THE MEXICAN INTERTEMPORAL BUDGET CONSTRAINT: PERSISTENT SIGNALS OF AN EVENTUAL COLLAPSE

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Resumen: Se examina la sustentabilidad del déficit de cuenta corriente en México antes de la crisis de fines de 1994. El artículo muestra que existían señales de que la economía no estaba satisfaciendo su restricción presupuestaria intertemporal mucho antes de que la crisis se presentara. La metodología usada sigue la de Wickens-Uctum, modificada para incluir el caso de posibles intervenciones.

Abstract: This paper examines the sustainability of the Mexican current account deficit prior to the December 1994 crisis. It tests whether or not the Mexican economy was satisfying its intertemporal budget constraint, and finds that signals of possible trouble without a change in policies were present long before the crisis. The tests used are based on the Wickens-Uctum criterion for the sustainability of current account deficits, extended to include the case of possible interventions.

1. Introduction

The Mexican economic crisis that started at the end of 1994 was not a surprise to many observers. As it is recounted in Urzúa (1996a), and as opposed to the Mexican debt crisis that erupted in August 1982, this time there was a good number of economists that warned about an impending financial collapse, some as far back as in 1992.

Most of the observers that foretold the crisis used as their main argument the long-run unsustainability of the Mexican current account deficits. Although the claim was never rigorously substantiated, it looked plausible given the secular real appreciation of the Mexican currency (the peso) since the late eighties, and the accompanying sizable current account deficits. Along those lines, Dornbusch and Werner (1994) wrote what is perhaps the most widely known foretelling paper (see Urzúa, 1996b, for a review of other possible reasons for the crisis).

The goal of this paper is to substantiate that claim by providing statistical evidence that signals of the unsustainability of the current account deficits were present long before the beginning of the financial collapse.

The next section offers a brief overview of the performance of the Mexican economy prior to the crisis, paying mostly attention to the variables relevant for the paper. Section 3, on the other hand, reviews the theory to be used to test for the sustainability of current account deficits. It is based on the work of Wickens and Uctum (1993), after allowing for the possibility of deterministic interventions in the relevant time series. The theoretical results are then used in Section 4 to test for the sustainability of the deficits prior to the crisis. Finally, Section 5 draws some concluding remarks.

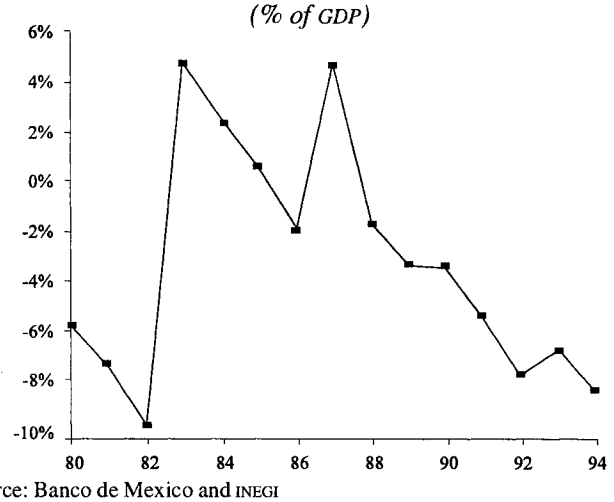
2. The Mexican Economy before the Crisis

The economic reforms undertaken by the Mexican government from the late eighties to the early nineties were hailed literally around the world, for a while. The reforms, made specially by the Salinas administration (1988-1994), ranged from a drastic trade liberalization (accomplished in two stages), to a sweeping privatization process, to even a free trade agreement with the United States and Canada (NAFTA).

Of course, we will not attempt to make here an objective appraisal of those reforms, such a task would require a lengthy book. Instead, this brief section will focus on a very narrow subject: the main determinants of the Mexican current account deficits prior to the crisis. Here, we will just try to identify, for later use, the main factors that could lie behind the path followed by the deficits from 1980 to 1994, as depicted in figure 1.

The large current account deficits that the Mexican economy endured during the early eighties are explained by the very high real GDP growth rates attained then, and an overvalued exchange rate. Already by 1982, those large deficits, together with a substantial increase in the world interest rates and a drop in oil prices, put the economy in a precarious financial situation. Thus, in August of that year, Mexico had to announce that it was unable to meet its foreign obligations. This event initiated what came to be known as the World Debt Crisis.

Figure 1
Mexico's Current Account Deficit, 1980-1994
(% of GDP)



Source: Banco de Mexico and INEGI

For the next two years, the Mexican economy was able to obtain current account surpluses, after a sharp devaluation and a drop of real GDP of more than 4% in 1983. In 1985, though, the surpluses had almost vanished as the economy gained some speed, and as the government suddenly accelerated the trade liberalization process (60% of the controlled good categories were removed from import licensing).

During 1986, the Mexican economy suffered a new recession, due mainly to a sharp drop in oil prices and the still present heavy burden of its external debt. These two external factors, coupled with bad domestic policies on the monetary and fiscal sides, sent subsequently the economy to an inflationary spiral.

By the end of 1987, the annual inflation rate was already greater than 150%. To control it, the government launched a somewhat heterodox plan that involved income policies, the reduction of the fiscal deficit, a sharp devaluation, and further trade liberalization. The plan came to be known familiarly as the *Pacto*, and it was a success: Inflation was lowered down without a recession, and the economy started to grow in the subsequent years (with the accompanying, and ever increasing, current account deficits). Another favorable development was the conclusion, in March 1990, of a debt and debt-service reduction scheme following the lines of the Brady Plan.

For our purposes, it is important to point out that from the beginning of the (first) *Pacto* until the eruption of the new crisis in December 1994, the exchange rate was tacitly used as a nominal anchor by the authorities. This was obviously true during an ephemeral period of a fixed exchange rate regime in 1988. But it was also true during the next type of regime: Although the government adopted, until January 1991, an official crawling peg, the daily devaluations were too small relative to the difference between the Mexican and US inflation rates. Finally, the claim continued to be true from 1991 to 1994, when an exchange rate band regime was adopted. Once again, the crawling peg, used as a center for the band, was too modest.

In November 1991, the government decided to adjust sharply its tariffs. But, afraid of the inflationary and political repercussions, it decided to halve the crawling peg of the peso and to lower the value added tax rates. The reduction of the daily devaluations was a mistake.[1] From 1991 to 1992, the annual current account deficit jumped from 5.2% to 7.5% of GDP, a percentage that was already larger than the one at the end of 1981 (just eight months before the beginning of the debt crisis). The authorities went back to the original peg in November 1992, but the change was clearly insufficient: even though in 1993 the economy grew a meager 0.6%, the current account deficit was only lowered to 6.6% of GDP.

We believe that it was in November 1992 when the authorities lost their last clear opportunity to attack the problem by devaluing the peso (coupled with an acommodating monetary policy). After that date, they were bound to let the currency to continue its appreciation for two

[1] As well as the lowering of the tax rate (see Urzúa 1996c).

reasons: First, NAFTA was going to be signed by the end of that year, and an aggressive exchange rate policy would not have been taken lightly by Mexico's new trade partners. And, second, there was going to be a presidential election in August 1994, which required both an economy growing strongly and the avoidance at all costs of a sharp devaluation.

But the picture became even gloomier in 1994: On January 1, the same day when NAFTA came into effect, there was an indian armed uprising in the South of Mexico, and in March the main presidential candidate was murdered apparently by members of his own party. Naturally, a speculative attack against the peso developed afterwards, which forced the authorities to open a line of credit with the us. Treasury, and to offer to investors dollar-indexed bonds (of which 28 billion dollars were outstanding at the beginning of the crisis!).

Although a full accounting of what happened in 1994 makes for a fascinating reading, it is not needed here. We will show below that the unsustainabilty of the current account deficit was evident in 1992, and, hence, that the political events that took place in 1994 only exacerbated the problem. But in order to show that, it does not suffice to estimate how overvalued was the currencysly overvaluated,[2] for such a discussion neglects other important factors (such as the income effect on the current account deficit). Instead, what it is needed is a model to derive a test for the sustainability of the current account deficits. To this we turn next.

3. The Sustainability of a Nation's Current Account Deficit

The budgetary position of an open economy vis a vis the rest of the world is determined by the evolving state of its current account. Thus, it is natural to ask for conditions under which a given path of current account deficits (or surpluses, for that matter) is sustainable in the long-run. In this section we review a test developed precisely for that purpose by Wickens and Uctum (1993). We also provide a simple extension to it that seems better suited for the case of the Mexican economy.

[2] Although some authors continue to believe so (see, for instance, Gil-Díaz and Carstens, 1996).

When an economy has a deficit at some point, it means that there is a negative change in the financial claims of that nation against the rest of the world. This fact is stated by the following identity:

$$a_t = \Delta f_t \tag{1}$$

where a_t is the current account deficit during period t, expressed in domestic currency and as a proportion of nominal GDP, and f_t is the net foreign indebtedness of the economy at t, once again expressed in domestic currency and deflated by nominal GDP.[3]

The (ex-post) real interest rate on f_t adjusted for real output growth will be defined as:

$$r_t = i_t - \dot{p}_t - \dot{y}_t \tag{2}$$

where the three terms on the right-hand side are, respectively, the domestic nominal rate of return, the inflation rate (measured by the rate of growth of the GDP deflator), and the real GDP growth rate.

Now assume that both the Uncovered Interest Parity Condition, UIPC and the rational expectations hypothesis hold. The suitability of the former assumption for the Mexican case will be discussed later, but it should be noted that the assumption is made here only for pragmatic reasons: If UIPC holds, then we do not have to make an explicit distinction between the assets held domestically or by foreigners.[4] This is very convenient in the case of Mexico, given the lack of reliable disaggregated information.

Using equation (2) and the last two assumptions, (1) can be reexpressed in terms of the primary current account deficit (the current account net of interest payments and interest receipts), c_t, as:

[3] The use of that deflator, something quite common in models for developing economies, allows us to dispose of nonstationarity effects due to inflation or real GDP growth.

[4] Naturally, the UIPC assumption is not required for the model. If UIPC does not hold because of, say, political risk, then one just needs to add to the primary current account deficit, defined in equation (3) below, the increase in interest payments that the nation has to incur due to that risk. See Wickens and Uctum, 1993, p. 426, for a general statement of the model.

$$c_t = \Delta f_t - r_t f_{t-1} \tag{3}$$

where the new variable is also expressed as a proportion of GDP. The first-order difference equation given in (3) will play the main role in deriving below the conditions for sustainability. But in order to state those conditions in a reasonably simple way, it is necessary to further assume that such difference equation is linear. That is, the adjusted real interest rate will be taken to be equal to a constant r.

For the purposes of this paper, the resulting linear difference equation is uninteresting when $r < 0$, for then a nation would never be at risk of becoming insolvent. This is not necessarily so, however, in the case of $r \geq 0$. Denoting by q the discount factor $1/(1+r)$, and using the symbol E_t for expectations given the information available up to time t, one can solve forward equation (3) to obtain the solution for that unstable case:

$$f_t = q^n E_t f_{t+n} - \sum_{i=0}^{n-1} q^{n-i} E_t c_{t+n-i} \tag{4}$$

For a country to be solvent at time t, it has to be the case that its net indebtdness f_t will have to be matched by the limit, as n goes to infinite, of the second term appearing on the right-hand side of equation (4), a sum that sooner or later will have to become positive by generating surpluses in the primary current account. Thus, the issue of the sustainability of the current account deficit boils down to assuring that the following transversality condition holds:

It should be now remarked that a condition similar to (5) appears in

$$\lim_{n \to \infty} q^n E_t f_{t+n} = 0 \tag{5}$$

the literature on the sustainability of government deficits (see, e. g., Trehan and Walsh, 1988, and references therein). Note that if one were to follow at this point that literature, the problem at hand could be approached by, first, rearranging and taking limits in (4) to obtain

$$\lim_{n \to \infty} q^n E_t f_{t+n} = f_t + \lim_{n \to \infty} \sum_{i=0}^{n-1} q^{n-i} E_t c_{t+n-i} \tag{6}$$

Next, by assuming that c_t is exogenous (and not Granger-caused by f_t). And, finally, by positing a particular linear time series process for

c_t and finding the conditions for which the right-hand side of (6) goes to zero.

It is to Wickens and Uctum's (1993) credit to have noted, however, that the assumption of the exogeneity of c_t is not necessary. This is an important point, for that assumption clearly goes against economic intuition: It is quite likely that both the level of net indebtedness and the interest payments on the debt will affect, through wealth and income effects, the state of the current account.

As an alternative to the typical procedure used in the literature, Wickens and Uctum make endogenous the primary current account deficit. They carefully posit a simple behavioral equation that allows them to obtain, after adding equation (3), a manageable two-dimensional linear stochastic system. Their equation is:

$$\Delta c_t = \eta + \alpha f_{t-1} + \beta c_{t-1} + e_t \qquad (7)$$

where e_t is a random variable that captures the additional effects of relevant omitted variables (say, the real exchange rate).

The error term can be stationary or nonstationary,[5] but note that it is implicitly assumed by Wickens and Uctum that the stochastic process followed by e_t is both linear and purely nondeterministic.[6] As in their paper, the first of these last two assumptions will continue to be made here, simply because it seems unlikely to be able to relax it in any operational way.[7]

The assumption of not having a deterministic component can be easily relaxed, however, by explicitly incorporating a process that allows for interventions of the type pioneered by Box and Tiao (1975). That is, instead of (7), the behavioral equation for the primary current account deficit to be considered here will be stated as

[5] In fact, Wickens and Uctum are able to derive their results without any restriction on the order of integration of e_t.

[6] Since in their proofs they have to make use of Wold's representation, which is only valid when those two conditions are present. See, e.g., Hannan and Deistler, 1988, p. 21.

[7] Although, of course, the stochastic process followed by the error term may very well be nonlinear in reality. For instance, as noted in section 2, the exchange rate was allowed to float inside a band prior to the crisis. As Engel and Hakkio (1994) have suggested, for such a regime the nominal (and hence the real) exchange rate could be better modeled with a Markov-switching process.

$$\Delta c_t = \eta + g(\delta, \omega, \xi_t) + \alpha f_{t-1} + \beta c_{t-1} + e_t \tag{8}$$

where: *(i)* the dynamic model for the deterministic variables is given by

$$g(\delta, \omega, \xi_t) = \sum_{j=1}^{k} \left\{ \omega_j(L) / \delta_j(L) \right\} \xi_{jt}$$

where L is the lag operator; *(ii)* for each j, $\omega_j(L)$ has roots outside, and $\delta_j(L)$ outside or on, the unit circle; and *(iii)* the components of the vector of exogenous variables ξ_t are dummy variables taking a value of 1 during the periods when an intervention is known to have occurred (note that all interventions are ***prior*** to t). The addition of possible deterministic interventions will allow us to circumvent, albeit artificially, the problem of accounting for changes in policies that could have influenced the evolution of the Mexican current account deficit.

Using now equations (3), (8) and (9), we can state the implied stochastic dynamic system that drives c_t and f_t as:

$$\begin{bmatrix} 1 & -1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \Delta f_t \\ \Delta c_t \end{bmatrix} = \begin{bmatrix} 0 \\ \eta + g(\delta, \omega, \xi_t) \end{bmatrix} + \begin{bmatrix} r & 1 \\ \alpha & \beta \end{bmatrix} \begin{bmatrix} f_{t-1} \\ c_{t-1} \end{bmatrix} + \begin{bmatrix} 0 \\ e_t \end{bmatrix}$$

This system can be recasted in a vector autoregresive form as which can be in turn rewritten as

$$\begin{bmatrix} \Delta f_t \\ \Delta c_t \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix} [\eta + g(\delta, \omega, \xi_t)] + \begin{bmatrix} r+\alpha & 1+\beta \\ \alpha & \beta \end{bmatrix} \begin{bmatrix} f_{t-1} \\ c_{t-1} \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} e_t$$

$$\Delta x_t = \mu_t + \Theta x_{t-1} + u_t \tag{10}$$

after defining $x_t = (f_t, c_t)'$, $u_t = (e_t, e_t)'$,

$$\mu_t = \begin{bmatrix} 1 \\ 1 \end{bmatrix} [\eta + g(\delta, \omega, \xi_t)], \quad \Theta = \begin{bmatrix} r+\alpha & 1+\beta \\ \alpha & \beta \end{bmatrix}$$

We can now solve (10) backwards, starting at period $t+n$, to obtain

$$x_{t+n} = (\mathrm{I} + \Theta)^n x_t + \sum_{i=0}^{n-1} (\mathrm{I} + \Theta)^i \mu_{t+n-i} + \sum_{i=0}^{n-1} (\mathrm{I} + \Theta)^i u_{t+n-i}$$

This equation can be used to finally find, after defining $\gamma = (1, 0)'$, an expression for the variables involved in the transversality condition (5):

$$q^n E_t f_{t+n} = \gamma' [q^n (\mathrm{I} + \Theta)^n x_t + \sum_{i=0}^{n-1} q^n (\mathrm{I} + \Theta)^i \mu_{t+n-i} + \sum_{i=0}^{n-1} q^n (\mathrm{I} + \Theta)^i E_t u_{t+n-i}] \qquad (11)$$

Thus, the question of the sustainability of current account deficits can be answered by finding the conditions for which the right-hand side of (11) goes to zero as n goes to infinite. The answer to that question is the Wickens-Uctum (sufficient) condition for sustainability: If λ_i ($i = 1, 2$) denotes a characteristic root of the matrix $\mathrm{I} + \Theta$, then it has to satisfy $|\lambda_i| < 1 / q = 1 + r$.

The reason is that under such a condition the three terms inside the bracket in equation (11) tend to zero.[8] This is clear for the first term, since the n-th power of matrix $q(\mathrm{I} + \Theta)$ tends to a matrix of zeros because $(q\lambda_i)^n$ goes to zero. A more difficult problem is to show that the third term also goes to zero, but this has been proved by Wickens and Uctum (1993). Finally, it becomes clear that the second term also goes to zero after rewriting it as:

$$\sum_{i=0}^{n-1} q^n (\mathrm{I} + \Theta)^i \mu_{t+n-i} = q^n (\mathrm{I} + \Theta)^n \sum_{j=i}^{n} (\mathrm{I} + \Theta)^{-j} \mu_{t+j}$$

But, what if after estimating (8) one cannot reject the hypothesis of $\alpha = 0$ (i.e., strong exogeneity of c)? In that case, as discussed earlier, (6) becomes the key equation. Under the assumption of c being integrated of order zero or one, Wickens and Uctum (1993) show that the sustainability issue boils down to testing whether or not the current account deficit, a, is not integrated. Once again, the claim can be trivially extended to the case when the series is perturbed by exogenous interventions.

[8] As noted in the text, the Wickens-Uctum condition is sufficient, but not necessary, for sustainability. This is so because there could be some extraneous relationship between the three terms in (11) that could make the whole expression go to zero in the limit, even if they don't go to zero individually. But that possibility seems so unlikely to really worry about it.

4. Tests for the Mexican Economy

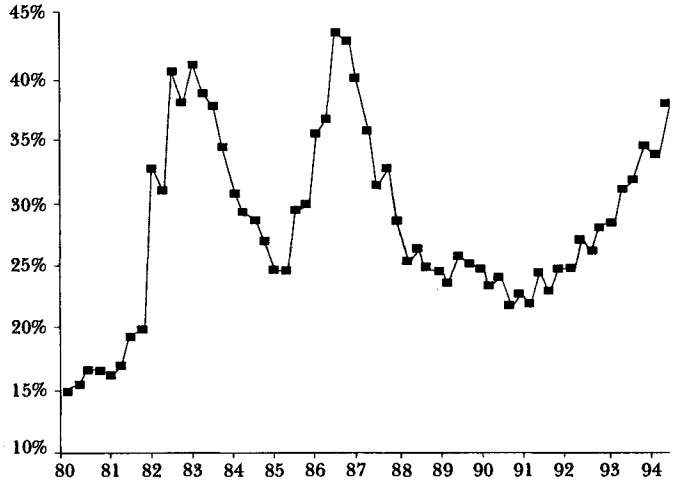
In this section we use the criteria mentioned above to determine whether or not the current account deficits of the Mexican economy were sustainable in the long-run without a change in policies. The sample to be used for that end covers the 1983:I-1994:III period; that is, the pre-crisis period during which the economy was liberalized. Quarterly observations for the trade balance and net transfers (the sum of which constitutes the primary current account deficit) were readily available. On the other hand, given the lack of disaggregated data, an estimate for net foreign indebtedness had to be constructed by cumulating the current account deficits starting in 1970.[9] Both series were annualized.

Figures 2 and 3 present the corresponding graphs of c and f, obtained after taking the ratio of those variables and nominal GDP. We were unable to reject the hypothesis of a unit root in both cases (c and f),

Figure 2
Balance of Trade, 1980:I-1994:III
(% of GDP)

[9] The source for the balance of trade and current account figures, together with the end-of-period exchange rate to transform them from dollars to pesos, was Banco de México. The quarterly figures for nominal GDP were taken from INEGI.

Figure 3
Net Foreign Indebtedness, 1980:I-1994:III
(% of GDP)



using both a Dickey-Fuller test, and a test due to Perron (1989) that allows for a structural break (a dummy and a time break). In order to avoid the well-known problem of "data-mining" while identifying the break point, which would be then data dependent (see Christiano, 1992), the break point was taken to be 1988:1, the first quarterly observation after the *Pacto* (see section 2).

As the next step, equation (8) was estimated in several ways (in all cases the errors exhibited autocorrelation of order at least 1): First, it was estimated without introducing any intervention. Second, it was estimated allowing for the same interventions as in the last paragraph. Finally, it was also estimated by adding an intervention (dummy) for the period 1983-1986. In all the cases the hypothesis of $\alpha = 0$ (i.e., strong exogeneity of c) was safely rejected. For instance, the resulting regression with no interventions was (after adding an AR(1) term):

$$\Delta c_t = \underset{(0.0111)}{-0.0008} - \underset{(0.0370)}{0.0023 f_{t-1}} - \underset{(0.1034)}{0.0898 c_{t-1}} + e_t$$

where the numbers in parenthesis are the standard errors.

Thus, the primary current account deficit is strongly exogenous in the case of the Mexican economy. Consequently, the issue of the sustainability of the current account deficit can be answered by testing whether or not the deficit a is non-integrated. For that end, both the Said-Dickey and the Perron tests were used to check for a unit root in that series. In both cases it was found that the series exhibited a unit root, and hence that the deficit was unsustainable in the long-run without a change in policies.

But a question remains: When did the series start to show unsustainability? To answer this question we repeated all the steps described above but reducing the end date quarter after quarter. Once again, it was found that c continued to be strongly exogenous in all cases. However, the integration property of a disappeared when the sample had as an end date 1992:11 or earlier. For instance, in the case of a Said-Dickey test, the t-value that was found by shortening the period one quarter at a time, with the first end period being 1994:111 and the last 1992:11, were: -1.16, -1.2, -1.5, -1.4, -1.5, -1.3, -1.5, -1.6, -2.3, -2.6, and -3.4.

5. Conclusion

As this paper has argued, a determinant factor of the Mexican economic crisis in 1994 was the series of increasingly large current account deficits that the economy endured for half a decade. They were so large and persistent that, as far back as mid-1992, they became unsustainable in the long-run barred a sharp change in economic policies.

Naturally, the crisis was also exacerbated by many other factors, such as the fragility of the financial sector (see Calvo and Mendoza, 1995), and the sclerosis of the political regime that has ruled Mexico for many decades. As opposed to the unsustainability issue, which has been temporarily solved by a sharp devaluation, these and other issues continued to play a role in the unsatisfactory stabilization process undertook during the 1995-1996 period. But that makes for another story.

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