

## Optimal Sequencing of Credible Reforms with Uncertain Outcomes†

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Revised: January 2009

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† The authors are grateful to Hernando Vargas for his comments, and the UIUC research board for support. Published version appears as: John P. Conley and William Maloney, "Optimal Sequencing of Credible Reforms with Uncertain Outcomes" *Journal of Development Economics*, Vol. 48, 1995, pp. 151-163.

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## **Abstract**

We study a two period representative agent economy in which economic liberalization is modeled as adding a positive random variable to the marginal product of capital. We show liberalization always raises the expected utility of agents. Agents may respond to this by increasing consumption in the first period. Consequently, consumption in the second period is sometimes smaller than the in the first depending on the realization of the random variable. This “tail” may cause the government to reject liberalization if declining GDP enters negatively in the government’s objectives. We apply these results to the Chilean experience of the 1980’s.

Keywords: Economic liberalization, Chile, Development, Sequencing Reforms.

JEL numbers: O16, O54

## 1. Introduction

A substantial literature on the optimal sequencing of economic reforms emerged in the mid-1980s prompted largely by a desire to understand the disappointing experiences with liberalization programs in the Southern Cone of Latin America. Ultimately, most observers continue to believe that there are substantial welfare gains to be reaped by giving freer play to market forces. But many have concluded that there are problems inherent in the transition process itself that argue against liberalizing all markets simultaneously. The dominant themes of this literature have been well-summarized by Edwards and Edwards (1987), Edwards (1989), and Choski and Papageorgiou (1986). Broadly, the main issues seem to be: minimizing adjustment costs (Little, Scitovsky, and Scott 1970, Michaely 1986, Rottemberg 1986), the implications of differential rates of adjustment between sectors (McKinnon 1973,1982, Krueger 1986, Mussa 1986), appropriate macro-policy during reforms and specifically exchange rate management (Dornbusch 1983, Edwards and Edwards 1987, Harberger 1986, Kahn and Zahler 1983, 1985, McKinnon 1991), and the welfare consequences of leaving one sector controlled while freeing another (Edwards 1989, Edwards and Wijnbergen 1986, Frankel 1983, Krueger 1986).

An especially heavy emphasis has been placed on the importance of uncertainty in the reform process, particularly that arising from incomplete government credibility (Calvo 1987, Daveri 1991, 1989, Froot 1988, Mussa 1986, Rodrik 1989). Eliminating uncertainty about government intentions appears to be the critical issue in the debate, almost to the exclusion of those previously discussed. In their summary of the Chilean case, for example, Edwards and Edwards contend: “It is, we believe, in the credibility sphere where the most important lesson on the sequencing of liberalization lies. In a sense, the implementation of a consistent and credible policy package is more important than determining ‘the correct’ order of liberalization.”<sup>1</sup>

This paper argues that *even if government policy is fully credible*, there remains

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<sup>1</sup> Edwards and Edwards (1987) p193.

another source of uncertainty which has significant implications for the sequencing of liberalization programs. Reform implies almost by definition a conscious altering of the underlying parameters of an economy, the effect of which will be precisely known only with the passage of time. In the interim, agents must base their actions on their expectations, which, if incorrect, may lead to an outcome which a government would prefer to avoid. In other words, because of the uncertainty intrinsic to the transition process itself, reform may have undesirable consequences in the short run even if government policy is consistent and credible.

Our analysis is motivated in part by a long standing puzzle about the extreme borrowing and savings behavior observed in Chile from 1979-82. As Table 1 shows, after three years of rapid GDP growth, following extensive structural reforms that included liberalizing both the current and capital accounts, national savings plummeted to a historic low in 1981.<sup>2</sup> At the same time, there was a dramatic surge in consumer borrowing which at times grew at 22% per month in real terms. In 1982, the boom collapsed. GDP fell 18% across the next year and a half, and would recover its 1980 level only six years later.<sup>3</sup> Individuals, corporations, and major banks found themselves deep in debt. The public sector suddenly came under major strain as it effectively renationalized the bankrupt financial sector and assumed billions of dollars in private sector foreign liabilities. This left the government with the largest per capita debt in Latin America.

What caused the tremendous decrease in savings and increase in borrowing? Perhaps the dominant explanation in the literature argues that agents saw a critical inconsistency in the overvaluation of the exchange rate that portended a reversal of the trade reform. As Edwards and Edwards write<sup>4</sup>

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<sup>2</sup> The government was running a budget surplus during this period, so the decline occurs entirely in private savings.

<sup>3</sup> Two widely cited causes of the decline in real activity were very high real interest rates of over 40% across the period, and the 30-40% overvaluation of the currency.

<sup>4</sup> Edwards and Edwards (1987) p 189.

..if agents believe that the trade reform will be reversed, they will tend to borrow heavily today, in order to finance a higher present consumption of imported goods. This indeed seems to have been the case in Chile in 1981. This is a perfectly rational strategy if it is expected that importable goods in the future will be more expensive due to the perceived hike of tariffs. This optimal behavior from a private perspective, however, may result in excessive (that is nonoptimal) borrowing from the social point of view.

While the authors present a nuanced description of this very complex period, they place primary responsibility for the indebtedness through the capital account on inconsistent and thus incredible government policy.

There is a contrasting view which holds the excess borrowing occurred in spite of full confidence in the reforms. Several well-known Chilean economists (Barandiaran 1987, Eyzaguirre 1988, Schmidt-Hebbel 1987, Zahler 1985)<sup>5</sup> find the source of this consumption boom in the reigning ambience of “triumphalism” or the conviction that Chile had overcome a decade of stagnation and “in ten years would be a developed nation... where 70% of the population would have color TV’s.”<sup>6</sup> Minister of the Economy Sergio de Castro would announce in his 1980 state of the economy speech “The economy is growing in such a way that in eleven years income per capita will double in contrast to past circumstances where this would have been achieved only after forty-six years...”<sup>7</sup> These pronouncements were made credible by the vast inflows of capital from abroad, on the order of 25% of GDP by 1981, and the international community’s praise for Chile as a growth miracle.

Such a vast increase in expected permanent income implies significant changes in

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<sup>5</sup> Corbo (1985) focuses more on perceived increases in wealth, particularly due to the stock market boom.

<sup>6</sup> Labor Minister Jose Piñera to 3000 union leaders, 1980.

<sup>7</sup> Quoted in Eyzaguirre (1988).

consumption behavior and this is what was observed. As Hachette and Lüders of the Catholic University in Santiago, the cradle of Chilean neo-liberalism argue,

The high GDP growth rates of the 1970's and early 1980's and the prevailing optimism with respect to income growth, reinforced by rapidly rising asset prices, raised expectations with respect to permanent income. This encouraged economic agents to increase consumption, particularly of durables, more rapidly than the growth of disposable income would seem to allow. In fact, agents went into debt to both domestic and foreign creditors, especially the latter, since foreign credit was more available and less expensive than domestic. As a result, domestic savings rates were significantly reduced.<sup>8</sup>

Lüders, reflecting on his tenure as Former Minister of the Treasury and of the Economy (simultaneously) immediately prior to the collapse has more explicitly emphasized the role of excessive expectations. "It was a period of euphoria. We were convinced we were on our way to becoming another Korea or Taiwan: we felt rich, we wanted to consume, we took on great debts..."<sup>9</sup>

The data, too, suggest that excessive faith in the pending fruits of the government's reforms rather than the reverse is in fact the more credible story, at least in the early phase of the reforms. First, it is clear from Graph 1 that the demand for consumer credit surged in late 1979 when all macro-economic indicators were encouraging, and lost momentum as the collapse in mid-1982 became anticipated. This is exactly the inverse of what the low credibility story would predict.<sup>10</sup> Second, consumer spending rose on all categories of goods, both foreign and domestic. As Table 1 shows, growth in domestically manufactured consumer durables outstripped almost all other categories of manufactures, rising almost 30% in 1980-81 relative to its 1979 level. That demand

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<sup>8</sup> Hachette and Lüders (1993).

<sup>9</sup> Interview with Constable and Valenzuela (1991) p. 193.

<sup>10</sup> Data on consumer credit collected from the Superintendencia de Bancos, Santiago, various issues.

increased for both imported and domestically produced goods suggests that its impetus was not a forecasted reversal of the external reforms.

Insert table 1 and graph 1 about here.

This point is made more clearly if we examine the quintessential non-tradeables sector, construction and real estate. As Edwards and Edwards note, a large fraction of foreign borrowing was directed to the construction and real estate sector. Graph 1, for example, shows housing prices were rising over 400% in real terms per year in two affluent Santiago suburbs, La Dehesa and Lo Curro.<sup>11</sup> While it could be argued that the dramatic movements in land prices suggest a speculative bubble financed by easy foreign capital, there is some reason to believe that what was happening was a dramatic realignment of the price of a commodity in limited supply, land. Construction as reported in the national accounts was growing at rates between 16% and 25% per annum. Private construction, measured in either square meters constructed or real pesos, grew over 40% in 1980, 2.5 times the previous 20 year high, and 20% in 1981. Like the building of what would turn out to be vast excess capacity in “caracoles” or shopping malls, this activity makes little sense interpreted as speculative behavior. These were long term investments predicated on the idea that Santiago was to be a far more prosperous city than it turned out to be.

Under this “triumphalist” interpretation, the ex-post socially nonoptimal debt was reasonable ex-ante given expectations of the future behavior of the economy and, contrary to the previous story, reflects full confidence in the reforms. In light of the recession of 1982, and subsequent fall of the growth rate to half that of the 1978-81 period, these expectations were clearly over-optimistic. The Chilean government, confronted with reconstituting a bankrupt financial system and shouldering the burden

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<sup>11</sup> Data collected weekly by authors from the real estate section of *El Mercurio*, the principal Santiago newspaper. As much as was possible prices correspond to houses with uniform characteristics. Prices are quoted in Unidades de Fomento, a real unit of account effectively indexed to the dollar.

of this debt, might legitimately wonder whether the costs arising from these unfulfilled expectations were outweighed by the efficiency gains of liberalizing the capital account.

While we do not put this interpretation forward as the exclusive explanation for the overindebtedness, it represents an underexamined dimension of the period with important policy implications. We can no longer dismiss the Chilean outcome purely as the result of bad policy but must acknowledge the possibility of the undesirable outcome arising even if the reform program were consistent and credible. Accounting for the possible downside risk that is intrinsic in reforms provides a reasonable explanation for why countries might rationally resist a full and simultaneous liberalization of all markets.

Our underlying point is very similar in spirit to the one made by Dornbusch (1991) in his discussion of why governments implement stabilization programs that are not fully credible.<sup>12</sup> Both papers conclude that randomness in the outcome of the reforms that is not related to credibility may dissuade governments from fully embracing policy measures which under certainty they would. We follow his approach in assuming the existence of a government welfare function, however, we do not rely on an explicit cost to liberalization to drive the result. Rather the cost arises endogenously from the uncertainty attending the reforms and would vanish entirely in a world of certainty.

To focus on this particular dimension of liberalization, we assume away all adjustment costs or lags that have concerned earlier studies of the topic and assume government policies to be fully credible. We consider the sequencing of a two part liberalization. The first affects some aspect of the real sector, which, to be consonant with the literature could be considered the current account. We model this as causing a once and for all rise in the marginal product of capital. The second is a freeing of the capital account. This allows agents the possibility of intertemporal smoothing of consumption through international borrowing and lending which was previously impossible.

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<sup>12</sup> If the government could know with certainty that full commitment to a stabilization would guarantee stabilization, or if there were not costs to a failed stabilization, then there is no reason for governments to resist. But if stabilizing has costs, and if there is always the possibility of a random shock that will cause the program to fail, the government will less than completely commit to the program.

In planning their intertemporal consumption profiles, agents must forecast the magnitude of the rise in the marginal productivity of capital. Since the reform is a one time event, however, they have little past experience upon which to draw. We assume that their prior distribution corresponds exactly to the objective distribution of the new marginal product of capital, which now has both a higher mean and variance than before the reforms. The expected rise in the marginal product of capital might be interpreted as a sort of mean impact of reform efforts drawn from the experiences of other countries with the variance due to unknown country specific factors. Alternatively we might argue that if the liberalization were repeated numerous times, the average impact would equal that expected but that in any given liberalization event temporally specific international or domestic factors combine to have a persistent effect on the impact of the reforms.

We show that if agents are fully able to borrow against their perceived higher permanent income through an open capital account, present consumption will increase. But the uncertainty surrounding the new value of the marginal product of capital implies a distribution of future consumption, income less debt repayments, as well. There is a tail of this distribution where for some realizations of the post-reform economy, debt repayments predicated on a more optimistic scenario will imply that future consumption will actually fall. Arguably, this is not a bad characterization of the situation of debt distress that both Chile and Argentina found themselves in following the collapse of the 1970's liberalization experiments.

If the government is concerned not only with maximizing the expected utility of private agents in the economy, but is also strongly averse to outcomes in which the standard of living declines, it will seek to truncate that segment of the distribution by prohibiting the indebtedness that makes it possible. The government may therefore choose to maintain control of the capital account. As more information is accumulated over time on how the economy is responding to the reforms, the variance of the distribution around the new marginal product of capital is reduced, diminishing this tail of bad realizations. The government can at that point permit freer consumption

smoothing and liberalize the capital account.

There are several reasons why the government may maximize a different program than agents. For example, agents may not be able to perfectly distinguish a bad from an unlucky government. Thus, a poor economic showing for any reason causes agents to rationally revise their estimate of the government's quality downward. If a government cares about staying in office then it must care about realized growth as well as the welfare of agents in this case. Alternatively, the government may not be able to credibly commit to forcing agents to fully bear the consequences wide spread economic losses. Political pressure may force the government to bail out investors, as the US government did during the savings and loan crisis. This creates a moral hazard for investors since they correctly believe that they are partially insured against the downside risk to which the nation is subjected as a consequence of their collective investment decisions. A third possibility is that there is a coordination problem similar to the isolation paradox proposed by Sen (1984). There, agents collectively want to leave a larger capital stock for posterity but realize that their individual savings decision has essentially no impact on the total stock. This can be modeled as agents' collectively caring about the growth rate and expressing their preference through the national government, but still maximizing purely private objectives.

## 2. The Model

Consider a representative agent economy with two periods, and a single consumption good. The agent is endowed with  $\omega > 0$  in the first period, and has an additively separable, von Neumann-Morgenstern utility function:

$$U(c_1, c_2) = u_1(c_1) + u_2(c_2).$$

We assume diminishing marginal utility in each period:

$$\frac{\partial u_t}{\partial c_t} > 0, \text{ and } \frac{\partial^2 u_t}{\partial c_t^2} < 0 \text{ for } t = 1, 2.$$

The agent can either consume his endowment or save it and invest for consumption in the second period. The agent has available a technology given by a production function  $G$  with the usual properties:

$$\frac{\partial G}{\partial s} > 0 \text{ and } \frac{\partial^2 G}{\partial s^2} < 0,$$

where  $s$  is savings choice. Thus, his budget constraints are:  $c_1 = \omega - s$  and  $c_2 = G(s)$ .

Now suppose that the government is considering a program of economic liberalization in two parts. The first may be thought of as any reform of the real sector. This could include deregulation, privatization, or, to frame the problem as is common in the literature, a removal of restrictions on international trade. We model the impact of the reform as adding a positive random increase in the productivity of investment. We constrain the effect to be always positive to ensure that none of our results are a consequence of the reforms themselves having a perverse impact.

Formally, let  $z$  be a random variable that can take values between 0 and  $k$ , with a distribution given by  $f(z)$ . After liberalization the second period budget constraint becomes:  $c_2 = (1 + z)G(s)$ . The government may also consider, as a second reform, liberalizing the capital account. This would permit agents to augment their domestic savings with foreign borrowing. The corresponding budget constraints are:  $c_1 = \omega - s + b$ , and  $c_2 = (1 + z)G(s) - (1 + r)b$ , where  $b$  is the amount the agent borrows (this is negative if the agent lends on international markets) and  $r$  is the international interest rate. As always, we require that consumption in both periods be nonnegative. This may cause difficulties if borrowing is allowed since the agent can never pay back more than they make in the second period. It also results in a nonconvexity in the problem since it has the potential to generate a second optimal program in which the agent borrows as much as he can, invests nothing, and plans on defaulting on the loan in the second period. We rule this out because it reflects unrealistic behavior by the lenders and we impose the borrowing constraint:

$$(1 + \bar{z})G(s) - (1 + r)b \geq 0,$$

where  $\bar{z}$  is the mean of the random variable  $z$ . This says that the agent must be able to pay back his borrowing in expectation.

Our results should be robust to other specifications provided that they are not so loose that the agent finds it in his interest to borrow the maximum and plan to go bankrupt in the second period.

We summarize these constraints below:

1. No liberalizations:

$$c_1 = \omega - s, c_2 = G(s).$$

2. Liberalize only the financial sector:

$$c_1 = \omega - s + b, c_2 = G(s) - (1 + r)b.$$

3. Liberalize only the real sector:

$$c_1 = \omega - s, c_2 = (1 + z)G(s).$$

4. Liberalize both sectors:

$$c_1 = \omega - s + b, c_2 = (1 + z)G(s) - (1 + r)b.$$

We begin by considering an economy that is undergoing real sector reform. We show below that if the capital account is opened at the same time, and the agent chooses to borrow on international markets, then first period consumption increases. Intuitively, if the agent sees his permanent income rising, he may save less, or if possible borrow, this period in anticipation of greater income in the second period. Define  $(c_1^b, c_2^b, s^b, b)$  to be the program when the agent is able to borrow, and  $(c_1^{nb}, c_2^{nb}, s^{nb})$  when the capital account is closed.

**Lemma 1.** *If  $b > 0$ , then  $c_1^b > c_1^{nb}$ .*

Proof/

1. Consider first the consumer problem when the financial sector is closed:

$$\max_{c_1^{nb}} u_1(c_1^{nb}) + \int u_2((1 + zf(z))G(\omega - c_1^{nb}))dz.$$

This gives the following first order condition:

$$\frac{\partial u_1(c_1^{nb})}{\partial c_1^{nb}} - \int (1 + zf(z)) \frac{\partial u_2(c_2^{nb})}{\partial c_2^{nb}} \frac{\partial G(s^{nb})}{\partial s^{nb}} dz = 0$$

Note that given the constraint, choosing the level of consumption in period one implies the agent's choice for period two. If the financial sector is open, on the other hand,

the agent must choose both consumption in period one and how much to borrow. This determines his savings choice and therefore his second period consumption. Here, the agent solves the following problem.

$$\max_{c_1^b, c_2^b} u_1(c_1^b) + \int u_2((1 + zf(z))G(\omega + b - c_1^b) - (1 + r)b)dz.$$

This gives the following two first order conditions:

$$\frac{\partial u_1(c_1^b)}{\partial c_1^b} - \int (1 + zf(z)) \frac{\partial u_2(c_2^b)}{\partial c_2^b} \frac{\partial G(s^b)}{\partial s^b} dz = 0$$

and

$$\int (1 + zf(z)) \frac{\partial u_2(c_2^b)}{\partial c_2^b} \left( \frac{\partial G(s^b)}{\partial s^b} - (1 + r) \right) dz = 0.$$

Now suppose that  $c_1^b \leq c_1^{nb}$ . By hypothesis,  $b > 0$  and so  $s^b > s^{nb}$ . Thus, the agent consumes more in the second period in expectation when the capital market is open. By the assumption of diminishing marginal utility, this means his marginal utility is lower in expectation when he is allowed to borrow. In addition, since he saves more, by the assumption of diminishing marginal productivity, the marginal product of saving is lower in expectation when the capital markets are open. The product of these two derivatives is therefore also smaller when there is borrowing. Formally:

$$\int (1 + zf(z)) \frac{\partial u_2(c_2^b)}{\partial c_2^b} \frac{\partial G(s^b)}{\partial s^b} dz < \int (1 + z) \frac{\partial u_2(c_2^{nb})}{\partial c_2^{nb}} \frac{\partial G(s^{nb})}{\partial s^{nb}} dz = 0.$$

Since by the first order conditions

$$\frac{\partial u_1(c_1^b)}{\partial c_1^b} = \int (1 + zf(z)) \frac{\partial u_2(c_2^b)}{\partial c_2^b} \frac{\partial G(s^b)}{\partial s^b} dz,$$

and

$$\frac{\partial u_1(c_1^{nb})}{\partial c_1^{nb}} = \int (1 + zf(z)) \frac{\partial u_2(c_2^{nb})}{\partial c_2^{nb}} \frac{\partial G(s^{nb})}{\partial s^{nb}} dz,$$

We conclude that

$$\frac{\partial u_1(c_1^b)}{\partial c_1^b} < \frac{\partial u_1(c_1^{nb})}{\partial c_1^{nb}}.$$

But by diminishing marginal returns, this implies  $c_1^b > c_1^{nb}$ , a contradiction.

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We are primarily concerned with how a rational government will behave knowing that agents will react to its reform in the way described above. We imagine that the government maximizes a welfare function with two arguments. The first is the expected utility of the representative agent. The second is the growth level of the standard of living as discussed earlier. In general, the government maximizes the expected value of:

$$W(U(c_1, c_2), (c_2 - c_1)).$$

Theorem 1 says that if opening the capital account would have any effect at all, then there will always be a welfare function that rationalizes keeping the account closed. In other words, a rational government that cares sufficiently about decreases in the standard of living will always find it optimal to liberalize the real sector first, and worry about the capital account later.

**Theorem 1.** *If  $b > 0$  when both sectors are liberalized simultaneously, then there exist welfare functions such that rational governments may choose to liberalize the real sector only.*

Proof/

Clearly, the expected utility of the agent is at least as high if both sectors are liberalized simultaneously than when only the real sector is liberalized since the agent has more degrees of freedom. It is easy, however, to construct welfare functions that place high negative weight on decreases in the standard of living. It is therefore sufficient to show that there exists a range of realizations of the random variable,  $z$ , for which the growth of the standard of living is reduced. But this is immediate since from Lemma 1, if  $b > 0$  under both liberalizations,  $c_1^b > c_1^{nb}$ . But there is a range of realizations of  $z$  starting at zero (but below the expectation) for which  $c_2^b < c_2^{nb}$ . Since for this range of  $z$ , the growth of the standard of living is reduced, the government may find it optimal not to liberalize the current account.

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### 3. An Example

In this section we provide a numerical example that illustrates the points made above. The conclusion to be drawn is that in non-pathological cases, a reasonable government may prefer to liberalize the real sector before the capital account because the optimal unconstrained borrowing choices of the agent may lead to a decline in economic growth.

In all of the examples below, let the utility function be:

$$U(c_1, c_2) = (c_1)^{\frac{1}{2}} + \delta c_2,$$

where  $\delta$  is the subjective rate of time preference.<sup>13</sup> Let the production function be:

$$G(s) = s^{\frac{1}{2}}.$$

Assume that the reform of the real sector converts this to:

$$G(s) = (1 + z)s^{\frac{1}{2}}$$

where  $z$  is a random variable uniformly distributed on the interval  $[0, k]$ .

1. If the government chooses not to liberalize either sector, the agent solves the following problem:

$$\max_s (\omega - s)^{\frac{1}{2}} + \delta s^{\frac{1}{2}}.$$

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<sup>13</sup> In this example  $\frac{\partial^2 u_2(c_2)}{\partial (c_2)^2} = 0$  which does not quite satisfy the assumption of *strictly* diminishing marginal utility made earlier. It is obviously possible to modify the example to satisfy this and get equivalent answers. We choose this simpler specification in the interest of clarity.

This gives the first order condition:

$$\frac{-1}{2(\omega - s)^{\frac{1}{2}}} + \frac{\delta}{2s^{\frac{1}{2}}} = 0,$$

which gives the solution:

$$s = \frac{\omega\delta^2}{(1 + \delta^2)}.$$

2. If the government chooses to liberalize the financial sector only, the agent's problem is changed to:

$$\max_{s,b} (\omega - s + b)^{\frac{1}{2}} + \delta(s^{\frac{1}{2}} - (1 + r)b).$$

This gives the following first order conditions:

$$\frac{-1}{(\omega - s + b)^{\frac{1}{2}}} + \frac{\delta}{2s^{\frac{1}{2}}} = 0,$$

and

$$\frac{1}{2(\omega - s)^{\frac{1}{2}}} - \delta(1 + r) = 0,$$

which give the solutions:

$$s = \frac{1}{4(1 + r)^2}.$$

and,

$$b = \frac{(1 + \delta^2)}{4\delta^2(1 + r)^2} - \omega.$$

3. If the government chooses to liberalize only the real sector, on the other hand, the agent's problem becomes:

$$\max_s (\omega - s)^{\frac{1}{2}} + \int \delta(1 + zf(z))s^{\frac{1}{2}} dz.$$

Remembering that  $z$  is uniformly distributed with mean  $\frac{1}{2}k$  and integrating, this becomes:

$$\max_s (\omega - s)^{\frac{1}{2}} + \delta(1 + \frac{1}{2}k)s^{\frac{1}{2}} dz.$$

This gives the first order condition:

$$\frac{-1}{2(\omega - s)^{\frac{1}{2}}} + \frac{\delta(1 + \frac{1}{2}k)}{2s^{\frac{1}{2}}} = 0,$$

and the solution:

$$s = \frac{\delta^2(1 + \frac{1}{2}k)\omega}{1 + \delta^2(1 + \frac{1}{2}k)^2}.$$

4. Finally, if the government chooses to liberalize both sectors, the problem the agent faces is:

$$\max_{s,b} (\omega - s + b)^{\frac{1}{2}} + \int \delta \left( (1 + zf(z))s^{\frac{1}{2}} - (1 + r)b \right) dz,$$

or, integrating:

$$\max_s (\omega - s + b)^{\frac{1}{2}} + \delta \left( (1 + \frac{1}{2}k)s^{\frac{1}{2}} - (1 + r)b \right) dz.$$

This gives the first order conditions:

$$\frac{-1}{(\omega - s - b)^{\frac{1}{2}}} + \frac{\delta(1 + \frac{1}{2}k)}{2s^{\frac{1}{2}}} = 0,$$

and

$$\frac{1}{2(\omega - s)^{-\frac{1}{2}}} - \delta(1 + r) = 0,$$

which give the solutions:

$$s = \frac{1 + \frac{1}{2}k}{4(1 + r)^2}.$$

and,

$$b = \frac{1 + \delta^2(1 + \frac{1}{2}k)^2}{4\delta^2(1 + r)^2} - \omega.$$

We imagine that the government's welfare function takes into account the expected utility of the agent and whether the standard of living increases or decreases. A simple specification is given below:

$$W(c_1, c_2) = \lambda U(c_1, c_2) - (1 - \lambda)NG(c_2, c_1),$$

where  $NG$  is the indicator function that takes the value one when there is no growth in the standard of living:

$$NG(c_1, c_2) \equiv \begin{cases} 1 & c_2 \leq c_1 \\ 0 & c_2 > c_1 \end{cases}.$$

Note that the expected value of  $NG$  is the proportion of times that the economy does not grow and represents the "bad tail" of the distribution.<sup>14</sup> Given the linearity of utility in the second period, the expected utility equals the utility of the expectation. Thus, the government's expected welfare can be reduced to:

$$E(W(c_1, c_2)) = \lambda U(c_1, E(c_2)) - (1 - \lambda)E(NG(c_2, c_1)),$$

where  $E$  is the expectation operator. Assume the following parameter values:

$$\delta = .9$$

$$r = .05$$

$$k = 1$$

$$\omega = .32$$

$$\lambda = .45.$$

If we calculate the expected welfare of each of the choices we find:

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<sup>14</sup> Obviously, there are other ways to model the government's concern for growth. It may be more realistic to take into account not only the fact of economic decline, but also the magnitude, for example. Our purpose here is merely to give a simple illustration of the phenomenon discussed in the previous section, not to argue that this is actually the form government welfare functions take.

<u>Reforms</u>	<u><math>s</math></u>	<u><math>b</math></u>	<u><math>c_1</math></u>	<u><math>E(c_2)</math></u>	<u><math>E(U)</math></u>	<u><math>E(NG)</math></u>	<u><math>E(W)</math></u>
None	0.143	0.000	0.177	0.378	0.761	0.000	0.342
Capital	0.227	0.187	0.280	0.280	0.781	0.000	0.352
Current	0.207	0.000	0.113	0.682	0.950	0.000	0.428
Both	0.510	0.470	0.280	0.578	1.049	0.083	0.426

Thus, we find that since the government is concerned about bad tails, its best policy choice in this case is liberalize only the real sector. Again, this result depends entirely on the fact that there is uncertainty about the realization of the random variable  $z$ . There is a tail of realizations for which the ex post consumption path is decreasing when both sectors are liberalized. If the mean growth was realized with certainty, on the other hand, consumption would not fall, and the indicator function would take an expected value of zero. The agent's expected utility would be the soul determinant of the government's actions in this case, and it would choose to liberalize both sectors simultaneously.

#### 4. Conclusion

This paper has suggested that uncertainty about the post reform underlying parameters is intrinsic to the transition to a more market based economy and has important implications for the optimal sequencing of liberalizations. Decisions made in the presence of such uncertainty can lead to socially undesirable outcomes, even if government policy is fully credible. We argue that in the case of the excessive indebtedness accompanying the Chilean reforms, the data are more consistent with a story of agents being fully confident in the reforms, but excessively optimistic about their impact, than with the more accepted explanation that stresses speculation against inconsistent and incredible government policies. Using a simple two period model, we show that due to

the costs of the downside risks of reform, governments may initially choose to maintain controls in some markets, and liberalize more completely as information becomes available about the impact of the reforms.

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