Board of Governors of the Federal Reserve System

International Finance Discussion Paper
Number 552
June 1996

THE TEQUILA EFFECT: THEORY AND EVIDENCE FROM ARGENTINA

Martín Uribe

Note: International Finance Discussion Papers are preliminary material circulated to stimulate discussion and critical comments. References in publications to International Finance Discussion Papers (other than an acknowledgement that the writer had access to unpublished material) should be cleared with the author or authors.

ABSTRACT

The Tequila Effect hypothesis states that the economic crisis that affected several South American countries in 1995 was caused by an exogenous capital flight triggered by the loss of confidence of foreign investors after the collapse of the Mexican peso in December 1994. I analyze the Argentine experience before and after the Mexican crisis and argue that the Tequila Effect played an important role in the 1995 crisis. I model the Tequila Effect in an optimizing, small, open economy, as a situation in which agents at time 0 learn that at some random future date foreign investors will pull their assets out of the country. The model captures key features of the Argentine crisis of 1995: the decline in aggregate domestic spending and the outflow of capital that began in December 1994; the credit crunch and interest rate hike of March 1995; the slow return of the real interest rate to its pre-crisis level, and the protracted decline in output and investment that began in March 1995.

The Tequila Effect: Theory and Evidence from Argentina

Martín Uribe*

1 Introduction

In April 1991 the Argentine government embarked on an ambitious inflation-stabilization program—the Convertibility Plan—whose main components were an exchange rate peg to the U.S. dollar and a far-reaching structural reform that included expenditure cuts, the privatization of virtually all state-owned enterprises, tax reform, and financial and trade liberalization. The initial results were impressive: high inflation disappeared instantaneously, output grew at an average annual rate of almost 8% between 1991 and 1994, and consumption and investment expanded at even higher rates. At the same time the trade balance showed large deficits and the real exchange rate appreciated.

This economic boom came to an abrupt end with the collapse of the Mexican Peso in December 1994 when a run on the Argentine banking system began that led to a traumatic credit crunch in March 1995 and put many financial institutions out of business. The financial crisis had disastrous real effects: In 1995, output declined 4.5% and gross domestic investment 16%; the trade balance turned positive for the first time in three years, reflecting a contraction in domestic spending; and the real exchange rate showed the first signs of depreciation as the economy entered a deflationary phase.

What caused this reversal of fortunes? One explanation is that a boom-recession cycle is inherent to exchange-rate based stabilization programs. Empirical studies (Kiguel and Liviatan, 1992; Végh, 1992) have found that the effects of exchange-rate based stabilization programs implemented in different countries and at different points in time are remarkably similar—initial economic expansion, trade balance deterioration and real exchange rate appreciation is followed by recession, trade balance improvement and real depreciation. A vast literature has been devoted to formalizing this explanation and different mechanisms have been advanced.[1]

*The author is a staff Economist at International Finance Division of the Board of Governors of the Federal Reserve System. I would like to thank Jaime Marquez, Pierre-Richard Agénor, Stephanie Schmitt-Grohé, and seminar participants at the Inter American Development Bank for helpful comments, and Sherrell Varner for editorial assistance. This paper represents the views of the author and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or other members of its staff. Address for correspondence: International Finance Division, Stop 24, Board of Governors of the Federal Reserve System, Washington, DC 20551, (202) 452 3780, e-mail uribem@frb.gov.

[1] For early explanations based on reduced-form models with sticky prices and adaptive expectations, see Rodríguez

An alternative explanation argues that business cycles in LDCs are to a large extent driven by movements in the interest rate in industrialized countries. Calvo, Leiderman and Reinhart (1993) find that the international interest rate is a significant determinant of the real exchange rate and of international capital flows to Latin America. Similarly, Dooley, Fernández-Arias and Kletzer (1996) find that the interest rate in developed countries is the main factor explaining movements in the secondary market price of foreign public debt of developing countries.

A third possible explanation for the reversal of fortunes is the "Tequila Effect" (or "Contagion Effect") hypothesis, which states that the Argentine crisis of 1995 was caused the reluctance of foreign investors to renew their loans to the country, resulting from the fear that it would soon follow in Mexico's footsteps. According to this hypothesis the change of confidence of foreign investors was exogenous to the country and, moreover, completely unrelated to domestic economic fundamentals.

In this paper, I undertake an empirical and theoretical investigation of the Tequila Effect hypothesis. In section 2, I examine the Argentine economic experience since the implementation of the Convertibility Plan in 1991, with emphasis on developments after the Mexican crisis of December 1994.[2] I argue that there was a clear Tequila Effect in the Argentine crisis of 1995, and that certain elements of that crisis can hardly be explained by either the exchange-rate based stabilization hypothesis or the international interest rate hypothesis.

In section 3, I present a model of a small, open economy that starts out as a net borrower from the rest of the world. As is well known, under the assumption that the rate of time preference equals the international real interest rate, the equilibrium in such an economy is characterized by a constant level of consumption and a positive trade balance large enough to service the (constant) net foreign debt. I refer to this scenario as the crisis-free equilibrium. I then model the Tequila Effect as a situation in which at some point, say period 0, domestic residents learn that at some future date foreign investors will decide to hold no domestic assets. I consider first the simple case of a perfect foresight, endowment economy, and then introduce uncertainty about the time of the pull out, and capital accumulation. Under perfect foresight domestic residents learn in period 0 the exact date, say period T, at which foreign investors will pull out of the country. In this case, consumption falls in period 0 and stays constant through period T at a level such that the stock of debt in period T is 0. In period $T+1$, consumption jumps up to the endowment level and stays at that level thereafter. The domestic interest rate is constant and equal to the international interest rate between periods 0 and $T-1$, jumps up in period T, and returns to its initial level in period $T+1$.[3]

(1982) and Dornbusch (1982). For models of temporary stabilization and imperfect credibility, see Calvo (1986, 1987) and further developments by Drazen and Helpman (1987, 1988), Calvo and Végh (1993), Reinhart and Végh (1995), and Mendoza and Uribe (1996), among many others. For supply-side explanations see Uribe (1993), Roldós (1995) and Lahiri (1995). Rebelo and Végh (1995) provide a survey of this literature.

[2]Calvo and Reinhart (1996) analyze cross country data on asset returns to identify contagion effects in financial crisis.

[3]The assumption that foreign investors pull *completely* out of the country is made for simplicity but is by no

This simple setup captures some key elements of the Argentine financial crisis of 1995, namely, the capital outflow that started right after the Mexican crisis in December 1994, the corresponding trade balance improvement, and the interest rate hike of March 1995. But it leaves out other important aspects of the data, in particular, the fact that at the time of the credit crunch in March 1995, the decline in aggregate demand that had started three months before greatly deepened, generating a significant improvement in the trade balance in the second quarter of 1995. To capture this feature of the crisis I analyze, in section 4, a version of the model in which domestic agents are uncertain about the time at which foreign investors will actually stop renewing their loans to the country. In this case, the credit crunch, although not completely unexpected, comes partly as a surprise and therefore induces a contraction in aggregate domestic spending.

A second aspect of the data that the basic model is unable to capture is the fact that although real interest rates came down substantially after the March 1995 peak, they stayed consistently above their pre-Mexican crisis levels through the rest of 1995 and beyond. The two versions of the model described above predict, contrary to this fact, an immediate return of the interest rate to its pre-crisis level. In section 5, I extend the model by allowing for capital accumulation. In this version of the model the slow convergence of the interest rate occurs as follows: the interest rate hike in period T causes a decline in investment, implying that the economy starts period $T+1$ with a lower stock of physical capital. From period $T+1$ on the economy is isolated from the international capital market and therefore collapses to the standard closed-economy, neoclassical growth model, which predicts that if the initial stock of capital is below its steady-state level, the capital stock converges monotonically from below to its long-run level and the interest rate, given by the marginal product of capital, converges monotonically from above. The decline in output that this third version of the model predicts is consistent with the recession observed in 1995 and, in particular, with the fact that the recession started after the interest rate hike in March 1995.

2 Argentina Before and After the Mexican Crisis

The Argentine economic policy of the 1970s and 1980s was characterized by fiscal irresponsibility and repeated attempts to stabilize prices. Because of chronic fiscal imbalances, each stabilization program resulted in higher inflation and greater public debt. When President Carlos Menem took office in July 1989, the situation was at a critical point. In the first half of that year, prices grew at an average monthly rate of 38% (figure 1) and the fiscal deficit was above 20% of GDP (table 1).

2.1 The Convertibility Plan and Structural Reforms

The two main elements of the stabilization strategy adopted by the Menem administration were a fixed exchange rate regime and a far-reaching fiscal reform. The "Convertibility Act," passed by Congress in March 1991, established a one-to-one exchange rate between the Argentine peso

means necessary. All results carry out under the assumption of partial pull out.

and the U.S. dollar, eliminated all exchange and capital controls, and required that most of the monetary base be backed by international reserves.[4] The fiscal reform had four main components: tax reform, cuts in government spending, a vast privatization program, and reductions in the domestic and foreign public debt.

As a result of an aggressive reform of the value-added tax which widened the tax base and fought evasion by computerizing the tax-collection system and increasing the number of random inspections of businesses, revenues from the value-added tax increased from 4% of GDP in 1990 to 5.5% in 1991 and 8.5% in 1992. Expenditure cuts came mainly from a drastic reduction in public employment, which in 1989 accounted for 40% of the federal administration's budget. Between April 1990 and December 1991 federal government employment was cut 23.3% (table 2). Around 70% of this reduction was achieved through a freeze on filling vacancies and the remainder came through a voluntary early retirement program that included severance pay.

Between 1989 and 1992, 51 state-owned enterprises were privatized generating, approximately $18 billion in cash and debt-reduction schemes. Income from this source represented 0.6% of GDP in 1990, 1.6% in 1991, and 1.2% in 1992. The revenue from the sale of assets was not the only way by which privatizations contributed to the reduction of the fiscal deficit: Inefficiencies in the administration of these enterprises together with politically determined prices, had resulted in systematic losses of around 4% of GDP (Edwards, 1996).

From 1989 to 1990 interest payments on the public debt (lines 4 and 6 of table 1) fell by 16% of GDP. The decline resulted from a series of controversial measures by which the government defaulted on most of the domestic public debt.[5] In addition, in 1991 the country, under the Brady Plan, reached a foreign debt reduction agreement by which the external debt—$ 61 billion at that time—was reduced about 9% and was financed at lower rates and longer, mostly 30-year, maturities.

2.2 The Initial Boom: 1991-1994

The Convertibility Plan succeeded in quickly stopping high inflation. The average monthly CPI inflation rate fell from 11.4% in the 12 months preceding the announcement of the plan to 2.2% in the 12 months following the announcement, 1.4% in 1992, .6% in 1993, and .4% in 1994 (figure 1). In spite of its steady decline, inflation stayed significantly above the rate of devaluation during the first four years of the plan, and, as a consequence, the real exchange rate steadily appreciated. The relative price of tradables in terms of nontradables, as measured by the CPI-adjusted exchange rate

[4]The charter of the central bank establishes that its holdings of government bonds cannot exceed 20 percent of international reserves.

[5]The repudiation process began on the first business day of 1990 with the implementation of the "Bonex plan." Under the plan, the government eliminated the deficit of the central bank The deficit of the central bank—also referred to as quasi-fiscal deficit—totaled in 1989 6% of GDP, and originated in interest payments, at market rates, on required reserves on time deposits. (Reserve requirements on time deposits were around 80% by that time.) The Bonex Plan forced depositors to exchange their time deposits for government bonds (bonex) in such terms that the public lost above 70% of the real value of their deposits. A similar strategy was applied to reduce the debt of the non-financial public sector.

between the Argentine peso and the U.S. dollar fell almost 25% between April 1991 and December 1994 (figure 2).

The initial phase of the plan was also characterized by a boom in output, consumption, and investment and by a large deterioration in the trade balance. Figure 3 shows annual observations for GDP and for the ratio of consumption, investment, and the trade balance to GDP for the period 1980-1995. During the pre-Mexican-crisis phase of the Convertibility Plan GDP grew at an average annual rate of 7.7%, total consumption at 8.7%, and gross domestic investment at 21.8%.[6] At the same time, imports grew at an average annual rate of 40.5% while exports expanded at only 3.0% per year, consequently, the trade balance deteriorated from a surplus of 6.6% of GDP in 1990 to a deficit of 4.8% of GDP in 1994.

2.3 The 1995 Financial Crisis

The rapid pace of economic expansion in the first four years of the Convertibility Plan ended abruptly with the Mexican crisis of December 1994. At that time a major financial crisis developed as the public began a massive withdrawal of bank deposits—first of peso-denominated deposits and then of dollar-denominated deposits (figure 4). Total peso- and dollar-denominated bank deposits, which had grown at an average annual rate of 57% between 1991 and 1994, declined at an annual rate of 62% in the first three months of 1995. To fulfill their customers' demands, banks were forced to stop making new loans (figure 5). As a result, total loans, which between 1991 and 1994 had grown at an average annual rate of 30%, declined in the first quarter of 1995 at an annual rate of 13%. This liquidity crisis led to a rise in interest rates. The prime rate rose from an average of 10% for peso-denominated loans and 8% for dollar-denominated loans over the period June 1993-December 1994 to a peak of 33% for peso-denominated loans and 22% for dollar-denominated loans in March 1995 (figure 6.[7] The interest rate hike, in turn, had a devastating effect on the stock market (figure 7).

The decline in bank deposits was accompanied by a strong preference for foreign currency which led to a sharp reduction in the stock of foreign reserves held by the central bank (figure 8). In trying to cope with this situation, the monetary authority in December of 1994 lowered reserve requirements from 43% to 33% for checkable deposits and from 3% to 1% for time deposits. On March 1, 1995, the government by decree, changed the charter of the central bank and granted the institution wide flexibility and discretion in providing liquidity, including the ability to acquire portfolios of banks in financial stress. This drastic change in monetary policy meant that the central bank became *de facto* a lender of last resort. In the two weeks following the change, the central

[6]The labor market did not experience a similar pattern. Although employment grew moderately between 1991 and 1993, the structural reforms in the public sector and the large change in relative prices contributed to an increase in the unemployment rate from 6.2% in October 1990 to 12.2% in October 1994.

[7]The spread between the peso and the dollar interest rate, which had been below 2% in the period 1993-1994 rose to around 10% in March 1995, reflecting the possibility that the public in the first quarter of 1995 feared not only a bank crisis but also an exchange rate collapse.

bank engaged in a massive expansion of domestic credit aimed at sterilizing the ongoing decline in the monetary base (figure 9). Between March 1 and March 14, 1995, international reserves fell $2 billion and the central bank sterilized 40% of the decline; in contrast, in the first two months of the year (January 2 to February 28), foreign reserves fell $2.5 billion and the central bank sterilized only 13% of the decline.

The credit crunch in the first quarter of 1995 marked the end of four years of economic growth following the initiation of the Convertibility Plan in April 1991. Industrial production grew 4% (4-quarter rate) in the first quarter of 1995 but fell drastically in the second and third quarters—4.6% and 9.5% respectively—(figure 10). The significant improvement in the trade balance observed in 1995 (figure 11) reflects a slowdown in aggregate domestic absorption.

On March 14, the government announced that it had regained access to credit through international financial institutions such as the IMF ($2.4 billion), the World Bank ($1.3 billion), and the IADB ($1.5 billion), and private foreign lenders ($1 billion). It also obtained a three-year $l billion loan from domestic entrepreneurs (the "patriotic" bond). On the same day, the government announced an austerity plan that included, among other measures, an increase in the value added tax rate from 18% to 21%, imposition of a 3% import tax, the elimination of export subsidies, and expenditure cuts of $1 billion. These announcements played an important role in containing the financial crisis. In the second quarter of 1995, bank deposits began to recover gradually and interest rates started to come down. However, total deposits and loans did not reach their pre-crisis levels in 1995. Similarly, the interest rate remained above its pre-Mexican crisis level throughout 1995. As a consequence of the financial crisis, in 1995 the Argentine economy sunk into a recession of major proportions with GDP falling 4.5%, and gross domestic investment 16%.

2.4 Discussion

The data show a clear relation between the timing of the Mexican and Argentine crises. Could this correlation be due to a common exogenous factor? As pointed out above, empirical studies have found that the interest rate in industrialized countries is the most important external factor affecting capital flows to Latin America (Calvo et al., 1993; Dooley et al., 1996). Figure 12 shows the U.S. intended federal funds rate for the period January, 1993 to May, 1996. The federal funds rate was constant at 3% from the beginning of the sample period until January, 1994. A tightening period started in February, 1994 when the Federal Reserve raised the intended federal funds rate 25 basis points. By June, 1994, the federal funds rate stood at 4.25% and by December at 5.5%. The last increase of that tightening period occurred in February, 1995 when the federal funds rate was increased by 50 basis points to 6%. An explanation of the Argentine crisis of 1995 based on movements in the interest rate in industrialized countries would suggest that the capital outflow process that initiated the crisis should have started early in 1994, when the U.S. monetary authority began raising interest rates, rather than in January, 1995, when most analysts were already anticipating the end of the tightening period.

Another explanation mentioned above argues that a boom-recession cycle is inherent to exchange-rate based stabilization programs like the Argentine Convertibility Plan. The temporariness or imperfect credibility hypothesis (Calvo, 1986; Calvo and Végh, 1993) says that if inflation acts as a tax on domestic spending, then a reduction in inflation perceived as temporary by economic agents will induce a substitution of current for future domestic spending, causing trade balance deterioration, real appreciation, and inflation. The increase in current domestic spending occurs because agents take advantage of the temporary reduction in the inflation tax. If at some point after the implementation of the stabilization program either the devaluation rate is permanently increased or agents learn that the stabilization program is permanent, the incentives for intertemporal substitution disappear and consumption falls to the level consistent with permanent income. Could these be the forces behind the 1995 Argentine recession? Under perfect foresight, the imperfect credibility hypothesis implies that the interest rate on dollar-denominated deposits is always equal to the international interest rate (Calvo, 1986; Calvo and Végh, 1993). Adding uncertainty may introduce an upward slopping path for the nominal interest rate on domestic-currency-denominated assets if the probability of abandonment of the plan increases as the moment of resolution of uncertainty is approached, but the interest rate on dollar-denominated assets is, as in the perfect foresight case, always equal to the international interest rate (Mendoza and Uribe, 1996). Therefore, the imperfect credibility hypothesis can explain the increase in the spread between peso and dollar interest rates, but not the escalation in dollar rates that occurred the first quarter of 1995.

Although elements of the two alternative hypothesis discussed above could have been present in the Argentine crisis of 1995, they can hardly explain its timing nor the dramatic rise in real interest rates in the first quarter of 1995. The Tequila or Contagion Effect appears to have played a significant role. It remains to investigate if a model of the Tequila Effect can provide a satisfactory account of the real effects associated with the Argentine crisis of 1995.

3 The Basic Setup

In this section, I present a simple setup of a small, open economy to analyze the Tequila Effect under certainty. The certainty case is a useful first approximation to the more realistic case involving uncertainty about the time of the pull out, which I analyze in the next section.

Consider a perfect-foresight economy populated by a large number of identical, infinitely lived consumers with preferences defined over sequences of consumption of a perishable, internationally traded good, c_t, and described by the utility function

$$\sum_{t=0}^{\infty} \beta^t U(c_t) \tag{1}$$

where $\beta \in (0,1)$ denotes the subjective discount factor and $U(\cdot)$ denotes the period utility function, assumed to be strictly increasing, strictly concave, and twice continuously differentiable.

In each period $t \geq 0$, the consumer is endowed with y units of the good and has access to a bond, b_t, that pays the real interest rate r_t in period $t+1$. Throughout, the consumer is assumed to enter period 0 with some debt carried over from period -1. The consumer's budget constraint is then given by

$$b_t = (1 + r_{t-1})b_{t-1} + y - c_t \tag{2}$$

$$\text{given} \quad (1 + r_{t-1})b_{-1} < 0.$$

The consumer chooses sequences of consumption and bond holdings so as to maximize his utility function subject to (2) and to a borrowing constraint of the form

$$\lim_{t\to\infty} \frac{b_t}{\prod_{j=0}^{t}(1 + r_j)} \geq 0, \tag{3}$$

that prevents him from engaging in Ponzi-type games. The optimal paths $\{c_t, b_{t+1}\}$ satisfy (2) and the following Euler and transversality conditions:

$$U'(c_t) = \beta(1 + r_t)U'(c_{t+1}) \tag{4}$$

$$\lim_{t\to\infty} \frac{b_t}{\prod_{j=0}^{t}(1 + r_j)} = 0. \tag{5}$$

3.1 Crisis-free Equilibrium

Suppose that agents have access to the international financial market, where the interest rate, r^*, is constant and satisfies $\beta(1 + r^*) = 1$.[8] In this case, the equilibrium conditions are obtained by substituting r^* for r_t in (2)–(5)[9]

$$U'(c_t) = U'(c_{t+1})$$

$$b_t = (1 + r^*)b_{t-1} + y - c_t$$

$$\lim_{t\to\infty} \frac{b_t}{(1 + r^*)^t} = 0$$

$$\text{given} \quad (1 + r^*)b_{-1} < 0$$

The first equilibrium condition implies that consumption is constant over time, while the second and third imply that consumption is given by

$$c^* = r^* b_{-1} + y.$$

This consumption rule implies that the stock of debt is constant and equal to b_{-1} for all $t \geq 0$.

[8] The assumption that the interest rate equals the rate of time preference is made for simplicity. It avoids the need to deal with trends in consumption and asset holdings which are not central to the issues discussed in this paper.

[9] I am assuming that $r_{-1} = r^*$.

3.2 The Tequila Effect

By the "Tequila Effect," or "exogenous financial crisis," I mean a situation in which at some point, say period 0, domestic agents learn that foreign investors wish to pull their assets out of the country by time $T > 0$.[10] Formally, the Tequila Effect sets in when domestic agents learn, at $t = 0$, that for $t \geq T$, b_t must be greater than or equal to $\underline{b}$, where $\underline{b} > b_{-1}$ and b_t denotes *aggregate* net foreign asset holdings in period t.[11] For simplicity, I assume that $\underline{b} = 0$, that is, that foreign investors wish to hold no assets invested in the domestic economy as of period T. Because before period T the country is not subject to any borrowing constraint, the equilibrium domestic interest rate must be equal to the international interest rate for $0 \leq t < T$. From period T on, the domestic interest rate must be greater than or equal to the international interest rate.[12] A competitive equilibrium is then a set of sequences $\{c_t, b_t, r_t\}_{t=0}^{\infty}$ satisfying the consumer's optimality conditions (2)–(5) and the restrictions

$$r_t = r^* \qquad t < T \tag{6}$$

$$r_t \geq r^*, \quad b_t \geq 0, \quad (r_t - r^*)b_t = 0 \qquad t \geq T \tag{7}$$

Equations (4) and (6) imply that consumption is constant between periods 0 and T, at a level denoted by c^{**}. Because the initial stock of assets is negative ($(1 + r_{-1})b_{-1} < 0$) and the stock of assets in period T must be non-negative ($b_T \geq 0$), c^{**} must be less than c^*, the consumption level under the crisis-free equilibrium, in order for the trade balance to be large enough not only to service the debt but also to cover some amortization each period. It can be shown that the equilibrium conditions (2)-(7) have a unique solution given by[13]

$$c_t = c^{**} \equiv c^* + \frac{r^* b_{-1}}{(1+r^*)^{T+1} - 1} < c^* \quad t \leq T, \qquad c_t = y \quad t > T,$$

$$b_t = b_{-1} \frac{(1+r^*)^{T+1} - (1+r^*)^{t+1}}{(1+r^*)^{T+1} - 1} \quad t \leq T, \qquad b_t = 0 \quad t > T,$$

$$r_t = r^* \quad t \neq T, \qquad r_{_T} = \beta^{-1} \, \frac{U'(c^{**})}{U'(y)} - 1 > r^*.$$

[10] Throughout the paper the behavior of foreign investors is taken as given. Calvo (1995), using a partial equilibrium model of optimal portfolio management, provides theoretical arguments for why it might be optimal for foreign investors to behave in a fashion consistent with the Tequila Effect hypothesis.

[11] Note that the notation does not distinguish between individual and aggregate net asset holdings. I assume that the borrowing constraint is imposed on the aggregate level of net asset holdings rather than on individual net asset holdings. Because consumers are assumed to be identical, however, this distinction does not affect the equilibrium. The distinction would make a difference if agents were assumed to be heterogeneous in preferences or endowments.

[12] The domestic interest rate may not be lower than the international interest rate, for such a situation would allow agents to make infinite profits by exploiting arbitrage opportunities.

[13] The uniqueness of the competitive equilibrium can be seen by noting that conditions (2)-(7) are identical to the Kuhn-Tucker conditions associated with the social planner's problem of maximizing the utility function (1) subject to

$$b_t \leq (1 + r^*)b_{t-1} + y - c_t$$
$$b_t \geq 0 \qquad t \geq T$$

given $r^* b_{-1} < 0$. This problem, in turn, has a unique solution because the objective function is strictly concave and the budget set is convex.

The equilibrium paths of foreign capital flows, the interest rate, and consumption are illustrated in figure 6. Foreign capital starts flowing out of the country at the beginning of period zero and flows at an increasing rate until period T, when there is an interest rate hike and the country goes into autarky. Interestingly, the jump in the interest rate occurs only in period T, though all the information about foreign investors' loss of confidence is revealed in period 0. The capital flight is accompanied by a corresponding improvement in the trade balance in period 0 that lasts until period T. Note that the equilibrium is unaffected by whether the decision by foreign investors to pull out in period T is permanent or transitory in the sense that whether or not agents can borrow from the rest of the world from period $T+1$ on is immaterial for the behavior of the variables of the model.

Which features of the Argentine recession of 1995 are captured by the Tequila Effect model? If one thinks of $t=0$ as December 1994, when the Mexican crisis occurred, and of $t=T$ as March 1995, when the interest rate hike occurred, the Tequila Effect hypothesis explains three important aspects of the 1995 Argentine recession: the sudden improvement in the trade balance in the first quarter of 1995; the capital flight that started in late December 1994 and that was reflected in the loss of reserves by the central bank and the decline in both peso- and dollar-denominated bank deposits; and the interest rate hike in March 1995, which marked the end of the initial phase of the crisis.

However, the simple model of the Tequila Effect fails to explain the observed deepening of the contraction in aggregate domestic absorption at the time of the interest rate hike. Instead, the model predicts a constant trade balance between periods 0 and T and a deterioration in period $T+1$ as consumption jumps to the endowment level.

4 Uncertain Timing of Crisis

In this section, I modify the baseline model by assuming that the time at which the domestic economy is subject to the aggregate borrowing constraint is uncertain. This modification seeks to capture the deepening of the contraction in aggregate domestic absorption and the widening of the trade balance observed in Argentina at the time of the interest rate hike in March 1995.

Assume that there exists an exogenous random variable s_t that takes the value 1 if the aggregate borrowing constraint is in place and 0 otherwise.[14] That is, if $s_t=1$, then $b_t \geq 0$ (but not necessarily the other way around, because the country's net foreign asset holdings can in principle be voluntarily non-negative at any time). Also assume that the borrowing constraint is imposed for sure no later than period T and that once the aggregate borrowing constraint is imposed it remains in place forever. Formally, the random variable s_t is assumed to satisfy $Pr(s_t=1|s_{t-1}=1)=1\ \forall t$ and $Pr(s_t=1)=1$ for $t \geq T$.

In this case, the equilibrium conditions are given by equation (2) and the following modified

[14] The methodology used in this section follows Drazen and Helpman (1988) and Calvo and Drazen (1993).

version of conditions (4)–(7)

$$U'(c_t) = \beta(1 + r_t)E_t\, U'(c_{t+1}), \tag{8}$$

$$\lim_{h\to\infty} E_t \frac{b_{t+h}}{\prod_{j=0}^{h}(1 + r_{t+j})} = 0, \tag{9}$$

$$r_t \geq r^*, \quad (r_t - r^*)(1 - s_t) = 0, \quad (r_t - r^*)b_t = 0, \quad b_t s_t \geq 0. \tag{10}$$

The second expression in (10) states that if the borrowing constraint is not in place, the domestic interest rate must be equal to the international interest rate r^*; the last expression in (10) states that aggregate net asset holdings must be non-negative at the moment the aggregate borrowing constraint is imposed. In characterizing the dynamics arising from these equilibrium conditions, it is useful to introduce some notation to distinguish the values taken by c_t, b_t and r_t in a *pre-crisis* period ($s_t = 0$) from those taken by c_t, b_t and r_t in the *crisis* period ($s_t = 1|s_{t-1} = 0$). Let c_t^{pc} denote the value taken by consumption in period t in the event $s_t = 0$, and c_t^c denote the value taken by consumption in the event $s_t = 1|s_{t-1} = 0$. Define b_t^{pc}, b_t^c, r_t^{pc}, and r_t^c in a similar fashion.

Figure 14 illustrates the equilibrium dynamics of capital outflows, the real interest rate, and consumption. Solid lines show pre-crisis values, broken lines show values in the period of the crisis (i.e., the period in which the borrowing constraint is imposed), and chain-dotted lines show values after the occurrence of the crisis. (Note that since any period in the interval $(0, T)$ is either a pre-, at-, or post-crisis period, each panel of the figure displays three different lines in this interval.)

As shown in the bottom left panel of the figure, consumption falls not only in period 0—as in the perfect foresight case—but also at the time of the crisis. The second decline is represented by the vertical distance between the solid and the broken lines. Consumption recovers one period after the crisis. Because at this point the economy is in autarky, consumption jumps to the endowment level. Before the crisis consumption is increasing over time, reflecting the positive income effect associated with the non-occurrence of the interest rate hike. This increase is represented by the vertical distance between the broken and the chain-dotted lines. The domestic interest rate is equal to the international interest rate until the moment at which the aggregate borrowing constraint is imposed, and then it jumps up. Note that the interest rate hike is more pronounced the earlier the borrowing constraint is imposed. Finally, capital outflows are positive and increasing over time, and they jump up when the borrowing constraint is imposed.

The intuition behind these results is the following: In any period $0 < t < T - 1$ in which the borrowing constraint has not yet been imposed, the probability that it will be imposed in period $t + 1$ is less than 1. Because consumers are assumed to be net borrowers from the rest of the world, it is optimal for them to save less than if they knew that the borrowing constraint will be imposed for sure in $t + 1$ but more than if they knew for sure that it will not be imposed. If the aggregate borrowing constraint is imposed in period $t + 1$, agents *ex post* undersaved and hence have to adjust their consumption downward. If, on the other hand, the borrowing constraint is not imposed in period $t + 1$, agents *ex post* oversaved and decide to spend part of that excess savings in the current period. This explains why consumption increases over time before the interest rate hike and falls

in the period of the interest rate hike.

The following proposition provides a formal characterization of the equilibrium.

Proposition 1 ***(Equilibrium Under Uncertain Timing of Crisis)***
Let c_t, b_t, and r_t denote consumption, net aggregate asset holdings, and the domestic real interest rate in period t respectively. Let $b_{-1} < 0$. Let s_t be an exogenous random variable taking values in $\{0,1\}$ such that $Pr(s_t = 1) = 1$ for $t \geq T$ and $Pr(s_t = 1|s_{t-1} = 1) = 1$ for $t \geq 1$. Let c_t^{pc} denote consumption in period t in the event $s_t = 0$ and c_t^c consumption in period t in the event $s_t = 1|s_{t-1} = 0$. Define b_t^{pc},b_t^c r_t^{pc},r_t^c analogously. Then the equilibrium conditions (2) and (8)-(10) imply that

(a) $c_0 < c_{-1} = r^* b_{-1} + y$,
(b) $c_t^c < c_{t-1}^{pc}$ for $0 \leq t < T$ and $c_T^c = c_{T-1}^{pc}$,
(c) $b_t^c = 0$ and $b_t^{pc} < 0$ $\forall t$,
(d) c_t^{pc} and c_c^c are strictly increasing in t,
(e) $r_t^c > r_{t+1}^c > r^*$ $\forall t \geq 0$.

Proof: See the appendix.

5 The Tequila Effect in a Production Economy

The two versions of the Tequila Effect model analyzed thus far capture several aspects facts of the Argentine recession of 1995 but leave other important facts unexplained. For example, the models predict that the real interest rate jumps at the time at which foreign investors pull out of the domestic economy and returns immediately to its pre-crisis level. However, the data shows that after the interest rate hike in March 1995, interest rates came down slowly and remained above their pre-crisis levels throughout 1995 (figure 6). Also, because they consider endowment economies, the models presented thus far say nothing about the behavior of output and investment, though the data shows that after the credit crunch of March 1995, output and investment declined sharply, and that, as shown in figure 10, the slowdown in output continued through 1995. In this section, I augment the baseline model with production and capital accumulation and argue that this variation has the ability to qualitatively capture the observed behavior of the real interest rate, output, and investment.

Consider the same structure described in section 3 but assume that output, y_t, instead of being exogenously given, is produced with physical capital, k_t, which depreciates at the constant rate $\delta \in (0,1]$. Specifically,

$$y_t = F(k_t)$$

$$k_{t+1} = (1-\delta)k_t + i_t$$

where i_t denotes gross investment and $F(\cdot)$ is a production function satisfying the Inada conditions.

Letting $f(k) \equiv F(k) + (1-\delta)k$, the household's stock of net foreign assets evolves according to

$$b_t = (1 + r_{t-1})b_{t-1} + f(k_t) - c_t - k_{t+1} \tag{11}$$

$$k_{t+1} \geq 0 \tag{12}$$

$$(1 + r_{-1})b_{-1} < 0 \quad \text{and } k_0 > 0$$

Households choose sequences of consumption, capital and bonds so as to maximize the utility function (1) subject to (3), (11), (12), and the initial conditions for bond holdings and capital, taking as given the sequence for the real interest rate. The first order conditions associated with this problem are equations (4), (5), (11), (12), and the following condition stating that in each period the household invests until the next period's marginal product of capital equals the current real interest rate

$$f'(k_{t+1}) = 1 + r_t. \tag{13}$$

A perfect-foresight equilibrium is a set of sequences $\{c_t, b_t, r_t, k_{t+1}\}_{t=0}^{\infty}$ satisfying these first order conditions and expressions (7) and (6). Expressions (7) and (6) reflect the restrictions on r_t and b_t imposed by the aggregate borrowing constraint in place from period T on. It can be shown that these equilibrium conditions have a unique solution.[15]

Figure 15 shows the equilibrium paths of the variables of interest. As in the endowment economy, consumption falls in period 0 and foreign capital starts to flow out of the economy. Between periods 0 and $T-1$ the interest rate is constant and equal to the international interest rate r^*, implying that consumption and investment are also constant during this period (see equations (4) and (13)). In period T the interest rate jumps up, provoking a decline in investment. Therefore the economy starts period $T+1$ with a lower stock of capital. Because from this point on the country is unable to borrow from the rest of the world, the dynamics toward the steady state are identical to those in a closed economy. Thus, the capital stock converges gradually and from below to k^*, and the interest rate, given by the marginal product of capital, converges monotonically and from above to r^*.

The prediction of a slow return of the interest rate to its pre-crisis level is a key difference with those of an endowment economy which predict an interest rate jumps in period T but an immediate return to its long-run level r^*.[16] Thus, allowing for capital accumulation helps explain

[15] As in the case of the endowment economy, the proof of this statement follows from the fact that the equilibrium conditions (4)-(7) and (11)-(13) are identical to those associated with the planner's problem of maximizing (1) subject to

$$b_t \leq (1 + r^*)b_{t-1} + f(k_t) - c_t - k_{t+1}$$
$$k_{t+1} \geq 0$$
$$b_t \geq 0 \qquad t \geq T$$

which has a unique solution because the objective function is strictly concave and the budget set is convex.

[16] As noted in section 4, the interest rate also returns immediately to r^* in the endowment economy model with uncertain timing of crisis.

the prolonged period of high real interest rates observed in Argentina after the Mexican crisis of December 1994. Finally, both this model with perfect-foresight and capital accumulation and the endowment-economy model with uncertain timing of crisis predict an improvement in the trade balance driven by a contraction in aggregate domestic spending at the moment at which the country becomes subject to the borrowing constraint. However, the nature of this improvement in the trade balance is quite different in the two cases. Under uncertain timing of crisis the improvement is due entirely to a decline in consumption. In the model with perfect-foresight and capital accumulation, consumption does not fall in period T but investment does, owing to the increase in the interest rate.

The following proposition provides a formal characterization of the equilibrium:

Proposition 2 *The sequences* $\{c_t, b_t, r_t, k_{t+1}\}_{t=0}^{\infty}$ *satisfying the equilibrium conditions (4)-(7)) and (11)-(13) are given by*

$$c_t = c^{***} < c_{-1} \quad for\ t \leq T, \qquad c_t = f(k_t) - s(k_t) \quad for\ t > T,$$

$$k_{t+1} = k^* \quad for\ t < T, \qquad k_{T+1} < k^*, \qquad k_t < k_{t+1} = s(k_t) < k^* \quad for\ t > T,$$

$$r_t = r^* \quad for\ t < T, \qquad r_t = f'(k_{t+1}) > r^* \quad for\ t \geq T,$$

$$b_t = (1+r^*)^{t+1} b_{-1} + \tfrac{(1+r^*)^{t+1}-1}{r^*}[f(k^*) - c^{***} - k^*] \quad for\ t < T, \qquad b_t = 0 \quad for\ t \geq T,$$

where c^{***} *and* k_{T+1} *solve the following two equations in two unknowns (the first of which ensures that* $b_T = 0$ *and the other that the Euler equation (4) holds in* T*),*

$$0 = (1+r^*)b_{T-1} + f(k^*) - c^{***} - k_{T+1} \tag{14}$$

$$U'(c^{***}) = \beta f'(k_{T+1}) U'(f(k_{T+1}) - s(k_{T+1})) \tag{15}$$

and $s(\cdot)$ *is the familiar closed economy neoclassical savings function, that is, for any* $k_0 > 0$ $k_{t+1} = s(k_t)$ *solves the following difference equation*

$$U'(f(k_t) - k_{t+1}) = \beta f'(k_{t+1})\, U'(f(k_{t+1}) - k_{t+2}) \tag{16}$$

$$\lim_{t \to \infty} k_t = k^* \tag{17}$$

Proof: See the appendix.

6 Conclusion

December 1994 marked the end of four years of extraordinary economic expansion of the Argentine economy under the Convertibility Plan. According to the Tequila Effect (or Contagion Effect) hypothesis, the financial and economic crises that followed had their roots in the collapse of the

Mexican peso which undermined foreign investors' confidence about the prospects for sustained stability and growth in Argentina and other Latin American countries and led to massive capital outflows.

Several conclusions arise from the empirical and theoretical investigation of the Tequila Effect that I perform in this paper. First, the empirical analysis suggests that the Tequila Effect played an important role in the 1995 crisis. Second, the two most popular explanations of business cycles in developing countries are shown to be unable to fully account for the developments following the Mexican crisis of 1995: the explanation based on movements in international interest rates as the main determinant of economic fluctuations in LDCs fails to explain the timing of th crisis, because while international interest rates began rising in early 1994, international capital started to flow out of Argentina in early 1995. An explanation based on imperfect credibility about the exchange rate policy fails to explain the dramatic increase in interest rates on dollar-denominated loans and deposits that took place in the first quarter of 1995.

Finally, the predictions of a simple model of the Tequila Effect in which domestic residents expect that at some point in the future foreign investors will stop renewing their loans to the country are shown to be consistent with many aspects of the Argentine recession of 1995, namely, the capital outflows right after the Mexican crisis, the corresponding trade balance improvement, and the interest rate hike in March 1995. Adding to the basic model uncertainty about the time at which foreign investors will actually pull out helps capture the deepening of the contraction in aggregate domestic spending that occurred at the time of the credit crunch of March 1995. Allowing for capital accumulation helps explain the observed slow return of the real interest rate to its pre-crisis level and the prolonged slowdown in output and investment.

Appendix

Proof of Proposition 1:

(c) Let us first show that $b_t^{pc} < 0 \; \forall t$. Suppose it is not. Then $\exists t < T$ such that $b_t^{pc} \geq 0$. But then if $s_t = 0$, the sequences $b_{t+j} = b_{t-1}$, $c_{t+j} = r^* b_{t-1} + y$, and $r_{t+j} = r^*$, $j \geq 0$ satisfy conditions (2) and (8)–(10) and therefore represent an equilibrium. Hence, $b_t^{pc} \geq 0$ implies $b_{t-1} \geq 0$, which leads, by repeating this reasoning, to $b_{-1} \geq 0$, a contradiction. Let us now show that $b_t^c = 0$ $\forall t$. Again, suppose it is not. Then $\exists t \geq 0$ such that $b_t^c > 0$. Because $b_{t-1}^{pc} < 0$, we have that $c_t^c = (1 + r^*) b_{t-1}^{pc} + y - b_t^c < y$. Also, $b_t^c > 0$ implies, from (10), that $r_t^c = r^*$, and therefore equation (8) implies that if $s_t = 1$, then $c_{t+1} = c_t^c < y$ and $b_{t+1} = (1 + r^*) b_t^c + y - c_{t+1} > (1 + r^*) b_t^c$. Following this argument leads to the conclusion that if $s_t = 1$ and $b_t^c > 0$, then $b_{t+j} > (1 + r^*)^j b_t^c$, which violates the transversality condition (9).

(b) The equality $c_T^c = c_{T-1}^{pc}$ follows from equation (8) and from the facts that $r_{T-1}^{pc} = r^*$ and that c_T is known in period $T - 1$. From equation (2) we have that $b_t^c = (1 + r^*) b_{t-1}^{pc} + y - c_t^c$ and $b_t^{pc} = (1 + r^*) b_{t-1}^{pc} + y - c_t^{pc}$. Combining these two equations and recalling that $b_t^c = 0$ and $b_t^{pc} < 0$ yields $c_t^c < c_t^{pc}$ for $t < T$. On the other hand, because $\beta r_t^{pc} = 1$, equation (8) implies that $U'(c_t^{pc})$ is a weighted average of $U'(c_{t+1}^{pc})$ and $U'(c_{t+1}^c)$; and because $c_{t+1}^{pc} > c_{t+1}^c$, it follows that $c_t^{pc} < c_{t+1}^{pc} < c_{t+1}^c$.

(a) To see that consumption falls on impact, note that because $c_0^c < c_0^{pc}$, it is sufficient to show that $c_0^{pc} < c_{-1}$. Suppose it is not. Then because $c_t^{pc} > c_{t-1}^{pc}$, we have that $c_t^{pc} \geq c_{-1} = r^* b_{-1} + y$, and from equation (2) it follows that $b_t^{pc} \leq b_{-1}$. This and the fact that $c_T^c = c_{T-1}^{pc}$ implies, again from (2), that $b_T^c \leq b_{-1} < 0$, which violates the borrowing constraint.

(d) I have already shown that $c_{t+1}^{pc} > c_t^{pc}$ for $t \geq 0$. Because $c_t^c = (1 + r^*) b_{t-1}^{pc} + y$, showing that $c_{t+1}^c > c_t^c$ for $t \geq 0$ is equivalent to showing that $b_t^{pc} > b_{t-1}^{pc}$ for $t \geq 0$ (where $b_{-1}^{pc} \equiv b_{-1}$). Combining $c_T^c = c_{T-1}^{pc}$ and $c_T^c = (1 + r^*) b_{T-1}^{pc} + y$ with equation (2) yields $b_{T-1}^{pc} = (1 + r^*)(b_{T-2}^{pc} - b_{T-1}^{pc})$, which implies that $b_{T-1}^{pc} > b_{T-2}^{pc}$ and that $r^* b_{T-2}^{pc} + y > c_{T-1}^{pc}$. This last expression, together with equation (2), in turn implies that $b_{T-2}^{pc} > b_{T-3}^{pc}$ and that $r^* b_{T-3}^{pc} + y > c_{T-2}^{pc}$. Continuing with this argument leads to $b_t^{pc} > b_{t-1}^{pc} \; \forall t \geq 0$.

(e) Statement *(e)* follows directly from the Euler equation $U'(c_t^c) = \beta(1 + r_t^c) U'(y)$ and the facts that c_t^c is less than y and is increasing over time. ■

Proof of Proposition 2:

It is sufficient to show that $r_t \geq r^* \; t \geq T$ and that $c^{***} < c_{-1}$, for all other equilibrium conditions are satisfied by construction. Equation (13) implies that $r_t \geq r^* \; t \geq T$ if and only if $k_{t+1} \leq k^*$ for $t \geq T$. In turn, it is a well-known result that the system (16)–(17) implies that k_t will converge monotonically to k^* from below if and only if $k_{T+1} \leq k^*$. I now show that equations (14) and (15) imply that this condition is in fact satisfied. and that $c^{***} < c_{-1}$ where $c_{-1} = r^* b_{-1} + f(k^*) - c_{-1} - k^*$.

Figure 6 depicts the two sets of pairs (c^{***}, k_{T+1}) satisfying equations (14) and (15) individually. Because b_{T-1} is a decreasing function of c^{***}, equation (14) implies that k_{T+1} is a decreasing function of c^{***}. This relation is shown as line LL' on the figure. Also, because $c_{-1} = r^* b - 1 + f(k^*)$, we have that for $c^{***} = c_{-1}$, the value of k_{T+1} that satisfies (14) is $k^* + b_{-1}$ (point a on the figure). On the other hand, because $f(\cdot) - s(\cdot)$ is a strictly increasing function, it follows that the right hand side of (15) is a decreasing function of k_{T+1}. Therefore, equation (15) implies that k_{T+1} is an increasing function of c^{***} (line EE' on the figure). I now show that if $c^{***} = c_{-1}$, then $k^* + b_{-1} < k_{T+1} < k^*$, that is, that the locus satisfying equation (15) passes through a point like b on figure 6. This, in turn, implies that the two loci intersect at a point like c located southwest of the point (c_{-1}, k^*). First, evaluate the right hand side of (15) at $k_{T+1} = k^*$. Because $\beta f'(k^*) = 1$

and $f(k^*) - s(k^*) = f(k^*) - k^* = c_{-1} - r^* b_{-1} > c_{-1}$, the right hand side of (15) is less than $U'(c_{-1})$, and, hence, for $c^{***} = c_{-1}$, equation (15) implies that $k_{T+1} < k^*$. Now evaluate the right hand side of (15) at $k_{T+1} = k^* + b_{-1}$. Because $\beta f'(k^* + b_{-1}) > 1$ and $f(k^* + b_{-1}) - s(k^* + b_{-1}) < f(k^*) + (1 + r^*)b_{-1} - (k^* + b_{-1}) = f(k^*) - k^* + r^* b_{-1} = c_{-1}$ (the last inequality follows from the strict concavity of $f(\cdot)$ and from the fact that $s(k) > k$ for $k < k^*$), the right hand side of (15) is greater than $U'(c^{***})$ and, hence, for $c^{***} = c_{-1}$, equation (15) implies that $k_{T+1} > k^* + b_{-1}$. This completes the proof that $k_{T+1} < k^*$ and $c^{***} < c_{-1}$. ■

References

Calvo, Guillermo A., "Temporary Stabilization: Predetermined Exchange Rates," *Journal of Political Economy,* 1986, 94, pp. 1319-29.

Calvo, Guillermo A., "Balance-of-Payments Crises in a Cash-in-Advance Economy," *Journal of Money, Credit and Banking,* February 1987, 19, pp. 19-32.

Calvo, Guillermo A., "Varieties of Capital Market Crises," mimeo, Center for International Economics, University of Maryland at College Park, 1995.

Calvo, Guillermo and Allan Drazen, "Uncertain Duration of Reform: Dynamic Implications," Working Papers in International Economics # WP4, Center for International Economics, University of Maryland at College Park, 1993.

Calvo, G. A., L. Leiderman and C. M. Reinhart, "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors," *IMF Staff Papers,* March 1993, 40(1), pp. 108-51.

Calvo, Guillermo A. and Carlos A. Végh, "Exchange Rate Based Stabilization Under Imperfect Credibility," in Helmut Frisch and Andreas Worgotter (Eds.),, *Open Economy Macroeconomics,* London, MacMillan Press, 1993, Chapter 1, pp. 3-28.

Calvo, Sara and Carmen M. Reinhart, "Capital Flows to Latin America: Is There Evidence of Contagion Effects?/," forthcoming in Morris Goldstain, Editor,, *Private Capital Flows to Emerging Markets,* Institute for International Economics, Washington, DC, 1996.

Dornbusch, Rudiger, "Stabilization Policy in Developing Countries: What Lessons Have We Learnt?," *World Development,* September 1982, special issue 10, pp. 701-8.

Dooley, Michael, Eduardo Fernández-Arias, and Kenneth Kletzer, "Is the Debt Crisis History? Recent Private Capital Inflows to Developing Countries," *The World Bank Economic Review,* January 1996, 10 (1), pp. 27-50.

Drazen, Allan and Elhanan Helpman, "Stabilization with Exchange Rate Management," *Quarterly Journal of Economics,* 1987, 11, pp. 835-55.

Drazen, Allan and Elhanan Helpman, "Stabilization with Exchange Rate Management Under Uncertainty," in Elhanan Helpman, Assaf Razin and Efraim Sadka (Eds.), *Economic Effects of the Government Budget,,* Cambridge, The MIT Press 1988: 310-27.

Edwards, Sebastian, "Public Sector Deficits and Macroeconomic Stability in Developing Economies," NBER working paper #5407, January 1996.

Kiguel, Miguel A. and Nissan Liviatan, "The Business Cycle Associated with Exchange-Rate Based Stabilizations," *The World Bank Economic Review,* 1992, 6, pp. 279-305.

Lahiri, Amartya, "Exchange-Rate Based Stabilization Under Real Frictions: The Role of Endogenous Labor Supply," mimeo Department of Economics UCLA, 1995.

Mendoza, Enrique G. and Martín Uribe, "The Syndrome of Exchange-Rate Based Stabilizations and the Uncertain Duration of Currency Pegs," International Finance Discussion Paper # 548, Board of Governors of the Federal Reserve System, Washington DC, April 1996.

Rebelo, Sergio T. and Carlos A. Végh, "Real Effects of Exchange-Rate Based Stabilization: An Analysis of Competing Theories," mimeo Department of Economics, University of Rochester, 1995.

Reinhart Carmen M. and Carlos A. Végh, "Nominal Interest Rates, Consumption Booms and Lack of Credibility: A Quantitative Examination," *Journal of Development Economics,* April 1995, 40(2), pp. 357-78.

Rodríguez, Carlos A., "The Argentine Stabilization Plan of December 20th," *World Development,* September 1982, special issue 10, pp. 801-11.

Roldós, Jorge E., "Supply Side Effects of Disinflation Programs," *IMF Staff Papers,* March 1995, 42(1), pp. 158-83.

Uribe, Martín, "Exchange-Rate Based Inflation Stabilization: The Initial Real Effects of Credible Plans," mimeo Department of Economics, The University of Chicago, February 1993.

Végh, Carlos A., "Stopping High Inflation: An Analytical Overview," *IMF Staff Papers,* September 1992, 39(3), pp. 626-95.

Table 1: ARGENTINA: FISCAL SURPLUS OF THE FEDERAL GOVERNMENT (1985-1992)
(in percentage of GDP)

	1985	1986	1987	1988	1989	1990	1991	1992
1. Primary surplus before income from sale of assets	1.9	1.5	-1.1	-1.4	0.7	1.3	1.1	2.2
2. Income from sale of assets	0.2	0.1	0.2	0.2	0.3	0.6	1.4	1.2
3. Primary Surplus of the Non-Fin ancial Public Sector (1+2)	2.1	1.6	-0.9	-1.2	1.0	1.9	2.5	3.4
4. Interest of the Non - Financial Public Sector	5.9	4.3	4.7	5.4	15.6	4.5	3.7	2.2
5. Total Surplus of the Non-Financial Public Sector (3+4)	-3.8	-2.7	-5.6	-6.6	-14.6	-2.6	-1.2	1.2
6. Surplus of the Central Bank	-2.8	-1.6	-0.9	-0.7	-5.9	-1.0	-0.5	-0.2
7. Total Surplus of the Public Sector (5+6)	-6.6	-4.3	-6.5	-7.3	-20.5	-3.6	-1.7	1.0
8. Surplus of the Public sector before sales of assets (7-2)	-6.8	-4.4	-6.7	-7.5	-20.8	-4.2	-3.1	-0.2

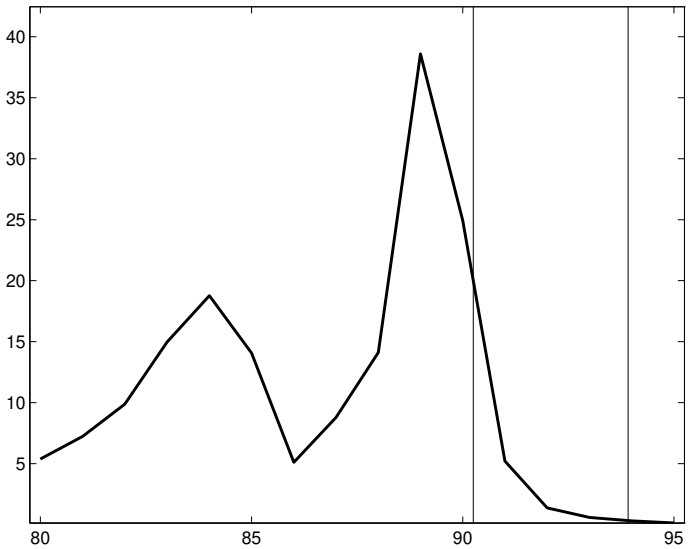
Source: Argentine Ministry of Economics.

Table 2: ARGENTINA: NUMBER OF PUBLIC EMPLOYEES
Federal Administration

	April 1990	December 1991
Central Administration	70,968	51,316
Decentralized Adminst ration and other special accounts	213,927	176,437
Agencies not included in the Budget	49,392	28,489
Total	334,297	256,242

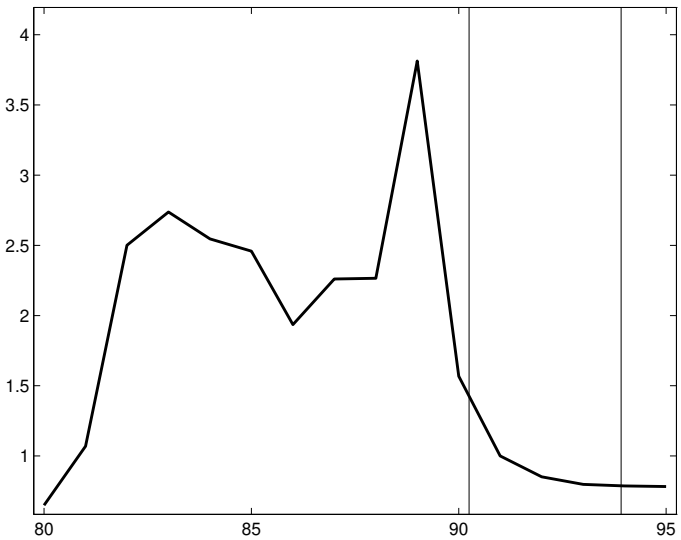
Source: Argentine Ministry of Economics.

Figure 1:
ARGENTINA: INFLATION
(CPI, monthly percentage rates)



Note: The two vertical lines mark the pre Mexican crisis phase of the Convertibility Plan.

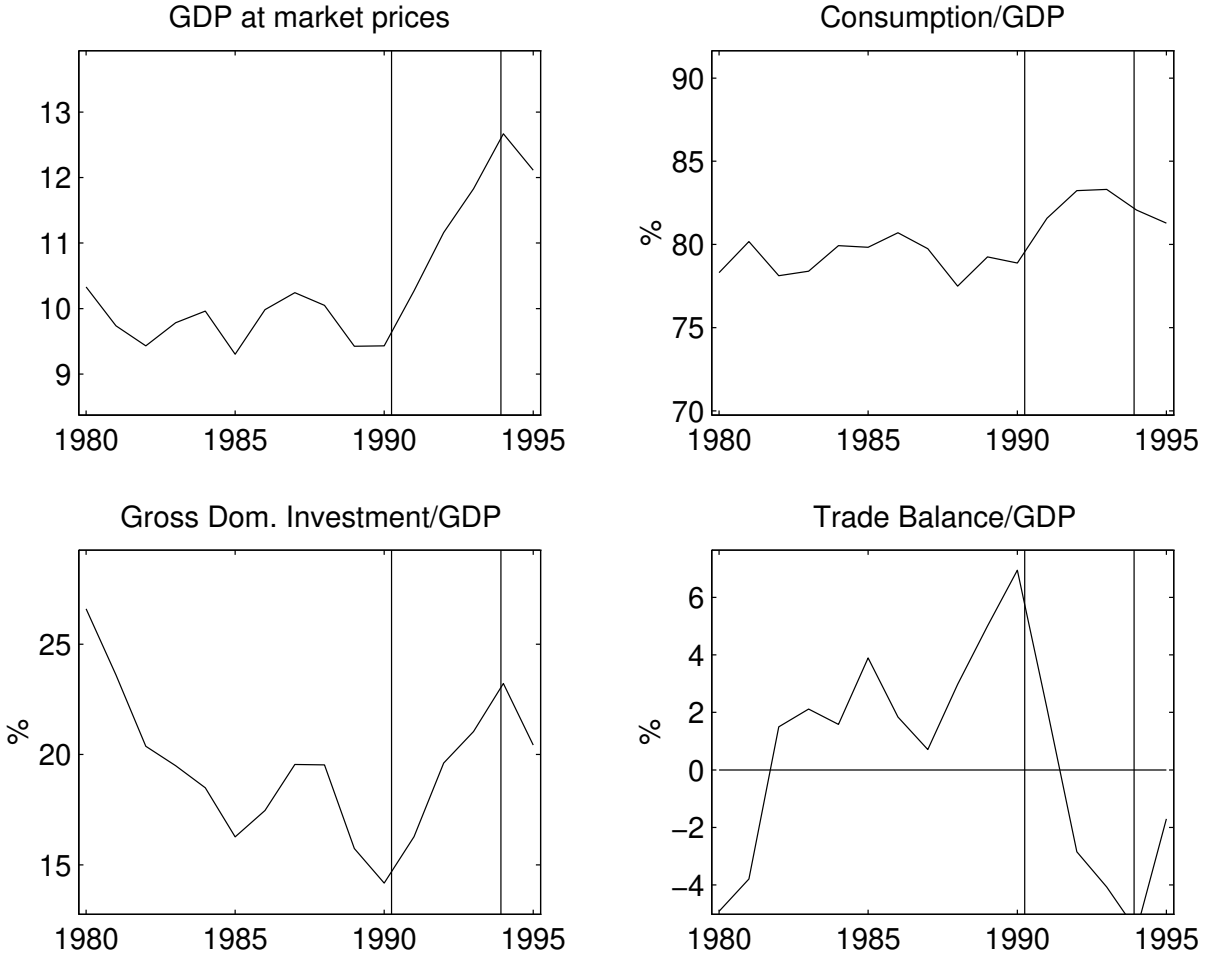
Figure 2:
ARGENTINA: REAL EXCHANGE RATE
(1991=1)



Note: (1) The two vertical lines mark the pre-Mexican crisis phase of the Convertibility plan. (2) The real exchange rate is measured as $E \cdot CPI^{us}/CPI^{ar}$, where E is the pesos-per-dollar nominal exchange rate and CPI^{us} and CPI^{ar} are US and Argentine Consumer Price Indexes respectively.

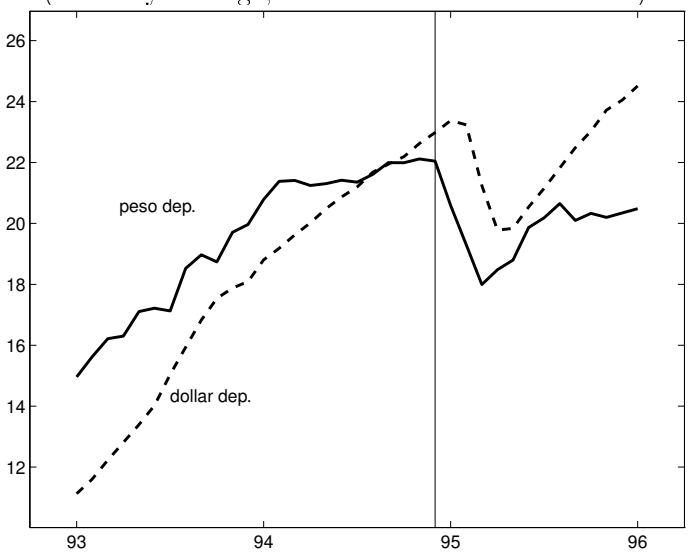
Figure 3:

ARGENTINA: AGGREGATE SUPPLY AND DEMAND



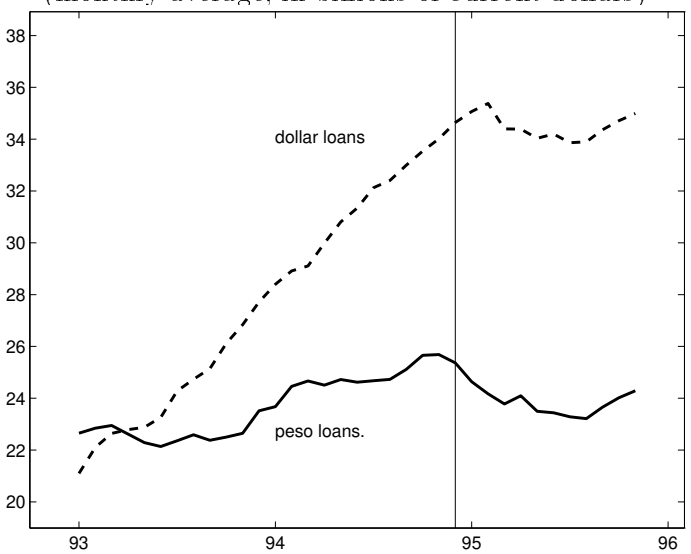
Note: The two vertical lines mark the pre Mexican crisis phase of the Convertibility Plan. GDP is in million of pesos of 1986. The 1995 figure for trade balance is an estimate by FIEL.

Figure 4:
ARGENTINA: BANK DEPOSITS
(monthly average, in billions of current dollars)



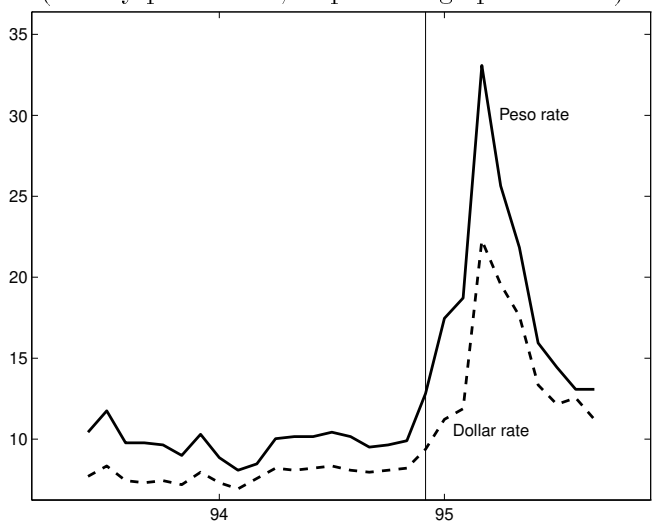
Note: The vertical line marks the Mexican crisis of December 1994.

Figure 5:
ARGENTINA: BANK LOANS
(monthly average, in billions of current dollars)



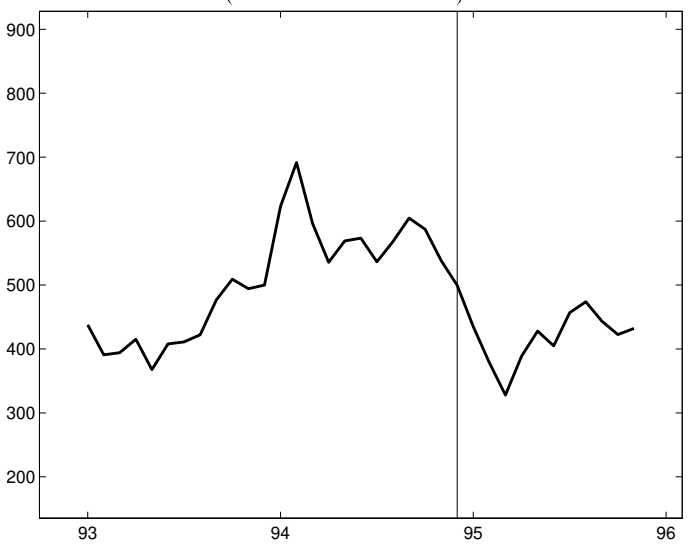
Note: The vertical line marks the Mexican crisis of December 1994.

Figure 6:
ARGENTINA: NOMINAL LOAN INTEREST RATES
(30-day prime rate, in percentage per annum)



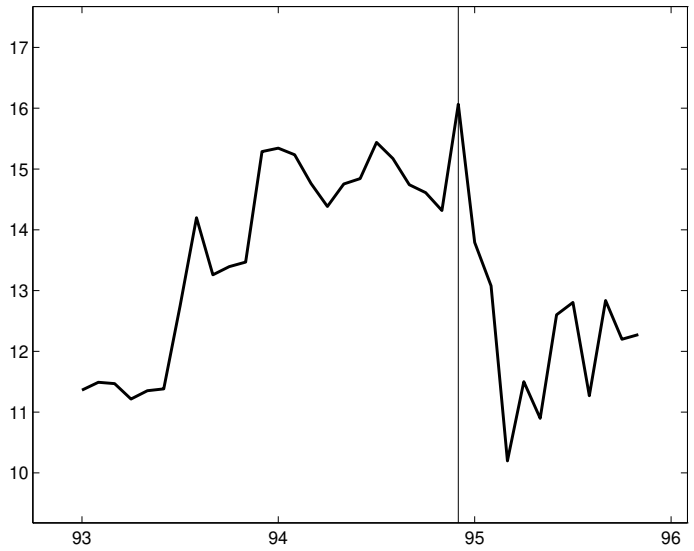
Note: The vertical line marks the Mexican crisis of December 1994.

Figure 7:
ARGENTINA: MERVAL STOCK INDEX
(in current dollars)



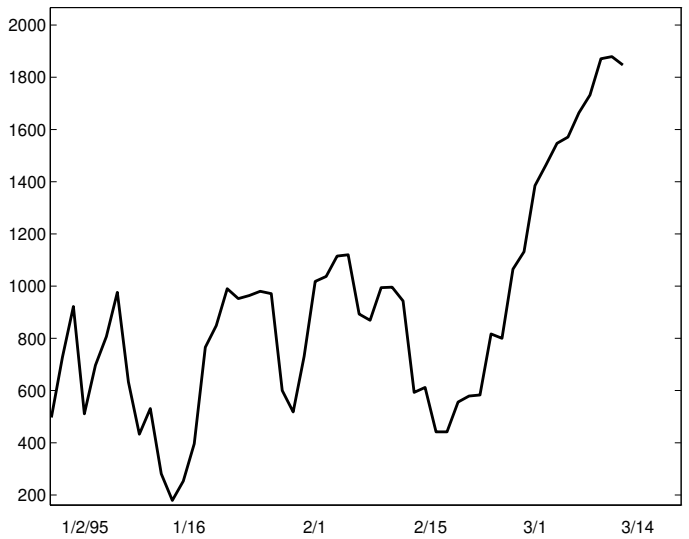
Note: The vertical line marks the Mexican crisis of December 1994.

Figure 8:
ARGENTINA: INTERNATIONAL RESERVES
(monthly average, in billions of current dollars)



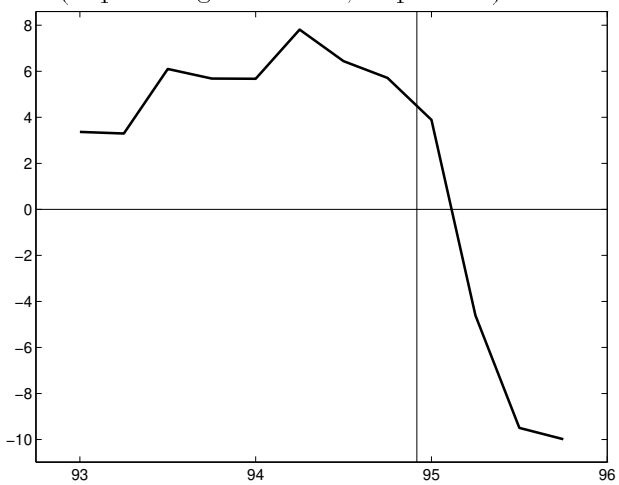
Note: The vertical line marks the Mexican crisis of December 1994.

Figure 9:
ARGENTINA: DOMESTIC CREDIT
(daily, In millions of current dollars)



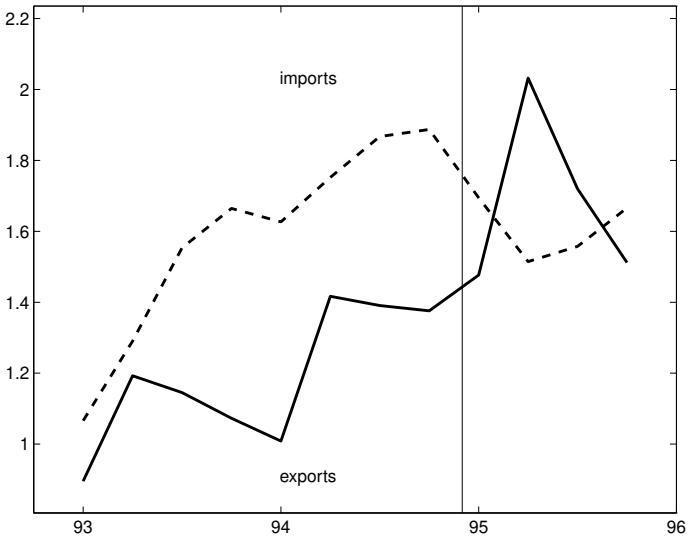
Note: Domestic Credit is defined as Monetary Base + Dollar Deposits of banks in the central bank - Total International Reserves of the central bank.

Figure 10:
ARGENTINA: INDUSTRIAL PRODUCTION
(4-quarter growth rate, in percent)



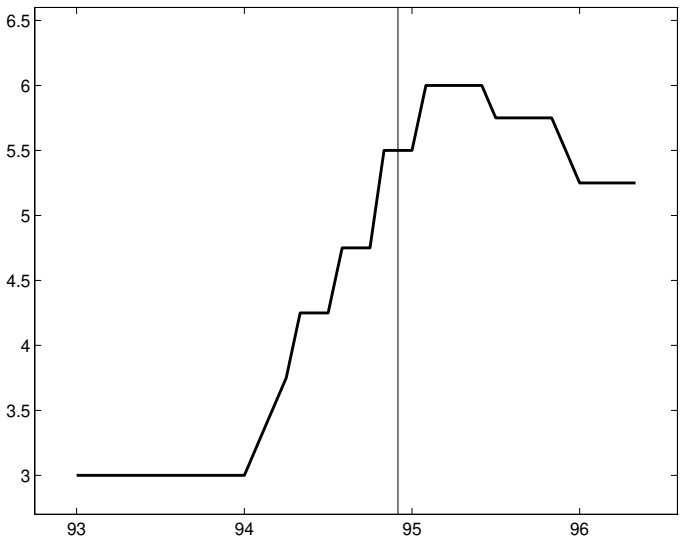
Note: The vertical line marks the Mexican crisis of December 1994.

Figure 11:
ARGENTINA: EXPORTS AND IMPORTS
(in billions of current dollars)



Note: The vertical line marks the Mexican crisis of December 1994.

Figure 12:
U.S. INTENDED FEDERAL FUNDS RATE
(End of month, in percent)



Note: The vertical line marks the Mexican crisis of December 1994.

Figure 13: THE TEQUILA EFFECT IN A PERFECT-FORESIGHT, ENDOWMENT ECONOMY

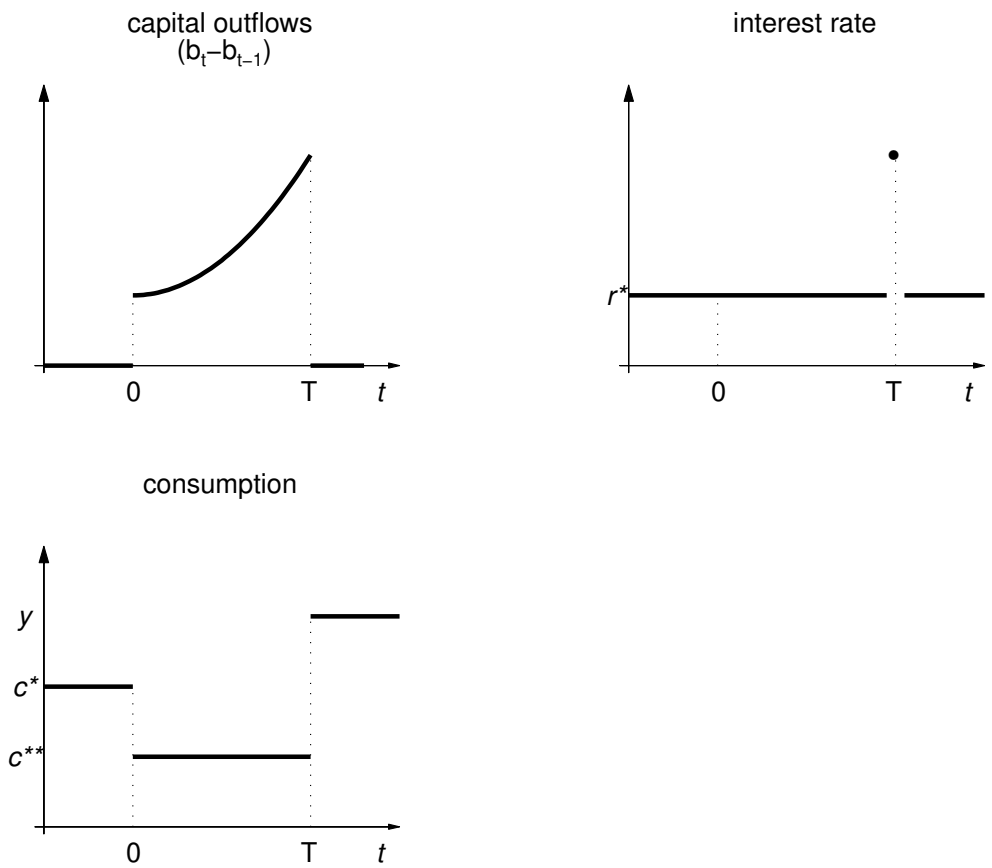


Figure 14: THE TEQUILA EFFECT UNDER UNCERTAINTY

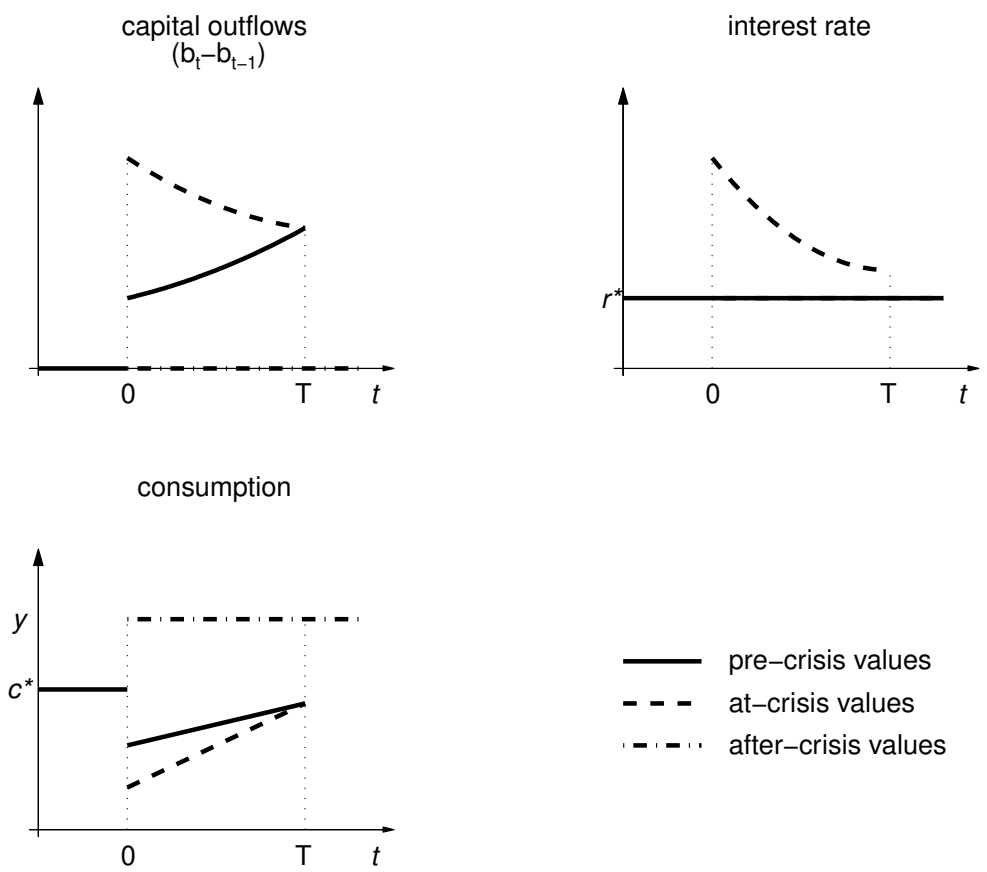


Figure 15: THE TEQUILA EFFECT IN A PRODUCTION ECONOMY

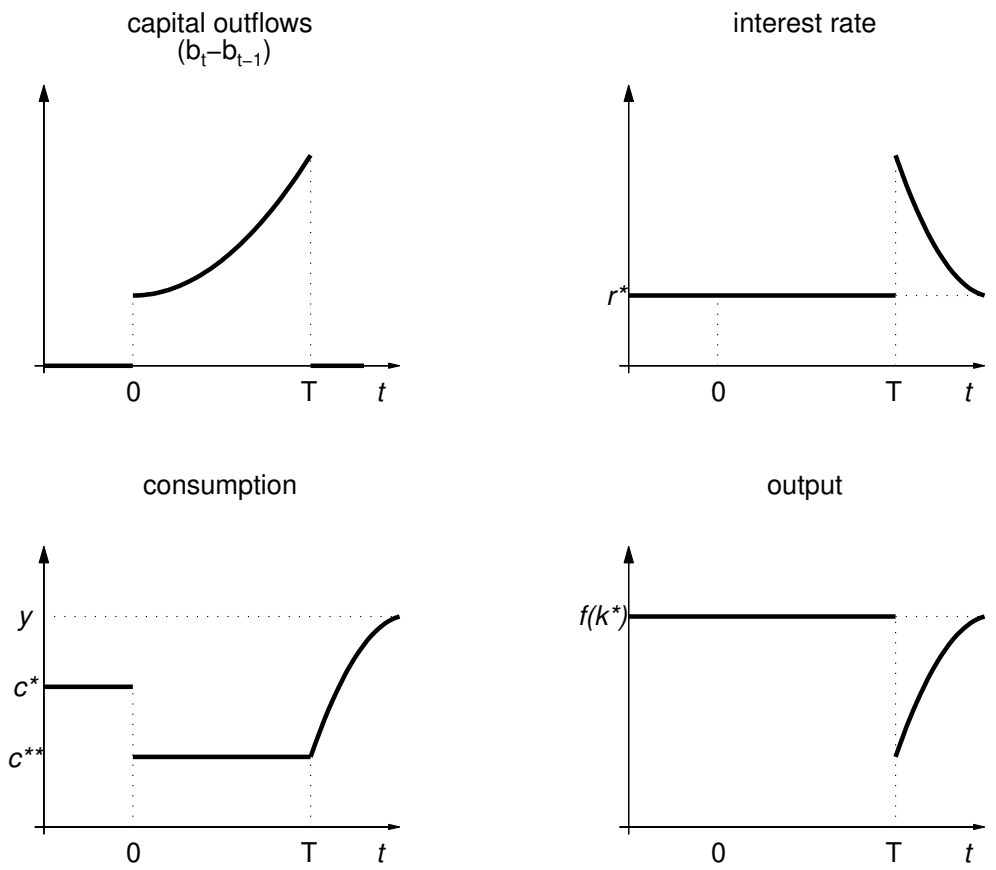
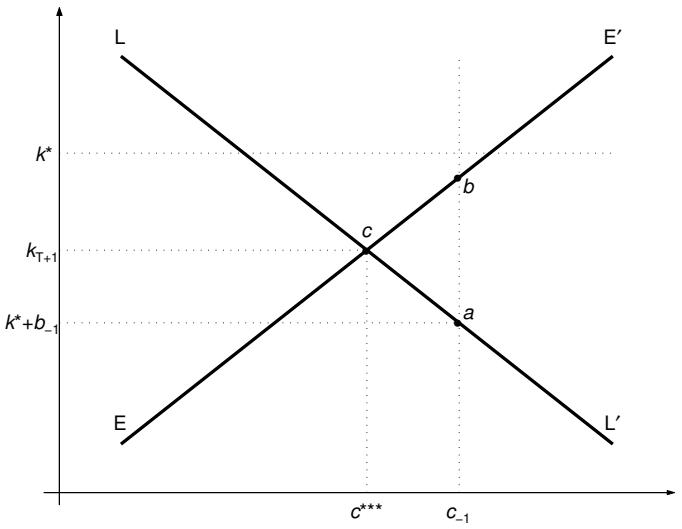



Figure 16: PERIOD-T CONSUMPTION AND INVESTMENT
IN THE PRODUCTION ECONOMY