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No. 9115

NORTH AMERICAN FREE TRADE AND THE PESO:  
THE CASE FOR A NORTH AMERICAN CURRENCY AREA

by

Darryl McLeod\*  
and  
John H. Welch\*\*

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# Research Paper

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Federal Reserve Bank of Dallas

This paper examines the effects and policy implications of recent developments in the North American free trade area. The authors discuss the possibility of a North American currency area and the implications for the region. They also discuss the possibility of a North American currency area and the implications for the region. They also discuss the possibility of a North American currency area and the implications for the region.

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THE CASE FOR A NORTH AMERICAN CURRENCY AREA**

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**Darryl McLeod\***

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**John H. Welch\*\***

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\*Assistant Professor of Economics, Department of Economics, Fordham University, Bronx, New York.

\*\*Economist, Research Department, Federal Reserve Bank of Dallas.

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Abstract

This paper discusses the nature and policy implications of recent fluctuations in the peso-dollar rate. We conclude that this is a propitious time for a shift in exchange rate regime but that a target zone for the peso has important advantages over a fixed rate or crawling peg system. Implementing this new regime as part of a "North American Dollar Area" agreement would benefit Mexico in particular and generally complement the NAFTA's goal of increasing regional trade and investment.

The North American Free Trade Agreement (NAFTA) now under negotiation presents an unprecedented opportunity for expanded trade and investment flows between the U.S., Canada, and Mexico.<sup>1</sup> It also raises the question of whether existing exchange rate relationships are consistent with the goals of the NAFTA. Although Europe's EEC is proceeding simultaneously with trade and currency integration, the relationship between trading blocks and currency regimes is not well established. Krugman (1989) offers some strong intuitive arguments of fixed over floating exchange rates, but the empirical evidence does not strongly support such a proposition [Obstfeld 1985 and Giavazzi and Giovannini 1990].

Following the U.S. dollar's long appreciation in the 1980s, the United States, Canada and other major OECD countries jointly set targets for its "soft landing" under the 1985 Plaza and 1987 Louvre Accords. During this period Mexico had less success with a dual rate and crawling peg system. Daily changes in the peso-dollar rate have recently slowed and there are reports Mexico will return to a fixed exchange rate in the near future.

This paper discusses the nature and policy implications of recent fluctuations in the peso-dollar rate. We conclude that this is a propitious time for a shift in exchange rate regime but that a target zone for the peso has important advantages over a fixed rate or crawling peg system. Implementing this new regime as part of a "North American Dollar Area" agreement would benefit Mexico in particular and generally complement the NAFTA's goal of increasing regional trade and investment.

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<sup>1</sup>See the studies in Federal Reserve Bank of Dallas [1991].

## Introduction and Summary

Exchange rate policy in Mexico presently faces two challenges. The immediate task is to preserve price stability while helping to sustain the country's ongoing investment boom. Currently, both the capital inflows helping to finance new investment and the slow devaluation helping to contain inflation are causing the peso to appreciate. Both price stability and accommodating capital inflows are worthwhile goals and may require an appreciation. An excessive appreciation eventually, of course, will hurt import competing and export industries. The threat to price stability and investment is not the peso appreciation *per se*, but the expectation of a future depreciation it creates. Unlike the slow descent of Canadian and U.S. currencies, peso depreciations tend to be large, rapid, and associated with higher inflation, capital flight, and a collapse of domestic investment.<sup>2</sup> The challenge for exchange rate policy, then, is both to head off another "crash landing" of the peso in the medium term and to facilitate a "soft landing" for the peso when a real depreciation does become necessary.

The recent rise of the peso adds some urgency to both of these problems. Some already fear the type of balance of payments crisis that have undermined similar stabilization *cum* liberalization programs elsewhere [see for example Harberger 1991]. Section II of the paper reviews the present level and recent dynamics of Mexico's real exchange rate. Our estimates suggest that the peso is presently 15% above its long term level. The significance of this

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<sup>2</sup>An estimated \$40-60 billion dollars in private wealth left Mexico during the past 15 years. Perhaps \$10 billion has returned during the past two years and more is likely to follow as the NAFTA proceeds on its fast track. Although this is a positive development overall, it does create problems for exchange rate policy. As discussed in section II, the problem is not peso appreciations but the abrupt depreciations that follow.

overvaluation is open to interpretation, however. The fall in real wages during the 1980s has kept unit labor costs relative to the U.S. roughly where they were in 1970. After jumping up in early 1991, inflation and real interest rates have resumed their downward trend, indicating that financial markets are not yet unduly concerned about the peso's ascent.

The Mexican economy possibly could "grow into" its present real exchange rate. Higher productivity and a NAFTA related shift in export demand could well sustain a permanently more expensive peso. Harberger (1991), however, argues that Mexico is not having Japanese or Korean style productivity booms that warrant a permanent appreciation. Disputing his claim is difficult with the available evidence. While private investment rose 14% in 1990 and exports have been growing at a rapid but slowing rate, neither statistic is yet exceptional compared to past booms.<sup>3</sup> Financial markets are vigorous, but the real export led investment boom has yet to hit full stride.

In fact a currency appreciation fueled by capital inflows, anticipated export revenues, and boisterous financial markets are alarmingly similar to Chile's program in the late 1970s and even to Mexico's 1981 oil boom. Section III compares Mexico today, Chile in the late 1970s, and Spain and Israel in the late 1980s. We argue that while Mexico has avoided many of the pitfalls of the earlier Southern Cone stabilization *cum* liberalization programs, it remains vulnerable in some areas and, more importantly, an extra "push" is needed to assure that the present upturn in investment turns into sustained economic growth. Spain found that extra boost in its entrance into the

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<sup>3</sup>This is not to say history will repeat itself. Manufacturing exports can lead to sustained productivity and export growth making a balance of payments crisis less likely, especially with a NAFTA. In the interim however, the economy is still vulnerable to external shocks so the possibility of a peso depreciation cannot be discounted.

European Economic Community (EEC) and the European Monetary System (EMS). Completion of the NAFTA hopefully will do the same for Mexico

Although most agree that the peso's ascent is an equilibrium phenomenon, there is some disagreement over the appropriate policy response. Harberger (1991) argues that capital inflows will soon strain the absorptive capacity of Mexico's economy and proposes measures to "smooth" the inflow of capital, such as an auction of dollar investment rights. Rudiger Dornbusch (1990) and Miguel Mancera Aguayo, Governor of the Banco de Mexico, are more sanguine about the prospect of a sustained appreciation.<sup>4</sup> They emphasize Mexico's competitive wages and the productivity gains from liberalization and restructuring.

In our view, both the "doing nothing" and capital controls response to the peso appreciation run the risk of reducing investment and capital inflows thereby cutting short a long overdue economic recovery. An alternate approach is to take advantage of the strong peso and political credibility of the Salinas government to institute a permanent change in exchange rate policy. A credible change in regime could extend and broaden the current investment boom by reducing expectations of another maxi-devaluation. A new regime that also preserved some scope for real depreciation would reduce the anticipated cost of adverse shocks, thus creating a less risky environment for trade and investment.

The most discussed reform is simply to return to a fixed exchange rate. This would help lock in recent inflation gains, at least temporarily, but has several important drawbacks. A commitment to a fixed peso rate is not credible as long as Mexico is vulnerable to oil price shocks, unfavorable election

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<sup>4</sup>See the interview with Miguel Mancera Aguayo in *Espana Economica*, April 1991.

devaluations by limiting their peso asset positions, real and financial. Also, limiting the peso's downward flexibility (a depreciation would require a sustained period of inflation below the U.S. rate) shifts the burden of external adjustment to other relative prices or policy instruments with potentially costly side effects. While past devaluations reduced growth and increased inflation, a NAFTA trade expansion is likely to make exports more price responsive and create more opportunities for switching from imports to domestic products. Devaluation could well assume its textbook "adjustment with growth" role just as Mexico forswears its use.

The option of a free floating peso or a free plus controlled dual rate system seems not to be "on the table" right now, perhaps because of the high priority placed on price stability. Though its financial markets are growing rapidly, the peso market is still underdeveloped.<sup>5</sup> Mexico's experience with a dual rate system was disappointing, as it kept neither inflation or capital flight at acceptable levels [Kaminsky 1987].

A strategy that has some advantages of both fixed and floating regimes is to adopt a "target zone" for the peso. If this is done as part of a broad "North American" currency area agreement involving swap arrangements and a negotiated band, its very announcement would create the "credibility enhancement" effect associated with a fixed rate regime. Perhaps most importantly, routine up and down movements of the peso within the band would gradually "desensitize" domestic prices to the nominal peso rate. By still allowing for gradual depreciations, it would also reduce expectations of a large devaluation thereby discouraging speculative runs on the peso.

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<sup>5</sup>See Black (1976) for a discussion of the minimum level of financial market development required to support a flexible exchange rate. The recent reopening of a formal futures market for the peso is step in this direction.



The actual cost of defending a currency band can be low, especially given the historically high levels of speculation against the peso. Krugman (1988) and others have shown how "friendly speculation" near the edges of the zone helps stabilize the exchange rate with very limited intervention from the monetary authority. Of course like a fixed rate system the currency band is only viable if the "fundamentals" (monetary growth, budget deficits etc.) are consistent across countries. With limited reserves, speculative attacks are still a possibility [Krugman and Rotemberg 1990, Flood and Garber 1989 and Bertola and Cabellero 1990]. Even with realignments, however, movements within the zone and uncertainty about the edges of the band still encourage stabilizing speculation. Recent studies of the European Monetary System (EMS) and Plaza Accords suggest that nominal exchange rate bands can smooth changes in real exchange rates while encouraging monetary and fiscal policy consistent with price stability [Fратиanni and Von Hagen 1990 and Klein 1991].

The rest of the paper develops these arguments in more detail. The next section evaluates the present appreciation and the prospect of a real peso depreciation over the medium term. Parallels with programs in Chile, Israel and Spain are discussed in section III. Section IV addresses the more difficult problem of implementing an exchange rate regime that both helps maintain domestic price stability and facilitates external adjustment without reducing investment and growth.

## II. The Problem with the Peso

After a long period of rapid growth and stable financial markets under a fixed exchange rate regime (1955 to 1975), management of the peso became more

difficult in the 1970s. Like most developing or middle income countries, Mexico did not switch to a floating exchange rate regime after the Bretton Woods accord ended in 1973. Instead, the government tried to maintain a fixed peso dollar rate with infrequent adjustments. When inflation accelerated to levels higher than the U.S. inflation rate during the early 1970s, the fixed peso rate led to a substantial real appreciation. The first major realignment of the peso occurred in 1976, after a period of overvaluation and episodes of capital flight.

After 1976, the Mexican government again fixed the peso to the dollar. A rising inflation rate, a major oil discovery, and capital inflows once again led to an appreciation that ended with an even larger speculative attack in 1982. Its reserves depleted, the government let the peso seek its own level; by year's end, the cost of the dollar rose to about 150 pesos, up from 25 in late 1981. The government still supported some transactions at an intermediate exchange rate of between 60 to 70 pesos per U.S. dollar and the dual rate period began. More aggressive devaluation of the controlled rate made it virtually identical to the "free" rate in late 1986. The resulting dramatic rise in inflation prompted the first "pacto" (the Pacto de Solidariedad Economica or PSD) program in late 1987. After initially freezing the peso for most of 1988, policy makers instituted a controlled slow crawl in 1989. Inflation fell dramatically, but not as much as the rate of devaluation causing a gradual appreciation peso (see figure 1).

In principle, real and nominal exchange rate movements reflect different phenomena. The real exchange rate (defined here as the relative price of traded versus non-traded goods) is only partially under the control of policy makers. The government can set the nominal exchange rate but generally cannot

control domestic prices. With flexible prices and well functioning financial markets, real exchange rate changes take place through both the nominal exchange rate and the price level. Movements in the real exchange rate should reflect "real" economic phenomena such as higher levels of domestic investment, productivity growth, terms of trade trends, etc. Since these "fundamentals" usually change gradually, real exchange rates should move slowly as well.

In Mexico real exchange rate *appreciations* are consistent with this textbook description, but peso *depreciations* are not. The problem with the peso is evident in figure 2 which plots Mexico's real exchange rate *vis a vis* the U.S. dollar over the last thirty years. Note that peso appreciations are slow and smooth. Depreciations, on the other hand, generally begin with an excessive fall or "overshooting" of the nominal rate. Inflation eventually restores the real exchange rate toward its new equilibrium level. This pattern of slow peso appreciation followed by an abrupt collapse has been repeated four times in the post-World War II period.

This type of sharp depreciations are simply not observed in the United States and Canada. Figure 3 compares the Mexico-U.S. exchange rate with that of Canada. Note that while Canada's recent appreciation has been even greater than Mexico's, its depreciations tend to be much smoother and less predictable. Moreover, the Canadian real rate exhibits little mean reversion. As discussed in the appendix, this large random walk component in Canada's real exchange rate implies that an appreciation will not necessarily be reversed. The real peso rate, in contrast, displays strong mean reversion

over a three or four year cycle.<sup>6</sup> The presence of a large transient component means that real peso appreciations send a different signal to financial markets and investors. Unlike the Canadian dollar or the U.S. dollar, a rise in the peso is likely to be reversed within three to four years. This pattern accentuates investment cycles and cuts short expansions as investors begin to shift out of peso denominated assets toward the end of the peso cycle.

The underlying source of peso fluctuations is a combination of policy mistakes and external shocks [McLeod and Sheehey 1991]. Managing exchange rates in a small open economy with a high degree of capital mobility is inherently a difficult task. Mexico's dollarization and capital flight problems remained latent as long as the peso-dollar rate was fixed and the country's investment booms were synchronized with those of the U.S. (see figures 4 and 6). After the oil boom and the 1982 collapse of peso, however, exchange rate volatility caused by capital flight and currency substitution became a primary focus of stabilization policy.

At the risk of over simplification, the evidence presented in McLeod and Welch (1991) and the appendix suggests that the portfolio shift toward Mexico, i.e. increases in investment in Mexico not matched by investment expansion in the U.S., are associated with peso appreciations while capital flight and the weak link between domestic and international prices cause large peso depreciations. Policy makers thus face a dilemma. An obvious way to avoid destabilizing depreciations is to prevent peso appreciations. If

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<sup>6</sup>This kind of mean reversion has been interpreted as an indicator of overshooting [Huizinga 1987] and as a test of the purchasing power parity hypothesis. As the discussion in the appendix indicates, the "overshooting" interpretation is more applicable in the Mexican case.

appreciations are associated with real capital inflows and investment booms, however, keeping the peso undervalued may discourage investment. In principle, real depreciations stimulate investment in the tradables sector, but this effect is not strong in Mexico. McLeod and Sheehey (1989) find that the drop in Mexican private investment during the 1980s was correlated with peso devaluations while public investment fell in response to higher external interest rates and external debt service.

The contractionary effect of devaluation on investment and manufacturing output is probably due to the severity of peso depreciations and to the fact that, after years of import substitution, the scope for easy switching from imports to domestic substitutes is limited.<sup>7</sup> Manufacturing exports have grown rapidly but still represent a relatively small fraction of GDP. The first problem can be reduced with better exchange rate policy, while the second will diminish with trade liberalization and export expansion.

The link between peso appreciation and investment booms also has important implications for the choice of exchange rate regime. As Obstfeld (1985) emphasizes, one of the principle advantages of a fixed rate regime is to discipline the monetary authorities (overly rapid growth of domestic money quickly leads to a loss of reserves). If exchange rate movements reflect mainly stop and go monetary policies, then a switch to fixed rates could help

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<sup>7</sup>The contractionary effects of devaluation and exchange rate instability also are documented by Faini and de Melo (1990). Devaluation discourages investment by raising the price of imported investment goods and intermediate inputs [Buffie 1986 and Branson 1986]. Cardoso (1991), however, finds no association between investment and real exchange rate once other factors such as external debt and terms of trade shocks are taken into account, suggesting that causality may run from these factors to investment via the real exchange rate. However, whether investment causes or is caused by the peso appreciation is irrelevant if preventing a real appreciation discourages investment (this applies *a fortiori* to temporary appreciations).

stabilize real exchange rates. If, on the other hand, exchange rate movements reflect real shocks, monetary discipline alone will not eliminate the need for real exchange rate changes or some other means of external adjustment.

Is Mexico in the midst of another real exchange rate cycle? Figure 2 suggests a 15% overvaluation as of March 1991. However, the actual erosion of export competitiveness is smaller because of the fall in real wages during the 1980s. As figure 5 indicates, real unit labor costs in Mexico relative to the U.S. are still at 1970 levels. Another possibility is that the long term relationship captured in figure 2 has changed so that no depreciation will be necessary. Productivity enhancing investment and a NAFTA shift in export demand warrant a permanent rise in the real exchange rate.

This investment boom has yet to materialize, however. Overall investment is still low by historical standards. The northeast quadrant of figure 6 shows the historical pattern of appreciation and investment. An export-led boom would occur in the southeast quadrant,<sup>8</sup> while the collapse of investment during the debt crisis took Mexico into the southwestern quadrant. To date, the current investment boom remains in the northwest quadrant, that is the same level of appreciation is now associated with a lower investment share of GDP.

The current private sector investment boom undoubtedly will be more productive and export oriented than past booms. It will have to be *much* more productive, though, to sustain a permanent peso appreciation (recall that the 1981 boom for all its excesses did result in a considerable expansion of

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<sup>8</sup>The presence of 1982 in this quadrant is misleading because most of the peso depreciation took place in the last four months of the year (after investment spending commitments had been made). Also Mexico's investment share was high only compared to the exceptionally low U.S. 1982 share.

export revenues from oil and petrochemicals). As the productivity adjusted exchange rates of figure 7 illustrate, Korean and Japanese style export booms involve productivity and export growth rates much higher than those achieved by Mexico during the past few years or, for that matter, during previous expansions.

The performance of the traded goods sector is encouraging but not extraordinary. Although manufacturing exports have grown rapidly since 1984, they have managed to just replace the oil export revenues lost to lower prices (see figure 8). Real export revenues have not increased since 1981. Imports, on the other hand, have grown substantially leading to a steady deterioration in the current account despite lower debt service payments under Mexico's "Brady Plan" debt accord. Even as the signing of NAFTA is negotiated, growth in export production by border industries has slowed considerably (due partly to the recession in the U.S.) as shown in figure 9.

Thus, while room for optimism exists, no compelling evidence has yet surfaced to indicate that the current appreciation of the peso will not be partially reversed at some future date. The question is, of course, how this depreciation will take place and how disruptive it will be. The answer to this question depends on how well financial markets allocate new investment funds and on what sort of exchange is in place. We now turn to these issues.

### III. Financial vs. Real Investment: Lessons from Spain and Chile

Financial markets in Mexico and throughout Latin America have been called upon to intermediate large capital inflows during the 1970s and then net outflows of capital during the 1980s. Transfers in both directions have led to stabilization problems, with capital outflows being of course the most

problematic [Welch 1990]. The transition from resource absorbing to resource transferring was particularly difficult for Mexico. The 1982 debt moratorium led to a decade of stagnate incomes, inflation, and capital flight [McLeod and Sheehey 1989 or Dornbusch 1990]. The recent resumption of capital inflows and private investment growth is encouraging and most are confident that Mexico's newly liberalized financial markets will allocate these new funds effectively [Skiles 1991].

Still, past investment booms fueled by capital inflows have turned out to be mixed blessings. In fact, large capital inflows during stabilization *cum* liberalization programs like the PECE often lead to a currency overvaluation that eventually undermines the entire program. Such problems were the main lessons of the so-called Southern Cone experiments in Argentina, Chile and Uruguay during the 1970s. Because of the similar degree of trade and financial liberalization, Chile's program in the late 1970s and early 1980s is probably closest to Mexico's. Chile also paid close attention to getting "the fundamentals" right, including balancing the government budget as has Mexico.

Mexico's program began with a large devaluation in 1987. The outgoing de la Madrid government instituted a stabilization policy combining heterodox incomes policies (the Pacto de Solidariedad Economica (PSD)) with a severe fiscal adjustment and a frozen nominal exchange rate. Salinas de Gortari renewed the program as the Pacto para Estabilización e Crecimiento Economico (PECE) adding a strong tax reform and a peso a day devaluation *vis-a-vis* the U.S. dollar (reduced to half a peso per day in 1990 as shown in figure 1).

Mexico's program contains many unique elements, but also is similar to a stabilization strategy widely used in Latin America. This so-called



"expectations management" approach attempts to manipulate inflation expectations by slowing the preannounced rate of devaluation (ultimately to zero).<sup>9</sup> While exchange rates dampen inflation fears, trade liberalization disciplines domestic price setters with import competition (purchasing power parity). Concurrently, liberalization of financial markets keeps domestic interest rates at international levels (uncovered interest rate parity). If prices are flexible and purchasing power parity holds, inflation soon converges to "world" rates while real interest rates remain at world levels and smooth reserve movements take care of any balance of payments problems. The "consistency" of the policy is secured by eliminating the primal source of inflation, monetized public sector budget deficits, through spending cuts, tax reform, etc..

More often than not, however, these programs work for two, three, or even four years, but then end in failure.<sup>10</sup> The most common problem is that domestic price inertia causes the economy to "overshoot" its long term real exchange rate leading to mounting current account deficits. To restore external balance, inflation must fall below international rates for a time [Dornbusch 1982]. The outcome of the program then becomes a race between the slow decline of inflation and interest rates with a potentially rapid depletion of the Central Bank's foreign exchange reserves. If the fall in inflation takes "too long", the local currency comes under speculative attack

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<sup>9</sup>Rodriguez (1979) and Fernandez (1985) succinctly summarize the theoretical underpinnings of this type of stabilization policy. The strategy follows from the monetary approach to the balance of payments and in particular its assumptions of purchasing power and interest rate parity.

<sup>10</sup>Successive failures usually lead to shorter periods over which exchange rate based stabilizations are successful. For example, the 1989 "Bunge y Borne" Plan imposed in Argentina in 1989 last only six months from July to December [Welch 1991].

and the program collapses, perhaps taking much of the domestic financial system with as in Chile and Argentina.

Failure, however, is not inevitable. Two significant exceptions to this pattern are Israel's inflation stabilization starting in the 1985 program and Spain's 1986 trade liberalization program. Fortunately, Mexico's stabilization incorporates some key features of these longer lived and more successful stabilization efforts. Israel made extensive use of incomes policies [Bruno 1989, Bruno and Piterman 1988, Cukierman 1988, and Pessach and Razin 1991] as implementation of full *ex post* wage indexation is considered a key flaw in the Chilean plan [Dornbusch 1982]. Similarly, the PSD and PECE placed great emphasis on coordinating wage and price increases.

Spain's long investment boom is related to its entrance into the EEC. Capital flows into Spain have helped finance this investment boom, leading to an appreciation of the peseta. Mexico's liberalization effort and the possible signing of the NAFTA are having similar effects. Like Spain and Israel, Mexico undertook its program with the support of international financial institutions willing to supply reserves at crucial points in the program (Spain joined the EMS while Mexico and Israel received outside support from the U.S. and International Monetary Fund).

Although Mexico now looks more like Israel and Spain, there are still some disturbing parallels to the Chilean case. Chile's trade and financial liberalization also led to large capital inflows, mainly in the form of foreign borrowing, which stopped abruptly in 1982. A significant part of Mexico's capital inflow, on the other hand, is returning "flight capital." Whether flight capital financed investment booms reduce or increase the vulnerability of the domestic financial system, however, remains to be seen.

Like Chile, Mexico is in the midst of a *financial boom*. The value of stocks traded in Mexican stock market has grown by more than 70% in 1991. Following Bernanke (1983) and Dixit (1989), respectively, Dornbusch (1991) and Tornell (1990) describe a two stage investment cycle observed in many Latin American countries. Uncertainty about future events (e.g. debt and trade negotiations, elections, etc.) makes the option to "wait and see" most attractive. In spite of the existence of a positive return to repatriation of financial capital and taking a position in existing assets, investors stop short of undertaking real irreversible investment. Clearly, Mexico is now in this first stage. Despite rapid growth of investment during the past year, investment spending has yet to reach the level of previous booms (see figure 4). One encouraging sign is the recent fall in real interest rates with a flat to negatively sloped yield curve, something that failed to materialize in Chile [Arellano 1984].

The Salinas administration clearly hopes that the signing of the NAFTA will propel the boom into the second "real investment" stage. A recent editorial appearing in Centro de Análisis e Investigación Económica (1991) highlights the similarities between Mexico and Chile during the 1970s when "the inflow of credits precipitated an increase in spending which included non-traded goods (for example an increase in construction), increasing the price level of these goods and leading to a real exchange rate appreciation. This process, nevertheless, was not sustainable because of a lack of policy consistency." They go on to argue, however, that the source of this macroeconomic inconsistency was microeconomic. That is, "the process of privatization consisted of the subsidized resale of public enterprises with financial problems to their prior owners and with interlocking equity with

other corporations in financial difficulty." Exactly how an inefficient privatization process translates into macroeconomic collapse is not spelled out, but the Salinas government is clearly aware of the problems Chile encountered.<sup>11</sup> The careful ownership regulation in the current bank privatizations reflect the Mexican government's concerns with financial stability.

Although Mexico has avoided (so far) many of the pitfalls of earlier Southern Cone programs, it remains vulnerable in some areas. The high level of internal and external public sector indebtedness, for example, increases the peso vulnerability to adverse shocks.<sup>12</sup> While the official government accounts actually show a financial surplus for early 1991, future adverse shocks to government revenues (e.g. a fall in oil prices) may still create the need for future internal borrowing. The government has set up a special "petroleum" reserve fund of roughly \$2 billion for just this eventuality. When this fund is exhausted, however, further internal borrowing could raise internal real interest rates (perhaps to leading more capital inflows) or raise the prospect of current or future money financed deficits. Such an eventuality would quickly bring the exchange rate regime under speculative pressures. Though the Banco de Mexico's foreign exchange reserves are high by historical standards (five months of imports or roughly U.S.\$14 billion), the

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<sup>11</sup>According to this editorial, Chile's program collapsed because "In directing many of the foreign loans to the reprivatized firms and dedicating resources to refinance non-performing loans, the government saw that needed to reverse the process of privatization, renationalizing many firms and absorbing their foreign loans" [CAIE 1991: 17, translation by the authors]. This story is similar to Diaz Alejandro's (1986) who winds up arguing against simultaneous financial and trade liberalization.

<sup>12</sup>The retirement of public debt by selling public assets or further "privatization" may decrease this vulnerability as has occurred in Chile since 1985.

potential for capital flight strictly limits the Bank's ability to defend the peso with reserves. A similar stock of reserves vanished during the foreign exchange crisis of 1988 and during the 1982 crisis \$10 billion fled the country in the matter of months.

The CAIE (1991) editorial cited earlier goes on to compare Mexico's recent experience to the more "positive" Spanish one. Spain has been running large current account deficits with an appreciating peseta since 1986. These capital inflows have sustained a prolonged investment boom. Harberger (1991) finds that Spain is close to emulating the Japanese experience of having a continually appreciating exchange rate and increasing per capita GDP. However, as Pérez-Campanero (1989 and 1990) points out, questions of fiscal adjustment and devaluation still plague Spain (even though Spain does not have a large internal debt like Mexico). The recent decline in tourism and the manufactures has led to speculation about the viability of the current peseta exchange rate. However, concerted intervention in June 1990 successfully averted a widely anticipated speculative attack on the peseta.

Why has Spain's experience been so "positive" compared to the Chilean case? The main reason cited by CAIE is the EEC. Hopefully, the NAFTA will have analogous results for Mexico. A complete evaluation of the Spanish case, however, must be suspended for a few years or at least until the current boom unwinds. Another overlooked aspect of Spain's success is its recent entry into the EMS. The credibility imparted by EMS membership is clearly recognized by Pérez-Campanero (1989) who observes, "The logic of greater credibility of anti-inflation policy within the EMS is - leaving aside the weight of political considerations - one of the strongest arguments justifying the Spanish decision to belong to the system" [Pérez Campanero 1989: 12].

#### IV. The Advantages of a Target Zone for the Mexican Peso

With its strong record of economic reform, the Salinas administration has a unique opportunity to permanently change Mexico's foreign exchange regime. Unfortunately, the literature on optimal currency areas does not provide much guidance in this context. The fact that Mexican priorities diverge from the traditional analyses which concentrate on monetary autonomy and unemployment partially explains this irrelevance. Mundell's (1961) link between optimal currency areas and factor mobility may be of more concern to the U.S. than to Mexico with its priority of restricting labor mobility. The cyclical employment consequences of a fixed exchange rate regime do not seem to be of large concern in Mexico at the moment. The Mexican government's main priorities still remain inflation and capital inflows with external adjustment a distant third consideration.

Fixing the exchange rate would help reduce inflation and encourage capital inflows, at least for a while. Expected inflation falls because the Banco de Mexico effectively adopts U.S. monetary growth targets. A fixed peso rate also encourages capital repatriation as long as no negative "news" fuels expectations of devaluation. The major flaw in a fixed exchange rate system, however, is that these benefits may be temporary. An adverse shock (or the peso's appreciation itself) can lead to devaluation rumors and the resulting capital flight can make these expectations self-fulfilling.

A crawling peg, on the other hand, allows more scope for quick adjustment to adverse shocks but at the cost of price stability. A growing consensus views a crawling peg targeting the real exchange rate as inflationary [Aghevli *et al*, 1991]. The dual rate system - a pegged commercial exchange rate combined with a floating financial exchange rate -

used from 1982 to 1987 did not perform as well as expected [Kaminsky 1990].

Mexico's continued use of the exchange rate as the economy's nominal anchor in its anti-inflation program limits the exchange regime choices available to the government. Given a choice between greater exchange rate flexibility and price stability, the Salinas administration understandably seems willing to sacrifice flexibility to maintain stability. This tradeoff, however, may not be as hard and fast as it seems.

The preliminary theoretical and empirical evidence on exchange rate target zones, although not definitive, is encouraging in this regard. The members of the European Monetary System (EMS) and the participants of the Louvre Accord have been able to maintain low or reduced inflation rates while still allowing some real and nominal exchange rate flexibility. Here we review some advantages of a target zone for the peso, for Mexico, and for the region as a whole.

Exchange rate target zones were first proposed in the late 1970s and early 1980s as a reaction to the initial rocky start for the floating rate system. These proposals combined with the formation of the EMS in 1979 were initially greeted with much skepticism and were widely regarded as a thinly disguised and vain attempt to return to fixed exchange rates. Contrary to initial prognoses, the EMS did not collapse and has actually achieved some of its original objectives. Both the levels and dispersion of inflation rates of member countries fell [Fратиanni and Von Hagen 1990]. Although interpretations of the evidence vary, this exchange rate stability was achieved at the cost of some additional real exchange rate fluctuation *vis-à-vis* currencies outside the system.

Most importantly, the EMS achieved price stability without a complete

freezing of or major misalignment of nominal exchange rates. The informal evidence suggests target zones can combine the price stabilizing effects of a fixed exchange rate with the real exchange rate flexibility of a floating regime. In fact, exchange rates may behave differently under a target zone than under fixed or floating rate regimes.

In a seminal paper, Krugman (1988) demonstrates why this might be the case. Rational speculators learn to anticipate Central Bank intervention or monetary policy shifts designed to defend the band. A credible band promotes this type of "friendly speculation" forming a "reflecting barrier" that sends the exchange rate back inside the band, even with little or no actual intervention by the monetary authority. With the monetary authority committed to intervene at the margin, or at the band's edge, exchange rate movements within the band are smoother than under a free float and can move away from fundamentals for periods of time without intervention.<sup>13</sup>

Flood and Garber (1989) argue that a speculative attack on a fixed exchange rate is analogous to a monetary authority defending a one-sided target zone. Krugman and Rotemberg (1990) develop a model of target zones that focuses on stabilizing the nominal exchange rate with limited reserves. The speculative attack thus becomes endogenous with its timing a function of the level of (remaining) reserves. They also show that a stable (S-shaped) exchange rate-fundamental path can be generated at some critical level of

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<sup>13</sup>Flood and Garber (1989) extend the model to a monetary rule which involves discrete intramarginal intervention, i.e. inside the band. The exchange rate path is the same with this type of intervention rule. On the other hand, when these policies are combined with the possibility of realignment rules, the exchange rate may be more unstable when the ability to intervene is not credible as in Bertola and Caballero (1990). The former case represents one with stabilizing speculation whereas the latter case represents one of destabilizing speculation.



reserves, i.e. the target zone becomes fully credible. Klein (1990) provides the explicit link to the price level and the real exchange rate. He shows that a credible target zone smooths not only the behavior of the exchange rate within the band but the behavior of the price level and the real exchange rate as well.

Empirical tests to date of this predicted exchange rate behavior yield mixed results (as have all theories of exchange rate determination). The behavior of exchange rates in a target zone have two testable implications: a) observed exchange rate variability should be confined to the middle of the target zone and b) the observed distribution of exchange rates should be bimodal with the highest densities being located at the edge of the band. Testing these non-linear relationships requires a choice of the relevant fundamentals. Flood, Rose, and Mathieson (1990) choose a set of explicit fundamentals and estimate the Krugman (1988) model directly. They discern little of the stabilizing non-linear exchange rate behavior posited in this work on target zones.

Others find this approach problematic and have concentrated on explaining exchange rate movements based upon implied fundamentals. Bertola and Caballero (1990) extend the framework to include realignment risk. Their findings are consistent with the qualitative evidence from a subset of EMS countries (Germany France, And Italy), but use only simple correlations of exchange rates and interest rates. Bertola and Svensson (1990) show that devaluation risk - with respect to both size and timing - may explain the poor fit in the prior attempts.

Stronger support for the target zone models comes from Rose and Svensson (1991) and Dominguez and Kenen (1991). Rose and Svensson (1991) use the model

of Bertola and Svensson (1990) combined with a time varying devaluation risk to show significant mean reversion of the French Franc/German Deutsche Mark nominal exchange rate within the band. This mean reversion may reflect the tendency for "friendly speculation" in a credible band. Dominguez and Kenen (1991) argue that the difficulties in identifying target zone dynamics are due to intramarginal intervention kept the exchange near the center of the zone until 1987. After 1987, financing of intramarginal intervention was curtailed and exchange rates behaved in a decidedly different way.

Mexico's history of speculative attack on the peso underscores the importance of foreign reserves (or the lack thereof) in determining the credibility of target zones (and fixed rates). A target zone negotiated as part of a North American Currency Agreement would greatly enhance the peso's credibility. A negotiated target zone for the peso would likely outperform a unilateral defense under any exchange rate regime. An explicitly cooperative agreement would also be more effective at voluntarily "tying the hands" of the monetary authorities. The main drawback for Mexico is that it would concede some control over its exchange rate policy.

The peso market created by a target zone would also encourage the development of market institutions necessary to support a full float of the peso at some future date. An unannounced "soft edged" band could put Mexico's flight capital to good use as speculators attempt to discover the limits of the band thereby helping the government slowly shift the target zone up or down. Finally, the strong link between exchange rate movements and inflation expectations means that a successful target zone would allow the exchange rate to continue in its price stabilizing role (assuming of course Mexico keeps its fundamentals in line). In fact the exchange rate continued

to play a stabilizing role in the Israel even after a target band was instituted in 1989 [Pessach and Razin (1991)].

With the nominal peso rate moving up and down within the band, peso fluctuations would become more routine. As long as the band was credible, small nominal depreciations of the peso would not be interpreted as signs of imminent collapse. Domestic prices would therefore become less sensitive to the exchange rate, allowing the peso to be gradually extracted from its role as nominal anchor for the price system (under a more stable exchange rate regime presumably money could reassume that role). Resolving the peso's future would also remove a significant source of uncertainty, encouraging more real as opposed to financial investment in Mexico.

A cooperative agreement with the U.S. and Canada regarding reserves and swap agreements would also enhance the credibility of PECE program and its successors. In fact the initial effect of a new monetary accord is likely to be a further appreciation of the peso, hopefully due to a new round of capital inflows and investment. The Spanish peseta further appreciated after Spain joined the EMS. Of course, the real test of both the EMS and its North American counterpart will be orchestrating a "soft landing" for the peso and the peseta.

The U.S. and Canada also have an interest in a formal currency agreement. A strong and stable peso would prolong Mexico's currently high demand for imported investment and intermediate goods. The U.S. in particular has seen its machinery and equipment exports to Mexico surge in recent months. The likely strengthening of the peso against the U.S. and Canadian dollars would raise relative Mexican wage rates thus easing the transition to freer trade for labor intensive industries in the U.S. and Canada (such as textiles

and electronics assembly).<sup>14</sup> Finally, forming a dollar area simply acknowledges and formalizes the monetary interdependence that already exists in the region, with the U.S. dollar as the hub of the monetary wheel. In return for the benefits just enumerated, Mexico would concede some control over what will become the key relative price of the NAFTA era, the peso-dollar exchange rate.

#### IV Concluding Remarks

The performance of North American foreign exchange rate markets will greatly influence trade and capital flows in North America, with or without a free trade area. Though not yet a subject of negotiation, exchange rate issues may soon take on some urgency as both the Canadian dollar and the Mexican peso are appreciating against the U.S. dollar. We have argued that in Mexico at least, the appreciation is a positive development reflecting capital inflows and an incipient real investment boom. Unlike the Canadian dollar appreciation, however, the peso's ascent causes concern if only because of its past history of abrupt collapse. The threat of renewed inflation and a balance of payments crisis leads Harberger (1991) to call for controls on capital inflows.<sup>15</sup> Tornell (1990) advocates a "Tobin tax" on foreign currency transactions to throw "sand in the wheels" of short term capital flows and encourage more "real" as opposed to financial investment in Latin

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<sup>14</sup>This process may also benefit Mexico. Following the peso's steep depreciation in the 1980s, various industries including steel, cement and textiles pressed for and won retaliatory trade actions against Mexican export products [Gruben 1991]. A negotiated band would make the argument that a competitive peso reflects some sort of export subsidy.

<sup>15</sup>Specifically, Harberger (1991) proposes an auction market for "dollar repatriation rights."

America.

Policies to slow and smooth capital flows may have some merit over the longer term, but they counterproductive right now. After ten years of zero per capita growth, the present investment boom and repatriation of flight capital are long overdue. Any measure which dampens the boom by rationing imports would probably reduce the portfolio shift toward Mexico rather than merely smooth it. A better strategy would accommodate the present appreciation of the peso while preparing for real depreciation. One way to do this is to implement a credible change in exchange rate regime, as Spain and Israel have done. A cooperative target zone system may best serve this objective.

## Appendix: Error Correction, Cointegration, and the Real Exchange Rate

This section describes the methodology used by McLeod and Welch (1991) in analyzing the behavior of Mexican, Canadian, and U.S. exchange rates. The interaction of exchange rates and price levels between countries is best analyzed by looking at the properties of the *cointegrating* vector as developed in Engle and Granger (1987).<sup>16</sup>

Cointegration means that (non-stationary) time series variables tend to move together such that a linear combination of them is stationary. Some have interpreted cointegration as representing a long run equilibrium relationship. Cointegration also has implications for the statistical analysis of these series. Further, differencing  $X_t$   $d$  times to generate a stationary time series and then estimating a VAR based upon the differenced series is inappropriate in the presence of cointegration. Granger (1981) develops what has come to be known as the Granger representation theorem: If the  $(N \times 1)$  vector time series  $X_t$  is first difference stationary, i.e.  $I(1)$ , and cointegrated, i.e.  $b=1$ , there exists an error correction form

$$\Delta X_t = A_1 \Delta X_{t-1} + \dots + A_{k-1} \Delta X_{t-k+1} + \Pi X_{t-1} + \varepsilon_t \quad (1)$$

where  $\Pi = \alpha\beta'$ ,  $\alpha = [\alpha_p, \alpha_e, \alpha_{p*}]$  is the error correction coefficient (or speed of adjustment) and  $\beta'$  is the cointegrating vector.

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<sup>16</sup>The definition of Cointegration: suppose an  $(N \times 1)$  vector time series  $X_t$  is integrated of order  $d$ , i.e. is stationary after differencing  $d$  times, or  $I(d)$ . The vector  $X_t$  is said to be cointegrated of order  $(d,b)$  or  $CI(d,b)$  if there exists a vector  $\beta$  such that  $Z_t = \beta'X_t$  is integrated of order  $(d-b)$  [Granger and Engle 1987: 252].

An important point of this theorem is that the VAR form should incorporate the long run equilibrium relationship between the levels. A VAR based purely upon differences would exclude this relevant information in addition to displaying infinite variance.

In general, there can exist (N-1) independent cointegrating vectors. A weakness in the Engle and Granger (1987) approach is that it offered no clear criterion for choosing the number of cointegrating vectors. Johansen and Juselius (1990) take a general maximum likelihood approach to choosing the number of independent cointegrating vectors, estimating  $\Pi$ ,  $\alpha$ ,  $\beta'$ , and testing restrictions on  $\alpha$  and  $\beta$ . Their technique is based upon the following general version of equation (1).<sup>17</sup>

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \mu + \varepsilon_t \quad (2)$$

The analysis of real exchange rates looks at the behavior of  $\beta' = [1, -1, -1]$  of the vector time series  $X_t = [p_t, e_t, p_t^*]$  with  $p$  equaling the natural logarithm of the domestic price level,  $e$  equaling the natural logarithm of the nominal exchange rate, and  $p^*$  equaling the natural logarithm of the foreign price level. The relationship  $\beta'X_t$ , therefore, just equals the natural logarithm of the inverse of the Mexican and Canadian real exchange rates *vis-à-vis* the U.S. A rise in  $\beta'X_t$  represents a real appreciation while a fall represents a real depreciation.

The U.S. price level is measured by the Producer Price Index, the Mexican price level is measured by the Consumer Price Index, and the nominal

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<sup>17</sup>The  $\Pi$  matrix is the same in equation (1) and equation (2). It can be shown that the level variable can take on any lag from 1 to  $k$  without affecting  $\Pi$ . The coefficients on the lagged differenced variables, of course, change.

Mexican price level is measured by the Consumer Price Index, and the nominal exchange rates are bilateral exchange rates. The measurement of the real exchange rate captures the now widely accepted definition which views the real exchange rate as the ratio of traded to non-traded goods [Edwards 1989]. One might object to the use of purely bilateral exchange rates as opposed to trade weighted exchange rates. Such an argument is mitigated somewhat by the fact that trade with the U.S. comprises roughly 70% of Mexican trade. Using trade weighted exchange rates will be left to further research.

The maximum likelihood estimates appear in tables A1 through A4. Each country has only one cointegrating vector according to tables A1 and A3. Tests in table A2 show that  $[1, -1, -1]$  is a cointegrating vector for Mexico but not for Canada. Further, the only  $\alpha$  which is significantly different from zero in the Mexican VAR is the one corresponding to the nominal exchange rate which means real exchange rate adjustment in the long run occurs by adjustments in the nominal exchange rate. Hence, commodity price arbitrage is weak in Mexico. Notice also that all the  $\alpha$ 's in the Canadian case are significantly different from zero except for the one corresponding to the nominal exchange rate. This suggests that prices in the U.S. and Canada are not sensitive to exchange rate fluctuations.<sup>18</sup>

The cointegration results suggest that the real exchange rate is stationary in Mexico while non-stationary in Canada. A way to gauge the size of the random walk in the real exchange rate is to employ Cochrane's (1988) technique of calculating the variance ratio statistics.<sup>19</sup> If the random walk

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<sup>18</sup>The results echo those suggested by Krugman (1989) in that exchange rates are the "dogs that didn't bark."

<sup>19</sup>A nice review of techniques looking for trends and random walks appears in Balke (1991) and Stock and Watson (1988).



component is large, the variance ratio will stay near 1 or rise above it. On the other hand, if the series tends to revert to a trend and the random walk component is small, the variance ratios should settle down below 1. Clearly, as illustrated in figures A1 through A3, the random walk component in Canadian real exchange rates is large while small in Mexican real exchange rates.<sup>20</sup> In fact, one sees significant reversion to mean in the Mexican real exchange rate after approximately three years.

Figure 2  
The Log of the Inverse of the Mexican Real Exchange Rate  
(Relative to the U.S. Dollar)



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<sup>20</sup>The results for the U.S.-Canada exchange rate are in agreement with prior work by Huizinga (1987).

Figure 1

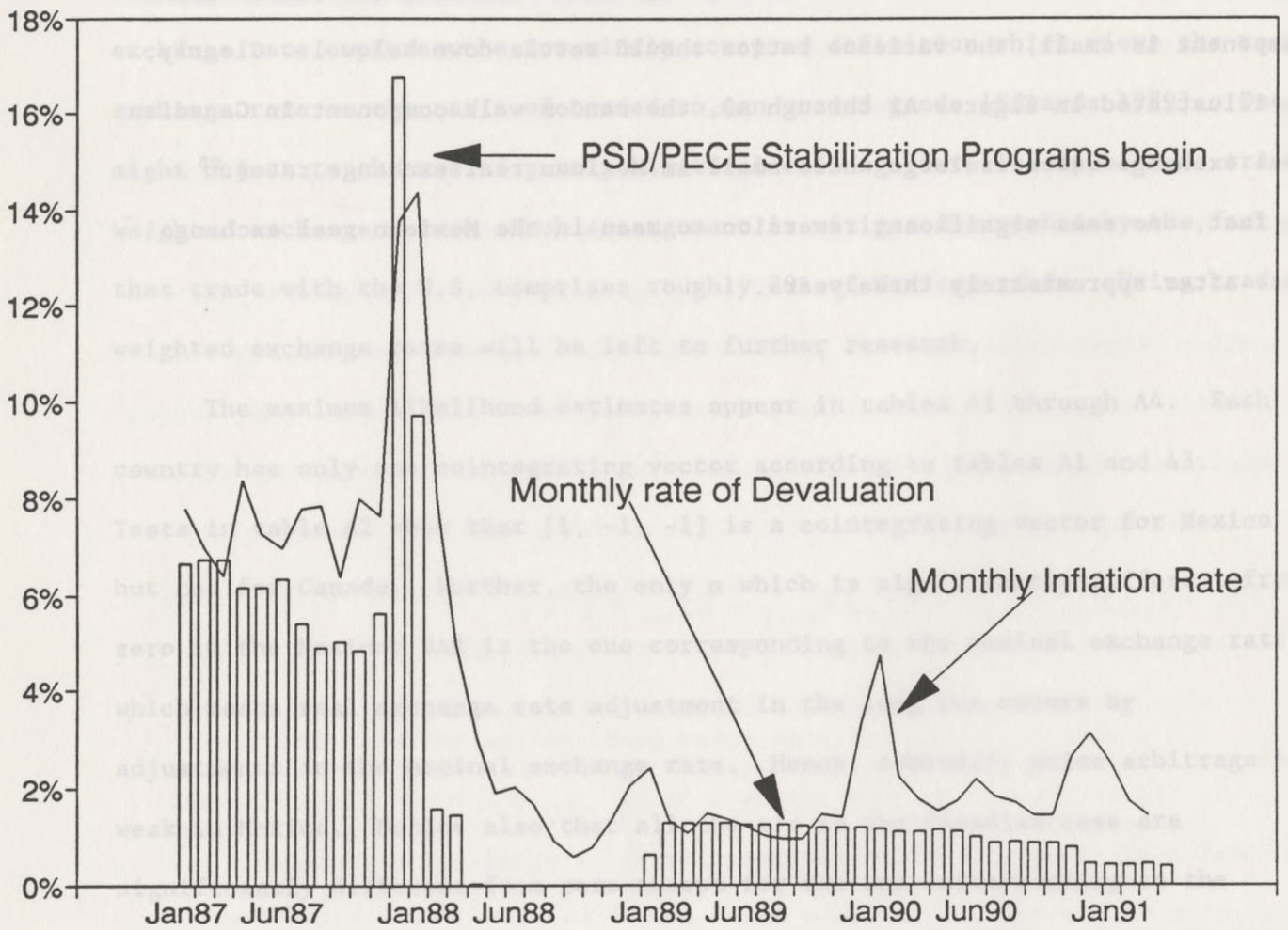


Figure 1  
Real Exchange Rate and Investment

Mexico's investment share of GDP  
relative that of the U.S.  
left axis.

Figure 2  
The Log of the Inverse of the Mexican Real Exchange Rate  
(Cointegrating Residuals)

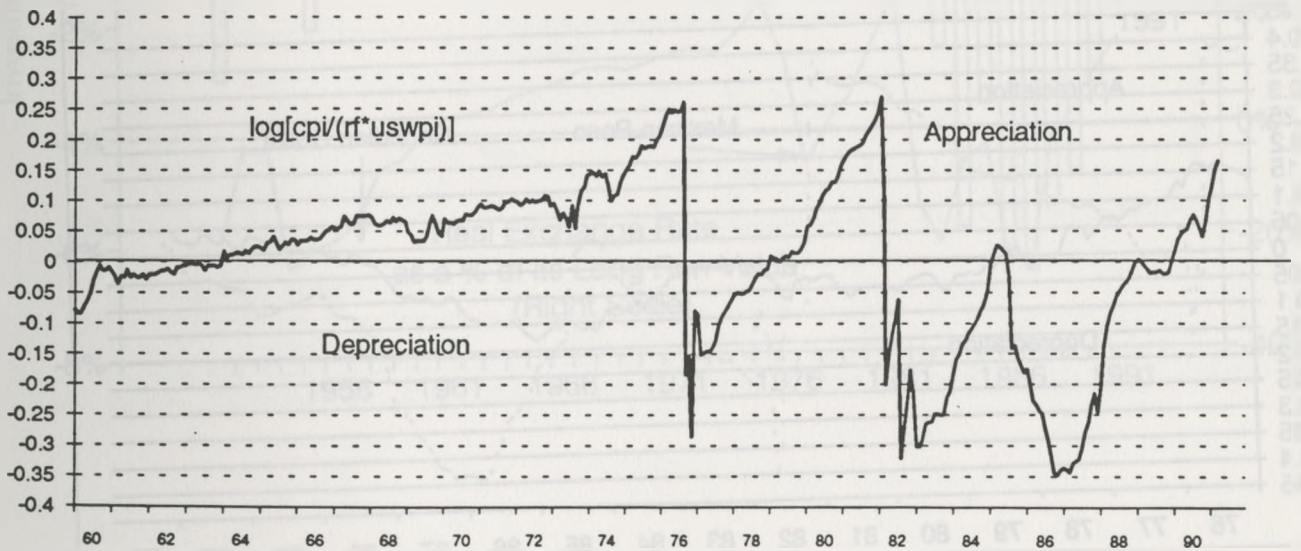


Figure 1

← PROPECE Stabilization Program begins

**Figure 3**  
**Real Value of Mexican Peso and Canadian Dollar**  
**Relative to U.S. Dollar**

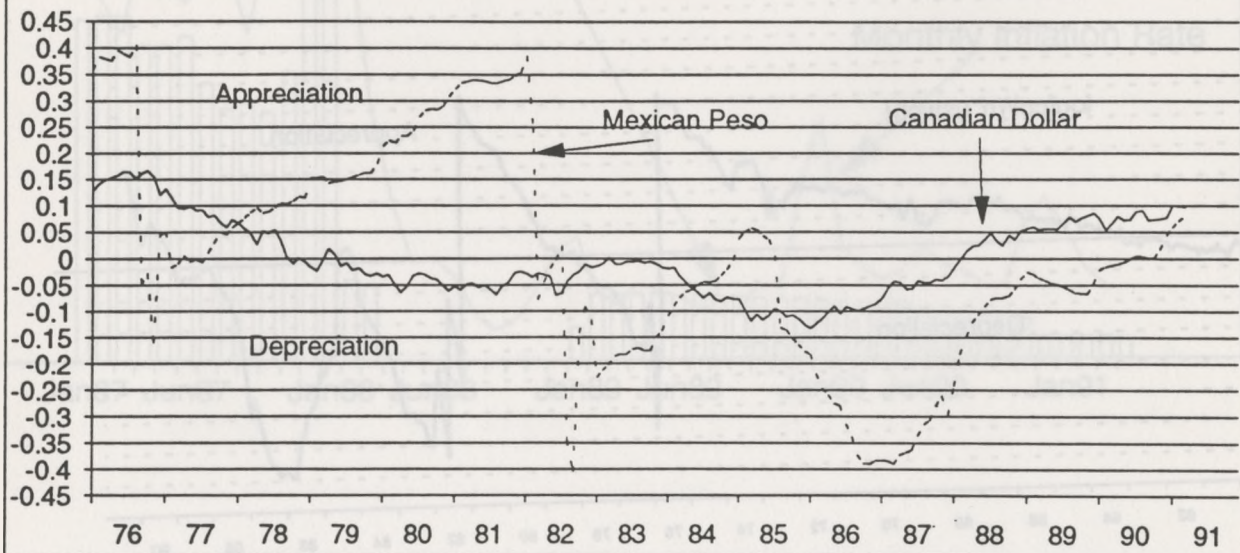


Figure 4

Real Exchange Rates and Investment

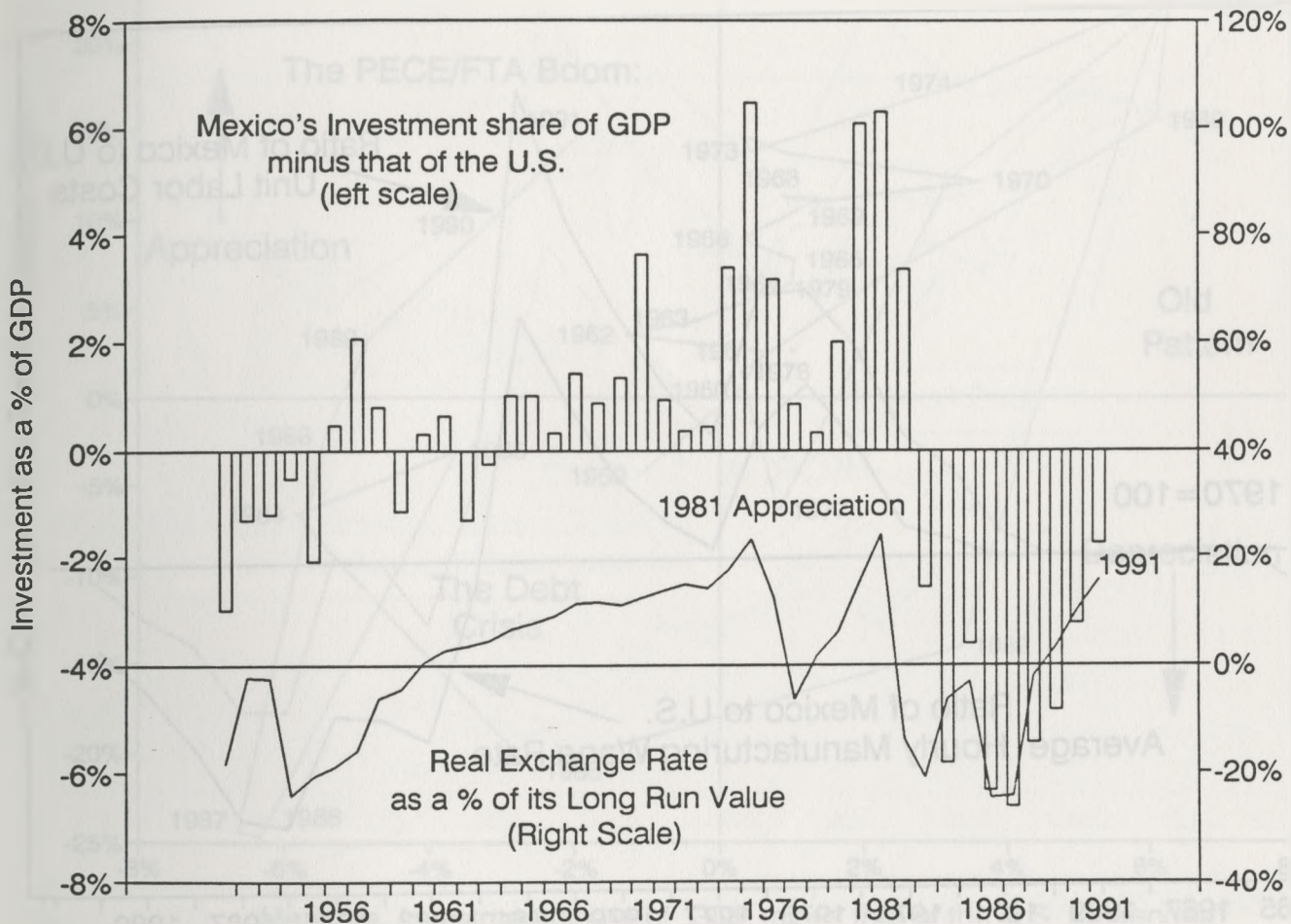


Figure 5

Relative Dollar Wage Rates  
and Unit Labor Costs in Manufacturing

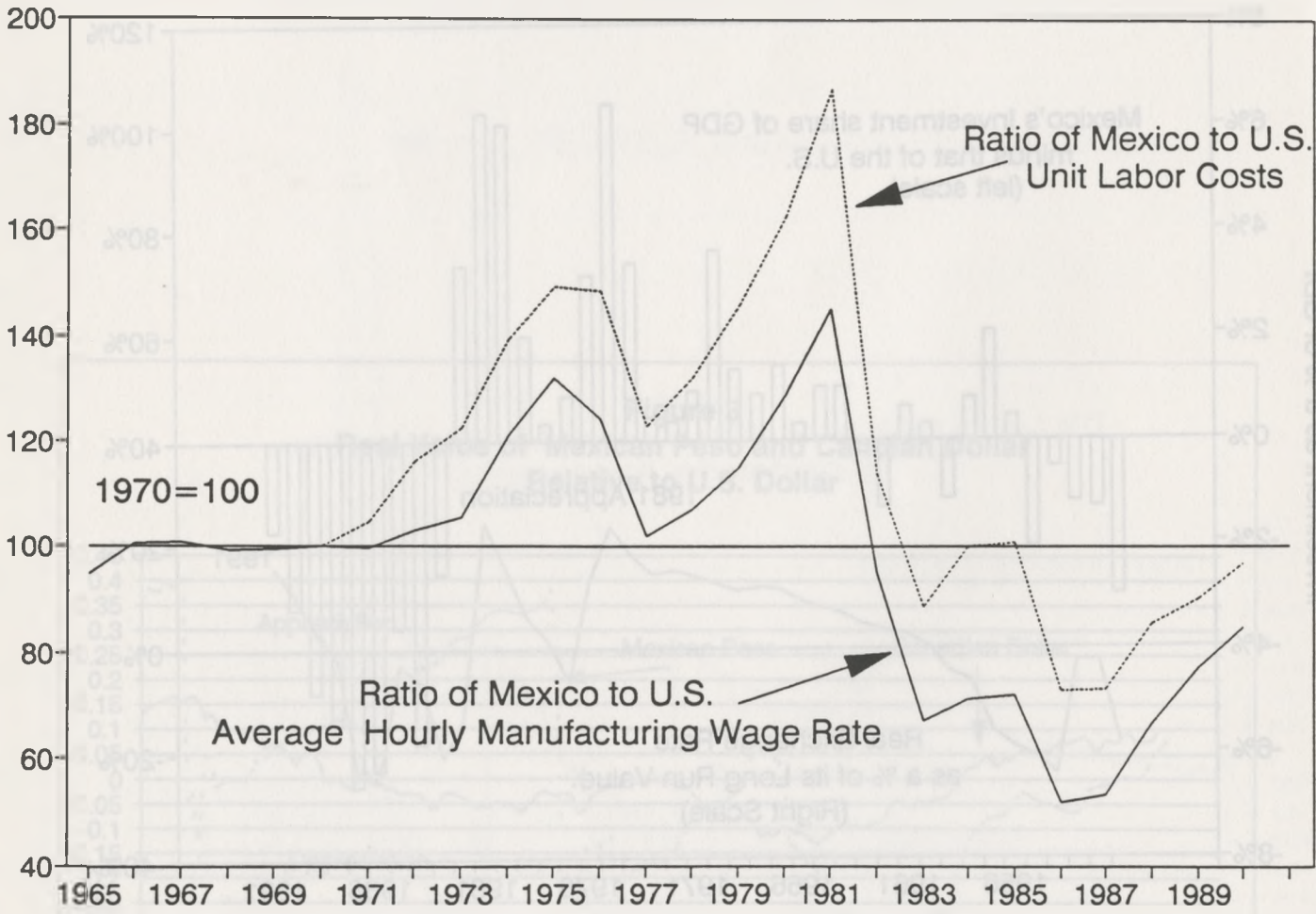


Figure 6

Exchange Rate Changes and Investment

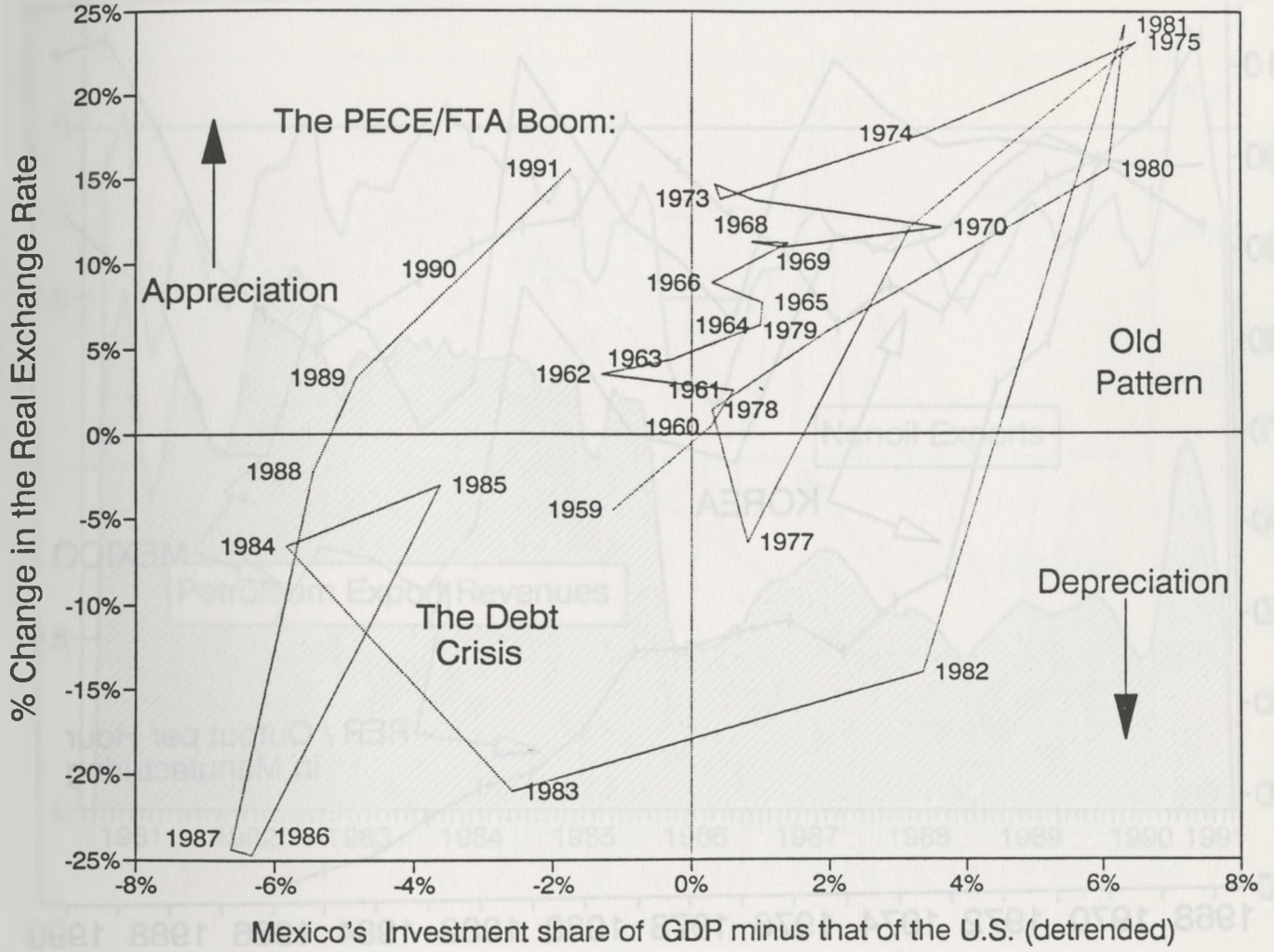


Figure 7

Productivity Adjusted Real Exchange Rates

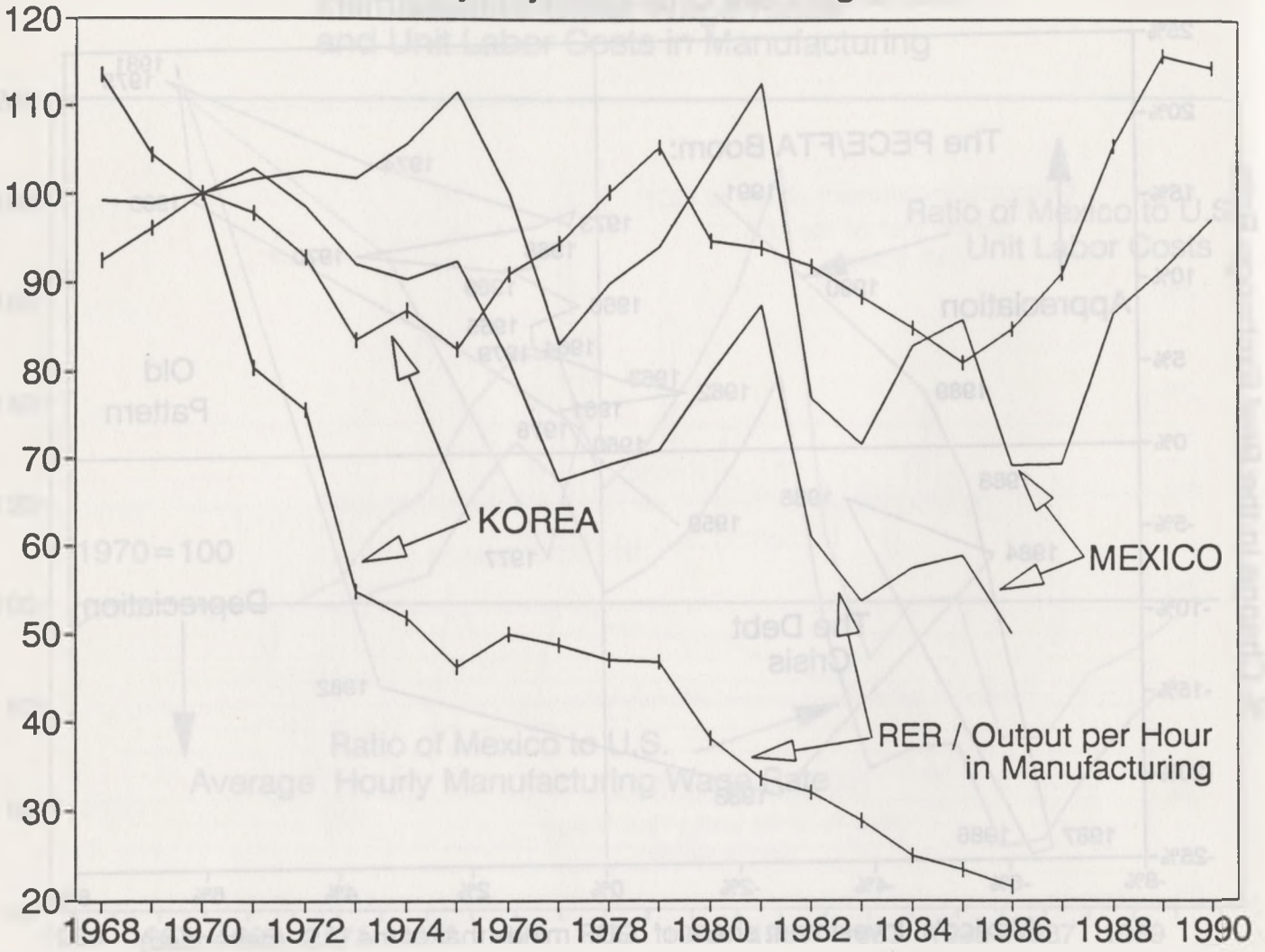
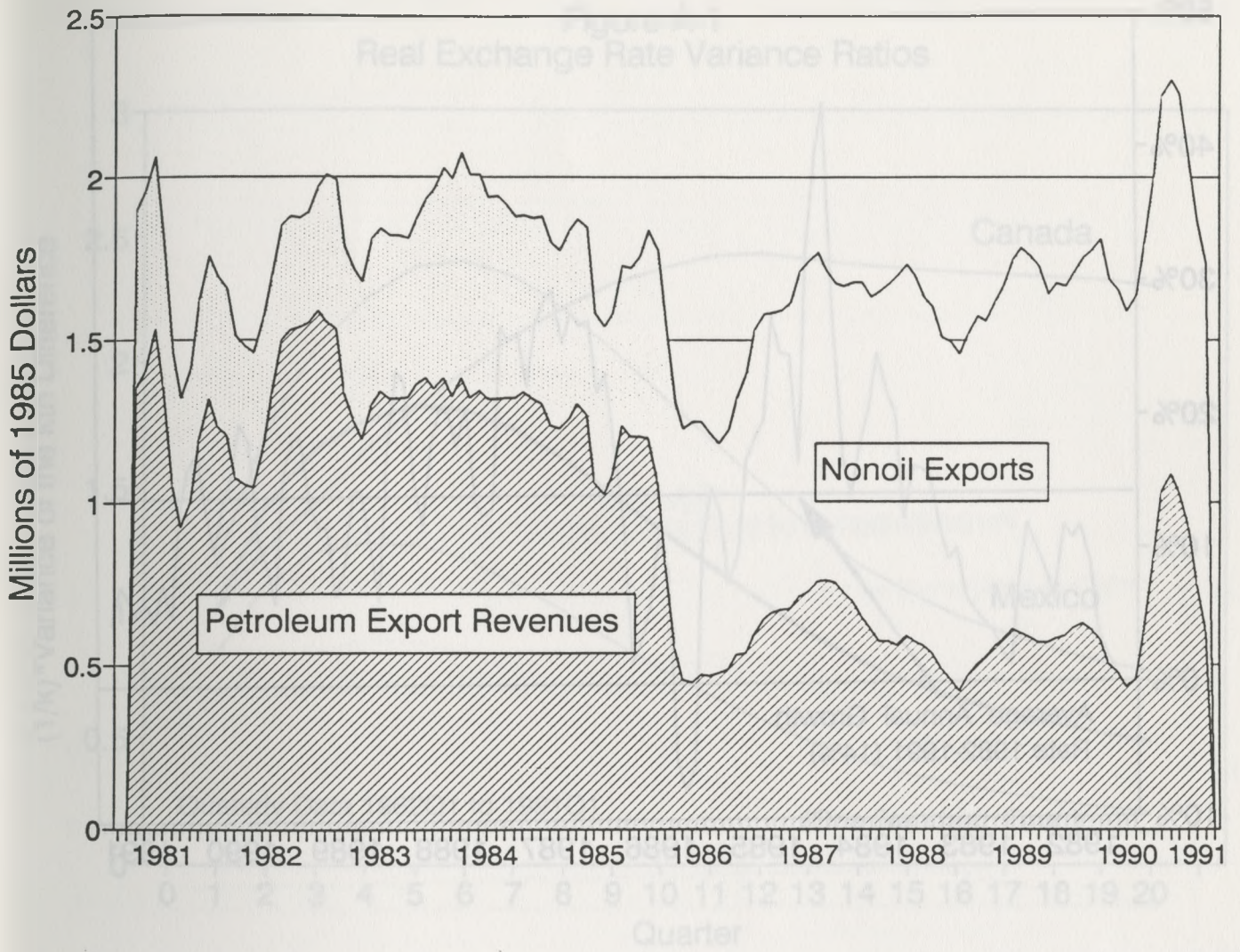




Figure 8  
Real Monthly Export Revenues (\$1985)



# Growth of Maquila Manufacturing Exports (seasonally adjusted)

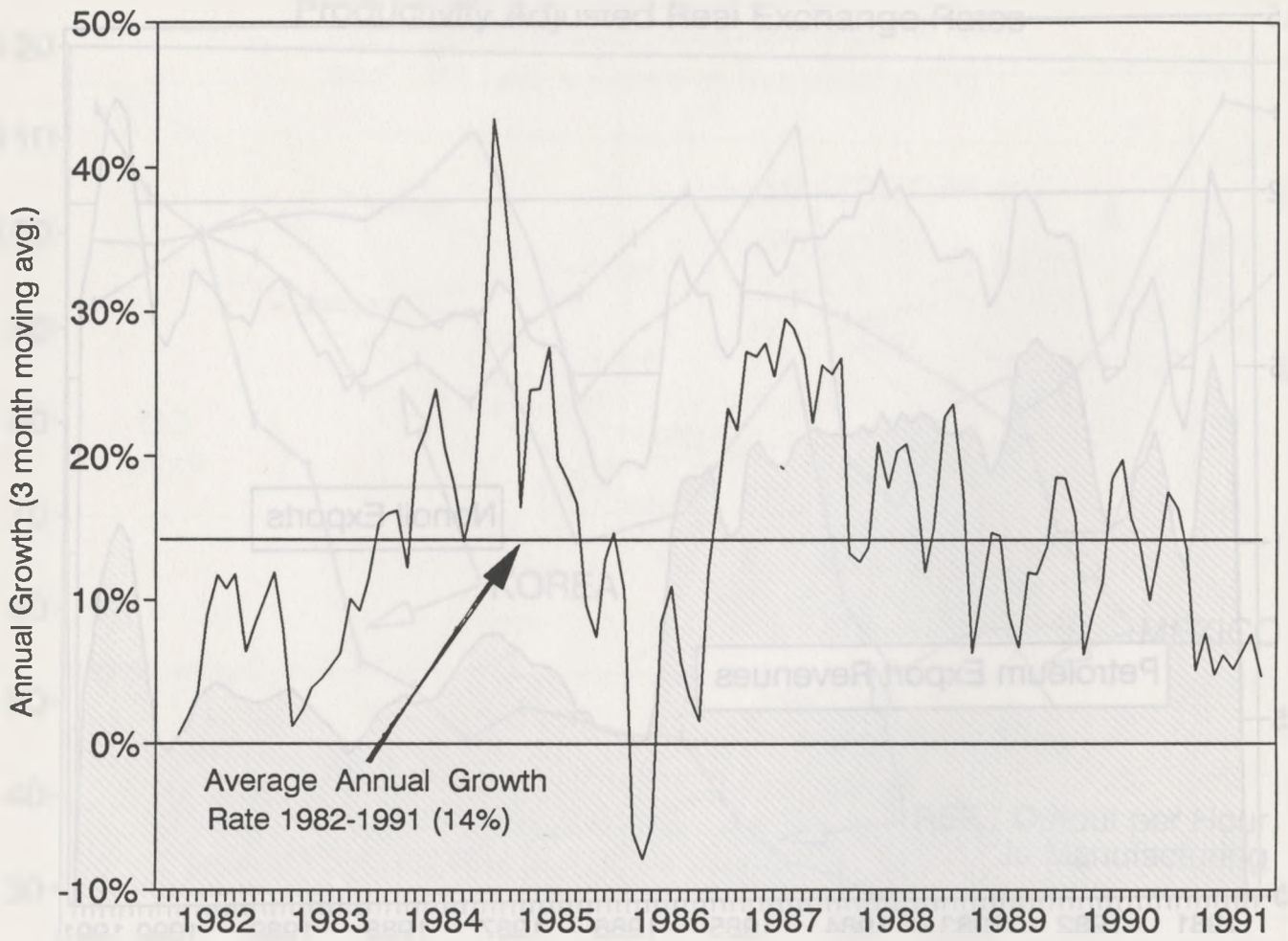


Figure A-1  
Real Exchange Rate Variance Ratios

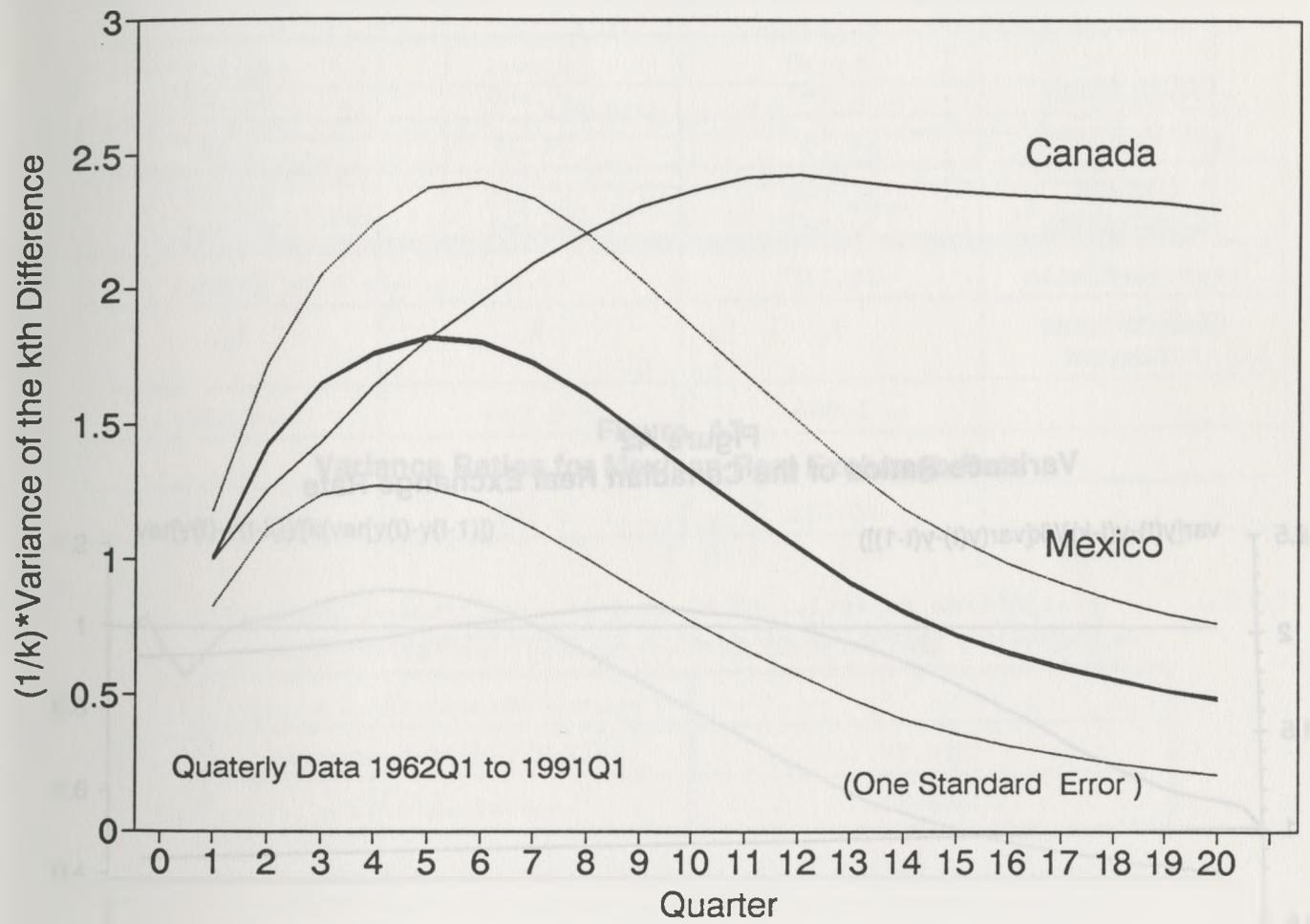
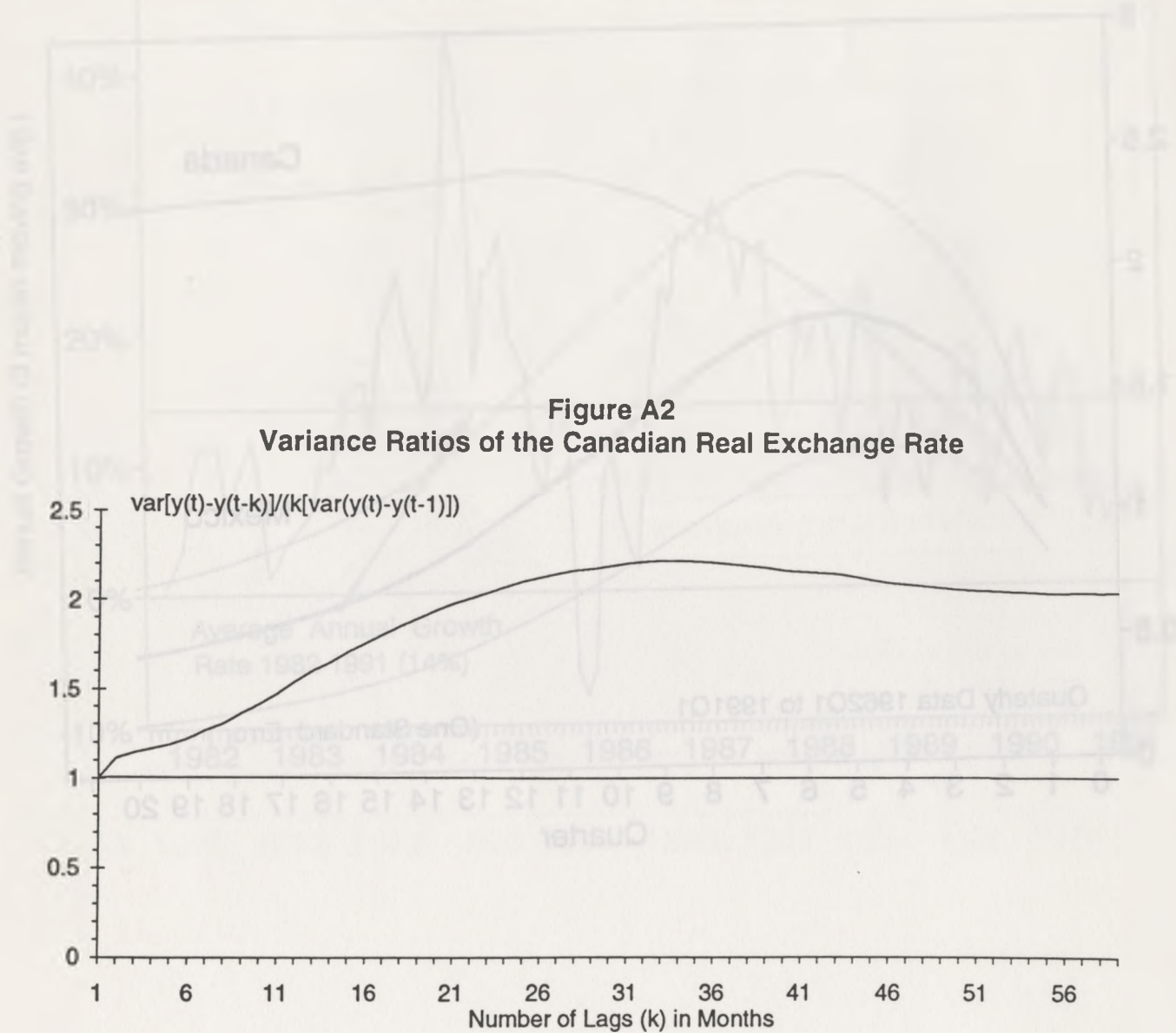
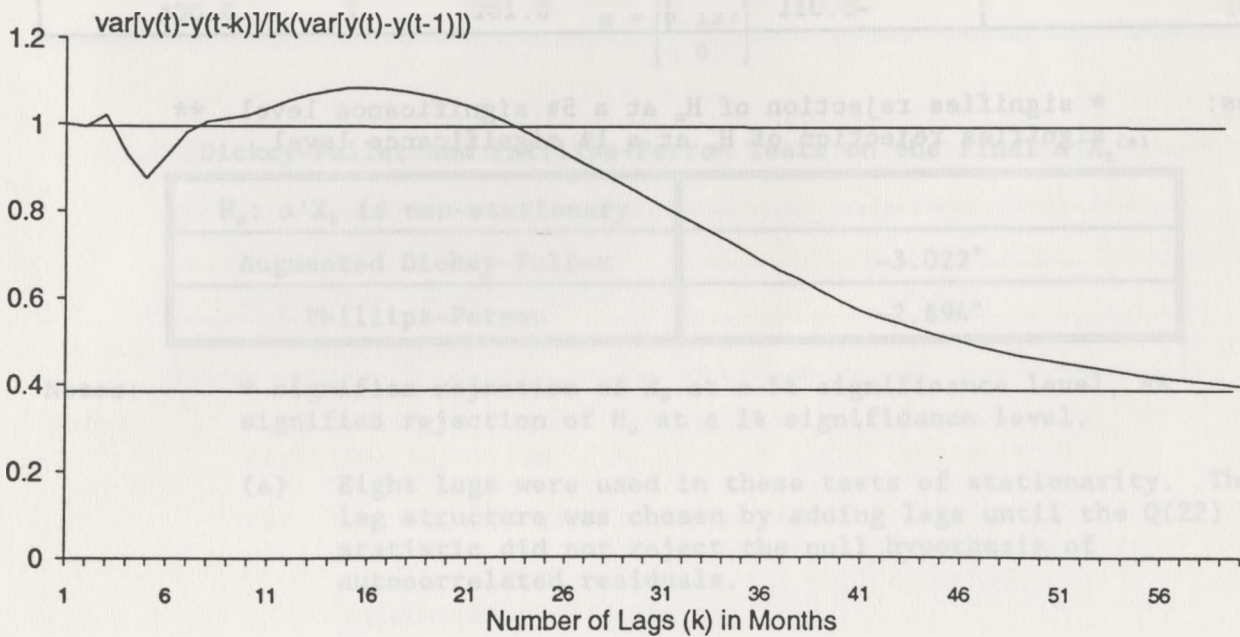


Figure A-1  
Real Exchange Rate Variance Ratios



**Figure A3**  
**Variance Ratios for Mexican Real Exchange Rate**



$H_0: \alpha'X_t$ is non-stationary	
Augmented Dickey-Fuller	-3.022*
Phillips-Perron	-2.894*

(a) Eight lags were used in these tests of stationarity. The lag structure was chosen by adding lags until the Q(22) statistic did not reject the null hypothesis of

Table A1

Mexico: Tests for number ( $r$ ) of Cointegrating Vectors for  $X_t = [p_t, e_t, p_t^*]'$ 

TRACE TESTS	$H_0: r=0$ $H_1: r=3$	$H_0: r=1$ $H_1: r=3$	$H_0: r=2$ $H_1: r=3$
test statistic	48.75**	14.22	1.42
MAXIMUM EIGENVALUE	$H_0: r=0$ $H_1: r=1$	$H_0: r=1$ $H_1: r=2$	$H_0: r=2$ $H_1: r=3$
test statistic	34.53**	12.80	1.42
UNRESTRICTED ESTIMATES	$\beta_p$	$\beta_e$	$\beta_{p^*}$
	1.000	-1.024	-0.985
	$\alpha_p$	$\alpha_e$	$\alpha_{p^*}$
	-0.011	0.102	0.004

Notes: \* signifies rejection of  $H_0$  at a 5% significance level, \*\* signifies rejection of  $H_0$  at a 1% significance level.

Table A2  
Mexico: Tests on  $\beta'$  and  $\alpha$

$H_0: \beta_p=1, \beta_e=-1, \beta_{p^*}=-1$	$H_0: \beta_p=0$	$H_0: \beta_e=0$	$H_0: \beta_{p^*}=0$
$\chi^2_{(2)}=3.78$	$\chi^2_{(1)}=18.97^{**}$	$\chi^2_{(1)}=19.88^{**}$	$\chi^2_{(1)}=13.36^{**}$
$H_0: \alpha_p=\alpha_{p^*}=0$	$H_0: \alpha_p=0$	$H_0: \alpha_{p^*}=0$	$H_0: \alpha_{p^*}=0$
$\chi^2_{(4)}=5.996$	$\chi^2_{(1)}=1.67$	$\chi^2_{(1)}=12.51^{***}$	$\chi^2_{(1)}=0.96$

Final Values of  $\beta$  and  $\alpha$ :

$$\beta = \begin{bmatrix} 1 \\ -1 \\ -1 \end{bmatrix} \quad (A1)$$

$$\alpha = \begin{bmatrix} 0 \\ 0.127 \\ 0 \end{bmatrix} \quad (A2)$$

Dickey-Fuller and Phillips-Perron Tests on the Final  $\alpha'X_t^{(a)}$

$H_0: \alpha'X_t$ is non-stationary	
Augmented Dickey-Fuller	-3.022*
Phillips-Perron	-2.894*

Notes: \* signifies rejection of  $H_0$  at a 5% significance level, \*\* signifies rejection of  $H_0$  at a 1% significance level.

(a) Eight lags were used in these tests of stationarity. The lag structure was chosen by adding lags until the Q(22) statistic did not reject the null hypothesis of autocorrelated residuals.

Table A3

Canada: Tests for number (r) of Cointegrating Vectors for  $X_t = [p_t, e_t, p^*_t]'$

TRACE TESTS	$H_0: r=0$ $H_1: r=3$	$H_0: r=1$ $H_1: r=3$	$H_0: r=2$ $H_1: r=3$
test statistic	34.13**	9.065	1.47
MAXIMUM EIGENVALUE	$H_0: r=0$ $H_1: r=1$	$H_0: r=1$ $H_1: r=2$	$H_0: r=2$ $H_1: r=3$
test statistic	25.07**	7.60	1.47
UNRESTRICTED ESTIMATES	$\beta_p$	$\beta_e$	$\beta_{p^*}$
	1.000	0.546	-1.293
	$\alpha_p$	$\alpha_e$	$\alpha_{p^*}$
	-0.008	-0.026	0.000

Notes: \* signifies rejection of  $H_0$  at a 5% significance level, \*\* signifies rejection of  $H_0$  at a 1% significance level.



Table A4

Canada: Tests on  $\beta'$  and  $\alpha$

$H_0: \beta_p=1, \beta_{p^*}=-1$	$H_0: \beta_p=0$	$H_0: \beta_e=0$	$H_0: \beta_{p^*}=0$
$\chi^2_{(1)}=17.44^{**}$	$\chi^2_{(1)}=11.83^{**}$	$\chi^2_{(1)}=3.025$	$\chi^2_{(1)}=14.86^{**}$
$H_0: \alpha_p=\alpha_{p^*}=0$	$H_0: \alpha_p=0$	$H_0: \alpha_e=0$	$H_0: \alpha_{p^*}=0$
$\chi^2_{(4)}=8.341^*$	$\chi^2_{(1)}=8.34^{**}$	$\chi^2_{(1)}=12.13^{**}$	$\chi^2_{(1)}=0.007$

Final Values of  $\beta$  and  $\alpha$ :

$$\beta = \begin{bmatrix} 1 \\ 0 \\ -1.19 \end{bmatrix} \quad (A3)$$

$$\alpha = \begin{bmatrix} -0.009 \\ -0.027 \\ 0.005 \end{bmatrix} \quad (A4)$$

Dickey-Fuller and Phillips-Perron Tests on the Real Exchange Rate<sup>(a)</sup>

$H_0: \alpha'X_t$ is non-stationary	
Augmented Dickey-Fuller	-0.828
Phillips-Perron	-0.700

Notes: \* signifies rejection of  $H_0$  at a 5% significance level, \*\* signifies rejection of  $H_0$  at a 1% significance level.

(a) One lag was used in these tests of stationarity. The lag structure was chosen by adding lags until the Q(22) statistic did not reject the null hypothesis of autocorrelated residuals.

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