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MEXICO

Selected Issues

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Approved by Western Hemisphere Department

September 30, 2003

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I. RESERVE ADEQUACY IN MEXICO[1]

This chapter analyzes reserve adequacy in Mexico. Reserve adequacy has been of renewed interest, as the authorities have introduced a new rules-based mechanism of dollar sales to reduce the rate of reserve accumulation. The strong growth in Mexico's international reserves since the Tequila crisis has led to a current level that seems adequate according to various criteria, including debt amortizations in the coming year, the risk of capital flight, and country-specific risks. Finally, projections of future reserve accumulation indicate that reserve adequacy is not likely to be at risk under baseline assumptions, even though the new mechanism would slow accumulation relative to the previous mechanism. Under an alternative scenario, with lower oil prices and less external financing of government operations, vulnerability ratios could start declining, pointing to the possible need for a more flexible mechanism over time to ensure reserves remain adequate.

A. Introduction

1. **Mexico has built up substantial international reserves in recent years, strengthening investor confidence and improving access to international capital markets for both the public and private sectors**. Recent experience with financial crises has shown that both holding and managing sufficient reserves, and disclosing adequate information to market participants, helps countries to prevent and better cope with external crises.[2]

2. **Mexico's reserve accumulation during 1996–2001 was helped by a purchase mechanism of foreign receipts, despite a sale mechanism of reserves to moderate exchange rate volatility.** The authorities put in place two mechanisms between 1996 and 2001, with different objectives. The first one (dollar put options) was aimed at accumulating reserves, as commercial banks bid for the right to sell U.S. dollars to the central bank during times of peso strength. The central bank accumulated close to US$12 billion through this mechanism. The second mechanism was aimed at moderating exchange rate volatility, with the central bank selling dollars to the market in times of significant declines in the value of the peso. This mechanism became operational ten times, with cumulative sales of around US$2 billion. Both mechanisms were suspended in 2001. Subsequently, the central bank moved to a system of no sales of dollar receipts, and reserves rose from US$45 billion at end-2001 to US$55 billion by mid-2003.

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[1] Prepared by M. Vera-Martin.

[2] See IMF (2001) for a more general discussion on reserve adequacy and management.

3. **Analysis of reserve adequacy for Mexico has been of renewed interest, as the authorities have introduced a new rules-based mechanism of daily dollar sales to reduce the rate of reserve accumulation**. The authorities argue that, given the current high level of international reserves and the anticipated pace of accumulation in the immediate future, the cost of holding reserves is progressively yielding lower net benefits. As a result, they announced a new rules-based mechanism to reduce the rate of reserve accumulation of reserves in March 2003. It specifies that 50 percent of net international reserves (NIR) accumulated in the previous quarter (excluding sales of reserves under the mechanism) would be sold in daily auctions in the next quarter, as long as the net quarterly reserve accumulation would surpass US$250 million (net of the dollar sales undertaken through this mechanism).[3] The mechanism is intended to reduce the rate of foreign reserves accumulation according to a rule, not as an intervention device to stabilize the exchange rate. In this regard, the authorities execute the daily sales at a pre-set time, eliminating the possibility of auctioning dollars at moments where the peso could be under pressure.

4. **The main findings of the paper are as follows**:

- Strong growth in Mexico's international reserves since the Tequila crisis has led to a current level that seems adequate according to various adequacy ratios. Reserves currently surpass two benchmarks for adequacy that take into account debt amortizations in the coming year, the risk of capital flight, and country-specific risks.

- Projections on gross international reserves indicate that reserve adequacy is not likely to be at risk under baseline assumptions, even though the new mechanism would slow reserve accumulation relative to the previous mechanism.

- Under an alternative scenario over the medium term, with lower oil prices and less external financing devoted to reserve accumulation, adequacy ratios would start declining. In this context, an alternative mechanism could be called for to ensure reserve adequacy is maintained.

5. **The structure of the paper is as follows**. Section B compares the level of reserves in Mexico with those in other emerging economies with sustained access to international capital markets using various indicators. Reserve adequacy is then evaluated according to two simple benchmarks. Section C discusses alternative projections of reserve accumulation. Section D concludes.

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[3] First implemented in May, the authorities started with daily auctions of US$32 million for the 3-month period from May to July. The Bank of Mexico (BOM) would sell US$14 million per day during the second 3-month period the system is operational, i.e. between August and October. Initial estimates suggested that total sales in 2003 would be US$3–4 billion.

B. Are Current Reserves Adequate?

6. **The literature on reserve adequacy, while highlighting the need for an appropriate level of reserves, has not provided firm guidance as to what specific level this should be**. Hence, in assessing reserve adequacy, it is necessary to rely on a variety of indicators, complemented by empirical studies on the revealed demand for reserves.[4] The analysis here considers four different indicators. First, the ratio of reserves to imports is considered, although recent studies note its declining importance. In particular, external vulnerability is no longer defined merely by current account shocks, but also by capital account shocks, as evidenced the Asian financial crisis. Second, the analysis looks at two vulnerability indicators: the ratio of reserves to short-term debt on a remaining maturity basis (STD); and the ratio of reserves to broad money. The first assesses a country's risk when it loses access to international capital markets, while the second measures the potential impact of a loss of confidence in the domestic currency, leading to capital flight. Third, the study looks at the ratio of reserves to dollarized deposits, which may be relevant given that the central bank cannot create dollar liquidity to offset a run on such deposits. Finally, reserves are viewed relative to net public sector external debt, indicating the capacity of the government to meet its external financing requirements without recourse to new sources of funds.

7. **Mexico has been accumulating international reserves at a strong pace since the Tequila crisis, leading to an improvement in all of the above adequacy ratios (Figure 1)**. This trend is in line with that observed in other emerging market economies. By end-June 2003, reserves[5] stood at US$55.3 billion, covering nearly four months of imports and 116 percent of short-term debt on a remaining maturity basis. This contrasts with the weak reserve position during the Tequila crisis; when reserves fell to US$4.9 billion, or 0.7 months of imports, in January 1995.

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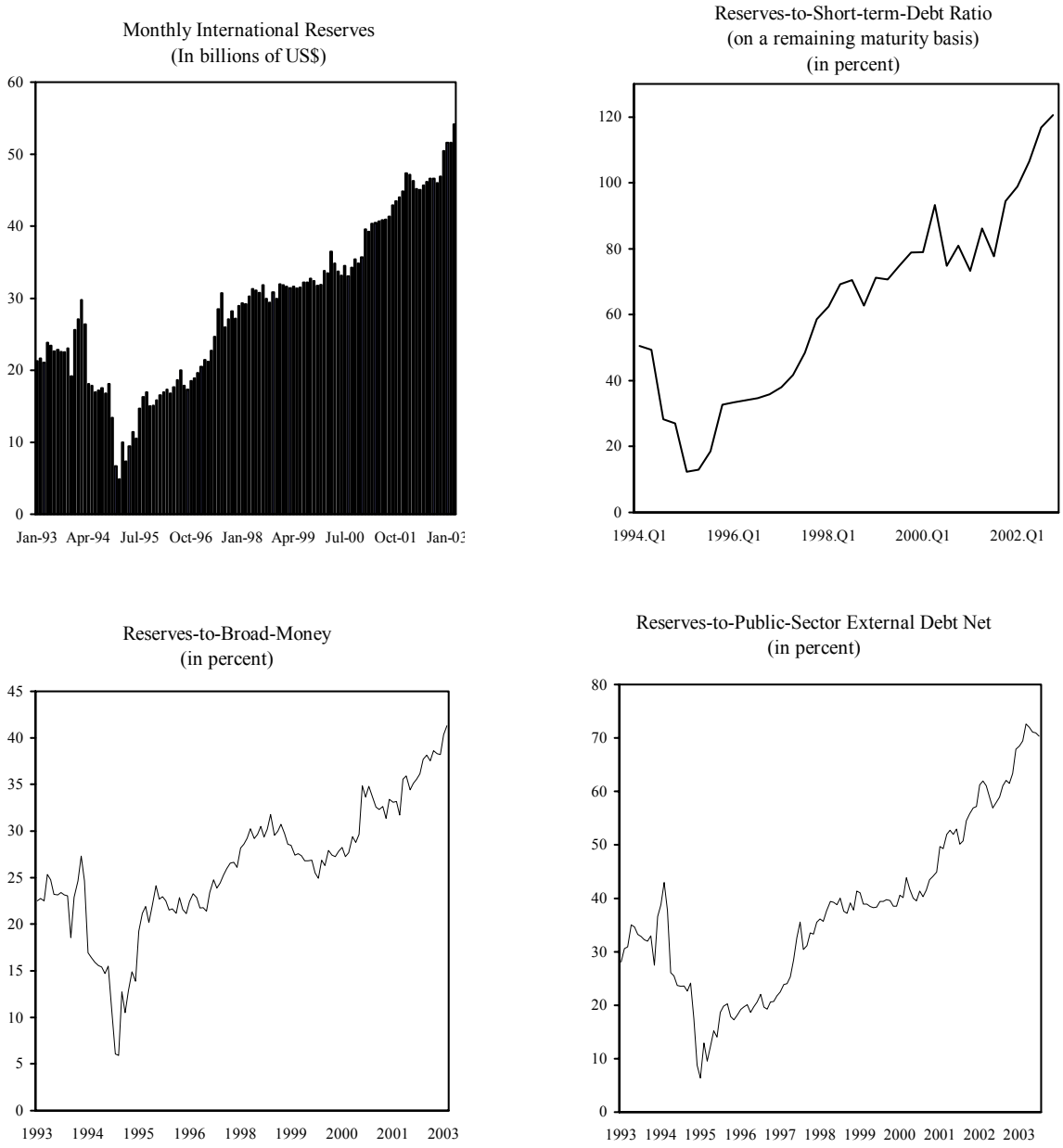
[4] IMF (2001) recommends complementing the analysis of reserve adequacy indicators with stress testing of the balance of payments to allow for a better understanding of the interaction between reserve adequacy, vulnerability, and country-specific factors and policies. An analysis of external sustainability for Mexico with stress testing of the balance of payments was prepared during the 2002 Article IV Consultation (see Country Report No. 02/238, IMF (2002)).

[5] The figures on reserves refer to the series "Total Reserves minus Gold", which includes the U.S. dollar value of monetary authorities' holdings of SDRs, reserve position in the Fund, and foreign exchange. This definition is different from the concept of "Net International Reserves", due to the fact that the latter excludes short-term liabilities with the Federal Government, Pemex, and other creditors, and includes liabilities with the IMF.

Figure 1. Mexico: International Reserves and Vulnerability Ratios



Source: Data from BOM, SHCP, IFS, and IMF staff estimates, except for data on short-term debt on a remaining maturity basis, which is from BIS/OECD/IMF/World Bank (series G,H,I), and IMF staff estimates.

8. **Although Mexico complies with the crude traditional rule of thumb of holding reserves covering three months of imports, it compares less favorably in this respect with some other emerging market economies**. Column 3 in Table 1 reports monthly average import coverage in 2002 for the countries in our sample.[6] The overall sample displays an average coverage of 8.6 months of imports. Only South Africa and Hungary had lower ratios than Mexico. This low coverage for imports is explained by the fact that *maquiladora*-related imports (in-bond assembly for re-export) are included. Excluding *maquiladora* imports (which accounted for 35 percent of gross imports in 2002) would lead to an increase in import coverage to around six months.

9. **As noted above, capital account considerations seem more relevant in light of recent international experience.** In this regard, Mexico's reserves seem sufficient to withstand well a capital account crisis due to a reversal in confidence. When analyzing the coverage of broad money in terms of reserves, Mexico compares well with the overall sample, with reserves covering around 40 percent of broad money, slightly above the sample average of 37 percent. Within Latin America, however, Mexico shows one of the lowest ratios, second after Brazil (29 percent). Chile, Colombia, and Peru hold reserves covering above 50 percent of broad money, and Venezuela holds reserves well above that level (60 percent). Mexico has a relatively low degree of dollarized deposits, particularly in relation to the rest of the region (at about 10 percent of M1).[7] It also operates a fully flexible exchange rate regime. The level of reserves appears, in this respect, to be adequate when weighted by the risk of a capital flight in Mexico. Mexico's attractiveness to international and domestic investors is among the strongest in the Western Hemisphere, and the country is one of only two countries in Latin America benefiting from an investment-grade rating.

10. **Mexico complies well with the recommendation that reserves should cover external debt amortization for a year, in the event of a halt in international market access**. In this regard, the ratio of reserves to short-term external debt on a remaining maturity basis (STD) is considered the most important indicator for emerging market economies. Several early warning system (EWS) studies have found that low levels of reserves with respect to STD have increased the probability of crisis.[8] In this regard, a rule of thumb has been put forward suggesting that reserves should allow a country to forego access to capital

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[6] The analysis considers 20 large emerging market economies that have generally enjoyed more or less uninterrupted access to international capital markets. The sample accounts for all emerging market regions (Asia, Eastern Europe, and Latin America). Data for the cross-country analysis is described in Table 1.

[7] Data from Faal and Thacker (2003).

[8] See, for example, Brassière and Mulder (1999), Rodrik and Velasco (2000), and Berg, Bozenstein, Milesi-Ferretti, and Patillo (1999).

Table 1. Mexico: Reserve Adequacy Indicators for Twenty Emerging Market Economies

Country	Exchange Rate (ER) Regime [1/]	Reserves/Imports [2/]	Reserves/Broad Money [3/]	Reserves/STD [2/]
All countries (average)		**34.0**	**37.1**	**233.6**
Countries with Flexible ER		35.8	37.0	188.6
Countries with Fixed ER		26.7	37.5	412.2
Argentina	Flexible	65.1	41.5	38.7
Brazil	Flexible	38.2	28.9	110.7
Chile	Flexible	45.8	55.4	146.6
China	Fixed	44.5	12.7	787.7
Colombia	Flexible	42.9	52.3	189.5
Czech Republic	Flexible	22.8	39.1	351.3
Hungary	Fixed	14.0	39.4	128.6
India	Flexible	50.8	19.5	718.8
Indonesia	Flexible	48.8	33.4	170.2
Korea	Flexible	38.4	30.4	223.4
Malaysia	Fixed	21.3	36.5	361.8
Mexico	Flexible	**14.2**	**39.0**	**132.0**
Peru	Flexible	65.5	55.1	110.2
Philippines	Flexible	21.0	35.2	150.8
Poland	Flexible	25.8	35.8	215.2
Russia	Flexible	29.8	54.5	247.7
South Africa	Flexible	11.3	11.0	59.7
Thailand	Flexible	28.3	30.0	294.3
Turkey	Flexible	23.8	30.4	86.1
Venezuela	Fixed	26.8	61.4	147.8

[1/] Flexible exchange rate refers to managed floating or independently floating exchange rates regimes. Fixed exchange rate regime refers to conventional fixed peg arrangements or pegged exchange rates within horizontal bands. For more details, see Annual Report on Exchange Arrangements and Exchange Restrictions (IMF, 2003).

[2/] In weeks of imports.

[3/] In percent. Ratios on reserves-to-imports and on reserves-to-broad money are monthly averages for 2002. The ratio of reserves-to-short-term-debt (on a remaining maturity basis) refers to 2002Q2.

Data Sources: All data are from the International Financial Statistics (IMF), except for short-term debt on a remaining maturity basis, which is from the Joint BIS/IMF/OECD/World Bank Statistics (series G (liabilities to banks due within a year), H (debt securities issued abroad due within a year), and I (non-bank trade credits due within a year)). Data on reserves refer to non-gold reserves (line 1.1.d). Broad money is computed as the sum of money (line 34) and quasi-money (line 35).

markets during a year, by covering short-term debt on a remaining maturity basis.[9] Column 5 in Table 1 reports the ratio of reserves to STD.[10] Mexico has a ratio of 132 percent in end-June 2002, although the ratio compares less favorably with respect to the sample average (233 percent). This is mainly due to the surge in reserve accumulation in the Asian economies, to an average above 400 percent of STD in mid-2002.[11] Within Latin America, Mexico's reserves are higher than the average of 125 percent.

11. **The level of reserves covers almost two thirds of net public sector external debt (NPED)**. This ratio could be interpreted as the ability of the country to pay its net liabilities without having to rely on any borrowing and regardless of the amortization profile. This ratio confirms the trend in reserve accumulation and shows the efforts of the Mexican authorities to reduce vulnerabilities in the economy to a capital account shock. At end-June 2003, reserves covered around 70 percent of net public sector external debt, compared with 6 percent at the time of the Tequila crisis in January 1995.

12. **Mexico's reserves are currently above a composite minimum benchmark estimated taking into account external debt amortizations, the risk of a capital flight, and country-specific risks**.[12] In particular, Mexico's reserves are compared with the minimum benchmark for holdings computed according to a methodology suggested by De Beaufort and Kapteyn (2001). Starting from the minimum of full coverage of short-term external debt,[13] an estimate of the potential for capital outflow stemming from residents is added to the minimum holding of reserves. A percentage of broad money is used as a proxy for potential capital flight. According to this measure, the risk of capital flight is indicated by 5 and 10 percent of broad money for countries like Mexico that have a flexible exchange

[9] Guidotti was apparently the first to propose such a rule at a seminar of the Group of 33 in Bonn in the spring of 1999. Greenspan (1999) also put forward such a rule, complemented by two enhancements—that average maturity of external debt should be above a certain threshold, and that countries implement a liquidity-at-risk standard.

[10] These data on short-term external debt on a remaining maturity basis are collected from creditor sources, and may differ from the data reported in individual IMF staff reports, which are usually obtained from the authorities.

[11] See Edison (2003) for a discussion on excess reserve accumulation.

[12] These results are in line with those reported in Edison (2003), which show that Mexico accounts for the bulk of reserve accumulation in Latin America since 1997, and has actual reserves above those warranted by fundamentals.

[13] As the analysis here is no longer cross-country comparative, data on short-term debt on a remaining maturity basis are from the Bank of Mexico and Fund staff projections, in line with the figures reported on Table 2 of the Staff Report for the 2003 Article IV Consultation.

rate.[14] Finally, the fraction of broad money covered is adjusted using an index of country risk. In this regard, the benchmark considers the international country risk index (CRI) for Mexico, which covers political, financial, and economic risks.[15] While reserves were somewhat below the composite benchmark until 2002, the level as of 2003 is 15 percent above the estimated adequacy range (Table 2).

Table 2. Mexico: Computation of a Minimum Reserve Benchmark

(In billions of U.S. dollars, unless specified)

	Short-term debt [1/]	Broad Money	CRI (in percent)	Benchmark Interval[2/] Lower Limit	Benchmark Interval[2/] Upper Limit	Reserves	Adequacy
1994	31.8	76.3	73.5	34.6	37.4	6.7	Below
1995	54.8	70.0	68.5	57.2	59.6	15.8	Below
1996	59.2	85.4	70.0	62.2	65.1	19.6	Below
1997	45.1	111.0	70.8	49.0	53.0	28.9	Below
1998	45.0	106.6	67.5	48.6	52.2	31.9	Below
1999	43.9	126.2	68.8	48.3	52.6	31.9	Below
2000	39.7	118.3	73.0	44.1	48.4	35.6	Below
2001	42.7	141.3	70.8	47.7	52.7	44.8	Below
2002	40.1	131.0	70.8	44.7	49.3	50.7	Adequate
Medium-Term Projections (see Section C)							
2003	38.8	143.0	70.8	43.8	48.9	56.0	Adequate
2004	36.7	155.4	70.8	42.2	47.7	59.8	Adequate
2005	40.1	168.9	70.8	46.1	52.0	63.6	Adequate
2006	40.9	183.7	70.8	47.4	53.9	67.4	Adequate
2007	45.1	199.9	70.8	52.1	59.2	71.3	Adequate
2008	47.1	217.5	70.8	54.8	62.5	75.2	Adequate

1/ On a remaining maturity basis.

2/ The benchmark interval covers short-term debt plus 5 (10) percent of broad money for the lower (upper) limit, adjusted by the country risk factor.

Sources: Data on short-term debt are from BOM and Fund staff estimates. Data on broad money are from IFS (IMF) and Fund staff estimates. Data on reserves from BOM and Fund staff estimates. Country risk index (CRI) is from the international country risk guide (ICRG).

[14] The authors suggest to adjust by a fraction of between 10 and 20 percent of M2 for managed float and fixed exchange rate regimes, and between 5 and 10 percent for floaters. This interval is consistent with the declining trend of the standard deviation of the reserves-to-broad money ratio, which ranges between 8 percent to 6 percent depending on the period considered.

[15] *The Economist*'s country risk index was also considered, yielding similar conclusions. Benchmark intervals are reported on the basis of the CRI, as it implied a more conservative level of reserve adequacy.

13. **The level of reserves is also adequate when the risk of capital flight is assessed against dollarized deposits.** The minimum benchmark is computed by including 100 percent of dollarized deposits, instead of the coverage of 5 and 10 percent of broad money.[16] The analysis indicates that reserves were below the benchmark until 2001. Following the subsequent increase to US$45 billion, reserves rose to 26 percent above the suggested upper limit of the benchmark by end-2002.

14. **The benefits of having international reserves need to be balanced against the holding costs**. According to the literature on the demand for reserves, a country balances the macroeconomic adjustment costs incurred if reserves are exhausted against the opportunity costs of holding reserves. As international reserves are usually held in the form of short-term interest bearing assets, the opportunity costs of holding reserves will be the difference between the domestic return on capital and the return obtained from holding the reserves. When analyzing the costs and benefits of holding reserves, positive externalities associated with higher reserve accumulation, including for example lower costs of external borrowing by both the public and private sectors, should also be taken into account.

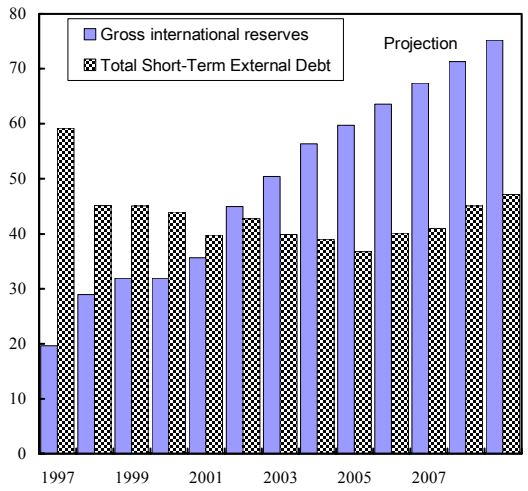
C. Projections of Reserve Accumulation

15. **A baseline projection for reserve accumulation would be consistent with a strengthening of the reserve position, although at a slower pace than in recent years (Figure 2)**. Accumulation depends mainly on oil export receipts and government financing operations in international markets (including PEMEX). Positive prospects for external financing opportunities and for continued strong oil exports (despite the baseline assumption of a decline in world oil prices, to around US$21.5 dollar per barrel over the medium term) would translate into further increases in Mexico's international reserve position, and thus further dollar sales by the central bank. Given current projections for oil prices and external financing estimates, Mexico would continue accumulating reserves strongly, with the level reaching US$75.2 billion by 2008. Despite the fact that new mechanism would reduce the rate of reserve accumulation, reserves are projected to increase by at least US$3.5 billion per year from 2004 onwards. By comparison, during 2002, Mexico accumulated reserves of US$5.5 billion per year.

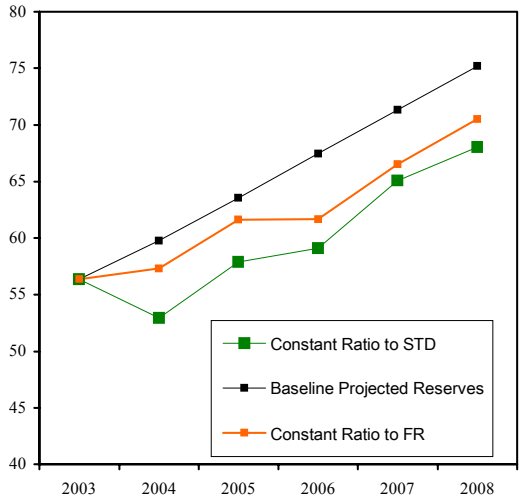
[16] Data from Faal and Thacker (2003).

Figure 2. Mexico: Projections of Reserve Accumulation

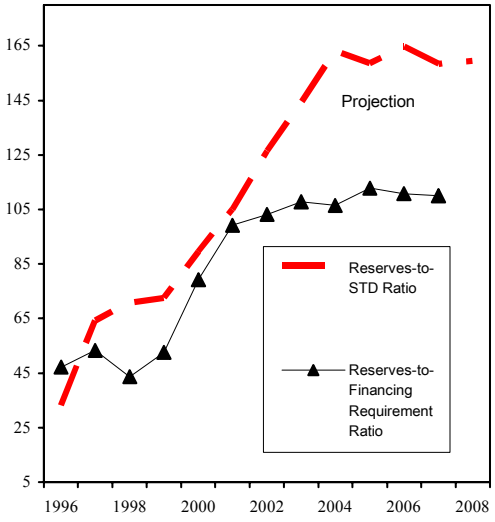
International Reserves and External Short-Term Debt
(on a Remaining Maturity Basis)
(In billions of U.S. dollars, end of period)



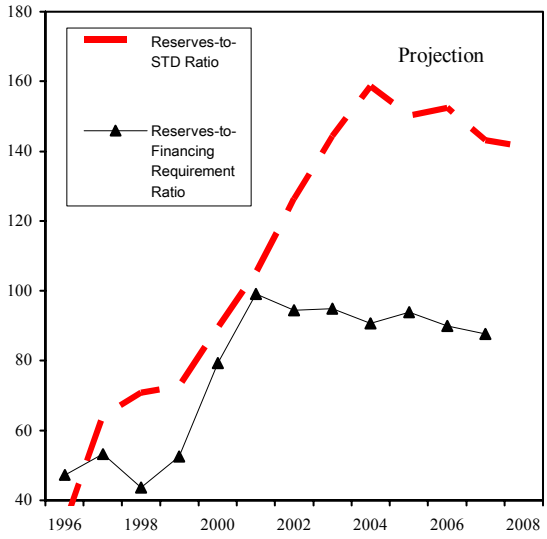
Baseline Projected Reserves and Scenarios on
Reserve Accumulation
(In billions of U.S. dollars)



Baseline Scenario: Evolution of Vulnerability Ratios
(In percent)



Alternative Scenario: Evolution of Vulnerability Ratios
(In percent)



Source: BOM and IMF staff estimates

16. **Under this scenario, both the ratio of reserves to short-term debt and to gross external financing requirements would continue to rise (Figure 2)**. In order to maintain these ratios constant, reserves would need to grow on average by 2.5 percent annually throughout 2008. In contrast, projected reserves rise by nearly 4 percent annually. The ratio of reserves to short-term debt (on a remaining maturity basis) would increase to nearly 160 percent, and reserves would cover 110 percent of the financing requirements of the balance of payments by 2008, up from 143 percent and 103 percent respectively in 2003.

17. **Thus, under the baseline scenario, reserves would well surpass the minimum benchmarks over the medium term**. Assuming a constant country risk index, reserve projections would be 22 percent, on average, above the upper limit of the minimum benchmark defined by De Beaufort and Kapteyn (2001), considering broad money coverage from 2003 onwards (Table 2). When considering full coverage of dollarized deposits, reserves would again be above the minimum benchmark during the projection period, by an average margin of 57 percent.

18. **Under an alternative scenario with significantly lower oil prices and less external financing of government operations (including PEMEX), reserve adequacy ratios could decline over the medium term**. This alternative scenario is constructed assuming a reduction of 50 percent of PIDIREGAS project financing going to international reserves accumulation, and oil prices for the Mexican mix falling sharply to US$10 per barrel over the medium term. In this case, the ratio of reserves to short-term external debt on a remaining maturity basis would decline by 2 percent over the medium term. The ratio of reserves to external financing requirements would decline significantly to 87 percent in 2008. Under this scenario, although reserve projections would exceed the minimum benchmark defined by De Beaufort and Kapteyn (2001), the margin would decline to only 6 percent in 2008.

D. Conclusions

19. **Reserves currently appear to be adequate in Mexico.** Different vulnerability ratios indicate that reserves compare well with levels in other emerging market economies. They comply with the rule of covering short-term debt on a remaining maturity basis, the most important vulnerability ratio. Reserves would also be sufficient to face a capital flight crisis related to a loss in the confidence of the domestic currency by residents, even though such an event has a low possibility of occurrence.

20. **Although the baseline projection for reserves shows a continuing strengthening in the reserve position, lower oil prices and less external financing could lead to declining adequacy ratios.** Reserves are projected to accumulate strongly despite the implementation of the new mechanism, by around US$3.5 billion per year over the medium term. Under the baseline scenario, adequacy ratios would continue their upward trend, and reserves would well surpass the reserve level suggested by De Beaufort and Kapteyn. Under an alternative scenario, with lower oil prices and less external financing of government operations, adequacy ratios could start declining, suggesting the possible need for an alternative mechanism to ensure that reserve adequacy is maintained**.**

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II. TOWARDS SUSTAINED DEBT REDUCTION: MEXICO'S FISCAL FRAMEWORK[1]

This chapter examines the recent experience with Mexico's fiscal management tools in light of the need for further consolidation. It concludes that a strengthening of the framework could play an important role in fostering deficit and debt reduction. We first review evidence on the cyclical behavior of fiscal policy in Mexico, finding that it has generally been pro-cyclical since the early 1990s. We then assess the performance of existing fiscal management tools from both a cyclical and longer-term perspective. Finally, we analyze the contribution that various fiscal rules could make towards achieving sustainable deficit and debt reduction. In particular, a medium-term fiscal framework, emphasizing broader measures of public liabilities, and including explicit debt-targets and expenditure growth ceilings, could play a useful role in the Mexican context. In addition to institutional reforms to strengthen expenditure control, expanding the tax base would reduce revenue volatility, strengthen automatic stabilizers, and enable the government to run sustained primary surpluses without undue expenditure compression.

A. Introduction

21. **Despite significant improvements in Mexico's fiscal position since the *tequila* crisis, important challenges remain.** While both the traditional and broad deficit measures fell in the second half of the 1990s, consolidation has stalled recently. The primary surplus remains low and non-oil balances have deteriorated, as high oil prices have offset weak non-oil tax performance. Moreover, the ratio of gross public debt to GDP edged up to almost 50 percent at end-2002, in spite of high oil prices. Public finances are still vulnerable to internal and external shocks, reflecting a narrow tax base, dependence on oil revenues, and relatively large public sector liabilities. The debt ratio could rise further over the medium term, assuming oil prices decline from current high levels, unless decisive consolidation measures are taken. Further deficit and debt reduction are key for reducing the vulnerability of public finances and creating scope for counter-cyclical policies.

22. **This paper examines the experience with Mexico's fiscal management tools in light of the need for further consolidation**. It concludes that a strengthening of the framework could play an important role in fostering deficit and debt reduction. We first review evidence on the cyclical behavior of fiscal policy in Mexico, concluding that it has generally been pro-cyclical since the early 1990s. The following section assesses the performance of existing fiscal management tools—the "budget adjustors" and the Oil Stabilization Fund (OSF)—in responding to shocks, as well as the authorities' medium-term framework, the *Programa Nacional de Financiamento del Desarollo* (PRONAFIDE). Finally, we analyze the contribution that various fiscal rules could make towards achieving sustainable deficit and debt reduction. In particular, a medium-term fiscal framework, emphasizing broader measures of public liabilities, and including explicit debt-targets and

[1] Prepared by E. Jenkner.

expenditure growth ceilings, could play an important role in the Mexican context. In addition to institutional reforms to strengthen expenditure control, expanding the tax base would reduce revenue volatility, strengthen automatic stabilizers, and enable the government to run sustained primary surpluses without undue expenditure compression.

B. Cyclical Behavior of Fiscal Policy in Mexico

23. **Several studies have concluded that fiscal policy throughout Latin America has tended to be pro-cyclical, preventing effective debt reduction during economic upswings** (WEO, 2002; WEO, 2003; Gavin and Perotti, 1997; Talvi and Végh, 2000). Contributing factors have been: the weakness of automatic stabilizers due to narrow tax bases and limited social security systems; credit constraints on government financing during economic downturns; large public sector debt burdens and rising debt servicing payments in downturns; weaknesses in fiscal management techniques; and political and institutional factors that weigh against public savings—and debt reduction—during upturns. Social expenditures and infrastructure investment tend to be the first casualties during economic crises, exacerbating income inequality and potentially constraining long-term growth prospects.[2] Calderón and others (2002) estimate that more than half of the total fiscal adjustment effort in Argentina, Bolivia, Brazil, Chile and Peru during the 1990s was achieved through infrastructure compression. As a result, long-run growth may have been lowered by 1 percentage point per year.

24. **A recent World Bank study concluded that fiscal policy has also been pro-cyclical in Mexico** (World Bank, 2001). Moreover, the authors found that a discretionary fiscal contraction is associated with a decline in GDP within the following two quarters. As a result, pro-cyclical changes in the fiscal stance have amplified the magnitude of the cycle. Social spending also shows pro-cyclical tendencies. During the1994–95 crisis, targeted spending per poor person decreased by 24 percent—driven both by reductions in social spending and an increase in the incidence of poverty (Hicks and Wodon, 2001).

25. **Using the primary fiscal impulse as a measure of discretionary fiscal policy illustrates the procyclicality of policy since the early 1990s (Figure 1)**.[3] Between 1991 and 2002, there was a significant, positive relationship between the primary impulse and changes in the output gap, with a correlation coefficient of 0.9. The factors underlying this tendency can be determined by decomposing the primary fiscal impulse into its components and estimating the relationship between changes in these fiscal variables and the cyclical component of GDP in a series of univariate regressions, using annual data for 1991 through 2002 (Table 1).

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[2] See Braun and di Gresia (2003), Hicks and Wodon (2001), Wodon and others (2000), Lloyd-Sherlock (2000), and Calderón and others (2002).

[3] The primary impulse is calculated using the standard IMF method for assessing discretionary fiscal policy changes (Schinasi and Lutz, 1991; Cordoba, 2001). In the case of Mexico, oil export receipts and nonrecurring revenue are excluded. Potential GDP and the output gap are estimated using a Hodrick-Prescott filter.

Figure 1: Output Gap and Fiscal Impulse in the 1990s

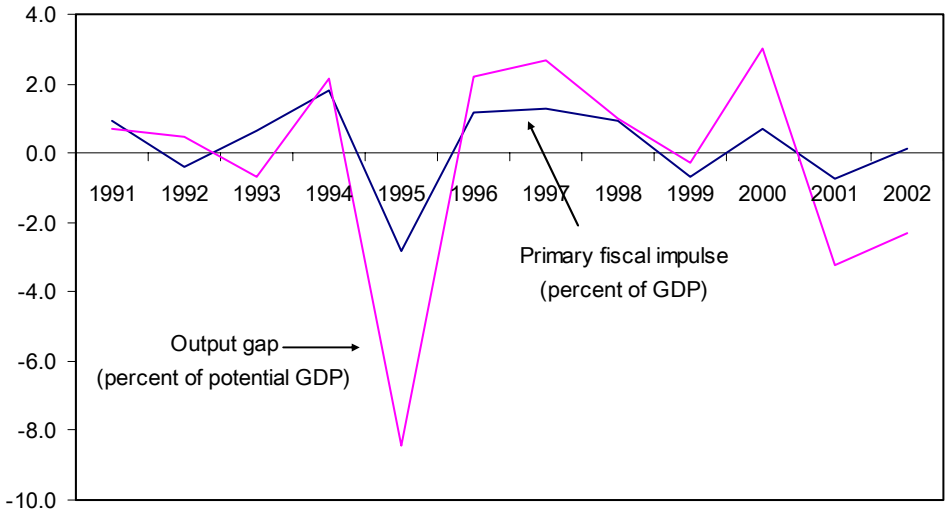


Table 1. Fiscal Variables and the Cycle, 1991-2002

	Relationship to changes in the output gap (as a percentage of potential GDP)	
	Betas 1/	Correlation coefficients
Primary fiscal impulse	**0.35** ***	**0.90**
Adjusted budgetary revenue 2/ 3/	**0.07**	**0.41**
VAT revenue 2/	0.00	-0.20
Income tax revenue 2/	0.07 *	0.52
Oil revenue (excl. export revenue) 2/	-0.03	-0.20
Other revenue 2/	0.03	0.27
Total primary spending 4/ 5/	**0.42** ***	**0.90**
Current spending 4/	0.32 ***	0.78
Capital spending 4/	0.10 **	0.67
Memorandum items		
Social spending 4/	0.17 ***	0.79
Interest spending 4/ 6/	-0.46 **	-0.73

Source: SHCP and staff estimates.

1/ Slope coefficients from a series of regressions of the change in fiscal variables on the change in the output gap.
2/ Changes, as a percent of GDP.
3/ Excludes nonrecurring revenue and oil export revenue.
4/ Changes, as a percent of potential GDP.
5/ Includes PIDIREGAS spending and all PSBR adjustors except financial requirements of development banks.
6/ Includes interest costs of bank restructuring.

Note: ***, **, and * denotes significance on the 99 percent, 95 percent, and 90 percent level, respectively.

26. **These results confirm a significant and positive relationship between the primary impulse and changes in the output gap.** On the revenue side, the ratio of income tax revenues to GDP has a positive relationship with the cycle, but the low coefficient confirms their limited stabilizing role in Mexico. The ratio of VAT revenues to GDP is found to be insensitive to the cycle. Oil revenue is found to move slightly counter-cyclically. Primary expenditures, in contrast, are highly correlated with the cycle and appear to drive the overall procyclicality of fiscal policy. Current expenditure and social spending appear to be more sensitive to changes in the output gap than capital expenditure—in contrast to the experience elsewhere in the region that capital outlays tend to be disproportionately compressed during crises. Interest expenditures, on the other hand, are negatively related to changes in the output gap, presumably reflecting a negative relationship between sovereign yield spreads and Mexican activity.

27. **Thus, fiscal policy in Mexico appears to be procyclical—or "leaning with the wind"—for a number of reasons**. First, automatic stabilizers are weak, given the small tax base, and absence of an extensive social security system. At the same time, primary expenditures are highly procyclical. This procyclicality seems to be associated with counter-cyclical movements in debt-servicing costs. As Table 1 shows, the coefficients on primary expenditures and interest payments are roughly offsetting, indicating that *overall* expenditures have been little affected by the cycle. But as interest payments have fallen in upswings, the savings have been used to finance higher primary spending, and the reverse has occurred in downturns. This is consistent with the general difficulty observed in Latin America of containing political pressures to spend windfall gains (WEO, 2003).

C. The Budget Adjustors and Oil Stabilization Fund: Evolution and Impact

28. **Two important fiscal management tools exist in Mexico to control budget execution and ensure saving of windfall revenues—at least in principle:** automatic budget adjustors to deal with unforeseen fluctuations in revenues; and an Oil Stabilization Fund (OSF) designed to smooth the effects on the budget of short-term fluctuations in oil prices. As this section demonstrates, however, neither has been particularly successful in containing spending pressures during economic upturns or periods of high oil prices.

29. **Since 1998, annual budget laws have included so-called fiscal adjustors.** These adjustors imply pro-cyclical expenditure cuts when revenues fall short of budget estimates, and counter-cyclical deficit reduction when revenues exceed expectations. The adjustors have evolved since their introduction (Table 2). While written into annual budget laws, the government retains discretion in applying the adjustors. Ceilings on new net indebtedness are legally binding, though, and provide a limit to the overall deficit that can only be modified by congress.[4]

[4] Budget laws contain other provisions to meet the deficit target, for example, that additional spending by public enterprises will only be authorized if it does not threaten the deficit target.

Table 2. Mexico: Annual Budget Adjustors

	Response to Higher Revenues 1/	Response to Lower Revenues
1998	1 percent of excess tax revenues over the first 9 months of the year to be spent on social and rural development, and road maintenance. The remaining 99 percent of excess revenues and all excess revenues of the last 3 months of the year to be saved.	Shortfalls in overall revenues in excess of 1 percent of tax revenues to be matched by spending cuts. Congressional approval required for cuts in excess of 10 percent of original tax revenues.
1999	1 percent of excess tax revenues over the first 9 months of the year to be spent on social and rural development, and road maintenance. The remaining 99 percent of excess revenues and all excess revenues of the last 3 months of the year to be saved.	Shortfalls in overall revenues in excess of 1 percent of tax revenues to be matched by spending cuts. Congressional approval required for cuts in excess of 10 percent of original tax revenues.
2000	Of all excess revenue above 0.13 percent of GDP, 40 percent to be allocated to the Oil Stabilization Fund (OSF), and 60 percent to be used for debt amortization.	Shortfalls in overall revenues in excess of 1 percent of tax revenues to be matched by spending cuts. Congressional approval required for cuts in excess of 10 percent of original tax revenues.
2001	33 percent of excess tax and oil revenue to be saved, 33 percent to be transferred to the Oil Stabilization Fund, and 34 percent to be spent on infrastructure investment in the South-Southeast, hydraulic infrastructure, and development projects in disadvantaged and oil-producing regions.	Shortfall in oil nontax revenue (derechos) caused by a lower oil price of up to $1.5/bbl to be met through full expenditure adjustment. If oil price lower by more than $1.5, up to 50 percent of total resources in OSF can be used. Shortfalls in excess of this amount to be met through expenditure adjustment. Any other shortfalls in budgetary revenues to be matched by spending cuts. Congressional approval required for cuts in excess of 5 percent of original tax revenues.
2002	33 percent of excess tax, nontax and oil revenue to be saved, 33 percent to be transferred to the Oil Stabilization Fund, and 34 percent to be spent on infrastructure investment in the South-Southeast, hydraulic infrastructure, and development projects in disadvantaged and oil-producing regions.	All shortfalls in oil revenue (not only those caused by a lower oil price) can be met through up to 50 percent of total resources in OSF. Shortfalls in excess of this amount to be met through expenditure adjustment. Transitory article permitted almost full depletion of OSF in March 2002 (Mx$8 billion). Any other shortfalls in budgetary revenues to be matched by spending cuts in specified areas. Congressional approval required for cuts in excess of 5 percent of original tax revenues.
2003	25 percent of excess tax, nontax and oil revenues to be saved, 25 percent to be transferred to the Oil Stabilization Fund, and 50 percent to be spent on infrastructure investment in the States.	Shortfalls in oil revenue can be met through up to 50 percent of total resources in the OSF. Shortfalls in excess of this amount to be met through expenditure adjustment. 2/ Any other shortfalls to be matched by spending cuts in specified areas. Congressional approval required for cuts in excess of 5 percent of original tax revenues.

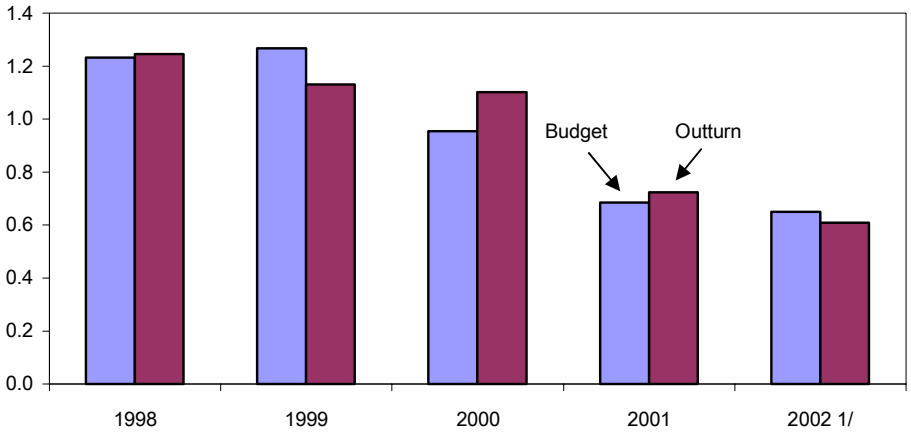
Source: Leyes de Ingresos y Egresos 1998-2003.

1/ Net of higher "nonprogrammable spending", such as federal revenue sharing and interest expenditure.
2/ As resources in the OSF were almost completely depleted in 2002, this effectively implies full expenditure adjustment.

30. **The adjustors were mainly designed to ensure that the "traditional" deficit does not exceed the budget target.** Indeed, the Mexican authorities have been very successful at meeting these targets (Figure 2). The traditional deficit is much smaller than the broader "augmented" deficit concept used in most staff analysis, however, as it excludes large public sector liabilities associated with bank restructuring in the aftermath of the Tequila crisis, PIDIREGAS investment projects, and financial requirements of the development banks (Figure 3). For example, the 2003 budget envisages a traditional deficit of 0.5 percent of GDP, whereas the PSBR amounts to 3.4 percent of GDP. Since 2001, the authorities have published net public sector borrowing requirements (PSBR) along with the traditional deficit.

Figure 2. Mexico: Traditional Deficit Budget Targets and Outturns 1998-2002

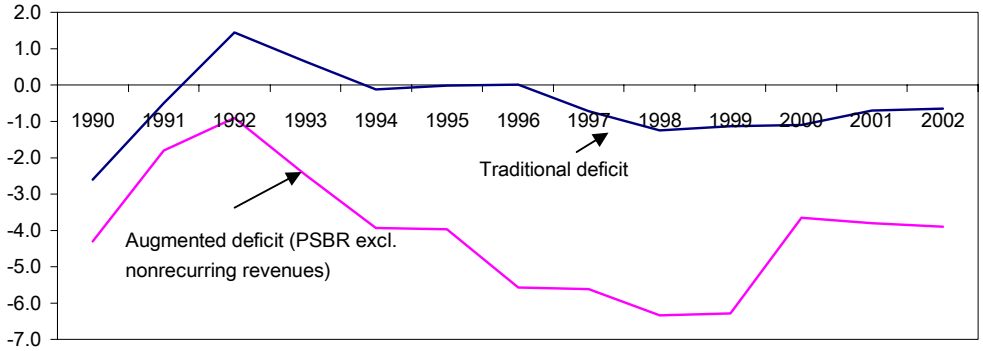
(In percent of GDP)



Source: SHCP and staff estimates.
1/ Excluding Banrural

Figure 3. Mexico: The Traditional and Augmented Deficit Definitions

(In percent of GDP)



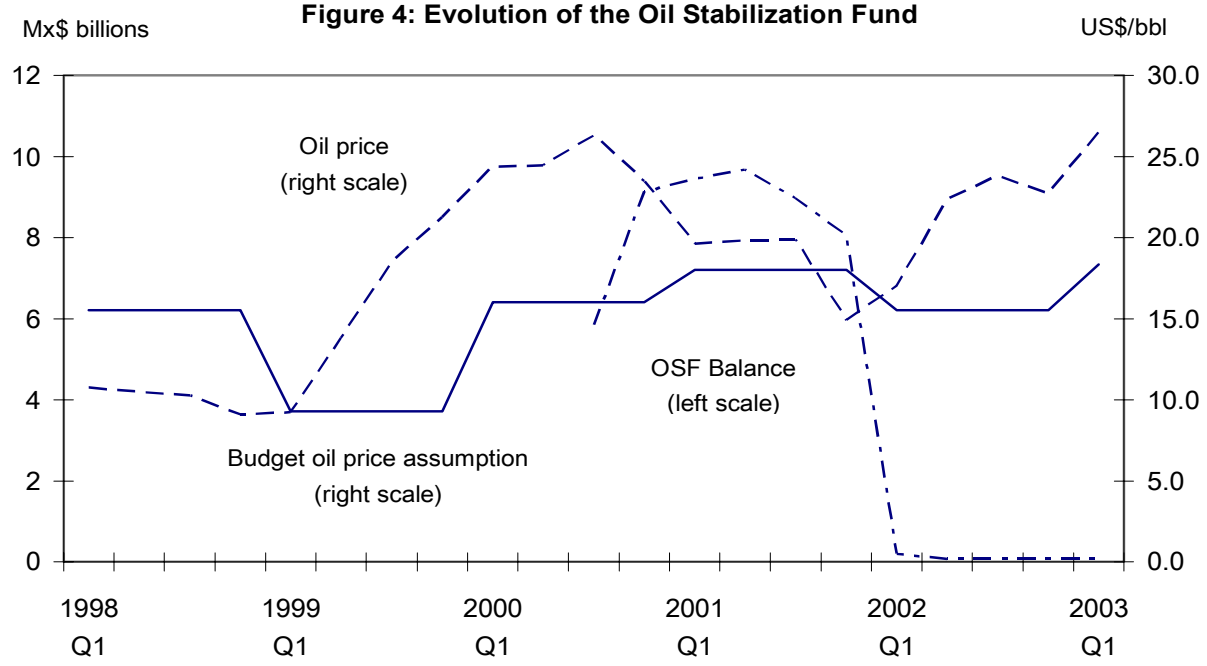
31. **The character of the adjustors changed with the introduction of the OSF in 2000.** Previously, oil revenues had been included in the overall revenue concept applied in the case of revenue shortfalls; they were excluded, however, from the definition of excess revenue, which was to be saved. In other words, oil revenues could compensate for non-oil tax revenue shortfalls, and windfall gains in oil revenues could be spent as long as there was not a shortfall in other revenue. In contrast, the original rules of the OSF were designed to provide a more robust cushion against oil price fluctuations: resources from the OSF could be used to offset low oil revenues when oil prices fell below a certain threshold, in an amount up to 50 percent of the contents of the Fund. The OSF was to be replenished with a third of overall excess revenues in years where total revenues exceeded budget estimates.[5]

32. **In practice, however, higher oil revenues have continued to be used to compensate for shortfalls in other revenues, as was the case prior to the OSF**. The revenue concept used to calculate transfers to the OSF includes total tax and oil revenue, such that oil windfall gains have often been used to compensate for tax revenue shortfalls. In 2000, of MEX$52 billion in higher-than-budgeted oil revenues, only MEX$9 billion was transferred to the OSF; in 2002, all excess oil revenues amounting to MEX$14 billion were used to compensate for tax revenue shortfalls, and in 2003 it is currently projected that, of MEX$47 billion in windfall oil revenues, only MEX$3.5 billion will accrue to the OSF. Moreover, in 2002, the rules for drawing on the resources in the OSF were changed to apply to any fluctuations in oil revenue, not just volatility caused by oil price developments. Simultaneously, by means of a temporary decree, the fund was depleted to offset large revenue shortfalls. It currently contains only MEX$75 million, or 0.001 percent of GDP—despite almost uniformly higher oil prices than envisaged in past budgets (Figure 4).

33. **The adjustor on the amount of excess revenues to be saved has also been reduced incrementally.** While only 1 percent of excess tax revenues over the first nine months of the year could be spent originally, in 2000 up to 0.13 percent of GDP in excess revenue could be spent (equivalent to about 1½ percent of budgeted tax revenues). From 2001, a third of excess revenue could be spent on investment; in 2003, the extra spending ceiling has been increased to 50 percent of excess revenue, and resources are to be turned over to the federal states. At the same time, shortfalls in tax revenue—if not offset by higher oil revenue—still have to be offset through cuts in expenditures.

[5] Transfers from and to the OSF are excluded from the augmented balance (PSBR) definition, which excludes all nonrecurring revenues; the traditional balance includes transfers from the OSF as revenues, and transfers to the OSF as an expense.

Figure 4: Evolution of the Oil Stabilization Fund



34. **Overall, these modifications, along with discretion in the implementation of the adjustors, have limited the deficit-reducing effect of the adjustors during economic upturns, while maintaining procyclical spending cuts during downturns**. After depletion of the OSF in 2002, the regime in effect transmits any revenue volatility vis-à-vis the original budget (in part caused by oil price fluctuations) to spending programs, albeit to a lesser extent during periods of higher revenues. In other words, while the adjustors help to enforce the traditional deficit target, they leave little room for the limited automatic stabilizers that do exist to come into play, and reinforce the procyclicality of public finances, in particular during economic downturns.

35. **In practice, the adjustors have been successful in reducing spending when revenue has fallen short, but failed to reign in expenditure during the boom year of 2000 (Table 3)**. While the adjustors were applied in 2000, in the sense that part of the additional revenue was saved and part was transferred to the OSF, additional spending was authorized beyond that implied by the adjustors, and a large reserve for potential tax reimbursements was created.[6] In contrast, in 1998, 2001 and 2002, the government

[6] In 2000, total excess revenues amounted to MEX$59 billion. Of this amount, MEX$10 billion was transferred to a reserve fund for tax re-imbursements; an additional MEX$17 billion went to higher nonprogrammable spending, which exceeded estimates despite significantly lower interest costs, mainly due to high one-off transfers in debtor support; and the remaining amount—MEX$32 billion—was divided in accordance with the adjustors laid out in the law (Table 2), implying higher programmable spending of MEX$9 billion, transfers to the OSF of MEX$9 billion, and a "lower deficit" of MEX$14 billion.

implemented expenditure cuts as revenues were below budget. In 1999, higher oil revenues and lower interest costs were to some extent offset by lower tax revenue, while the deficit still remained below target.

36. **Despite the adjustors' relative effectiveness in meeting targets for the narrow deficit, they have no impact on fiscal consolidation.** They are not legally binding, and are up for renewal with each annual budget. This has permitted congress to allocate a rising share of excess revenues to investment spending, instead of using windfall gains for debt reduction. Most privatization receipts are excluded. Also, public enterprises can spend higher revenues provided they meet their primary balance target, although some additional mechanisms are in place to reign in excessive spending in this sector. More generally, the adjustors are a limited tool that works only on the margin – or in relation to the budget that has been adopted in the first place, which in itself lacks a medium-term context; in addition, it focuses on the traditional, narrow deficit, as opposed to the augmented deficit, or net public sector borrowing requirement (PSBR).

Table 3. Mexico: Budget Execution 1998-2002

(In billions of pesos)

Budget 1/					
	Total revenue	Oil revenue	Oil price (US$)	Total spending	Traditional balance
1998	803	300	15.5	851	(47)
1999	950	297	9.3	1,013	(58)
2000	1,124	375	16.0	1,177	(53)
2001	1,302	413	18.0	1,343	(40)
2002	1,405	396	15.5	1,445	(40)
Outturn 1/					
	Total revenue	Oil revenue	Oil price (US$)	Total spending	Traditional balance
1998	783	253	10.2	831	(48)
1999	956	311	15.7	1,009	(52)
2000	1,188	427	24.8	1,248	(61)
2001	1,271	387	18.6	1,312	(42)
2002 2/	1,377	409	21.6	1,411	(38)
Difference 1/					
	Total revenue	Oil revenue	Oil price (US$)	Total spending	Traditional balance
1998	(20)	(47)	-5.4	(21)	(1)
1999	7	14	6.5	(3)	6
2000	63	52	8.8	71	(8)
2001	(31)	(26)	0.6	(32)	(2)
2002 2/	(28)	14	6.1	(34)	3

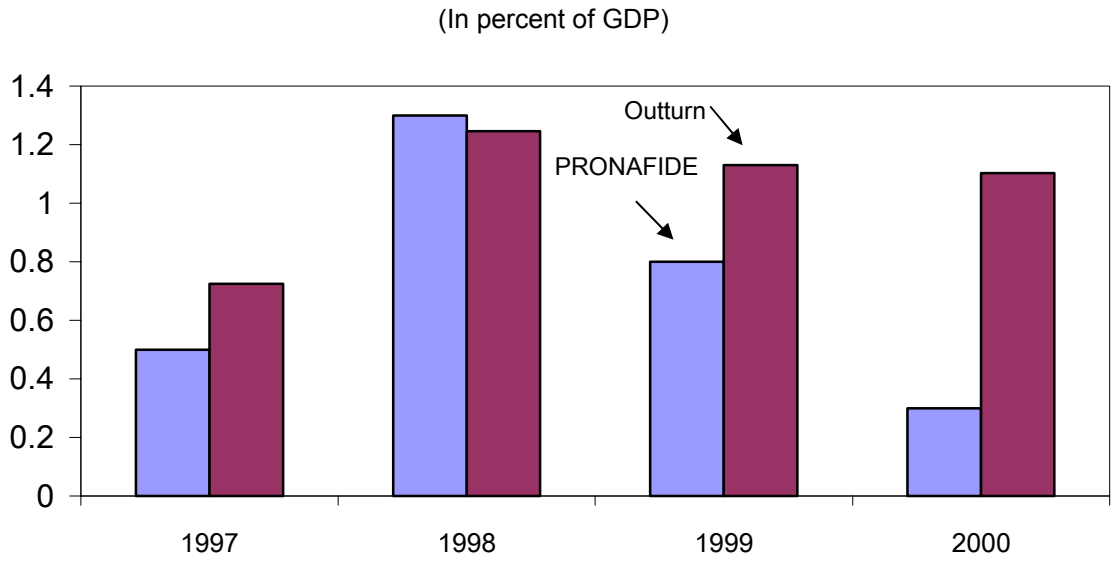
1/ Total spending and revenue numbers may not add up to the deficit shown above due to extrabudgetary operations.

2/ Excluding Banrural, an operation for which higher spending was authorized by congress.

D. The PRONAFIDE Framework

37. **Each new administration in Mexico has developed a National Development Plan (*Plan Nacional de Desarollo*), backed up by sectoral plans, and a financing framework, PRONAFIDE**. PRONAFIDE's deficit and debt targets are not legally binding, have no formal connection to the annual budget process, and have not traditionally been updated during the life of the plan—all of which tend to limit PRONAFIDE's relevance for annual budget discussions. For example, the Zedillo government's traditional balance targets included in the 1997–2000 PRONAFIDE were missed by increasingly wide margins over the life of the plan, despite higher average growth rates and higher non-oil revenue than envisaged (Figure 5).

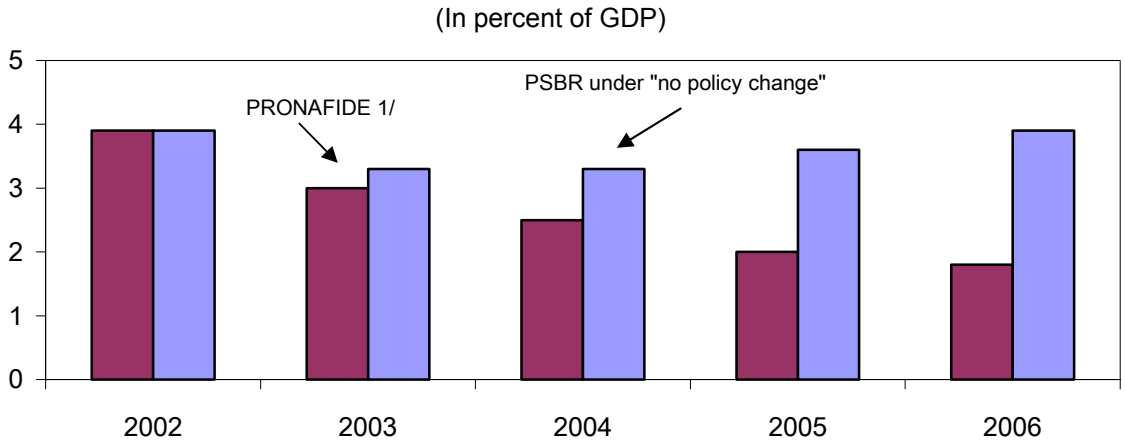
Figure 5: 1997-2000 PRONAFIDE Traditional Budget Deficit Targets Versus Outturns



38. **The current 2002-2006 PRONAFIDE targets for the augmented deficit and debt, published in 2002, are also at risk unless further consolidation measures are implemented. PRONAFIDE aimed at substantial fiscal consolidation and debt reduction between 2002 and 2006**. The 2002 fiscal outturn and the 2003 budget objective for the "traditional" balance were in line with PRONAFIDE, excluding the restructuring of the rural development bank BANRURAL, and the objective for the PSBR was more than achieved in 2002. But the PSBR envisaged in the 2003 budget, as well as the outturn for the debt levels in the first quarter, exceed targets, and the gap would widen further unless new

measures are introduced (Figure 6).[7] The "no policy change" scenario shown assumes no tax reform, and primary spending remaining constant as a share of GDP at its 2003 level.[8] Even adhering to this path would require considerable effort given existing spending pressures, as well as other risks to the outlook, such as the cost of a potential pension reform.

Figure 6: PRONAFIDE PSBR Deficit Targets and Projections under "No Policy Change"



Source: SHCP and staff estimates.

1/ PRONAFIDE midpoint between the two scenarios as shown in IMF Country Report No. 02/237.

39. **Moreover, even if PRONAFIDE targets for the augmented balance from 2004 onwards were met, debt levels would remain above the path originally envisaged**. Due to a combination of slow GDP growth in 2002-2003 and a rise in the peso value of external debt caused by currency depreciation, the ratio of augmented debt to GDP would remain above the PRONAFIDE path (Figure 7).

E. A Fiscal Framework for Debt Reduction

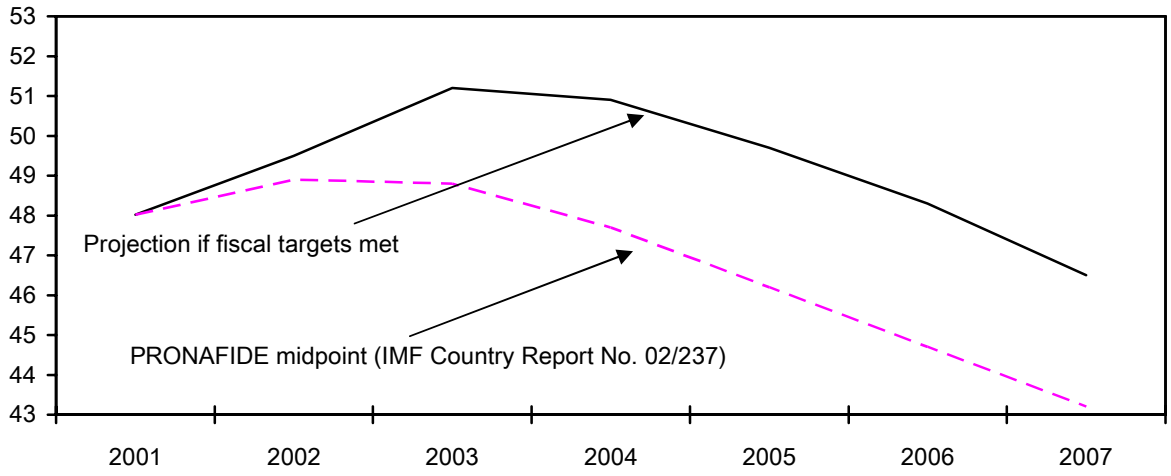
40. **Fiscal consolidation in many countries has been accompanied by institutional reform**, notably by enshrining fiscal responsibility principles in policy frameworks. In Latin America, several countries have introduced fiscal responsibility laws, with varying degrees of success (Brazil, Argentina, Ecuador, Colombia and Peru), and Chile has adopted a structural balance rule. There is some evidence that fiscal rules have helped to fend off political-economy pressures, especially by imposing hard budget constraints on subnational governments. Sweden and the Netherlands constitute impressive examples of fiscal consolidation achieved in the context of rules-based frameworks.

[7] Refers to the "inertial" scenario in PRONAFIDE.

[8] Net of higher infrastructure investment financed out of excess revenues in 2003.

Figure 7: Gross Augmented Public Sector Debt

(In percent of GDP)

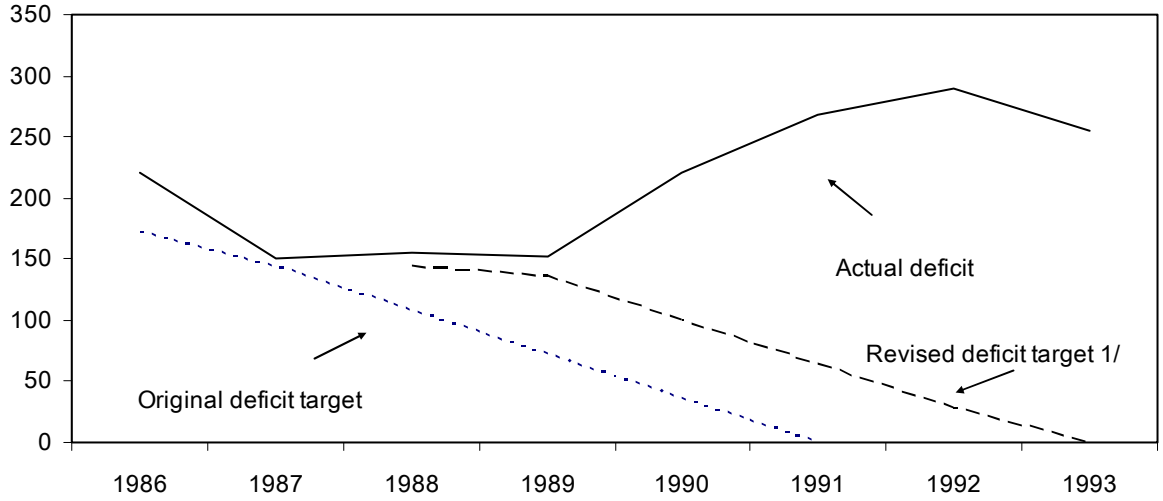


Source: SHCP and staff estimates.

41. **Nevertheless, fiscal rules are not a panacea, and cannot substitute for true political commitment to structural reforms fostering long-term, sustainable spending adjustments.** The failure of the Gramm-Rudman-Hollings framework to reign in the U.S. fiscal deficit in the late 1980s and early 1990s demonstrates the difficulty of achieving fixed targets absent political agreement on indispensable structural policy changes and without credible enforcement mechanisms (Figure 8). The U.S. experience in the 1990s with fiscal consolidation under the Budget Enforcement Act (BEA) in the context of greater political commitment was substantially more successful (Kell, 2002). Thus, fiscal rules can generally only strengthen policies that are already credible, as opposed to in themselves ensuring full credibility. Also, a simple, clear definition and complete transparency in fiscal accounting are key to ensuring the success of any rule.

42. **A framework for promoting further fiscal consolidation in Mexico could consist of two elements: fiscal responsibility principles to limit deficits over the medium term, combined with up-front tax reform measures**. Tax reform to raise significantly non-oil revenues would enhance the authorities' ability to run primary surpluses and reduce public sector liabilities without undue expenditure compression. However, broad political support for fiscal consolidation may be difficult to establish—not least since the narrow deficit usually under public scrutiny and the focus of budget discussions has diminished to 0.5 percent of GDP. In this context, additional safeguards in the form of fiscal responsibility principles could help to constrain spending pressures in the event of a tax reform to ensure further reductions in deficit and debt.

Figure 8: The U.S. Deficit Compared with the Gramm-Rudman-Hollings Targets
(In billions of U.S. dollars)



Source: CBO (2003)
1/ Revised targets contained in the Balance Budget and Emergency Control Reaffirmation Act of 1987.

43. **In 2001, the Mexican authorities presented a budget reform proposal to Congress**. It included a constitutional amendment that would require that: the budget be set in a medium-term context, and be balanced over a four-year cycle; all excess revenues be saved; and expenditures adjust in the event of revenue shortfalls. Prospects for passage of the reform bill are currently uncertain. Also, it would apply only to the traditional deficit, as opposed to the PSBR.

44. **Placing annual budgets in a medium-term framework with debt objectives and expenditure growth ceilings could promote greater discipline in budget discussions**. At the same time, the risk of some activities being shifted outside of the traditional budget definition could be minimized by framing any fiscal responsibility principle in terms of broad measures of the deficit. Moreover, transmission of oil price volatility to spending programs could be avoided by focusing on the non-oil balance. Such a framework could also provide room for counter-cyclical policy once fiscal credibility has been fully established.[9] A further refinement would be to incorporate borrowing by subnational governments in debt targets. While such borrowing has been stable and low in recent years at just under 2 percent of GDP, including it in the fiscal responsibility framework would help reduce its potential to become a

[9] As a first step in this direction, fiscal transparency will be enhanced by the planned publication of a revised public sector definition in line with the new GFS by end-June, and the possible incorporation of medium-term macro-fiscal projections in the economic guidelines underlying the annual budgets.

significant contingent liability, as has occurred at times in the past. As recently as in 1996–97, all states needed to be bailed out by the federal government following the 1995 *tequila* crisis (Giugale and others, 2000).[10]

Medium-term debt targets

45. **Medium-term debt targets can help anchor a fiscal consolidation path.** In principle, such a framework would allow temporary deviations, but fiscal slippages would trigger compensation over time for to safeguard the ultimate objective of fiscal consolidation: debt reduction. In practice, difficulties are manifold, however, and include determination of an optimal target level of public debt, and an optimal consolidation path; agreement on underlying macroeconomic assumptions; and identification of a credible mechanism to distinguish between temporary exogenous shocks—such as a temporary exchange rate depreciation, which would not require a fiscal response—and permanent changes that require fiscal adjustment. Also, an issue currently under discussion is the treatment of debt created to finance productive infrastructure investment.

46. **Few countries implement explicit debt targets, and their experience has been mixed.** For example, the Maastricht criteria for EMU membership included a quantitative target of 60 percent of GDP on public debt. New Zealand has endorsed the medium-term objective of keeping debt below 30 percent of GDP. Since 1998, Canada has committed to keeping the debt-to-GDP ratio on a downward track, with the objective of reducing central government debt to below 40 percent of GDP. Prior to the 2001 crisis, Argentina's Fiscal Responsibility Law established limits on debt and expenditure growth (Craig and Manoel, 2002).

47. **Various approaches have been developed to identify sustainable debt levels, which can help orient policy-makers by setting an upper limit to the target range**. No specific level is universally applicable, of course. The Maastricht criterion of a maximum debt level of 60 percent of GDP is an example. While this might be a suitable ceiling for an industrial country with strong institutions for macroeconomic management, lower debt-to-GDP ratios of around 50 percent have been associated with financing problems in many emerging-market countries in the past (Reinhart and others, 2003; WEO, 2003). One approach is to establish a benchmark debt level by calculating the present discounted value of a country's expected future primary surpluses based on past performance (WEO, 2003). The authors find that most emerging markets actually borrow 2½ times more than their fiscal track record would safely permit. Moreover, taking into account the volatility and uncertainty surrounding future revenues in the face of shocks to potential growth or commodity prices, the sustainable level of debt in countries vulnerable to such shocks would be even lower.

[10] In 2000, a new regulatory framework for debt management by states and municipalities was put in place, "outlawing" federal bail-outs, and requiring local governments to collateralize borrowing and to obtain credit ratings.

48. **In the case of Mexico, the 2002 PRONAFIDE implicitly acknowledged the desirability of debt reduction by envisaging a 5 percent reduction in net debt between 2002 and 2006 from the initial level of 43 percent of GDP**. The ultimate target for the debt ratio was not identified, however. Factoring in fiscal risks in the form of Mexico's low revenue base and dependence on oil revenues by including shocks to growth and the oil price would reduce the sustainable debt level. By the same token, the sustainable debt level would rise if a comprehensive tax reform were to expand the tax base.

49. **After the introduction of an explicit debt objective, mechanisms—insulated from the political process—need to be developed to achieve the target**. In the case of Mexico, greater non-oil tax revenue mobilization would make the fiscal framework more resilient to spending pressures and social spending needs. At the same time, as discussed above, institutional changes would be needed to ensure significant saving of windfall revenues "for rainy days" and further debt reduction.

Medium-term expenditure ceilings

50. **Growth of public spending could be limited to take advantage of favorable economic conditions to reduce the debt burden.** Over the past 5 years, real primary spending grew by 1.2 percent on average—which seems restrained relative to potential GDP, but high when contrasted with real average growth in non-oil tax revenue of only 0.8 percent.

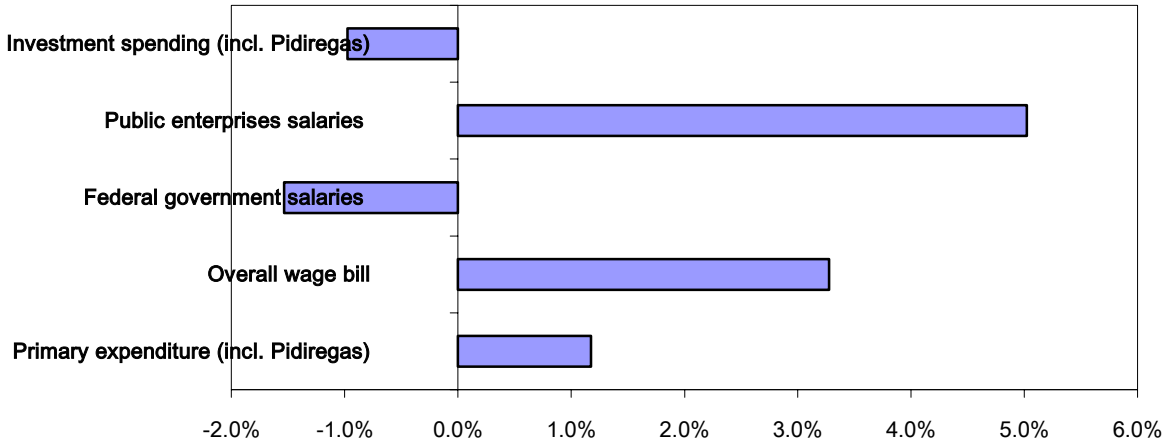
51. **Many countries have implemented medium-term expenditure rules**. Examples in Europe include Sweden, the Netherlands, Finland, and the United Kingdom, while the BEA in the United States set caps on growth of discretionary spending. In Latin America, Brazil's Fiscal Responsibility Law limits the percentage of central government and subnational spending on public sector employees and prevents the creation of permanent spending mandates without corresponding increases in permanent revenue or cuts in other permanent spending items. Peru has limited annual growth in primary spending to the inflation rate plus 2 percentage points, and Argentina's Fiscal Responsibility Law limited increases in primary spending to real GDP growth—to be kept constant in nominal terms should growth turn negative. In Colombia, the Subnational Fiscal Responsibility Law limits expenditures by subnational entities.

52. **Several issues need to be addressed in implementing medium-term spending rules.** General issues include: the margin of error of medium-term macroeconomic projections, or how conservative growth and inflation projections should be; the right measure of flexibility on the margin; and the importance of safeguarding the quality of spending, or of avoiding undue compression of certain expenditure items, such as infrastructure investment or social spending, or accumulation of wage arrears. Some countries have excluded certain spending programs from their rules for this reason.

53. **In Mexico there are difficulties with controlling some spending components**, especially wage expenses by public enterprises (Figure 9). Also, employment at the local government level—and associated wage expenses—have increased over the past decade, whereas federal employment has been reduced (Gil Díaz, 2001). One approach to addressing

this problem would be to cap overall spending growth, especially of "permanent spending mandates," such as wage outlays, or non-oil tax revenues—similar to the provision in Brazil. Moreover, enterprises could be made to operate in a more transparent and commercial framework. Any such provisions, however, would require addressing complex public sector contracts and other rigidities in public sector wage setting.

Figure 9: Average Real Growth of Selected Expenditures 1997-2002

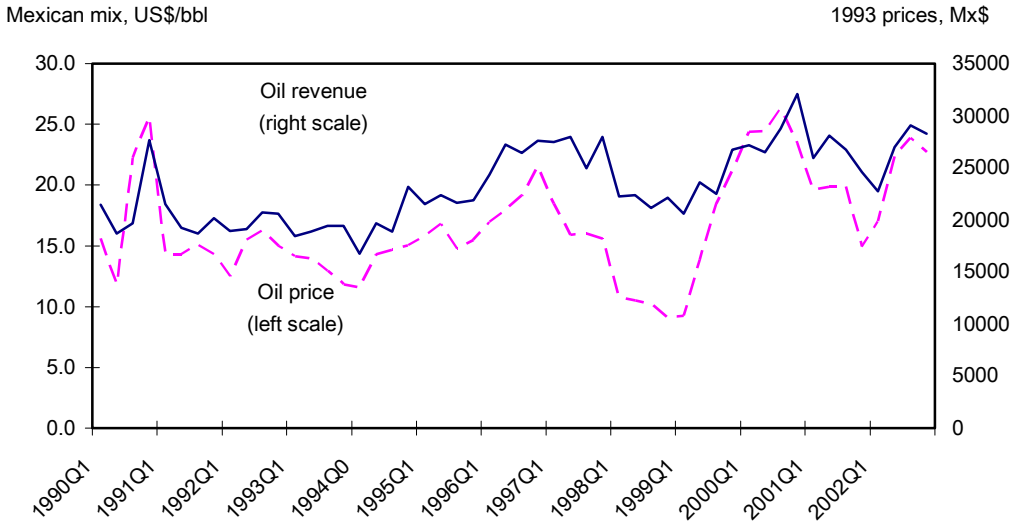


Structural balance target

54. **Once credibility has been established fully, Mexico could adopt a structural balance target to support economic activity through countercyclical policies**. The large share of oil revenue in total revenue—about a third—suggests an approach that takes into account fluctuations in oil prices as well as cyclical swings in activity, as used in Chile with copper prices. Technical complications with this approach include identifying the long-term level of oil prices, making cyclical adjustments, and the difficulty of choosing a target level. In practice, it may also prove difficult to establish sufficient credibility to avoid the recurrence of financing constraints during economic downturns, which may have driven counter-cyclical policy in the first place.

55. **Oil price movements are, not surprisingly, closely related to total budgetary oil revenue** (Figure 10). As discussed above, the current OSF rules offer only limited protection against fluctuations in the oil price and revenues vis-à-vis the budgeted price and revenues—and since its depletion in 2002, no unanticipated oil revenue shortfalls can be compensated for.

Figure 10: Oil Prices and Revenues in the 1990s



56. **A rough calculation adjusting primary balances throughout the 1990s for cyclical factors and changes in oil prices shows that adjustments would have been most significant during the *tequila* crisis and the boom year of 2000 (Figure 11)**. More often than not, these two adjustments would be mutually offsetting (Figure 12), in line with the previous finding that oil revenues tend to move counter-cyclically.[11] In contrast, in Chile the output gap and copper income components are positively correlated (Philips, 2001). If the counter-cyclical behavior of oil revenues in Mexico were to persist into the future, the importance of making explicit adjustments in the budget for the cycle and oil price fluctuations would be reduced.[12]

[11] Tax revenues were adjusted for divergence from potential GDP with an elasticity of 1. Total oil revenues were adjusted for each percentage point fluctuation of the actual oil price from the average oil price for 1990–2002 with an elasticity of 0.4. This simple elasticity was estimated using the logs of quarterly oil prices and real oil revenues, seasonally adjusted, during 1990–2002.

[12] In this context, the historical counter-cyclicality of oil revenues is not likely coincidental, as higher world oil prices depress activity in the United States and thus Mexico.

Figure 11: Actual and Structural Primary Balances in Mexico in the 1990s
(Percent of GDP)

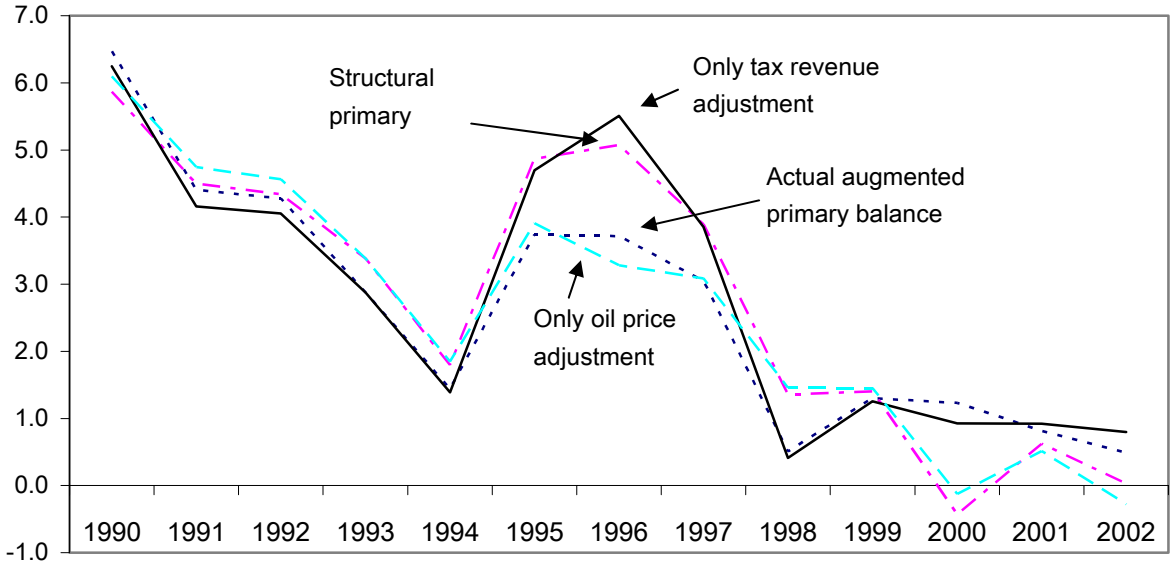
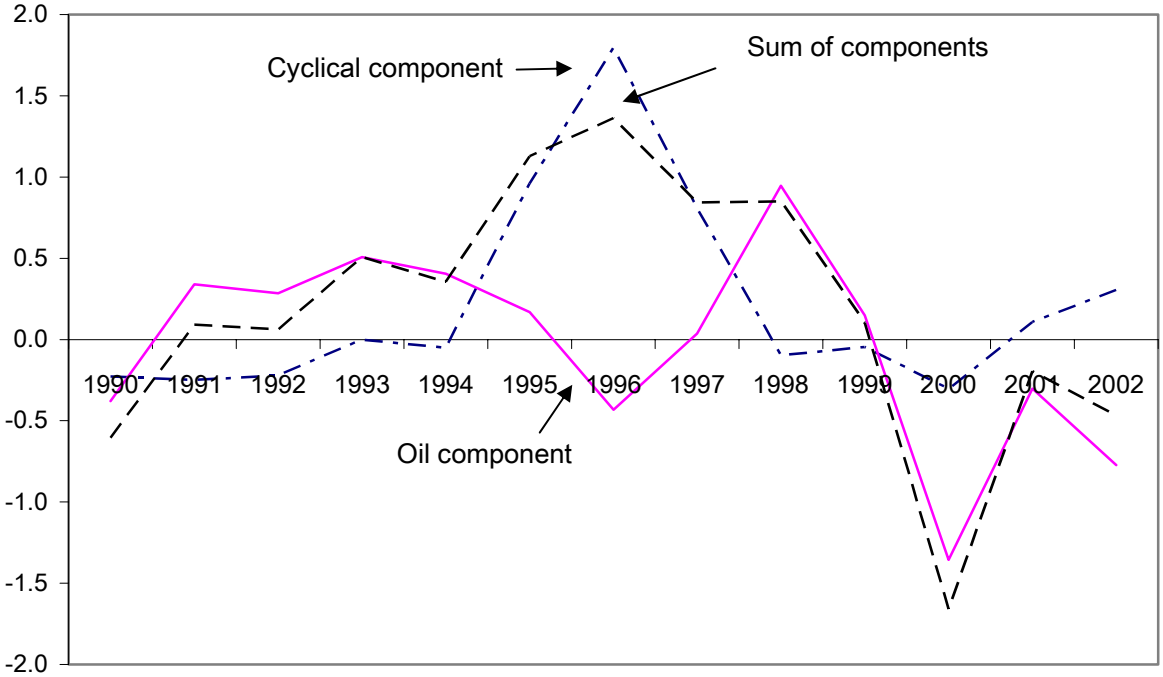


Figure 12: Structural Adjustment Components
(Percent of GDP)



F. Conclusions

57. **Mexico has made significant strides in improving its fiscal position since the mid-1990s.** But existing fiscal mechanisms have weaknesses from the point of view of ensuring further consolidation. The budget adjustors and the OSF, for example, only operate in relation to the initial annual budget assumptions, which in turn are not directly linked to the medium-term path for broad measures of the deficit and debt laid out in PRONAFIDE. As a result, the existing framework is not, in itself, likely to lead to further reductions in broad measures of the public deficit and debt, as envisaged in PRONAFIDE.

58. **Progress in achieving sustained debt reduction would likely be furthered by enhancements to the institutional framework**. These could include: comprehensive tax reform; focusing on augmented debt and deficit measures ; setting annual budgets in medium-term context – as envisaged in the draft budget reform; and implementing a fiscal rule constraining public expenditure growth, anchored by explicit, medium-term debt targets. Once the level of public debt has been brought down, and credibility has been established, the adoption of a structural balance target would provide scope for automatic stabilizers to moderate cyclical fluctuations within a medium-term framework.

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III. A Model of Inflation in Mexico[1,2]

This chapter examines the determinants of inflation in Mexico since 1997. A model of wage and price inflation is formulated using an expectations-augmented Phillips curve framework with both forward- and backward-looking inflation components, proxies for excess demand, and relative price shocks. The model is estimated using data from 1997 to mid-2003. Wage dynamics appear to be driven mostly by inflation expectations, lagged inflation and to a lesser extent the output gap. Price inflation is in turn driven by wage inflation and price shocks, including to administered prices and the exchange rate. The similarity of the inflation process in Mexico to that in countries with a longer history of low and stable inflation suggests that the disinflation strategy pursued since the mid-1990s has provided a credible nominal anchor.

A. Overview

59. **Previous studies of inflation in Latin America have shown that episodes of high inflation tend to be associated with the monetization of large fiscal deficits, aggravated by exchange rate volatility and extensive wage indexation**. To a lesser extent, these phenomena were characteristic of Mexico in the 1980s. With Mexican inflation declining to much lower levels in recent years, a fresh look at the inflation process is in order to examine whether it has become more similar to those in countries with a longer experience of relatively low and stable inflation.

60. **Unsurprisingly, given Mexico's previous history of high and variable inflation in the 1980s to mid-1990s, some observers initially discounted the decline in inflation after 1995 as transitory.** Disinflation was, however, maintained through a long economic expansion (1996–2000) and in the presence of various types of inflationary shocks. Certainly, a shift to inflation targeting has played a role in preserving this relatively stable outcome, but it also appears that some types of shocks that previously had a strong influence on inflation now have less influence.[3] For example, the experience of small open economies in Latin America and elsewhere has been that large currency depreciations usually generate a substantial increase in inflation. In recent years, however, despite sharp depreciations of the peso and rising import prices, growth in retail prices in Mexico has remained subdued, with only a limited effect on consumer price inflation. The apparent reduction in exchange rate

[1] Prepared by E. Faal.

[2] The study period was chosen to exclude the turbulent period leading to the 1994–95 crisis and its aftermath, and to also coincide with period of the authorities' disinflation program.

[3] Taylor (2000) suggests that the level of exchange rate pass-through declines as the level of inflation is lower, mainly because the pricing power of firms is eroded.

pass-through provides an example of a direct and visible change in pricing behavior that has had a bearing on recent inflation performance.[4]

61. **At the same time, the program of market liberalization that began with NAFTA entry in 1994, and extended from product and capital markets to labor markets, has had important consequences for price behavior.** Domestic competition has increased, centralized wage setting has been replaced by a decentralized system, and trend productivity growth has risen. Each of these developments is conducive to achieving lower and more stable inflation, at least in the short to medium term, and may have reinforced the effects of reduced exchange rate pass-through. Moreover, these changes have occurred against the background of more disciplined policy formation in Mexico. Macroeconomic management since the 1994–95 crisis has focused on achieving medium-term price stability, lower fiscal deficits, prudent debt management to reduce vulnerabilities, implementation of structural reforms, and integration with NAFTA. In this regard, an important step undertaken after the collapse of the Mexican peso at end-1994 was to focus monetary policy on attaining medium-term price stability, and to address banking sector problems by specific programs, with the cost to be assumed by the fiscal authority.

62. **Monetary policy has subsequently evolved into an inflation targeting framework in the context of a flexible exchange rate system**. Importantly, the inflation objective has now become the nominal anchor for the economy.

63. **We analyze wage and inflation dynamics in Mexico for the period 1997–2003.** The framework consists of two relationships. The first is an augmented Phillips curve that relates contractual wage inflation to a measure of the output gap, inflation expectations, and lagged inflation. The domestic price level is set as a mark-up over production costs, with the latter represented by wages and import prices**.** The mark-up varies according to the state of aggregate demand. Finally, changes in "administered" prices are assumed to affect the aggregate price level.

64. **The chapter is organized as follows**. First, we present descriptive statistics on inflation, showing how the variability of inflation and its determinants has changed over time. Second, we briefly discuss developments in the main determinants of inflation in Mexico. Third, we develop an empirical model of wage and price inflation and estimate it for the period 1997–2003. The estimation period is then truncated and the model is used to generate out-of-sample inflation forecasts. Policy implications are discussed in the final section.

[4] Baqueiro, Diaz-Leon, and Torres (2003) found that the level of exchange rate pass-through weakens as inflation falls.

B. Inflation and its Determinants: Stylized Facts

65. **Mexico's inflation performance over the past 2½ decades is illustrated in Figure 1.** Two measures of inflation are shown—core and headline. Table 1 presents descriptive statistics for inflation and its determinants since 1981. Several interesting features are apparent from these data:

- Inflation has been highly variable over the long run. Average inflation declined from about 75 percent in 1983–89 to 5¾ percent in 2002. High inflation in the 1980s was associated with the monetization of large and unsustainable fiscal deficits, aggravated by frequent devaluations of the exchange rate and a high degree of wage indexation.

- Inflation fell in the early 1990s with exchange-rate-based stabilization, but increased in 1995 in the face of the economic crisis.

- The authorities responded to the 1994–95 crisis by implementing a stabilization plan centered on reducing the fiscal deficit and orienting monetary policy toward disinflation in the context of a flexible exchange rate regime.

- The authorities' disinflation program was consolidated with the introduction of inflation targeting in 2001. Subsequently, inflation has been maintained below target, with the exception of 2002, when increases in administered prices caused a temporary rise in inflation.

- The data show the increasing "resilience," or lack of lasting response, of inflation to external and domestic shocks. Table 1 and Figure 2 compare the variability of inflation with that of various shocks. The standard deviation of inflation has fallen significantly since the 1980s, while the standard deviations of the exchange rate, wages, and administered and agricultural prices have fallen by less. As a result, the ratio of the variability of the shocks to that of inflation in the 2000–03 period generally rose relative to the 1980s, with the change being particularly notable in the case of the exchange rate and administered prices.

C. Determinants of Inflation in Mexico: Recent Developments

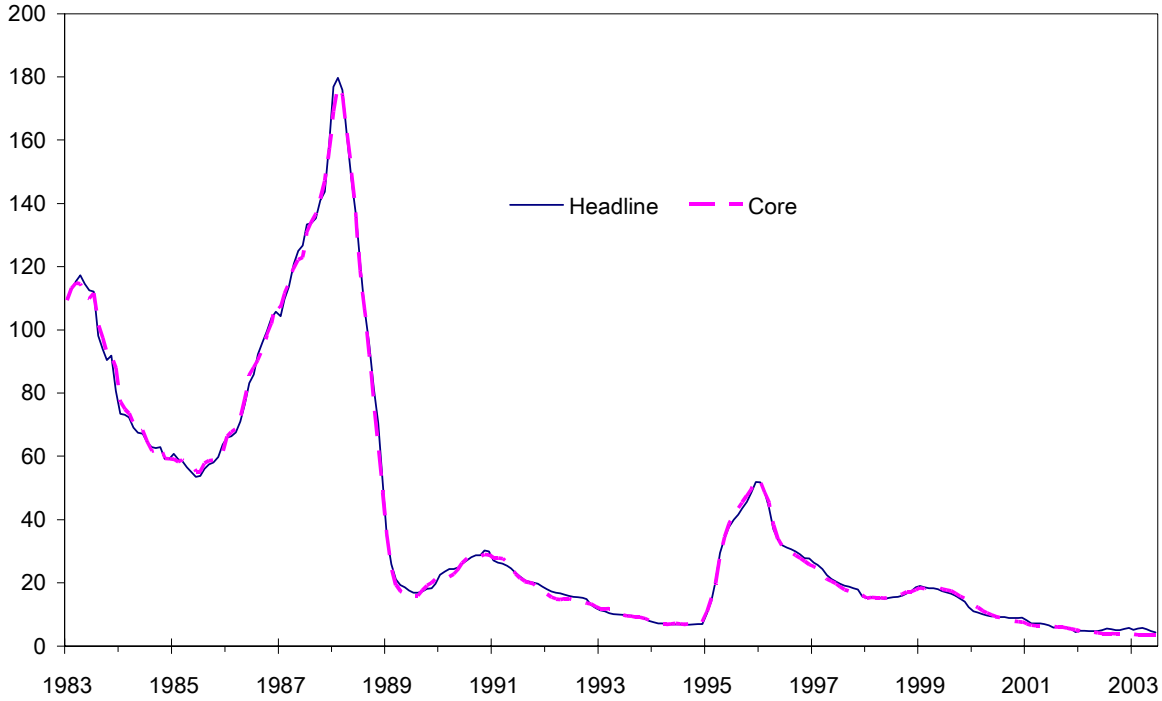
66. **We focus in this section on developments in some of the key influences on inflations in Mexico**. The framework described above suggests a set of domestic and foreign inputs that are relevant to the inflation process in Mexico. These include wages and productivity, imported inputs to production, the exchange rate, and relative price shocks.

Table 1. Mexico: The Variability of Inflation and its Determinants, 1981-2003

	Mean	Standard deviation	Standard deviation relative to that of Inflation
	1981:1 -1989:12		
Headline inflation	74.7	41.3	1.0
Contractual wages	...	...	...
Exchange rate	77.8	59.8	1.4
Import prices	3.3	3.1	0.1
Output gap	-0.1	5.6	0.1
Productivity	...	...	...
Administered prices	90.6	64.2	1.6
Agricultural prices	84.6	36.8	0.9
Inflation expectations	...	...	...
	1990:1 -1995:12		
Headline inflation	19.4	11.2	1.0
Contractual wages	...	...	...
Exchange rate	20.5	32.1	2.9
Import prices	2.1	1.9	0.2
Output gap	-0.1	1.0	0.1
Productivity	7.4	3.0	0.3
Administered prices	23.9	14.0	1.2
Agricultural prices	14.0	11.0	1.0
Inflation expectations	...	...	...
	1996:1 -1999:12		
Headline inflation	22.2	9.1	1.0
Contractual wages	18.5	1.7	0.2
Exchange rate	11.1	10.5	1.2
Import prices	-0.1	1.0	0.1
Output gap	0.2	1.0	0.1
Productivity	4.8	3.1	0.3
Administered prices	23.9	10.2	1.1
Agricultural prices	25.0	14.6	1.6
Inflation expectations	14.1	1.9	0.2
	2000:1 -2003:6		
Headline inflation	6.7	2.0	1.0
Contractual wages	8.7	3.0	1.5
Exchange rate	2.5	7.1	3.6
Import prices	1.3	1.8	0.9
Output gap	-0.1	0.6	0.3
Productivity	3.4	2.1	1.1
Administered prices	12.0	7.1	3.6
Agricultural prices	4.5	3.4	1.7
Inflation expectations	6.2	2.1	1.0

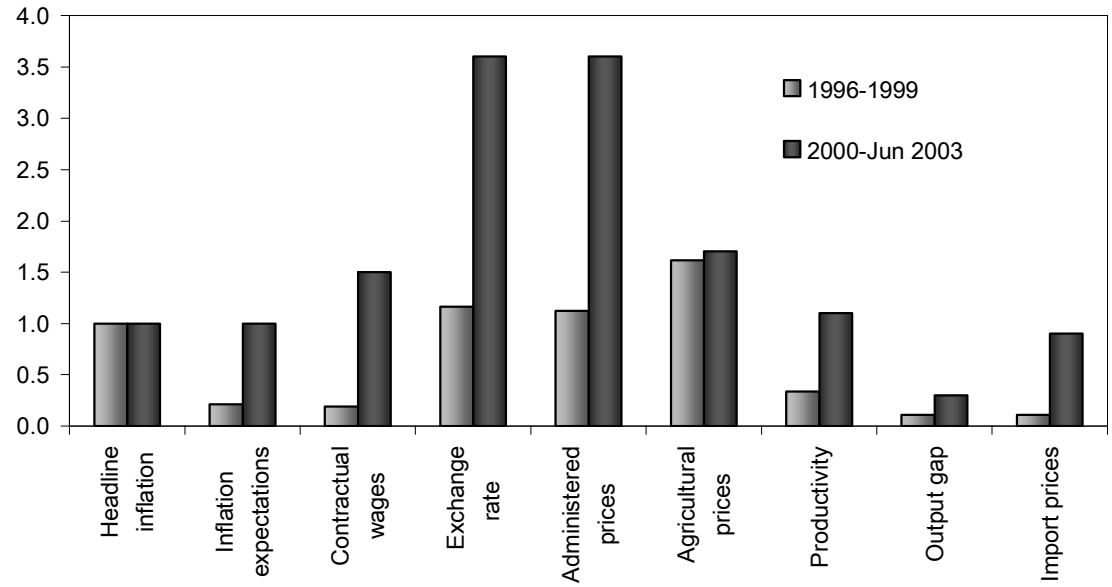
Source: Bank of Mexico; and staff estimates.

Figure 1. Mexico: Headline and Core Inflation, 1983-2003
(In percent)



Source: Bank of Mexico.

Figure 2. Mexico: Ratio of Inflation and its Determinants, 1996-2003
(Ratio of Standard Deviations)



Sources: Bank of Mexico; and Fund staff estimates.

67. **A key influence on inflation is the rate of wage inflation**. For many years, labor unions were important in setting working conditions in Mexico for some sectors of the labor force.[5] Wages were to some extent centrally determined and indexed to the cost of living. This increased the likelihood of direct transmission of price shocks to wages and the potential for a wage-price spiral, as occurred in the early 1980s. However, beginning in the 1980s and through the 1990s, changes were implemented that significantly increased the flexibility of the labor market. The government implemented a restrictive income policy to control inflation in 1983. In December 1987, labor, business and government reached an agreement called the *Pacto,* in which they agreed to coordinate closely wage demands with a view to moderating union wage demands and increasing employment. Subsequently, the privatization of state enterprises and entry into NAFTA in the 1990s coincided with a decline in unionization, and the increased pressure on domestic firms to compete internationally compelled them to reduce labor costs by hiring part-time workers and sourcing out segments of the production process. Reduced unionization and more decentralized wage bargaining lowered the tendency for wages to be indexed to past inflation, thus removing the direct transmission of prices to wages.[6]

68. **Inflation performance in the 1990s has also been affected by labor productivity growth**. Trend growth in productivity has averaged about 2 percent since mid 1990s. At the same time, wage earners seem not to have captured all of the productivity gains in the form of higher real wages, which have grown at a lower rate than trend productivity (Table 1). This has led to lower growth in unit labor costs (ULC), which has contributed to disinflation.

69. **Exchange rate movements can affect inflation through both direct and indirect channels.** The direct channel reflects the impact of exchange rate movements on the domestic currency price of imports. The effect on final prices will depend on the extent to which importers and distributors change their profit margins in response (which may itself be endogenous to the process driving the exchange rate). In any event, except in the extreme case where changes in import prices are fully offset by changes in margins, some proportion of import price changes will be passed through to final prices.[7]

70. **The indirect channel reflects the impact of the initial rise in final prices on other costs, including wages, and inflation expectations.** The importance of these indirect effects is likely to depend on the process believed to driving the exchange rate, and in turn the underlying credibility of the monetary policy framework. To the extent that inflation is

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[5] Zapata (1992) observes that the rate of unionization in state enterprises was close to 100 percent since the Federal Labor Law fostered unionization among state workers.

[6] Under the current system of wage setting, indexation of wages to a cost of living measure does not occur regularly, unless explicitly allowed by specific contracts.

[7] Various studies, including Dwyer and Lam (1994), find a tendency for firms to partially but not fully absorb the effects of currency depreciation.

believed to be well-anchored by a credible policy commitment, the second-round impact of exchange rate changes is likely to be limited. Absent such a commitment, however, exchange rate changes may well be interpreted as signaling long-lived changes in prices, implying a greater effect on other prices and inflation expectations.

71. **Changes in other relative prices can also influence inflation.** In Mexico, important components of the overall CPI basket have prices that are set by various governmental organizations in ways that may not reflect the forces determining market-based prices. These are collectively referred to as "administered" prices, and consist primarily of energy prices and those set by other public utilities. These are incorporated in the inflation model via a term reflecting changes in administered prices relative to the overall CPI.[8]

D. Model Estimation

72. **In this section, we analyze the inflation process in terms of a two-equation model consisting of an expectations-augmented Phillips curve for wages and a mark-up equation for prices.** The model incorporates both backward- and forward-looking elements in the inflation process.[9] It is derived from the following 2 equations. All variables are in logs, *w* stands for wages, *p* for the domestic price level, *p** for foreign export prices, *z* for foreign prices expressed in domestic currency, *e* for the exchange rate (defined as the domestic currency price of foreign currency), y_{gap} for the output gap, π is inflation and *E* is the expectations operator.

$$\Delta w_t = \theta E_{t-1}\pi_t + (1-\theta)\pi_{t-1} + \phi ygap_{t-1} \quad (1)$$

$$p_t = \beta_1 w_t + \beta_2 z_t^* + \beta_3 ygap_{t-1} + \beta_4 admp_{t-1} \quad (2)$$

73. **Equation (1) defines wage dynamics as a function of expected inflation, past inflation, and the output gap**. Equation (2) indicates that consumer prices are a function of wages, foreign prices, the administered prices and the output gap. The derived Phillips curve will be vertical in the long run if we assume that the sum of the coefficients on expected and past inflation is equal to one in equation (1). This ensures that no long-run trade-off exists between the level of inflation and excess demand pressures.

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[8] Ball and Mankiw (1994 and 1995) also argue that firms react proportionately more to large price shocks than to smaller ones. This is because they face adjustment costs, and would therefore be more inclined to change prices in response to large shocks than small shocks.

[9] See Chadha, Masson, and Meredith (1992) for a discussion of the rationale for including both forward- and backward-looking components of the inflation process.

74. **As noted previously, we model consumer inflation as a mark-up over unit costs of production, which we assume to be determined by contractual wages and foreign prices, as well as movements in administered prices**. Movements in foreign and administered prices are expressed in real terms by defining them as the deviation of the 12-month percentage changes in the variable from previous period inflation.[10] To solve the model for inflation, we first difference equation(2) such that:

$$\pi_t = \alpha + \beta_1 \Delta w_t + \beta_2 (\Delta p^* - \pi_{t-1}) + \beta_3 \Delta y_{gap} + \beta_4 (\Delta admp - \pi_{t-1}) \quad \textbf{(3)}$$

The final version of equation (3) for estimation is described in equation (4), where *L* is the lag operator:

$$\pi_t = \alpha + \beta_1 (L) \Delta w_t + \beta_2 (L)(\Delta p^* - \pi_{t-1}) + \beta_3 (L) \Delta y_{gap} + \beta_4 (L)(\Delta admp - \pi_{t-1}) \quad \textbf{(4)}$$

75. **We estimate wage dynamics and price inflation by ordinary least squares following a general-to-specific approach.** All data except the output gap are obtained from the Bank of Mexico website. Potential output and the output gap are estimated by applying the Hodrick-Prescott filter to the monthly global economic activity index (IGAE) for Mexico obtained from *INEGI*.[11] The gap measures the proportionate deviation of actual from potential output. The estimation period covers 1998:09–2003:06. Wages growth is measured as the increase implied by contractual wage settlements; overall inflation and the change in foreign prices are measured as the 12-month changes in the respective variable, while inflation expectations are the 12-month ahead definition based on BOM surveys. All parameters are expected to be positive. The overlapping observations in our measurement of the dependent variables are likely to induce moving average processes in the residuals—these are accounted for by explicitly introducing moving average terms in the estimation process.

76. **The estimation results for the wage equation exhibit the expected properties.** Table 2 shows that the weight on backward-looking inflation is about one third, while that on the forward-looking component is about two thirds. The relatively large weight on forward-looking inflation suggests a comparatively low degree of inflationary inertia The fact that the coefficients on backward- and forward-looking inflation sum to roughly one also suggests that the long-run Phillips curve is vertical—i.e. that there is no long-run trade off between

[10] Defining shocks in this way avoids the potential problems of regressing inflation on its own components.

[11] The latter is highly correlated with both quarterly and annual GDP— a regression of IGAE on quarterly GDP yields a coefficient of 0.9, and the fraction of variance of GDP explained by the regression is about 90 percent.

activity and inflation.[12] The intercept term is positive and significant, proxying for the effect of productivity growth on real wage gains, while the sensitivity to the output gap is borderline significant at the 10 percent level. The regressors explain most of the movements in contractual wages, with an adjusted R-squared of about 0.96. In addition, the White test for Heteroskedasticity and Breusch-Godfrey test on the residuals allow rejection of the presence of heteroskedasticity and autocorrelation, respectively.

Table 2: Mexico: Estimation Results for Wages, 1998–2003

Variable	Coefficient	T-Statistics	P-value	
Constant	0.020	3.853	0.000	*
Output gap(-1)	0.131	1.387	0.171	
Inflation expectations	0.697	3.434	0.001	*
Lagged inflation	0.325	2.006	0.050	*
MA(1)	0.725	5.314	0.000	*
Adjusted R-squared	0.957	...	...	
Diagnostic tests				
Jarque Bera test for normality of the residuals	0.868		0.648	
Serial correlation First order-Durbin Watson	1.971			
Serial correlation:-Higher order-Breusch-Godfrey LM Test	2.131		0.037	
White Heteroskedascity Test (F-Statistics)	0.136		0.907	
Homogeneity				
Wald F-Test	0.264		0.609	
Normalized restriction	0.033	0.523		

Source: Staff estimates.

* Significant at the 5 percent level.
P-values give the probability that the null hypothesis is accepted.

77. **The estimation results for the inflation equation are also as anticipated (Table 3).** The coefficients on contractual wage increases indicate that domestic input costs dominate total production costs. The restriction that the sum of the coefficients on wage growth is unity is easily accepted, consistent with dynamic homogeneity of the wage-price process. The

[12] This restriction easily passes a Wald test.

change in the output gap also helps to explain inflation, presumably capturing cyclical changes in mark ups over variable costs. Foreign prices affect domestic inflation with a "passthrough" coefficient of about 0.07, suggesting an impact that is typical of other economies with trade shares similar to Mexico that have enjoyed an extended period of low and stable inflation. Changes in administered prices also have a significant impact. The overall fit of the equation is high, with an R^2 of 0.99.

Table 3. Mexico: Estimation Results for Inflation in Mexico, 1998–2003

Variable	Coefficient	T-Statistics	P-value	
				*
Constant	-0.018	-2.119	0.039	*
Change in output gap	0.087	3.503	0.001	*
Wages	0.329	11.362	0.000	*
Wages (-1)	0.400	12.091	0.000	*
Wages (-2)	0.299	12.332	0.000	*
Foreign prices (-1)	0.073	4.029	0.000	*
Admiistered prices (-1)	0.122	2.402	0.020	*
MA (1)	1.960	17.153	0.000	*
MA (2)	1.609	13.386	0.000	*
MA(3)	0.760	6.640	0.000	*
Adjusted R-squared	**0.993**	**...**	**...**	
Diagnostic tests				
Jarque Bera test for normality of the residuals	1.041		0.594	
Serial correlation First order-Durbin Watson	1.920			
Serial correlation: Higher order-Breusch-Godfrey LM Test	2.781		0.009	
White Heteroskedascity Test (F-Statistics)	0.986		0.477	
Homogeneity				
Wald F-Test	0.147		0.703	
Normalized restriction	0.029	0.383		

Source: Staff estimates.

Significant at the 5 percent level.
P-values give the probability that the null hypothesis is accepted.

78. **The estimated equation also passes the usual diagnostic tests**. The Breusch-Godfrey tests statistics for up to 6 lags and the White tests are below their critical values, indicating absence of higher-order serial correlation or heteroskedasticity, respectively.

E. Model Simulation

79. **The two-equation model was then simulated to generate dynamic forecasts for the endogenous variables, based on the historical paths for the exogenous variables.**[13] The results are shown in Figure 3. The ± 2 standard errors of the actual and simulated outcomes for wages and inflation are shown in the graphs. The results illustrate how the model would have tracked if we had used it in 1999 to make a forecast for the economy through the sample period, assuming we had used the correct paths for the exogenous variables. The graphs show that as a one-step ahead predictor, the model performs quite well, although the ability of the model to predict wages, in particular, deteriorates during the last 12 months of the sample. In particular, the equation tends to overpredict wage growth since late 2002. This overprediction could reflect two factors: (i) an underestimation of the effect of the output gap on inflation, given that actual output was below potential over this period; or (ii) an overestimation of underlying inflation expectations based on the survey measure, which responded quite strongly to price shocks over this period that turned out to be temporary.

F. Conclusions

80. **The paper provides evidence that the inflation process in Mexico is driven by factors characteristic of those in other countries.** The degree of inflation persistence is relatively low and is dominated by the highly significant forward-looking inflation variable. Taking at face value, this implies that reducing inflation is less costly (in terms of output loss) than in countries with much higher inflation persistence.[14] We find significant coefficients for all the key determinants of wage and price inflation included in our model.

81. **Contractual wage setting plays a central role in the inflation process.** The estimation of the wage equation exhibited the desired dynamic properties, with about one third of wage inflation explained by backward-looking expectations, while the forward-looking component, thought to be increasingly important in the transition period after the changes in monetary policy and exchange rate regime explains two-thirds. The coefficients on contractual wages in the price equation indicate that domestic input costs dominate total production costs.

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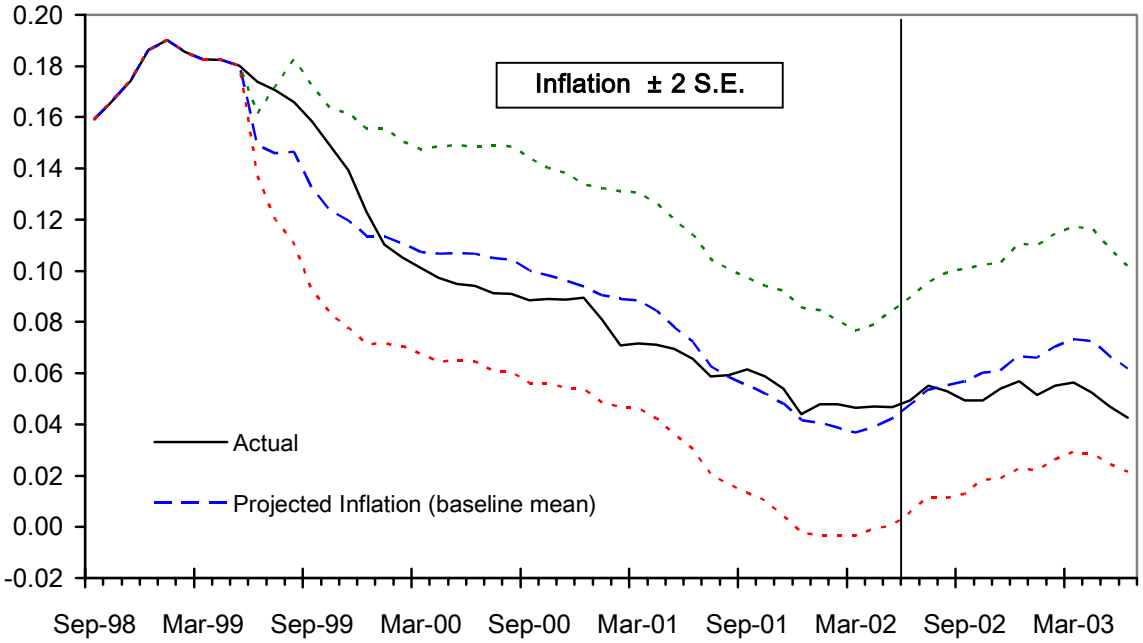
[13] The model can also be used to explore the linkages between wage and price inflation and the appropriate response of monetary policy. To do so requires augmenting the model with a policy reaction function, such as a Taylor rule, or an objective function for policy.

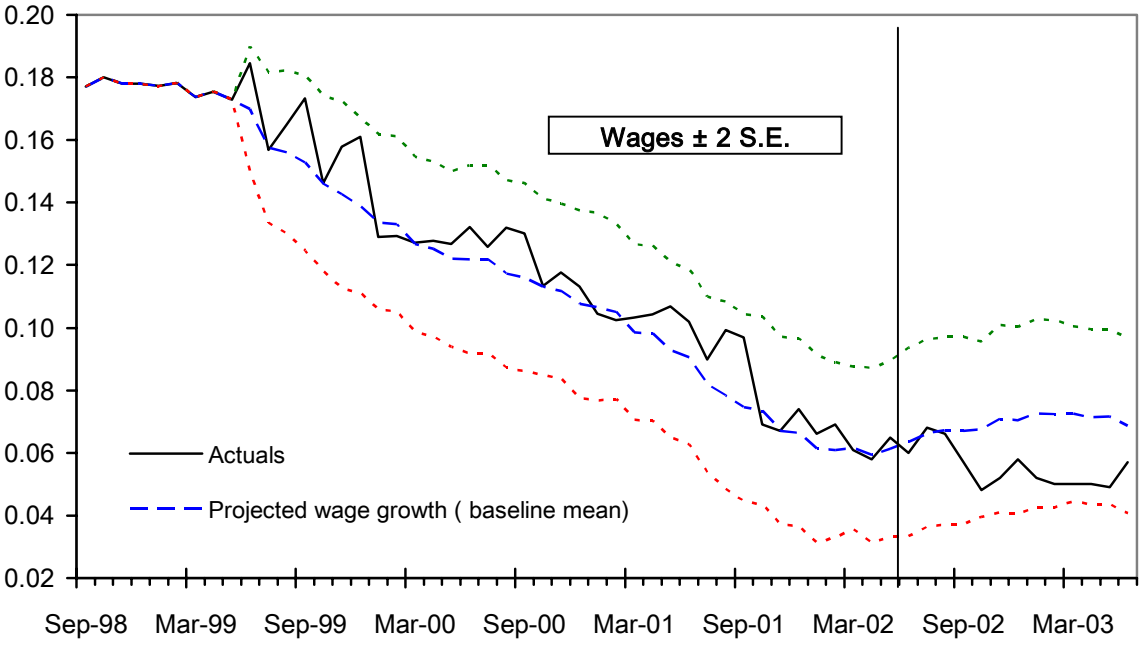
[14] See Chadha, Masson, and Meredith (1992).

82. **Of the other supply factor in the price equation, international prices appear significant, but appear to only have a small transitory effect on prices.** It appears to be relatively unimportant compared with the other supply variables. One interpretation is that the disinflation process in Mexico since 1996 reduced the pricing power of firms and the degree of pass-through of exchange rate changes into inflation. The other supply factor, administered prices also play important roles in the inflation process. They tend to be more volatile due to the influence of weather and public pricing decisions.

83. **Dynamic simulations have also been included in the paper to mimic the response of wages and prices.** The model, while simple in structure, provides a useful framework to summarize and forecast wage and price inflation in Mexico. Future work could model explicitly the expectations process and include a policy reaction function to gauge the appropriate response of monetary policy to inflationary shocks.

Figure 3. Dynamic Forecasts of Estimated Model, 1998-2003





Source: Fund staff estimates.

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IV. DOLLARIZATION IN MEXICO [1]

This chapter extends previous work on dollarization in Mexico in three respects. First, it covers the period 1990–2003, which has been characterized by a clear decline in dollarization. Second, we experiment with a broader definition of dollarization than has been used in previous studies. Third, a variable proxying for vulnerability to external shocks is included to assess its significance in explaining the reversal of dollarization using an extended portfolio balance model. We find that reduced vulnerability to external shocks is significant in explaining the reversal. Regarding other explanatory variables, we find that the sign on the expected depreciation of the peso is also significant but negative, which we interpret as reflecting the effect of prudential regulations in limiting dollarization.

A. Overview

84. **Despite enhanced financial stability, informal dollarization has remained high or even increased since the early 1990s in several Latin American countries, but has declined in Mexico**. In Bolivia and Peru, for instance, dollarization rose during the 1990s and has declined only slightly since 2000, with overall dollarization ratios still high at about 65 percent for Peru and 92 percent for Bolivia. The ratio of foreign currency deposits (FCDs) to total deposits remains even higher, in the 80–90 percent range, for these countries. These experiences contradict the common assumption that the substitution process between currencies is symmetric, responding to changes in the determinants of dollarization—particularly financial instability—in both directions (Buchs, 2000). In this regard, Mexico stands out in that the extent of dollarization has been more closely linked to periods of financial instability, and has reversed as stability has been restored. The experience since 1996–97 is a particularly striking example (Figure 1).[2]

85. **This paper studies the reversal in dollarization since 1996 in Mexico, an episode as yet not covered in the literature.** Several studies have examined dollarization in the 1970s and 1980s (see below), but there does not appear to have been any analysis of the reversal since 1996. We fill this gap, and extend previous work in three respects: (i) by analyzing the factors that could explain the reversal since 1996; (ii) by using a broader definition of currency substitution than in previous studies on Mexico includes dollar holdings of Mexicans in U.S. banks; and (iii) by explicitly modeling external vulnerability to examine its significance in explaining the reversal.[3]

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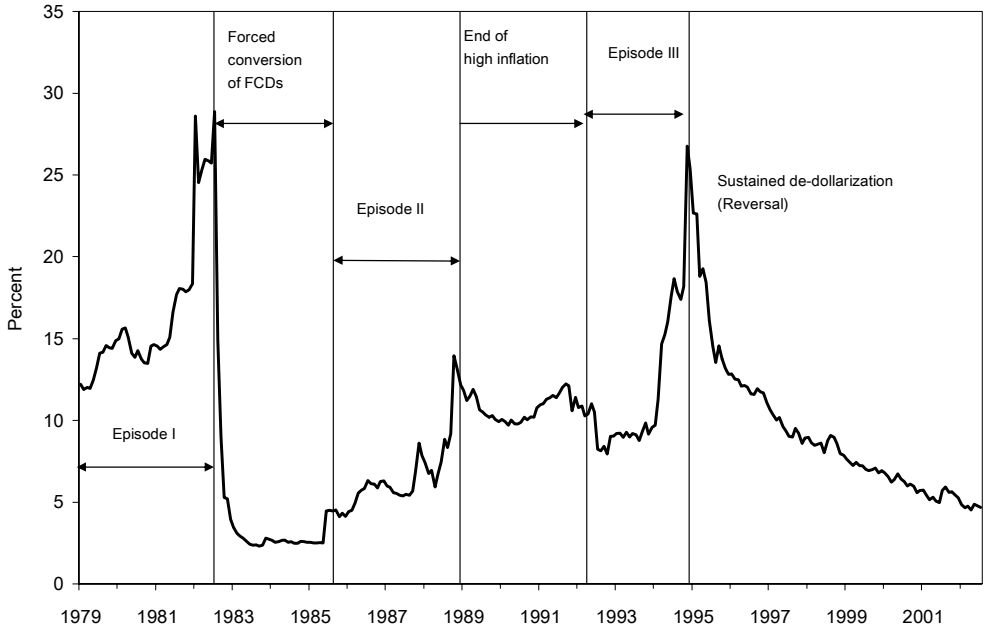
[1] Prepared by E. Faal and N. Thacker.

[2] Some transition economies, such as Estonia and Poland, have also experienced a decline in dollarization as their economies have stabilized.

[3] Information on bank notes in circulation is not available, but is likely to be negligible as most transactions are in pesos.

Figure 1. Mexico: Foreign Currency Deposits to Broad Money (M4)



Source: Bank of Mexico; and Fund staff estimates.

86. **The paper is structured as follows.** Section B provides a brief review of the literature on currency substitution in Mexico. Section C describes the trends in dollarization from 1977 until the mid-1990s, and the impact of these developments on residents' decisions to hold foreign currency. Section D focuses on the post 1994–95 crisis period, describing broad macroeconomic developments and their role in explaining the reversal in dollarization. Section E describes the econometric model and estimation results, while Section F provides some general conclusions and policy implications.

B. Literature on Currency Substitution

87. **Several explanations have been advanced to explain the persistence of informal dollarization in some countries.** Among the reasons cited commonly for this asymmetric response are the following:

- Episodes of high inflation tend to remain in memory for longer than periods of low inflation, and are assigned more weight in portfolio allocation decisions (Ramirez-Rojas, 1985; Clements and others, 1992 and Agenor and Khan, 1992).

- Adjustment costs create a hysteresis, or "ratchet" effect, so that once domestic residents convert monetary holdings into dollars, it is costly for them to return to the local currency, even after inflation decreases. Thus, temporary increases in inflation may have a permanent effect on the demand for domestic money (Dornbusch and Reynoso, 1989; Guidotti and Rodriguez, 1992; Clements and Schwartz, 1993).

- The existence of "network externalities" means that, as more people use dollars, the transactions costs of using dollars decrease (Uribe, 1995).

- Episodes of financial instability create permanent reputational differences between "hard" and "soft" currencies. Once agents have shifted to holding hard currencies as a result of high inflation or exchange rate depreciation, they resist moving back to soft currencies even though financial conditions stabilize (Yotopoulos, 1997).

88. **In the case of Mexico, some empirical studies have found exchange rate expectations to be a key determinant of currency substitution.** Previous empirical studies on dollarization in Mexico include Ortiz (1983), Ramirez-Rojas (1985), Rogers (1992a, b), and Gruben and Welch (1996). Ortiz examined currency substitution during 1933–80, focusing on the behavior of the ratio of foreign currency demand deposits to domestic currency demand deposits. Using a quarterly demand for money function, he found that this ratio was positively related to expectations of exchange rate devaluation and foreign exchange risk. Ramirez-Rojas compared the experience in Argentina, Mexico, and Uruguay from 1970 through the early 1980s. Defining dollarization as the ratio of foreign currency deposits (FCDs) to the total money stock (which included FCDs), he also found that the expected change in the exchange rate (proxied by the inflation differential) increased dollarization.

89. **On the other hand, Rogers (1992a, b), using data for 1978–85, found a statistically significant *negative* relationship between dollarization and the expected rate of peso depreciation.** He interpreted this to mean that depositors anticipated a breakdown of full convertibility between peso and dollar deposits as expectations of peso depreciation increased, precipitating a run on foreign currency deposits. Gruben and Welch (1986) examined the effect of deteriorating bank loan quality on the dollarization ratio, finding a significant negative relationship between dollarization and nonperforming loans, and the conventional positive relationship between expected peso devaluation and dollarization. They concluded that the results in Roger's study represented a case of a "missing variable"—specifically bank asset quality.[4]

C. Definition and Trends in Dollarization in Mexico

Definition of dollarization

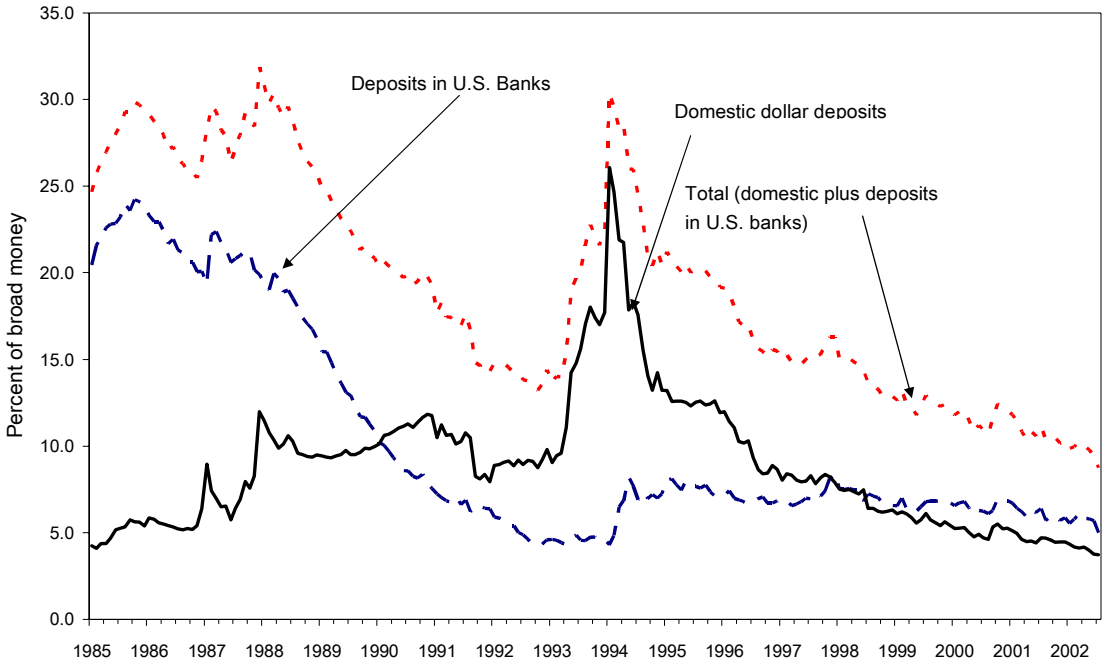
90. **Most studies have measured dollarization as the ratio of foreign currency deposits (FCDs) in domestic banks to broad money (M2*).*** An important issue is whether this measure may underestimate the full extent of dollarization given the existence of cross-border dollar deposits held by Mexican residents, particularly in the United States. Such holdings could reflect the desire of Mexican residents to insure against the risks of

[4] In a rejoinder, Rogers tried to duplicate the Gruben and Welch analysis using their data set but was unable to reach similar conclusions.

confiscation by domestic authorities, the inability to hold FCDs in the domestic banking system, or simply increased integration with the United States following entry into NAFTA in 1994.

91. **In this paper, we explicitly take account of cross-border deposits**. We define foreign currency deposits of Mexicans as the sum of FCDs in the domestic banking system plus cross-border deposits held by Mexican residents in U.S. banks. In the same vein, we use a wider definition of broad money, defined as broad money (M4) plus the cross border deposits of Mexicans in U.S. banks.[5] This provides a more comprehensive measure of dollarization, including both portfolio and transactions motives for holding foreign currency. As seen in Figure 2, the inclusion of cross-border deposits significantly affects the level of the dollarization ratio, although the broad trends are the same, with the exception of the period during the 1994–95 crisis. This divergence is discussed below.

Figure 2. Mexico: Dollarization Ratios, 1985-2003



Source: Bank of Mexico; U.S. Department of Treasury; and Fund staff estimates.

[5] M4 includes M2 plus domestic financial assets held by nonresidents plus deposits in branches and agencies of domestic banks abroad.

Trends in dollarization

92. **The economic crisis of 1976 led to an extended period of macroeconomic instability.** In the early 1970s, Mexico's inflation differential with the United States was low and stable, oscillating around 2 percent; the exchange rate was fixed; there were no capital controls; and dollarization was almost absent. The economic crisis of 1976, however, led to the first devaluation of the peso since the 1950s, and the fixed exchange rate system was replaced with a flexible regime. Mexico started an adjustment program, supported by the Fund, aiming at improving the fiscal situation, but the discovery of large petroleum reserves in 1977 led the government to embark on an ambitious public sector-led growth strategy. Although this strategy was initially successful in generating growth, which averaged 8 percent during 1978–81, the public sector borrowing requirement doubled from an average of 7 percent of GDP in 1976–78 to 14 percent of GDP in 1981, despite record oil receipts. This was accompanied by an appreciation of the real effective exchange rate, accelerating inflation and a deterioration in the current account.[6] While the public sector deficit was initially covered by credit from the central bank, by 1981 external loans had become the main source of financing.

93. **The inconsistency of the exchange rate policy with the expansionary fiscal stance led to an increasing realization that the situation was untenable, and in turn increased dollarization**. The premium on the forward exchange rate started to rise and residents switched from domestic to foreign currency, with dollarization reaching 28 percent of M4 in 1981. A balance of payments crisis ensued in 1982, with two sharp devaluations in February and in August. The first devaluation temporarily reduced speculative pressures on the peso, but as capital flight intensified and international perceptions of Mexico's ability to repay its external debt worsened, access to capital markets was severely reduced. This forced the authorities to devalue again in August 1982.

94. **At the same time, FCDs were declared inconvertible into pesos at the market rate.** The government announced a forced conversion of the outstanding stock of FCDs into domestic currency at a pre-determined rate, and imposed foreign exchange and capital controls in an attempt to resolve the debt crisis amidst dwindling reserves.[7] The observed dollarization ratio dropped from nearly 30 percent in August 1982 to 3 percent by December 1982, despite high inflation and a negative interest rate differential with the United States. The remaining FCDs in the banking system reflected mainly official holdings.

95. **In December 1982, Mexico embarked on another stabilization program supported by the IMF, but it was derailed by a series of external shocks**. The main objective of this program was to reduce inflation, and improve the balance of payments

[6] The current account deficit increased from 3.1 percent of GDP in 1978 to 5.8 percent of GDP in 1981 despite a sevenfold increase in oil receipts.

[7] The previous change in regulations had been introduced in March 1977, when restrictions on holding FCDs were eased.

situation through cuts in public sector deficits and reduced monetary expansion. The primary deficit started to improve from 1983 onwards, and recourse to central bank financing was severely curtailed. However, a number of exogenous shocks led to a weakening of the fiscal position and inflation began to rise. Meanwhile, restrictions on FCDs were eased in 1985 and eliminated in 1987, establishing full convertibility once again. As a result, FCDs started to grow.

96. **In December 1987, the government adopted a radically altered stabilization strategy—the *Pacto*—and in March 1988 introduced a fixed exchange rate system in a bid to stabilize the economy.** The peso was fixed to the U.S. dollar from March to December 1988. Nevertheless, dollarization continued to increase. This may have been due to what Khor and Rojas-Suarez (1991) have called the "peso problem," that is, the fixed exchange rate system did not instill confidence, and expectations of the future spot rate consistently over-estimated the actual future spot rate as market participants believed that the fixed exchange rate system would not last for long. As a result, people saw continued merit in maintaining high levels of foreign currency deposits. Under the circumstances, given the continued divergence of market expectations of the exchange rate from the announced fixed rate, the authorities allowed the exchange rate to depreciate at a pre-determined rate and fiscal restraint was intensified. The general policy strategy was successful in arresting inflation, which dropped from 160 percent in 1989 to 12 percent in 1992, and further to single digits in 1993. The dollarization ratio, which had jumped to about 15 percent in 1989, declined to under 10 percent. Mexico was seen as entering a period of sustained prosperity.

97. **The next crisis came in 1994, however, when Mexico experienced a series of financial shocks, reflecting in part adverse political events, an over-appreciated exchange rate, and loose fiscal policy.**[8] There was also increased competition for funds from other emerging market economies, combined with higher U.S. dollar interest rates in the world market. In late 1994, the peso came under speculative attack. In the face of continued market pressure, the authorities were forced to devalue the peso by raising the upper limit of the exchange rate band to 15 percent. In the event, this failed to stem the outflow of reserves, which dropped to about US$6½ billion at end-December 1994 compared with about US$17 billion just three months previously. On December 22, 1994 the peso was allowed to float. Nonetheless, it continued to weaken, as people realized that the government lacked the resources to pay US$29 billion in Tesobonos falling due in 1995. This uncertainty was quickly reflected in a rising dollarization ratio, which jumped to almost 30 percent in 1994–95. In an effort to regain macroeconomic stability, the government agreed on an emergency economic plan with labor and business comprising tight monetary and fiscal policy, accompanied by major structural reforms, including privatization of banks, increases in government controlled prices and a higher VAT rate.

[8] The country also experienced political turmoil and violence during this period.

98. **The adoption of tight monetary and fiscal policies resulted in a decline in inflation, while improved public finances and the floating rate system helped to restore confidence in macroeconomic policies.** In 1996, the Bank of Mexico (BOM) revised prudential regulations on banks with respect to FCDs, which had the effect of discouraging such deposits (see below). As a result, Mexico has witnessed a gradual and sustained decline in the FCD ratio since 1997. The decline in the dollarization ratio, despite large capital inflows, probably reflects a combination of prudent fiscal and monetary policies and combined with prudential regulations on the banking system, which promoted macroeconomic stability and improved confidence.

99. **Foreign currency loans in Mexico have also declined significantly since the 1994 crisis.** The ratio of foreign currency loans to total resources—include resources available in the domestic financial system (M4 plus bank's external debt)—dropped from nearly 60 percent in 1994 to under 10 percent in 2003 (Figure 3).[9] Figure 3 also suggests that foreign checking accounts in domestic banks closely mirror developments in foreign trade.

D. What Explains the Reversal in Dollarization in Mexico?

100. **Two important developments since the 1994–95 crisis may help explain the reversal in dollarization in Mexico**: (i) the introduction of strict prudential regulations affecting FCDs, beginning in 1996; and (ii) orthodox economic policies that resulted in declining inflation, a generally positive real interest rate differential between Mexico and the United States, and increased confidence in macroeconomic policies. The latter is also reflected in progressively improving credit ratings since the adoption of the floating exchange rate regime in late 1994.

Regulations

101. **Under current regulations instituted in 1996, banks are permitted to offer foreign currency deposits in checking accounts payable in Mexico provided the holders of such accounts are either**: (i) residents of the twenty-kilometer northern border region of Mexico, or those living in Baja California or Baja California Sur; or (ii) firms domiciled in Mexico. Commercial banks are also permitted to offer foreign currency deposits for foreign firms with operations in Mexico provided such deposits are payable abroad. In addition, commercial banks can offer foreign currency accounts in other countries for residents of Mexico. However, there are prudential regulations to ensure that banks invest FCDs in liquid assets, and to prevent maturity mismatches between foreign currency assets and liabilities. The regulations imply that banks can only earn marginal returns on such deposits, reducing their incentives to mobilize them. The more important regulations are described in Box 1, while Box 2 compares these with regulations in Bolivia and Peru, which are still characterized by high dollarization.

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[9]Total resources include resources available in the domestic financial system (M4 plus bank's external debt).

Confidence in macroeconomic policies and reforms

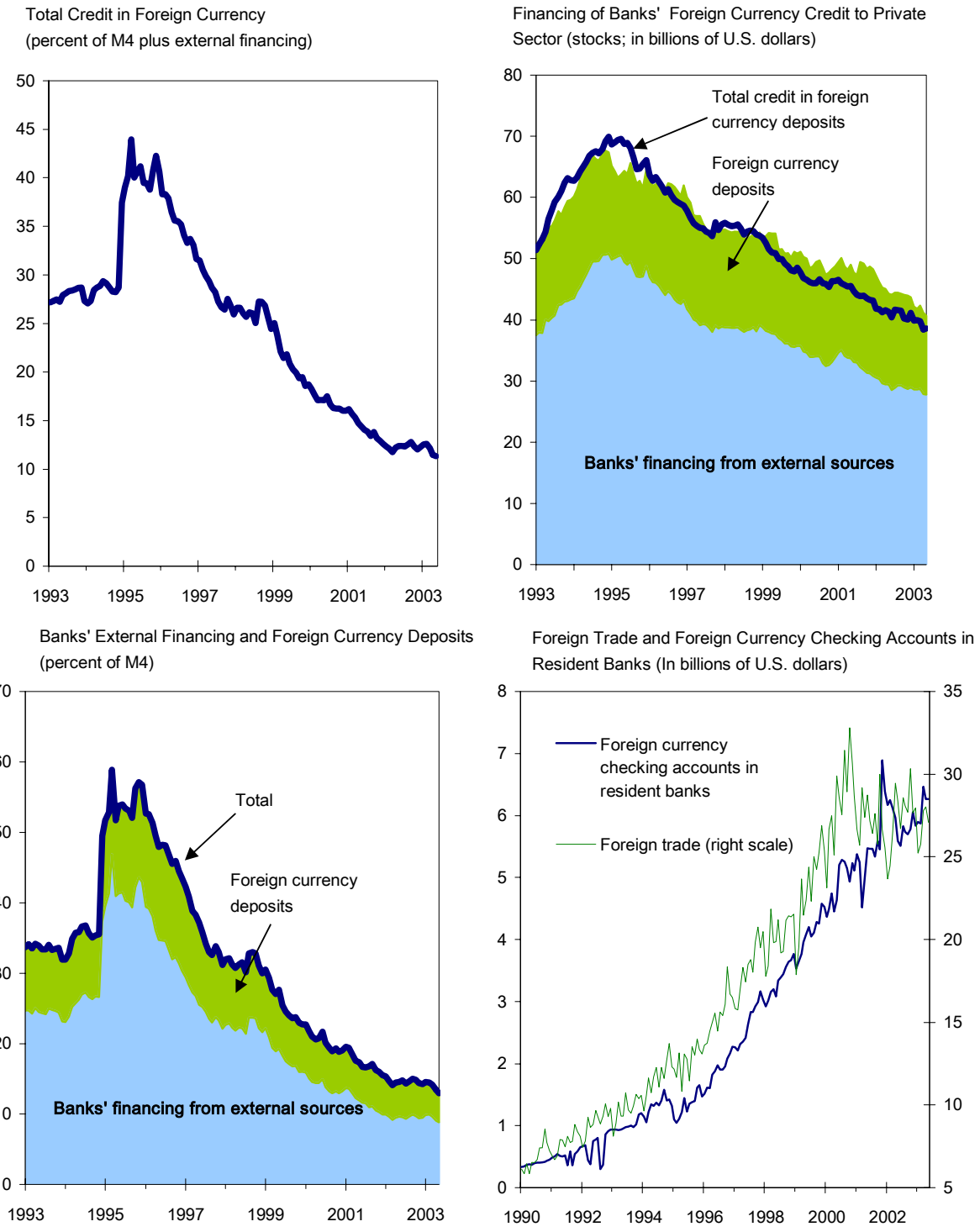
102. **Economic stability is likely to be a necessary, if not sufficient, condition for a reversal in informal dollarization.** The focus of macroeconomic management in Mexico since the 1994–95 crisis has been to ensure low inflation and stable exchange rates, limit fiscal deficits, manage debt prudently to reduce vulnerabilities, and implement structural reforms and integration with NAFTA. One of the most important steps undertaken after the collapse of the peso in late 1994 was to spell out clearly that the principal focus of monetary policy was on attaining medium-term price stability, and that banking sector problems would be addressed by specific programs, with the cost to be assumed by the fiscal authority.

Box 1. Mexico: Prudential Regulations on Banks

The following prudential regulations are currently in effect on foreign currency assets and liabilities:

- For all foreign currency liabilities with a maturity of up to 60 days, banks must maintain liquid assets equivalent to 50 percent of liabilities with a maturity of 1 day, 48.3 percent of liabilities with a maturity of 2 days, and so on. Liquid assets are defined as (i) cash in US$ or in any other freely convertible foreign currency, (ii) T-bills, T-notes and T-bonds issued by the U.S. government with maximum maturity of one year, and (iii) one-day notice deposits in foreign financial institutions rated P-1 by Moody's Investors Service or A-1 by S&P. These liquid assets cannot be used as collateral, credits, repurchase agreements, or any similar operations that restricts their availability.
- The remaining foreign currency holdings can be used for granting credits or investing in other assets based on the guidelines in the Law on Credit Institutions and other applicable provisions. However, there are limits on the amount that banks are allowed to lend to individual borrowers.
- Irrespective of the counterparty's residence, total liabilities of commercial banks denominated in or referred to in foreign currency (excluding cash and highly liquid assets as determined by the BOM) must not exceed an amount equal to 183 percent of the capital base (in line with the Basel Accord) of the respective bank.
- At the close of daily operations, assets in foreign currency must be equal to or greater than liabilities in foreign currency in each of the four groups, where assets and liabilities have to be classified into the following four groups—with maturity of 1 day; 8 days or less; 30 days or less and 60 days or less.
- Net open foreign exchange position of a bank must not exceed 15 percent of its capital.
- Credit institutions have to report daily (no later than 9:00 a.m. the following day) on all their foreign currency transactions.

Figure 3. Mexico: Credit in Foreign Currency, 1990-2003



Source: Bank of Mexico; staff estimates.

Box 2. Mexico: Current Prudential Regulations on Foreign Currency Holdings by Banks Selected Latin American Countries

Type of restriction/regulation	Mexico	Bolivia	Peru
Foreign exchange accounts permitted	(i) Residents in border areas (ii) Embassies, consulates and international organizations (iii) Firms resident in Mexico (iv) Other firms but as long as payments are made abroad	Residents and nonresidents	Residents and nonresidents
Accounts in domestic currency convertible to foreign currency	Not permitted.	Permitted (for both residents and nonresidents).	Permitted (for both residents and nonresidents).
Lending in foreign currency	Total liabilities of commercial banks denominated in or referred to in foreign currency (excluding cash and highly liquid assets as determined by the BOM) must not exceed an amount equal to 183 percent of the basic capital stock (in line with the Basel Accord) of the respective bank.		Permitted. Since (October 2002), banks lending criteria must consider financial risks associated to currency mismatch at the firm level.
Liquidity requirements on FCDs	For all foreign currency liabilities of up to 60 days banks must maintain liquid assets (see Box I)	10 percent on time deposits with a maturity of up to 720 days, none beyond that.	20 percent of short-term foreign currency liabilities must be held in liquid assets.
Reserve requirements	No reserve requirements.	2 percent reserve requirement on FCDs with a maturity of up to 360 days.	FCDs are subject to a marginal reserve requirement of 20 percent. Currently, the average rate is about 30 percent.
Open foreign exchange positions	Limit is 15 percent of net capital.	Limit is 80 percent of the value of banks' net worth minus their fixed assets for excess buy position, and 20 percent for excess sell position.	Prudential limit of 100 percent of the net worth over the long foreign exchange position and a limit of 2.5 percent over the short foreign exchange position of the financial institution.
Other restrictions	Assets must be equal to or exceed liabilities in each of the four maturity groups.	None	None.
Reporting requirements	All foreign exchange transactions to be reported daily.	None.	All foreign exchange transactions to be reported daily on an aggregated basis.

103. **Since 1996, the Bank of Mexico has pursued a gradual process of disinflation.** Monetary policy since then has converged on a framework that includes two main elements—an annual inflation target, and the use of a daily objective for settlement balances, the "corto", to affect interest rates in the pursuit of inflation targets—within a floating exchange rate regime. Importantly, the inflation objective, has now become the nominal anchor for the economy.

104. **Currency instability is one of the principal factors causing individuals to seek a "safe haven" in a foreign currency**. As noted above, the peso was allowed to float on December 22, 1994 following a failed effort to defend the currency by widening the exchange rate band. This ended the era of speculative attacks on the peso and, combined with relatively low inflation, the exchange rate has been much more stable. For example, the exchange rate depreciated by a mere 3 percent in 1996–97 compared with 44 percent in 1995. In 1998 the exchange rate depreciated by about 22 percent, mainly reflecting the external environment associated with the Russian and Brazilian crises. Since then the exchange rate has moved in a narrow range and even the recent Argentine crisis had little effect. This has played a strong role in returning confidence in the domestic currency, and may have contributed to the gradual de-dollarization of the economy.

105. **The banking sector suffered a sharp contraction during the 1994–95 crisis, in response to which the authorities took a number of steps to limit the impact of the crisis.** In addition to taking over some banks and liquidating others, the authorities designed debtor support programs, mainly involving incentives for debt restructuring; lengthening loan maturities and assuring a constant real interest rate on debt through an indexation mechanism based on CPI inflation. Although the fiscal costs of rescuing the banking sector were significant, this approach moderated the impact of the crisis on the domestic economy, and banks have strengthened their balance sheets considerably.[10]

106. **International financial markets have also responded favorably to the improved performance of the Mexican economy, as evidenced by stronger ratings by credit rating agencies.** Most recently, Mexico's foreign-currency denominated bonds were upgraded to investment-grade status by both S&P and Fitch IBCA, and Moody's upgraded Mexico's sovereign debt to investment grade in February 2002. The recent prepayments of Brady bonds resulted in a further improvement in Mexico's sovereign rating. This has widened the investor base, and interest rate differentials between Mexico and the United States have declined further. International bond spreads, as represented by EMBI+ for Mexico, have also been generally declining, although they increased temporarily during the Russian and Brazilian crises. The EMBI+ spread for Mexico, as of August 2003, stood at just over 200 basis points, compared with an average of about 500 basis points for all emerging markets. As a result, Mexico now attracts about 15 percent of total capital flows to emerging market economies.

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[10] Estimates show that the net (including expected recovery of assets) fiscal costs of these various support programmes was about 20 per cent of GDP for 1995–97, half of which derived from the take-over of banks.

E. Empirical Analysis

107. **Empirical studies on dollarization and currency substitution have generally been based on simple models of relative currency demand.** These models incorporate a mix of inflation, exchange rate expectations, and interest rate differentials as the main explanatory variables.[11] We follow in this tradition, specifying a portfolio balance model in which assets are assumed to be imperfect substitutes and domestic residents can hold domestic currency, foreign currency denominated accounts in the domestic banking system, and domestic and foreign currency denominated bonds. The latter takes into account the increasing openness of the Mexican economy after NAFTA, and the increasing integration of its financial markets with those of the rest of North America.

108. **We consider the following stylized money demand equations:**[12]

$$m_t^f = \beta_0 + \beta_1 y_t - \beta_2 \left(i_t^d - \rho_t\right) + \beta_3 i_t^f \qquad (1)$$

$$m_t^d = \alpha_0 + \alpha_1 y_t + \alpha_2 \left(i_t^d - \rho_t\right) - \alpha_3 i_t^f \qquad (2)$$

where m^d and m^f denote the real demand for deposits in Mexico at time t in local and foreign currency respectively; y is real income at time t; ρ is an unobserved time-varying "risk premium"on domestic assets, i^d and i^f represent nominal rates of return on domestic bonds and foreign bonds respectively. In this formulation, the relevant yield on domestic assets is defined as being net of risk, either in the form of default or exchange rate risk. Subtracting equation (2) from equation (1), we obtain the following equation for the log dollarization ratio (d_t):

$$d_t = m_t^f - m_t^d = \left(\beta_0 - \alpha_0\right) + \left(\beta_1 - \alpha_1\right) y_t - \left(\beta_2 + \alpha_2\right)\left(i_t^d - \rho_t\right) + \left(\beta_3 + \alpha_3\right) i_t^f \qquad (3)$$

If we further assume that uncovered interest parity holds when allowance is made for the risk premium noted above such that $i_t^d = i_t^f + E_t \Delta e_t + \rho_t$, where E is the expectations operator and e the log of the exchange rate, we can eliminate the unobserved ρ_t from equation (3) as follows:

[11] Rogers (1983), Cuddington (1983), and Alami (2001).

[12] All variables are in logs, except interest rates.

$$d_t = m_t^f - m_t^d = (\beta_0 - \alpha_0) + (\beta_1 - \alpha_1) y_t + (\beta_2 + \alpha_2) i_t^f + (\beta_3 + \alpha_3) i_t^f + (\beta_2 + \alpha_2) E_t \Delta e_t \quad \textbf{(4)}$$

109. **Following Ortiz (1983), we define the expected depreciation of the domestic currency as the inflation differential *(π^d-π^f)* between Mexico and the U.S.** We also include in this stylized framework a variable v_t, which we interpret to be a buffer for external shocks, defined as the ratio of foreign reserves to external short-term debt. The variable ε_t is a random disturbance term. The final specification for estimation is shown in equation (5):

$$\begin{aligned} d_t = m_t^f - m_t^d &= (\beta_0 - \alpha_0) + (\beta_1 - \alpha_1) y_t + [(\beta_2 + \alpha_2) + (\beta_3 + \alpha_3)] i_t^f \\ &+ (\beta_2 + \alpha_2)(\pi_t^d - \pi_t^f) - \beta_4 v_t + \varepsilon_t \end{aligned} \quad \textbf{(5)}$$

110. **As previously mentioned, the analysis uses a broader definition of dollarization than in previous studies.** We measure dollarization as the ratio of foreign currency deposits of residents with domestic banks *plus* the deposits of Mexicans in U.S. banks, divided by the sum of M4 and the deposits of Mexicans in the U.S. banking system expressed in pesos. This helps to capture both foreign currency deposits in the domestic banking system and foreign currency held abroad.[13]

111. **A brief description of the variables and the expected signs of their coefficients in the estimated model is provided below**:

- **Real income.** The effect of domestic income on the relative demand for dollar balances is ambiguous ex ante. Cuddington and Alami have argued that it is possible for the income variable to have a negative effect, depending on whether domestic portfolio considerations dominate transactions demand or not. Portfolio considerations dominate if the coefficient on income is negative.

- **Expected depreciation.** According to the conventional portfolio model specification, an increase in expected rate of depreciation would lead to an increase in the demand for dollars as opposed to pesos, so that the coefficient would be positive. If there are factors that prevent agents from behaving as expected, for example, measures that restrict free movement between currencies or assets, the estimated coefficient could well be insignificant.[14] The introduction of new measures restricting the holding of foreign currency deposits, as in 1996, could even result in a negative sign on the expected depreciation variable. Specifically, a forced shift into domestic currency assets would be expected to lower their equilibrium rate of return. In the context of equation (4), this would be reflected in an increase in the expected rate of

[13] This definition does not significantly alter the results compared with that using M4 alone.

[14] As mentioned earlier, Rogers obtained a negative sign for this coefficient and interpreted this to imply the presence of convertibility risk.

depreciation. In other words, domestic currency holdings would be observed to rise at the same time as expected depreciation increased.

- **Return on dollar deposits.** The coefficient captures portfolio shifts. An increase in the rate of return on foreign currency deposits is expected to increase the demand for foreign currency assets relative to domestic assets.

- **Vulnerability.** We use the reserve coverage of short-term external debt to proxy the extent to which the economy may be vulnerable to external shocks.[15] Assuming that a high level of reserves is taken as a signal that the central bank can respond effectively to shocks, thus imparting confidence in the domestic currency, we would expect the coefficient on this variable to be negative.

112. **Our data cover the period 1990M1–2003M6. All data are in logarithms and were taken from the Bank of Mexico's *Indicadores Economicos* (www.banxico.org.mx)**. It is well known that if time series are not stationary, the distributions of the conventional test statistics will be biased. The levels of all the series are nonstationary; differencing the data and performing unit root tests established that the variables could be characterized as I(1) processes.[16]

Cointegration and error correction

113. **Since the variables in the model are I(1) and endogenous, we expect that the dollarization variable will be cointegrated with the variables on the right-hand side of equation (5).** The long-term relationship corresponds to the cointegrating relationship(s), while the short-term dynamics—i.e. the error correction model—return the variables to equilibrium after a shock. [17] The maximum likelihood technique of Johansen and Juselius (1990) is used to determine the rank (*r)* and identify a long-run dollarization relationship among the cointegrating vectors. The number of lags used in the VAR is based on the evidence provided by both likelihood ratio tests. When serial correlation of the residuals was present, a sufficient number of lags were introduced to eliminate it.

114. **The null hypothesis of no cointegration was rejected using both the λ-max (maximum Eigenvalue statistics) and trace tests, in favor of one cointegrating relationship.** Both tests indicate one cointegrating vector at the 1 and 5 percent level. We then consider a dynamic error-correction model that takes the form of an autoregressive distributed lag to capture the short-run dynamics of the specification in equation (5). The

[15] This is consistent with the indicators used by the Fund to assess vulnerability of countries to economic crisis.

[16] A useful discussion of unit root tests can be found in Perron (1989) and Phillips and Perron (1988).

[17] One problem with the Johansen and Juselius procedure is that it is not able to exactly identify the parameters in the a and b matrices. Only if just one cointegrating vector is found can we make concrete conclusions about a unique long-run relationship between the variables.

regression results are presented in Table 1. The signs of the coefficients generally correspond to those implied by the portfolio balance, with the exception of that on exchange rate expectations which is negative suggesting the presence of an "identification problem" arising from the role of prudential regulations, as discussed above. [18]

115. **All contemporaneous short-run coefficients are statistically insignificant, with the exception of the vulnerability variable, which is significant and has the expected sign.** The lagged values of return on foreign assets, the vulnerability variable, and the ECM coefficients are all significant in the long run. The explanatory power of the model is relatively low, however, suggesting that factors outside the model may have affected the dollarization ratio.

Table 1. Mexico: Estimation Results Using ARDL Procedure 1990-2003

Variable	Coefficient	T-Statistics		P-value
Constant	0.082	2.00	*	0.048
Short-run dynamics				
d(Expected depreciation)	-0.024	-0.86		0.389
d(Return foreign assets)	0.019	0.22		0.812
d(Vulnerability)	-0.006	-6.35	*	0.000
d(Real income)	-0.017	-0.64		0.527
Long-run dynamics				
Expected depreciation (-1)	-0.023	-0.96		0.338
Return foreign on asset (-1)	0.025	1.78		0.077
Vulnerability (-1)	-0.002	-3.48	*	0.000
Real income (-1)	0.001	0.48		0.629
Dollarization ratio (-1)	-0.088	-2.26	*	0.030
Adjusted R-squared	0.277	...		...
Durbin-Watson Statistics	1.882			

* Significant at the 5 percent level.

[18] We did not include a dummy variable for the 1996 changes in regulations in our analysis since we wanted to test for the reversal of the sharp dollarization episode of 1994–95. Including a dummy results in multiple cointegrating vectors.

F. Conclusions

116. **Previous attempts to estimate the magnitude and determinants of currency substitution in Latin America have presented evidence of hysteresis in the dollarization process.** In the case of Mexico, however, dollarization has been trending down and displays little evidence of hysteresis. Our analysis suggests that the expected depreciation of the peso is significant in explaining dollarization in Mexico, but the sign on the coefficent is negative. We attribute this counter-intuitive outcome to the effectiveness of prudential regulations on foreign currency deposits since 1996. These regulations may have discouraged banks from operating such accounts, since the net return is marginal. On the other hand, a reduction in vulnerability to external shocks enhances the credibility of macroeconomic policies and induces a reduction in the level of dollarization in Mexico.

117. **The results also suggest that prudential regulations could be effective in discouraging FCD holdings, without the distortionary effects of stringent direct measures to regulate FCDs.** Mexico had to abandon the forced conversion of dollar accounts to domestic currency in 1987 as it substantially increased convertibility risk and the credibility of policy. This in turn led residents to demand sharply higher real interest rates to hold domestic currency accounts.[19] Since then, Mexico has implemented policies that limit the incentives for ownership of FCD accounts while not directly limiting individuals' capacity to hold such accounts in foreign countries. While the latter option, in effect, allows all Mexicans to open foreign currency accounts abroad through local banks in Mexico, it makes it unattractive for banks to want to do so since the net income from doing so is marginal. Complemented by the strict prudential regulations on banks, this has effectively allowed Mexico to de-dollarize its economy. Finally, our findings suggest that increased resilience of Mexican economy to external economic shocks played important roles in reducing dollarization.

[19] See Savastano (1990), and Berg and Borensztein (2000).

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V. Explanations for the Recent Behavior of the Mexican Peso[1]

This chapter looks at the behavior of the peso/U.S. dollar exchange rate since 1999, examining to what extent Mexico's trade links with the U.S. economy, regional shocks in Latin America, and changes in global risk perception toward emerging market economies, explain the evolution of the Mexican peso. In this context, it pays particular attention to the close correlation between the peso/dollar and dollar/euro rates since 1999, compared with the behavior of selected other currencies. It also looks at the recent breakdown in the close co-movement of the peso/dollar and dollar/euro exchange rates, focusing on the role of changes in reserve management policy and international competitiveness.

A. Introduction

118. **Following the abandonment of the exchange rate target band in late 1994 and subsequent turbulence in local financial markets, Mexico adopted a flexible exchange rate system**. Since then, the exchange rate has been allowed to move freely, apart from temporary periods when the Bank of Mexico has participated in the foreign exchange market through well-defined rules. This chapter looks at the behavior of the peso/U.S. dollar exchange rate (MEX-USD) in recent years to shed light on the factors that may have driven exchange rate movements in this floating-rate environment.

119. **A phenomenon that we pay particular attention to is the close correlation analysts have noted between movements in the peso/dollar exchange rate and the U.S. dollar/euro (USD-EUR) exchange rate, especially in the past 2–3 years**. Specifically, the peso has tended to depreciate against the dollar when the dollar has depreciated against the euro, reflecting in some sense an "over-shooting" by the peso of dollar movements against the euro. This chapter examines various factors that could account for this apparent regularity, including: Mexico's strong trade links with the U.S. economy; shocks in Latin American financial markets that may have affected both the peso/dollar and dollar/euro exchange rates; and changes in global market appetite for risk that may have affected emerging market exchange rates and the dollar/euro rate. The paper then turns to the more recent apparent "disconnect" between movements in the peso/dollar and dollar/euro rates, assessing the importance of the change in reserves management strategy announced in the spring of 2003, and also concerns about Mexico's international competitiveness.

B. Correlation With the Dollar/Euro Rate

120. **Figure 1 shows the movements in the peso/dollar rate from January 1999 to end-August 2003**.[2] The peso gradually appreciated for much of the period from 1999 until early

[1] Prepared by N. Thacker.

[2] Daily exchange rate data from Bloomberg are used for the analysis.

2002, even though economic activity in Mexico slowed sharply in 2001 and inflation remained higher than in trading partners. There was a marked shift in direction starting in April 2002, however, with the peso more than fully reversing its earlier appreciation over the following 12 months. Market sentiment shifted again in late March 2003, partly coinciding with the reduction of risk aversion in international markets due to apparent resolution of the U.S.-Iraq conflict and partly coinciding with the announcement by the Bank of Mexico (BOM) that it would automatically sell half of its reserve accumulation over the previous quarter to the market, starting in May 2003 (for details see Box 1, EBS/03/326). Finally, the summer of 2003 witnessed renewed weakness in the peso that took it close to previous lows.

Figure 1. Mexico: Mexican Peso Versus the U.S. Dollar: 1999-2003

Source: Mexican Authorities.

121. **The top panel of Figure 2 shows these movements in the peso/dollar rate in relation to those in the dollar/euro rate over the same period**. It is apparent that the two have behaved similarly over much of the period, both in terms of low-frequency trends and higher-frequency movements around these trends. The obvious exception is the period since March 2003, when first the strength and then the weakness of the peso/dollar rate contrasted with the opposite movements in the dollar/euro rate. The tendency for the two exchange rates to move in tandem in recent years is supported by the correlation coefficients shown in Table 1 and the rolling correlations shown in the second panel of Figure 2. The correlation between movements in the peso/dollar and dollar/euro rates over the period as a whole is 0.68, with the relationship being stronger in the post-2000 period (with a correlation coefficient of 0.91) than during 1999–2000 (with a correlation of 0.40).[3]

[3] Although, as noted above, the correlation has broken down in recent months, with a correlation coefficient from May to end-August 2003 of -0.55.

Table 1. Mexico: Correlation Matrix-Selected Currencies

January 1999 - End-August 2003

	USD-EUR	MEX-USD	CAD-USD	BRL-USD	CLP-USD	THB-USD	ZAR-USD	PLZ-USD	CZK-USD
USD-EUR	1.00	0.68	-0.63	0.18	-0.03	-0.55	-0.44	-0.68	-0.78
MEX-USD		1.00	-0.36	0.63	0.45	-0.02	-0.04	-0.42	-0.78
CAD-USD			1.00	0.21	0.28	0.52	0.68	0.18	0.29
BRL-USD				1.00	0.92	0.55	0.58	-0.27	-0.66
CLP-USD					1.00	0.74	0.74	-0.15	-0.52
THB-USD						1.00	0.69	0.16	0.08
ZAR-USD							1.00	0.03	-0.16
PLZ-USD								1.00	0.67
CZK-USD									1.00

January 1999 - End-December 2000

	USD-EUR	MEX-USD	CAD-USD	BRL-USD	CLP-USD	THB-USD	ZAR-USD	PLZ-USD	CZK-USD
USD-EUR	1.00	0.40	-0.14	-0.28	-0.78	-0.78	-0.90	-0.92	-0.97
MEX-USD		1.00	0.39	-0.10	-0.29	-0.21	-0.11	-0.34	-0.37
CAD-USD			1.00	0.19	0.26	0.47	0.48	0.12	0.17
BRL-USD				1.00	0.56	0.46	0.29	0.43	0.29
CLP-USD					1.00	0.89	0.76	0.81	0.69
THB-USD						1.00	0.87	0.79	0.73
ZAR-USD							1.00	0.82	0.88
PLZ-USD								1.00	0.92
CZK-USD									1.00

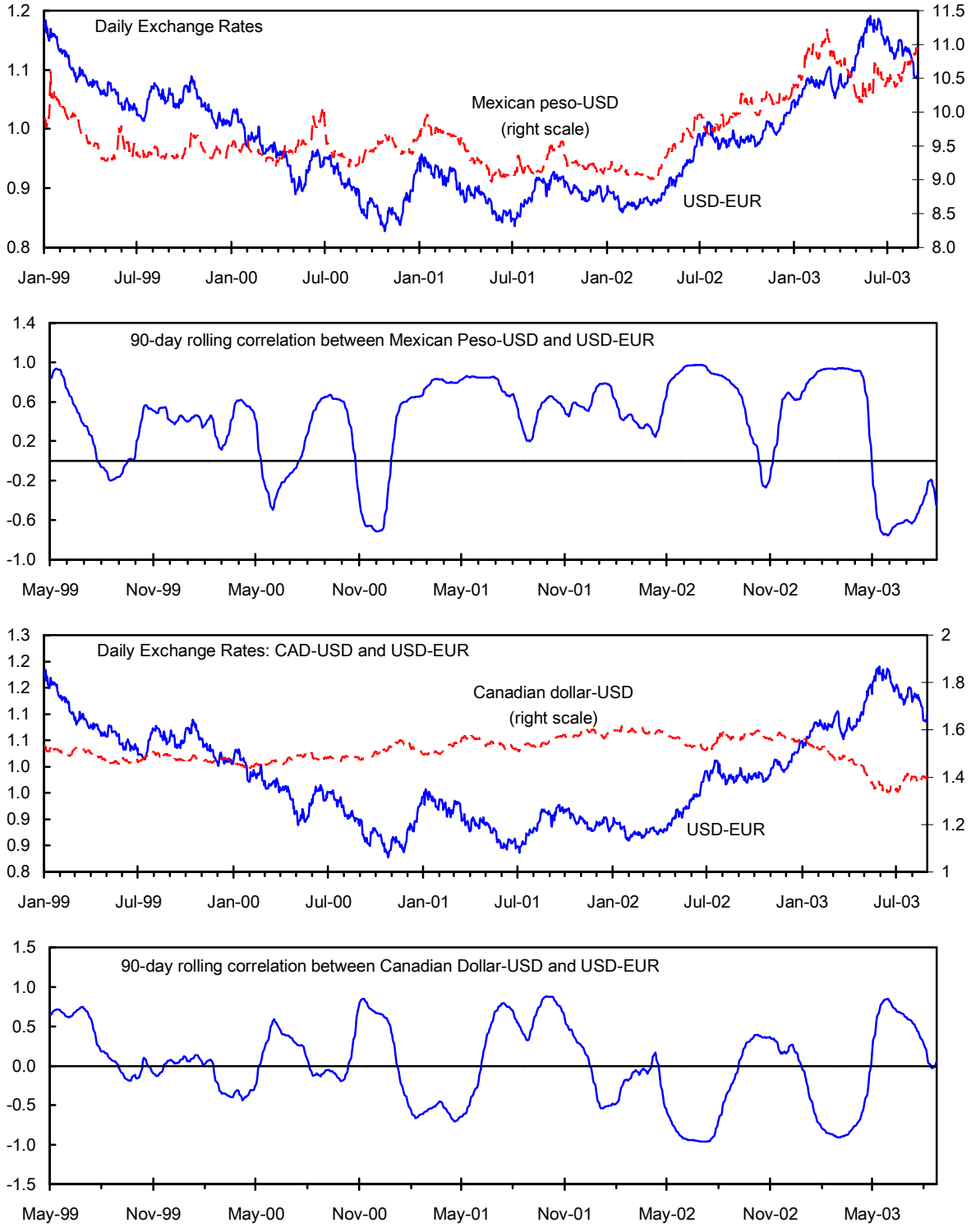
January 2001 - End-August 2003

	USD-EUR	MEX-USD	CAD-USD	BRL-USD	CLP-USD	THB-USD	ZAR-USD	PLZ-USD	CZK-USD
USD-EUR	1.00	0.91	-0.79	0.62	0.58	-0.73	-0.44	-0.68	-0.92
MEX-USD		1.00	-0.62	0.73	0.58	-0.66	-0.43	-0.58	-0.85
CAD-USD			1.00	-0.15	-0.17	0.50	0.68	0.60	0.57
BRL-USD				1.00	0.86	-0.38	-0.01	-0.31	-0.74
CLP-USD					1.00	-0.38	0.16	-0.20	-0.72
THB-USD						1.00	0.00	0.38	0.82
ZAR-USD							1.00	0.39	0.10
PLZ-USD								1.00	0.58
CZK-USD									1.00

Sources: Bloomberg; and Fund staff estimates.

Notes: USD-EUR denotes U.S. dollars per Euro. All other currencies are quoted in terms of the U.S. dollar (USD) per U.S. MEX denotes Mexican pesos; CAD denotes Canadian dollars; BRL stands for Brazilian real; CLP denotes the Chilean peso; THB represents Thai baht; ZAR stands for South African rand; PLZ denotes Polish zloty; and CZK denotes Czech koruna.

Figure 2. Mexico: Movements in the Mexican Peso and the Canadian Dollar vs. the Euro



Source: Bloomberg; and Fund staff estimates.

122. **The co-movements in the peso/dollar and dollar/euro rates over this period could reflect various factors**. Distinguishing among these factors and determining their relative importance is of interest, in part because the underlying sources of the correlation are likely to determine how durable it will be in the future. The following are three explanations that could account for this phenomenon:

- **Shocks to U.S. activity**. When U.S. activity slows, the dollar tends to depreciate against the euro, and at the same time Mexico experiences a negative shock to exports. With the U.S. being Mexico's main trading partner, the peso tends to depreciate against the dollar in response to this deterioration in external demand.

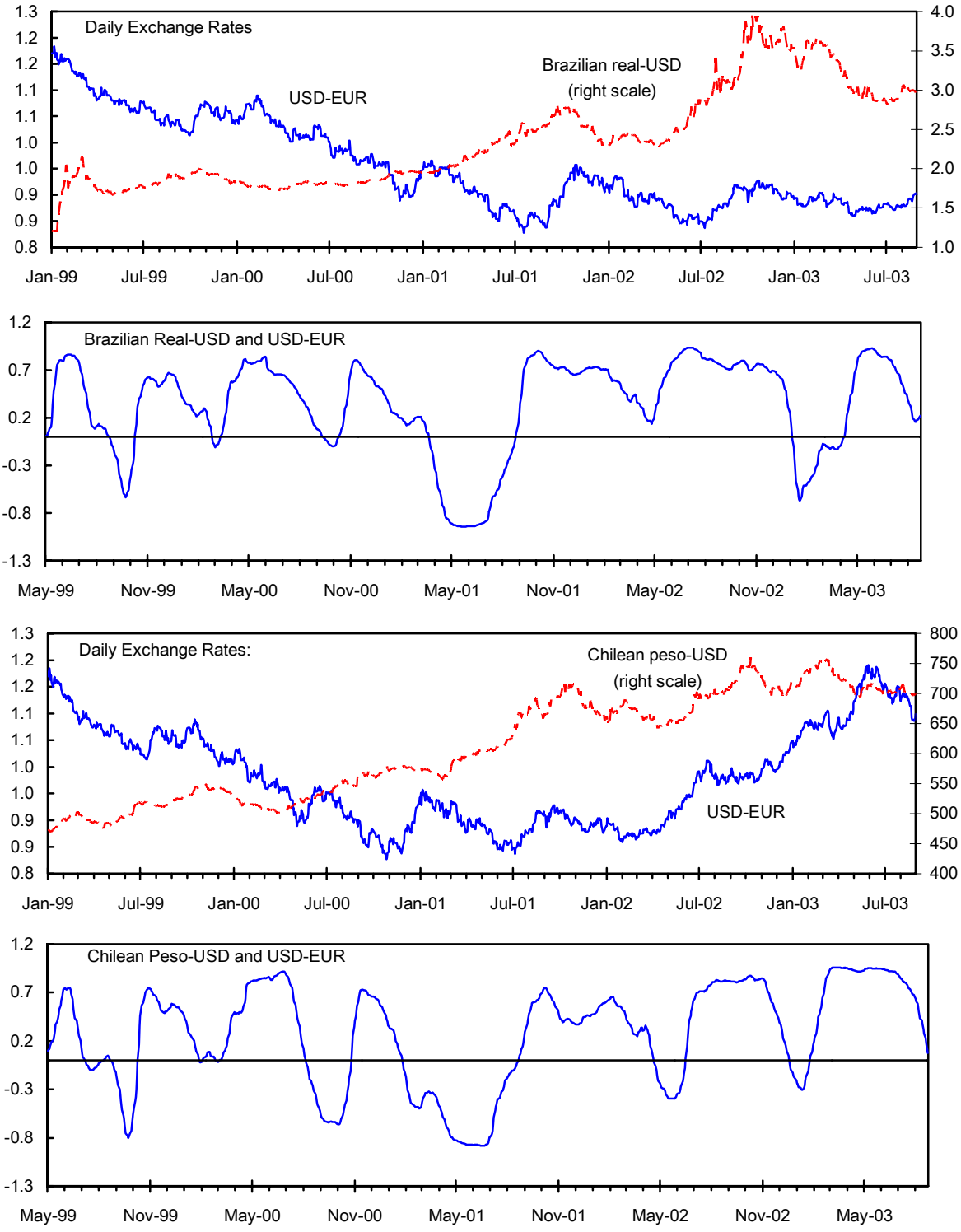
- **Volatility in Latin American financial markets**. Financial turbulence in the region, particularly in 2001–02, affected both the bilateral exchange rates of regional currencies (including the peso) against the U.S. dollar, and possibly also the value of the dollar versus the euro. In this explanation, the causation is the reverse of that described above, being from Latin American shocks to the dollar/euro exchange rate.

- **Shocks in global capital markets**. Recent years have witnessed significant swings in global market appetite for risk, affected yield spreads and demand for assets in both developed and emerging capital markets. To the extent that these shocks have induced co-movements in the dollar/euro rate and the exchange rates of emerging market currencies against the dollar, they could explain the correlation between the peso/dollar and dollar/euro rates.

123. **To shed light on the possible role of these factors in explaining movements in the peso/dollar rate, we examine the correlations between other selected currencies and the dollar versus the dollar/euro rate**. The following currencies are included: the Canadian dollar, Brazilian real, Chilean peso, Thai baht, South African rand, Polish zloty and the Czech koruna. Canada is chosen because, like Mexico, it is a NAFTA member with a high share of exports destined to the U.S. market. If peso/dollar movements are largely driven by U.S. shocks through trade channels, one might expect to see a similar pattern for the Canadian dollar as for the peso. In contrast, if financial shocks in Latin America have driven movements in the peso/dollar rate, one might expect to see the Brazilian real and Chilean peso behaving similar to the peso. Finally, if the peso/dollar rate has been driven by changes in global market sentiment, this would likely be reflected in similar movements in the currencies of other emerging market economies with floating exchange rates, including Thailand, South Africa, Poland, and the Czech Republic.

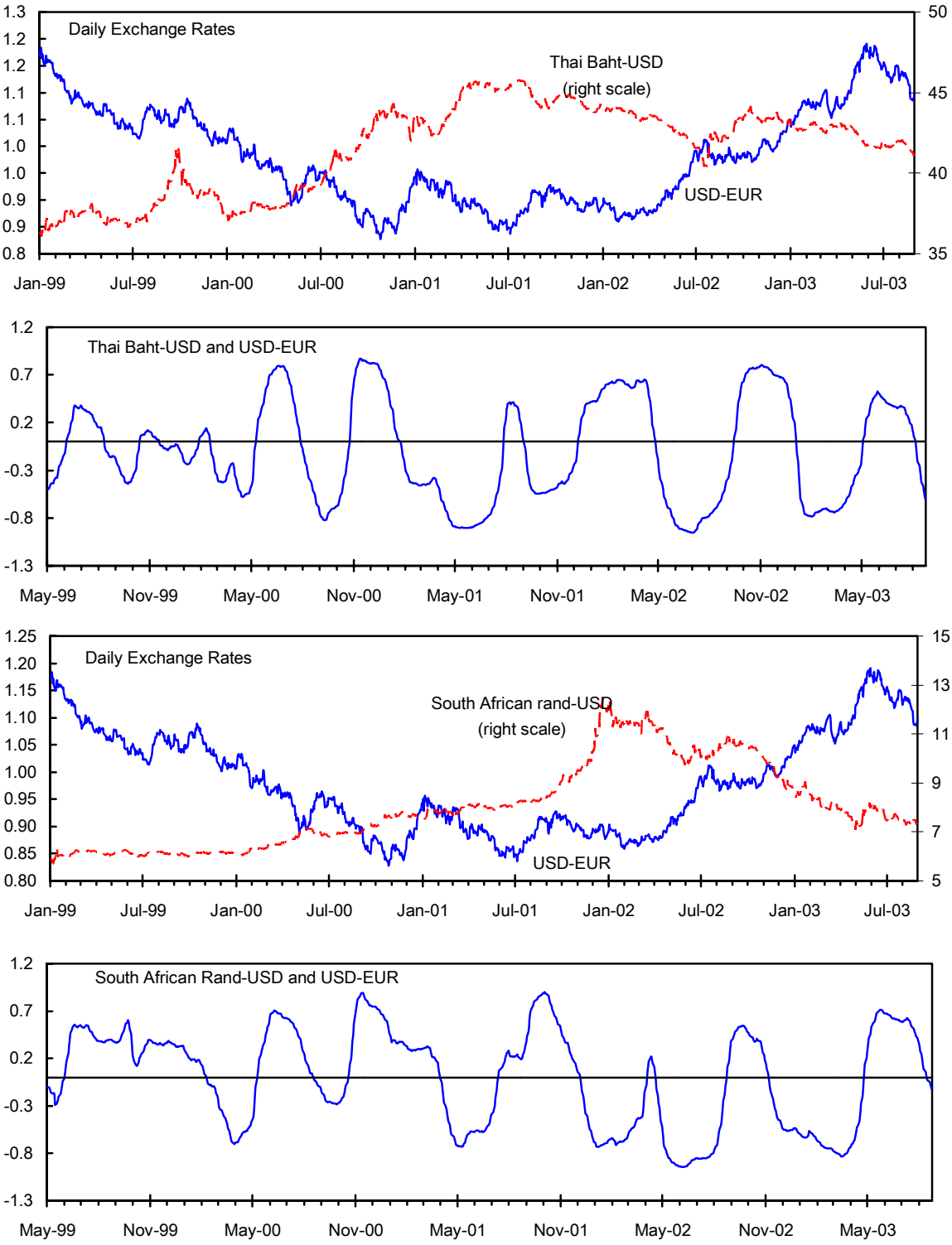
124. **Figures 3a to 3c provide a visual impression of the extent to which these other currencies have moved in line with the dollar/euro rate over the 1999–2003 period**. While there are brief periods when the currencies exhibit similar movements, they tend to be short-lived. This general pattern is confirmed by the predominantly negative correlation coefficients in the first row of the correlation matrices in Table 1, although there are some notable exceptions, as discussed below. The rest of this section assesses the various explanations for the behavior of the peso/dollar rate in light of these stylized facts.

Figure 3a. Bilateral Exchange Rates and 90-day Rolling Correlation with the USD-EUR, Brazilian and Chilean Currencies



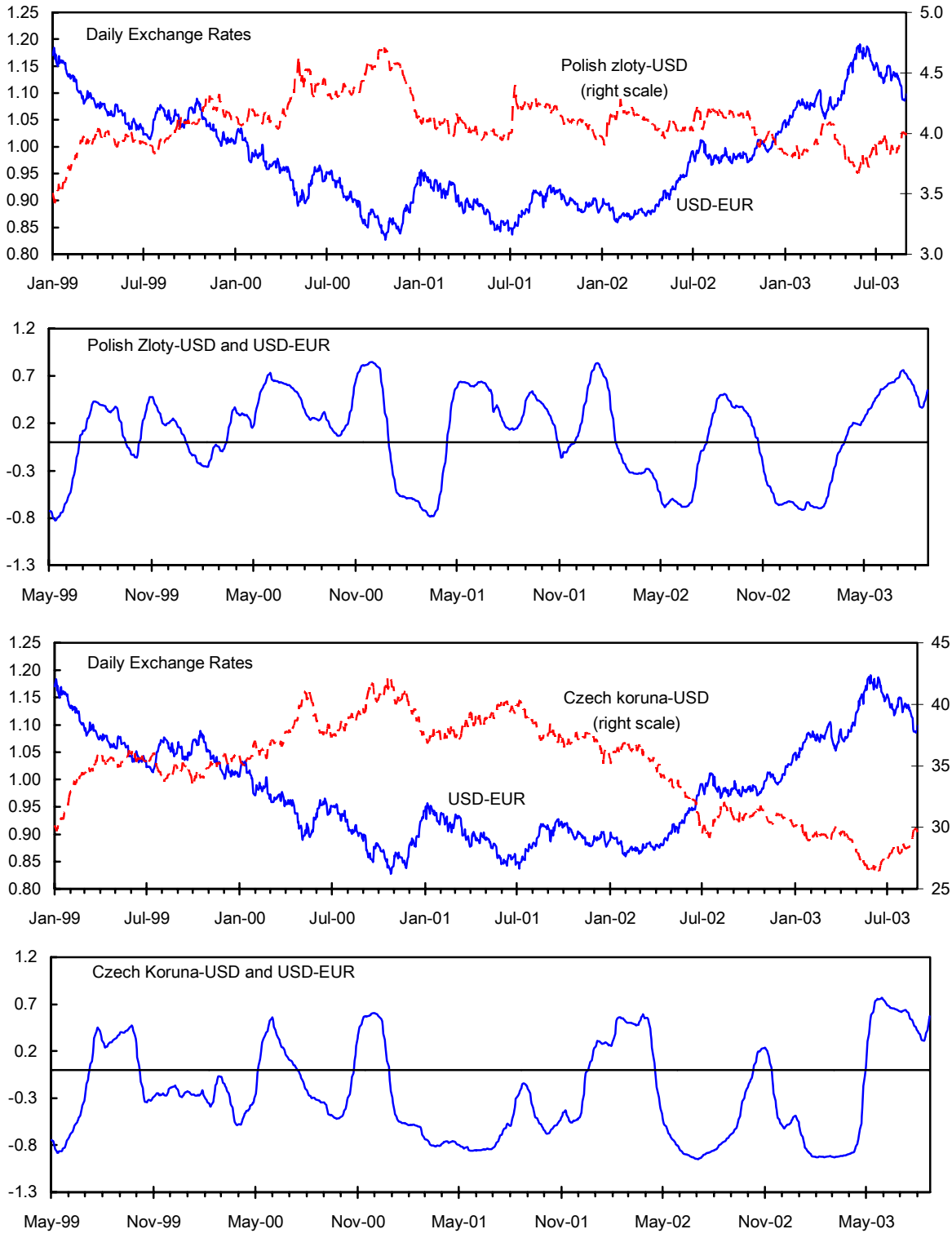
Source: Bloomberg; and Fund staff estimates.

Figure 3b. Bilateral Exchange Rates and 90-day Rolling Correlation with the USD-EUR, Thai and South African Currencies



Source: Bloomberg; and Fund staff estimates.

Figure 3c. Bilateral Exchange Rates and 90-day Rolling Correlation with the USD-EUR, Polish and Czech Currencies



Source: Bloomberg; and Fund staff estimates.

Mexico's trade links with the United States

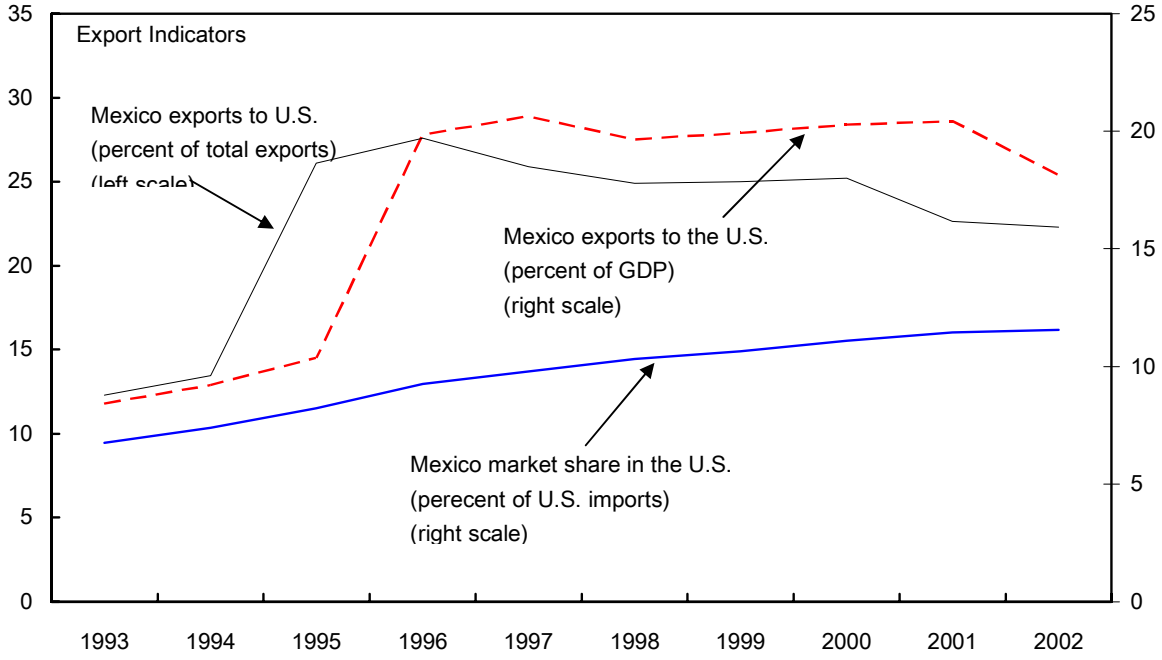
125. **Figure 4 shows various indicators of Mexico's trade dependence on the U.S. economy**. The share of Mexican exports in GDP has more than doubled from about 12 percent in 1992 to 25 percent in 2002, with almost 90 percent of non-oil exports going to the U.S. market, and most oil exports marketed to U.S. oil companies. At the same time, Mexico's share in U.S. imports has doubled to nearly 12 percent during this period. The lower panel of Figure 3 indicates the close relationship between movements in Mexican exports and U.S. industrial production since the late 1990s.[4] In terms of broader measures of activity, a regression of four-quarter growth in Mexican real GDP on growth in U.S. real GDP (lagged one quarter) from 1999Q1 to 2003Q2 yields a slope coefficient, or "beta," of 1.52, with an R^2 of 0.76. This is consistent with the view that Mexican activity is "leveraged" by a factor of more than one to the U.S. economy, possibly explaining an "over-shooting" of the exchange rate in response to shocks to actual or expected U.S. activity.

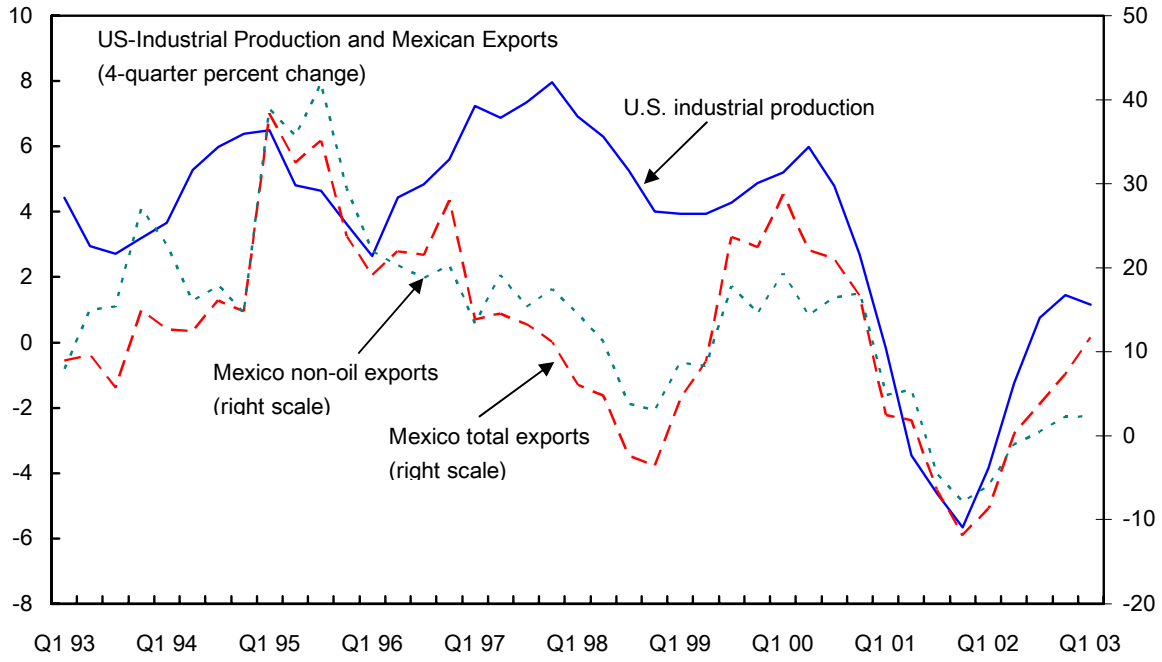
126. **In the case of Canada, about 85 percent of exports are destined to the U.S. market, similar to the Mexican share**. Canadian and U.S. GDP growth rates are also closely related, with a beta from the regression described above of 0.97, with an R^2 of 0.84. But, as shown by the correlations in Table 1, the behavior of the Canadian dollar has been opposite to that observed for the peso — that is, when the U.S. dollar has weakened against the euro, the Canadian dollar has strengthened against the U.S. dollar, with the negative correlation being of roughly the same magnitude as the positive correlation for the peso/dollar rate over the period as a whole. The correlation coefficient for the Canadian dollar is also negative over the two sub-periods. The contrast in behavior could reflect the somewhat lower dependence of Canadian growth on U.S. growth, with a beta of slightly less than one as opposed to well over one for Mexico. This, in turn, could result from Canada's greater scope for using countercyclical monetary and fiscal policies to offset negative shocks from the United States, given the well-established credibility of the fiscal and monetary policy framework.

127. **To further assess the importance of trade links in explaining currency movements, we consider the correlation of the two European currencies in the sample —the Polish zloty and the Czech kurona—with the dollar/euro rate**. Both countries have a relatively high trade dependence on the euro area, with about 70 percent of their exports being destined to the European Union. Nevertheless, the betas with respect to euro-area GDP, at 0.41 for Poland and 0.50 for the Czech Republic, are considerably lower than those discussed above for Mexican and Canadian activity with respect to U.S. GDP. In any case, if these currencies exhibited the same "overshooting" as the Mexican peso, we would expect them to appreciate against the euro when the euro appreciates against the dollar, and vice versa. In fact, the correlation coefficient between the zloty/euro rate and the dollar/euro

[4] See Economic Integration in the Americas: Lessons from NAFTA in United States—Selected Issues (EBS/03/253).

Figure 4. Mexico: Export Dependence on the United States





Sources: Authorities; and Fund staff estimates.

rate is consistently positive at 0.84 for the full period, and 0.72 and 0.95 for the first and second sub-periods respectively. These positive correlations indicate a response opposite to the "overshooting" behavior observed for the peso—i.e., the zloty tends to depreciate against the euro at the same time as the dollar depreciates. A similar pattern holds for the Czech koruna: the correlation between the koruna/euro rate and the dollar/euro rate is 0.07 for the period as a whole, although it switches sign from 0.69 for the first sub-period to -0.41 in the second period.

128. **The absence of supporting evidence for these other economies does not necessarily undermine the hypothesis that the behavior of the peso/dollar rate is driven, at least in part, by trade linkages**. None of the other three economies considered above has a *"beta"* with respect to U.S. activity that exceeds unity, as does Mexico, which could explain why the peso is the only currency to overshoot. Furthermore, there are differences in policy regimes and various other factors that could lead to alternative exchange rate behavior. On balance, we conclude that trade linkages with the U.S. could explain part of the behavior of the peso/dollar rate, although there is not strong corroborating evidence from the behavior of other currencies.

Shocks in Latin American financial markets

129. **We now examine whether financial market shocks in Latin America, particularly during the turbulent period from 2001 to early 2003, can explain the correlation between the peso/dollar and euro/dollar exchange rates**. These shocks put pressure on yield spreads and currencies throughout the region, because of both trade and financial market interdependencies.[5] They may also have driven movements in the dollar/euro rate, either because of a view that the U.S. economy would be more affected than Europe by problems in Latin America, or because of portfolio effects on exchange rates given that most of the crisis countries had large external liabilities denominated in dollars.

130. **To explore this story, we examine the correlations between two other regional currencies with floating exchange rates—the Brazilian real (BRL-USD) and Chilean peso (CLP-USD)—with the dollar/euro rate**. As shown in Table 1, the correlations between these currencies against the dollar and the dollar/euro rate were negative (highly so for the CLP) during the 1999-2000 sub-period, opposite to the positive correlation observed for the MEX-USD rate. But the correlations for the real and the Chilean peso become large and positive in the period beginning in 2001, around the time of the Argentinean crisis. It is notable that this also corresponds to a rise in the correlation between the peso/dollar and euro/dollar rates to 0.91 from 0.40 during the first sub-period. The other interesting point to

[5] The latter would be more important in the case of Mexico, as its trade shares with the rest of the Latin American region are relatively low. Financial market interdependencies could arise from investor aversion to taking risks in the region, either because of herding effects or the negative impact on portfolios of institutions with investments across the region of losses in specific countries.

note is that the correlations between these currencies and the dollar all became negative after March 2003, the time at which financial market pressures in the region had largely subsided.[6]

131. **It appears, then, that spillovers within the region may have a significant effect on exchange rates during periods of market turbulence, even though Mexico and Chile both enjoy investment-grade credit ratings**. To the extent that the recent (relative) stability in regional markets continues, it may be the case that the correlation between peso/dollar and dollar/euro exchange rates will be less strong than during the period from 2001 to early 2003 of high market volatility.

Global capital market shocks

132. **If changes in risk perception and/or appetite by global investors underlie the co-movements in the peso/dollar and euro/dollar rates, one might expect to see similar correlations in the currencies of other emerging market countries with floating exchange rates, such as Thailand and South Africa**. These countries are also of interest because their trade flows are relatively diversified, meaning that any correlations with the dollar/euro rate are more likely to arise from financial market shocks than the strength of direct trade linkages. In the event, however, Table 1 indicates that the correlations between the Thai baht and the dollar and the South African rand and the dollar with the dollar/euro rate are consistently negative, both for the sample as a whole and for the two sub-periods.

133. **The implication that shocks in global capital markets are not responsible for the correlation between the peso/dollar and euro/dollar rates is further supported by the negative correlation (-0.21) found between the EMBI spread for emerging markets as a whole and the peso/dollar rate**. Thus, as the EMBI spread for emerging markets rises, the peso tends to appreciate against the dollar. It appears, then, that portfolio diversification works in Mexico's favor compared with emerging markets as a whole, probably reflecting its investment-grade credit rating.

C. Behavior of the Peso in Recent Months

134. **While the U.S. dollar continued to depreciate against the euro in the spring of 2003, it reversed course during June to August, perhaps reflecting the end of the Iraq war and improving signs of U.S. recovery, while the euro-area economy has remained sluggish.** Unlike the previous experience, however, when peso appreciation accompanied dollar appreciation, the peso moved in opposite directions over this period, appreciating against the dollar between March and mid-May, and subsequently reversing course. As a result, the previous positive relationship between the peso/dollar and dollar/euro rates has broken down, with the recent correlation standing at -0.55. To understand these more recent

[6] The correlation between the BRL-USD and USD-EUR rate from April–August 2003 is -0.64, and for the CLP-USD and USD-EUR rate is -0.24.

movements in the peso, we look at the new reserve management policy of the BOM and changing views about Mexico's external competitiveness.

Change in reserve management strategy

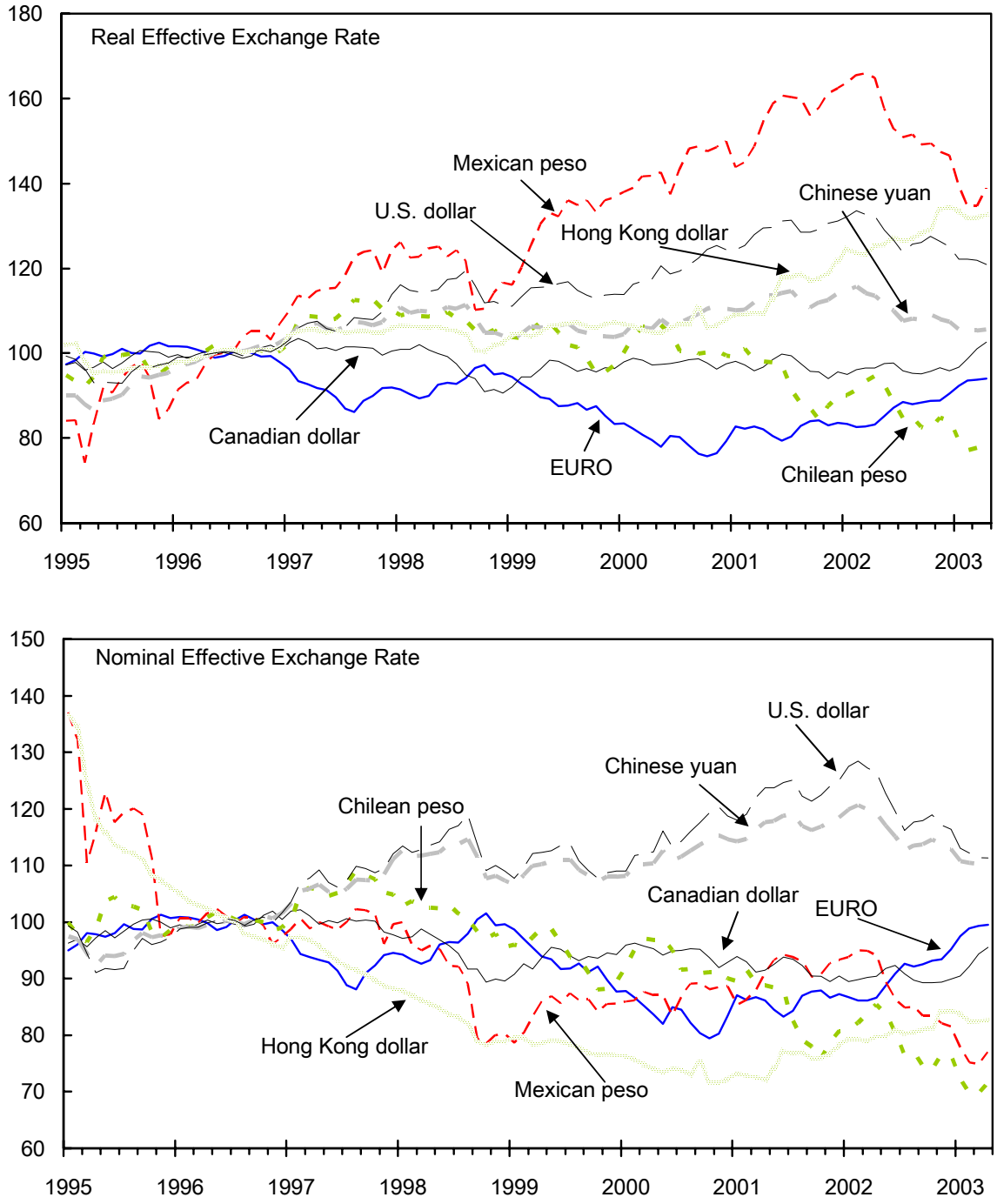
135. **The BOM started selling foreign exchange in the interbank market starting May 2, in line with the new policy announced on March 20. From May to July, the BOM sold an average of US$32 million per day, or a total of US$2.1 billion, equal to half of the reserves accumulated in the first quarter**. During the current quarter, the BOM will sell an additional US$910 million. The peso appreciated by about 10 percent between early March and mid-May, influenced by reduction of risk aversion in international markets and by the new policy announcement on March 20. From mid-May to early September, the peso depreciated sharply.

External Competitiveness

136. **Figure 5 shows the evolution of the nominal and real effective exchange rates (NEER and REER) since 1995 for the Mexican peso, the Chinese yuan and selected other currencies**. While the NEER of the Mexican peso has depreciated quite significantly, in real terms it shows a significant appreciation for much of the period, with some reversal since early 2002. In contrast, for the other currencies, real effective appreciation has been rather modest. Since early 2002, China's real effective exchange rate has also depreciated, moderating the gain in Mexico's competitiveness from the depreciation in its real effective exchange rate over this period.

137. **Against the background of these longer-term movements in real exchange rates, the more recent failure of exports to respond to positive U.S. economic indicators has raised concerns that Mexico may be losing competitiveness, especially to China**. The continued sluggishness of Mexican exports to the U.S. and rapid growth in China's exports to the U.S. has increased China's market share in the U.S. For the first seven months of this year, China's market share was marginally higher at 11.2 percent compared with Mexico's at 11.0 percent. While U.S. manufacturing growth is critical to Mexican exports and analysts believe that the projected recovery in U.S. manufacturing will boost Mexico's exports, increasing emphasis has been placed on structural reforms to help ensure Mexico's competitiveness. In the last few years, China has undertaken major structural reforms, and further ongoing reforms of the state-owned enterprise sector combined with effective currency depreciation is likely to boost China's competitiveness further. On the other hand, rigidities in the labor market in Mexico, the lack of investment in infrastructure, low fiscal revenues to invest on education and health, and stalled electricity and telecommunications sector reforms have inhibited productivity growth. The increasing focus by market analysts on these longer-term competitiveness issues in recent months may well underlie the weakening in the peso.

Figure 5. Effective Exchange Rates, Mexico and Selected Countries



Source: Mexican authorities; and IFS.

D. Concluding Remarks

138. **Market analysts have noted a high correlation between the peso/dollar and dollar/euro exchange rates in recent years.** Based on the observed movements in other currencies against the dollar over this period, the evidence supports the view that financial shocks in Latin America can explain much of the co-movement in the two currencies. To the extent that these shocks are not as pronounced in the period ahead, the correlation between the two exchange rates may not be as high as in the recent past. Mexico's continuing strong trade and economic dependence on the U.S. economy, though, is still likely to have an ongoing effect on peso/dollar developments, at least until policy credibility is fully established.

139. **Independent of these external shocks, developments in recent months underscore the role that domestic factors can play in driving peso/dollar movements.** First, the change in the mechanism used to determine international reserves accumulation announced in March seemed to have some transitory effect on the exchange rate. Subsequently, concerns about Mexico's longer-term competitiveness in the face of increasing international competition and the slow pace of structural reforms have likely contributed to a reversal in the strength of the peso. These developments serve to illustrate that empirical regularities in the historical data reflect the nature of the underlying shocks; as these shocks change, so will the pattern of movements in exchange rates.

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