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Management of Oil Windfalls in Mexico

Historical Experience and Policy Options for the Future

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Robert Duval-Hernandez

Policy options for protecting Mexico's economy from volatility in oil revenues without eliminating the benefits from rising prices include a stabilization fund and hedging strategies on international markets. A stabilization fund and hedging strategies can complement each other—the fund working as the main recipient of revenues, and the hedging strategies managing short-lived movements in prices. This joint strategy would reduce the size of the fund and the probability of its going bankrupt.

Summary findings

The macroeconomic impact of commodity windfalls has provided fertile ground for research since the 1970s. Particularly affected are developing economies that rely heavily on commodity exports. In the case of oil windfalls, cross-country experience is vast: Indonesia, Kazakhstan, Mexico, Nigeria, the Russian Federation, and República Bolivariana de Venezuela have all been buffeted by such windfalls. Everhart and Duval-Hernandez investigate Mexico's experience.

They provide an overview of oil's impact on the Mexican economy and of the management of oil rents engineered by the government from the 1970s to date. A third of government revenues come from the hydrocarbon sector—especially oil exports. The reliance of public finances on a single commodity means that shocks threaten the economy's fiscal balance and stability.

Policy options for protecting the economy from volatility in oil revenues without eliminating the benefits from rising prices include a stabilization fund and hedging strategies on international markets, which the authors discuss. The stabilization fund smooths consumption and reduces the costs associated with volatile spending. The fund and hedging strategies can complement each other—the fund working as the main recipient of revenues, and the hedging strategies managing short-lived movements in prices. This joint strategy would also reduce the size of the fund and the probability of its going bankrupt.

Management of Oil Windfalls in Mexico: Historical Experience and Policy Options for the Future
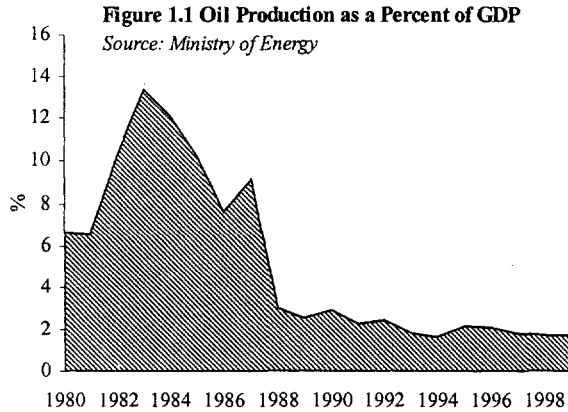
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INTRODUCTION

1.1   The macroeconomic impact of commodity windfalls has provided fertile research grounds for the last twenty years. Particularly affected are developing economies with a heavy reliance on commodity exports. In the case of oil windfalls, cross-country experience is vast: Nigeria, Indonesia, Venezuela and Mexico are examples of countries buffeted by these windfalls. This study will investigate the Mexican experience.

1.2   Since the beginning of the twentieth century Mexico has utilized its oil resources in a significant manner. In 1938, the oil industry was nationalized by the President Lázaro Cárdenas, initiating a period of state control in the hydrocarbons sector that continues today. In the decades of industrialization, oil's importance in the economy diminished as manufacturing and service sectors grew. By the beginning of the 1970s, the oil sector represented only 2.5 percent of GDP and 3.5 percent of federal government tax revenues.

Figure 1.1 Oil Production as a Percent of GDP
Source: Ministry of Energy

1.3   In recent years oil production's importance to the Mexican economy has varied, fluctuating from almost 14 percent of GDP in 1983, down to 1.7 percent in 1999. As figure 1.2 shows, oil exports (as a percentage of total exports) have also decreased over time. Although this suggests a relative lessening of the dependency on oil exports, it is important to note that oil revenues still represent about one third of public sector revenues, and since the late 1970s the Mexican government has relied on oil revenues for financing expenditures and managing debt.

Figure 1.2 Composition of Exports
Source: INEGI

☐ oil exports ☐ non-oil exports
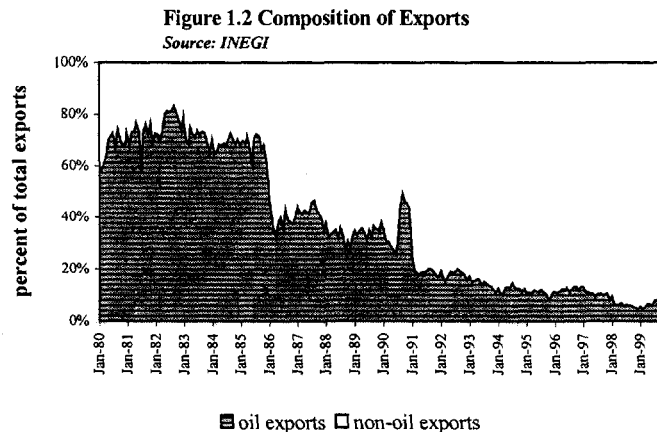
1.4   This study provides an overview of the impact of oil on the Mexican economy, and the management of oil rents engineered by the government from the 1970s to date. The first section provides an overview of the impact of the oil industry on the economy during the last twenty-five years. Section two reviews the main findings of the literature on rent management of commodity windfalls. Sections three and four describe the Mexican experience in oil

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rents management from 1973 to 1986 and from 1986 to date.[1] The last section concludes and presents policy recommendations.

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[1] 1986 represents a natural break point for the study, it is the year of the greatest oil price drop in Mexico's experience with exports.

I. OIL AND THE MEXICAN ECONOMY

1.5   After twenty years of economic stability and growth (the so-called "desarrollo estabilizador" period), Mexico began the 1970s with a new administration ushering in new macroeconomic policies. Troublesome outcomes of Luis Echeverria's administration included: increased public expenditure without a corresponding increase in government revenues, greater intervention of the state in the economy, growing inflation, a large foreign debt resulting from aggressive public sector borrowing, and an overvalued exchange rate. By 1976 private capital fled the country and a balance of payments crisis ensued, forcing the government to abandon exchange rate controls, leading to a peso devaluation of 40 percent.[2]

1.6   During this period major changes occurred in the oil market. The Arab oil embargo of October 1973 rocketed oil prices by almost 400 percent and roiled the world economy. About that time, PEMEX, the Mexican state-owned oil enterprise, made important discoveries of petroleum reserves in the south of the country. Initial consequences of the oil shock were negative for Mexico because production was inward oriented and did not cover domestic demand, however in the long run the internal and the external shocks were going to radically change the Mexican economy.

1.7   In 1976 José López Portillo was elected president, bringing with him a new economic strategy, a strategy basing economic growth on the exploitation of the recently discovered oil reserves. López Portillo hoped to emerge from the recession via increased oil exports at favorable prices and relaxed fiscal constraints.

1.8   The Mexican government used revenues from the new oil exports largely to finance major investment programs. In a famous speech to the Congress Jorge Díaz Serrano, the Director of PEMEX, stated:

> The World can be sure of some twenty more years living in the petroleum era, and Mexico has this time to generate wealth by taking advantage of high demand levels [and] high price levels paid at present and that will continue to rise until the year 2000. [...] The political cost for the country would be too high if we delay the construction of a powerful production platform that grants ourselves a permanent place in the world concert [...Mexico] will be stronger as the power of its oil industry augments, but we should never forget that this is a race against the clock.[3]

1.9   This statement shows, at least to a certain extent, that the government was conscious of the fragility of funding development of the country with oil production, and indicates that mismanagement came about as a result of excessively optimistic oil price forecasts.

1.10   During the 1973-1981 period several imbalances and inadequate policies had accumulated and increased the fragility of the economy. The current account deficit

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[2] For a brief summary on the macroeconomic environment during this period see Lustig (1992), ch.2 and García Alba and Serra (1984), ch. 1-3.

[3] Morales et. al. (1988), p.91

widened, generated by a rise in intermediate goods imports. These imbalances in the external accounts[4] were financed with external borrowing as the Mexican peso became increasingly overvalued. No longer sustainable, in 1981 a massive capital flight occurred, eliciting a government response of attempting to finance this flight with further short-term foreign borrowing. These policy missteps, coupled with the downturn in oil prices, led to the Mexican debt crisis of 1982. As Garcia and Serra (1984) point out, "if the downturn in [oil] prices had a dramatic impact at the end of the administration it was because the imbalances in fiscal and balance of payments accounts had reached a level that made them extremely sensitive to foreign currency."

1.11   In February 1982 the government devalued the peso by 70 percent. Although the current account deficit was largely corrected with this devaluation, the overall balance of payments deficit did not improve due to the increasing interest payments on external debt. Adding to the malaise were the following missteps: creation of a dual exchange rate system, suspension of payments on its external debt, implementation of foreign exchange controls, and nationalization of the private banks. Meanwhile, oil prices continued their declining trend until mid-1983. Over this period crude lost nearly 30 percent of its value, but still remained close to the end-1979 value (see Fig. 1.3).

Figure 1.3 Price History of Mexican Crude (nominal prices)
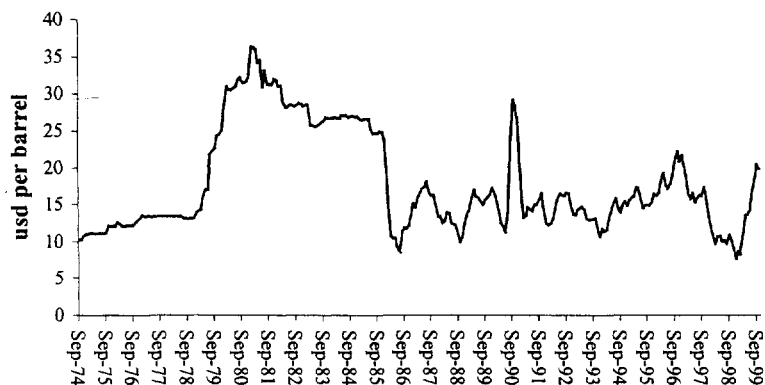
Source: INEGI and Garcia and Serra (1984)

1.12   In the years following, the Mexican government initiated radical structural adjustments aimed at meeting the crushing debt burden, some in response to conditions

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[4] By 1981 the trade deficit amounted to 3725.4 million US$, but excluding PEMEX transactions this deficit rises to 16044.7 million US$. See Garcia Alba and Serra (1984).

for receiving financial support of the IMF. From 1982 to 1985 the Mexican economy went into a severe recession. Structural adjustment policies had minor success in reordering the economy, and although oil prices remained stable around 25 US$ per barrel, by the end of 1985 another balance of payments crisis gripped the economy.


Box 1. *Dutch Disease*

Dutch Disease arises when a natural resource windfall generates a sudden increase in export earnings and draws resources out of the production of traded goods. So named after the crisis suffered in the 1960's by the Dutch manufacturing sector, caused by the export boom in the natural gas industry. The phenomenon could just as easily be called the Indonesian-Mexican-Nigerian-Venezuelan (oil), Thai (rice, rubber, tin), Colombian (coffee), Ivory Coast (coffee, cocoa, wood), or Zambian, Zairian (copper) disease.

Increased revenues resulting from a commodity boom increase the demand for goods in the economy and raise the price of non-tradables. As the price of tradable goods are internationally fixed, the impact of higher wages and real exchange rate appreciation diminish the overall productivity in the sectors that produce those goods. The long-run effects in the economy are uncertain depending on the specific macroeconomic conditions of the country and the policy response of the authorities. However, in the short-run, Dutch Disease has posed quite a challenge to several developing economies.

1.13   Before going any further with the analysis of the macroeconomic impact of the oil windfalls on the economy, some clarification of the nature of this episode is in order. Among the direct implications of the "Dutch Disease" syndrome are the appreciation of real exchange rate during the boom period and the diversion of resources away from the non-booming trading sectors. Examining Figure 1.4 it can be seen that until 1986 the real effective exchange rate and oil prices moved together, however in the years following, their movement appears unrelated.

Figure 1.4 Real Effective Exchange Rate vs. Oil Prices
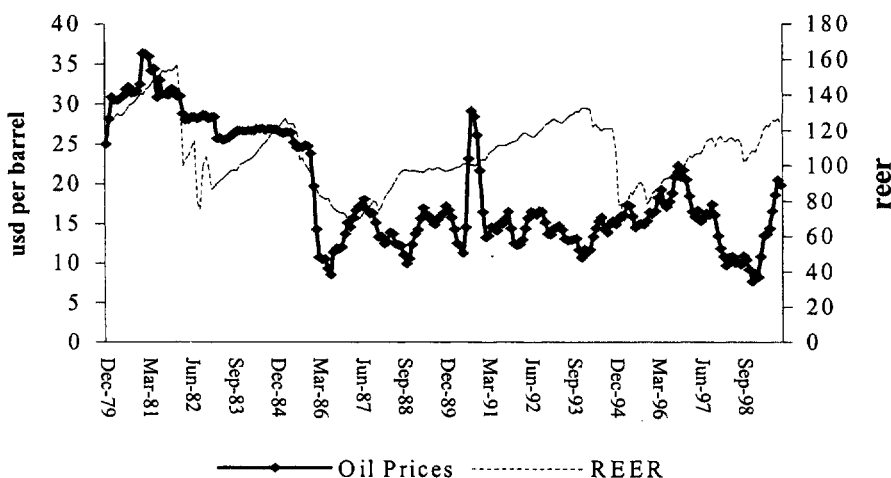
Source: IMF and INEGI

1.14   Further, a review of Table 1.1 reveals that GDP growth by sectors continued apace. It can be seen that the non-mining sectors were strong (i.e., the non-resource boom sectors of the economy), growing at rates between 6 and 7 percent, and in particular the manufacturing sector grew at a rate of 5.4 percent during the period of 1977-1982. Therefore, as Gavin (1996) points out, "what is **not** apparent from the production data is anything resembling the crowding out of nonbooming sectors depicted in "Dutch disease" theories; in early stages of the oil boom the entire economy grew rapidly, and in 1981-1985 the entire economy was correspondingly depressed."

Table 1.1 Average Annual GDP Growth

	1970-1972	1973-1976	1977-1982	1983-1986
Total	*6.16*	*5.95*	*6.57*	*-0.44*
Agriculture and Fishery	3.56	2.37	3.83	1.44
Mining	2.89	7.60	13.21	-0.72
Manufacturing Industry	6.27	5.68	5.40	-0.50
Construction	4.36	7.97	6.63	-5.36
Electricity, Gas and Water	9.79	10.21	8.89	4.52
Commerce, Restaurants and Hotels	7.21	6.44	8.80	-2.62
Transports & Communications	8.96	9.40	6.77	0.53
Financial Services and Housing	5.31	5.16	4.99	4.20
Other Services	7.08	5.90	5.96	1.13
Imputed Banking Services	7.87	5.47	9.73	3.03

Source: INEGI

1.15   An important feature is that when the authorities were confronted with a negative oil shock, adjustment in the oil industry was not accomplished via reductions in personnel, but with falling real average earnings (see Figure 1.5). It is interesting to note that although earnings fell in the oil industry with the 1981 shock, they remained considerably above the mean real earnings in other public sector employment.

Figure 1.5 Employment and Real Wages in Oil Industry

PEMEX Employment

Average Earnings in Public Sector
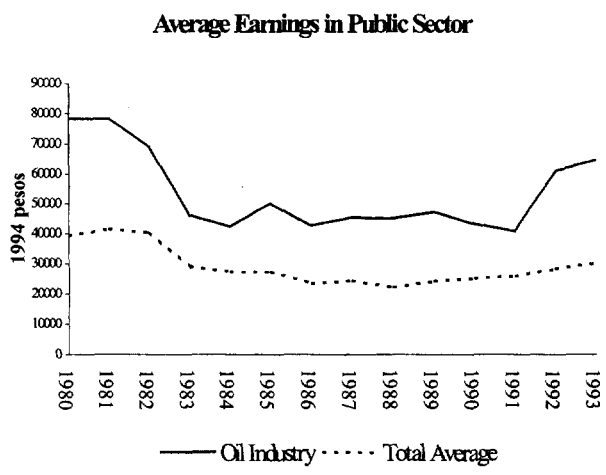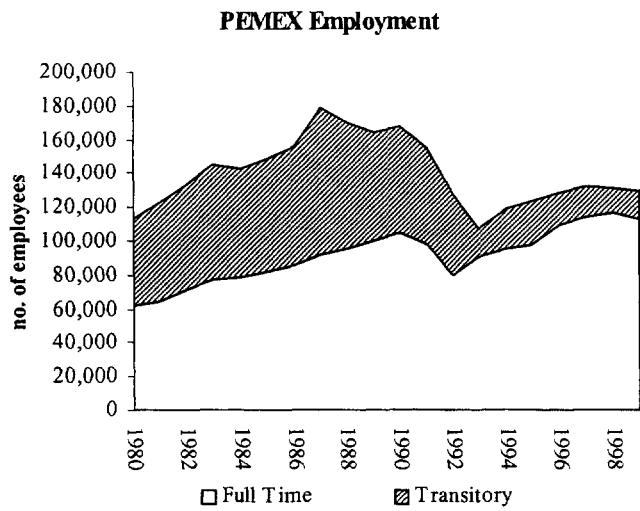
Source: INEGI

1.16   Mexico began 1986 with a balance of payments crisis, suspension of IMF financing (a consequence of failing to meet the required fiscal targets), and lingering effects of a major earthquake occurring in September of the previous year. In this environment oil prices began a precipitous drop. Between February and March 1986, the price per barrel fell from 25 US$ per barrel to 10 US$, a loss for the year of approximately 8.5 billion dollars in incoming foreign currency reserves, or 6.7 percent of

GDP.[5] The World Bank and the IMF intervened, attempting to alleviate Mexico's misery but a severe recession ensued: GDP fell by nearly 4 percent, inflation rose to more than 100 percent and the peso devalued by more than 45 percent. It was also in those years that the composition of Mexican exports changed radically (recall Figure 1.2), with a substantial reduction in the oil component. Nevertheless, the terms of trade remain heavily influenced by movements in oil prices (see Figure 1.6).

Figure 1.6 Terms of Trade and Oil Prices
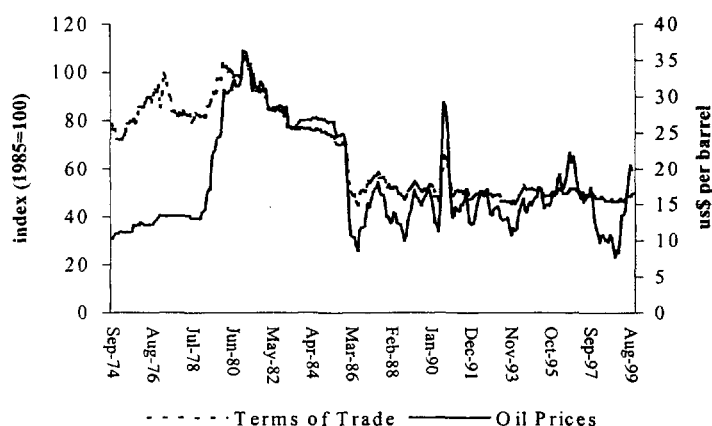
1.17   The relationship between oil prices and inflation is a bit more curious, with oil prices appearing to lead at times but this is a relationship undoubtedly confounded by the domestic price-fixing regime (see Figure 1.7). One thing quite apparent in the chart is the impact of the differing policy responses of the authorities when faced with a budget shortfall in 1986 versus 1998. Monetary financing of the deficit was used in 1986 with the concomitant rise in inflation, whereas fiscal cuts were the primary response in 1998.

Figure 1.7 Inflation Rate and Oil Prices

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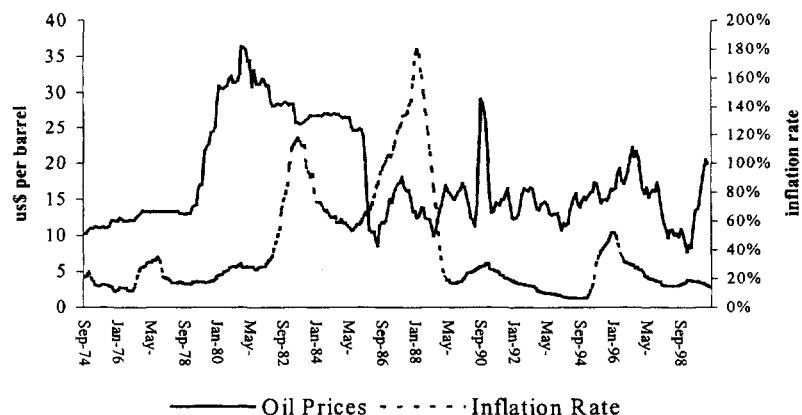
[5] Lustig (1992).

1.18   In the second half of the 1980s the Mexican economy continued to struggle. The authorities implemented additional structural adjustment policies, with the intent of opening of the economy, diversifying exports, and augmenting the participation of the private sector in the economy. From 1987 to 1993 the price of oil fluctuated around a mean of 14.25 US$ per barrel, with the exception of the Gulf War episode that briefly raised prices to 30 US$ per barrel. At the same time, the volume of oil exports stabilized around a level of 1300 thousand barrels per day (Figure 1.8).

Figure 1.8 Volume of Crude Exports vs. Oil Prices
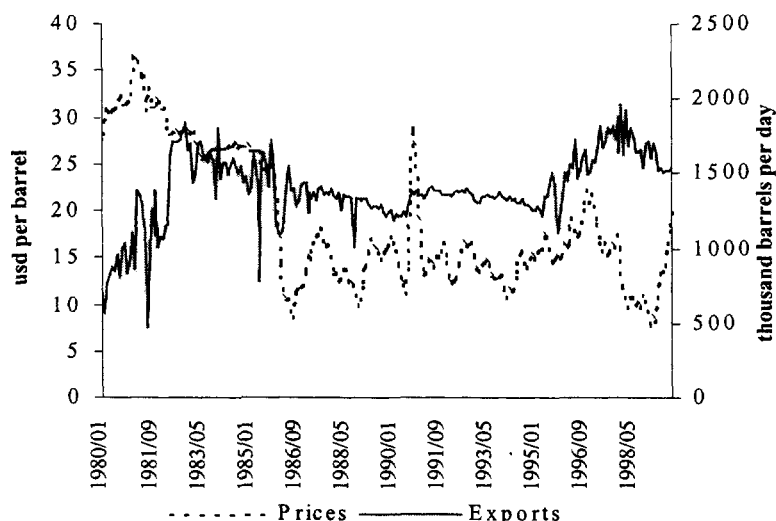

Source: INEGI

1.19   In 1994 oil prices began rising again. By year-end a large current account deficit had accumulated, financed largely with volatile short term debt denominated in foreign currency. Coupled with an overvalued peso and a number of other missteps, the famous 1994-95 crisis ensued. The recession in 1995 was severe, although the recovery was quicker than in previous crises. During that year oil exports began to rise. Higher exports with rising prices generated a crucial flow of revenues, important when the economy was depressed. Although this strategy was effective, it is not a sustainable policy in the long run.

1.20   The fall in oil prices that began in early 1997 would last until December 1998. Mexican authorities continued increasing the volume of oil exports and production, attempting to offset the decline in value of oil exports. Apparently the government never anticipated prices falling to the levels reached the following year and continued investing in oil infrastructure, a policy consistent an expectation of increased price and demand.[6] The situation in 1998 was difficult for oil producing economies, just as some of the key importers were entering a turbulent time of their own (East Asian economies). The price

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[6] This is also the year that the PIDIREGAS investment agreement began. These agreements finance infrastructure projects with private sector resources. Some projects will become public investment as the government repays its debt to the private sector, others will become private investment with a long-term supply contract.

of Mexican crude reached levels below 7 US$ per barrel in 1998, the lowest price in two decades.

1.21   In response to the fall in prices the Mexican government signed an agreement with two major oil producers, Saudi Arabia and Venezuela, to contract the international oil supply. Other OPEC countries soon joined this agreement. Nevertheless, this did not reign in the price decline, in part because of the still-depressed demand for oil and because of a lack of commitment from some of the signers. In March 1999 a new agreement between eleven major oil producers stopped the fall in oil prices and prices have recently approached Gulf War and early 1980s levels.

II. OIL WINDFALLS: STYLIZED FACTS

1.22   In this section some of the main findings of the windfall literature are presented.[7] There are two main problems generated by the oil windfall gains that can be identified, one is the exchange rate overvaluation, and the other is the rise in expenditures by the public and/or private sector. With regard to exchange rates, the overvaluation reflects an increase in the relative price of non-traded goods, with factors being shifted away from the tradable sector and drawn into the production of non-tradable goods. This in turn increases the oil dependency of the economy.

1.23   On the expenditure side, there are several possible difficulties depending on whether the major impact occurs in the public or in the private sector. When the oil gains accrue primarily to the private sector, myopic responses from the actors may arise, carrying serious consequences if the economy lacks developed financial markets. A deficient financial market does not provide sufficient instruments to attract savings from the producers who gain from the windfall, leading to a sub-optimal allocation of resources in the economy (ex. over-investment in boom-related sectors). Additionally, if the private beneficiaries of the windfall do not have access to information resources they may fail to anticipate movements in prices and make inappropriate decisions.

1.24   On the public sector side, the effect may be reflected in procyclical fiscal policies that exacerbate the cycles of the economy and threaten the long-run sustainability of the fiscal accounts. From a theoretical standpoint windfall gains should be viewed as an uncommitted rent, as valuable as any other income stream. In practice these revenues often have been committed to particular uses, mainly the financing of large infrastructure projects with a concomitant rise in government consumption. Spending the windfall on public investment is a prudent tact only if the internal rate of return of the financed projects is higher than the interest rate offered at the international capital markets. The government consumption alternative is viable only if the gains are expected to be permanent (e.g., if oil prices remain permanently high), a heroic assumption given the volatility of international oil prices.

1.25   Other problems that may arise along with the windfall are the increase in net external borrowing and inflation growth. Inflation often comes as a byproduct of overspending policies. With the onset of a windfall a number of developing countries increased their external borrowing, benefiting from the willingness of commercial banks to lend during the bonanza period. However, when oil prices retrench, managing a high inflationary environment with rising external debt becomes a significant macroeconomic problem.

1.26   When analyzing the policy responses to oil windfalls, it is generally acknowledged that there are no "magic rules" policy makers should follow when confronted with a windfall. The particular conditions of each economy will lead to different conclusions and policy recommendations that incorporate the specificity of each case. However, there are some lessons of what should be *avoided*, based on the experience of the last thirty years.

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[7] This section follows Gelb (1986b) and (1988), Cuddington (1988), and Varangis *et.al.* (1995).

1.27 It is generally acknowledged that revenues arising from oil windfall gains should not be treated as a permanent source of income. Experience shows that volatility in oil prices is high, and non-economic events may trigger a radical movement in these prices; hence governments should try to limit the expansion of their consumption expenditures according to their permanent income level. One instrument that helps in this consumption smoothing process is a revenue stabilization fund (saving during the boom and spending during the bust). However, these funds have presented problems in terms of the opportunity cost (forgone investment revenues) and the political pressures that they may confront.

1.28 An alternative strategy is attempting to increase domestic savings. This can be achieved by accumulating foreign assets, reducing external debt, increasing investment in the economy, etc. The best alternative should be chosen based on efficiency and equity grounds in a long-run perspective. International experience shows that it is common among governments of developing countries to use windfall gains to finance large public investment projects. But, as previously mentioned, this alternative is appropriate only if the internal rate of return of the projects is higher than the interest rate offered at international capital markets, difficult to assess ex ante. It is also important consider the timing of the investment expenditure in order to smooth the cycles in the economy, a feat requiring near-perfect foresight. A historical review of the efficiency of several public investment projects indicates many were highly inefficient and did not accomplish their role of enhancing productivity growth in the economy.

1.29 Another alternative use of the windfall is external debt repayment (or reduction of borrowing), an attractive alternative depending on the demand for foreign exchange and the capability of the economy to sustain the level of debt.[8]

1.30 Modern financial instruments may also be of help in reducing the impact of oil price volatility. Hedging techniques may reduce price uncertainty (but not always revenue uncertainty) with relatively low transactions costs. This technique of stabilizing revenue can be very successful in protecting the economy from short term fluctuations in oil prices. However, for this system to work efficiently, good financial infrastructure (e.g., accounting/monitoring systems) and training is prerequisite. For countries that can fulfill these requirements, hedging seems to be a promising alternative when confronting an oil windfall.[9]

1.31 Finally, it is important to stress the need for tighter monetary policy in order to control inflationary pressures in the economy. As Varangis et. al. (1995) state, "monetary policy should balance concerns over inflation with concerns over currency appreciation." Sterilization can generally be achieved via commodity bonds and investment in foreign assets.

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[8] As Cuddington (1988) points out: "it is costly to repay existing loans today if the country is going to have to turn around and borrow more soon after the boom has subsided. The strength of this point is enhanced by the fact that the cost of borrowing may be higher after the boom subsides and creditworthiness is re-evaluated," (p.52).

[9] Mexico successfully used hedging techniques to reduce oil price volatility generated by the Gulf War in the early 1990s.

III. THE MANAGEMENT OF OIL RENTS IN MEXICO, 1973 TO 1986

1.32   This section presents estimates of the windfall rents received by Mexico from the late 1970s to 1986 and analyzes the management of these rents. It is important to note that the term "windfall" should be used with caution for Mexico, strictly speaking this term means an unexpected gain or a sudden discovery. As previously mentioned, Mexico has utilized its oil resources extensively since the beginning of the century. Nevertheless it was during the late 1970s that the combination of rising oil prices, discoveries of reserves in the south of the country, and the government's strategy change of opening oil production to external markets that created a flow of resources to the economy, allowing characterization as an oil windfall.

1.33   As previously mentioned, the contribution of oil to fiscal revenues has been approximately thirty percent, reaching a peak in 1983 (see Figure 1.8).

Figure 1.8 Oil Revenues as Percentage of Public Sector and Federal Government Revenues, 1977-1986

Public   Sector

Federal Government

——— Oil Duties - - - - - Tax on Gasoline
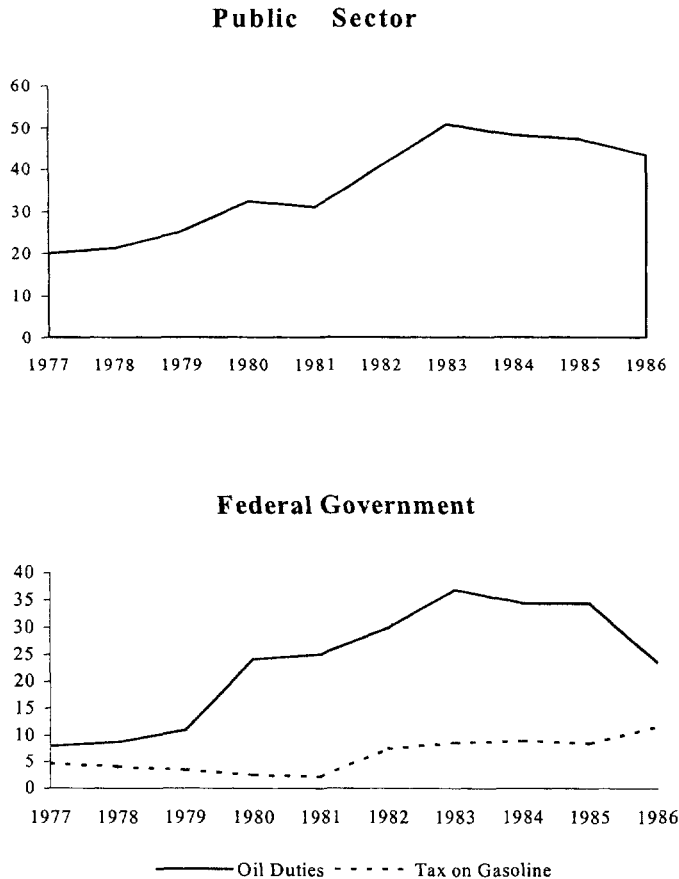
Source: SHCP

1.34   Quantifying the impact of oil windfalls consists of obtaining the difference between the actual outcome in oil and non-oil production against a counterfactual

scenario. This scenario is a projection of the trends the economy would have followed in the *absence* of an oil shock. The technique used in this paper to estimate oil windfalls follows Bevan et al (1992). The exercise is done using national accounts statistics, employing the national income identity,

$$Y = O + NO = C + I + R \qquad (1)$$

where total production (Y) can be divided in oil (O) and non-oil (NO) production,[10] that equals the gross domestic expenditure (GDE), formed by consumption (C) and investment (I), plus the resource balance (R).

1.35   To construct a counterfactual scenario it is necessary to define a base period (denoted superscript h) that serves as a benchmark, reflecting a phase of relative stability prior to the windfall shock on the economy.[11] The projections from this base period form the counterfactual scenario. The construction of this counterfactual is an arbitrary exercise and the resulting estimates of the oil windfalls depend much on the assumptions utilized in the construction process. For example, estimates of the oil windfall for Mexico over the period 1979-1981 fluctuate from 1.1 to 4.3 percent of GDP, depending on the technique used to measure the windfall.[12]

1.36   In the construction of the counterfactual scenario it is assumed that relative prices do not change. GDP (both mining and non-mining) is assumed to grow at the base years rates (1970-1975 for Mexico[13]), that is

$$Y_{t+1}^{c} = (1 + g^{h})Y_{t} \qquad (2)$$

where the superscript c denotes the counterfactual scenario and g^{h} is the average growth rate in production during the base period.

1.37   To obtain the counterfactual estimate for the components of GDE and the resource balance, consumption and the resource balance are assumed to maintain constant proportions of GDP from the base period. Investment is obtained as a difference from the national accounts identity,

$$
\begin{aligned}
C_{t}^{c} &= \alpha^{h} Y_{t}^{c} \\
R_{t}^{c} &= \beta^{h} Y_{t}^{c}
\end{aligned}
\qquad (3)
$$

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[10] The division applied in this estimation is between mining and non-mining production. The reason for this is lack of data on sub-sector production after 1993. Given that on average oil extraction accounts for more than the half of the mining production, this assumption does not introduce a significant bias in the estimates.

[11] It is important to note that the selected base period is used for short-term estimations only. By no means this can be taken as a long-term trend scenario of the oil sector. Therefore, as windfalls are estimated in different periods, different base years must be selected.

[12] For estimates of the Mexican case see Gavin (1986), Gelb (1988), Tornell and Lane (1994).

[13] Although this period was not stable for the overall economy, oil production was relatively stable at that time.

where α^h, β^h are the respective consumption and resource balance average percentage of GDP during the base period. Table 1.2 shows the estimates employing this technique.[14]

1.38   From the estimation it appears that the shock generated growth in both mining and non-mining GDP, however, in the latter the cumulative effect[15] is negative (after the 1982 shock). It can also be seen that public consumption increased even in the midst of the negative 1982 shock, while private consumption was generally negative.

1.39   Finally, as expected, investment rose during the boom years but the when the effects of the 1982 crisis are included, the overall estimate yields a negative outcome. This is not to say that the country would have been better without the oil windfall. It must be remembered that inadequate macroeconomic policies *and* the fall in oil prices caused the 1982 crisis. Nevertheless, it can be seen that a significant amount of the benefits gained from the windfall were lost in subsequent years.

Table 1.2 Oil Windfalls in Mexico, Effects of the Shock

(Million pesos 1993 prices)

| | GDP | | | Gross Domestic Expenditure | | | | Resource |
	Total	Mining	Non-Mining	Total Consumption	Public Consumption	Private Consumption	Investment	Balance [a]
1975	0	0	0	0	0	0	0	0
1976	-12568.4	46.5	-12621.4	-18957.3	6260.8	-25218.1	1413.1	4975.7
1977	-33736.1	134.8	-33885.0	-41943.8	2130.9	-44074.6	-21379.9	29587.6
1978	-16257.9	720.5	-17001.3	-35445.4	4546.3	-39991.6	-8780.1	27967.5
1979	9972.1	1481.4	8457.7	-17175.2	7437.3	-24612.5	9784.1	17363.3
1980	36431.3	3131.9	33254.7	14938.3	10725.7	4212.7	25706.2	-4213.3
1981	62542.1	4376.6	58107.4	29567.5	15177.3	14390.2	50121.3	-17146.7
1982	-5147.5	5038.4	-10259.3	-34589.3	11704.2	-46293.6	-41086.7	70528.4
1983	-113424.1	4364.2	-117879.1	-117145.6	8661.2	-125806.8	-121790.1	125511.6
1984	-146859.3	4104.3	-151074.1	-141764.3	9546.0	-151310.2	-129791.1	124696.1
1985	-193748.2	3487.6	-197368.5	-180295.5	3892.8	-184188.4	-128686.0	115233.4
1986	-311197.1	2230.0	-313584.9	-256519.4	-1496.6	-255022.8	-187689.3	133011.6
Total[15]	-288394.6	14610.3	-303356.0	-356235.2	46246.5	-402481.8	-220387.0	288227.6

a/ Resource balance is defined as the balance of exports minus imports of goods & services, expressed in local currencies. It can be obtained by subtracting total consumption and investment from total GDP.

1.40   In order to better assess these magnitudes, table 1.3 presents the estimated windfall as a percent of GDP.

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[14] For this estimate the counterfactual growth rates are 5.6 percent for the mining output and 6.3 percent for non-mining.

[15] This overall balance is estimated as the net present value in 1975 using a 10 percent interest rate.

Table 1.3 Oil Windfalls in Mexico, Effects of the Shock

(percent of GDP)

	GDP			Gross Domestic Expenditure				Resource
	Total	Mining	Non-Mining	Total Consumption	Public Consumption	Private Consumption	Investment	Balance [a/]
1975	0	0	0	0	0	0	0	0
1976	-1.78	0.01	-1.79	-2.68	0.89	-3.57	0.20	0.70
1977	-4.62	0.02	-4.64	-5.74	0.29	-6.03	-2.93	4.05
1978	-2.04	0.09	-2.14	-4.45	0.57	-5.02	-1.10	3.51
1979	1.14	0.17	0.97	-1.97	0.85	-2.82	1.12	1.99
1980	3.82	0.33	3.49	1.57	1.12	0.44	2.70	-0.44
1981	6.03	0.42	5.60	2.85	1.46	1.39	4.83	-1.65
1982	-0.50	0.49	-1.00	-3.36	1.14	-4.49	-3.99	6.84
1983	-11.48	0.44	-11.93	-11.86	0.88	-12.74	-12.33	12.71
1984	-14.35	0.40	-14.76	-13.85	0.93	-14.79	-12.68	12.18
1985	-18.45	0.33	-18.80	-17.17	0.37	-17.54	-12.26	10.98
1986	-30.80	0.22	-31.03	-25.39	-0.15	-25.24	-18.57	13.16

1.41   For the sake of international benchmarking, a single technique must be used across countries. Reproduced below are the estimates provided by Tornell and Lane (1994). The upper panel of Table 1.4 shows the total oil windfall estimate, TOT[16], as a percentage of GDP and of total exports, X. Here it can be seen that the Mexican windfall was small relative to other countries, around 0.7 percent of GDP, while for other countries the average was of around 6.5 percent of GDP during the 1979-1982 period. The lower panel of the table presents the adjustment to the windfall. It is important to note that Indonesia responded with an improved current account, while the opposite occurred for Mexico and Nigeria. Interestingly, Mexico responded with the largest increase in investment,[17] in relative terms, consistent with previous claims regarding the use of the windfall for Mexico.

1.42   Note the remarkable increase in savings during the boom period for Mexico. According to Gavin (1996), this increase can be attributed mainly to the private sector.[18] A possible interpretation of this is that (private) agents perceived the windfall as temporary. Nevertheless, this rise in savings was not enough to ameliorate the current account deficit. Finally, note that Mexico incurred fiscal deficits, contrary to Indonesia, which benefited from the large windfall revenues without radically expanding their expenditures.

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[16] TOT is defined as the terms of trade shock, or

$$TOT = X*(\%\Delta Px/\%\Delta Pm).$$

[17] Gelb (1984) reports that between 1970-1979 Mexico realized 59 macroprojects (costs exceeding $100 million US$), an amount close to 18 percent of GDP. Most were channeled to the hydrocarbons sector.

[18] Gavin estimates that around 30 percent of the windfall was saved.

Table 1.4 International Comparison of Oil Windfalls

	Oil Windfall					
	Indonesia		Mexico		Nigeria	
	TOT/GDP	TOT/X	TOT/GDP	TOT/X	TOT/GDP	TOT/X
1979	9.7	27.6	0.4	13.1	13.4	26.5
1980	8.6	24.8	2.1	17.8	20.1	15.4
1981	1.5	5.7	0.8	6.8	3.0	9.6
1982	-0.8	-3.4	-0.4	-2.8	-3.0	-7.4
	Adjustment to the Windfall					
	Indonesia		Mexico		Nigeria	
$\Delta CA/GNP$	1.82		-2.35		-1.25	
$\Delta S/GNP$	4.8		8.15		-4.7	
$\Delta I/GNP$	3.7		3.8		-5.9	
$\Delta REV/GDP$	3.85		3.1		NA	
$\Delta EXP/GDP$	0.85		5.8		1.55	

Note: CA stands for Current Account, S for savings, I for domestic investment, REV for central government revenue shares, EXP is central government expenditure. The term Δ denotes average changes from 1979-82 relative to 1975-77.

Source: Tornell and Lane (1994)

1.43   Figure 1.9 shows that high growth in investment accompanied the rise in oil prices and the Mexican government decision of exploiting this commodity.[19] As discussed in the previous section, a strategy of spending commodity windfalls on investment may be an effective alternative. However, problems arise when large, inefficient infrastructure projects are financed, compounded if the expenditure timing is procyclical. Tornell and Lane (1994) outline a portion of the history of Mexican investment:

(...) these projects, far from being the realization of profitable investment opportunities, were vehicles for redistributing fiscal resources. First an agreement with the oil workers' union stipulated that 40 percent of all contracts granted by PEMEX (...) were to be awarded to the union (...) The second example has to do with SOEs, which increased in number from 504 in 1975 to 1155 in 1982. The expansion of the parastatal sector included the bailing out of struggling private firms. The government ended up owning a loss-making cabaret, a bicycle plant and a cookie producer, among others. Parastatals also expanded in production capacity. The most prominent example is the industrial complex developed in the town of Lazaro Cardenas, which consisted of a steel plant, a fertilizer plant, a capital equipment plant and a big diameter pipe producer. Although the steel plant was designed to produce two million tons of plate (final good), it did not produce even one million tons of slab (intermediate good) (...) All these plants had operating losses. The third example concerns a major private industrial group: Alfa. It embarked on an aggressive diversification program, financed by external borrowing. A number of these investments turned out to be unprofitable and in 1981, months before the debt crisis, it received from the government $500 million to repay its debts.

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[19] The correlation of the two series during the period 1979-1998 is 0.82.

Figure 1.9 Public Investment and Oil Price, 1979-1986
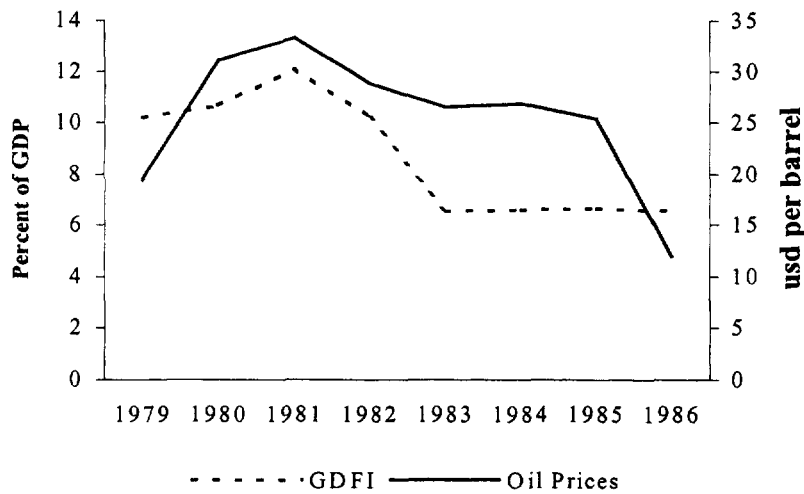
Source: INEGI

1.44   Mexico's history of boom-bust investment is quite apparent in Figure 1.9. Gavin (1996) calculates that the petroleum windfall resulted in a large transfer of income from the private to the public sector, particularly after the 1979 oil price increase. His estimates show that from 1975 to 1981 (when oil prices reached their peak) the oil windfall accruing to the public sector approached 51.5 billion US$, while the private sector saw its income reduced by 16 billion US$ due to oil price increases. External borrowing financed the remaining budget deficit in the public sector. However, at the same time there was an implicit subsidy to domestic consumers through domestic oil price subsidies; the lost revenues created distortions in relative prices and worsened the fiscal accounts. Estimates of this subsidy over the period 1975-1987 indicate it fluctuated from 0.2 to 4 percent of GDP.[20]

IV. THE MANAGEMENT OF OIL RENTS IN MEXICO, 1986 TO DATE

1.45   Post-1986 the growing diversification in the export sector resulted in the composition containing a far lower percentage of oil, yet the opportunity for yet another windfall was on the horizon. In August 1990 Iraq invaded Kuwait and started a crisis leading to the Gulf War. The duration of this war was short and by the end of February 1991 the United States declared a cease-fire. The uncertainty of the crisis in the Persian Gulf drove prices in August 1990 to 158 percent of their June level. This incredible rise generated a windfall that quickly vanished (or, better stated, never materialized). By February oil prices had returned to their pre-war level.

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[20] Gavin (1996).

1.46   During this episode the Mexican government reacted differently based on previous experience with oil windfalls (although the fiscal dependency on oil continued, see Figure 1.10 below). Given the political nature of the price rise, the Mexican authorities anticipated a short-term fluctuation and used hedging techniques to ensure fixed revenue from oil exports in case the war ended quickly. This management of the windfall allowed the Mexican authorities to benefit from the large but short-lived rising prices without exposing the economy to the negative consequences that followed.

Figure 1.10 Oil Revenues as Percentage of Public Sector and Federal Government Revenues, 1986-1999
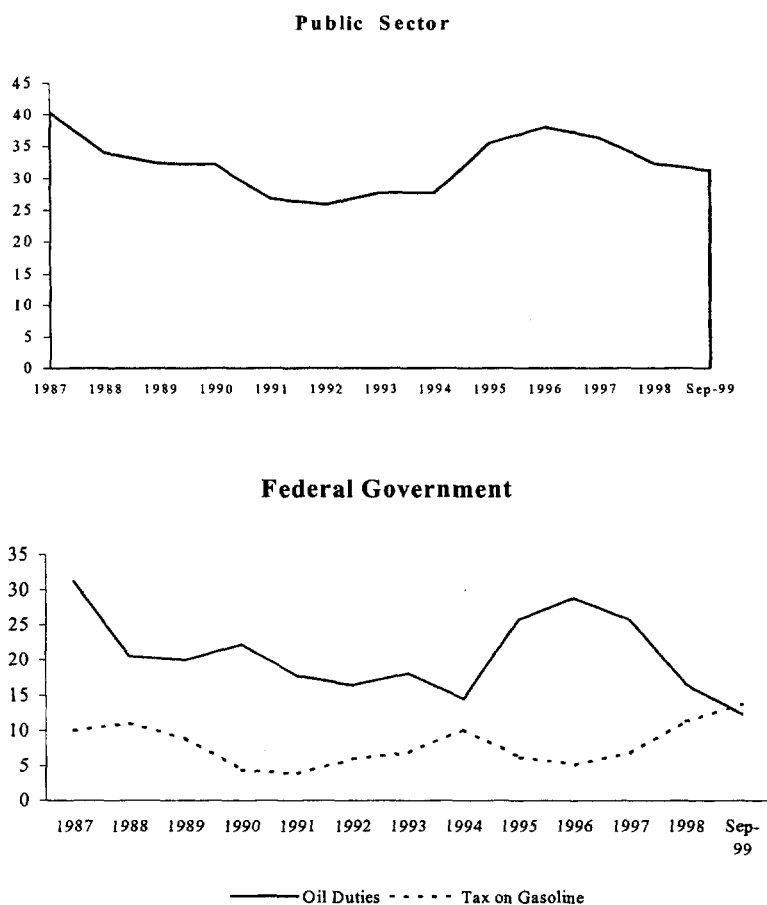
Source: SHCP

1.47   After the Gulf War episode, international oil prices remained relatively stable for the next three years and started rising again in 1994. As oil prices rose over the 1995-1996 period, the volume of exports rose as well (recall Figure 1.7). In Table 1.5 the estimation of this windfall is presented. For this exercise the selected base years are 1991-1993, when the price of oil was relatively stable.

Table 1.5 Oil Windfalls in Mexico, Effects of the Shock

(Million pesos 1993 prices)

| | GDP | | | Gross Domestic Expenditure | | | | Resource |
	Total	Mining	Non-Mining	Total Consumption	Public Consumption	Private Consumption	Investment	Balance
1993	0	0	0	0	0	0	0	0
1994	20422.4	160.3	20257.3	16030.4	-314.1	16344.5	22750.2	-18358.2
1995	-96487.9	-542.3	-95958.0	-105585.4	-6172.6	-99412.8	-85939.7	95037.1
1996	-70087.5	513.1	-70623.7	-118362.1	-11300.9	-107061.2	-45252.5	93189.5
1997	-20676.5	1033.5	-21746.8	-90128.0	-11472.1	-78656.0	6504.2	62633.3
1998	6483.8	1386.7	5043.2	-65333.8	-17661.4	-47672.3	23475.7	48341.9
Total[21]	-123930.5	1650.0	-125671.0	-263740.5	-32679.3	-231061.2	-65322.3	204664.4

1.48   Table 1.6 presents these estimates as a percentage of GDP

Table 1.6 Oil Windfalls in Mexico, Effects of the Shock

(percent of GDP)

| | GDP | | | Gross Domestic Expenditure | | | | Resource |
	Total	Mining	Non-Mining	Total Consumption	Public Consumption	Private Consumption	Investment	Balance
1993	0	0	0	0	0	0	0	0
1994	1.56	0.01	1.54	1.22	-0.02	1.25	1.73	-1.40
1995	-7.84	-0.04	-7.80	-8.58	-0.50	-8.08	-6.98	7.72
1996	-5.42	0.04	-5.46	-9.15	-0.87	-8.27	-3.50	7.20
1997	-1.50	0.07	-1.57	-6.52	-0.83	-5.69	0.47	4.53
1998	0.45	0.10	0.35	-4.51	-1.22	-3.29	1.62	3.34

1.49   From tables 1.5 and 1.6 it can be seen that the price rise of 1994 generated a small windfall in the mining sector. This allowed the Mexican government to recover part of the 1995 recession induced fiscal shortfall with oil revenues (recall Figure 1.10). Additionally, given the recent devaluation episode, when transformed to Mexican pesos the oil revenues from exports (in US$) had a greater impact in the economy. One relevant feature from the estimates is that, contrary to the 1980s episode, government restrained consumption in the crisis. Investment fell in the first years after the crisis before recovering.

1.50   During this period consolidated PEMEX revenues grew at a 12 percent rate per year in real terms, and part of these revenues were reinvested to expand the productive capacity of PEMEX. An important feature of this period is that the Mexican government allowed the rise in domestic prices of hydrocarbons, which helped adjust the misalignment of internal pricing with external.

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[21] This overall balance is estimated as the net present value in 1993 using a 10 percent interest rate.

1.51   Authorities attempted to offset the severe reduction in oil prices occurring in 1997 with increased exports. However, this measure did not stem the tide of deteriorating public sector revenues, forcing the authorities to adopt fiscal austerity measures. Among the policy reactions were severe expenditure cuts in non-salary current expenditures and investment expenditures, in particular, infrastructure projects for PEMEX, CFE and the transportation sector (see Figure 1.11). Increases in the value added tax and the IEPS[22] rate also helped alleviate fiscal pressures.

Figure 1.11 Oil Prices and Public Investment. 1987-1998.
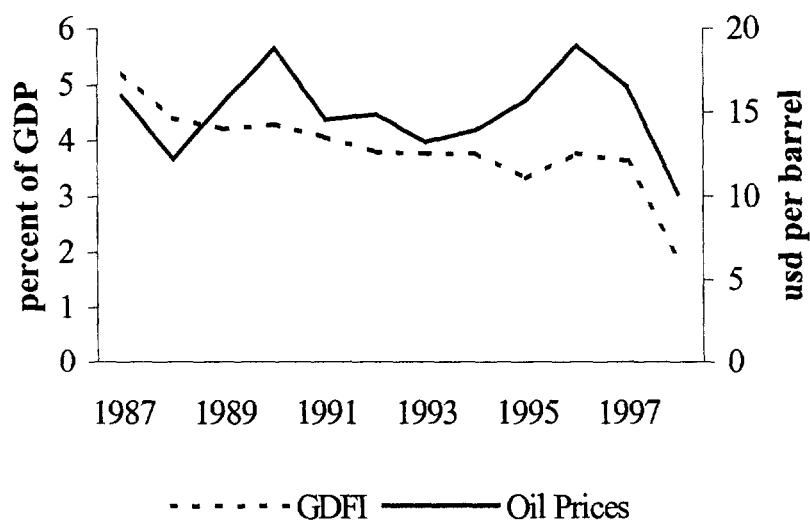
- - - - - GDFI ———— Oil Prices

Source: INEGI

1.52   As oil prices began recovering in the second quarter of 1999, it appears another oil windfall is in the offing, whose duration cannot be predicted. The size of this windfall may not to be very large due to production/export cutbacks agreed to in early 1999. Nevertheless, revenues generated by this "windfall" have been used to offset fiscal pressures resulting from delays in privatizing airports. However, in the budget approved for the year 2000, a political struggle within congress resulted in some expected oil revenues being earmarked for increased social expenditure.[23] In particular, more optimistic scenarios on future oil prices resulted in an expenditure plan greater than the original budget presented. In addition, if oil revenues surpass these budgeted amounts, the remaining resources would be used to fund higher non-programmable expenditures (in particular, interest payments), to make transfers to subnational governments, and to repay debt.

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[22] IEPS stands for "Impuesto Especial sobre Producción y Servicios", and is a commercial excise tax paid for gasoline, diesel, and natural gas used in vehicles.

[23] "Recortes al gasto público, anticipa Ernesto Zedillo", *El Financiero*, January 6, 2000, p.8.

V. POLICY ALTERNATIVES

1.53   Oil production plays an important role in Mexican economy. Approximately one-third of Government revenues comes from the hydrocarbon sector and, in particular, from oil exports. The reliance of public finance on a single commodity creates a potential situation where shocks may threaten the fiscal balance and stability of the economy.

Figure 1.12 Mexico Budget Indicators, Percent of GDP: 1980 - 1998
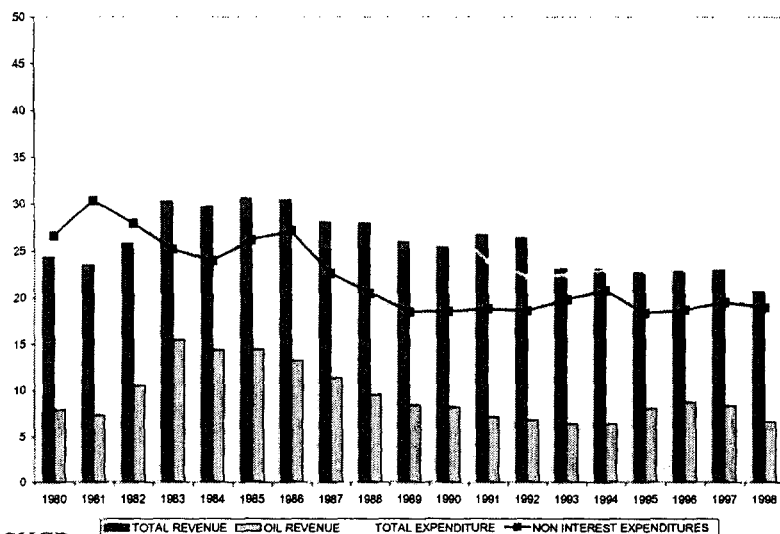
Source: SHCP

1.54   In front of this situation several policy alternatives must be carefully examined in order to protect the economy from volatility in oil revenues, without eliminating the benefits that arise when prices rise. Two policy alternatives already mentioned to face the instability in oil revenues are stabilization funds and hedging strategies on international markets.

1.55   On one side the use of hedging instruments is an attractive alternative. Options can be used to protect producers from declining prices, allowing them to benefit from upward movements in prices. However, there are some problems behind this strategy. First, the administration of these instruments is complex and knowledge intensive. Second, the size of the markets is still small if compared to the amounts that a large producer would like to hedge. Finally, premiums can be expensive especially in an environment of volatile prices, (which is the case of oil).

1.56   On the other side stabilization funds have the advantage of generating a smooth consumption pattern by saving extraordinary revenues and by depleting the fund's balance in front of a price downturn. Nevertheless in order to establish a stabilization fund, prices must not follow a random walk process and a good alternative on where to save the fund's resources must be available. Also clear and strict rules must be issued to isolate the fund from political pressures. For a detailed discussion of these topics refer to

Varangis and Larson (1996), Engel and Meller (1993), Arrau and Claessens (1992), Lewin (1999).[24]

1.57   In this section we present as an exercise a back of the envelope estimation of a stabilization fund for Mexican oil exports revenues. The methodology is based on one of the funds presented in Basch and Engel (1993) for a simple case where the country that establishes the fund has no restrictions to credit. The implications of using this simple case are analyzed below, as well as some other insights needed to build a more realistic fund.

1.58   The main assumption underlying this stabilization fund is that the designer country can invest or save a fraction of its windfall income, and it can borrow when oil revenues are below their average value. By assuming a quadratic instantaneous utility function and an interest rate r equal to the rate of discount δ, we can obtain an optimal rule of consumption equal to:

$$c_t = \bar{y} + \frac{r}{1+r} \sum_{i=1}^{t} \left(y_i - \bar{y} \right)$$

and

$$c_t - c_{t-1} = \frac{r}{1+r} (y_t - \bar{y})$$

where y_t is oil exports income at period t, $\bar{y}$ is the average of these revenues and r is the interest rate coupon paid by a long-term bond.[25] The optimal consumption rule says that the consumption at period t should equal the average revenues from oil exports plus (or minus) the accumulated fraction of surplus (or deficit) in revenues that can be supported in the long run (by means of the paid coupons). Thus, as Basch and Engel claim "the average level of consumption with or without the optimal stabilization fund is the same; however, income uncertainty is considerably lower with a fund".

1.59   The accumulated balance of the fund at period $t+1$ is:[26]

$$A_{t+1} = (1 + r_t)(A_t + y_t - c_t)$$

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[24] Actually of the major stabilization funds implemented in Latin America, only the Chilean Copper Stabilization Fund (CSF) has positively contributed to build a strong fiscal stance.

[25] For this exercise it was selected an unweighted average of the rates paid by U.S. coupons with maturity greater than 10 years.

[26] Since these conditions are derived from a finite-horizon optimization problem, at the final period T the condition that should hold is $A_T=0$, however for the objectives of this study this condition is not relevant, since we have not determined when T would take place. For a general exposition of these models see Blanchard and Fischer (1989).

1.60   For this exercise the fund was estimated as if it were established in January 1986, at the end of the great fall in prices of that year. One of the requirements to create a fund like the previously sketched is to have an idea of the long-run level of oil export revenues. For this purpose the ideal would be to have an econometric model of revenues and oil prices. Given that these prices (and revenues) are influenced by a wide variety of factors (including demand-driven factors, oligopolistic reactions from suppliers, political events, etc.), finding a straightforward time series model for them is not an easy task. For that reason, and given that we are only presenting an approximate estimation of an oil stabilization fund and its advantages, we do not undertake that modeling alternative. Instead, we calculate the long-run level of oil revenues by using the mean estimated at time t. In other words we use $\bar{y}_t$ instead of $\bar{y}$. As a more complex model of the behavior followed by prices and revenues becomes available this estimation can be improved.

1.61   Another drawback of the designed stabilization fund here presented is the assumption of full credit availability for the exporter country. The problem is evident: when prices fall the international financial markets are reluctant to lend to the commodity exporter countries. To solve this problem an empirical version of saving models in front of borrowing constraints (e.g. Deaton, 1991) could be implemented. Some applications of these models to the stabilization fund case have been presented in Arrau and Claessens (1992) and Hausmann et. al. (1993). Nevertheless, the requirements to estimate the statistical processes followed by prices and revenue are too demanding (and still under methodological discussion) to be undertaken in this first approach exercise.

1.62   Figure 1.12 presents oil exports revenues versus the monthly savings generated by the fund. As it can be seen the fund responds efficiently to changes in revenues.

Figure 1.12 The stabilization fund monthly savings and oil export revenues
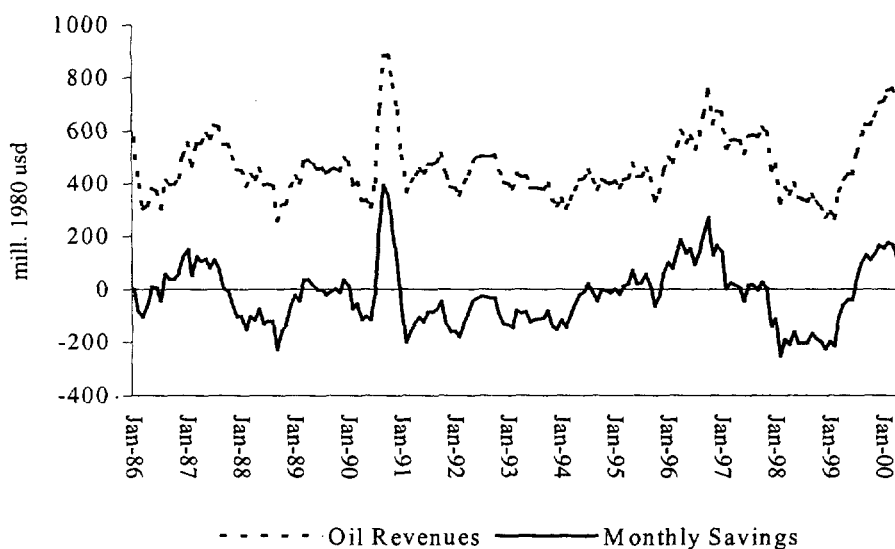
Source: Bank Staff estimates

1.63   The accumulated resources in the fund at period t are presented in Figure 1.13. It must be remembered that negative values mean that the country is incurring debt to finance the optimal consumption path. In this plot it can be seen that in front of the most recent downturn in prices in 1997-98 the fund would have financed the forgone revenues and it would have avoided the radical cuts in expenditure that actually took place.

Figure 1.13 The accumulated balance and oil prices
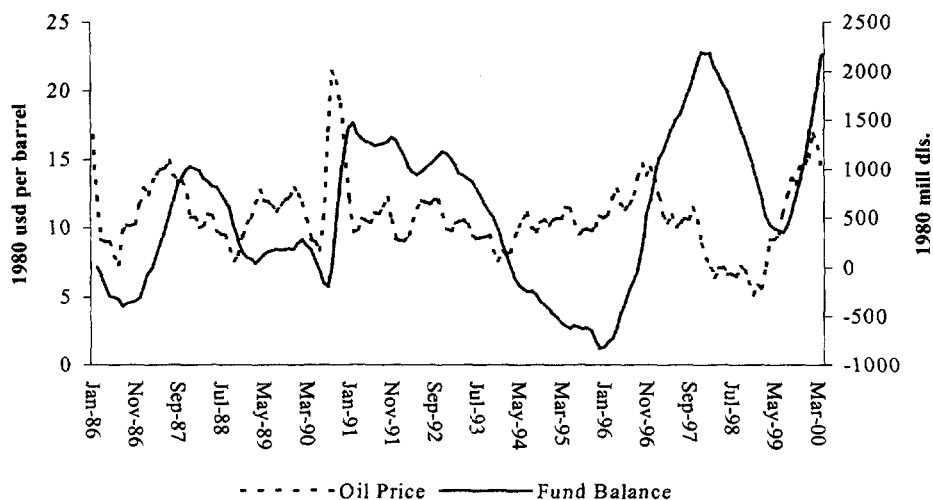
Source: Bank Staff estimates

1.64   Although these estimations are very raw and need to be refined, they illustrate the advantages of having a stabilization fund, in terms of smoothing consumption and reducing the costs associated to volatile expenditures.

1.65   Finally, for the case of oil revenues both the stabilization fund and the hedging strategy can work as complements rather than as substitutes. While the fund can work as the main recipient of revenues, hedging strategies can be used to manage short-lived movements in prices. This joint strategy would also reduce the size of the fund and the probability that the fund go bankrupt.

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