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A RAND NOTE

**Medium-Term Prospects for the Mexican Economy:  
Some Modeling Results**

C. R. Neu

July 1990

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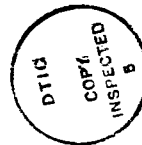
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A simple model simulates developments in the Mexican economy over the next 20 years. When there is uncertainty, the model errs in the direction of optimism about Mexican prospects. A base case scenario illustrates that without a net inflow of foreign capital, the peso cannot be sustained at current real levels. This case also serves as a point of reference in assessing the effects of changes in other exogenous factors. A variety of positive factors creates an optimistic scenario that represents the best one might hope for over the medium-term future, one in which there is only a minor devaluation of the peso and no decline in real income. The model can also produce a pessimistic scenario that suggests the worst that might happen to the Mexican economy. The scenarios demonstrate that the Mexican economy is on something of a knife edge. Whether Mexico undergoes robust or slow growth will be determined largely by factors that only the Mexican government can affect directly. The U.S. government can provide technical assistance and encouragement, facilitate foreign capital inflows, and reduce barriers to imports of Mexican products.

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## Medium-Term Prospects for the Mexican Economy: Some Modeling Results

C. R. Neu

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## **PREFACE AND ACKNOWLEDGMENTS**

The research described in this Note is an element of a larger research project, sponsored by the Under Secretary of Defense for Policy, assessing the prospects for political stability in Mexico during the next ten to fifteen years. The state of the Mexican economy will not, of course, be the only or necessarily the most important factor influencing the prospects for political stability. Continued disappointing economic performance, however, will almost certainly increase the risk of political instability. Policymakers in the United States, therefore, are justifiably concerned about Mexico's economic prospects and about the factors that will influence them. The research reported here addresses these questions.

I have been aided in this research by RAND colleagues Keith Crane and David Ronfeldt, who have been unfailingly generous in sharing their superior knowledge of Mexican economic and political institutions. Donald Henry also provided valuable assistance in the form of an unusually careful and insightful review of an earlier draft of this Note. Whatever errors or evidence of naivete remain are, however, my responsibility.

This research was prepared as part of the International Economics Program in the National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense.

## SUMMARY

The 1980s have been difficult years for the Mexican economy, characterized by declining real per capita income, high inflation, capital flight, difficulty attracting foreign capital, and a heavy external debt servicing burden. Major economic reforms have been instituted in the last few years, but future prospects for the Mexican economy are still highly uncertain.

These prospects will be influenced by a variety of internal and external factors. Among the most important of these will be oil prices, agreements negotiated with creditors concerning principal or interest rate reductions on Mexico's external debt, Mexican domestic saving rate and the degree to which government deficits can be held in check, Mexico's ability to attract additional foreign lending and direct investment, and the extent of economic reforms that will raise Mexican productivity.

To explore the importance of these and other factors, a relatively simple model was constructed to simulate developments in the Mexican economy over the next 20 years. Formally, the model is a Solow-type, neoclassical growth model expanded to allow explicit modeling of exchange rate developments. Parameter estimates used in the model are derived from recent Mexican economic experience. When there is some uncertainty about the appropriate values for certain parameters, the model generally errs in the direction of optimism about Mexican prospects. Sensitivity analyses on the most problematic parameters suggest that plausible changes in model parameters do not result in significant qualitative changes in model simulations.

A base case scenario illustrates that without a net inflow of foreign capital (in the form of either lending or direct investment) the peso cannot be sustained at current real levels (assuming that other important elements of the Mexican economic situation—oil prices, saving rate, productivity growth rates, etc.—remain essentially unchanged). Without substantial capital inflows, the peso will fall sharply against the dollar. This devaluation will increase the cost to Mexicans of imported goods and increase the real debt servicing burden, both contributing to a one-time decline in real income of some 3 percent. After this adjustment, real gross national product (GNP) growth will stabilize at a bit below 4 percent per year

(about 2 percent per year in per capita terms), somewhat lower than the rate of growth achieved from the mid-1960s through the mid-1970s.

This base case also serves as a point of reference in assessing the effects of changes in other exogenous factors. Among the findings yielded by such exercises are the following:

1. Impossibly large net inflows of foreign capital would be required to maintain the real value of the peso at 1988 levels, and there appears little prospect of avoiding a major decline in the peso (with its attendant decline in real income) simply through foreign borrowing. The inevitable exchange rate adjustment could, however, plausibly be postponed with no longer-run negative implications for the economy until after National Assembly elections scheduled for 1991.
2. The debt relief package agreed to by Mexico and its creditor banks in July 1989 will reduce but not eliminate the necessary devaluation of the peso and the resulting decline in real income. For a few years, the debt relief package raises the real income growth rate slightly, but in the longer run debt forgiveness of this magnitude does nothing to speed Mexican real income growth.
3. An immediate 25 percent increase in oil prices that is sustained in real terms will reduce the necessary devaluation of the peso and almost completely eliminate the near-term decline in real GNP. In the long run, these higher oil prices will add some two-tenths of 1 percent to the growth rate of real income.
4. A failure by the Mexican government to control the fiscal deficit could lead to a reduction in total domestic saving (which is the sum of private saving and government dissaving). Recent years have seen the domestic saving rate rise to about 25 percent of GNP. From the mid-1960s to the mid-1970s, though, the domestic saving rate was only about 17 percent of GNP. If savings were to return to that level, the effect on real GNP growth would be severe: long-run real GNP growth would be reduced by about 1 percent per year.

By combining a variety of positive factors, the model creates an optimistic scenario for the Mexican economy that represents the best one might hope for over

the medium-term future. The assumptions that lie behind this optimistic scenario are:

- debt reduction of \$12.9 billion (or its equivalent in interest rate reductions) as a result of the July 1989 agreement between Mexico and its creditor banks;
- oil prices 25 percent higher in real terms than in 1989;
- total factor productivity growth of 2 percent per year;
- real export volumes growing 10 percent more rapidly than the real incomes of Mexico's trading partners; and
- sufficient capital inflows to maintain the real value of the peso through 1991, and capital inflows in subsequent years of about 1.8 percent of Mexican GNP.

These assumptions generate a scenario in which there is only a minor devaluation of the peso and no decline in real income. The long-run growth rate for real income is quite robust: about 5.7 percent per year and more than 4 percent per year in per capita terms.

Similarly, the model can produce a pessimistic scenario that suggests the worst that might happen to the Mexican economy in the absence of major upheavals or dislocations. The assumptions behind the pessimistic case are:

- debt reduction of only about \$10 billion (or its equivalent in interest rate reductions) as a result of the July 1989 agreement;
- a domestic saving rate of 17 percent of GNP, as opposed to the 25 percent achieved in recent years;
- real export growth that is proportional to real income growth among Mexico's trading partners;
- total factor productivity growth of only one-half of one percent per year; and
- zero net capital inflows after 1989.

These assumptions produce a scenario that is very pessimistic indeed. Real GNP drops sharply in the near term and resumes growing at a very disappointing rate of only about 2 percent per year. This translates into declining

per capita incomes until well beyond the turn of the century—clearly a politically unsustainable situation.

Better or worse outcomes than the optimistic and pessimistic scenarios depict are possible, of course. These scenarios, though, are adequate to demonstrate the point that the Mexican economy is on something of a knife edge. The differences in the assumptions that underlie the optimistic and pessimistic cases are not large in historical terms. Precedents for either set of assumptions can be found in recent Mexican history, as can examples of larger changes in underlying conditions than are reflected in the differences between the two cases.

Thus, during the next 10 to 15 years Mexico could undergo either growth that is quite robust or growth that is catastrophically slow. Which will occur will be determined largely by factors that only the Mexican government can affect directly. The U.S. government can assist, though, by providing technical assistance and encouragement and to a limited degree by facilitating foreign capital inflows (from private sources, from international financial institutions, and possibly in the form of direct loans from the U.S. government) and by reducing barriers to imports of Mexican products.

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## I. INTRODUCTION

This Note describes a relatively simple model of the Mexican economy and offers some thoughts about the prospects for Mexican economic growth in the medium term—the next ten to fifteen years—that arise from simulations performed using the model.

The model was developed in the course of a larger project aimed at assessing the medium-term prospects for continued political stability in Mexico and identifying U.S. policies that might help to assure such stability. Clearly, political stability in Mexico—or in any country, for that matter—depends on many factors, only some of which are related to economic growth. No assessment of the prospects for political stability can stop with an assessment of economic prospects. In the case of Mexico, however, consideration of the medium-term economic prospects must be a central element of any overall political assessment.

At present, Mexico faces no serious external threat to its political stability. Neither, despite the tumult of the recent election campaign, do there exist domestic elements seeking to subvert or to overthrow the established government. The flow through Mexico of illegal drugs bound for the United States raises legitimate fears about the ability of Mexican political and governmental institutions to withstand the corruption that has grown out of the drug trade in other countries. So far, though, these institutions appear to be holding their ground.

If there is a threat to Mexican political stability, it will most likely arise from the disappointed economic expectations of Mexico's people. The 1980s have been difficult years for the Mexican economy. Rapid growth in the 1960s and the oil-fired boom of the 1970s have given way in the 1980s to declining real income per capita, rapid inflation, capital flight, difficulty in attracting foreign capital, and a heavy external debt servicing burden. Real gross domestic product in Mexico was at about the same level in 1987 as it was in 1981, and during the same period real wages of manufacturing workers fell by 50 percent. Despite major economic reforms instituted in the last few years—most notably trade liberalization, privatization of key industries, and the removal of barriers to foreign investment—Mexico still faces the need for further painful economic adjustment. Continued economic hardship may someday lead to a widespread rejection of government policies and institutions,

as workers, peasants, the urban poor, or an increasingly squeezed middle class decide that they have little left to lose, that their prospects must be better in a radically changed political environment. The most striking fact of recent Mexican history may well be that despite this hardship, the nation's political and social structure has in fact remained largely intact.

There is, of course, no way to be sure that this state of affairs will continue. Neither can any economic analysis predict the ability of people or institutions to withstand economic hardship. Economic analysis can, however, provide insights into the likelihood that this hardship will be relieved in the near future, and can help identify the conditions that will make renewed economic growth possible.

### **WHY A MODEL?**

There has been no shortage of opinions in recent years about Mexico's economic plight or its medium-term prospects. Newspapers, political speeches, and well-intentioned reports have been filled with assertions that Mexico's economic future is bleak because of this or that condition, that all will be well if only certain conditions are met, that Mexico cannot possibly continue to service its international debt, that further borrowing by Mexico is essential, or that further borrowing will lead only to ruin. Seldom are these assertions accompanied by well-articulated economic analyses or careful descriptions of the assumptions on which they are based. As a consequence, it is hard to know which assertions deserve any credence.

A variety of factors will influence an economy at any given time, and few analysts are able to keep track of all of them without some more or less formal analytic structure. Often these factors will act to push the economy in opposite directions, and it is only by carefully quantifying the magnitude of each influence that we can know which factors will predominate. Finally, because the forces that shape an economy can sometimes interact in surprising ways, it is dangerous to extrapolate current trends into the future. It is often the case that economic phenomena create influences that bring about their own reversal. For all of these reasons, analysis is aided if we have at hand a set of consistent, clearly specified, and quantitative relationships that describe how an economy operates and how it changes over time. In other words, analysis is aided if we have a model of the economy.

### **WHY A SIMPLE MODEL?**

The Mexican economy is obviously very complex, and a model that aims at capturing all this complexity would also be very complex. And constructing such a model would probably be impossible. The structure of the Mexican economy has undergone a number of radical changes during the last 40 years: the "green revolution" in agriculture; the discovery of oil; the boom and subsequent bust of oil prices; the rise and then partial decline of populist, statist economic policies; the erection and then dismantling of barriers to foreign trade and investment; and so on. It is virtually impossible to identify any period in recent Mexican history during which economic policies, demographics, external economic conditions, etc., were similar to what Mexico will face in the coming years. It is thus difficult to use history as a guide in identifying any but the most basic aggregate relationships that govern the operation of the Mexican economy. Mexico's economic history has not been stable enough to support a large and detailed model of its economy.

Neither is a detailed model necessary to explore the issues that will do the most to shape Mexico's medium-term future. Debt servicing requirements, oil prices, exchange rates, and import and export volumes can all be represented in relatively simple models.

Finally and perhaps most importantly, simple models are often more effective aids to insight than large and complex ones. It is possible to understand at an intuitive level the workings of a simple model and to see why it produces the results it does. As models grow in size and complexity, they quickly become "black boxes," generating results that cannot be easily understood or explained. No model can be sophisticated enough to eliminate the need for judgment and interpretation; and to be useful, a model must provide a framework on which to apply judgment and interpretation. With a complex model, it can be hard to know just how to incorporate judgment.

### **MEXMOD: A SIMPLE MODEL OF THE MEXICAN ECONOMY**

The remainder of this Note is devoted to describing MEXMOD, a simple model of the Mexican economy, and to reporting on exercises performed with it to explore possible future paths of the Mexican economy.

Essentially, MEXMOD is a way to get the complicated arithmetic of the Mexican economy right, a way to make sure that we are using a consistent set of

rules to describe how the Mexican economy works. It provides a way of testing the consequences for Mexico's future of different assumptions about how the economy works and about exogenous factors. In this way, it will help us to understand the range of possible futures that Mexico may face and some of the factors that will be most important in determining which of these futures Mexico will eventually have to live with.

It is important at the outset to be clear about what MEXMOD is not. It is not a forecasting tool. Our aim with MEXMOD is to understand better how oil prices, interest rates, debt reduction plans, economic growth in the United States, and other factors will influence economic conditions in Mexico. Nothing in the model will help us predict the future course of any of these important variables, however, and consequently we will not be in a position to advance a single "most likely" scenario for Mexico's future. Neither will MEXMOD allow us to understand what factors will affect income distribution among different classes of interests in Mexico. This is a serious shortcoming; whether the lot of all Mexicans improves roughly together or whether whatever economic gains are to be had will be concentrated in some narrow groups will have profound consequences for Mexico's future political and social stability. It would be very useful to have a tool that would allow exploration of these issues. Unfortunately, in this effort such a tool has remained beyond reach.

## II. MODEL STRUCTURE

For the most part, the MEXMOD model is a standard neoclassical growth model of the sort first developed by Robert Solow. It differs from the standard Solow-type models in that it incorporates an explicit mechanism for exchange rate determination. This section details the structure of the MEXMOD model. It also describes how key model parameters were estimated, the degree of confidence associated with these estimates, and how these parameters might be varied in exploring possible future scenarios for the Mexican economy.

### THE PRODUCTION FUNCTION

Real output,  $Q$ , is a function of labor employed,  $L$ , and the available capital stock,  $K$ . The model posits a simple Cobb-Douglas relationship with constant returns to scale and a rate of (non-factor specific) total factor productivity growth of  $\tau$ :

$$Q = Ae^{\tau t} L^{\alpha} K^{1-\alpha}, \quad (1)$$

where  $A$  is a scaling constant.

In a Cobb-Douglas formulation,  $\alpha$  and  $(1 - \alpha)$  represent the shares of labor and capital, respectively, in national income. Figure 2.1 shows how these shares have varied since 1950. The line plotted represents the share of "non-labor" income, that is, the share of national income not accounted for by wages and salaries. Included in this "non-labor" income are both returns on capital and proprietors' income (for example, the income of owner-proprietors of small shops or the income of land-owning small farmers). Proprietors' income is some unknown mix of labor income and return on capital; proprietors contribute both capital and labor to their enterprises. The fraction of national income going to capital, then, is overstated in Figure 2.1. The share of capital is probably further inflated in this figure because of the existence of a large informal or "off-the-books" sector in the Mexican economy. Incomes earned in the informal sector are presumably not included in the official income accounts. One might guess that the share of labor income is higher in the informal sector than it is in the formal sector; capital intensive activities are less easily hidden from authorities than activities requiring mostly labor. A "correct"

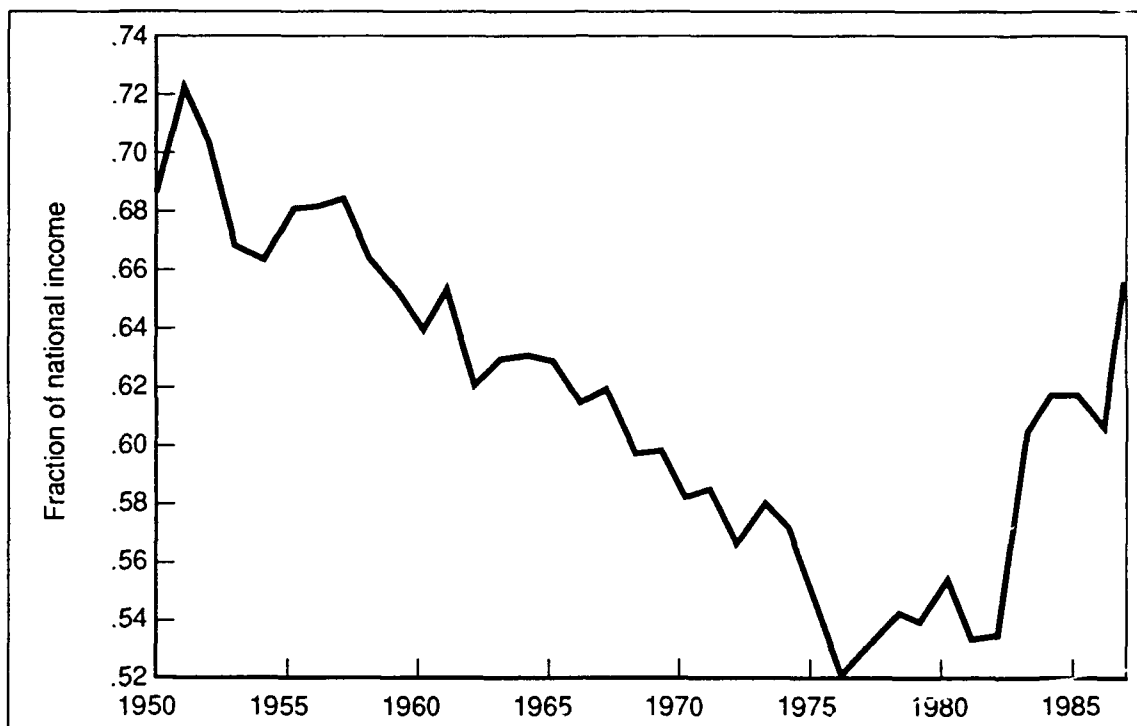


Fig. 2.1—Division of national income (share of non-labor income)

accounting would therefore presumably add more to labor income than to capital income.

“Base case” applications of the model take the uncorrected share of “non-labor” income shown in the figure as the true share of capital. This yields a value of about one-third for  $\alpha$ . Since we know that the figure understates the share of labor, however, it is important to explore the implications of using a higher value for  $\alpha$  in model alternative simulations.<sup>1</sup>

One approach to testing the plausibility of estimates about different values for  $\alpha$  is to consider what they imply about rates of return on capital. Differentiating

<sup>1</sup>Figure 2.1 provides a striking illustration of the difficulties inherent in trying to estimate even relatively simple relationships for the Mexican economy. The share of labor, and therefore the appropriate value of  $\alpha$  in the Cobb-Douglas function, has fluctuated from .28 to .48 and then back to .33 in the space of 38 years. These fluctuations reflect (at least roughly) major changes in Mexican economic policies. The decline in labor shares that began in 1982, for example, reflects the new economic policies of the de la Madrid administration and the rise of interest payments on domestic government debt as a major component of national income. With basic relationships in the economy so unstable, estimation becomes problematic.

Equation 1 with respect to the capital stock yields an expression for the social rate of return on capital:

$$\frac{dQ}{dK} = \frac{(1 - \alpha)Q}{K}.$$

In 1987, gross domestic product (GDP) in Mexico was 4,793 billion pesos at 1980 prices. The capital stock was estimated at 12,863 billion pesos, also at 1980 prices. Substituting these values into the expression for social rate of return and using a value of .33 for  $\alpha$  gives a social rate of return on capital of about 25 percent—not an unrealistic figure for a capital-short developing economy. Increasing  $\alpha$  to .50 yields an estimated social rate of return of about 19 percent.

The key to the long-term characteristics of this model (or any other growth model) is the rate of total factor productivity growth, designated  $\tau$ . Reflected in total factor productivity growth are the myriad of factors that influence output beyond the simply measured inputs of undifferentiated labor and capital. Among these factors are the character and the skill level of the work force; the vintage of the capital stock and the efficiency with which it is utilized; the level of technological, financial, and managerial sophistication evidenced in productive enterprises; the degree to which government policies and regulations hinder or promote efficient production; the *degree of overmanning in enterprises*; and so on.

Clearly, it is impossible to observe and quantify all of these factors. The usual practice is to estimate the rate of total factor productivity growth as a residual: all growth that is not accounted for by increases in inputs (in this model, labor and capital) is attributed to total factor productivity growth. Table 2.1 shows estimates, calculated by two different methodologies, of total factor productivity growth in Mexico over various recent periods. What is striking is that both methodologies suggest that there was negative growth in total factor productivity during the period 1970 through 1987; during this period increases in labor and capital more than accounted for the growth in output that actually took place. The experience was better over the longer 1960-through-1987 period, with Mexico achieving total factor productivity growth rates in the neighborhood of 1 percent per year. Higher rates of total factor productivity growth were recorded during the 1960s (2.5 to 3 percent per year), between 1971 and 1974 (about 2.75 percent per year), and during the oil boom years of 1977-1981 (about 2.25 percent per year).

Table 2.1

MEXICAN TOTAL FACTOR PRODUCTIVITY GROWTH  
PERCENT PER YEAR

|           | Method A | Method B |
|-----------|----------|----------|
| 1960-1987 | 1.61     | 0.80     |
| 1970-1987 | -0.73    | -0.10    |
| 1960-1969 | 3.12     | 2.41     |
| 1971-1974 | 2.78     | 2.75     |
| 1977-1981 | 2.37     | 2.20     |

NOTE: Method A assumes that the share of labor in national income remained constant at 33 percent over the entire period 1960 through 1987. Method B assumes that the share of labor was as shown in Figure 2.1.

In the past two or three years, Mexico has adopted a variety of policies that may be expected to bring higher total factor productivity growth. The most important of these are probably trade liberalization, reduced barriers to foreign direct investment, and sales of state-owned enterprises. Nonetheless, rates of total factor productivity growth above about 1 percent per year would be higher than what Mexico has achieved overall during the past quarter century, and rates of growth above 2 percent a year have been achieved only for short periods. With this in mind, "base case" scenarios generated by the model are built on an assumption that total factor productivity will grow at a rate of 1 percent per year, while "optimistic" scenarios assume total factor productivity growth of 2 percent per year.

#### DEMAND FOR LABOR

This model also assumes that the real wage adjusts so as to clear labor markets. In other words, the demand for labor always equals an exogenously determined supply of labor. The principal justification for this assumption is that

Mexico has only the most rudimentary system of unemployment compensation. As a consequence, the unemployed have very strong incentives to find employment. Many may find employment in the informal or underground sectors, and it seems unlikely that there are many workers who are truly unemployed. The equation defining the demand for labor, then, is simply:

$$L = L_0. \quad (2)$$

## WAGE DETERMINATION

Like most neoclassical growth models, this model assumes profit maximizing behavior on the part of firms. No one, of course, would argue that this is an accurate description of all firms in the Mexican economy; stories of overmanning, for example in the parastatal sector, abound. This assumption is used only in calculating an aggregate real wage, however, and has no effect on any other model outputs. With an eye toward the dubious nature of this assumption, this Note does not report model results on real wages. This equation is presented only in the interest of documenting the full MEXMOD model.

Profit maximizing behavior on the part of firms suggests that the real wage must be equal to the marginal product of labor, or that the condition

$$W = \frac{dQ}{dL} \quad (3)$$

must hold.

## CAPITAL FORMATION

Capital formation is given by the identity

$$\frac{dK}{K} = \frac{I}{K} - \delta, \quad (4)$$

where  $I$  is real gross investment, and  $\delta$  is the depreciation rate. Figure 2.2 shows the history of the depreciation rate as reflected by Mexican government figures for capital consumption and the capital stock. The rising depreciation rate is consistent with a change in the character of the capital stock as the Mexican economy has developed. In earlier years, the capital stock may have consisted of relatively long-lived, basic capital: structures, simple machines, etc. As the economy has developed, shorter-lived capital such as sophisticated machine tools, computers, etc., may have come to constitute a larger share of the total capital stock. "Base case" scenarios use a depreciation rate of 4.2 percent per year.

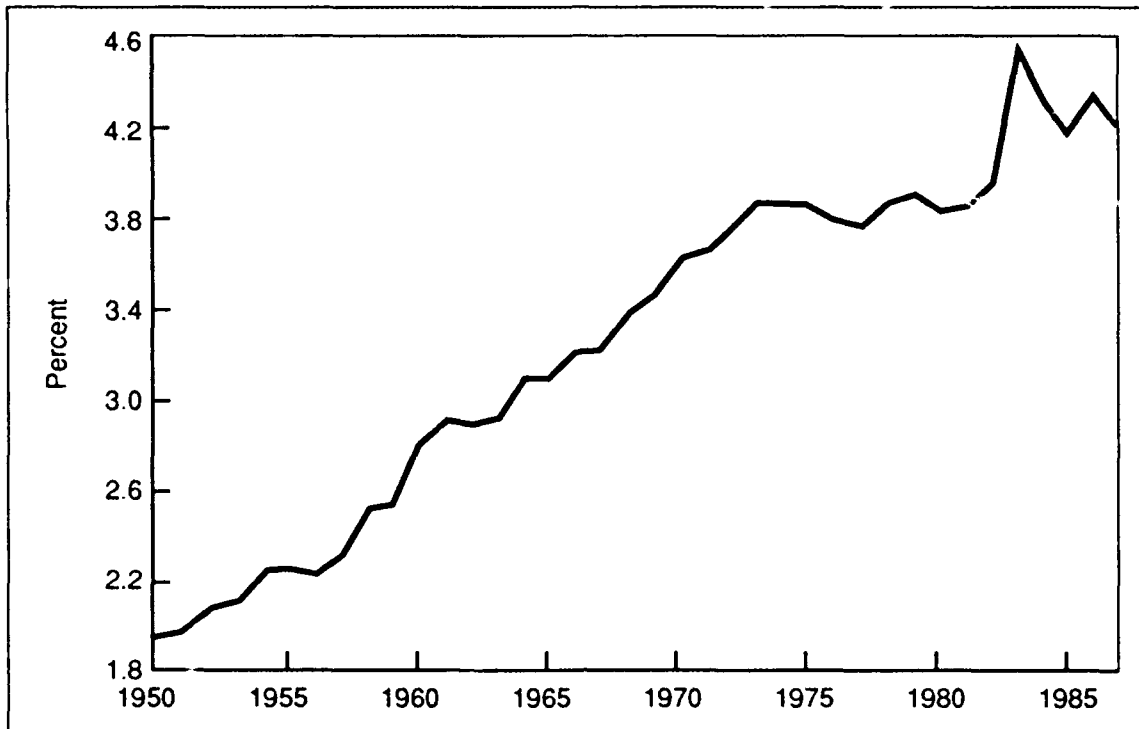


Fig. 2.2—Depreciation rate

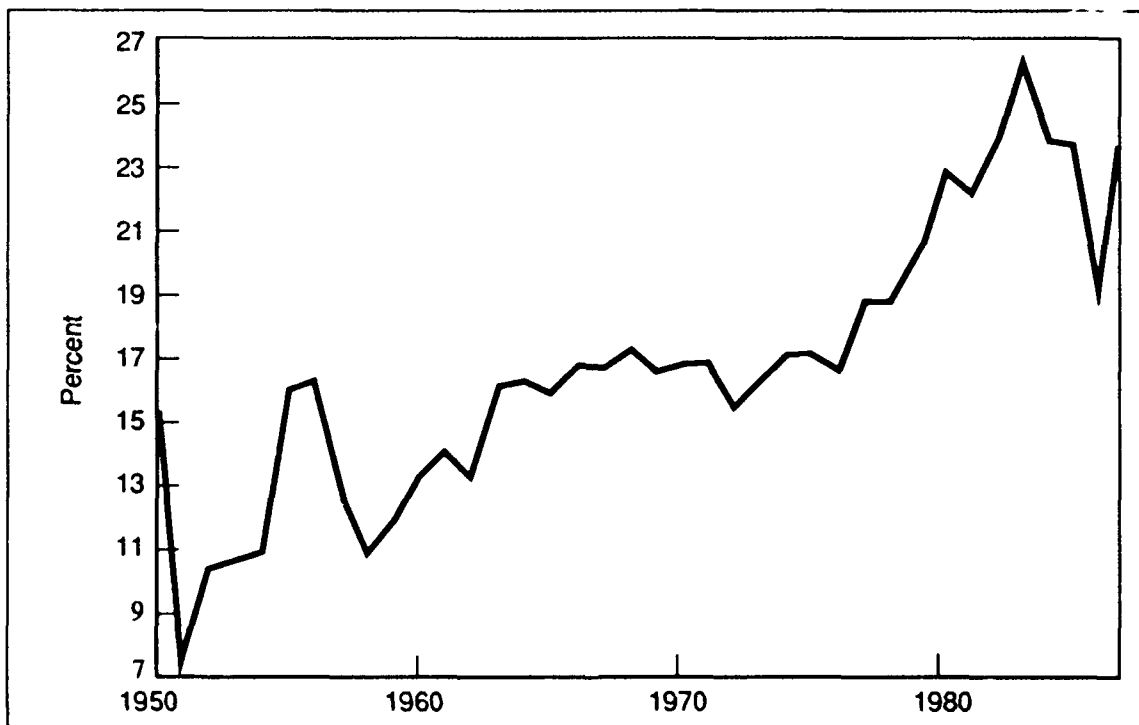


Fig. 2.3—Saving rate (gross domestic saving/GNP)

## INVESTMENT

Gross investment is determined by the standard investment/saving identity:

$$I = S + F - \Delta R. \quad (5)$$

In this equation,  $S$  is total domestic saving,  $F$  is the net inflow of foreign capital, and  $\Delta R$  is the change in foreign exchange reserves held by Mexican financial authorities, all expressed in constant peso terms. Both  $F$  and  $\Delta R$  are exogenous to the model.  $F$  is exogenous because it depends in large part on the willingness of foreigners to lend to or invest in Mexico and on the extent of capital flight or repatriation. Both of these depend on a large number of political and economic factors and cannot be credibly modeled. The change in Mexican foreign exchange reserves is a policy variable and therefore not readily modeled. Values of  $F$  and  $\Delta R$  used in "base case" scenarios will be discussed below.

Total domestic saving (the sum of private saving and public dissaving) is assumed to be a constant share of GNP ( $Y$ ):

$$S = \sigma Y. \quad (6)$$

In the base case scenario, the domestic saving rate is assumed to be constant at 25 percent. As Figure 2.3 illustrates, this level of domestic saving is not unprecedented, but it is clearly at the high end of the range of domestic saving rates that have been achieved in Mexico in recent years. To the extent that this saving rate is unrealistically high, the model will generate estimates of saving, investment, and economic growth that are biased upward. If the Salinas administration manages to achieve major reductions in the government deficit, however, a saving rate of 25 percent could turn out to be too low.

## THE GNP/GDP IDENTITY

GNP ( $Y$ ) is related to GDP ( $Q$ ) by the standard GNP/GDP identity:

$$Y = Q - M_f \quad (7)$$

where  $M_f$  are net factor payments to foreigners.

## NET FACTOR PAYMENTS TO FOREIGNERS

Net factor payments to foreigners (represented in dollar terms by  $\$M_f$ ) are assumed to equal some prevailing interest rate ( $r$ ) times Mexico's (negative) net foreign investment position (represented by  $\$D$ ):

$$\$M_f = r\$D. \quad (8)$$

This formulation ignores the fact that Mexico (like most other countries) typically pays a higher interest rate on its foreign borrowings than it earns on its foreign deposits. Similarly, it ignores the fact that returns on foreign direct investment (by foreigners in Mexico or by Mexicans in other countries) are not always reflected in prevailing interest rates. These are clearly drawbacks in structure of the model, but to correct them would require detailed assumptions about and accounting of foreign lending to Mexico (relatively easy), deposits by Mexicans in foreign banks (difficult), direct investment in Mexico by foreigners (very difficult), and Mexican acquisitions of foreign assets (nearly impossible). The only feasible course is to apply a single interest rate to the net investment position and equate changes in this investment position each year with the current account position.<sup>2</sup>

## IMPORTS AND EXPORTS

Mexican real imports of goods and services ( $M_{g\&s}$ ) are assumed to be a function of real income ( $Y$ ) and the real exchange rate ( $E_r$ , expressed in pesos per dollar):

$$M_{g\&s} = MY^\lambda E_r^\mu. \quad (9)$$

Real non-oil exports of goods and services ( $X_{no}$ ) are a function of real income in the rest of the world ( $Y_{ro}$ ) and the real exchange rate:

---

<sup>2</sup>In 1987, Mexican net factor payments to foreigners amounted to \$7.2 billion. During this period, Mexico was paying 13/16 (0.8125) of a percentage point above the London Interbank Offer Rate (LIBOR) on its syndicated bank loans. Six-month LIBOR averaged 7.30 percent in 1987. At an interest rate of 8.11 percent (average LIBOR plus 13/16), net factor payments of \$7.2 billion imply a net international investment position of minus \$88.8 billion dollars in 1987, somewhat lower (as one would expect) than estimated Mexican foreign debt—at that time in excess of \$100 billion. The Mexican current account deficit in 1988 was \$2.9 billion, and Mexican foreign exchange reserves declined by \$7.1 billion during the year, suggesting a net international investment position of minus \$98.9 billion at the end of 1988.

$$X_{no} = XY_{row}^{\eta} E_r^{\epsilon} \quad (10)$$

$M$  and  $N$  are scaling constants.

The initial estimates of the relevant elasticities,  $\tau$ ,  $\mu$ ,  $\eta$ , and  $\epsilon$ , used simple regressions based on annual data for the period 1962 through 1988. The independent variables in these equations were real income (Mexican income in the import equation and U.S. income—a proxy for income in the rest of the world—in the export equation), the real peso/dollar exchange rate,<sup>3</sup> and the real exchange rate in the previous year. The initial estimates of income elasticities were very high. They suggest that a 1 percent rise in Mexican real income would bring a 1.4 percent increase in real imports. Likewise, a rise in rest-of-the-world real income of 1 percent would result in a 2 percent rise in Mexican real non-oil exports. These high elasticities presumably reflect Mexico's entrance into the world economy and the dramatic expansion of trade that came with it during the last 25 years. Clearly, the Mexican economy is not yet fully open to international trade, and all opportunities for export have not yet been exploited. One might expect to see Mexican trade growing more rapidly than either Mexican or foreign income in future years, but it is difficult to believe that the very high rates of trade growth seen in recent years can be continued.

To generate somewhat more conservative estimates of future Mexican trade, the import and export equations were reestimated, constraining the relevant income elasticities to equal one. The resulting price elasticities:

$$\mu = -0.93 \quad \epsilon = 0.67$$

were used in the "base case" scenario.<sup>4</sup> An assumption that income elasticities are

<sup>3</sup>These regressions used the controlled rather than the free exchange rate, since the former is relevant in most trade transactions. The free exchange rate moves closely with the controlled rate, and this choice is probably not important to the simulations generated with the model.

<sup>4</sup>The final version of the model applies the sum of the estimated coefficients for the contemporaneous and lagged exchange rate variables to a single contemporaneous exchange rate term. The final form of the model, then, posits more rapid adjustment of trade flows to exchange rate changes than is really the case, and the model therefore exhibits more exchange rate stability than the real world presumably does.

The price elasticities associated with the unconstrained estimations were:

$$\mu = -0.87 \quad \epsilon = 0.66.$$

equal to one is clearly too conservative; the implications of more rapid trade growth are explored in the Appendix.

Note that the sum of the absolute values of  $\mu$  and  $\epsilon$  is greater than one. The Marshall-Lerner condition is therefore satisfied, and the foreign exchange value of the peso will be stable.

## OIL EXPORTS

The volume of Mexican oil exports ( $X_{ov}$ ) and the dollar price of these exports ( $\$ P_o$ ) are assumed to be exogenous to the model. The actual values for oil exports and prices used in various scenarios are discussed below. Mexican oil export revenue in billions of dollars ( $\$ X_o$ ) is given by the identity:

$$\$X_o = X_{ov} \cdot \$P_o \cdot 0.365. \quad (11)$$

The constant factor 0.365 is necessary since oil export volumes are expressed in millions of barrels per day.

## EXCHANGE RATE DETERMINATION

As noted above, net capital inflow into Mexico and the change in Mexican foreign exchange reserves are assumed to be exogenous to the model. The real exchange rate is assumed to adjust so as to equate the current account deficit (imports of goods and non-factor services plus net factor payments minus non-oil exports minus oil exports) to the net capital inflow minus the change in foreign exchange reserves. In other words, the real exchange in each period is such that the following equation holds:

$$\$M_{g\&s} + \$M_f - \$X_{no} - \$X_o = \$F - \$\Delta R, \quad (12)$$

with all quantities expressed in dollar terms, where  $\$M_{g\&s}$  and  $\$X_{no}$  are functions of the real exchange rate,  $E_r$ .

In this model, Mexican and U.S. price levels (denoted by  $P$  and  $P_{us}$ , respectively) are also exogenous.<sup>5</sup> The nominal exchange rate ( $E$ ), then, is given by:

---

<sup>5</sup>The rationale here is that monetary policy affects the real economy only in the short run. This model is intended to characterize the medium- and long-term prospects for the Mexican economy, and therefore it ignores the short-run effects of monetary policy. In the long run, monetary policy affects only the price level, and inflation rates are simply a reflection of monetary policies.

$$E = E_o \cdot E_r \frac{P}{P_{us}}, \quad (13)$$

where  $E_o$  is the nominal exchange rate in the base year.

### NET FOREIGN INVESTMENT POSITION

The change in the net foreign investment position in any period is equal to the current account balance (which is in turn equal to the net inflow of foreign capital minus the change in official reserves) minus the amount (if any) of debt forgiven by foreign creditors (\$Z). Denoting all of this in dollar terms yields:

$$\Delta \$D = \$F - \Delta R - \$Z. \quad (14)$$

### BALANCE OF PAYMENTS IDENTITY

The Mexican capital account (including changes in holdings of official assets) must be equal to the negative of the current account, with all quantities expressed in dollars:

$$\$F - \Delta R = \$M_{g\&s} + \$M_f - \$X_o - \$X_{no}. \quad (15)$$

### CLOSING THE MODEL

The model is closed by adding three identities that transform real peso values into nominal dollar values:

$$\$M_{g\&s} = \frac{P_{us}}{E_o} M_{g\&s} \quad (16)$$

$$\$X_{no} = \frac{P}{E} X_{no} \quad (17)$$

$$\$M_f = \frac{P}{E} M_f. \quad (18)$$

Note that nominal imports of non-factor goods and services are deflated by the U.S. price index (a proxy for rest-of-the-world prices), rather than Mexican prices, to arrive at real imports.

The final model, then, has 18 equations. The 18 endogenous variables, 9 exogenous variables, 8 parameters, and 3 scaling constants are summarized in Table 2.2.

Table 2.2

VARIABLES AND PARAMETERS IN MEXMOD

| Name                         | Variable                                                                               | Units            |
|------------------------------|----------------------------------------------------------------------------------------|------------------|
| <b>Endogenous Variables:</b> |                                                                                        |                  |
| $Q$                          | Real GDP                                                                               | 1980 pesos       |
| $L$                          | Labor demanded                                                                         | persons          |
| $K$                          | Capital stock                                                                          | 1980 pesos       |
| $W$                          | Real wage                                                                              | index            |
| $I$                          | Real gross investment                                                                  | 1980 pesos       |
| $S$                          | Real total domestic saving                                                             | 1980 pesos       |
| $Y$                          | Real GNP                                                                               | 1980 pesos       |
| $M_f$                        | Real net factor payments                                                               | 1980 pesos       |
| $\$M_f$                      | Nominal net factor payments                                                            | dollars          |
| $M_{g\&s}$                   | Real imports of goods and non-factor services                                          | 1980 pesos       |
| $\$M_{g\&s}$                 | Nominal imports of goods and non-factor services                                       | dollars          |
| $X_{no}$                     | Real exports of non-oil goods and services                                             | 1980 pesos       |
| $\$X_{no}$                   | Nominal exports of non-oil goods and services                                          | dollars          |
| $\$X_o$                      | Nominal exports of oil                                                                 | dollars          |
| $E$                          | Exchange rate                                                                          | pesos per dollar |
| $E_r$                        | Real exchange rate                                                                     | index            |
| $\$D$                        | Net foreign investment position (negative)                                             | dollars          |
| $F - \Delta R$               | Real inflow of foreign capital minus change in real value of foreign exchange reserves | 1980 pesos       |
| <b>Exogenous Variables:</b>  |                                                                                        |                  |
| $\$F$                        | Nominal inflow of foreign capital                                                      | dollars          |
| $\Delta R$                   | Nominal change in foreign exchange reserves                                            | dollars          |
| $L_0$                        | Labor force                                                                            | persons          |
| $\$P_o$                      | Average price of Mexican oil exports                                                   | dollars/barrel   |
| $X_{oil}$                    | Oil export volume                                                                      | mmbbl/day        |
| $P$                          | Mexican price level                                                                    | index            |
| $P_{us}$                     | U.S. price level                                                                       | index            |
| $Y_{rou}$                    | Real income of Mexico's trading partners                                               | 1980 dollars     |
| $r$                          | Interest rate on Mexican borrowing                                                     | percent          |

**Parameters:**

- $\tau$  rate of net factor productivity growth
- $\alpha$  share of labor in national income
- $\sigma$  saving rate
- $\delta$  depreciation rate
- $\lambda$  income elasticity of real imports of goods and non-factor services
- $\mu$  price elasticity of real imports of goods and non-factor services
- $\eta$  income elasticity of real non-oil exports
- $\epsilon$  price elasticity of real non-oil exports

**Scaling Constants**

- $A$  Scaling constant in production function (equation 1)
- $M$  Scaling constant in import equation (equation 9)
- $X$  Scaling constant in export equation (equation 10)

### III. THE BASE CASE SCENARIO

This section describes a "base case" scenario for the Mexican economy. The aim here is to lay out a standard set of assumptions about factors that will affect the course of Mexican economic development. These assumptions and the pattern of economic growth that they generate will provide a point of reference against which other assumptions and other patterns of growth can be compared. The base case scenario also provides a convenient vehicle for illustrating the basic characteristics of growth patterns generated by the MEXMOD model, characteristics that will be common to many of the scenarios developed. It is important to stress that the base case scenario does not represent the author's (or anyone else's, for that matter) best guess about the future of the Mexican economy. Indeed, as noted below, some base case assumptions are almost certainly incorrect. The base case does, however, illustrate the basic nature of the economic problems facing Mexico and serves as a convenient starting point for an exploration of possible solutions to these problems.

This section first lays out the assumptions about exogenous variables that lie behind the base case scenario. It then describes the patterns of growth that result from using these assumptions in the MEXMOD model and discuss the meaning of these results. The section concludes with a report on the results of some sensitivity analyses aimed at understanding how model results may be affected by plausible changes in the base case assumptions.

#### ASSUMPTIONS ABOUT EXOGENOUS VARIABLES

##### Oil Exports

The basic assumptions about oil export volumes and prices are that both will remain roughly at levels of mid-1989. After peaking at about 1.54 million barrels per day in 1983, Mexican exports of crude oil have declined and stabilized in the neighborhood of 1.35 million barrels per day. (See Figure 3.1.) In recent years, exports of petroleum products have added about 10 percent to revenues from exports of crude oil. The base case scenario assumes that crude oil exports continue at 1.35 million barrels a day and that petroleum product exports continue to add some 10 percent to export earnings.

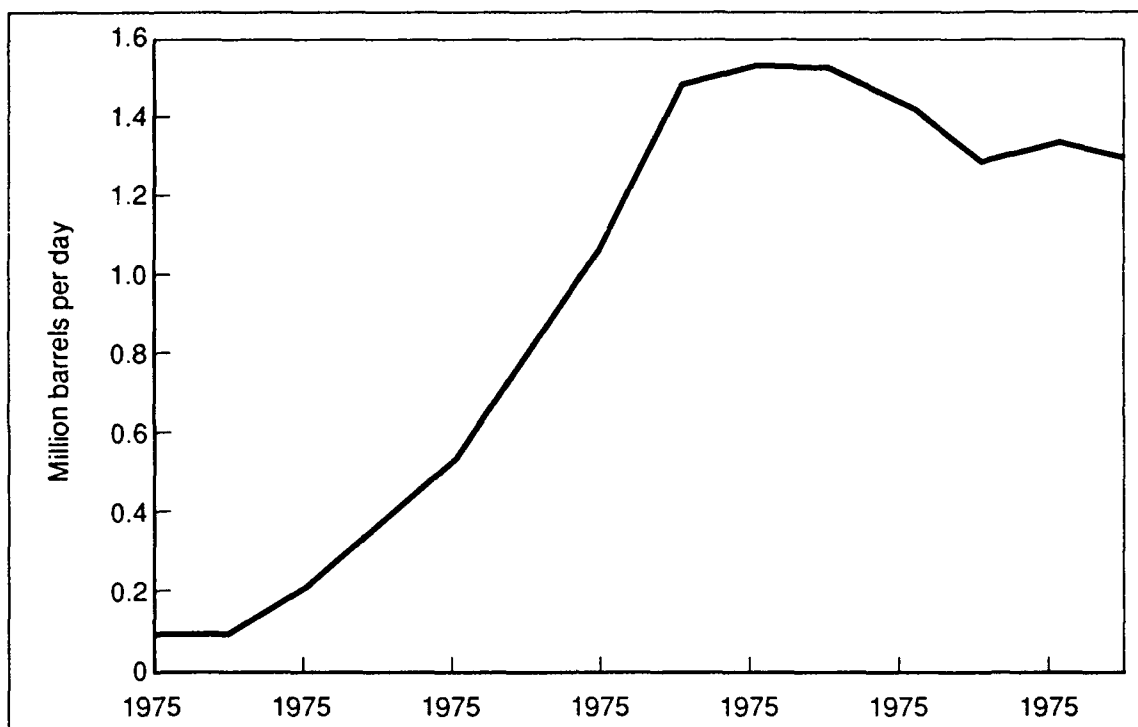


Fig. 3.1—Mexican exports of crude oil

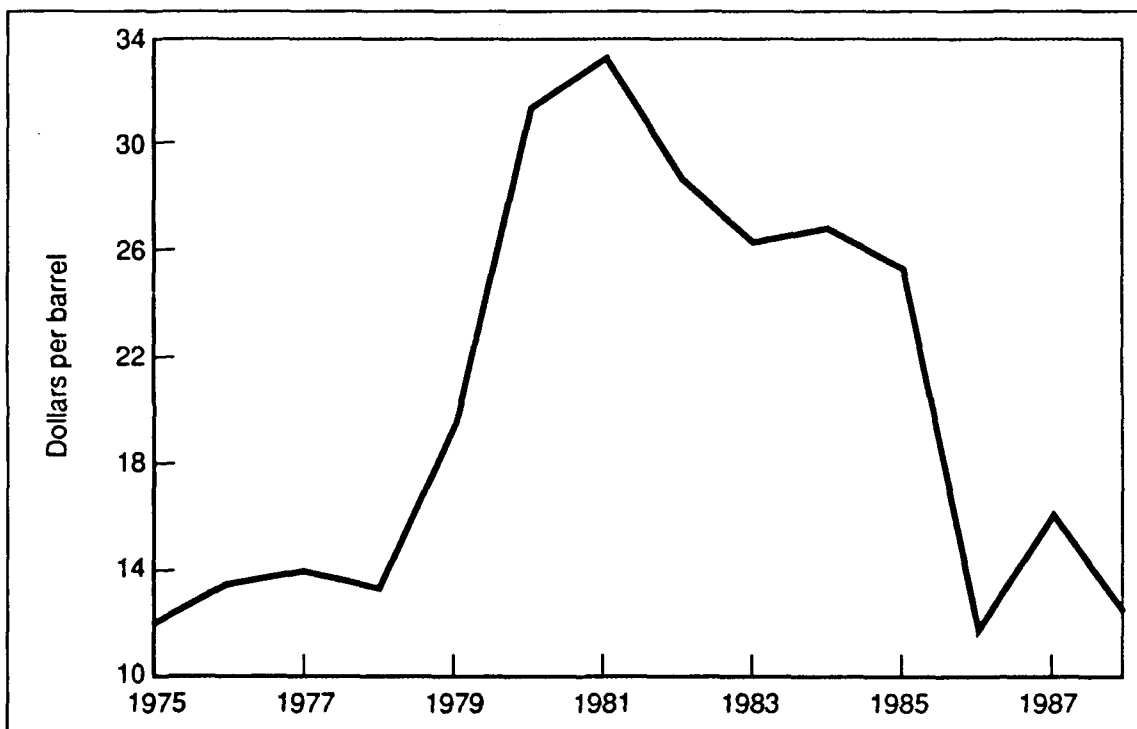


Fig. 3.2—Mexican crude oil export prices

The average price of Mexican crude oil exports has fluctuated widely during the last ten years, reaching a peak of \$33.18 per barrel in 1981, before plummeting to only \$12.30 per barrel in 1988. (See Figure 3.2.) World oil prices rose sharply in 1989, and by April the average price for all Mexican crude oil exports (a blend of Mayan and Isthmus crudes) had risen above \$18 per barrel. Some of this rise was the result of temporary conditions elsewhere in the world influencing oil supply—an explosion and fire on a North Sea oil platform and the grounding of a tanker in Alaskan waters, both at the end of March. The peak prices of April were not sustained. By mid-May, full production in the North Sea and regular shipping from Alaska had resumed, and prices had returned to roughly the same levels that had prevailed immediately before the supply interruptions—an average of about \$16 per barrel for Mexican crude exports.

The base case assumes that the dollar price of Mexican oil will remain constant in real terms at \$16 (1989 dollars) per barrel. Assuming an average dollar inflation rate of 5 percent, nominal oil prices in the base case are as shown in Table 3.1.

Table 3.1

**MEXICAN CRUDE OIL PRICES—BASE CASE**  
(dollars per barrel)

|      |       |      |       |
|------|-------|------|-------|
| 1989 | 16.00 | 1999 | 26.06 |
| 1990 | 16.80 | 2000 | 27.37 |
| 1991 | 17.64 | 2001 | 28.73 |
| 1992 | 18.52 | 2002 | 30.17 |
| 1993 | 19.45 | 2003 | 31.68 |
| 1994 | 20.42 | 2004 | 33.26 |
| 1995 | 21.44 | 2005 | 34.93 |
| 1996 | 22.51 | 2006 | 36.67 |
| 1997 | 23.64 | 2007 | 38.51 |
| 1998 | 24.82 | 2008 | 40.43 |

**Real Growth in the Rest of the World**

Mexico's exports of non-oil goods and services depend on the level of economic activity in the rest of the world. (For these purposes, "the rest of the world" is almost synonymous with "the United States.") The base case assumes that real income growth in Mexico's export markets increases at a rate of 3 percent per year.

### Mexico's Population and Labor Force

Base case assumptions about Mexican population and labor force growth are based on World Bank projections.<sup>1</sup> In the base case scenario, the Mexican labor force growth rate is a bit less than 3 percent per year in the early 1990s and declines gradually to about 2 percent per year by the end of the first decade of the next century. As the current very large cohort of young people reaches working age, the share of the total population accounted for by workers gradually increases. Total population growth rates decline from a bit more than 2 percent per year in the early 1990s to about 1.4 percent per year by 2008. Table 3.2 details the base case assumptions about both labor force and population.

Table 3.2

#### MEXICAN LABOR FORCE AND POPULATION—BASE CASE (in millions)

|      | Labor<br>Force | Population |
|------|----------------|------------|
| 1989 | 26.98          | 85.63      |
| 1990 | 27.75          | 87.43      |
| 1991 | 28.52          | 89.33      |
| 1992 | 29.29          | 91.26      |
| 1993 | 30.05          | 93.20      |
| 1994 | 30.81          | 95.17      |
| 1995 | 31.58          | 97.15      |
| 1996 | 32.36          | 99.14      |
| 1997 | 33.14          | 101.12     |
| 1998 | 33.93          | 103.10     |
| 1999 | 34.74          | 105.06     |
| 2000 | 35.57          | 107.01     |
| 2001 | 36.35          | 108.78     |
| 2002 | 37.15          | 110.58     |
| 2003 | 37.97          | 112.40     |
| 2004 | 38.80          | 114.26     |
| 2005 | 39.66          | 116.15     |
| 2006 | 40.45          | 117.74     |
| 2007 | 41.25          | 119.36     |
| 2008 | 42.07          | 120.99     |

<sup>1</sup>Projections from Edward Bos, International Bank for Reconstruction and Development; personal communication.

These assumptions are roughly consistent with a forecast that new U.S. immigration laws will prove effective in reducing the flow of working-age Mexicans to the United States. During the 1980s, net Mexican emigration to the United States was an estimated 300,000 to 350,000 per year. Base case assumptions reflect a marked reduction in this rate: to 122,000 per year in 1990 and to 36,000 per year by 2007. This is obviously a tenuous assumption; the Appendix contains some sensitivity analyses based on different assumptions about Mexican emigration.

### **Mexican Net Factor Payments**

As noted in the previous section, the MEXMOD model represents Mexico's international financial situation only in a very simplified form. The model applies a single interest rate to Mexico's net international investment position, ignoring the effect on net interest payments of changes in the composition of Mexico's international assets and liabilities. An assumption about what interest rate to apply is essentially an assumption about the average rate of return on all foreign lending to and investment in Mexico.

Before the July 1989 agreement between Mexico and its creditor banks, the bulk of Mexico's syndicated debt to foreign banks carried an interest rate 13/16 of a percentage point above the six-month dollar London Interbank Offer Rate (LIBOR). At the time of the July agreement, six-month dollar LIBOR stood at about 8.6 percent, implying an interest rate in the neighborhood of 9.5 percent on Mexican debts to foreign banks. (Debts to banks accounted for about half of an overall Mexican net international investment position of about negative \$100 billion.) Under the terms of the July agreement, some banks may elect to reduce the interest rate on their Mexican loans to 6.25 percent. How many banks will choose this option is unknown, and thus it is impossible to estimate what effect these reductions will have on average Mexican interest payments. New lending to Mexico will almost certainly be at rates similar to those prevailing before the agreement. Other Mexican debts—short-term credits from banks, supplier credits, credits from official export credit agencies, and credits from international financial institutions like the International Monetary fund—presumably carry interest rates somewhat lower than the 9.5 percent rate associated with syndicated bank credits. There can be no way of knowing what the rates of return on foreign direct investments in Mexico may be. Neither is it possible to know the rate of return

being earned on Mexican flight capital that has been invested abroad. In the absence of other information, an assumption was made (albeit a heroic one) that on average these assets are earning rates of return similar to what is being earned on loans.

What all this suggests is that in mid-1989 (before implementation of the July agreement) Mexico may have been making annual net factor payments amounting to about 9 percent of its (negative) net investment position. The base case scenario assumes an interest rate of 10 percent for the next 20 years. There is no particular justification for this slightly higher interest rate level other than that it is a round number and that prevailing interest rates were a bit higher in May 1989, when most of these simulations were actually being run, than in July.

### **Mexican Inflation**

In the base case, it is assumed that the current Mexican efforts to control inflation will be generally successful and will result in a long-run inflation rate of 20 percent—a bit better than what Mexico has achieved to date under the terms of the Economic Solidarity Pact. Technically, this is not a very important assumption, because the structure of the model is such that the Mexican inflation rate does not affect any real variables, only the exchange rate and the wage rate.

### **U.S. Inflation**

It is assumed that U.S. inflation will be steady at 5 percent per year. This is a bit higher than in 1987 or 1988 and a bit lower than most forecasters believe will be achieved in 1989. Unlike the Mexican inflation rate, the U.S. inflation rate does have an effect on real model variables. Because Mexican external debt is denominated principally in dollars, changes in the U.S. price level affect the real value of Mexican debt and the real cost of servicing the debt.

### **Changes in Mexico's Foreign Exchange Reserves**

The base case assumes that Mexican foreign exchange reserves will remain unchanged after 1989—that is, that after 1989 Mexican monetary authorities take no action to support the peso. This reflects a policy markedly different from the exchange rate policy that is part of the current Economic Solidarity Pact; current policy is for Mexican authorities to allow the peso's value vis-a-vis the dollar to

decline at a fixed rate of one peso per dollar per day. It is assumed that Mexican authorities will stick with this policy through 1989. The model suggests that maintaining the sliding peso exchange rate will require spending some \$3 billion in foreign exchange reserves, if Mexico is able to attract a net capital inflow of \$7 billion during the year. (See below.) For 1989, then, a reduction of Mexican foreign exchange reserves of \$3 billion is assumed. At the beginning of 1989, Mexican foreign currency reserves were only \$6.6 billion. Given the potential cost in foreign exchange reserves of trying to maintain the current sliding exchange rate, some change in exchange rate policy seems inevitable. The nature of a new policy is difficult to predict, however; a simple "no intervention" policy was chosen for use in the base case.

### **Net Capital Inflows**

The base case also assumes no net inflow of foreign capital into Mexico after 1989. New borrowing and investment in Mexico just offsets principal repayments and Mexican investments abroad. In 1989, a net capital inflow of \$7 billion is assumed, the amount Mexico claimed it needed during its 1989 negotiation with its creditor banks. The assumption of zero net capital flows, together with the previous assumption of no change in the Mexican foreign exchange reserve position, implies a balanced current account for the next 20 years. This is unlikely to be the case, of course, but since one of the reasons for undertaking this modeling exercise is to explore the consequences of different levels of foreign lending to or foreign investment in Mexico, the case of no net capital influence provides a convenient starting point.

### **Assumptions About Model Parameters**

Base case values for model parameters were noted in the preceding section. For convenience, however, they are summarized in Table 3.3.

Table 3.3

MODEL PARAMETER VALUES—BASE CASE

| Parameter  | Description                                                        | Assumed Value |
|------------|--------------------------------------------------------------------|---------------|
| $\tau$     | rate of net factor productivity growth                             | 0.01          |
| $\alpha$   | share of labor in national income                                  | 0.33          |
| $\sigma$   | saving rate                                                        | 0.25          |
| $\delta$   | depreciation rate                                                  | 0.042         |
| $\lambda$  | income elasticity of real imports of goods and non-factor services | 1.00          |
| $\mu$      | price elasticity of real imports of goods and non-factor services  | -0.93         |
| $\eta$     | income elasticity of real non-oil exports                          | 1.00          |
| $\epsilon$ | price elasticity of real non-oil exports                           | 0.67          |

THE MEXICAN ECONOMY IN THE BASE CASE

The most striking features of the base case assumptions are the cessation of net capital inflows into Mexico after 1989, and the cessation at the same time of Mexican expenditures of foreign exchange reserves in order to support the peso.<sup>2</sup> The immediate consequence of these assumptions is that the value of the peso relative to the dollar falls sharply—by some 60 percent—from 1989 to 1990. (See Figure 3.3.) This is of course not surprising. The peso is clearly overvalued today, requiring constant inflows of foreign capital or intervention by Mexican financial authorities to maintain its value or to moderate its decline.<sup>3</sup> When capital inflows

<sup>2</sup>These two assumptions are really the same. In real life, the only difference between a capital inflow of \$1 billion and a reduction in foreign exchange reserves of \$1 billion is that the increase in net factor payments in later years arising from the two developments will be slightly different. The interest payments on an additional \$1 billion of debt will typically be slightly higher than the interest earnings forgone as a result of a \$1 billion reduction in foreign exchange reserves. In the MEXMOD model, however, the spread between borrowing and deposit interest rates is ignored, and borrowing an extra billion dollars is exactly equivalent to reducing foreign exchange reserves by a billion dollars.

<sup>3</sup>During 1988, when its policy was to maintain a fixed nominal exchange rate between the peso and the dollar, Mexico enjoyed net capital inflows of \$2.9 billion. Nonetheless, expenditures of \$7.1 billion in foreign exchange reserves were necessary to maintain the peso's value. From the beginning of 1989, Mexican policy has been to allow the peso to decline by one peso per dollar per day. Data on foreign exchange reserves are not yet available for the early months of 1989, but most observers believe that outlays of foreign exchange reserves have continued.

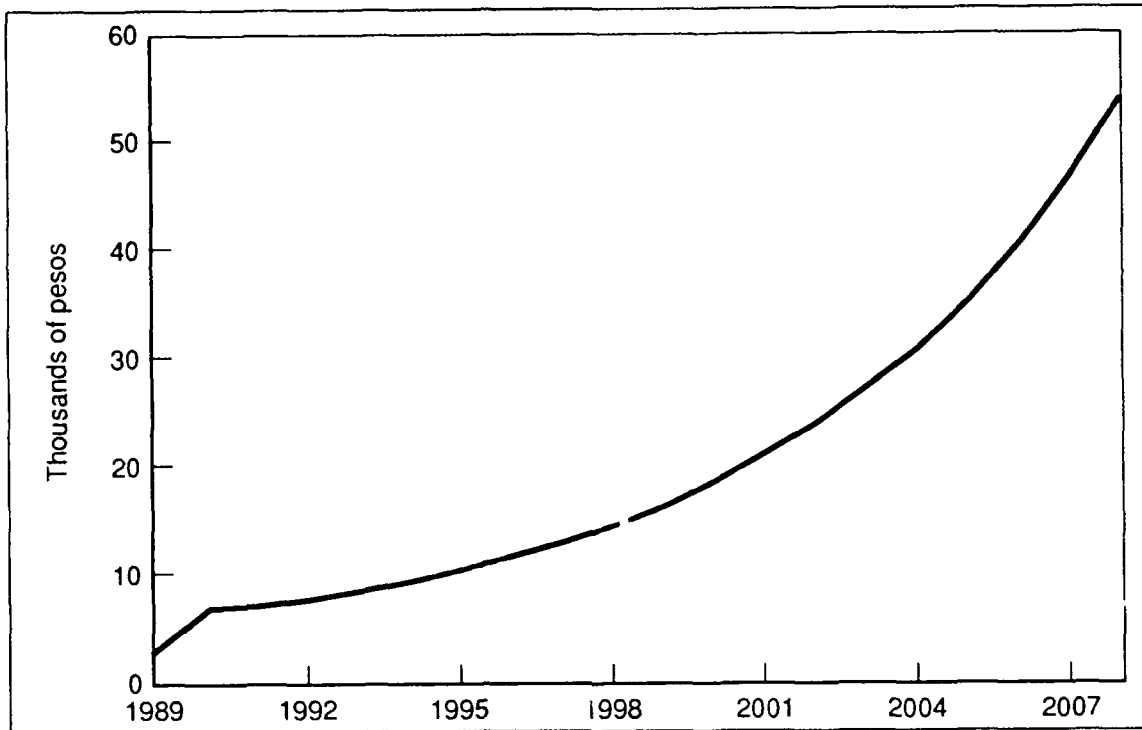


Fig. 3.3—Base case: exchange rate (pesos per dollar)

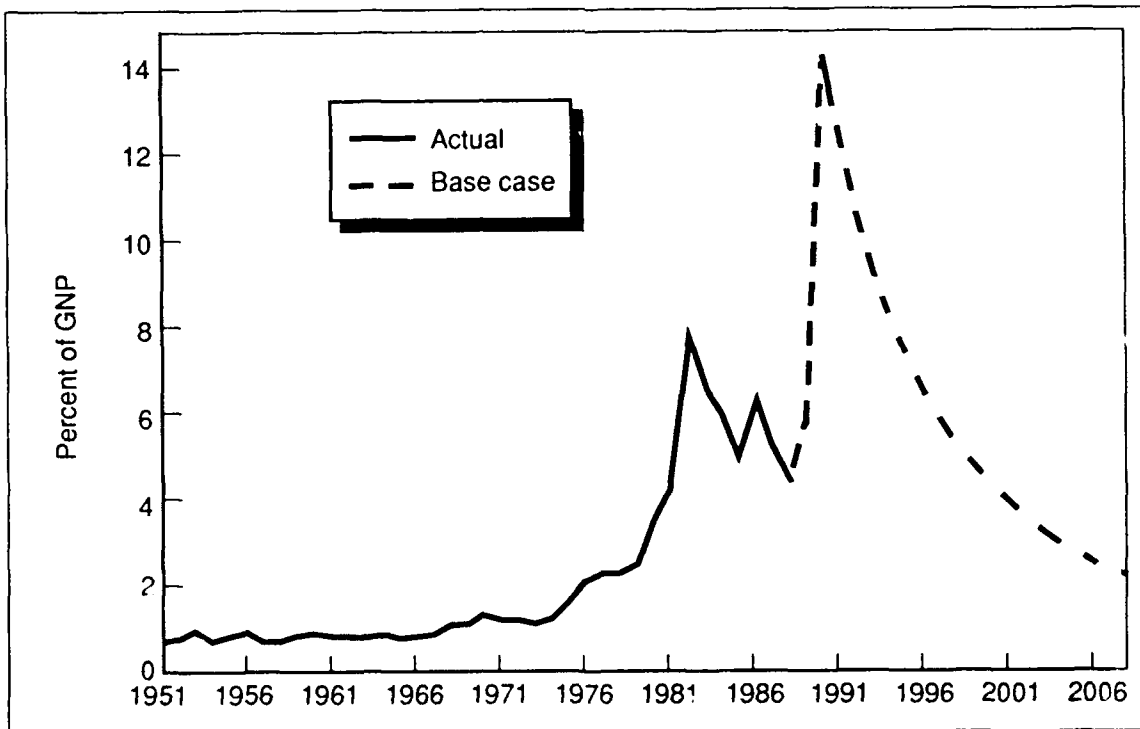


Fig. 3.4—Net factor payments (percent of GNP)

and exchange market intervention cease (as is assumed in the base case), the peso declines.

After the initial sharp decline, the peso continues to decline—but more slowly—against the dollar. This nominal depreciation of the peso is largely a reflection of the assumption that Mexican inflation remains more rapid than U.S. inflation. In real terms, the peso actually strengthens a bit against the dollar during the period from 1990 to 2003. By the turn of the century, though, these changes in the real exchange rate have become quite small (less than 1 percent per year), and the real peso/dollar exchange rate is essentially constant.

One consequence of the sharp drop in the value of the peso in 1990 is that the real value of the Mexican debt service increases sharply. Because Mexican debt is denominated mostly in dollars, a rise in the value of the dollar brings a rise in the peso costs of servicing the debt. Figure 3.4 shows that Mexican net factor payments rise dramatically from a bit less than 6 percent of GNP in 1989 to more than 14 percent of GNP in 1990. After 1990, the ratio of net factor payments to GNP declines sharply as net debt ceases to grow (because of the assumption of no net capital inflows after 1990) while GNP continues to grow and the real exchange rate strengthens.<sup>4</sup> By 1997, net factor payments are back to their 1989 levels.

Sharply increased real debt servicing costs reduce real income in Mexico. Figure 3.5 shows that Mexican real GNP declines by about 3 percent in 1990. After the painful exchange rate adjustment has been accomplished, however, real income growth jumps to 4.8 percent in 1991 and eventually settles down to a rate of about 3.8 per year. The historical rates of real income growth illustrated in Figure 3.5 help to put these growth rates in perspective. The decline in real income associated with devaluation of the peso is not as large as the declines that Mexico experienced in 1983 and 1986. The growth rates possible after the exchange rate adjustment are not as high as those achieved from the mid-1960s through the mid-1970s, but they are comparable to the highest one-year growth rates achieved during the 1980s.

The difference between real GDP (the goods and services actually produced in Mexico) and real GNP (the goods and services available for absorption in Mexico)

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<sup>4</sup>In the base case, the nominal value of the Mexican net debt (or more precisely, the negative net investment position) remains constant. Because this debt is denominated in dollars and dollar prices are rising, the Mexican *real* net debt is declining.

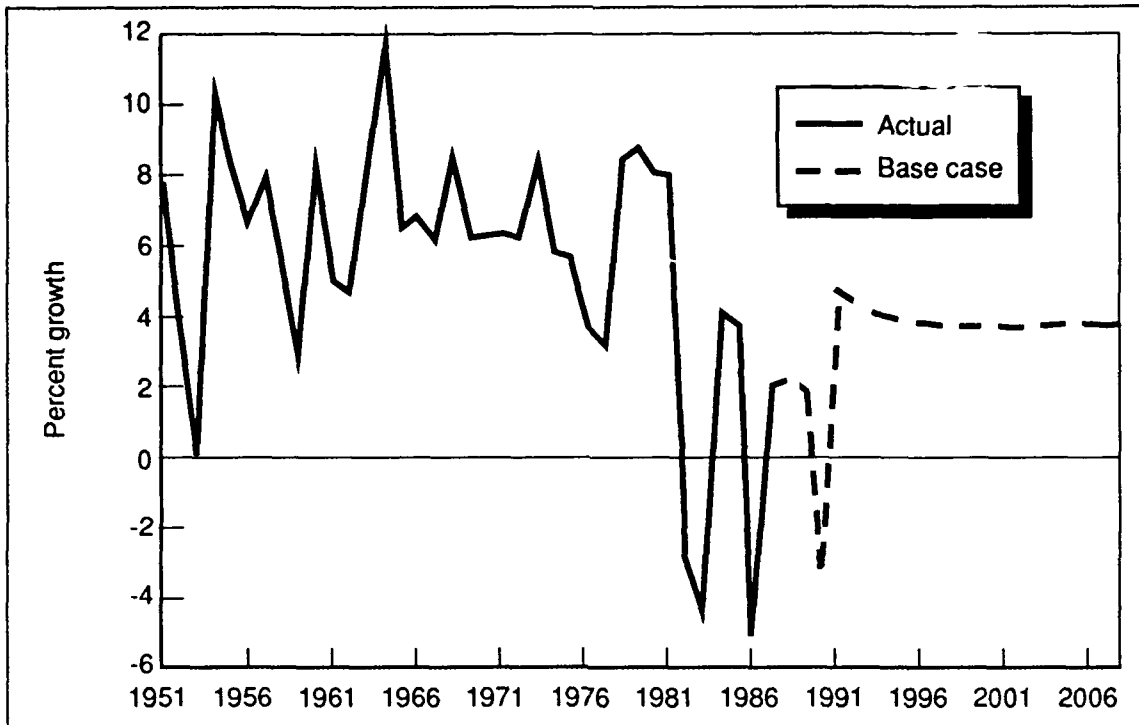


Fig. 3.5—Real income growth (percent per year)

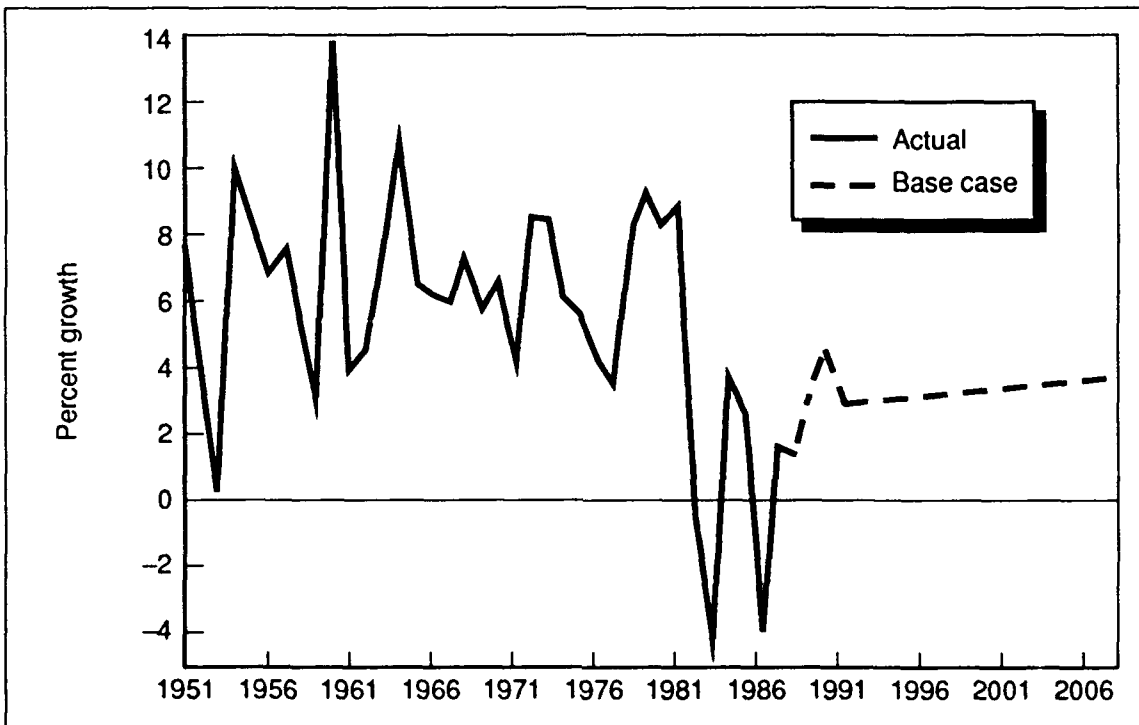


Fig. 3.6—Real GDP growth (percent per year)

is the value of net factor payments. Real GDP does not decline sharply in 1990 when real GNP does. Indeed, the real GDP growth rate actually increases in 1990. (See Figure 2.6.) This, in turn, is the result of the large inflow of foreign capital and the reduction of foreign exchange reserves in 1989. By the investment/savings identity (see Equation 5 in Section II), these boost investment in 1989. Higher investment in 1989 yields a higher capital stock and higher GDP in 1990. The inflow of capital and the depletion of foreign exchange reserves cease in 1990, and investment consequently slows. Real GDP growth falls off in 1991 as a result. Nonetheless, real GDP growth does not fall below about 2.9 percent a year, and by the early part of the next century climbs to about 3.5 percent per year. As was the case with real income, these post-adjustment growth rates are respectable, but not as high as those of the 1960s and 1970s.

Growth of real per capita income shows a pattern similar to that of real income growth: a sharp decline in 1990 with subsequent recovery to a maintainable level in the neighborhood of 2 percent per year. (See Figure 3.7.)<sup>5</sup>

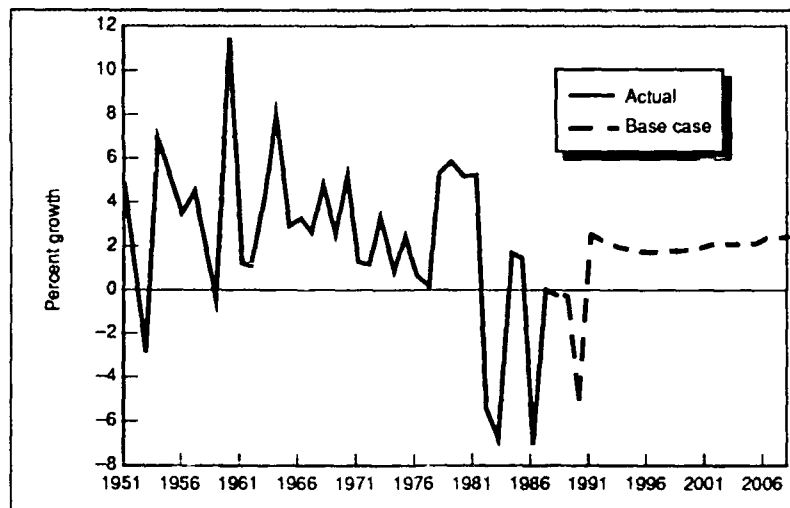


Fig. 3.7—Real per capita income growth (percent per year)

<sup>5</sup>In considering the implications of economic developments for political stability, per capita consumption may be more relevant than per capita income. Given the assumptions of the model—specifically the assumption that total domestic saving is a fixed proportion of GNP (Equation 6)—per capita consumption (both public and private) will necessarily grow at the same rate as per capita income unless there is some change in the domestic saving rate. In only two of the cases considered in this Note (Scenario LOSAVE, discussed in Section IV, and Scenario PESS, discussed in Section V) is the saving rate varied. In the interests of brevity, the charts included here show only growth rates of per capita income. In the two cases where the saving rate changes, relative levels of real consumption are discussed.

## WHAT THE BASE CASE SCENARIO MEANS

The base case is not to be taken as a forecast. Exogenous factors may develop differently than assumed. The parameters used in the base case may not be exactly right; and even if they are correct today, they may change in the future. Above all, the model that underlies the base case scenario is very simple; it does not reflect many elements of the Mexican economic situation. Nonetheless, the base case scenario does provide a qualitatively plausible picture of what we might expect for the Mexican economy if there is no net inflow of foreign capital in the future.

The basic message of the base case scenario is that if the net flow of foreign capital into Mexico is interrupted, Mexico will face a painful adjustment. This adjustment will be brought on by a sharp decline in the value of the peso. A weaker peso will raise the price to Mexicans of imported goods and reduce real incomes. A weaker peso will also increase the real cost of servicing the Mexican external debt and increase the share of Mexican output that must be devoted to debt service. A smaller share will be available for Mexicans, and real incomes will fall further. Needless to say, the sort of sharp decline in real income postulated in the base case scenario would impose serious material hardship on many Mexicans. Coming, as it would, after the economic reverses of the 1980s, it could also present a serious political problem for the Mexican government: a further decline in Mexican living standards could do serious damage to the credibility of a government that has undertaken major changes in economic policy with the loudly proclaimed aim of revitalizing the Mexican economy.

The base case postulates an end to net capital inflows from 1990 on. As a consequence, both the value of the peso and real income fall sharply in 1990. The timing of these developments, of course, is arbitrary. There is no suggestion that a cessation of net capital inflows is particularly likely in 1990. A real concern for Mexican authorities, though, is that sometime—and perhaps sometime soon—foreign banks will choose to lend no more to Mexico and non-bank lenders and direct investors will be unwilling to replace the lost bank credit. The base case illustrates the consequences of this happening in 1990. The effects of a drying up of net foreign investment will be qualitatively the same whether they happen in 1990 or in any other year in the near future. The important element of the base case scenario is not the postulated timing of an end to net capital inflows but the consequences of such a development, whenever it might occur.

After adjustment to a weaker peso, the Mexican economy can be expected to show growth rates that might be termed respectable but certainly not outstanding. Real output may grow at 3 to 3.5 percent per year; real income growth would be in the 3.5 to 4 percent range; and real per capita income would rise by some 2 percent per year. Growth rates like these would be considered good in most industrialized countries. For a still developing country, though, and particularly for a country that has just been through an extended period of economic stagnation and where there is a widely perceived need not simply to grow but also to make up for lost time, growth at these rates may not be seen as adequate. Importantly, these growth rates would be well below those achieved in the 1960s and 1970s under a very different set of government economic policies. Thus, even if the near-term decline in Mexican real income could somehow be avoided or if the government could survive the political fallout of such a decline, restiveness over inadequate growth rates could well persist. The economic and political problems facing the Mexican government are not only in the near term.

The questions to be considered, then, are whether there is any way to mitigate or to avoid entirely the decline in real income that arises in the base case from the sharp devaluation of the peso and whether it will be possible to generate higher growth rates in the long run. Continued infusions of foreign capital could, of course, strengthen the peso for a while and reduce or at least postpone the difficult adjustment to a weaker peso. Over time, though, a continuing inflow of foreign capital would also increase required Mexican net factor payments to foreigners, which will themselves drain away real Mexican income. In the near term, the choice facing Mexico is a relatively simple one: Let the peso fall now, get the painful adjustment over with, and then do what is possible (including perhaps more foreign borrowing) to generate higher growth in the future; or, continue to support the peso in the hopes that it will be possible eventually to grow out of the need for an adjustment. Much of the rest of this Note will be devoted to exploring whether this latter course is feasible—whether in fact it will be possible for Mexico to grow out of the need for adjustment. Part of that exploration will be to try to illustrate the costs and potential benefits of postponing the adjustment if it cannot be avoided entirely.

These, of course, are precisely the questions that are currently facing the Mexican government, the U.S. government, and Mexico's creditors: Will new

borrowing and more time allow Mexico to avoid a painful adjustment and establish itself on a path to sustainable growth, or will new borrowing simply postpone the day of reckoning, perhaps making the necessary adjustment even more painful when it inevitably comes?<sup>6</sup>

Because the model that generates these scenarios is a medium- to long-term model, it necessarily ignores some short-term issues and therefore understates the seriousness of the policy problems facing Mexican economic authorities. The model simply assumes that Mexican inflation is somehow reined in from its pace of more than 100 percent per year in 1988 to 20 percent per year. This, of course, will not be easily engineered.<sup>7</sup> Fiscal austerity may lead to a near-term collapse of aggregate demand and a decline in real GNP. Monetary stringency will push up interest rates and discourage investment. Wage and price controls may lead to distortions, invite postponement of investment or production until controls are lifted, or simply create a pent-up inflation that will become apparent when controls are lifted. In the long run, the rate of Mexican inflation will not influence real economic variables such as output or employment, and the model reflects this long-run independence. (In standard economic jargon, the model assumes money neutrality.) By ignoring a very real near-term difficulty, though, model results—as reflected in the base case or in other scenarios—must be viewed as optimistic. They assume the Mexican authorities somehow solve their most pressing near-term problem.

### **SOME SENSITIVITY ANALYSES**

The essential characteristics of the base case scenario are unchanged if model parameters are altered within reasonable bounds. That is, the characteristics of the base case grow out of the Mexican economic condition—as reflected by

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<sup>6</sup>The base case assumes a real rate of return on capital of about 25 percent per year. (See the discussion of Equation 1 in Section II.) The cost of foreign capital (the real U.S. interest rate plus depreciation) is in the neighborhood of 10 percent per year. If these parameters are even remotely correct, the clearly optimal policy for Mexico is to borrow and invest as much as possible; the return on foreign capital is much greater than the cost. This is not the same thing, however, as suggesting that Mexico should postpone adjustment of an overvalued peso for as long as possible.

<sup>7</sup>The wage and price restraints that are part of the current Economic Solidarity Pact have succeeded in lowering inflation in 1989 to somewhere in the neighborhood of 15 percent per year. The real test, though, will come when these restraints are removed, as one day they must be.

the model—and not out of the choice of a peculiar set of model parameters. The Appendix provides detailed demonstrations of the effects of plausible changes in model parameters.

#### IV. ALTERNATIVE SCENARIOS: CAN MEXICO HOPE FOR BETTER?

The implications of the base case scenario are disturbing:

1. Without capital inflows in the future, Mexico faces a near-term decline in real income and living standards.
2. After adjustment to a weaker peso, Mexican real growth rates are likely to return to levels that are respectable, but not as high as were achieved during the 1960s and 1970s and perhaps not high enough to be politically acceptable.

This section will explore some possibilities that might lead to more or less sanguine views of Mexico's prospects. In particular, it will consider the likely effects of continued foreign lending to Mexico, debt forgiveness, and interest rate reductions. It will also sketch the benefits that might be brought to Mexico by such *dei ex machinae* as higher oil prices.

##### CONTINUED FOREIGN LENDING TO MEXICO

The most striking feature of the base case scenario is the drop in Mexican real income that results from a sharp decline in the value of the peso. The peso's decline, in turn, is the result of the cessation of foreign capital inflows after 1989. The most direct possibility for avoiding a near-term decline in real income would be for Mexico somehow to attract enough foreign lending (or investment) to maintain the real value of the peso.

The MEXMOD model has been used to calculate the volume of foreign investment that would be required to maintain the real peso/dollar exchange rate at its 1988 level.<sup>1</sup> Figure 4.1 shows the results of this calculation, with actual past volumes of capital inflows included to provide perspective. (In the figures that follow, the scenario reflecting these inflows of capital is denoted EREAL.) In 1989, the model suggests that Mexico would need about \$6.4 billion of foreign capital (in addition to \$3 billion from Mexican foreign exchange reserves) to maintain the real

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<sup>1</sup>Because Mexican inflation is assumed to continue at 20 percent per year while U.S. inflation is steady at 5 percent, the nominal value of the peso vis-a-vis the dollar declines at a rate of 15 percent per year in this scenario.

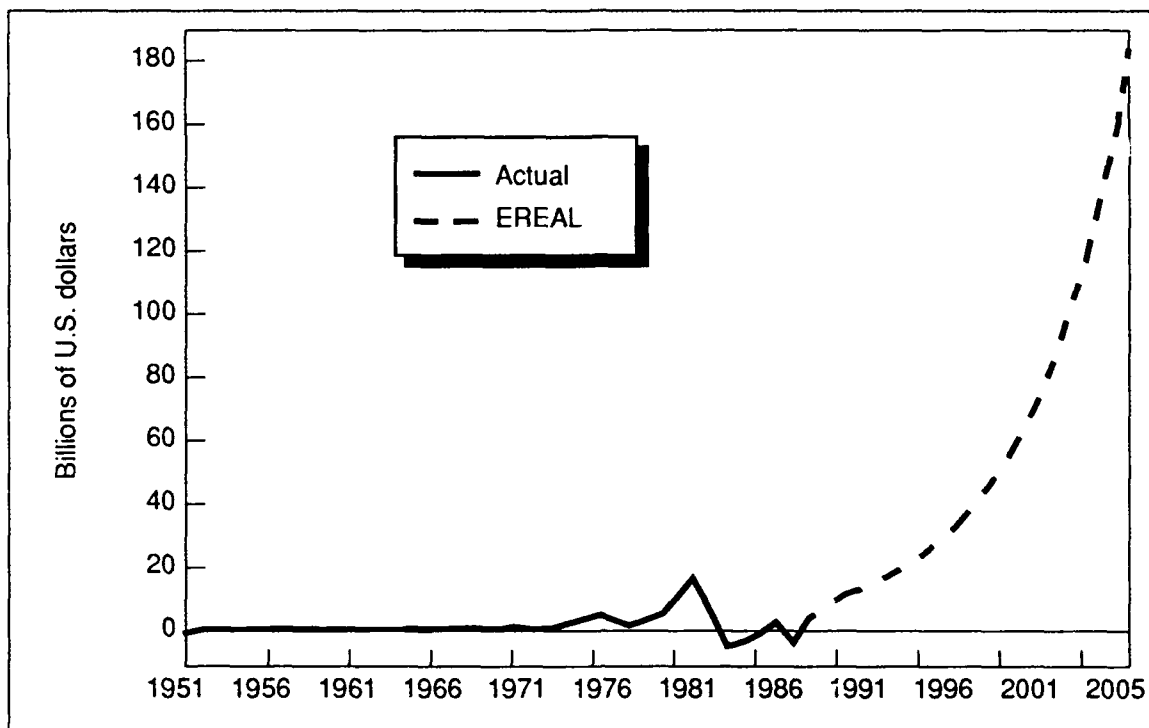


Fig. 4.1—Scenario EREAL: net capital inflow to maintain constant real exchange rate

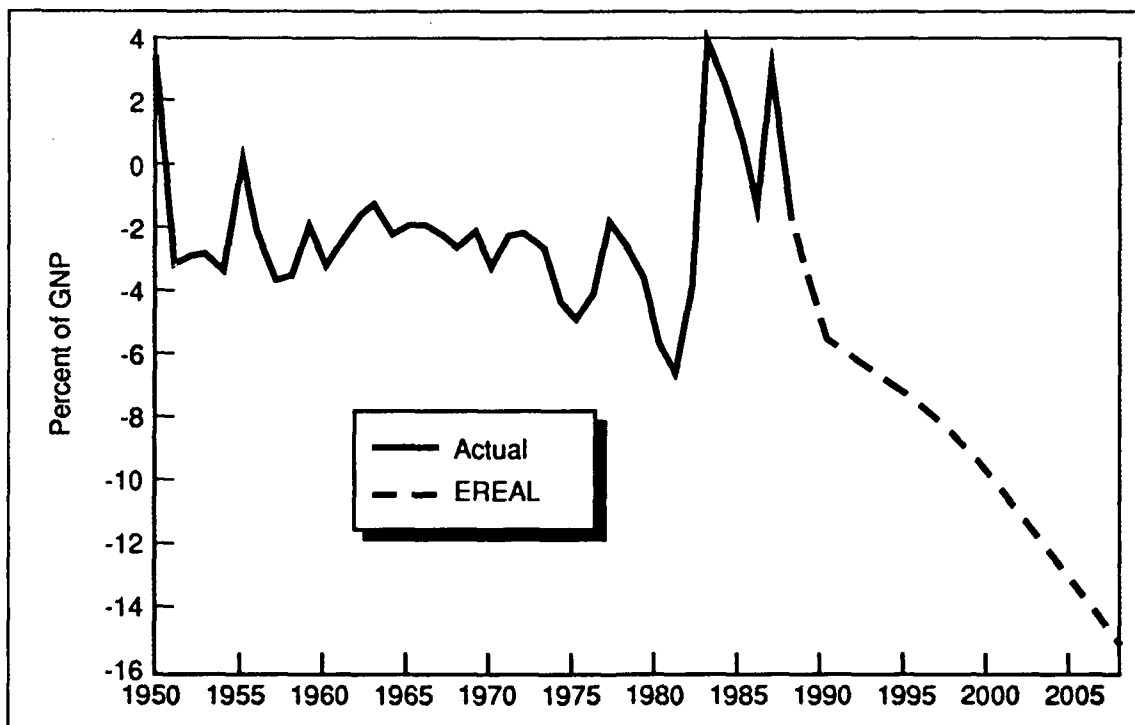


Fig. 4.2—Scenario EREAL: current account balance (percent of GNP)

exchange rate at the 1988 level.<sup>2</sup> In succeeding years, progressively larger volumes of foreign capital are required. By 1994, an inflow of some \$20 billion is needed; by 2004, nearly \$100 billion is needed; and by 2008, the necessary capital inflow is a staggering \$186 billion.

One should never attach very much significance to the specific numbers generated by simple economic models. One should be particularly leery about developments that are supposed to take place 20 years in the future. It would be wrong, though, to ignore the qualitative conclusions suggested by this exercise: Maintaining the real exchange rate would require a large and rapidly growing inflow of foreign capital—flows much larger than it is reasonable to expect that Mexico could attract.

To understand how large the necessary flows of foreign capital are, it is useful to remember that the stock of Mexican "flight capital" in other countries that might be attracted back to Mexico by sound economic policies is generally estimated to be in the neighborhood of \$50 billion. The full repatriation of this "flight capital" would be adequate to maintain the real exchange rate for only the four years 1990–1993. Beyond that, heavy foreign lending or investment would be required. Figure 4.2 also provides some perspective on how large the required capital flows are. This figure shows these flows (which are by definition equal to the Mexican current account deficit) as a percentage of Mexican GNP. Current account deficits of utterly unprecedented size would be the result of such an inflow of foreign capital.

If it were somehow possible for Mexico to attract such huge capital flows, the Mexican economic outlook would be considerably brighter. Figure 4.3 shows that with the capital inflow real Mexican GNP would grow by 4.5 percent in 1990, rather than *declining by more than 3 percent* as it would if the inflow of foreign capital were cut off entirely. In addition, a continuing capital inflow after 1990 would bring steadily rising real growth rates—above 6 percent per year by the end of the model period. This should not be surprising. Massive investment by foreigners would produce rapid growth in almost any country.

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<sup>2</sup>The current Mexican policy of allowing the nominal peso/dollar exchange rate to rise by one peso per day will actually result in a modest *appreciation* of the peso in real terms during 1989. Holding the real exchange rate steady would require a slightly smaller inflow of foreign capital than would trying for this appreciation. Thus, the capital inflow during 1989 is \$6.4 billion in scenario EREAL, compared to \$7 billion in the base case.

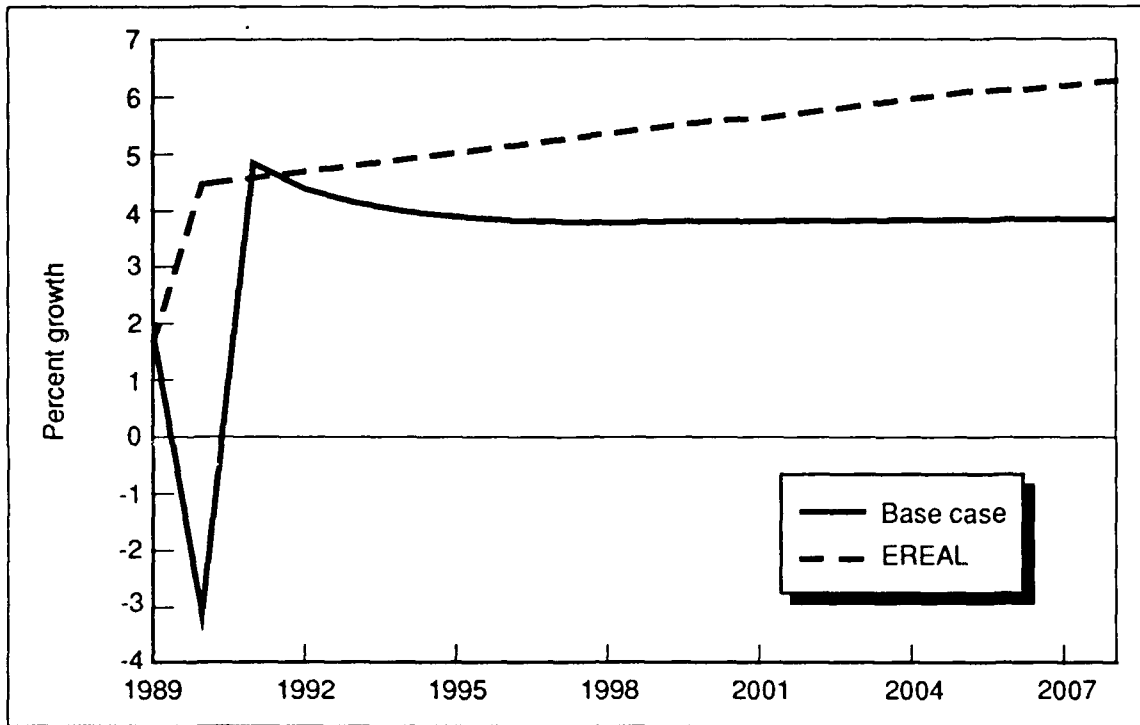


Fig. 4.3—Scenario EREAL: real income growth (percent per year)

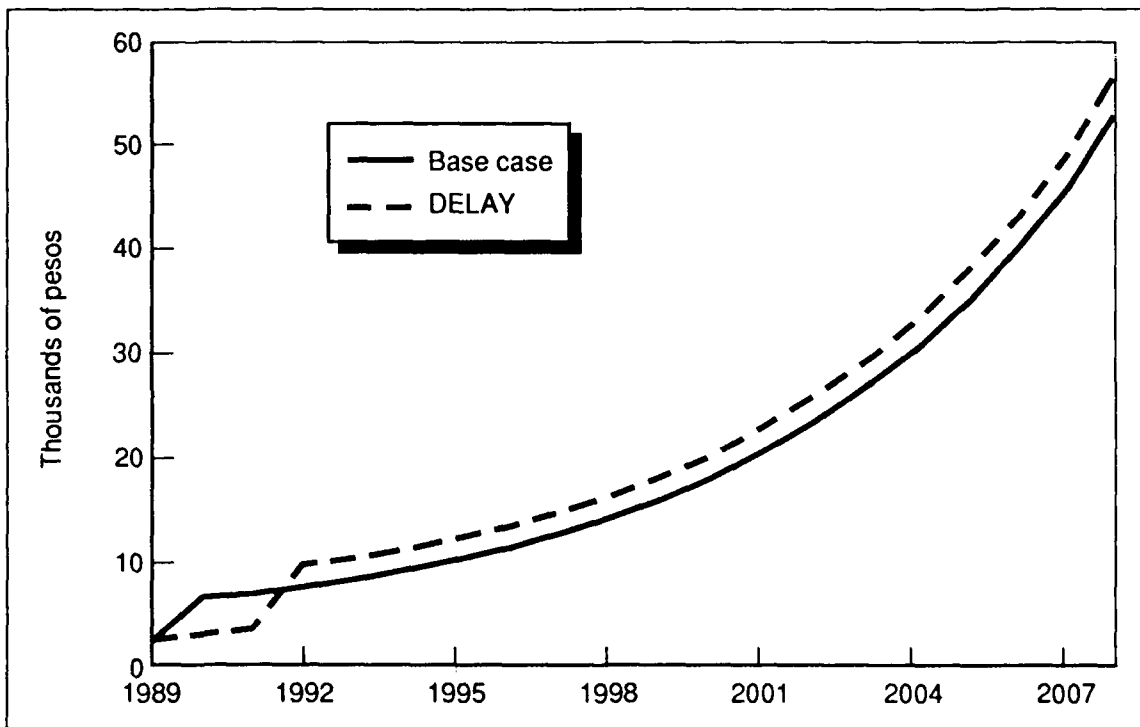


Fig. 4.4—Scenario DELAY: exchange rate (pesos per dollar)

What is more surprising, though, is that such massive borrowing by Mexico would not lead to a sharp rise in the share of Mexican GNP that would have to be devoted to net factor payments. Indeed, by maintaining the real value of the peso, these very large inflows of capital would act to hold down the real burden of net factor payments. Figure 4.4 shows that heavy borrowing would allow Mexico to avoid the steep rise in the share of income going to net factor payments that resulted in the base case from the sharp decline in the real value of the peso. In scenario EREAL, the share of GNP going to net factor payments rises gradually over the model period, but until 1997 it stays below the same share in the base case.

In essence, foreign borrowing constitutes a grand Ponzi scheme: as long as large and growing volumes of foreign lending are forthcoming, the peso will not fall and neither will real income. As with all Ponzi schemes, though, there will come a point where the necessary flow is insupportable. Then the whole scheme comes crashing down. For politicians with time horizons of only a few years, though, the prospect of continued borrowing can be seductive. If only the flow of foreign capital can be maintained for a couple more years. . . .

#### **POSTPONING THE ADJUSTMENT**

Maintaining the current real peso/dollar exchange rate would require unrealistic amounts of foreign lending or investment in future years. During the early years of such a policy the capital flows required would be large by historical standards, but perhaps not utterly out of the question. It might, therefore, be possible for Mexico to postpone for a short while—two or three years, say—the devaluation of the peso that will eventually be necessary.

Such a policy might be politically attractive. The current government's claims to legitimacy are somewhat tenuous and would almost certainly be strengthened by a period of good economic performance. The economic dislocations that would accompany a sharp decline in the peso would certainly generate political tensions—tensions that might be managed more easily by a government that has had a few years of relative prosperity to consolidate its position. More practically, elections for the Mexican National Assembly are scheduled for the summer of 1991. What would be the economic consequences of trying to prop up the peso (and consequently real income) through foreign borrowing until these elections are past?

Scenario DELAY reflects the results of such a policy. This scenario assumes sufficiently large inflows of foreign capital during 1989, 1990, and 1991 to maintain the real value of the peso at its 1988 level. (The amounts required are \$6.4 billion, \$10.8 billion, and \$12.6 billion, respectively in these years.) With the elections safely out of the way (and the government's hand presumably strengthened), capital inflows cease in 1992 and in subsequent years, and Mexico faces up to the consequences of a peso devaluation.

Figure 4.4 shows that postponing the exchange rate adjustment increases the size of the necessary adjustment when it finally does come. In the base case, the peso declines by a little over 60 percent between 1989 and 1990. In scenario DELAY, the peso decline between 1991 and 1992 is 65 percent. From 1992 onward, the peso is weaker in the DELAY scenario than in the base case.

Not surprisingly, a larger decline in the value of the peso brings a larger one-year decline in real income. (See Figure 4.5.) In the DELAY scenario, real income falls 4.7 percent in 1992 compared to a fall of 3.1 percent in 1990 in the base case. After the exchange rate adjustment, real GNP growth rates are similar in both scenarios. Perhaps more important, though, is that delaying the adjustment has almost no effect on the levels of real GNP in the long run. (See Figure 4.6.) Heavy borrowing during the 1989-1991 period keeps real income above base case levels during those years, but by the time the exchange rate adjustment has been completed in 1992, real GNP falls back to almost exactly the level that would have prevailed if the peso decline had been allowed to happen in 1990.

The message here is that delaying the inevitable peso devaluation might be a viable strategy. The more the adjustment is delayed, the bigger it will have to be, but there is no significant longer-run penalty for postponing it. Other advantages might accrue from a strategy of postponement. Oil prices might rise during the intervening years, lessening the magnitude of the necessary decline. (Oil prices might, of course, also fall.) U.S. inflation might also increase, reducing the real value of Mexican debt servicing. Certainly, the Mexican government will be tempted to postpone an inevitable day of reckoning. Any government would. These calculations suggest that, since there is little long-run cost to doing so, this might not be a bad strategy.

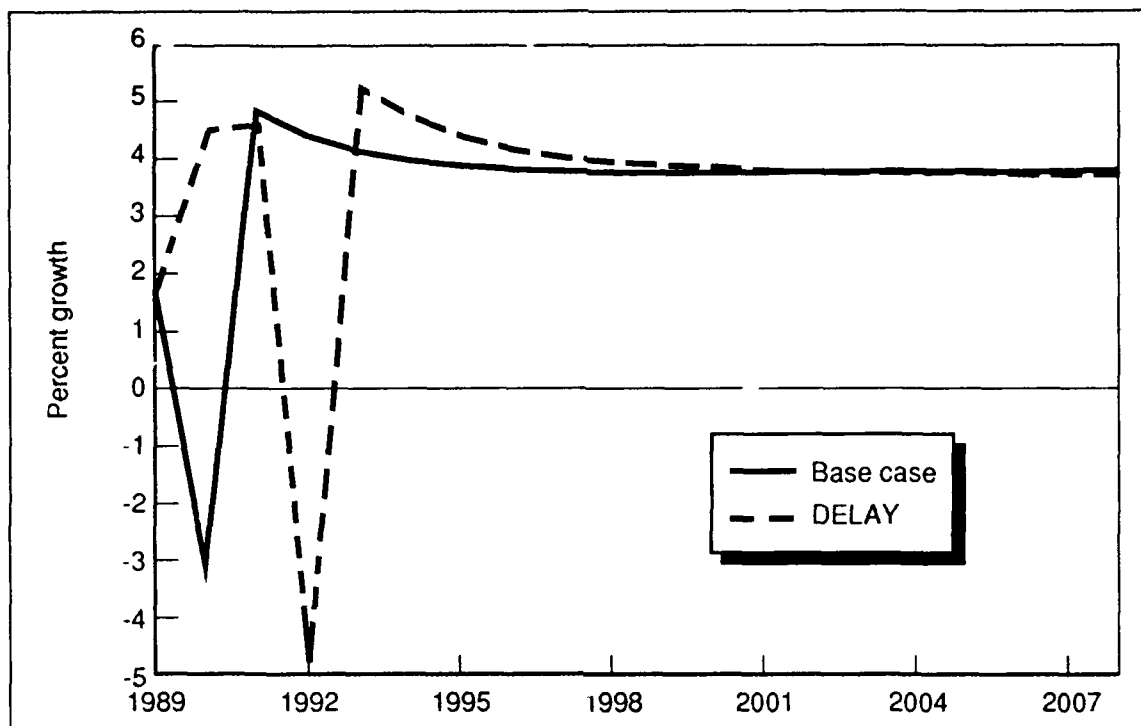


Fig. 4.5—Scenario DELAY: real income growth (percent per year)

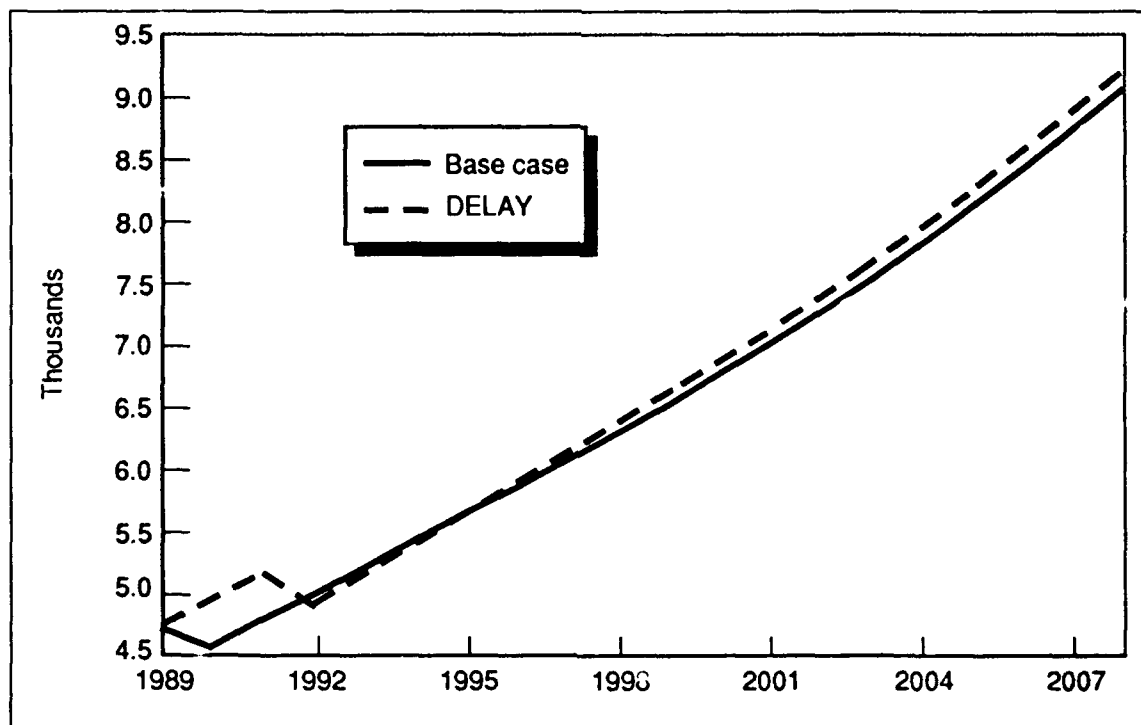


Fig. 4.6—Scenario DELAY: real income (billions of 1980 pesos)

## DEBT FORGIVENESS AND INTEREST RATE REDUCTIONS

Under the terms of the July 1989 agreement between Mexico and its creditor banks, each bank will choose among three options:

1. It can forgive 35 percent its outstanding loans to Mexico.
2. It can reduce the interest rate on all its Mexican loans to 6.25 percent.
3. It can make additional loans (equal to 25 percent of its existing exposure) to Mexico at prevailing market rates.

It is not yet clear how many banks will choose each option, and so it is not yet possible to estimate how much Mexican debt may be forgiven and how much will carry lower interest rates. For the purposes of the model, the first two choices facing banks are essentially equivalent. To see this, suppose first that all banks choose the first option, debt forgiveness. At the time of the July agreement, Mexico's debts to commercial banks amounted to about \$54 billion. A 35 percent reduction in this total would mean debt forgiveness of about \$19 billion. Since the model assumes that Mexico is paying 10 percent interest on its foreign debt, forgiveness of \$19 billion of this debt results in a \$1.9 billion reduction in annual interest payments. Now suppose that all banks choose the second option, interest rate reduction. An interest rate reduction of 3.75 (10 minus 6.25) percent on \$54 billion will result in annual interest rate savings of about \$2 billion per year.<sup>3</sup> Thus, applying the 35 percent reduction rule to a billion dollars of Mexican debt has almost exactly the same result as applying the interest rate reduction formula to a billion dollars of Mexican debt.

To get some idea of the consequences of these debt relief measures, it is useful to examine the extreme case in which all banks choose either the first or the second option. (It is assumed that debt to be forgiven will be forgiven as of the end of 1989 and that reduced interest rates will be effective from January 1, 1990.) These consequences are simulated in scenario REDUCE.

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<sup>3</sup>The rough equivalence of these two options is, of course, no accident. The amounts by which principal and interest rates were to be reduced were calculated by the negotiators to produce roughly equivalent relief. Debt forgiveness and interest rate reductions of these amounts have similar consequences for Mexico. The two options may, however, be viewed differently by bank regulators in some countries, and an effort was made to allow banks to structure their debt relief so as to minimize regulatory difficulties.

Reduced debt servicing requirements result in a somewhat stronger peso in scenario REDUCE than in the base case. (See Figure 4.7.) The consequence of this is that the decline in Mexican real income associated with the ending of foreign capital inflows is eliminated. (See Figure 4.8.) To be sure, the growth rate of real GNP declines somewhat in 1990 from its level in 1989, but it is still positive—about 1 percent. This compares with an outright decline in real GNP of a bit more than 3 percent in 1990 in the base case. Despite continued growth of real income, though, real per capita GNP falls in 1990 (Figure 4.9), but the decline is much smaller and more likely to be politically manageable than the decline associated with the base case. Neither is debt relief on this scale sufficient to keep net factor payments from rising sharply as a share of Mexican GNP in 1990. (See Figure 4.10.) The rise, though, is smaller than in the base case—to less than 10 percent of GNP rather than more than 14 percent.

Although large-scale debt forgiveness or interest rate reductions could go a long way toward eliminating the need for a painful adjustment in the near term, they would do little to improve the long-term prospects for the Mexican economy. Notice in Figure 4.8 that although the decline in real GNP in 1990 is avoided in scenario REDUCE, growth rates in the years immediately following are lower than in the base case. By the turn of the century, growth rates in the two cases are indistinguishable. More to the point, the actual levels of real GNP in the two cases are very similar. After 1995, the level of real GNP in the debt forgiveness case is less than 2 percent higher than real GNP in the base case.

#### LIKELY EFFECTS OF THE JULY 1989 AGREEMENTS

Scenario REDUCE reflects the consequences of all of Mexico's creditor banks' choosing either to forgive Mexican debts or to lower interest rates on existing debts. Banks have a third option, however—to make new loans to Mexico equal to 25 percent of loans already outstanding. No one knows yet how many banks will choose each option, but recent news stories suggest that about one-fifth of the creditor banks (accounting for an unspecified share of total Mexican debt) will choose to lend new money.<sup>4</sup>

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<sup>4</sup>See, for example, "Debt Accord May Save \$1.2 Billion," *The Financial Times*, August 4, 1989.

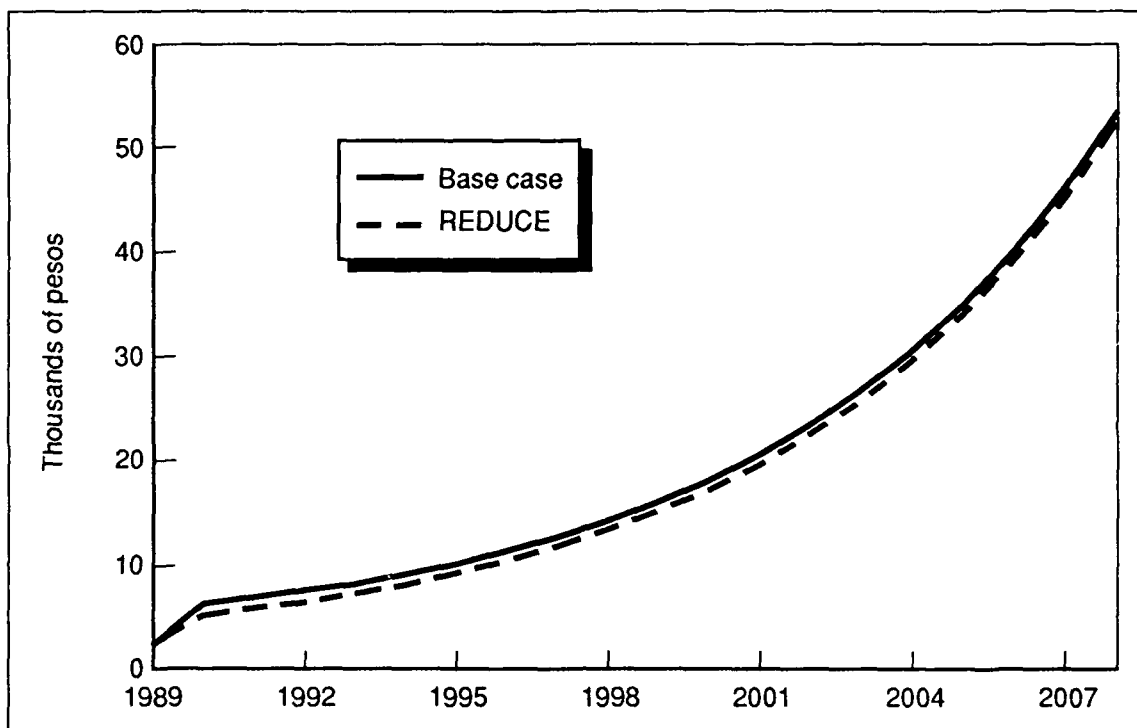


Fig. 4.7—Scenario REDUCE: exchange rate (pesos per dollar)

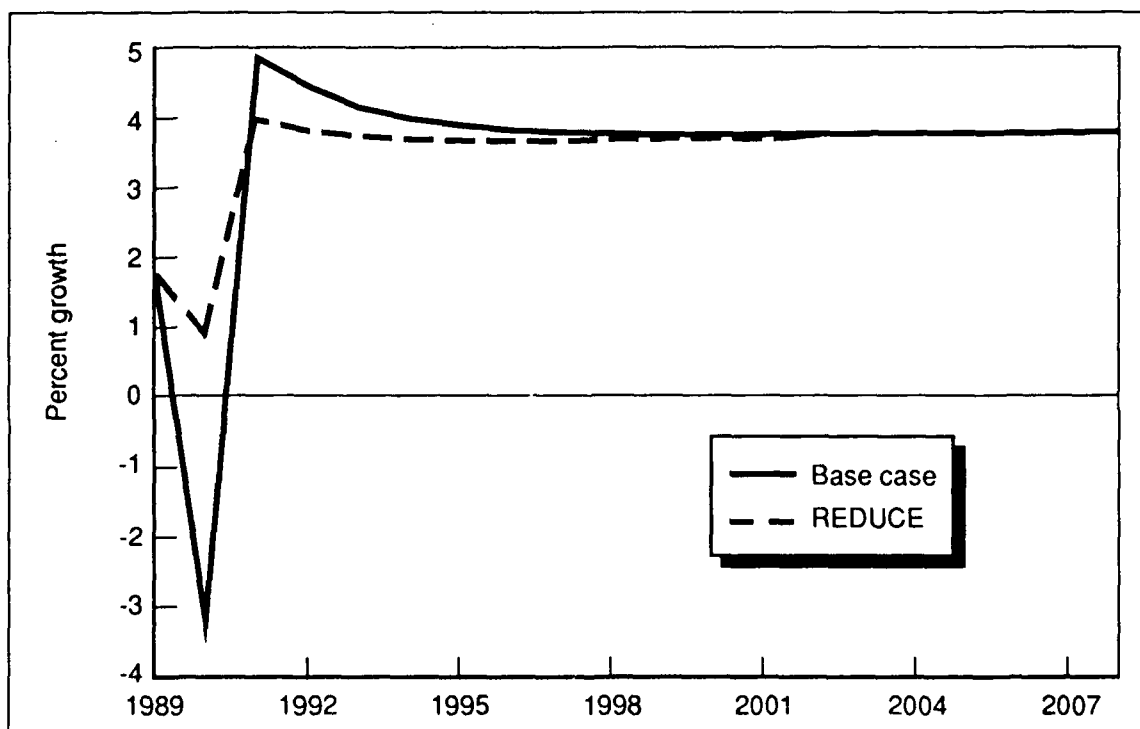


Fig. 4.8—Scenario REDUCE: real income growth (percent per year)

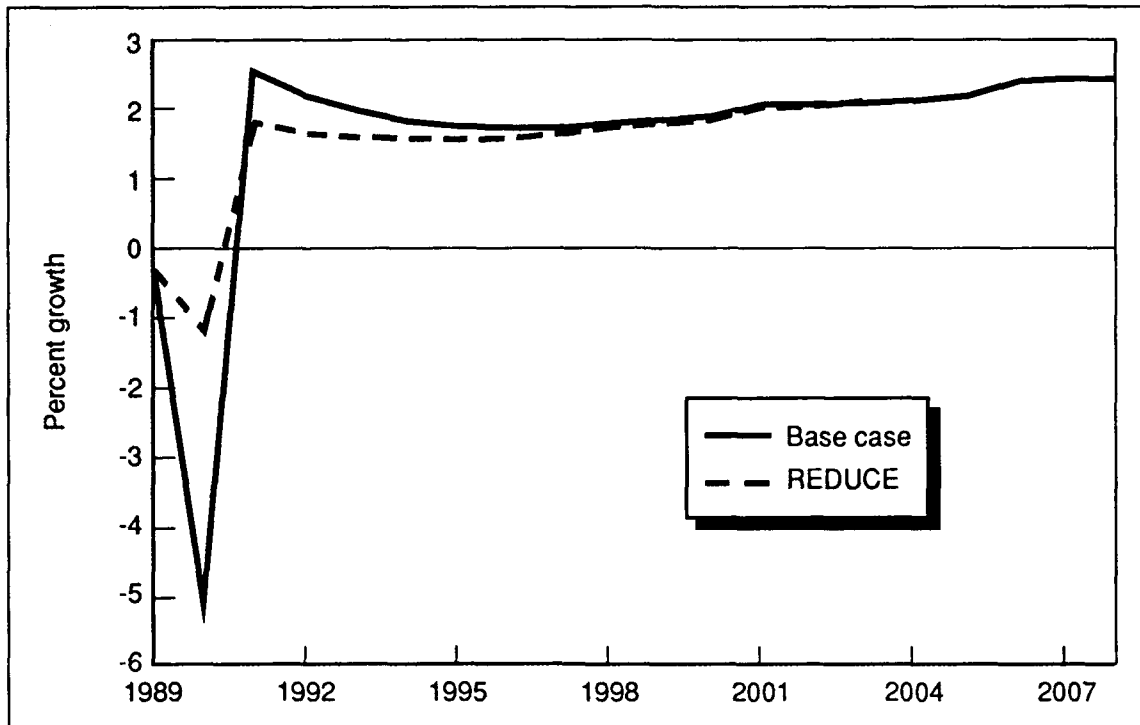


Fig. 4.9—Scenario REDUCE: real per capita income growth (percent per year)

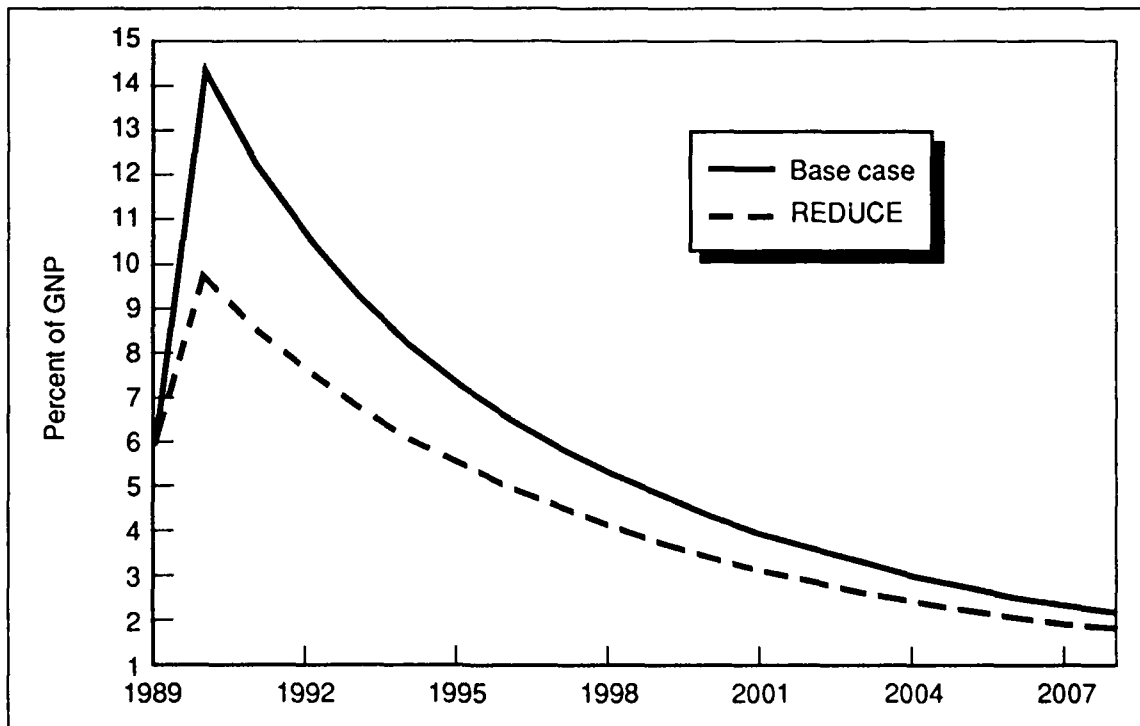


Fig. 4.10—Scenario REDUCE: net factor payments (percent of GNP)

Scenario AGREE suggests the consequences of a final outcome in which banks accounting for 20 percent of total Mexican debt to banks choose to increase their exposure to Mexico by 25 percent. (There are conflicting press accounts concerning exactly how much of Mexico's debt to banks is actually covered by the July agreement. This scenario adopts a conservative figure of \$46 billion.) These banks provide \$2.3 billion of new lending, while the remaining banks forgive \$12.9 billion of debt or grant equivalent interest rate reductions. This scenario also assumes enough additional foreign lending for Mexico to maintain the current peso-a-day devaluation against the dollar for the rest of 1989.<sup>5</sup> After 1989, net capital inflows go to zero.

Not surprisingly, scenario AGREE is intermediate between the pessimistic base case and the generally optimistic scenario REDUCE. Real GNP declines in 1990, but by only about 1 percent rather than the 3 percent of the base case. (See Figure 4.11.) Real per capita income and net factor payments show the same patterns in scenario AGREE as in the base case, but the detrimental swings are of somewhat smaller magnitude. (Figures 4.12 and 4.13.)

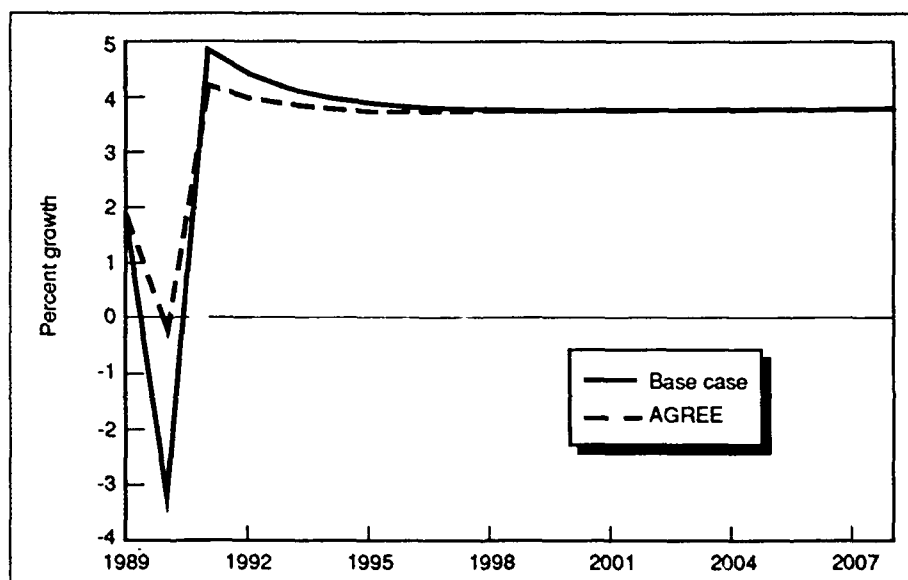


Fig. 4.11—Scenario AGREE: real income growth (percent per year)

<sup>5</sup>Under the terms of the July agreement, Mexico will borrow an additional \$7 billion from the World Bank and from the government of Japan. The funds will serve as collateral (on a rolling basis) for principal and interest payments to those banks that agree to principal and interest rate reductions. Because these funds must be retained as collateral, they are not available to be spent by Mexico. They are essentially ignored in the context of the model.

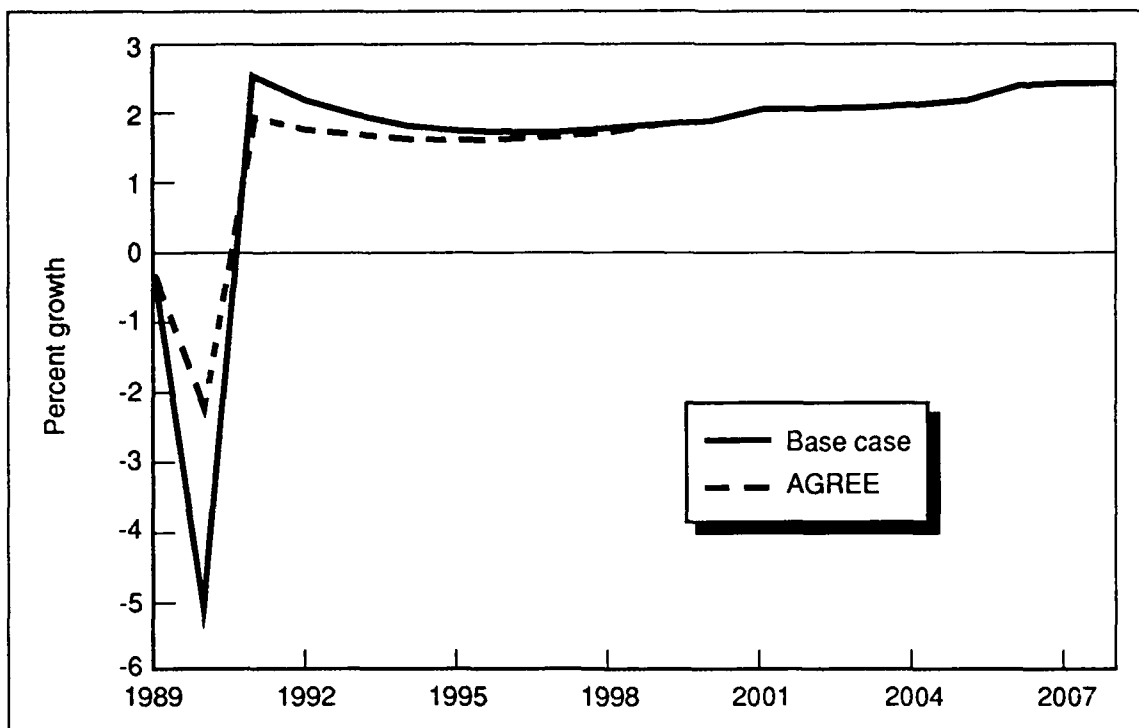


Fig. 4.12—Scenario AGREE: real per capita income growth (percent per year)

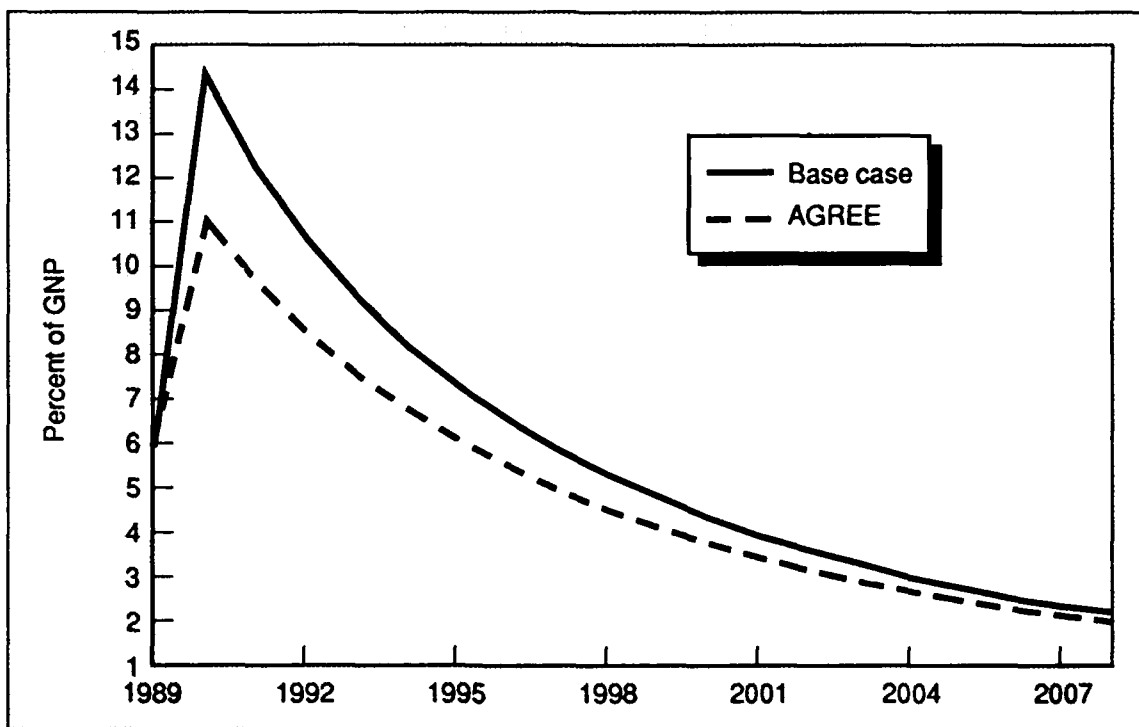


Fig. 4.13—Scenario AGREE: net factor payments (percent of GNP)

The main point here is that although the recent agreement between Mexico and its creditor banks will certainly prove beneficial to the Mexican economy in the near term, the debt relief and new financing it will bring are unlikely to be enough to avoid a further decline in Mexican living standards in the next few years. This decline may be particularly problematic for the government in the light of the optimistic rhetoric that followed the agreement's conclusion.

### HIGHER OIL PRICES

Mexico's economic difficulties in the 1980s can be traced in part to the sharp decline in oil prices since 1981. Not surprisingly, higher oil prices in the future would improve Mexico's prospects for acceptable economic growth. Scenario HIOILP postulates oil prices 25 percent (four dollars per barrel, in 1989 dollars) higher than in the base case, beginning in 1990. In 1990, these higher prices increase Mexico's oil export revenues by about \$2.3 billion, somewhat more than the reduction of interest payments that would result if all of Mexico's creditor banks chose to forgive 35 percent of Mexico's debt.<sup>6</sup> As one might expect, the consequences of higher oil prices are similar to the consequences of debt reduction. Higher oil prices reduce the devaluation of the peso in 1990 (Figure 4.14) and nearly eliminate the decline in real GNP that comes as a result of peso devaluation (Figure 4.15). Higher oil prices also bring a higher sustained rate of real income growth after adjustment to a weaker peso—about 4 percent per year in the high oil price scenario, compared to about 3.8 percent per year in the base case.

The sensitivity of the Mexican economic outlook to changes in oil prices should be sobering for anyone trying to make a true forecast of the Mexican economic future or trying to design policy on the basis of such forecasts. Oil prices are of course notoriously volatile, and fluctuations as large as those postulated in scenario HIOILP have not been uncommon in recent years. (Indeed, the combination of an explosion on a North Sea oil platform and the grounding of the *Exxon Valdez* were sufficient to produce at least a temporary rise in oil prices about half as large as is postulated in this scenario.) An oil price rise of four dollars a barrel is easy to imagine. If such a rise had taken place in the early part of 1989,

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<sup>6</sup>In the out years of this scenario, the higher oil prices do more for the Mexican economy than does debt reduction. This is because the nominal gap between oil prices in scenario HIOILP and in the base case scenario continues to grow while the nominal reduction in debt payment that results from debt reduction stays constant.

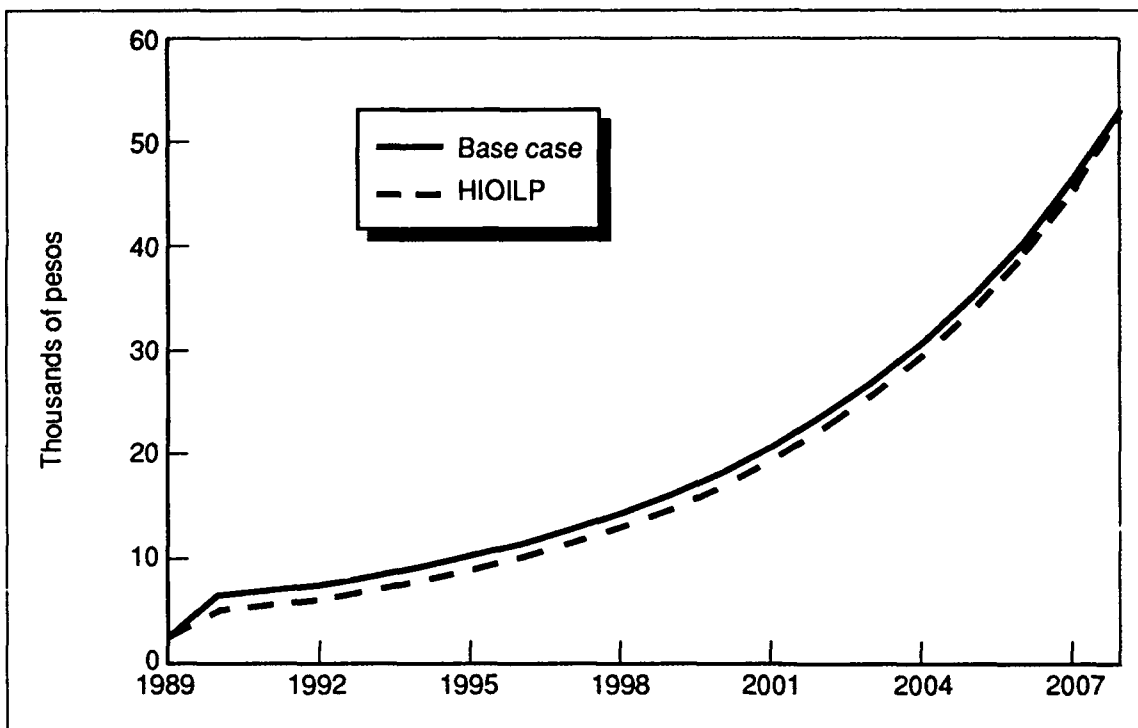


Fig 4.14—Scenario HIOILP: exchange rate (pesos per dollar)

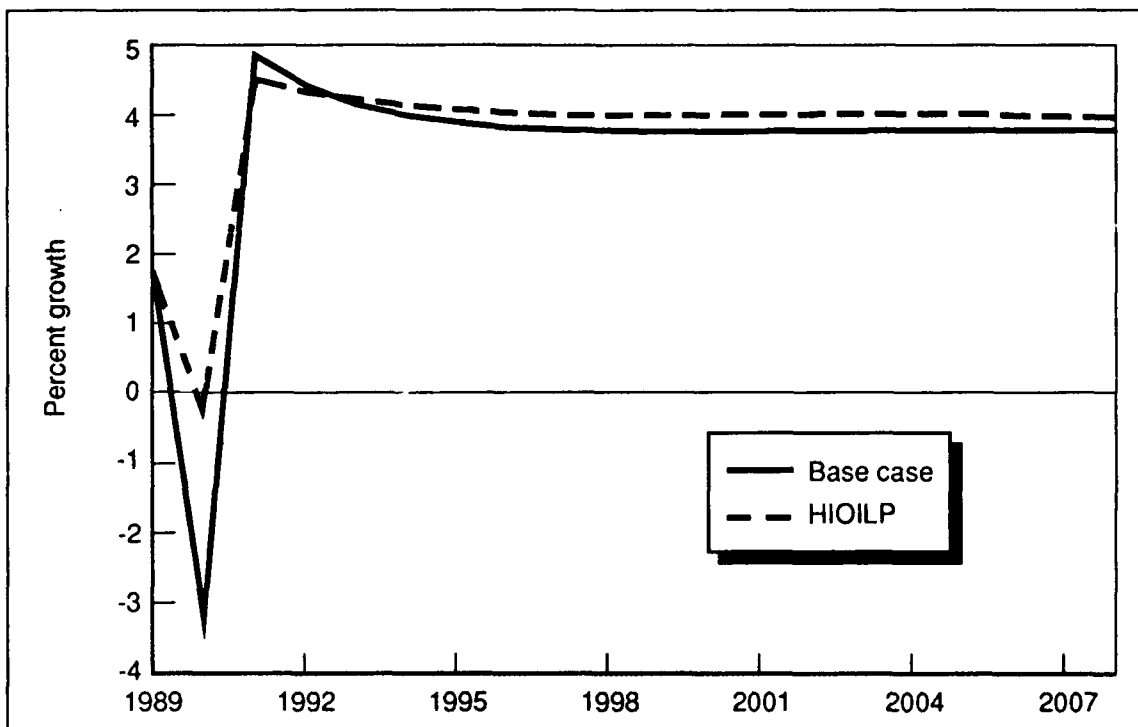


Fig. 4.15—Scenario HIOILP: real income growth (percent per year)

the entire tedious and politically costly exercise of negotiating Mexican debt relief could have been skipped. The price rise would have done more for Mexico than months of negotiations with bankers.

#### VARIATIONS IN SAVING RATES

The base case scenario reflects relatively optimistic assumptions about Mexico's ability to generate internal savings. The base case assumes a saving rate of 25 percent of GNP. As Figure 2.3 illustrates, however, saving rates this high have been achieved only recently. From the mid-1960s to the mid-1970s, total domestic savings hovered at around 17 percent of GNP. Whether or not Mexico will be able to achieve saving rates as high as those assumed will depend critically on how successful the Salinas administration is at controlling government spending. So far, indications are promising. After years of economic stagnation, though, there is bound to be growing pressure for government spending on social services, infrastructure, and consumer subsidies. These pressures will doubtless increase if there is an exchange rate-related decline in real incomes in the next few years.

Lower saving rates would mean reduced investment and slower economic growth. To assess the consequences of a lower saving rate, scenario LOSAVE posits total domestic saving at 20 percent of GNP. This is markedly below what is assumed in the base case but still well above what was achieved before 1979.

Because lower saving reduces investment, the long-run growth rates of both total and per capita real income are lower (by roughly one percentage point) in the low saving case than in the base case (Figures 4.16 and 4.17). The lower saving rate provides an immediate boost to total consumption (private plus public consumption), and in 1990 real per capita consumption is about 5.6 percent higher in the low saving case than in the base case. Reduced investment and lower output growth quickly cut into the volume of goods and services available for consumption, and by 1995 per capita consumption in the two cases is about equal. By the end of the simulated period, real per capita consumption is more than 12 percent lower in the low saving case than in the base case. Clearly, any assessment of Mexico's future growth prospects is very sensitive to assumptions about the overall national saving rate.

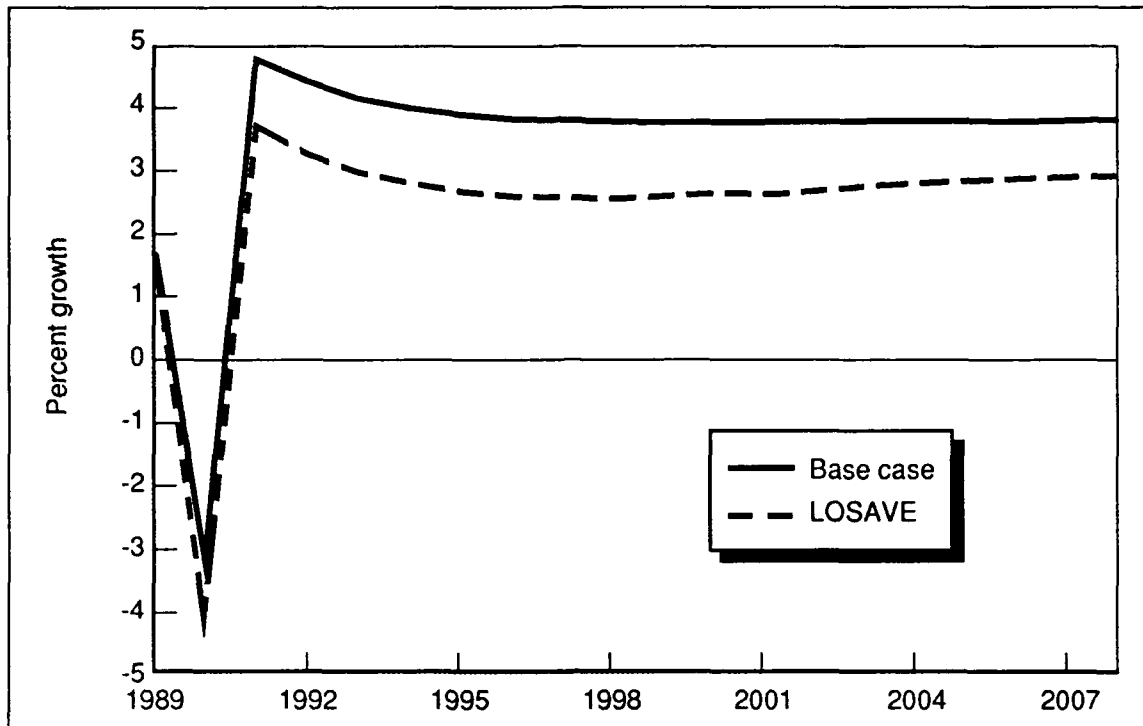


Fig. 4.16—Scenario LOSAVE: real income growth (percent per year)

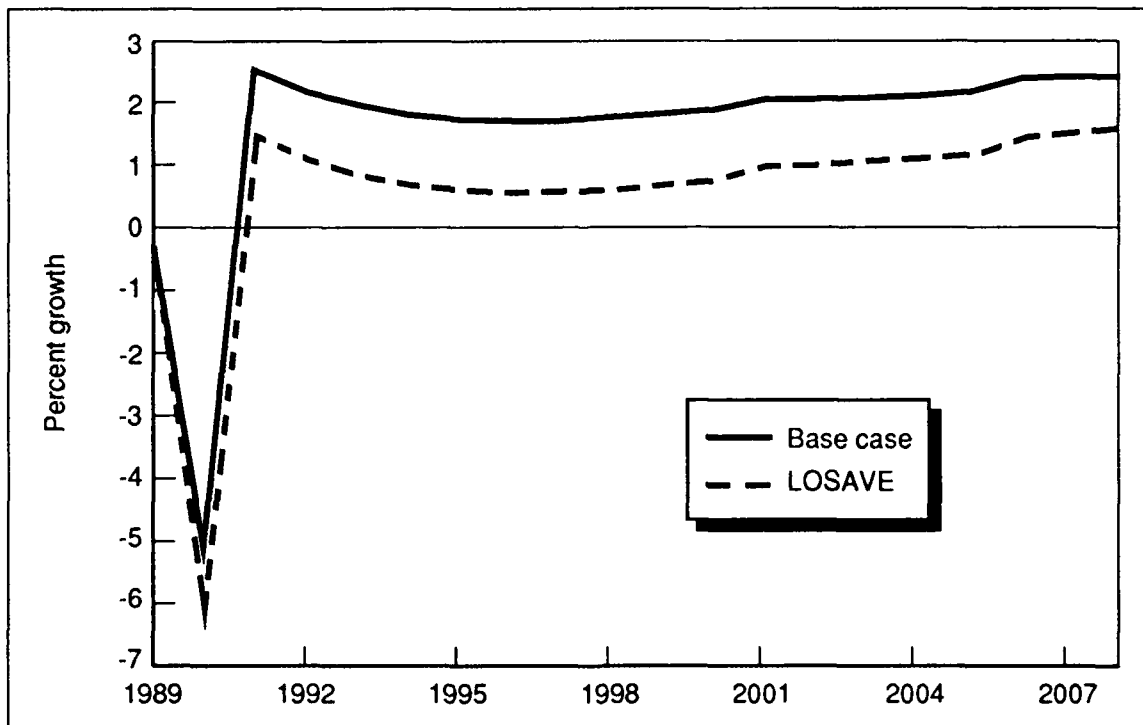


Fig. 4.17—Scenario LOSAVE: real per capita income growth (percent per year)

## U.S. INFLATION RATE

Consideration of the consequences for the Mexican economy of a rising U.S. inflation rate provides a good example of the need for a formal model. In this case, one's intuition is likely to lead to an incorrect conclusion. A formal model is necessary to sort out what the actual effect of higher U.S. inflation is likely to be.

Intuitively, one is tempted to apply the standard axiom that inflation is good for debtors. Because Mexico's foreign debt is denominated principally in dollars and fixed in nominal terms, more rapid inflation in the United States will decrease the real value of Mexico's interest payments. A given nominal interest payment will require forgoing a smaller volume of imports from the United States. With a smaller real interest burden, Mexico should be able to retain a larger share of its total production for consumption and investment, thus raising real income in both the near term and the long term. Inflation in the United States should, it would seem, be in Mexico's interest.

Model results show that this is not necessarily so, however. The critical factor is the extent to which U.S. inflation also affects the dollar price of Mexico's oil exports. Let us first consider the case in which U.S. prices are rising at 8 percent per year, rather than at the 5 percent rate assumed in the base case. Let us also assume, though, that oil prices are unchanged from the base case. That is, let us assume that nominal oil prices rise at only 5 percent per year. (This seems unlikely, but such a scenario will illustrate the importance of assumptions about relative prices.) In Figures 4.18 and 4.19, this scenario is designated INFLATE.

Note first in Figure 4.18 that long-term growth of Mexican real GNP is slower in the high U.S. inflation case than in the base case. Initially, reduced real interest payments allow more rapid growth of Mexican income than in the base case. As the real value of Mexico's oil exports declines, however, this advantage erodes. Decreased real interest payments are offset by decreased real earnings on oil imports. At the outset, net factor payments to foreigners and oil revenues are about equal, and these two factors roughly cancel out: there is not much difference between the real income growth in the high inflation and the base cases. As time goes on, though, oil revenues become larger than net factor payments, and the declining real value of oil exports begins to dominate. Put another way, over time Mexico's terms of trade deteriorate. Because Mexico is assumed to have a balanced current account in both scenarios, deteriorating terms of trade are reflected in a

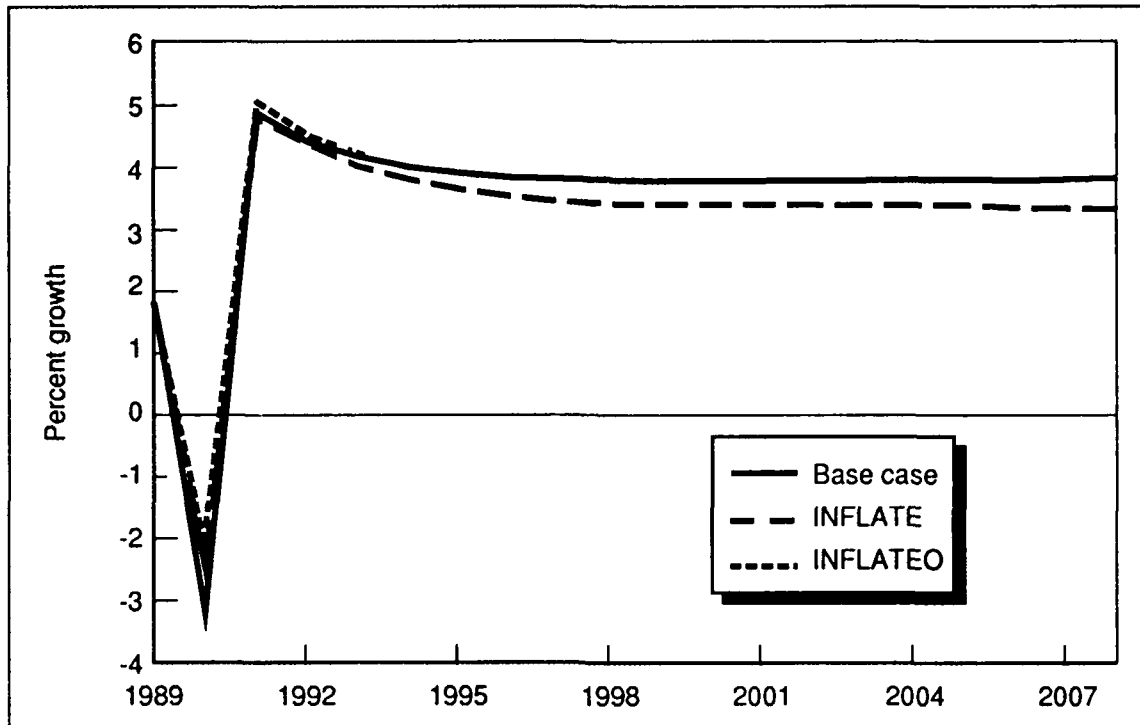


Fig. 4.18—Scenario INFLATE: real income growth (percent per year)

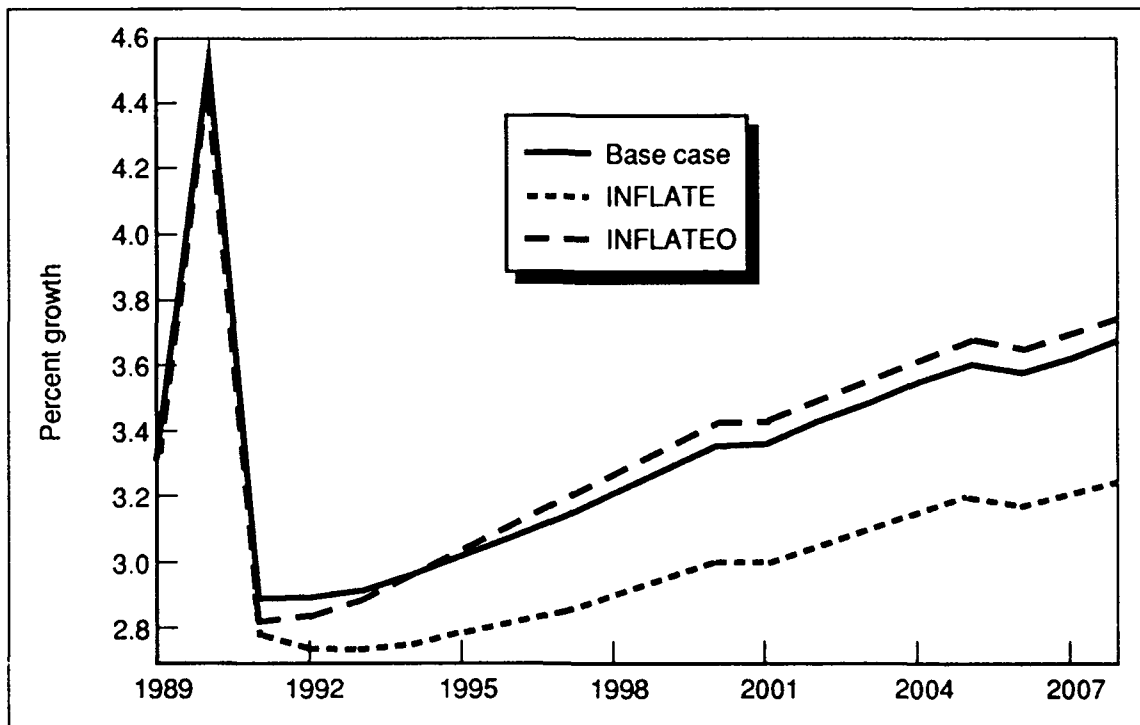


Fig. 4.19—Scenario INFLATE: Real GDP growth (percent per year)

declining real value of the peso. This declining real value reduces Mexican real income, because Mexicans can buy fewer foreign goods. Lower real income results in lower saving, and lower saving results in slower growth of real GDP (Figure 4.19). This contributes, in turn, to even slower growth of real income.

A second scenario (designated INFLATEO) shows the consequences of higher U.S. inflation that is fully reflected in oil prices. In this scenario, U.S. prices and nominal oil prices both rise at 8 percent. In this case, Mexico's terms of trade do not deteriorate, and real income growth is boosted. Higher real income leads to higher saving, which leads to more rapid growth of real GDP (Figure 4.19). The differences are not great, however. In the long run, a rise in U.S. inflation that is fully reflected in oil prices adds less than one-tenth of a percent to Mexico's growth rate of real output and just a bit more than one-tenth of a percent (not easily seen in Figure 4.18) to annual growth of real income.

One does not need to stop here, though. While it is probably reasonable that rising U.S. inflation will raise the price of Mexico's oil exports, it is also likely that rising U.S. inflation would raise interest rates on Mexico's foreign debt. These higher interest rates would offset any gains that would result from a declining real value of Mexico's debt. If real dollar interest rates remained constant—that is, if nominal rates rose by the same amount as the dollar inflation rate—and if real oil prices remained constant, all of these changes would cancel each other out, and higher U.S. inflation would have no effect other than to make the nominal value of the peso stronger than it was in the base case. No real values would be affected.

The conclusion to draw from this is that higher U.S. inflation will do little to improve Mexico's prospects. A very sharp rise in U.S. prices, ideally led by an even sharper rise in oil prices, with dollar interest rates lagging behind, might bring some temporary benefit to Mexico. (One might imagine such a scenario in some future oil crisis.) Modest increases in the U.S. inflation rate, though, will have minimal effects on the Mexican economy, even in the unlikely case that nominal dollar interest rates do not rise to compensate for the higher inflation.

## V. OPTIMISTIC AND PESSIMISTIC CASES

The scenarios presented in the preceding section illustrate the likely effects on the Mexican economy of a variety of specific external and internal developments. These scenarios provide some indication of which factors are likely to be most important in shaping Mexico's economic future. They do not, however, do much to illustrate the best or the worst that might plausibly be expected for the Mexican economy over the next ten to twenty years. This section presents two scenarios that may be said to bound the set of reasonable possibilities for the Mexican economy in the medium term. This is not to argue that the Mexican economy could not perform better than the following "optimistic" scenario suggests, or worse than the "pessimistic" scenario suggests. Extremely favorable or unfavorable circumstances could of course develop. Oil prices could double or quadruple, as they have in the past. Mexico could face a social or political crisis that would lead to serious economic dislocation. Barring major upheavals or discontinuities in either Mexico or the rest of the world, though, these scenarios may suggest the best and the worst that could happen to Mexico.

### AN OPTIMISTIC CASE

The assumptions that lie behind the optimistic scenario of Mexico's future economic prospects are these:

1. *Debt reduction.* Banks accounting for 80 percent of Mexico's debt to commercial banks choose to reduce either principal or interest rates on their Mexican loans. As noted in the last section, this would be equivalent to some \$12.9 billion in debt forgiveness.
2. *Higher U.S. inflation.* U.S. prices rise at an 8 percent rate after 1989. Higher U.S. inflation reduces the real burden of servicing Mexico's dollar denominated debt.
3. *Higher oil prices.* The average price of Mexican oil exports rises to \$21 per barrel in 1990, 25 percent higher than the base case price of \$16.80. In succeeding years, the nominal price of oil rises 5 percent per year. Since the U.S. inflation rate is assumed to be 8 percent per year, the real price of oil is actually falling in this scenario after the

initial sharp rise in 1990. By 1997, the real oil price is back to the level assumed in the base case.

4. *Higher total factor productivity growth.* The rate of total factor productivity growth is 2 percent per year, compared with 1 percent per year in the base case. This rate of total factor productivity growth is not unprecedented in Mexico, but it has not been sustained for more than a few years at a stretch. (See Section II.) Achieving the rates of productivity increase assumed here will require major and continuing reform of Mexican economic institutions.
5. *More rapid export growth.* The income elasticity of demand for Mexican exports is 1.1, rather than 1.0 as assumed in the base case. This assumption is consistent with considerable trade liberalization in the United States and other parts of the developed world.
6. *Foreign borrowing.* Mexico is able to attract a net inflow of foreign capital sufficient to maintain the real value of the peso until after the National Assembly elections in 1991. (The amounts required are \$8.2 billion in 1990 and \$10.4 billion in 1991.) After 1991, Mexico is able to attract a net capital inflow each year equal to about 1.8 percent of Mexican GNP.

Figure 5.1 shows the path of the peso/dollar exchange rate in the optimistic scenario (labelled OPT). The peso declines only slightly in nominal terms during 1990 and 1991 (and, by assumption, not at all in real terms). When attempts to maintain the real value of the peso are abandoned in 1992, there is a devaluation, but it is mild relative to what we saw in the base case. Because underlying factors (higher oil prices and more rapid export growth) are acting to strengthen Mexico's trade position, delaying the necessary adjustment of the exchange rate reduces the size of the necessary adjustment. In these circumstances, delay seems an attractive policy. A longer delay would help to smooth out the adjustment even further. The capital inflows necessary to delay the exchange rate adjustment beyond 1991 become (possibly) unrealistically large, however. (The converse of this message is also true, of course: in circumstances where underlying factors act to weaken the trade position, delay will increase the size of the necessary adjustment.)

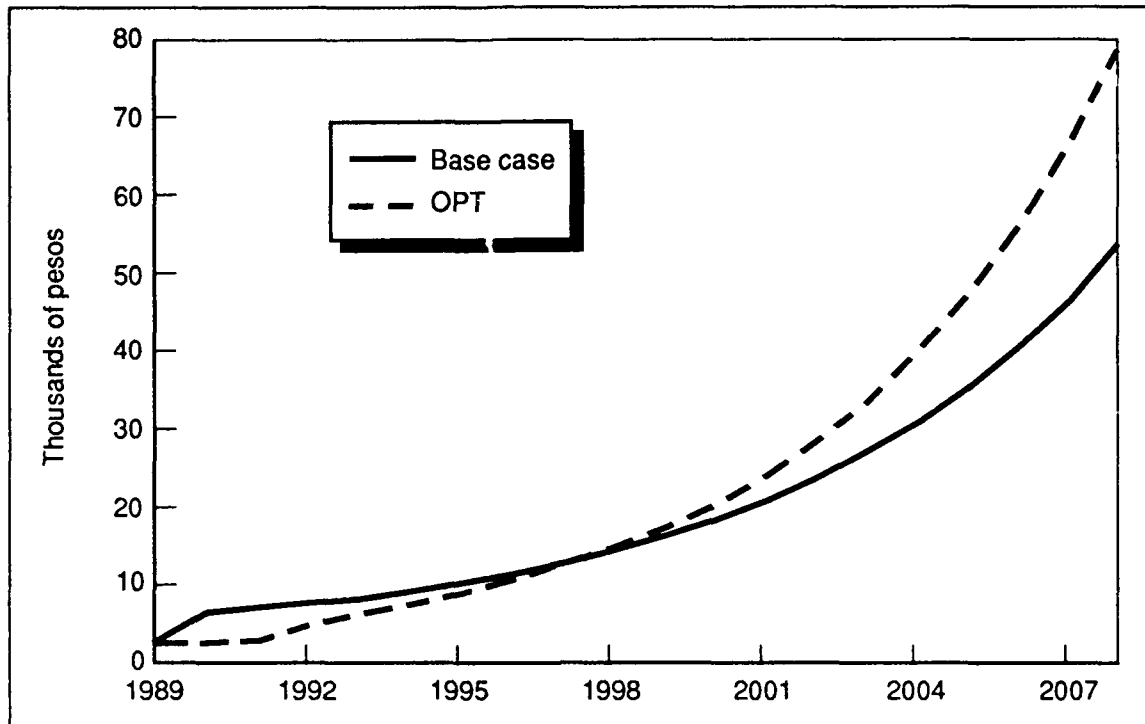


Fig. 5.1—Scenario OPT: exchange rate (pesos per dollar)

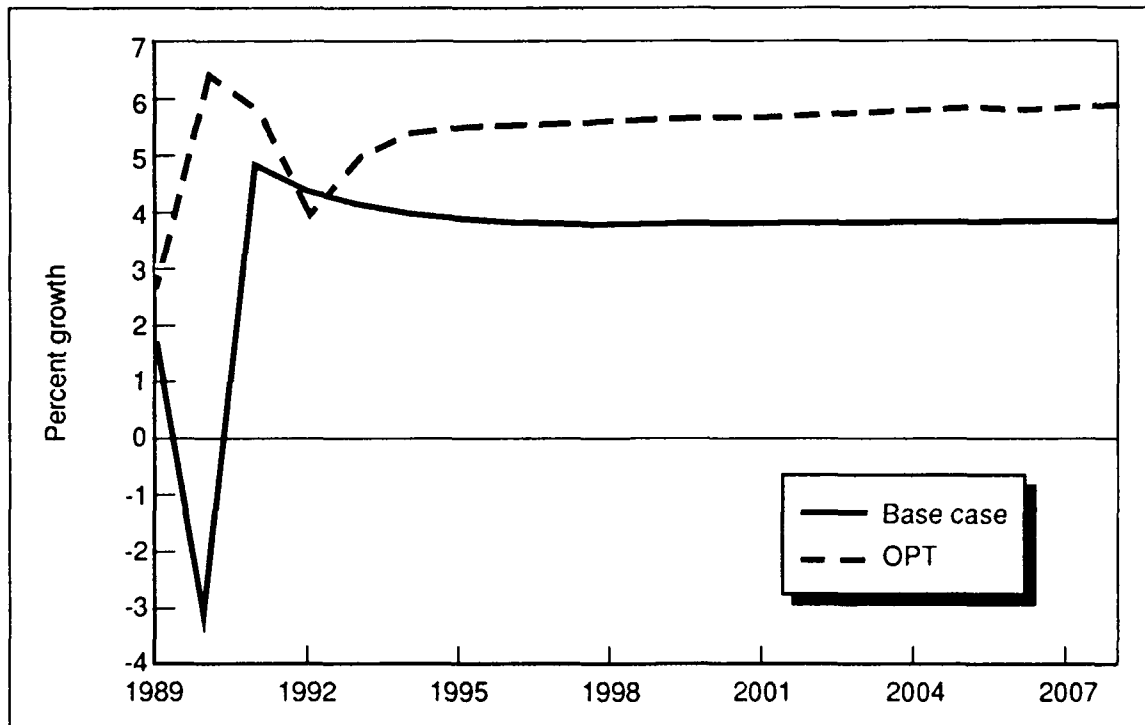


Fig. 5.2—Scenario OPT: real income growth (percent per year)

Without a sharp devaluation of the peso, there is no absolute decline in Mexican real income. (See Figure 5.2.) There is a small temporary slowing of growth in 1992, when the relatively small adjustment occurs. The long-run steady state growth rate in this scenario is about 5.3 percent per year, well above the 3.8 percent rate of the base case. The optimistic scenario also avoids any declines in real per capita incomes and produces per capita growth rates that reach almost 4 percent per year by the end of the simulation period. (See Figure 5.3.)

Another consequence of avoiding a major devaluation is that the burden of servicing Mexico's foreign debt rises only slightly above current levels. At their peak in 1993, net factor payments are only 6.6 percent of Mexican GNP, compared to about 6 percent in 1989. Even with continuous inflows of foreign capital after 1992, the burden of net factor payments continues to decline. (Figure 5.4.)

#### A PESSIMISTIC CASE

The assumptions that lie behind the pessimistic case are these:

1. *Debt reduction.* Although the July 1989 agreement between Mexico and its creditor banks still brings important debt relief for Mexico, the fraction of banks choosing to reduce either principal or interest is smaller than in the optimistic case. In this case, the effective amount of debt forgiveness is \$10 billion (as compared with \$12.9 billion in the optimistic case.)
2. *Lower saving rate.* Total Mexican domestic saving is only 17 percent of GNP rather than the 25 percent assumed in the base case and in the optimistic scenario. Although the Mexican saving rate has been higher in recent years, 17 percent was typical during the periods of populist economic policies from the mid-1960s to the late 1970s. (See Figure 2.3.) A reduced saving rate might come about in the future if the Mexican government deficit widens as a consequence of pressures on the government to restore subsidies and to take over control once again of major industries.
3. *Lower total factor productivity growth.* Efforts to reform Mexican economic institutions are less than fully successful; as a result, total factor productivity growth is only 0.5 percent per year.

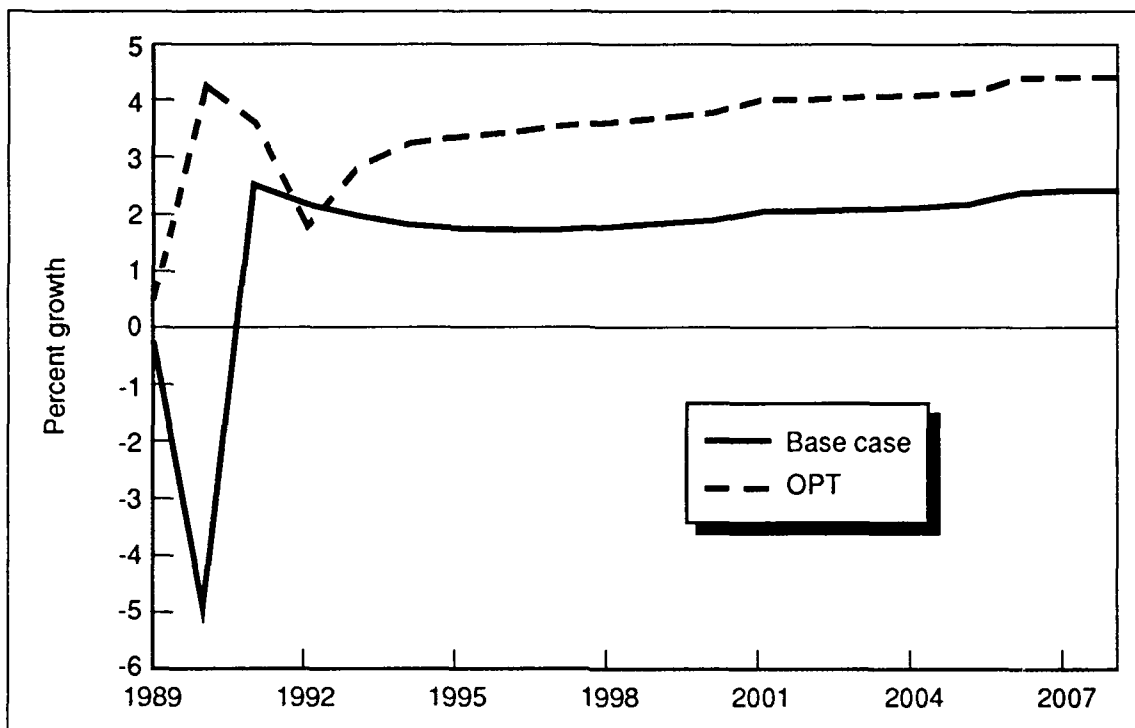


Fig. 5.3—Scenario OPT: real per capita income growth (percent per year)

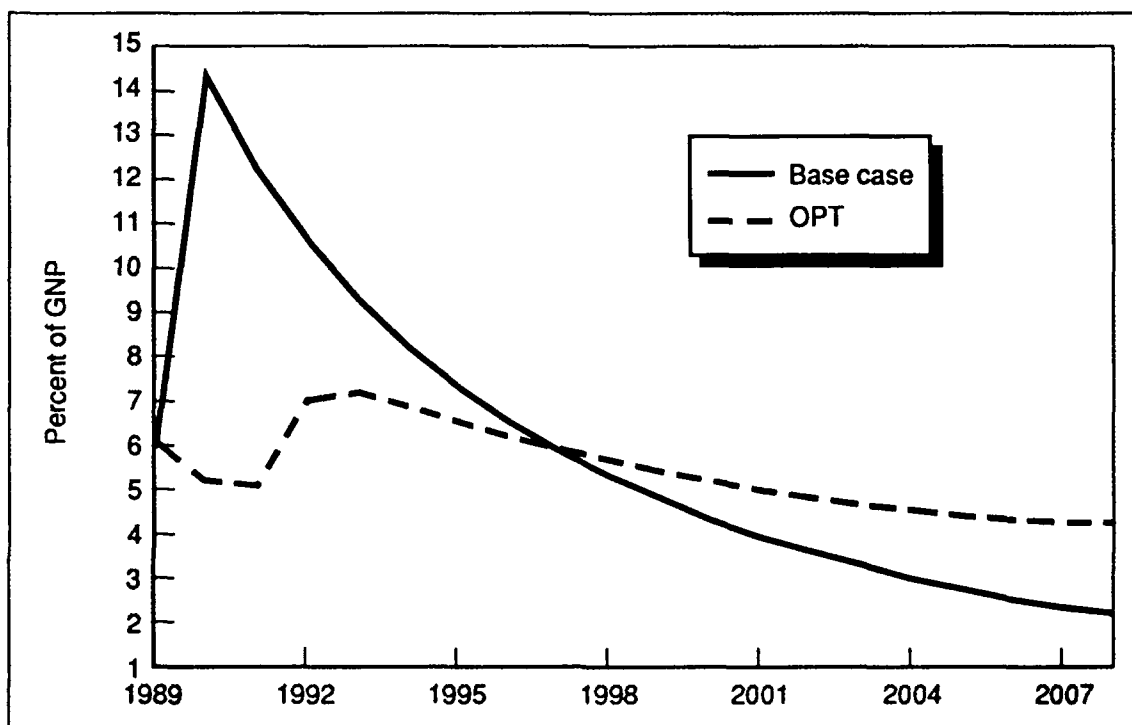


Fig. 5.4—Scenario OPT: net factor payments (percent of GNP)

4. *No net capital inflows.* Banks and foreign investors remain wary of Mexico's future economic prospects and provide no net inflow of foreign capital after 1989.

The debt relief assumed in this scenario (labeled PESS) does keep the peso/dollar exchange rate from falling as sharply in the pessimistic case as in the base case. (Figure 5.5.) This results in a decline in real GNP in 1990 that is smaller than in the base case but still substantial. (Figure 5.6.) The lower total factor productivity growth and the lower saving rate in the pessimistic case, however, result in a much lower long-term rate of real income growth than in the base case. In per capita terms, real income growth is negative for most of the simulation period. (Figure 5.7.) The assumed reduction in the domestic saving rate brings a one-time rise in real per capita consumption; but after that, real per capita consumption shows growth rates identical to real per capita income. That is, real per capita consumption declines for most of the simulation period. By the end of the simulation period, real per capita consumption in the pessimistic case is 28 percent below its level in the base case.

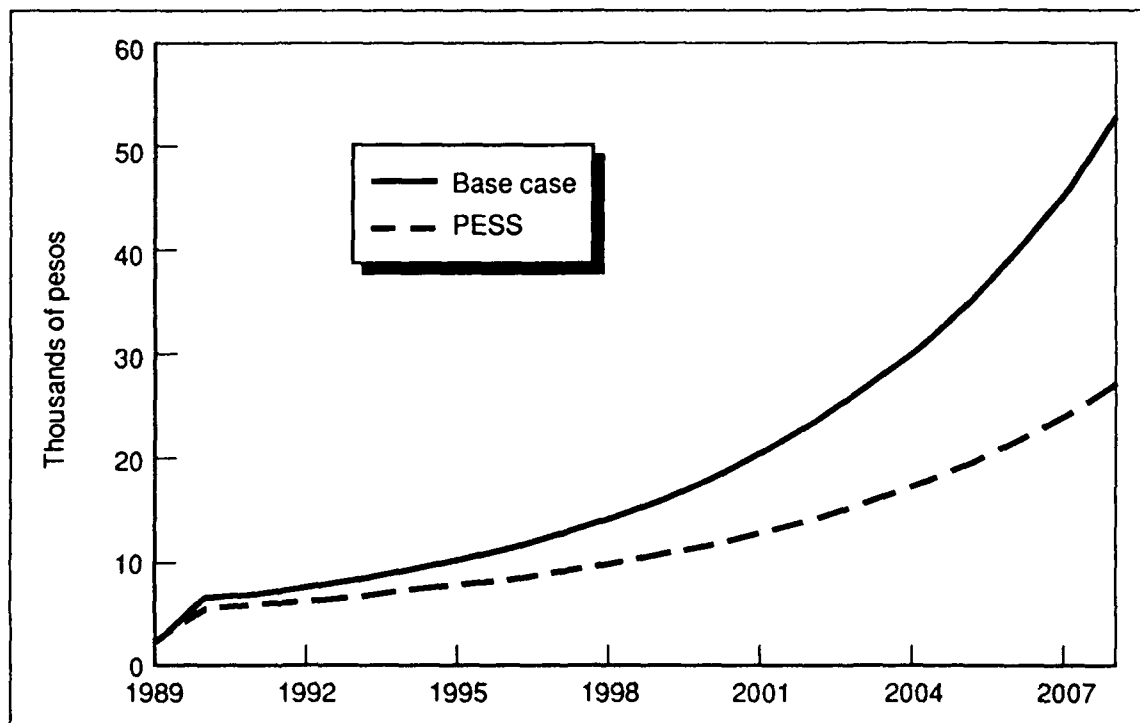


Fig. 5.5—Scenario PESS: exchange rate (pesos per dollar)

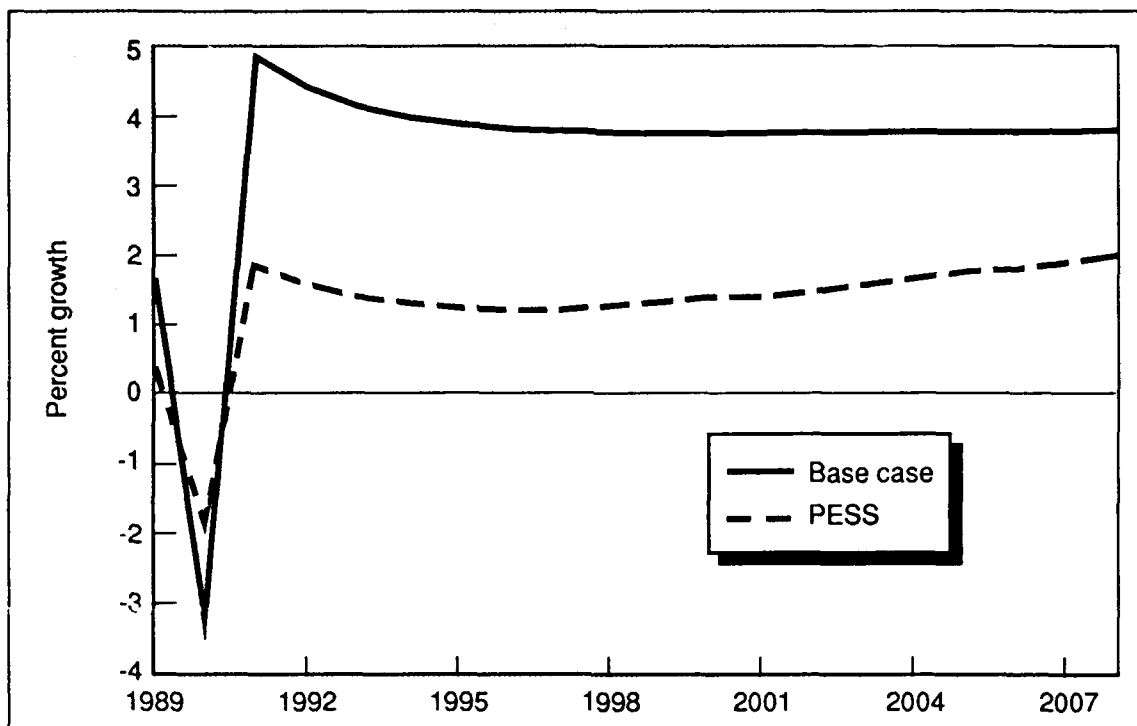


Fig. 5.6—Scenario PESS: real income growth (percent per year)

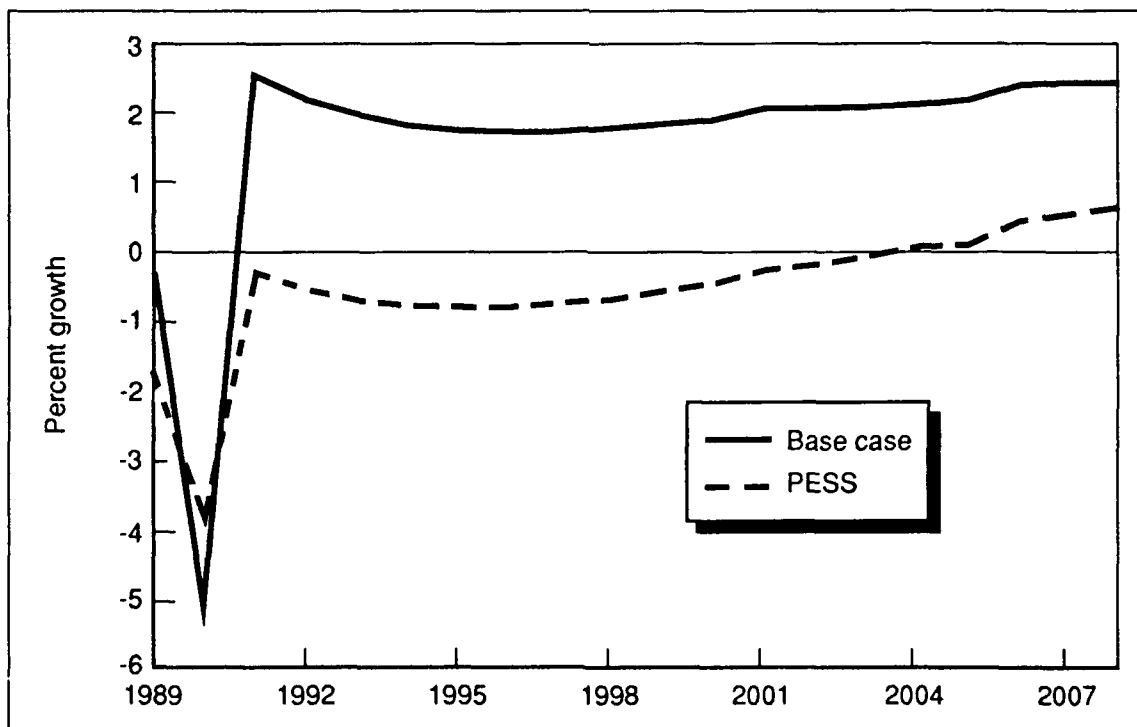


Fig. 5.7—Scenario PESS: real per capita income growth (percent per year)

Needless to say, 12 or 15 years of declining real per capita income and consumption in Mexico would be untenable. It would almost certainly breed political instability. It is important to remember, though, that the situation giving rise to this disastrous scenario is characterized by:

- total factor productivity growth that is more rapid than the average for the last 28 years,
- a national saving rate that was typical for an extended period in the 1960s and 1970s, and
- an inflow of foreign capital that is adequate to offset repayments of debt principal and Mexican capital outflows.

In short, these are not extreme assumptions. The implication should be clear: Failure to make the Mexican economy more efficient through economic reform, failure to control the government deficit, and failure to attract significant amounts of foreign capital over the next ten to twenty years could easily spell disaster for the Mexican economy, and with it the Mexican political system.

## VI. SOME CONCLUSIONS

The preceding sections suggest that Mexican economic prospects could be quite bright. Reasonable assumptions about oil prices, growth in export volumes, total factor productivity growth, domestic saving, and inflows of foreign capital can combine to generate projections of quite robust growth. Absolute declines in real per capita income can be avoided, and by the turn of the century real per capita income could be growing by more than 4 percent annually. Exercises with the model also suggest, however, that other assumptions—just as reasonable—about the same factors can project economic circumstances in Mexico that would be truly disastrous: a sharp decline in living standards sometime in the next few years, and gradually declining real per capita income in succeeding years.

What may not be immediately apparent is that the starting assumptions for the most optimistic and the most pessimistic scenarios are not all that far apart. Consider the following:

- Both scenarios assume debt reduction roughly in line with what was agreed upon by Mexico and its bank creditors in July 1989.
- The pessimistic case foresees oil prices no lower in real terms than they are today. The optimistic case assumes oil prices only 25 percent higher. To put this in perspective, the change in average oil prices from 1988 to 1989—a period that has not been marked by major disruptions in oil markets—was more than 40 percent.
- The pessimistic case assumes domestic saving at the rate that prevailed in Mexico from the mid-1960s through the mid-1970s. The most optimistic case assumes a saving rate that has been achieved only in the most recent years. Domestic saving in the future will depend critically on the ability of the Mexican government to control the government deficit. The Salinas administration has made a creditable start in this direction, but it is still too early to be sure of complete success.
- The difference in the growth of Mexican export volumes between optimistic and pessimistic cases is small—less than one-third of one per percent per year. Whether the United States or other

industrialized countries can or will offer Mexico sufficiently liberalized trading rules to allow even this modest increase in export growth remains to be seen.

- The pessimistic case assumes a rate of productivity growth that is roughly in line with Mexican experience over the last 25 years. The rates of productivity growth embedded in the optimistic case are not unprecedented, but have been achieved in Mexico for brief periods only. Achieving these rates of productivity growth in the future will require large-scale and continuing reform of Mexican economic institutions.
- The optimistic scenario depends on a continuing substantial inflow of foreign capital into Mexico. The pessimistic case assumes that enough new foreign investment and lending is forthcoming to offset private sector capital flight and scheduled repayments of debt principal by Mexico. In short, the pessimistic case assumes a larger net inflow of foreign capital than Mexico was able to attract in 1988.

The point here is that Mexico's economy is poised on something of a knife edge. The difference between dramatic economic success and catastrophic failure, and quite plausibly between political cohesion and severe instability, will be determined by changes in underlying circumstances and conditions that are small by historical standards.

The modeling exercise provides some clues as to what the U.S. government can and cannot do to improve Mexico's economic prospects. Some important factors, such as oil prices, are quite beyond the control of U.S. authorities. Other factors can be influenced directly only by Mexico itself: the size of the government deficit and thus domestic saving; the pace of economic reform and thus the rate of productivity growth; and the incentives for Mexicans to maintain financial assets in Mexico and thus the extent of capital flight. In these areas, the United States can provide encouragement and technical assistance, but presumably little else.

The model also illustrates the importance of some external factors in shaping Mexico's economic future—principally the extent of debt forgiveness and capital flows into Mexico. The recent three-way negotiations (involving the Mexican and U.S. governments and Mexico's creditor banks) suggest that the U.S. government can play a role in encouraging both debt forgiveness and new lending, but during the next few years the scope for new initiatives of this sort (at least insofar as

private capital is involved) is likely to be quite limited. The U.S. government could take direct action in the area of trade policy to enhance Mexico's economic prospects, eliminating obstacles to Mexican exports. A worthwhile subject for future research will be the potential for U.S./Mexican trade liberalization and the likely consequences of such measures for the Mexican economy.

Finally, the U.S. government has the capacity to lend directly to Mexico or to support lending to Mexico by the World Bank or the International Monetary Fund. The model suggests that the capital resources necessary to support an acceptable growth rate in Mexico in coming years will be far greater than could plausibly be provided through a combination of U.S., World Bank, or I.M.F. lending. Nevertheless, lending from these sources could be crucial as part of a strategy to postpone painful adjustments in Mexico for a year or so. If other underlying factors are acting to strengthen the Mexican economy, postponing the adjustment process may be an attractive strategy, giving Mexico time to build up an economic cushion, the better to absorb the inevitable adjustment. As long as the situation is not seriously deteriorating, the model also suggests that the future economic costs associated with temporizing policies are not high; U.S. assistance in postponing necessary economic hardship to a time when the current government has consolidated its position more thoroughly might be a workable strategy.

## **Appendix**

### **SOME SENSITIVITY ANALYSES**

This Appendix demonstrates the effects of changes in some key model parameters and assumptions.

#### **Variations in Trade Elasticities**

Section II noted that unconstrained estimation of the import and export equations (Equations 9 and 10) produces suspiciously high values for the income elasticities of Mexican imports and non-oil exports. Rather than use these estimated elasticities in the base case, the equations were reestimated, constraining the income elasticities to equal one. Using the unconstrained estimates, however, does not change the basic story. (Appendix Figures A.1 through A.3 compare some aspects of the base case scenario with the scenario using unconstrained elasticity estimates in the trade equations. The latter case is denoted TRADE.) Although the peso is stronger in the out-years of scenario TRADE, the near-term sharp devaluation is not avoided (Figure A.1). Consequently, the sharp increase in net factor payments as a fraction of GNP is not avoided either (Figure A.2). Real income growth rates are almost identical in the two scenarios (Figure A.3).

#### **Variations in Shares of National Income**

Section II also noted some uncertainty about the estimate of  $\alpha$  in the production function (Equation 1). The uncertainty arises because it is not possible to divide proprietors' income into returns to capital and to labor. Scenario SHARES tests the sensitivity of model results to variations in the value of  $\alpha$ . In the base case, the share of labor in national income ( $\alpha$ ) is 0.33 and the share of capital ( $1 - \alpha$ ) is 0.67. In scenario SHARES, these shares are reversed. This reversal almost certainly overcorrects for any bias in the original estimate of  $\alpha$ , and yet there is little difference between the base case and SHARE scenarios. (See Figures A.4 through A.6.)

### **Variations in the Effectiveness of U.S. Immigration Policies**

The base case rests on an assumption that recently enacted U.S. immigration laws are sufficiently effective to reduce the net flow of Mexican workers to the United States—initially by about a third and in the future by considerably more. Scenario HIEMIG tests the sensitivity of model results to assumptions about the rate of emigration from Mexico. In essence, this scenario postulates that Mexican emigration is unaffected by changes in U.S. laws. As would be expected, both the Mexican labor force and total Mexican population grow more slowly in this scenario. In the HIEMIG scenario, labor force growth is initially about 0.5 percent slower per year than in the base case, with the difference declining to about 0.3 percent by early in the next century. Total population growth is about 0.3 percent per year lower in the early years of the HIEMIG scenario and about 0.2 percent per year at the end of the model period.

Figures A.7 through A.11 illustrate the effects of this change. Note that both real output growth (Figure A.7) and real income growth (Figure A.8) are a bit slower in the HIEMIG case than in the base case. Slower labor force growth brings slower economic growth. There is little difference in the exchange rate (Figure A.9), net factor payments as a share of GNP (Figure A.10), or growth of real per capita income (Figure A.11). The effect on the exchange rate is probably understated. The model does not take account of remittances by Mexican workers abroad. In reality, the larger scale of Mexican emigration in the HIEMIG case would probably bring about higher remittances, which in turn would strengthen the exchange rate beyond what is predicted by the model. It seems unlikely, though, that this effect would importantly change the general character of the model simulations.

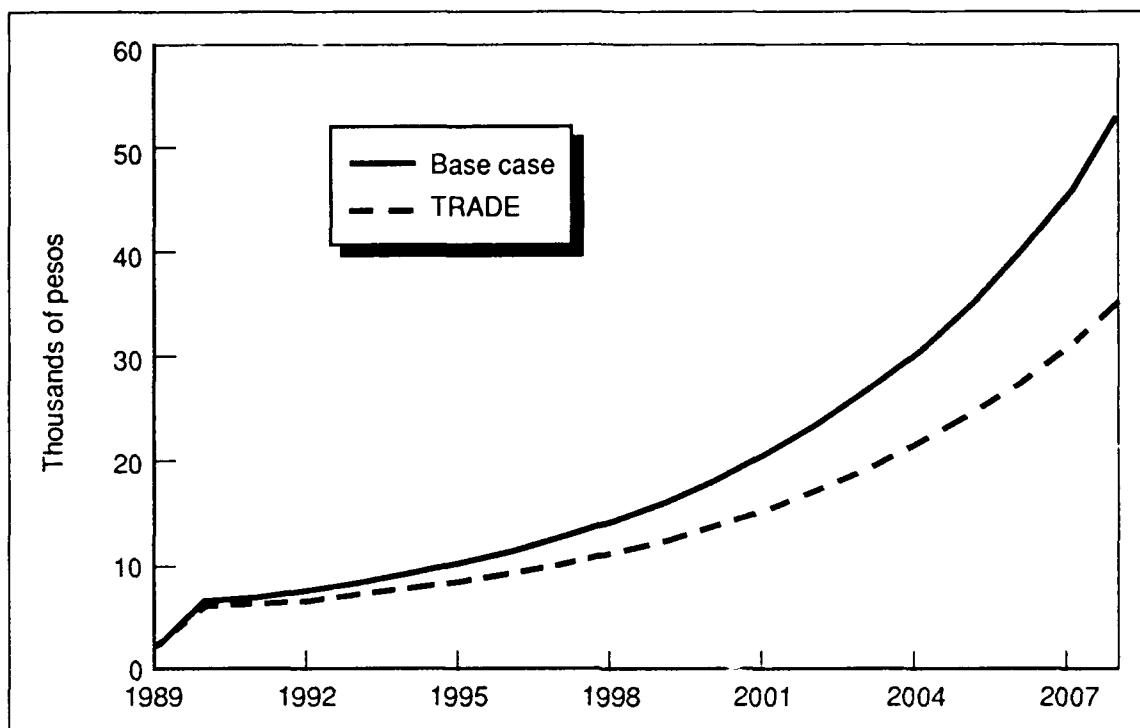


Fig. A.1—Scenario TRADE: exchange rate (pesos per dollar)

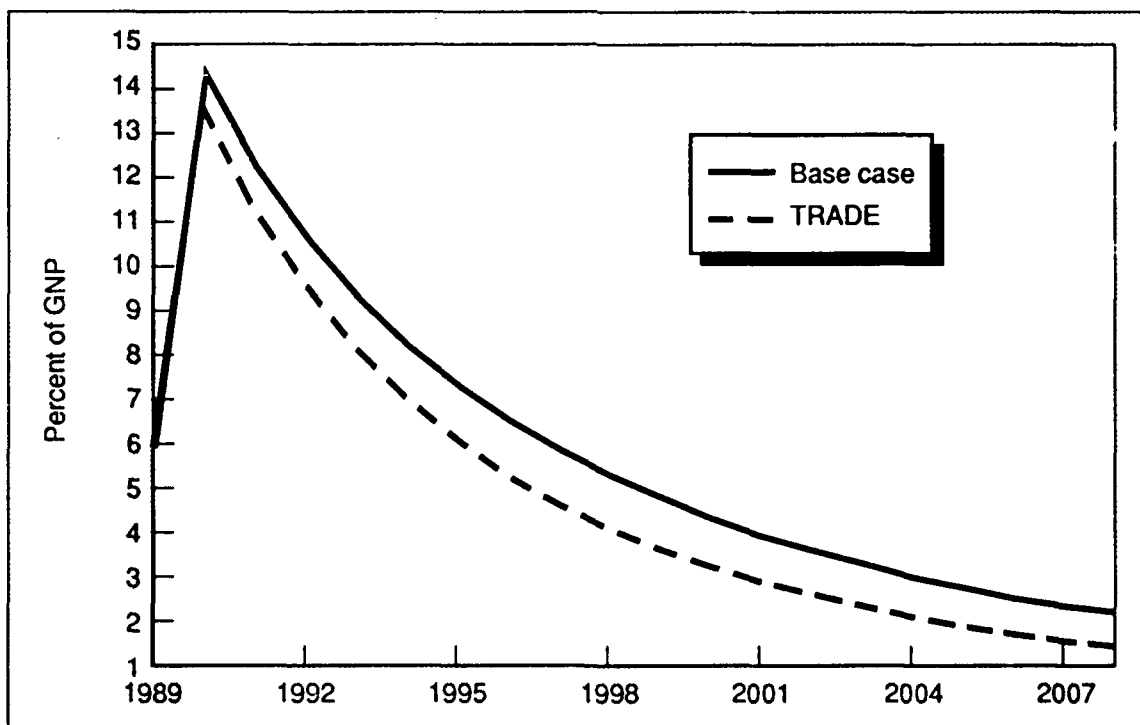


Fig. A.2—Scenario TRADE: net factor payments (percent of GNP)

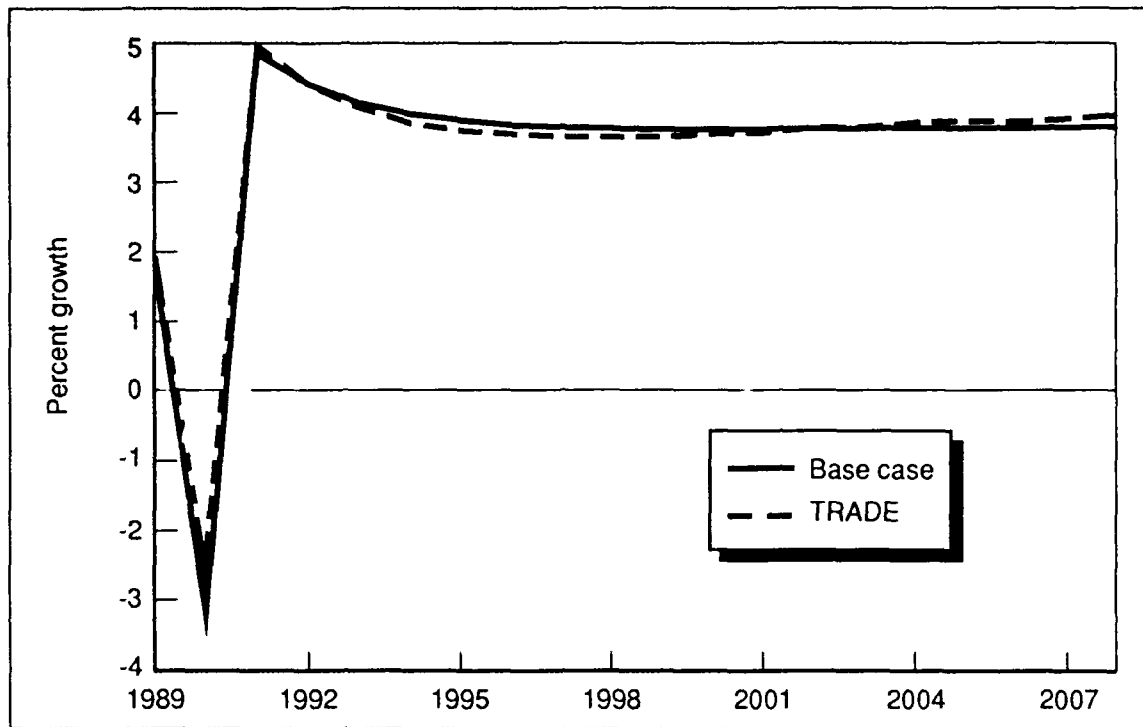


Fig. A.3—Scenario TRADE: real income growth (percent per year)

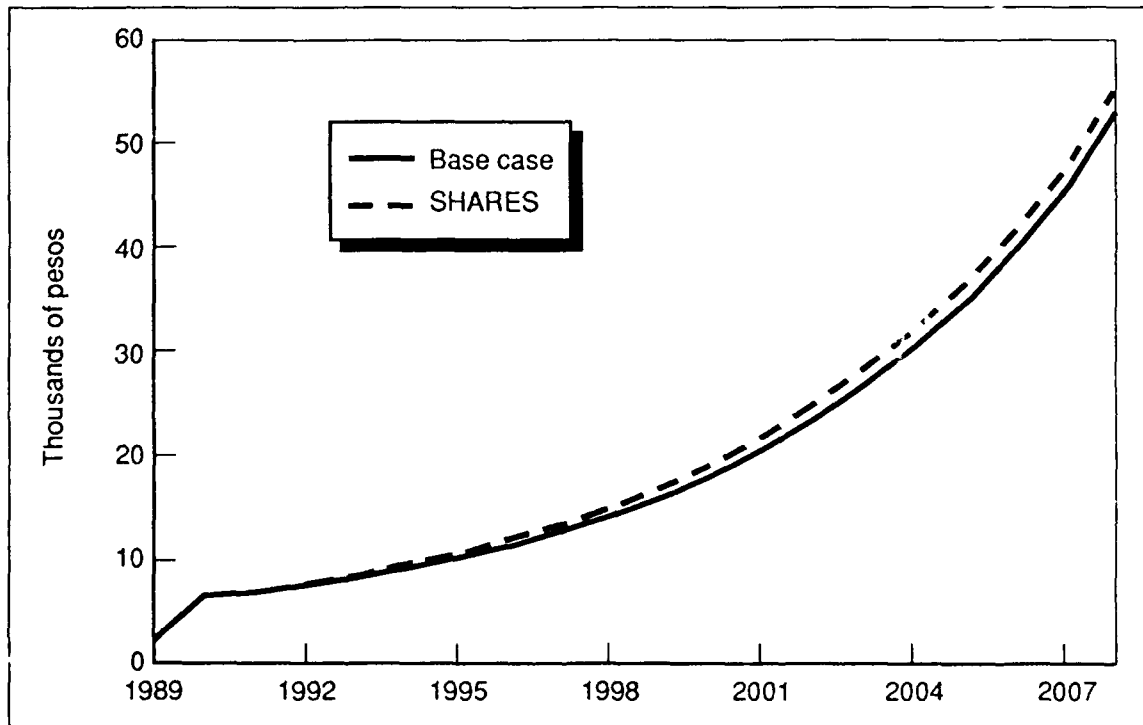


Fig. A 4—Scenario SHARES: exchange rate (pesos per dollar)

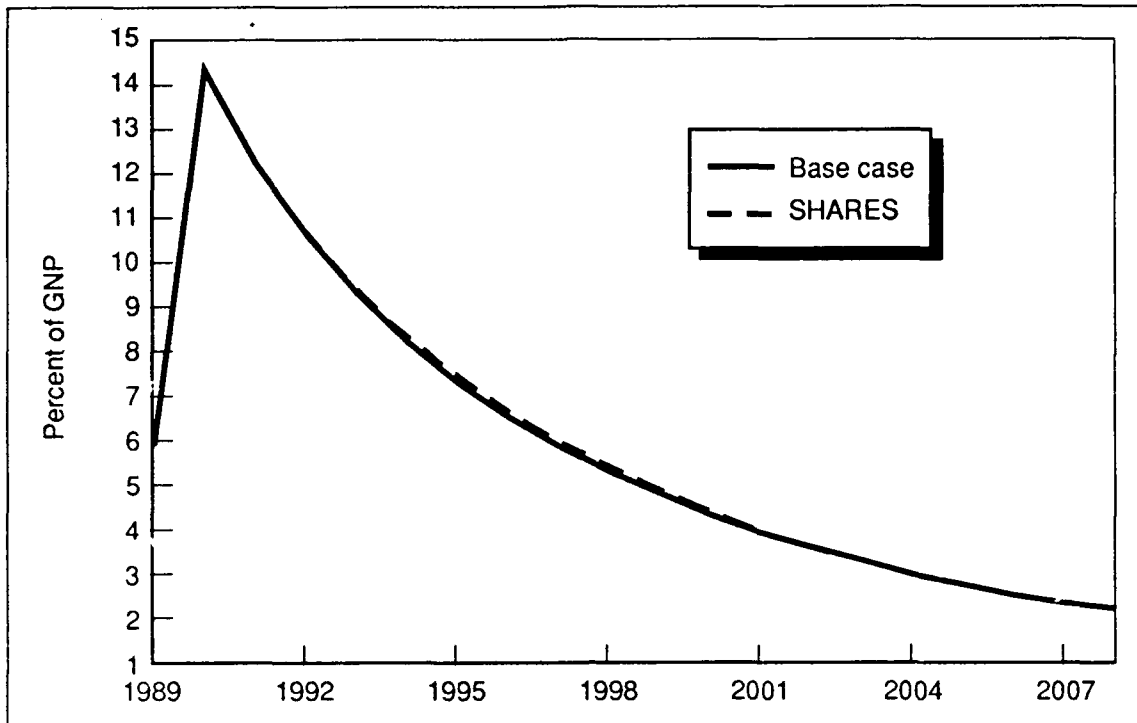


Fig. A.5—Scenario SHARES: net factor payments (percent of GNP)

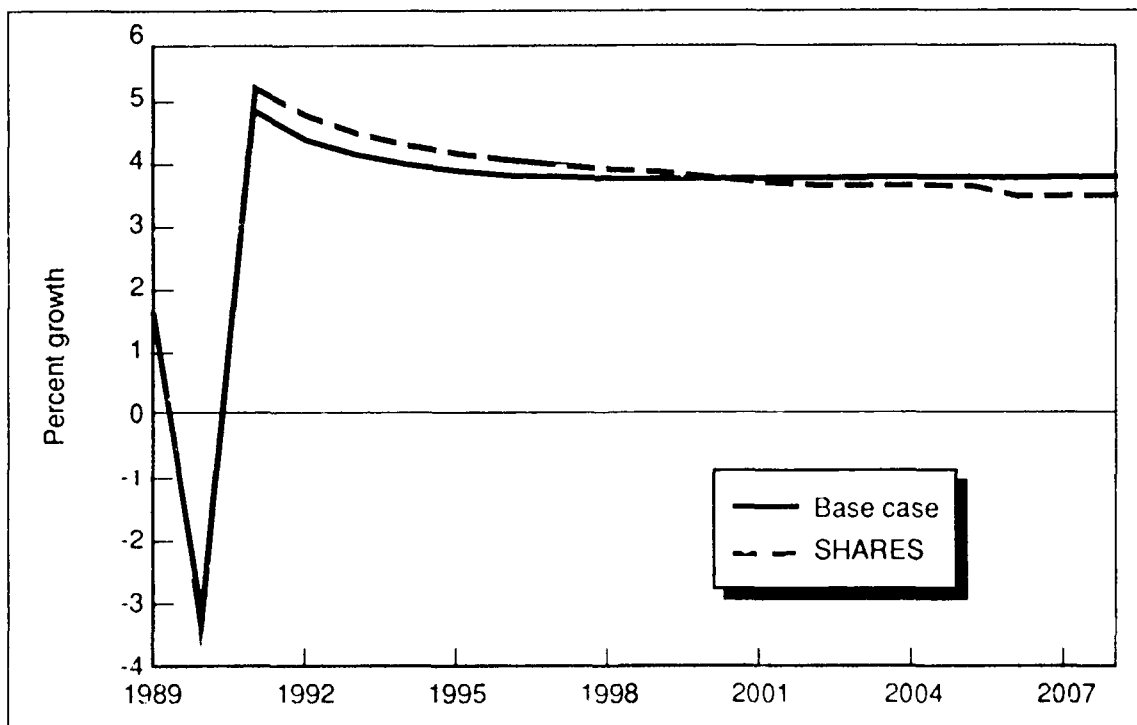


Fig. A.6—Scenario SHARES: real income growth (percent per year)

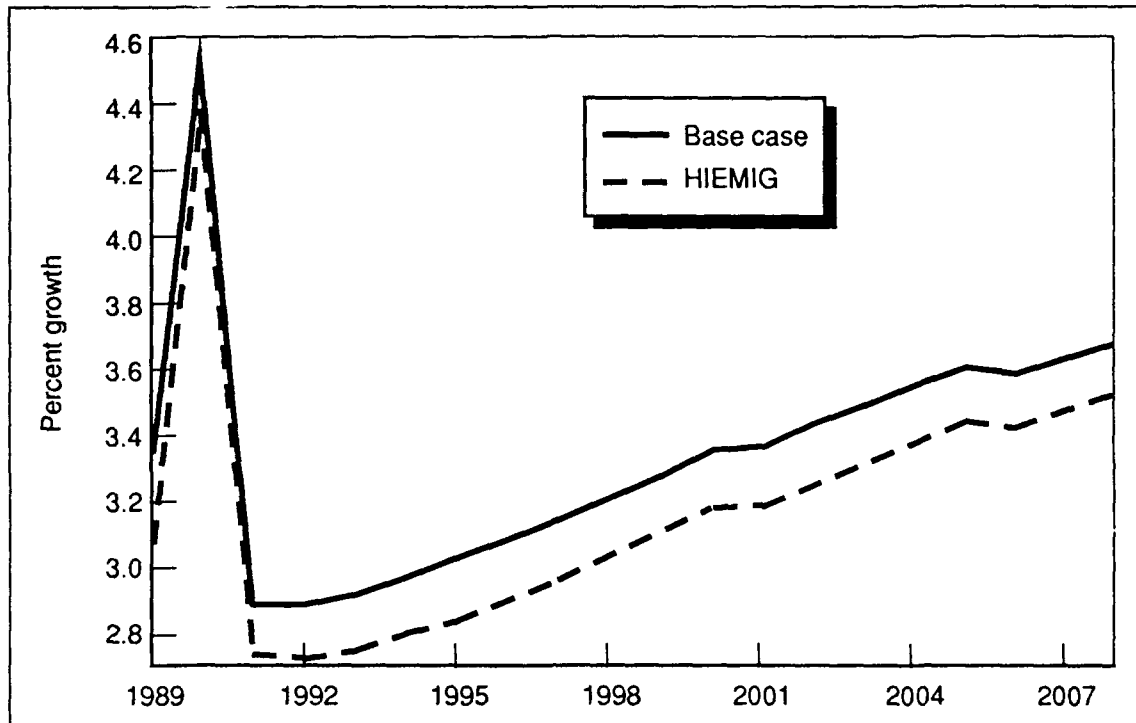


Fig. A.7—Scenario HIEMIG: real GDP growth (percent per year)

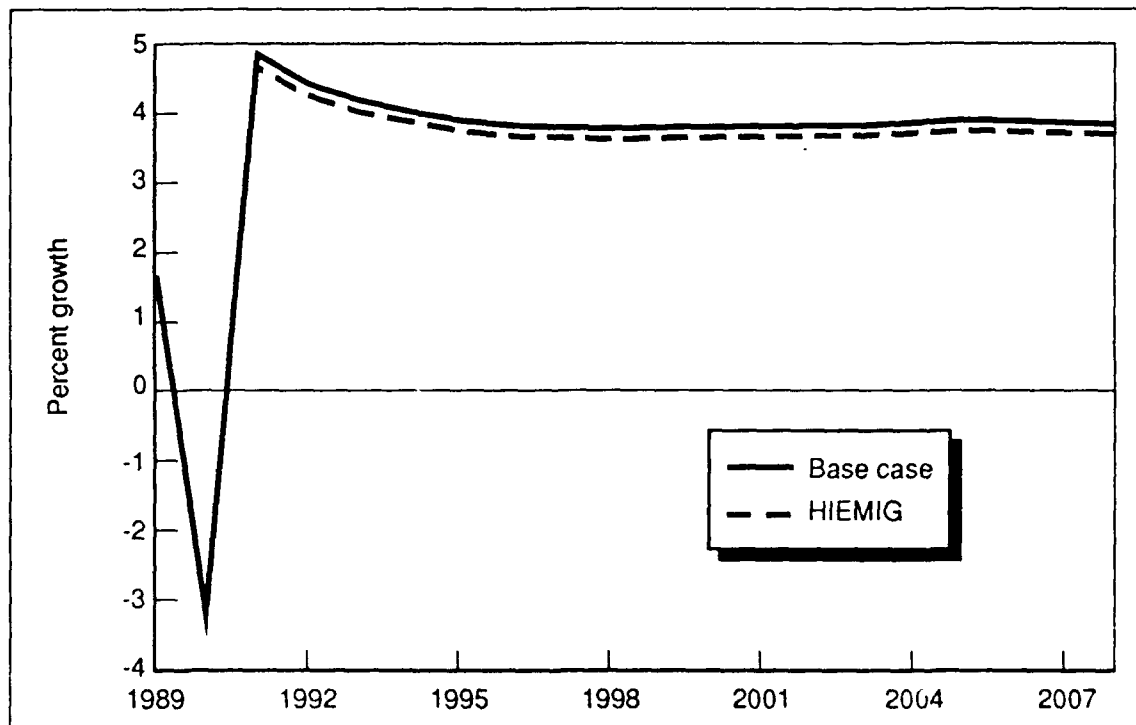


Fig. A.8—Scenario HIEMIG: real income growth (percent per year)

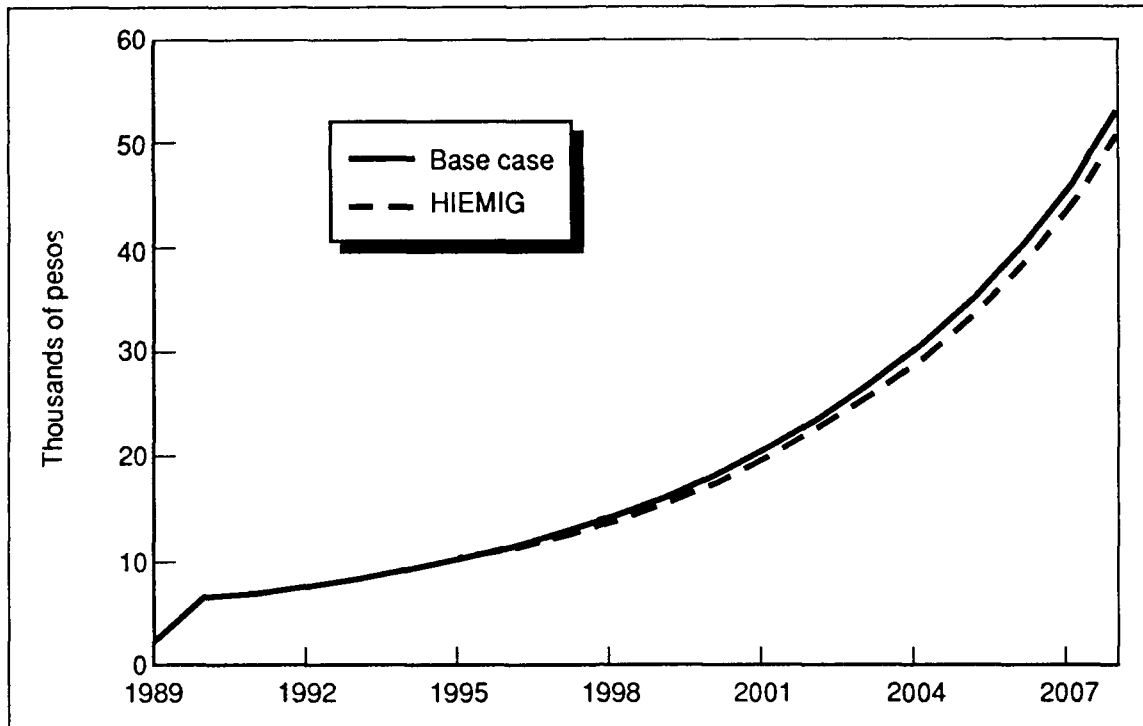


Fig. A.9—Scenario HIEMIG: exchange rate (pesos per dollar)

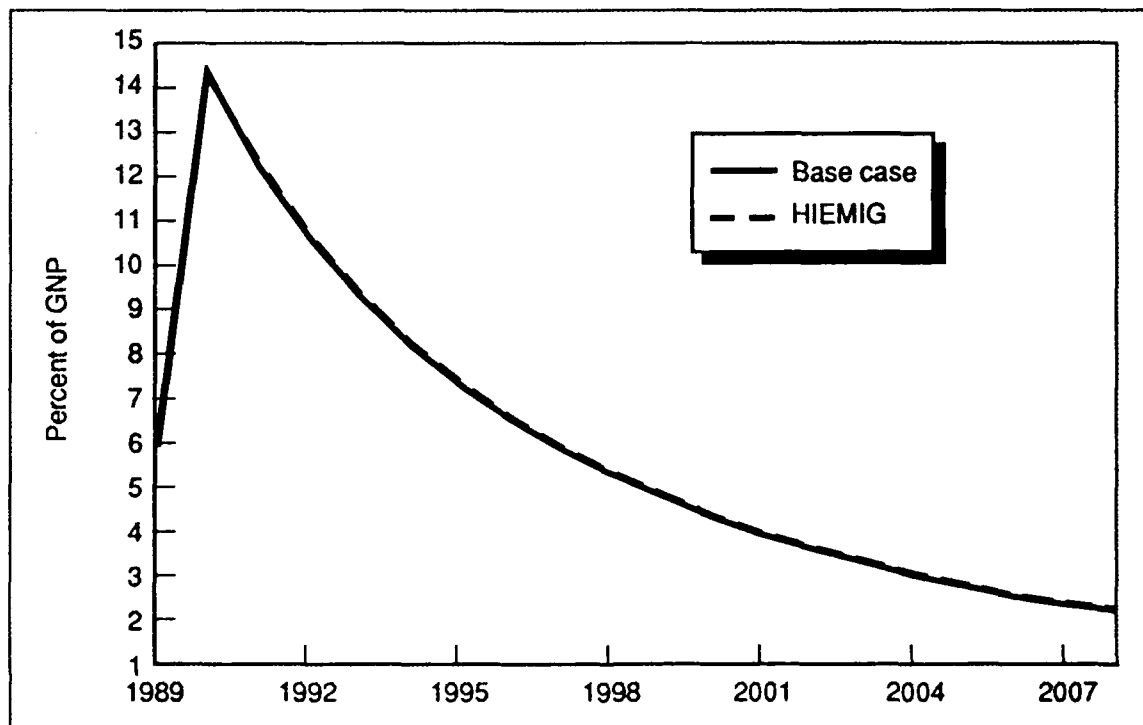


Fig. A.10—Scenario HIEMIG: net factor payments (percent of GNP)

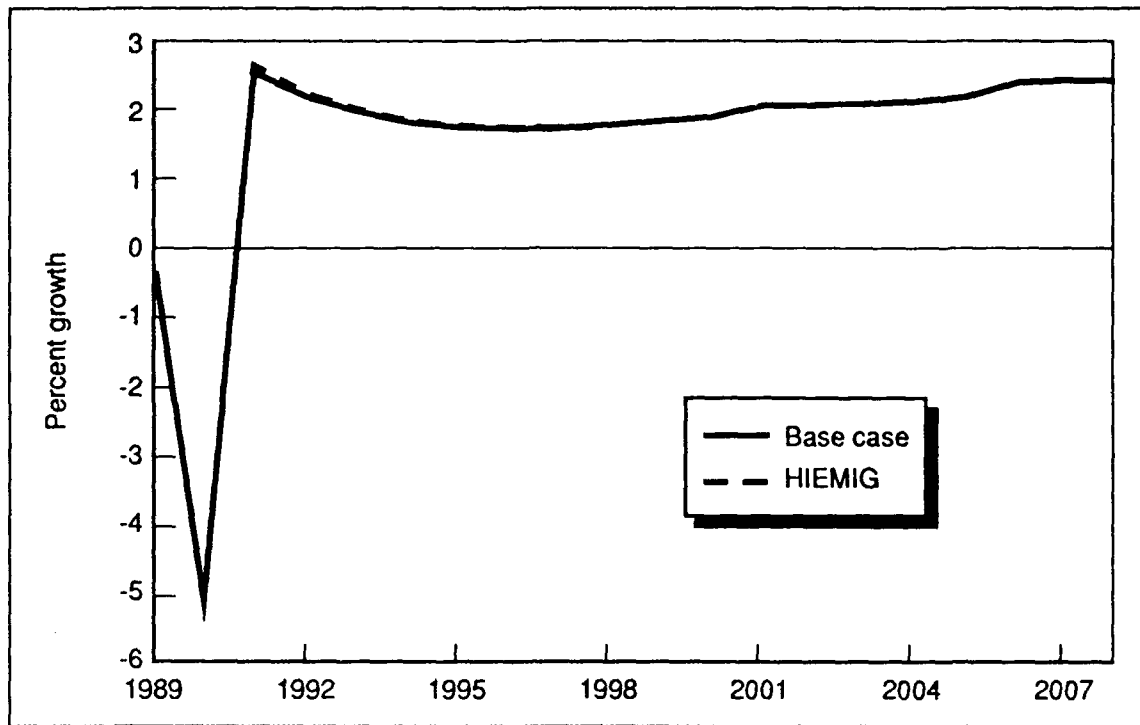


Fig. A.11—Scenario HIEMIG: real per capita income growth (percent per year)