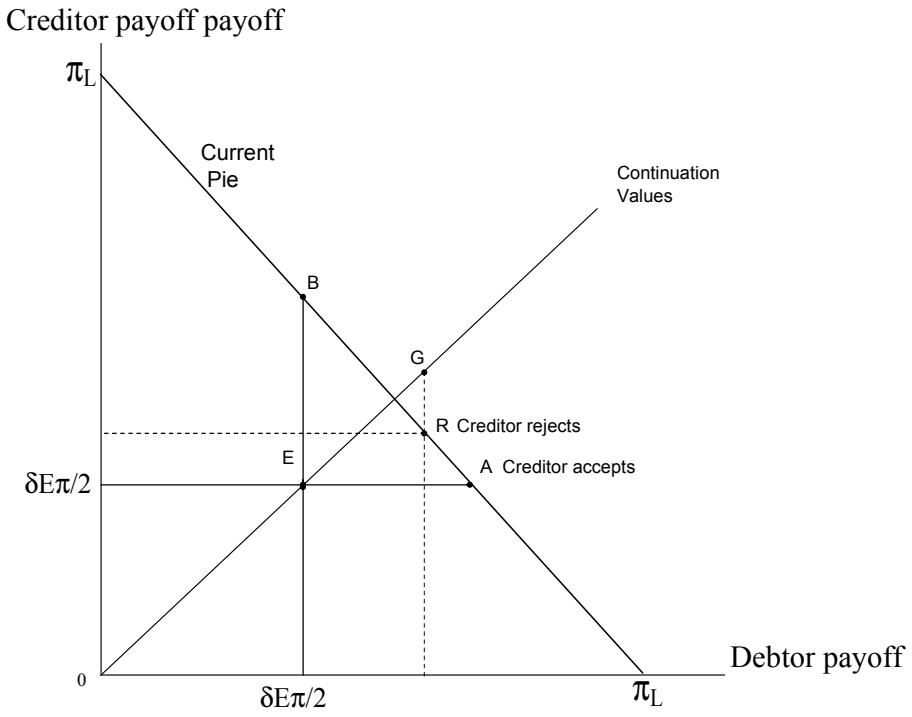

Figure 1: Continuation values and efficient delay

With relatively low growth prospects, therefore, the bargaining model therefore predicts an immediate settlement. Note that continuation values in the interior of the set of feasible settlements are Pareto-dominated by points on the line segment AB, i.e. current settlement dominates delay. At point E, for example, by offering the creditor no more than its continuation value, the debtor can achieve the payoff of A which improves on continuation.

Delay becomes attractive with bullish growth prospects, however. There are no current settlements that Pareto-dominate point G, for example. The best offer that the debtor can make is the excess of the pie over his own continuation value , indicated by the point R in the figure: as this offer of $\pi_L - \delta E\pi/2$ falls below the creditor's continuation value, however, it will not be accepted.

Formally, delay will occur when $\pi_L - \delta E\pi/2 < \delta E\pi/2$, i.e. when $\pi_L < \delta E\pi$. Put in terms of the expected growth rate, Eg, and the discount rate, r, the model predicts

delay in bargaining when Eg $= (E\pi - \pi_{L)} / \pi_L > (1- \delta)/ \delta = r$, which is essentially the same condition as in Merlo and Wilson (1998).

Could delay in the Argentine negotiations be accounted for by prospective economic recovery? Dhillon et al. (2006) report official forecasts of GDP growth in dollar terms of about 13% p.a. for the year following the debtors 'offer' in Dubai (not far below the actual recovery of 15% in the resources available for servicing dollar debts, consisting of 9% real growth and a 6% recovery of the real exchange rate) . With expected growth in the resources available exceeding a benchmark discount rate of 4%, it is concluded that delay was economically efficient.

The preceding analysis ignores the possibility that the debtor may have private information about future growth prospects. How will bargaining be affected if there is asymmetry of information? Assume that it is the informed agent[3] (the debtor) who is trying to signal his type. Let type 1 be a 'Bear' who expects no recovery and type 2 be a 'Bull', a relative optimist who looks forward to economic recovery. Consider the case where growth prospects exceed the discount rate for the Bull; and the reverse is true for the Bear.

Formal conditions for a separating equilibrium where the Bear makes an offer which leaves the creditor indifferent (so he accepts), but the Bull makes an offer that is refused (so there is delay to permit for economic recovery) are provided in Appendix A. They are illustrated in Figure 2, where point R indicates continuation values for the Bull, point N those for the Bear, and C those of the creditor (whose beliefs are assumed to be a weighted average of R and N). The Bear's offer of $\delta E_1\pi/2$, indicated by the horizontal line through R, is the minimum the creditor will accept; and prompt settlement on these terms is attractive for the Bear as the remainder, labelled $y_{1,}$ available for the debtor exceeds his own continuation value. So there need be no delay.

[3] In a bargaining game where the buyer makes offers for a product whose quality is the private information of the seller, Vincent (1989) found a unique Bayesian equilibrium which involves the buyer making a monotonically increasing offers, where initial delay allows the buyer to acquire information. With the aid of a two period example, where the product can be of high or low quality, it is shown how a buyer starts with a low offer so that, if the offer is rejected, "he knows he can go after the owner of the high-quality object and extract the maximum surplus". In Vincent's model, it is the uninformed buyer who makes offers designed to extract information from the seller.

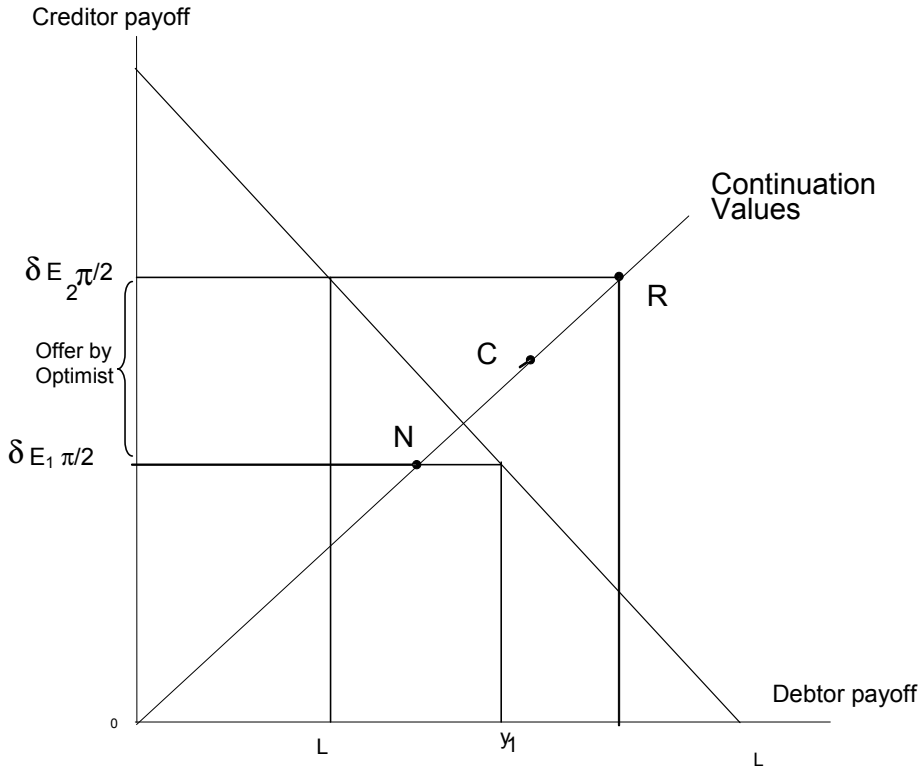

Figure 2: Bulls and bears: a separating equilibrium with delay.

What about the Bull, whose continuation values lie outside the current pie? To ensure separation, the offer must not be too mean. Specifically, it must not leave the debtor more than y_1: this would tempt imitation by a Bear. So the offer must be above $\delta E_1 \pi/2$. Given that separation has been achieved, the offer must lie below the creditor's continuation value of $\delta E_2 \pi/2$ to ensure rejection (so the debtor's own claim must be strictly greater than the quantity labelled L). In a separating equilibrium, therefore, the creditor can be offered *any amount in the range between the two continuation values on the vertical axis* (leaving the debtor with a residual lying strictly between L and y_1).

Could it be the desire of a bullish debtor to achieve a separating equilibrium that delayed the Argentine swap? This does not seem very likely – since the need to avoid imitation by a pessimist would have led to a considerably more generous offer to

creditors than was observed at Dubai.[4] In the next section, therefore, we consider an alternative explanation for the low offer at Dubai, namely the debtor's desire to achieve a settlement that would prove sustainable.

Section 2: Sustainability and delay in bargaining

Sustainability in the Argentine case

Though sovereign default was declared at the end of 2001, serious efforts to restructure Argentina debt only began when the interim administration of President Duhalde was replaced in the elections of 2003. It was in September of that year, at the meetings of the IMF and the World Bank in Dubai, that the Argentine government led by President Kirchner revealed its negotiating stance. It was determined to reach a durable settlement with its creditors: the consequences of default had proved so disastrous that a prompt but unsustainable settlement was unacceptable. The specific strategy for reducing the debt exposure of the economy involved three principal commitments: to run a primary surplus of 3% of GDP; to limit the cost of debt service to this figure; and to exempt preferred creditors from restructuring.

How the first two commitments effectively determined the size of the write-down and ensured continued contraction of debt relative to GDP is sketched analytically in Appendix B. The third commitment, to pay full compensation for preferred creditors,[5] meant there was little was left for other private creditors. Specifically, with the cost of servicing preferred creditors estimated at almost $3 billion and a depressed level of GDP, worth $130 bn in 2003, these constraints left an annual flow of only about a billion dollars for private creditors – a 'Dubai residual' of less than one percentage point of GDP[6].

[4] Assume that the Bear expects no growth, so P is the discounted value of *half the current* pie. With a discount rate of about 4%, this means the minimum offer by the Bull would need to be close to half the pie to achieve separation. But this is much more generous than the Dubai 'residual' -- the amount left over for the creditors after payment in full to preferred creditors, see next section -- which was estimated to be only about *about a third* of the pie in Dhillon et al. 2006.

[5] These included both International Financial Institutions (such as the IMF, the World Bank and the IADB) and domestic bondholders who had lent into arrears.

[6] See Appendix B for more detail.

With the recovery of GDP and some appreciation in the real exchange rate, however, these sustainability constraints became less binding, freeing up more than one percent of GDP for private creditors. The settlement of 2005, which was closely in line with these sustainability criteria, nevertheless involved a haircut of 67% for creditors, as indicated in Table 1 above.

Bargaining with sustainability

To analyse the process of debt renegotiation when sustainability per se plays an important role, let the bargaining process be as before, but redefine the debtor's preferences. Assume utility is linear in (equal to) the payoff only for payoffs greater than or equal to s, the amount a Cautious debtor believes is required to ensure sustainability. For any allocation less than s, the Cautious debtor gets no utility. How does this affect the game? We begin with the case where s is common knowledge.

In the final-period ultimatum game, the creditor will be forced to increase the offer to s if breakdown is to be avoided, see Table 3 (with the debtor's payoff is followed by that of the creditor, as before).

	Depression (p)	Recovery (1-p)
Debtor' s Offer (1/2)	π_L , 0	π_H , 0
Creditor's Offer (1/2)	s, π_L - s	s, π_H - s

Table 3 Final period payoffs (probabilities shown in parentheses)

First period continuation values will reflect the shift of bargaining power in favour of the debtor, becoming $\delta(E\pi + s)/2$ and $\delta(E\pi - s)/2$ for debtor and creditor respectively: and the condition for delay becomes :π_L - max $\{\delta(E\pi+s)/2, s\} < \delta(E\pi-s)/2$.

Increasing the continuation value of the agent who makes the first period offer clearly makes delay more likely, but reducing the continuation value of the recipient offsets

this: and in the case where the sustainability condition does not bind in period 1, the likelihood of delay is unchanged[7].

Figure 3 illustrates for the borderline case of no delay, where $\delta E\pi = \pi_{L,}$ and in the absence of constraints point C would ensure prompt settlement as it matches the continuation values for both players. The sustainability constraint is shown as the vertical line with intercept s; and its effect in ruling out many of the Pareto-efficient, first-period allocations is indicated by the dotted line. The constraint ensures the debtor a minimum of s in the second period ultimatum game: and its impact on continuation values is shown by the shift from C (on the 45 degree line through the origin) to D (on the 45 degree line with a horizontal intercept of δs). As it satisfies the sustainability constraint and offers the both players the same payoffs as postponing a settlement, there will be no delay at D either. The shift in equilibrium indicates how sustainability concerns have altered the balance of bargaining: the fall in the creditor's continuation value has generated a transfer of $\delta s/2$ to the debtor who will receive s in the second period, even if he is not proposer.

[7] In this case the condition for delay is

$\pi_L - \delta(E\pi+s)/2 < \delta(E\pi-s)/2$ or $\pi_L - \delta E\pi/2 < \delta E\pi/2$ or $\pi_L < \delta E\pi$ as before.

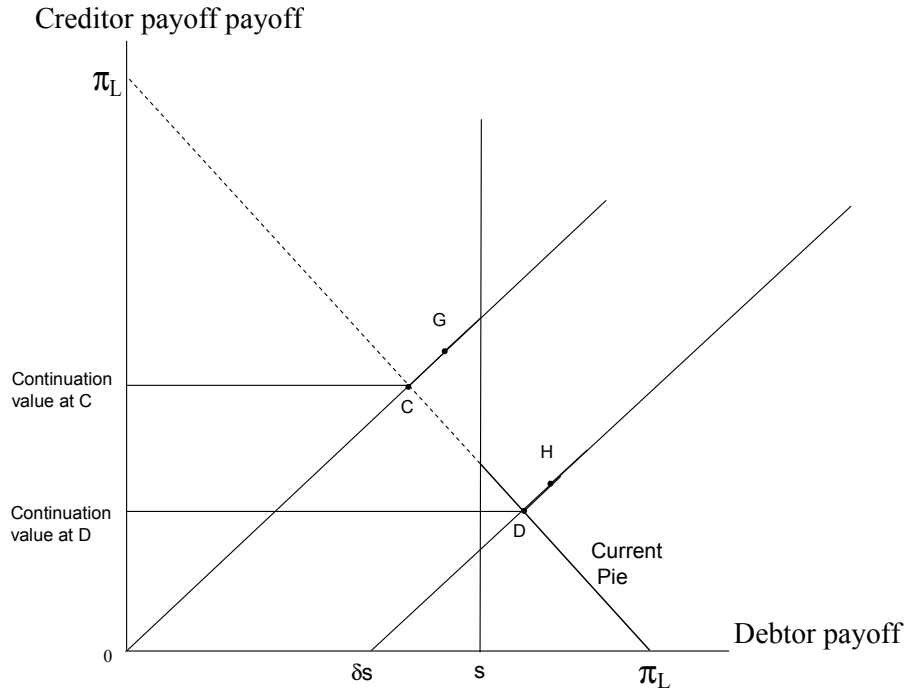

Figure 3 No delay: just reallocation

Delay will follow for continuation values such as G and H lying outside the set of feasible allocations.. The shift from G to H reflects the strategic advantage gained by a debtor known to be committed to achieving sustainability. In fact point H (together with a second period outcome of s for the debtor) corresponds broadly to the interpretation of the Argentine swap advanced by Dhillon et al.(2006), where delay is ascribed to relatively favourable growth prospects and the predicted settlement is close to what the debtor needed for sustainability. The latter appears as something of a happy coincidence in their analysis, as sustainability factors play no explicit role. Here, by contrast, sustainability provides a common-knowledge floor to what the debtor will accept in the second-period ultimatum game.

When the sustainability condition is binding in period 1, it can itself prevent prompt settlement that would otherwise have occurred. This is shown in Figure 4, where the effect of the sustainability constraint in reducing the set of Pareto-efficient allocations currently available is shown as before, but – with a greater discount rate - there is a relatively smaller impact on continuation values. Delay ensues as the debtor is unable

to make a current offer that matches the value of continuing. Formally, note that $s > \delta(E\pi+s)/2$ implies $(2-\delta)s > \delta E \pi$, which allows the relevant condition for delay

$$\pi_L - s < \delta(E\pi-s)/2$$

to be rewritten as

$$\pi_L < \delta E\pi/2 + s(2-\delta)/2.$$

In particular, when $s(2-\delta) > \pi_L > \delta E\pi$, delay will occur due to sustainability concerns, when otherwise it would not.

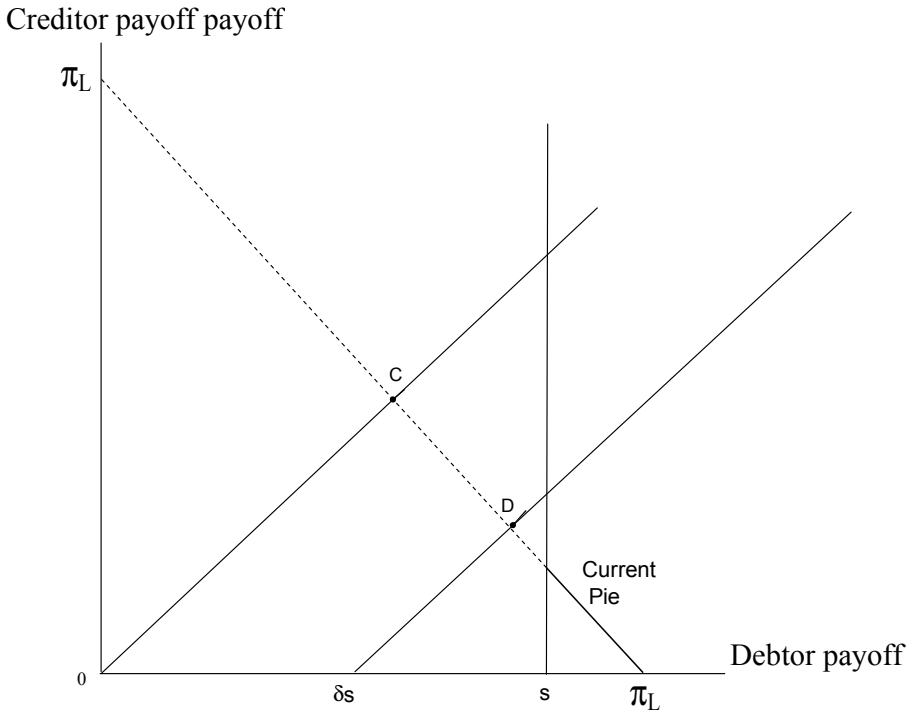

Figure 4: A sustainability constraint with delay and reallocation ($s>\delta(E\pi-s)/2$)

Could it have been sustainability *and not growth* that caused delay after Dubai? Assuming a sustainability requirement[8] of $s/\pi_L = 0.7$, the relevant condition $s(2-\delta) > \pi_L$ implies that the discount factor would have had to be less than 0.57, i.e. a discount rate of about 75% p.a. The discount rates needed to make sustainability cause delay seem excessive: but in the next section, where there is asymmetric information about sustainability, we find delay is consistent with much less discounting.

[8] Obtained from assuming a pie of 2.64% of GDP, as in Dhillon et al.(2006), and noting that the Dubai residual, π- s, was about 0.8% GDP, see Appendix. So $s/\pi = 1 – (0.8/2.64) = 1- 0.3 = 0.7$.

Section 3: Sustainability and delay with asymmetric information.

In this section we analyse extend the analysis by allowing information about sustainability to differ as between creditor and debtor. Specifically, we assume the debtor may be one of two types -- one concerned with sustainability, the other not -- where the debtor knows his type but the creditor is not sure. Even when there are no prospects for economic growth, delay can arise in this setting as a costly signal by the debtor concerned with sustainability, designed to secure an improvement in continuation game payoffs.

The two types of debtor, labelled Cautious and Optimistic, differ in the utility they get from consuming their part of a 'pie' of size π. For both, utility is linear in their payoff, but for the Cautious debtor (as above) there is a discontinuity to reflect concern about the sustainability of any settlement. (We use a two-period example where there is a common discount factor $\delta < 1$.) Two such contrasting views of the sovereign debtor are provided by Porzecanski (2005), who portrays Argentina as a 'rogue debtor' who got a large write-down for no good reason, and by the recent United Nations Report (2005) on the co-responsibility of creditors and debtors, which stresses the common interest of creditors and debtors in securing economic recovery and a sustainable settlement.

The bargaining game is specified as follows. Let π denote the size of the pie that is to be divided between the debtor and creditor. For the Optimistic debtor $u_O = \pi_O$ for any allocation, but for the Cautious debtor this is only true for $\pi_S > s$; for any allocation less than s, $u_S = 0$. The debtor knows his type, the creditor does not, but the latter believes that the debtor is Optimistic with probability P_o. (This initial prior is bounded from below for reasons that will be made clear.) The debtor makes the initial offer in the first period; but each party has equal probability of making an offer in the subsequent period. Breakdown payoffs are zero for both players in period two. In the event that delay occurs in period one, however, the debtor enjoys an inside option, x, which is greater for the Cautious debtor than for the Optimist, i.e. $x_S > x_O$. We study the Perfect Bayesian Equilibria of this bargaining game.

Last Period payoffs

We begin with the ultimatum game in the final period, when the belief of the creditor have evolved and is denoted P_1. Consider the creditor's offers at extreme values of P_1. As indicated in Table 4a, the offer is zero unless the debtor is thought to be concerned about sustainability; in which case it is s.

Creditor's Belief as to debtor's type	Creditor's offer to debtor	Payoff for creditor
$P_1 = 1$ (it's an Optimist)	0	π
$P_1 = 0$ (it's not)	s	π - s

Table 4a Creditor's offers with extreme beliefs

For less extreme beliefs, $0 < P_1 < 1$, the creditor's expected payoff from a high offer (of s), acceptable to either type, will be π - s ; but the expected payoff from a low offer (of zero) , acceptable only to the Optimist, will be $P_1\ \pi$. If $P_1\ \pi > \pi$ - s , the creditor will do better by making a low offer, and conversely for $P_1\ \pi < \pi$ - s. When $P_1 = (\pi - s)/\pi$, the two offers have the same expected payoff, and we assume that the debtor randomises, offering low with probability θ and high with probability $(1-\theta)$.

To summarise, the creditor's offers are shown as a function of his priors in the table.

Creditor's Belief as to debtor's type	Creditor's offer	Expected payoff for creditor
$P_1 > (\pi - s)/\pi$ (it's probably an Optimist)	0	πP_1
$P_1 = (\pi - s)/\pi$	0 with probability θ and s with probability $(1-\theta)$	$\theta \pi P_1 + (1 - \theta)(\pi - s)$
$P_1 < (\pi - s)/\pi$ (it's probably Cautious)	s	π - s

Table 4b Creditor's offers in the ultimatum game for all values of belief

As for the debtor, his offer to the creditor is simply zero - which will be accepted in this ultimatum game.

From the perspective of the initial period, bearing in mind that each player has a 50% probability of making the next offer, the expected discounted payoffs as a function of the prior are as in Table 5:

Creditor's Belief as to debtor's type	Expected payoff for debtor (for both types)	Expected Payoff for creditor
$P_1 > (\pi - s)/\pi$ (probably an Optimist)	$\pi\,\delta/2$	$\pi\,P_1\,\delta/2$
$P_1 = (\pi - s)/\pi$	$[\pi + (1-\theta)s]\,\delta/2$	$[\theta\pi\,P_1 + (1-\theta)(\pi - s)]\delta/2$
$P_1 < (\pi - s)/\pi$	$(\pi + s)\,\delta/2$	$(\pi - s)\delta/2$

Table 5 Continuation values in the initial period of bargaining

Assume that the debtor makes the offer in the initial period. In a separating equilibrium, the offers will be conditioned on one or other of the extreme priors, as follows:

	Debtor's payoff	Offer to creditor	Outcome
$P_1 = 1$ (it's an Optimist)	$\pi - \pi\,\delta/2$	$\pi\,\delta/2$	High offer will induce creditor to accept
$P_1 = 0$ (it's not)	$\pi - x_0$ $> \pi - \pi\,\delta/2 + s\,\delta/2$	$x_0 < (\pi - s)\,\delta/2$	Offer too low to be accepted

Table 6 Debtor's offers in a separating equilibrium

Offers consistent with separation are illustrated in Figure 5, where point B indicates the continuation values for the known Optimist and point C for the debtor known to be Cautious. The offer of $\pi\,\delta/2$ shown by the horizontal line through B is attractive enough for the creditor to accept given that he believes he is dealing with an Optimist;

but an offer of $x < (\pi - s)\,\delta/2$ is too low to be accepted by a creditor who believes he is dealing with a Cautious debtor as it lies below the full information continuation values shown at point C. These are separating offers.

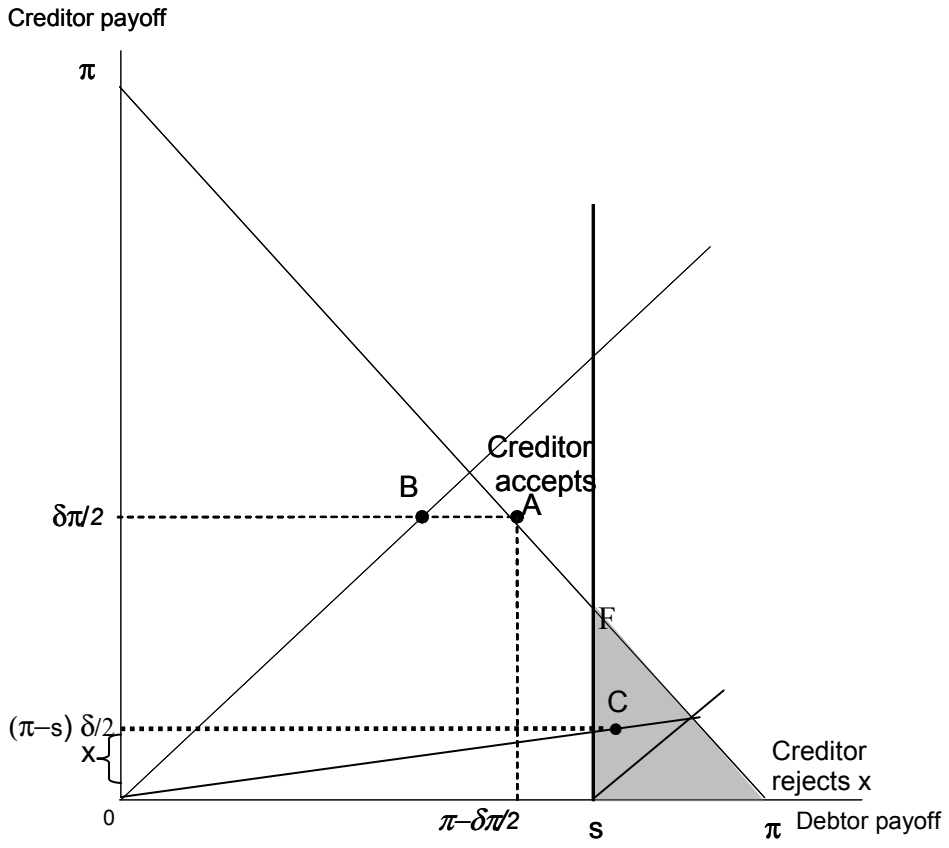

Figure 5 A mean offer from the cautious debtor in a separating equilibrium

Consider now the conditions required to ensure that the types reveal themselves in a separating equilibrium with delay: namely (i) that Cautious doesn't imitate Optimist; (ii) that Optimist doesn't imitate Cautious; and (iii) that Cautious wants to delay.

To ensure that the Cautious debtor reveals himself requires that he will not do better by imitating an Optimist, i.e. that the present discounted value of continuing and being identified as Cautious exceeds the benefits of settling quickly so point C lies to the right of point A in the figure.

Thus condition (i) requires that

$$(\pi + s)\,\delta/2 > \pi - \pi\,\delta/2 \quad \text{or} \quad s > 2\,\pi\,(1 - \delta)/\delta;$$

i.e. sustainability concerns have to be sufficiently important to outweigh the cost of delay. Rewriting this as:

$$s/\pi > 2\,\pi\,(1 - \delta)/\delta$$

we see that, for $\delta = 0.8$ for example, the perceived needs of sustainability would need to be at least 50% of the pie in order for delay to be an attractive strategy for the cautious debtor: and the required sustainability ratio, s/π, rises sharply as higher rates of discount (lower δ) increase the cost of this signalling strategy. If this condition is satisfied, however, then after one period of delay the cautious debtor will receive a payoff of s if it is the creditor who makes the offer; or the whole pie if he holds all the cards in the ultimatum game.

How this condition for delay compares with what was found earlier in the full information case is illustrated in Figure 6. Note that for $s/\pi = 0.7$, this condition only requires $\delta > 0.85$ so values of δ greater than 0.9, as at point D for example, which rule out delay with symmetric information, are consistent with delay in a signalling equilibrium.

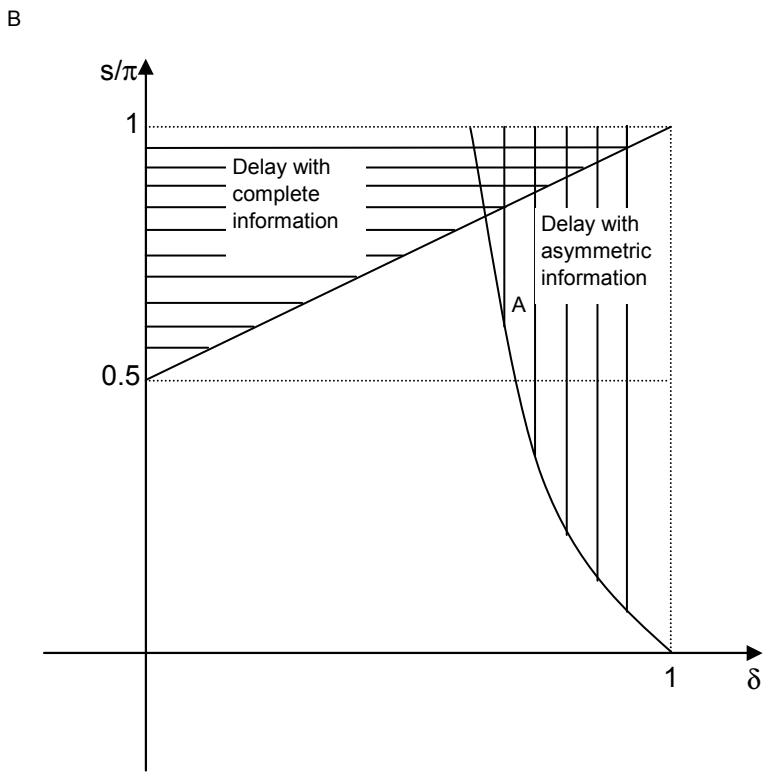

Figure 6 Discounting, delay and information

To verify the other conditions, the inside option ω_O available to the Optimist needs to be taken into account. To show (ii), that Optimist does not imitate Cautious, note that if he does, $P_1 = P_0$. If $P_0 > (\pi - s)/\pi$, and the creditor thinks the debtor is probably an Optimist, then the expected payoff for an optimist who delays will be $\omega_O + \pi\,\delta/2$, where ω is the inside option for the Optimist. To ensure that there is no incentive to imitate Cautious in this way requires that this is less attractive than settling, i.e.

$\omega_O + \pi\,\delta/2 < \pi - \pi\,\delta/2$.

As can be seen from rewriting this as

$\omega_O < \pi(1 - \delta)$,

this gives an upper bound on the inside option for the Optimist.

Will Cautious want to delay, condition (iii) above? Observe that if Cautious makes an offer to the creditor of $(\pi - s)\delta/2$, this will signal to the creditor the debtor type so that $P_1=0$; and given $P_1=0$ the creditor will choose to accept debtor's offer. For Cautious to

want delay, therefore, requires that continuation value together with inside option ω_S is more attractive than settling, i.e.
$\omega_S + (\pi + s)\delta/2 > \pi - (\pi - s)\delta/2$. This
implies a lower bound on the inside option for the Optimist, as can be seen by rewriting this as
$\omega_S > \pi(1 - \delta)$.

Could this account of bargaining help to explain the delay in restructuring on the part of the Argentine government under President Kirchner? Parametrically, if the situation in Argentina can be represented by point lying in the rectangle A in Figure 6, then it satisfies condition (i) above. The calculations reported earlier, with $s/\pi = 0.7$ and δ close to one, support this interpretation. What about the inside options? Some economists argued that the inside option was not worth much and Argentina should have settled earlier; while others, more cautious, felt that delay offered an important breathing space for the economy to make a sustainable recovery. These views seem to confirm the inequality required to generate an equilibrium with delay, namely $\omega_S > \pi(1 - \delta) > \omega_O$, i.e. that conditions (ii) and (iii) are also satisfied.

To apply the signalling interpretation, one could interpret the meagre Dubai 'residual', which was all that Argentina reckoned was available for private creditors in September 2003, as a low offer driven by sustainability concerns. Like the low offers indicated by x in Figure 5, however, this was designed to be rejected, leading to delay and a reappraisal of the debtor's type, and finally to a settlement that respected these sustainability concerns.

Anecdotal support for this interpretation is provided in Liascovich (2005, pp.226-7), a recent biography of Mr. Lavagna the Argentine Finance Minister at the time. On the low offer at Dubai and the sustainability concerns lying behind it, he writes:

> Some time before the offer [at Dubai], Lavagna was already preparing the field: he realised that after the offer "there are going to be sad faces everywhere". And indeed the first reaction of the creditors was of rejection… But the Argentine offensive was not restricted to Dubai. [President] Kirchner in New York, one day after the offer, had an interview with President George Bush, who said, "Keep on negotiating firmly with the

> creditors". And the Argentine President used the auditorium of UN General Assembly to criticise the international financial organisations and ask for support in reduction debt and [promoting] growth. "It's never been known to recover debts from the dead", he said in his speech.

As for improving the offer to achieve a final settlement, Liascovich (2005, p.247) continues:

> The strategy was to maintain the posture of Dubai as long as possible, so that the effect of a new offer would come as a relief…. On the 1st of June [2004] in Buenos Aires Lavagna presented an improved offer which would be the definitive version of the swap. After eight months of insistence, from President Kirchner downwards, that the offer of Dubai would not change, this new offer was a better deal for the creditors. There was no change in the instruments involved in the swap, but there was in the recognition of unpaid interest.

The close coincidence of the final swap with the sustainability requirement[9] calculated by the Argentine government is consistent with our model of bargaining with sustainability, corresponding to point F in Figure 5, but only so long as creditors played an important role in determining the final offer[10]. Sgard (2004), for example, argues that the swap was made on terms designed to appeal to investment banks who had apparently bought up much of the outstanding debt.

Positive growth prospects will, in a two period framework, tend to undermine the signalling role of delay; although high discount rates - enough to offset growth expectations - will tend to preserve the signalling role (see point A in Figure 6, for instance). An alternative possibility is that delay may reflect growth prospects in one period, as the economy pulls out of depression for example, and occur for signalling reasons in the subsequent period. This idea is briefly explored in Appendix C where there is cumulative delay for these reasons in a three period model.

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[9] The figures in Dhillon et al. (2006, Table 3) indicate that, even after economic recovery, the sustainability ratio based on the Government's strategy outlined in the Appendix, imply an s/π ratio of 55%, while the swap itself is estimated to represent a payoff of about 53%.

[10] Technically, of course, the offer of 2005 was made by the Argentine government, so an ultimatum game would predict nothing for the creditors. But take-it-or-leave it offers by the sovereign debtor, designed after consultation with creditors and the IMF, are the typical outcome in most of the cases shown in Table 1, Roubini and Setser (2004a) and the write-downs are typically smaller than was negotiated for Argentina - suggesting that creditors play a major role, despite the identity of the party making the offer

Section 5 Conclusion

A key feature of the Argentine debt negotiations was the time taken to arrive at a swap acceptable to a super-majority of the creditors. Political factors may well have prevented serious negotiation for over a year, but delay continued until over three years had elapsed since default.

In a tractable two-period framework, it is clear that bullish prospects for economic recovery are a plausible cause for 'efficient delay' in the absence of contingent contracts, as in Merlo and Wilson (1998). Even in the absence of growth prospects, however, debtor concern for sustainability may also cause delay. (Sustainability does not only refer to growth promotion: it may involve distributional factors including the provision of public goods.) If, moreover, there is asymmetric information about growth prospects or sustainability requirements, we have seen that delay can function as a costly signal by which the Cautious debtor can indicate his type. We offer this signalling game as an interpretation of the bargaining strategy adopted by the Argentine government in 2003.

In their assessment of the reasons for delay, Roubini and Setser (2004a) stress the heterogeneity of both creditors and of contracts; and they argue that the IMF should play a key role in coordinating creditors[11]. In the model we propose, the IMF could help to reduce delay by providing information: if growth prospects or sustainability conditions are common knowledge, there is no need for a Cautious debtor to use delay as a signal.

A potentially serious challenge to carrying out this informational role is that the IMF, as senior creditor, faces a 'conflict of interest': it has presumably an incentive to exaggerate sustainability requirements in favour of the debtor so as minimise other claims on the debtor's resources. Would such induced compassion for debtors not be checked by its creditor-dominated Executive Board? If not, this informational task could be delegated elsewhere: to the Inter-American Development Bank for cases in Latin America, for example.

[11] They also argue that the IMF could orchestrate 'debtor in possession' finance, Roubini and Setser (2004b).

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Technical Appendices

APPENDIX A: Bulls, bears and delay: Private information about growth prospects

Assume there are two types of debtor, differing in their beliefs about prospects for growth in the pie. Let type 1 be the 'bear', a Pessimist with regard to growth prospects: let type 2 be the 'bull', a relative Optimist. Let each type i attach the probability p_i to the low growth outcome π_L and the probability 1- p_i to the high growth outcome π_H ; and let the expected value of the pie be indexed accordingly, so

$E_i \pi = p_i \pi_L + (1- p_i) \pi_H$, where $p_1 > p_2$.

Assume that the creditor has prior beliefs (q, 1-q) as to the type of creditor (1,2); and let the creditor's prior probability of the low outcome be denoted

$p^c = q\, p_1 + (1 - q)\, p_2$, and the expected value of the pie for the creditor be denoted

$E^c\pi = p^c \pi_L + (1- p^c) \pi_H$.

Bargaining takes place as before. Let (q', 1-q') denote the posterior beliefs of the creditor; and let the expected value of the pie for the creditor given these posterior beliefs be denoted

$E'\pi = p' \pi_L + (1- p') \pi_H$ where $p' = q'\, p_1 + (1 - q')\, p_2$.

Given equal probability of creditor or debtor proposing in the second period, continuation values can be calculated as $\delta E_i \pi/2$ for debtor of type i and $\delta E'\pi/2$ for the creditor with posterior beliefs q'.

Efficient delay, whatever the type.

If *both* types are sufficiently bullish that prospective growth exceeds the discount rate in each case (i.e. $\delta E_i \pi > \pi_L$, for 1 = 1,2), there will be 'efficient delay'. Observe that the maximum possible offer by type i debtor is $\pi_L - \delta E_i \pi/2$; and that, with such offers, the creditor will deduce the debtor's type and reject[12]. See Table.

[12] The only other equilibrium possibility is that both debtors make the same offer, so q' = q: in this case it can be shown that there is still delay.

Max offer from debtor	Creditor's continuation payoff	Condition for creditor to reject satisfied?	Creditor's posterior belief
$\pi_L - \delta E_1 \pi/2$	$\delta E_1 \pi/2$	$\pi_L - \delta E_1 \pi/2 < \delta E_1 \pi/2$ yes	$q' = 0$ (It's an Optimist)
$\pi_L - \delta E_2 \pi/2$	$\delta E_2 \pi/2$	$\pi_L - \delta E_2 \pi/2 < \delta E_2 \pi/2$ yes	$q' = 0$ (It's an Optimist)

Table A.1: Both types bullish, so $\delta E_i \pi > \pi_L$, for 1 = 1, 2

No delay.

On the other hand, if both types are sufficiently bearish, with prospective growth lying below the discount rate in each case, (so $\pi_L > \delta E_i \pi$, for 1 = 1,2), there will be no delay on the equilibrium path.

Bulls and Bears: separating equilibrium with delay

Consider the case where the growth prospects exceed the discount rate for the Bull; and the reverse is true for the Bear. Can one find a separating equilibrium where the Bear makes an offer which leaves the creditor indifferent (so he accepts), but the Bull makes an offer that is refused (so there is delay)?

Let y_i , the amount the debtor retains when making the maximum possible offer to the debtor, be defined by the equation $\pi_L - y_i = \delta E_i \pi/2$. [Note that $\pi_L - y_1 < \pi_L - y_2$, and $y_1 > y_2$.] Then this separating equilibrium can, we claim, be achieved by the offers described in the Table.

Offer from debtor (debtor, creditor)	Expected continuation payoff for creditor	Conditions for creditor to reject satisfied?	Creditor's posterior belief

$(y_1, \pi_L - y_1)$	$\delta E_1 \pi/2$	$\pi_L - y_1 = \delta E_1 \pi/2$ No	$q' = 1$ (It's a Bear)
$(y_2, \pi_L - y_2)$	$\delta E_2 \pi/2$	$\pi_L - y_2 < \delta E_2 \pi/2$ Yes	$q' = 0$ (It's a Bull)

Table A.2 Separating equilibrium with delay

Formally, for this to be an equilibrium, we need to confirm that
(i) Type 1 has no incentive to imitate type 2;
(ii) Type 2 has no incentive to imitate type 1;
(iii) Type 1 has incentive to delay.

As for the last point, it is pretty clear that the Bull has an incentive to delay in a separating equilibrium: his perceived continuation values are outside the current pie. It is fairly straightforward to confirm that the other two conditions are also satisfied.

APPENDIX B: Sustainability Conditions in the Argentine case

Dynamics of debt reduction

It is straightforward to show how the first two sustainability constraints proposed at Dubai could put the debt on a convincingly downward path relative to GDP. The commitment *to maintain a primary surplus, s, at 3% of GDP* ensures that debt will be falling relative to GDP, at least below the critical value of the debt/income ratio, *d*, shown as *d** in Figure B.1. This is evident from the dynamics of *d* whose time derivative to a linear approximation can be written as:

$$\delta d/\delta t=(r-g)\, d - s = 0.014\, d - 0.03 \qquad \text{(B.1)}$$

where s=0.03 and $r=x\ 0.04+(1-x)\ 0.055$; where x denotes debt excluded from restructuring as a percentage of all debt after restructuring and is set at 0.72; and *g,* the growth rate of the economy, is set at $=0.03$. (Note that we use post-crisis real rates of 5.5% for this purpose. Note also that in this linear approximation we are using post-swap values of restructured debt, i.e. this approximation is only valid in the neighbourhood of point B.)

As there is positive feedback from *d* to $\delta d/\delta t$, the dynamics of debt are explosive, with *d* rising at increasing speed to the right of *d** and contracting ever more quickly to the left. At *d** itself, the surplus covers the real interest cost of debt corrected for the growth rate of the economy i.e. $s=(r-g)\, d$, so $\delta d/\delta t =0$

The second condition, *that the surplus should cover the (real) interest cost of debt at the time of restructuring„* i.e. *s=rd* ensures that the contraction of debt would proceed at a rate of at least 3% p.a. after restructuring. In fact it determines the write-down. Substituting this into equation (B.1.) gives the 'initial condition' of equation (B.2.):

$\delta d/\delta t = -gd$ or $\delta d/\delta t\,(1/d) = -g = 0.03$

(B.2.).

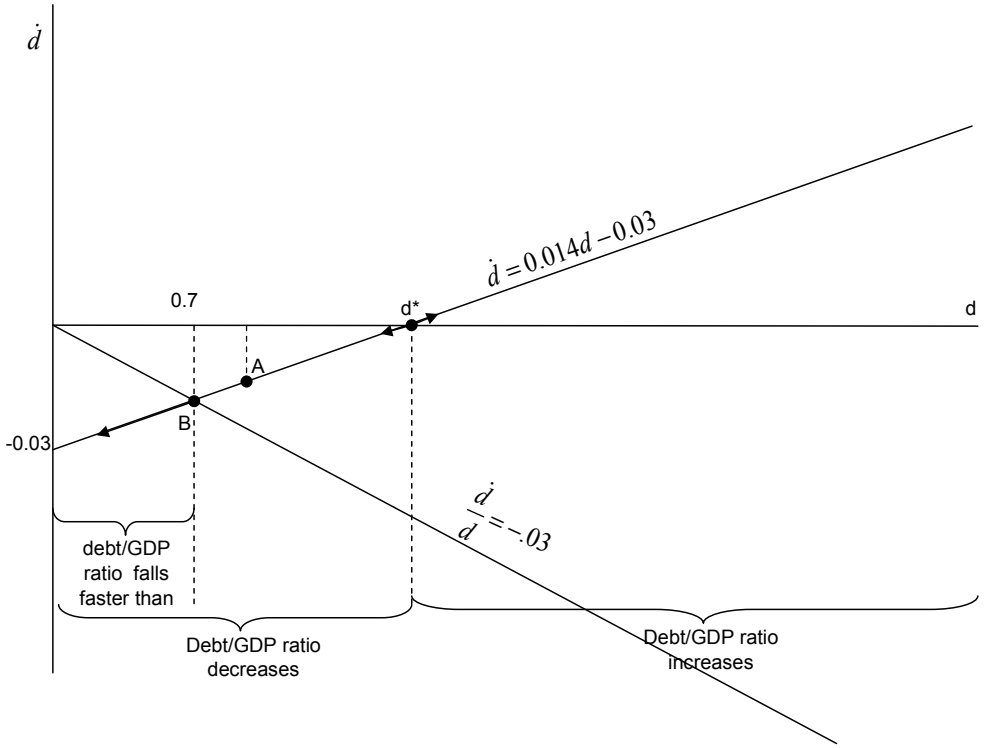

Figure B.1: Dubai conditions for debt sustainability

Together these conditions define the strategy for reducing indebtedness. First to reduce the debt level discretely by a write-down, as shown by the move from A to B in the figure: then to reduce the debt/income ratio gradually, but at an increasing rate, as shown by the arrow to left of B.

Privileged creditors and the 'Dubai residual' for private creditors

The table below, reproduced from Dhillon et al.(2006), indicates the problem facing the Kirchner administration and the implications of applying their criteria for sustainability. The resources allocated to servicing debt with a face value of $182b were constrained to only $3.9: with $2.8 of this pre-empted by preferred creditors, the

Dubai residual remaining for private creditors was about a billion dollars, i.e. less than 1% of GDP of approximately $130 billion in 2003. .

	Sovereign Dollar debt	Service cost(2)@ 10.5%	Debt service proposed at Dubai	Recovery Rate(3)
Total debt	$182 (140% of GDP(1))		$3.9 (3.0 % of GDP)	
Preferred Creditors	$81		$ 2.8	
Others *including* past-due interest	$101	$10.6	**$1.1** (0.8 % of GDP)	10c
Others *excluding* PDI	$81	$8.5	$1.1	13c (4)

Notes (1): 2003 GDP approx $130bn (GDP at current market prices of 376bn pesos[13] converted at 2.90)
(2): For source of the real rate of 10.5%, see Dhillon et al (2005).
(3): Recovery rate = debt service / service cost
(4): Market value of $1.1bn capitalised at 10.5% = $10.5bn which is 13% of $81bn

Table B.1: Debt outstanding and sustainable debt service at Dubai [1]

At post-crisis real interest rates of about five percent, settlement on these terms would have represented a recovery rate of about 27% on debt to private creditors with a face value of $80 billion without past due interest (PDI). But at the high real interest rates prevailing at the time, the implied recovery rate for private creditors was about half that, 13 cents in the dollar on debt without PDI see last column. (Including past due interest of about $10 billion reduces the recovery rate to 10cents.)

To see how closely the negotiations were tied to sustainability considerations, in Figure B.2 we show the limit to debt service plotted as increasing with GDP (at 2004 prices). The dashed line depicts the 3% of GDP limit on debt service; and the parallel solid line shows the residual available for paying the creditors who own defaulted bonds after servicing preferred debt in full (at a cost of $2.8bn a year).

[13] Ministerio de Economía y Producción (2005, Informe 51)

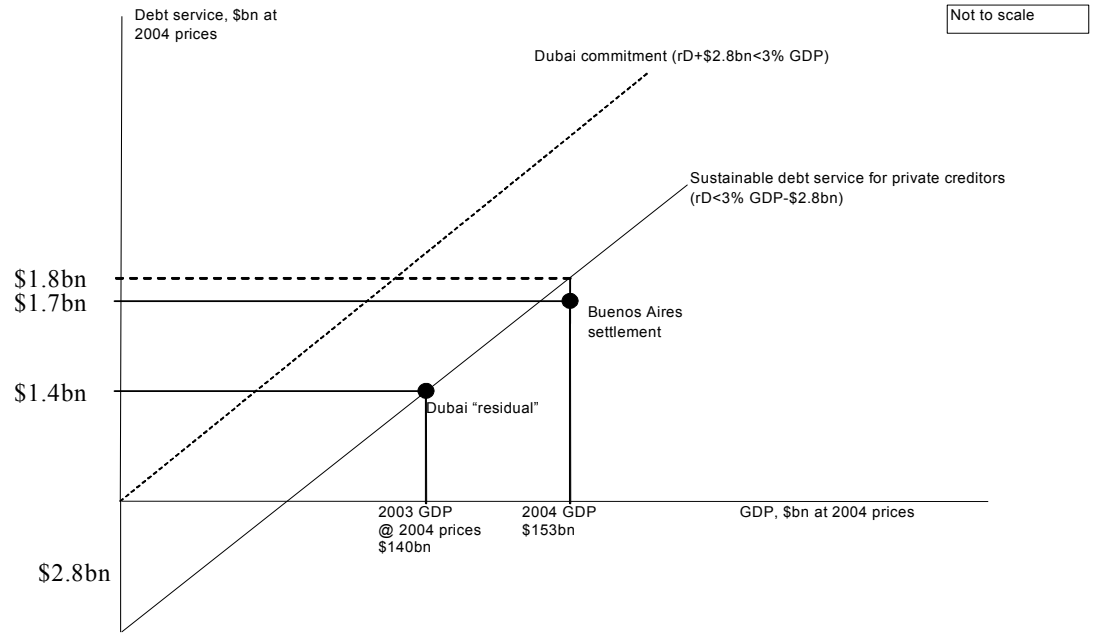

FIGURE B.2**:** Bargaining subject to a sustainability constraint

Debt restructuring in 2003 might well have called for transfers to the creditors in violation of the sustainability condition. Over time, however, the residual available for creditors increased (so that by 2004 it comes out as $1.8n) and creditors were made aware of how seriously sustainability factors were being taken. Note that the actual ('Buenos Aires') offer accepted by the creditors in 2005, valued at $1.7bn (assuming the recovery rate on offer is extended to those outside the swap), is quite close to sustainability.

APPENDIX C: **Recovery and sustainability as separate causes for delay**

From the discussion in the text, it may seem that recovery and sustainability are alternative and mutually incompatible explanations for delay. In this appendix, however, we indicate briefly how recovery and sustainability can each contribute to cumulative delay bargaining. By extending the bargaining model by an extra period, we find that two periods of delay can occur, the first due to prospects of recovery and the second due to signalling of sustainability concern.

In the three-period case, the timing of events is as follows;

	Size of Pie	Proposer	Outcome
t = 1	π_L	debtor makes offer	if offer accepted, game ends; if offer rejected, game continues, and conditional on φ, nature chooses π is $\{\pi_L , \pi_H\}$ with prob p, 1-p; s is {0 , s } with prob q, 1-q.
t = 2:	π_L or π_H	with prob ½ debtor makes offer with prob ½ creditor makes offer	if offer accepted game ends; if offer rejected, game continues to final period (with no intervention by nature)
T = 3	π_L or π_H	with probability ½ debtor makes offer with probability ½ creditor makes offer	if offer accepted game ends; if there is no agreement, there are disagreement payoffs of (0,0).

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The computations are similar to those for the two period model in the main text: the essential innovation is that the creditor may have the opportunity to make an offer in the penultimate period (here period 2). We begin by noting the continuation payoff to the creditor from rejecting the debtor's current offer at t=1 denoted $\tilde{a}$ is defined as:

$$\tilde{a} = \delta\left[p\left\{ q\left(\frac{\delta\pi_L}{2} \right) + (1-q)\left(\delta\left(\frac{\pi_L - \bar{s}}{2} \right) \right) \right\} + (1-p)\left\{ q\frac{\delta\pi_H}{2} + (1-q)\left(\delta\left(\frac{\pi_H - \bar{s}}{2} \right) \right) \right\} \right]$$

Suppose that following two inequalities are satisfied:

(a) $\pi_L - \tilde{a} < \frac{\delta}{2} E\pi$

so the Optimistic debtor will delay in period 1;

(b) $\pi_L - \tilde{a} < s$

so the Cautious debtor will delay in period one,

then, providing the conditions for delay the penultimate period derived for the pure signalling case in Section 3 are also satisfied, there will be two-period delay in bargaining.

Note that because $\tilde{a} < \delta E\pi / 2$ the conditions (a) and (b) are more stringent than in the full information case discussed in Section 2. The reason is that the risk that the creditor faces a Cautious debtor lowers his continuation payoff.