STABILIZATION, CREDIBILITY AND REGIME DEPENDENT REAL EXCHANGE RATES

Peter A. Prazmowski
School of Economics, Kingston University

Abstract

This paper studies a dynamic error correction model (ECM) highlighting the consequences of regime changes and of credibility on the performance of real exchange rates during stabilization. The analysis shows that the structural parameters of the ECM, from which an equilibrium real exchange rate is calculated, will be subject to structural breaks reflecting regime and credibility changes. Empirical evidence is presented on the Mexican 1988 and 1995 stabilization episodes.

JEL Classification: E31; F31

Keyword(s): equilibrium real exchanges rates, inflation stabilization, credibility, regime changes, ECM, Mexico.

1. Introduction

One of the most relevant aspects of stabilization is the appreciation of real exchange rates. This behavior is common among different nominal anchors, especially exchange rate based and money based stabilization. This stylized fact, which is well documented in Calvo and Végh (1999), and more recently in Fisher et al. (2002), has inspired a literature under two broad approaches. The first, focuses on a framework that assumes the real exchange rate starts out at its steady state level prior to stabilization and that several aspects of the program cause a subsequent appreciation. The second shows that as a consequence of internal and external misalignments, the real exchange starts out off equilibrium and converges to its steady state after stabilization policies are implemented.

Within the former framework, however, there has been two potential explanations. One understands that various aspects of stabilization lead to higher aggregate demand, raising nontradable prices and causing a real appreciation of the exchange rate. Calvo and Végh (1993) argue that if stabilization is not credible, consumers will increase spending while conditions remain stable. Uribe (1995) and Roldos (1995) view inflation as a tax that, when reduced through stabilization, will boost investment and consumption. Rebelo and Végh (1994) highlight that fiscal reforms associated with stabilization programs reduce the need for distortionary financing, increasing permanent income, leading to higher consumption. Finally, Erceg and Levin (1996) argue that structural reforms found in most stabilization programs, cause a higher desired for capital stock, leading to increases in output.

The second explanation holds that during stabilization, inflation is slow to decline to international levels due to overlapping contracts, imperfect credibility, and backward looking expectations that under nominal exchange rate stability or a fixed nominal exchange rate anchor, leads to an appreciation of the real exchange rate. Rodríguez (1982) models nontradable inflation as depending on excess demand for nontradable and upon expected inflation, which is assumed to adjust sluggishly to changes in actual inflation. In Dornbusch and Werner (1994) inflation depends on wage growth, which is determined by expected inflation and proxied by lagged inflation. In this two cases, the slow adjustment of prices under a fixed nominal exchange rate causes a real appreciation of the exchange rate. In Edwards (1994) wage growth depends on the credibility of the stabilization program. If the program is less than fully credible and under a nominal exchange rate anchor, nontradable inflation resulting from wage inertia leads to a real appreciation of the exchange rate.

In the later framework, however, balance-of-payments misalignments and a highly devalued nominal exchange rate prior to stabilization cause the real exchange rate to be depreciated relative to its equilibrium level. In turn, this gap causes inflation in nontradable prices, which under a nominal exchange rate anchor, leads to a real appreciation of the exchange rate.

Notably, this last approach has not been well explored in the literature. Kamin (2001) proposes a partial adjustment mechanism, and tests the model using a dynamic specification and Mexican data. He finds that inflation in Mexico is well explained by an error-correction model (ECM) linking the real exchange rate to detrended absorption.

Under this framework, an equilibrium exchange rate is estimated and compared to the observed real exchange rate during the 1988 Mexican stabilization program. The results show that inflation continues until a balance is reached between the real exchange rate and its equilibrium level, and allow a clear understanding of the potential real exchange rate gap that must be corrected before inflation fully stabilizes. One advantage of this approach is the successful blend of both equilibrium and inertial theories in an ADL-ECM format that reconciles the contribution of each explanation to the appreciation of the real exchange rate after stabilization. One limitation, however, is the lack of a theoretical framework in developing the partial adjustment ADL-ECM. A rigorous supporting background could provide useful insights in understanding the fundamentals behind the behavior of real exchange rates during stabilization.

This chapter illustrates that such partial adjustment mechanism is broadly consistent with a two-goods, tradables/nontradables, model with an optimizing social planner that switches stabilization preferences to contain inflation. Interestingly, the analysis reveals that by allowing a policy game and a probability of success to stabilization, the structure of the ECM will be subject to structural breaks reflecting changes in stabilization preferences and credibility. The analysis of structural breaks in the cointegration vector is of interest in the empirical literature on stochastic integrated process (see, for example, Gregory and Hansen, 1996; Saikkonen and Liutkepohl, 2000); although, a theoretical framework linking structural breaks and regime shifts is still unclear, at least, within the stabilization literature (Quintos and Phillips, 1993).

The present investigation tackles this gap. Firstly, it provides a framework for understanding the links between structural breaks and regime-credibility changes that are present during stabilization. Secondly, the results have important implications regarding the size of the gap consistent with inflation stability. If changes in stabilization preferences and credibility are large, the gap could disagree substantially from the one ignoring structural breaks. As a consequence, an inadequate treatment of these structural changes could mislead the authorities in the design and management of exchange rate policies.

The model is applied to the Mexican 1988 *Pacto* program and the 1995 ERBS plan introduced after the *Tequila* crisis of 1994. In what remains, section 3 highlights the Mexican reforms and stabilization episodes of 1988 and 1995. Section 2 develops the theoretical framework. Section 4 presents the data and empirical results. Section 5 concludes.

2. Stabilization and structural reforms in Mexico

Before proceeding with the formal modeling strategy and econometric exercise, it is important to highlight some of the salient features of the Mexican ERBS programs of 1988 and 1995. The Mexican *Pacto,* starting in 1988, and the ERBS introduced after the *Tequila* crisis of 1994, shared a number of features. The *Pacto* program led to a drastic opening of the economy, deregulation and privatization of state-owned companies, and a exchange rate based stabilization supported on restrictive fiscal and monetary policies.

The program had three stages. In the first, between February and December of 1988, the nominal exchange rate was fixed, meanwhile nominal wages provided an anchor for inflation.[1] Between January of 1989 and November of 1991, devaluation was preannounced and set below the inflation rate under parity. However, the amount by which the peso devalued was progressively diminished as the anchor consolidated. In November 1991, some flexibility was allowed to the exchange rate under a band with a sliding ceiling and flat floor. The band was kept until October 1994 when NAFTA became a considerable issue, and pressures from political and other internal developments, that ultimately led to the December 1994 crisis, required the introduction of a new stabilization program in 1995.

[1] The *Pacto* was in fact a consensus among the government, the private sector and labor unions which, on an annual basis, provided a forward looking solution to the establishment of prices, wages and exchange rate changes (see, Dornbush and Werner, 1994)

The new stabilization plan of 1995 was an extension of the *Pacto* program, reinforcing many of the reforms already in place (Werner, 1994). In particular, 1995 was also an ERBS with one important difference: The new program did not implement a devaluation band, returning to a fix nominal exchange rate anchor that was later allow to grow under parity as the program consolidated.

A fundamental aspect of these programs and one that has attracted considerable attention in the literature, was the fashion in which wages were set. Both the *Pacto* and the 1995 programs provided a forward looking mechanism in the formation of inflation and wage expectations. The forward looking scheme did not attenuate inertial inflation, however, and caused a significant appreciation of the real exchange rate after the 1988 *Pacto* (see Edwards, 1996), and the 1994 *Tequila* crisis (see Edwards, 1998).

After 1988, the appreciation of the currency led to capital inflows that allowed to finance large and unsustainable current account deficits. In the same fashion, after the 1995 program, foreign capitals returned and the same strategy was followed, until 1998 when a devaluation of the currency cleared some of the accumulated misalignments.

Two important question still remain, however: Was the potential gap between the actual and the equilibrium real exchange rate consistent with the observed macroeconomic performance after both programs were introduced? And if so, was monetary policy and its credibility in part responsible for the difference? Some analysts argue that in the early stages of the Mexican *Pacto*, the currency was well undervalued, providing a comfortable cushion for the real exchange rate to appreciate. The analysis shows that the Mexican peso was undervalued in both the 1988 and 1994 episodes, although the misalignment was larger in 1988. The results also suggest that the 1995 program performed better than the 1988 *Pacto*, in part due to a greater credibility component.

3. The model

This section presents a model that captures many of the salient features of the Mexican 1988 and 1994 programs. In particular, the forward looking mechanism in the formation of wage expectations, as well as the credibility aspect of the programs that was evident when the anchors went under considerable pressure, are important contributions.

This is a small open economy in which the monetary authorities follow a devaluation "real target" rule defined by[2]

$$\Delta s_t = \Delta e_t - \psi \Delta x_{t-1}, \tag{1}$$

[2] The term "real target" is somewhat misleading as it denotes two different types of polices. Some authors refer to it as PPP rule; while others define it as a policy aimed at accommodating changes in real exchange rate fundamentals. This type of regime has being followed historically by many countries, especially in Latin America, and is understood to be one of the fundamental causes of high inflation equilibrium (see, for example, Hamann, 1999).

where s_t is a real exchange rate index, e_t is the nominal “spot” exchange rate, $x_t = p_t - p_t^*$ is the gap between local and foreign prices, Δ is a difference operator and ψ is a parameter that measures the weigh that past inflation differentials have over the real exchange rate.

In addition, the monetary authorities have an imperfect control of the nominal exchange rate by means of an official instrument δ_t, such that

$$\Delta e_t = \delta_t + \varepsilon_t \quad , \tag{2}$$

where $\varepsilon_t \sim N\left(0, \sigma_\varepsilon^2\right)$ is a random term capturing the imperfect “speculative” response of the nominal exchange rate to the policy instrument.

Following a variant of a standard framework, this economy produces tradable and nontradable goods.[3] Tradable prices are related to international prices under the law of one price

$$\Delta p_t^T = \Delta e_t + \Delta p_t^*, \tag{3}$$

While nontradable prices are determined by domestic supply and demand. Demand responds to a measure of excess nontradable pressures and by the real exchange rate; whereas, supply is determined by real wages that are

[3] In particular, we follow a variation of Edwards (1998) model.

measured in terms of nontradable prices. At equilibrium, nontradable inflation is given by[4]

$$\Delta p_t^N = \beta_1 \Delta p_t^T + \beta_1 \Delta e_t + \beta_2 \Delta w_t + \beta_3 A_t \,, \qquad (4)$$

where w_t are nominal wages and A_t is detrended domestic absorption, assumed to follow a random walk process given by

$$A_t = A_{t-1} + \nu_t \,, \qquad (5)$$

where $\nu_t \sim N\left(0, \sigma_\nu^2\right)$ is a demand shock.[5] In (4), the β parameters, derived from the equilibrium condition in the nontradable market, are given by $\beta_1 = d_1/(d_1 + s_1)$, $\beta_2 = s_1/(d_1 + s_1)$ and $\beta_3 = -d_2/(d_1 + s_1)$, where $d_1 < 0$ is the price demand elasticity of nontradable, $d_2 > 0$ is the expenditure elasticity demand for nontradable, and $s_1 < 0$ is the real product price supply elasticity of nontradable.

---

[4] The equilibrium condition is defined by

$$D\left(p^T / p^N,\ A\right) = S\left(W / p^N\right),$$

where the parameters in (4) are a combination of the supply and demand eslasticities after differentiation. Note that in principle, equality should not strictly hold, as the difference can be satisfied through trade.

[5] In Edwards (1992), excess demand pressures are approximated by changes in domestic credit, whereas in Edwards (1996) by detrended real M2. In this setup, and following Kamin (2001), excess demand pressures are approximated by detrended industrial production.

Nominal wages are defined as a weighted average of past inflation differentials and the “surprise” changes in the official instrument δ_t. Specifically,

$$w_t = \mu\left[E_{t-1}\delta_t - \delta_t\right] + (1-\mu)\Delta x_{t-1}. \tag{6}$$

In (6), which is one of the fresh contributions of the paper, E_{t-1} is an expectations operator conditional on the information set and μ is the weight placed on forward looking expectations. If $\mu = 1$, wages are set according to the expected changes in monetary policy, whereas if $\mu = 0$, they are determined according backward looking inflation expectations.

From equations (3)-(6), aggregate inflation, which is an average of tradable and nontradable inflations, is given by

$$\Delta x_t = \left[E_{t-1}\delta_t - \delta_t\right] + \Delta e_t + A_{t-1} + \nu_t, \tag{7}$$

where, for simplicity and without loss of generality, all coefficients were normalized to unity.

Notice that expectations remain explicit in (7) as there exists a policy game with a sequence of events in which expectations are followed by a speculative shock and then by a policy response with the use of the imperfect instrument. In reaction to the shock, the monetary authorities try to adjust the nominal exchange rate in an effort to minimize an objective loss function *à la* Edwards (1998).

$$E_{t-1}L_t = E_{t-1}\left[x_t^{\ 2} + \lambda\left(s_t - s_t^*\right)^2\right], \tag{8}$$

where λ measures the preferences between inflation and real exchange rate targets, and s_t^* is an equilibrium real rate.[6]

Finally, and following Kamin (2001), the equilibrium real exchange rate is a decreasing linear function in domestic absorption

$$s_t^* = a - bA_t\ . \tag{9}$$

3.1. Pre-stabilization equilibrium

The problem of the monetary authorities implies minimizing equation (8) with respect to δ_t and subject to equations (1), (2), (7) and (9), taking expectations as given. The first order condition for the optimization problem is given by

$$E_{t-1}\delta_t - (\lambda+1)\delta_t + (1-\lambda b)A_{t-1} - \lambda s_{t-1} + \lambda a + \Delta e_t + (\lambda - \gamma)\psi\Delta x_{t-1} = 0\ . \tag{10}$$

[6] These loss objective functions provide a very convenient framework when analyzing inflation stabilization episodes, as the introduction of a stabilization program implies a change of preferences towards greater inflation control with lower values of λ. In the case of a pure ERBS, $\lambda = 0$.

Substituting the policy rule (2) in (10) and taking expectations gives

$$E_{t-1}\delta_t = \left[\lambda a + (1-\lambda b)A_{t-1} - \lambda s_{t-1} + (\gamma - \lambda)\psi\Delta x_{t-1}\right]\frac{1}{\lambda - 1}. \tag{11}$$

Lastly, substitution of (11) in (10) provides the optimal path for inflation

$$\Delta x_t = \theta\psi\Delta x_{t-1} + \theta\phi\Delta e_t + \theta\left[s_{t-1} - s^*_{t-1}\right] + \upsilon_t , \tag{12}$$

which is expressed in ECM transformation with $\phi = (1-\lambda^2)/(\lambda+1)$, a strength of adjustment coefficient given by $\theta = \lambda/(1-\lambda^2)$, and an equilibrium real exchange rate, derived from the normalized ECM, given by

$$s^*_t = a - (b - \lambda)A_t . \tag{13}$$

Note that all "deep" structural parameters in (12) and (13) depend on the choice of stabilization preference λ. In particular, θ has undefined limits when $\lambda = 1$ and is negative for $\lambda > 1$, which has an important policy implication. Since the condition for stability, under stationarity, requires that $0 \le \theta < 1$, the only rational policy for inflation stability would be

$0 \leq \lambda < \frac{1}{2}[\sqrt{5}-1]$; otherwise, any value above or below these limits would result in an explosive inflation path. It might be possible, however. that because of political and other institutional arrangements, values of λ above the upper limit are chosen, leading to a high inflation equilibria. For example, it could be the case of a monetary authority that "fears floating" (Calvo and Reinhart, 2002) and is more inclined in keeping the exchange rate overly appreciated, leading to a higher inflation equilibria.

In addition, the slope of the equilibrium real exchange rate also depends on λ. This structural dependence, which is set in the inflation process as well as on the ECM, results from agents anticipating the choice of policy preferences in the formation of expectations. Higher preferences towards real exchange rate control will result in a lower equilibrium and, in the case that $b-\lambda<0$, will change the direction in which A_t affects the ECM., switching from a Balassa-Samuelson to a Pigout type effects and vice versa.

3.2. Stabilization under a nominal anchor

A nominal anchor under a stabilization program is understood as a change of preferences to a value of $\lambda = 0$. Consequently, in this particular case, the inflation gap disappears such that $\Delta x_t = 0$, and the implicit equilibrium real exchange rate becomes

$$s_t^* = a - bA_t \,. \qquad (14)$$

with a strength of adjustment given by $\theta = 0$. The fact that $\theta = 0$, implies that the ECM is no longer present in the inflation process as such corrections are not necessary when inflation is fully anchored under a stabilization program.[7] Note the resemblances of equation (14) and (9), implying that under stabilization the equilibrium real exchange rate returns to its fundamentals.

3.3. Credibility

The issue of credibility during stabilization has been well analyzed in the literature (see, Agenor and Taylor, 1992). The conventional way of incorporating credibility in the inflation dynamics is by placing a probability of success to the stabilization program (see Edwards, 1996).[8] In particular, it is assumed that agents assign a value $q \in (0,1)$ to the probability that the program will be maintained, treating it as a credible commitment rule. That is, there is a probability of success such that the authorities will behave in a manner consistent with equation (14), and a probability $(1-q)$ that the pre-

[7] Empirically, if a pure ERBS is successfully introduced, one would observe a non-significant ECM on an inflation equation such as (12).

[8] The analysis on credibility has also been extended to evaluate the determinants of such probabilities, mainly in terms of fiscal and monetary factors (Prazmowski, 2002).

stabilization rule, equation (13), will be maintained. This means that inflation becomes a weighted average of pre and post-program dynamics, such that

$$\Delta x_t = (1-q)\theta\psi\Delta x_{t-1} + (1-q)\theta\phi\Delta e_t + (1-q)\theta\left[s_{t-1} - s_{t-1}^*\right] + \upsilon_t \qquad (15)$$

with an equilibrium real exchange rate given by

$$s_t^* = a - \left[b - (1-q)\lambda\right]A_t , \qquad (16)$$

with a strength of adjustment equal to $(1-q)\theta$.[9]

There are several important conclusions derived from equations (15) and (16). Firstly, both the slope and strength of adjustment of the ECM depend on the underling probabilities assigned to the program. The greater the probability of success, the lower the slope and the speed of adjustment of the ECM, implying a lower equilibrium and less dependence on the ECM for stabilizing inflation. This means that a less than fully credible anchor will decrease both the equilibrium towards which the real exchange rate needs to converge in order to fully stabilize inflation, as well as the speed of convergence towards such equilibrium. As a consequence, inflation will take longer to adjust making the stabilization effort more vulnerable to exogenous shocks.

[9] Note that λ represent pre-stabilization preferences that are assumed to remain constant after the program is introduced.

Secondly, if the program is fully credible, with $q = 1$ for example, local inflation would immediately converge towards world inflation (i.e., $\Delta x_t = 0$). In this case, as in Edwards (1998), inertial inflation disappears and the equilibrium real exchange rate will again return to its fundamentals, equation (14). Finally, the slope of the equilibrium real exchange rate could be negative or positive depending on the probability of success after the program is introduced. For example, one may empirically observed a slope that changes signs reflecting different regime perceptions on the success of the program. Hence, changes in q will be reflected as structural breaks in the ECM from witch the equilibrium real exchange rate is calculated. These structural breaks can be interpreted as changes in agents' perceptions on the success of stabilization, providing an important feedback about the performance of the program.

4. Empirical evaluation

This section presents the econometric exercise for the estimation of

$$\Delta x_t = \gamma_0 \Delta x_{t-1} + \gamma_1 \Delta e_t + \Theta\left[s_{t-1} - s^*_{t-1}\right] + \upsilon_t\,, \tag{17}$$

with an equilibrium real exchange rate defined by

$$s_t^* = \alpha + \beta A_t \,, \qquad (18)$$

where $\alpha = a$ and $\beta = -[b - (1-q)\lambda]$, and a strength of adjustment given by $\Theta = (1-q)\theta$. Equations (17) and (18) will be estimated for Mexico using quarterly, seasonally adjusted data for real de-trended log industrial production as a proxy for absorption (A);[10] domestic inflation (Δp), calculated as log changes in the consumer price index (CPI); world inflation, calculated as log changes in the United States (US) CPI (Δp^*); log changes in the nominal exchange rate (Δe), and the log of a real exchange rate index (s), calculated as the ratio of the US CPI to local CPI times the nominal exchange rate between Mexico and the US ($P^* E/P$). The data set ranges from the first quarter of 1981 up to first quarter of 2001, including the *Pacto* program implemented in January 1988 and the 1995 ERBS after the *Tequila* crisis of 1994. Data source, description, and construction are presented in the appendix.

Before turning to the formal econometric exercise, the integration consistency of the series will be verified using the Augmented Dickey and Fuller test. Table 1 shows that the price gap and the nominal exchange rate follow first order integrated *I*(1) processes; whereas, the real exchange rate and de-trended industrial production follow *I*(0) processes, providing a consistent stationary structure. In addition, Figure 2 illustrates a clear

---

[10] Detrending was carried out using Hodrick and Prescott (1997) filter.

cointegrated relationship between the real exchange rate and de-trended industrial production. Cointegration is also confirmed in Table 2 by a Johansen (1991) test that shows at least one cointegrated relationship.

Table 3, on the other hand, shows the estimation of equation (17).[11] All relevant statistics, as well as the significance and direction of the underlying coefficients, are in order. The intercept of the inflation equation is negative, the coefficient on detrended industrial production is positive, and the strength of the adjustment coefficient, equal to 0.09 (0.03, p < 0.001), is positive and close to zero, implying that there exists a stable ECM that corrects inflation differentials at a very slow pace. Figure 3 and the ADF test on the residuals ($-8.66,\ p < 0.001$) revealed stationarity, confirming the ECM (Engle and Granger, 1987). The normalized ECM corresponding to equation (16), is given by[12]

$$s_t^* = \underset{(0.1)}{0.25} - \underset{(1.06)}{3.33} A_t \,. \tag{19}$$

As expected, equation (19) indicates that the equilibrium real exchange rate is decreasing in detrended industrial production. In particular, for every percentage point that industrial production growth above trend, the equilibrium real exchange rate, consistent with a zero inflation gap, falls by

[11] The estimation was carried out using an IV method. The instruments chosen were the lags of the log changes in the exchange rate, inflation differentials and detrended industrial production. The lengths of the lags were selected using various information criteria.

[12] See Bårdsen (1989) for details on estimating the standard errors of the normalized ECM.

about 3⅓ of a percentage points. In the absence of demand pressures, however, the equilibrium real exchange rate is about 1.28 Mexican pesos per US dollars.

Turning to the structural stability of (19), the theoretical conclusions suggest that the structural parameters of the ECM will move over time reflecting changes in stabilization preferences and success probabilities. In particular, if q is time dependent due to program success perceptions, (18) becomes

$$s_t^* = \alpha + \beta_t A_t \qquad (20)$$

where β_t is the time-varying-coefficient (TVC).[13]

Figure (4) compares the actual and the equilibrium real exchange rate calculated under equations (18) and (20). The results show some interesting conclusions: During the 1988 program, the estimated ECM calculated under the TVC approach departs significantly from the constant coefficient alternative, although both calculations tend to converge after the 1994 *Tequila* crisis. This suggests two things. First, it shows that structural changes do matter in the calculation of the ECM, and that those changes could significantly affect the conclusions derived from an equilibrium approach to

[13] See Hamilton (1994) for a technical discussion of TVC techniques. In particular, the TCV methods is an updating algorithm in which equation (17) and (18) are estimated using the first k observations, where k is the number of coefficients to be estimated in (17), and new observations are added until T-k coefficient estimates are obtained. These T-k estimates are termed time varying coefficients (TVC).

the real exchange rate.[14] Secondly, the convergence observed after 1994 suggest that parameter stability was achieved with the 1994 stabilization attempt. In order words, after 1994 the recursive approach coincides with the full sample estimate.

Figure (4) also suggests that the observed real exchange rate index was considerably more depreciated than both measures of equilibrium prior to the 1988 program. However, the correction required was significantly larger according to the TCV approach. The disequilibria gradually disappeared as the program consolidated until achieving convergence in 1994. Convergence was slow, apparently due to a less than fully credible program, resulting in a considerable degree of inflation persistence, real exchange appreciation and inflow of foreign capital that helped finance large and unsustainable current account deficit. The deficit lead to the 1994 crisis.

A somewhat different story holds after the 1994 *Tequila* crisis. Starting in 1994, the observed real exchange rate index overshooted as a result of several political and socio economic factors, the NAFTA controversy of October 1993, and pressures coming from current account misalignments. In contrast to the 1988 episode, however, both measures of equilibrium jumped in 1995 reflecting the significant slow down in industrial production. The correction of the real exchange rate required to stabilize inflation under the new 1995 anchor was significantly smaller than during the 1988 *Pacto*. After

[14] Keep in mind that 20 observation were allowed for initialization when calculating the TVC.

1995 and similar to the 1988 case, the disequilibria between the observed and equilibrium measures gradually disappeared, fully converging in 1999.

Why these two episodes are significantly distinct, specially in the size of the gap that was required for inflation stability? This question can be better understood using the conclusions derived from the changes in credibility that occurred during both stabilization programs and the information inherent in the movements of β_t. Figure 5 shows the TVC estimate of the slope of the ECM alongside the standard error bands.[15] According to the theoretical results, this coefficient should vary over time reflecting changes in the success probabilities of stabilization. The greater the success probability attributed to the program, the smaller will be the slope coefficient of the ECM. The results show additional interesting conclusions. With the introduction of the *Pacto* in 1988, the slope felt sharply indicating a credible stabilization anchor. This drop continued until 1990 when it started reverting back, coincidently the time when the monetary authorities implemented the second phase of the program with the introduction of a devaluation strategy. Accordingly, this approach probably signaled a lost of the anchor and a reversal towards the pre-stabilization "real target" regime. The model suggests that the lost of credibility on the anchor, caused the slope to increase steadily until 1994 when the *Tequila* crisis exploded and the new IMF program was introduced.

[15] The evolution of the constant using the TVC method revealed, as expected from the model, that it remained fairly constant through the sample period.

After the introduction of the new program in 1995, the slope felt sharply again and continued decreasing as credibility on the new anchor gradually consolidated. The slope and hence the credibility on the success of the new program settled below the post-stabilization level of 1988. In this regard, the results suggest that the stabilization effort of 1995 was more credible and indeed successful than the 1988 episode. It is important to mention that the devaluation strategy followed in the 1988 program was abandoned after the *Tequila* crisis and is perhaps one of the fundamental reasons why the 1988 *Pacto* lost credible.

5. Conclusions

This paper developed a framework that allows understanding the implication of changes in stabilization preferences and success probabilities in the evolution of an equilibrium real exchange rate index during stabilization. In doing so, the analysis shows that regime and credibility changes will alter the post-program structural characteristics of the equilibrium real exchange rate. This hypothesis was tested on the Mexican 1988 and 1995 stabilization episodes. The findings revealed that the observed real exchange rate could converge to a higher or lower equilibrium, or move away from it, depending on a combination of aggregate economic activity, policy objectives and credibility.

In particular, the results suggest that the 1988 *Pacto* program rapidly gained credibility, but it was lost when a more flexible exchange rate policy was allowed in 1990. A lower probability of success, a considerable degree of real exchange rate appreciation, a fragile financial system, large current account deficit financed by capital inflows, and other political and internal developments, ultimately led to the 1994 *Tequila* crisis and the introduction of a new stabilization program in 1995. The new program was shown to be more credible than the 1988 *Pacto*. In general, the proposed theoretical model, incorporating policy preferences and credibility, provides an adequate description of inflation and real exchange rate dynamics during the Mexican 1988 and 1994 stabilization episodes, and could provide important feedback on the performance of alternative stabilization policies.

References.

Agénor, P. R., and M. K., Taylor, 1992, Testing for Credibility Effects, IMF Staff Papers, 39 (3), 545-571.

Bårdsen, G., 1989, The Estimation of Long-Run Coefficients from Error Correction Models, Oxford Bulletin of Economics and Statistics, 54, 345-50.

Calvo, G., and C. A., Végh, 1993, Exchange Rate Based Stabilization under Imperfect Credibility, in Helmut Frisch and Andreas Worgotter. Open Economy Macroeconomics, London, UK, MacMillan, 3-28.

Calvo, G.A., and Végh, C.A., 1999, Inflation Stabilization and BOP Crises in Developing Countries, in Taylor, J.B. and M. Woodford, (eds), Handbook of Macroeconomics, 1, 1531–1614.

Calvo, G.A., and Reinhart, C.M., 2002, Fear of floating, Quarterly Journal of Economics, 117, 379-408.

Dornbusch, R., and A., Werner, 1994, Mexico: Stabilization, Reform and no Growth, Brookings Papers on Economic Activity, 1, 253-315.

Edwards, S., 1992, Exchange Rates as Nominal Anchors, NBER 4246.

Edwards, S., 1996, Exchange Rate Anchors, Credibility and Inertia: A Tale of Two crises: Chile and Mexico, America Economic Review, 86 (2), 176-180.

Edwards, S., 1998, Two Crises: Inflationary Inertia and Credibility, The Economic Journal, 108, 665-80.

Engle, R. F., and C. W. J., Granger, 1987, Co-integration and Error Correction: Representation, Estimation, and Testing, Econometrica, 55, 251-276.

Erceg, C.J., and A.T., Levin, 1996, Structures Investment and the Dynamic Behavior of the Real Exchange Rate. Working paper, Board of Governors of the Federal Reserve System, Washington, DC.

Fischer, S., R., Sahay, and C. A., Végh, 2002, Modern Hyper and High Inflations, Journal of Economic Literature, 40, 837-880.

Gregory, A., and B., Hansen, 1996, Residual-based tests for cointegration in models with regime shifts, Journal of Econometrics, 70, 99–126.

Hamann, A. J., 1999, Exchange-Rate-Based Stabilization: A Critical Look at the Stylized Facts, IMF Working Paper.

Hamilton, J. D., 1994, Time Series Analysis, Princeton University Press.

Hodrick, R. J., and E. C., Prescott, 1997, Postwar U.S. Business Cycles: An Empirical Investigation, Journal of Money, Credit, and Banking, 29, 1-16.

Johansen, S., 1991, Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models, Econometrica, 59, 1551-1580.

Kamin, S. B., 2001, Real Exchange Rates and Inflation in Exchange-Rate-Based Stabilizations: An Empirical Examination, Journal of Development Economics, 64, 237-253.

MacKinnon, J. G., 1996, Numerical Distribution Functions for Unit Root and Cointegration Tests, Journal of Applied Econometrics, 11, 601-618.

MacKinnon, J., 1991, Critical Values for Cointegration Tests, Chapter 13 in Long-Run Economic Relationships, R. F., Engle and C. W., Granger (Eds), London, UK, Oxford University Press.

Osterwald-Lenum, M., 1992, A Note with Quintiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics, Oxford Bulletin of Economics and Statistics, 54, 461-472.

Prazmowski, P. A., 2002, Endogenous Credibility and Stabilization Programmes: Evidence from the Dominican Republic, Applied Economic Letters, 9, 933-937.

Quintos, C.E., and P. C. B., Phillips, 1993, Parameters constancy in cointegrating regression. Empirical Economics 18, 675–703.

Rebelo, S., and C. A., Végh, 1994, Real effects of exchange rate based stabilization: An analysis of competing theories, NBER Macroeconomics Annual, 125-74.

Rodríguez, C. A., 1982, The Argentine stabilization plan of December 20th, World Development, 10, 801-11.

Roldos, J. E., 1995, Supply-Side Effects of Disinflation Programs, IMF Staff Papers, 42, 158-183.

Saikkonen, P., and H., Liutkepohl, 2000, Testing for the cointegrating rank of a VAR process with structural shifts, Journal of Business and Economic Statistics 18, 451–464.

Uribe, M., 1995, Exchange-Rate-Based Inflation Stabilization: The Initial Real Effects of Credible Plans, International Finance Discussion Paper, 503, Board of Governors of the Federal Reserve System, Washington, D.C.

Werner, A., 1994, Mexico: Stabilization, Reform and No Growth, Brooking Papers in Economic Activity, l, 253-315.

White, H., 1980, A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test for Heteroskedasticity, Econometrica, 48, 817-838.

Table 1 Stationarity test based on ADF

Variable	ADF†
p-p^*	-1.46
Δp- Δp^*	-3.65*
e	-1.65
Δe	-5.23*
s	-3.05**
Δs	-8.79*
A	-4.46*

Note: * and ** denote significance at the 1% and 5% level under MacKinnon (1991) critical
The data is available by request to the authors.
† Estimation sample is 1981.1-2001.1

Table 2 Johansen cointegration test (RER and detrended industrial production)

Null hypothesis	H_0 r = 0; H_1 r ≥ 1	H_0 r ≤ 1; H_1 r = 2
Eigenvalue	0.28*	0.11
λ_{trace}	23.75	6.29
λ_{trace} 95% critical value	19.96	9.24
λ_{trace} 99% critical value	24.60	12.97
λ_{max}	17.46	6.29
λ_{max} 95% critical value	15.67	9.24
λ_{max} 99% critical value	20.20	12.97

Note: * and ** denote rejection of the hypothesis at the 1% and 5% level under Osterwald-Lenum (1992) critical surface. The statistics ltrace and lmax are the trace and maximal eigenvalues under Johansen (1991) cointegration test. Vector autoregression includes constant term.

Table 3 IV regression results for the inflation gap (Δx_t)

Variable	Coefficient
a	-0.16 *
	(2.80)
s_{t-1}	0.09 *
	(2.89)
A_{t-1}	0.30 **
	(2.07)
Δe_t	0.12 *
	(2.79)
Δx_{t-1}	0.68 *
	(4.91)
R^2 (adjusted)	0.77
N (adjusted)	79
σ^2 (regression)	0.03
DW	2.04
ADF	-8.66*

Note: * and ** denote significance at the 1% and 5% level respectively. t-statistics in parenthesis.
Estimation sample is 1981.1-2000.1 using White's (1980) Heteroskedasticity-consistent covariance.
ADF critical surfase based on MacKinnon (1996) one-sided p-values.

Data definition Table

Variable	Definition[†]
P	MEX Consumer Price Index (1995=0)
*P**	USA Consumer Price Index (1995=0)
E	Nominal Exchange Rate (MEX$/US$)
A	MEX Detrended Industral Production

Data is drawn from the Intenational Monetary Fund IFS (CD).
The data is available by request to the authors.

Figure 2 log (1/RER) vs. log of detrended industrial production

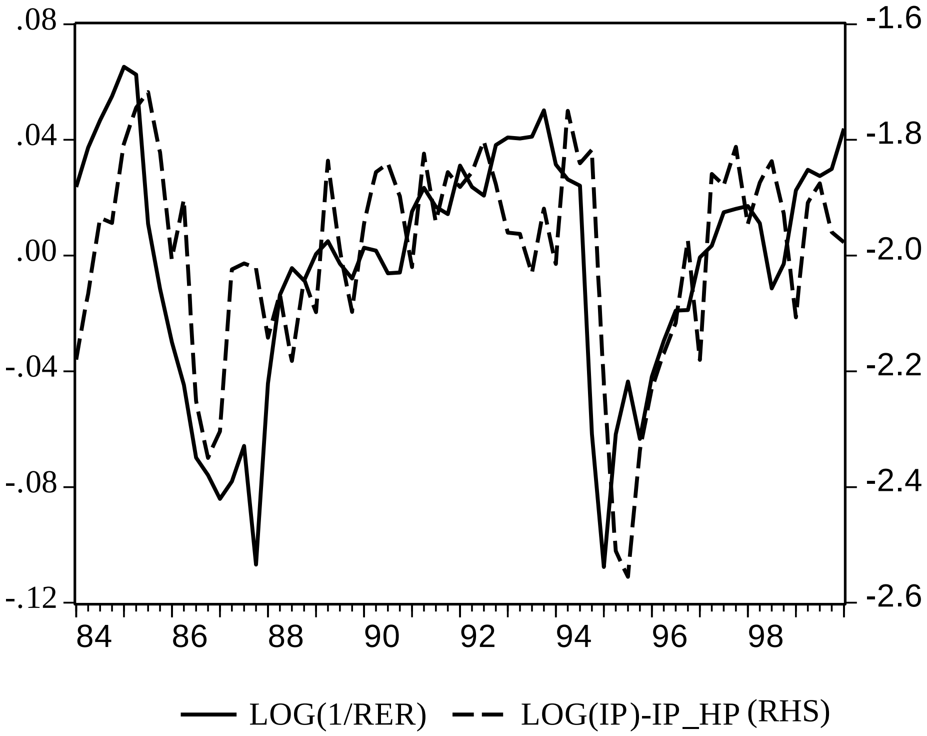

Figure 3 Residuals from inflation equation (Table 3)

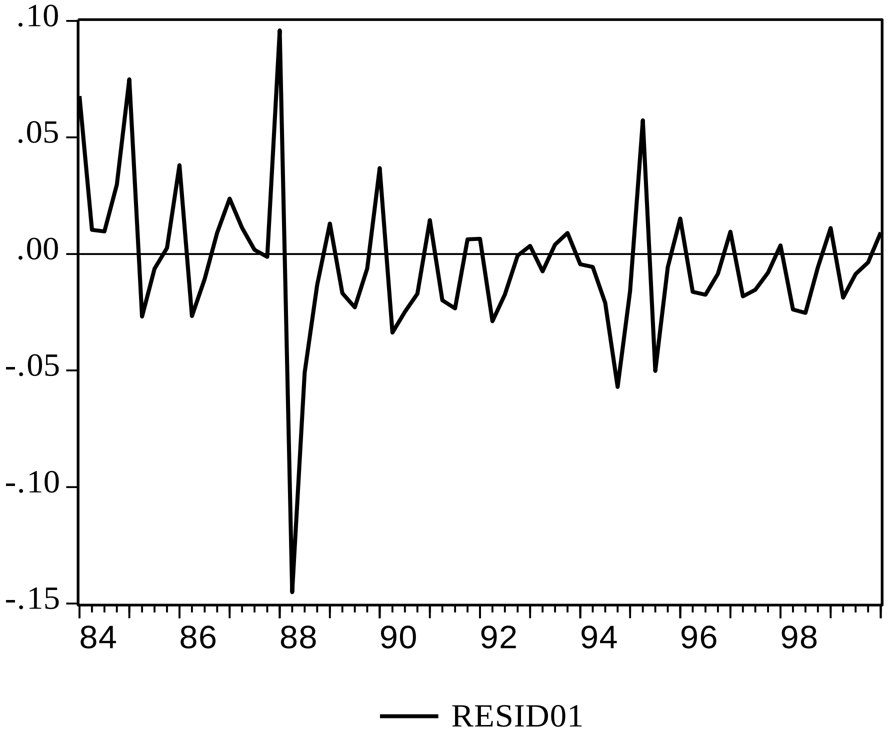

Figure 4 Observed vs. equilibrium RER (constant and TVC cases)

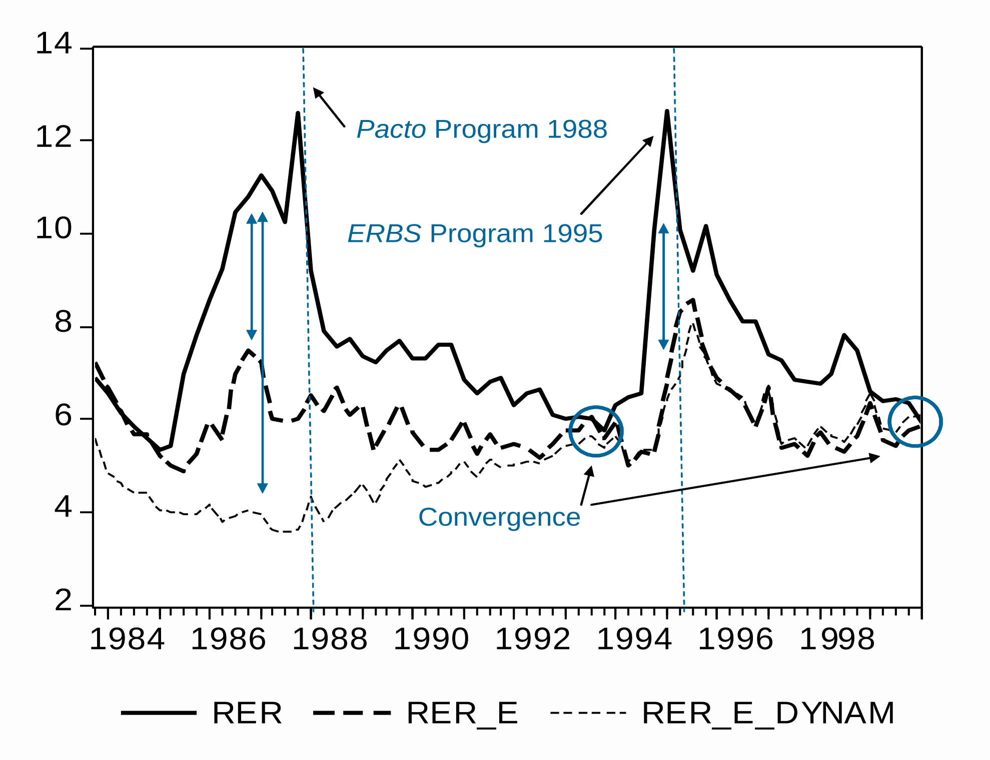

Figure 5 TVC slope of normalized ECM