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**Exchange Rate Pass-through and Partial
Dollarization: Is there a Link?**

by

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Exchange Rate Pass-through and Partial Dollarization: Is there a Link?

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Abstract

This work examines the way dollarization affects the transmission channel of nominal exchange rate fluctuations into domestic inflation for 13 countries in Latin America between 1980-00. Contrary to “conventional wisdom” I find that dollarization across countries is not positively associated with a higher degree of exchange rate pass-through. Moreover, within a country, increases in dollarization are not associated with an increase in pass-through. The policy implications are that partially dollarized countries can still adjust their real exchange rate through nominal devaluations and that increases in dollarization do not hinder their ability to do so. Two alternative methodologies are followed: (i) long run pass-through is estimated using an Error Correction Model. When using the 20-year time period, pass-through estimates for most countries are close to one supporting a long-term stable relationship close to PPP. When breaking the time period into two, pass-through estimates are more heterogeneous. Long term pass-through coefficients and dollarization are not significantly correlated across countries. There is a consistent but also insignificant relationship between a higher speed of adjustment and the degree of dollarization. (ii) Yearly pass-through coefficients were computed and regressed in a panel framework using dollarization and inflation as explanatory variables. The cross-country dollarization coefficients are ambiguous supporting the long run pass-through results. Within country estimates are insignificant and split in sign. Inflation is negatively but not significantly correlated with the degree of yearly pass-through both within and across countries.

¹ This is a revised version of a paper prepared for the World Bank Conference on Dollarization in Latin America held at the Universidad Torcuato di Tella in Buenos Aires, Argentina on June 5-7 2000. The author thanks participants for many useful comments. Remaining errors are mine.

1. Introduction

Perhaps as a result of the international capital markets turmoil, academic and policy makers have revived the old debate of fixed versus flexible rates for developing countries with a new variation: the desirability of relinquishing one's own domestic currency altogether and adopting a hard currency instead, namely the dollar. This paper takes the view that in practice, the choice is not a discrete one and that there is a continuum of possibilities where from one extreme to the other a country can let its currency float freely, intervene in the exchange market with or without pre-determined rules, pursue a fixed exchange rate, implement a currency board, or adopt the dollar as legal tender. Just in Latin America, on one extreme, there is Panama where the dollar is legal tender and it is the only currency available, Ecuador is in the process of dollarizing, and Argentina has a currency board. On the other extreme, there are countries like Brazil and Venezuela where dollar bank accounts are not allowed. In the middle, there have emerged a whole series of *ad hoc* regimes, which vary in their degree of dollarization:² Bolivia, Peru, Nicaragua, and Uruguay maintain their own currency and most transactions are denominated in their own currency but a high proportion of bank savings are in dollars.

The purpose of this paper is not to advocate or even evaluate the welfare implications a higher or lower degree of dollarization but rather to investigate macroeconomic policy making under these partially dollarized regimes. In particular, whether dollarization affects the degree and speed of transmission of nominal exchange rate movements into domestic inflation; i.e. the degree and speed of exchange rate pass-through of the nominal exchange rate into domestic inflation.³

The study of exchange rate pass-through in Latin America is important to policy makers for two reasons: (i) Because monetary policy affects only the nominal exchange rate directly. The effects on the real exchange rate depend on the degree to which movements in the nominal exchange rate translate into inflation. A firm tenet of the monetary approach is that in the long run, a nominal devaluation translates one for one into an increase in the domestic price level eliminating any changes in the real exchange rate. In practice, a nominal devaluation will translate into a real depreciation if wages and prices are less than fully flexible and there is not an accommodating monetary policy.

(ii) When faced with an external balance policy makers in partially dollarized economies have been reluctant to devalue the nominal exchange rate (or increase the crawl depending on the regime) on the arguments that because of a high degree of dollarization, nominal exchange rate movements translate entirely and quickly into inflation; i.e. a higher degree of dollarization implies as higher and faster exchange rate pass-through.

² The definition of dollarization used in this work is the proportion of banking liabilities denominated in dollars.

³ The definition of pass-through in this work is given by $\phi_i = \frac{\Delta P_i / P_i}{\Delta(EP^*) / EP^*}$ and is interpreted as the degree to which

changes in the nominal exchange rate translate into domestic prices. The clarification is important because during the late 1980s revival of the study of pass-through in the United States the interest was on the effects of exchange rate movements on import and export prices (See Baldwin and Krugman a,b,c, for the original arguments).

The effects and presence of dollar indexation are well known: “an economy that is strongly indexed- and in particular, with exchange rate influences on indexation – an attempt at creating employment via easy money would be frustrated and exchange rate depreciation precipitates offsetting wage and price inflation.”⁴ In an economy that is perfectly dollar indexed, a nominal devaluation translates instantaneously into a rise in all prices and wages barring any real effects. In a high inflation regime where prices are revised very often, the nominal exchange rate is often used as a benchmark and “studies of high inflation show close cumulative movements of internal prices and the exchange rate;” i.e. dollar indexation.⁵

The argument in partially dollarized economies arises because most of them experienced high inflation and, in many cases, hyperinflations in the 1980s, during which the nominal price index tracked nominal price index quite closely becoming heavily dollar indexed. In fact many prices were quoted in dollars on a day-to-day basis in countries like Argentina, Bolivia, and Peru. As inflation abated, dollarization ratios increased, and many prices continued to be quoted in dollars, “conventional wisdom” simply assumed that high dollarization ratios implied that the level of dollar indexation remained high.⁶ The issue has seldom been contested to the point even IMF country documents justify the policy almost as a matter of fact: “the real effects of a nominal devaluation in country are limited due to the high degree of dollarization.”⁷

Using price and dollarization data for 13 countries in Latin America, I found no significant cross-country or within-country relationship between dollarization and pass-through contradicting, the “conventional wisdom” that predicts a positive relationship between the level of exchange rate pass-through and the degree of dollarization. The policy implications are that (i) countries with a higher degree of dollarization do not have a smaller ability to adjust the real exchange rate through nominal exchange rate fluctuations and (ii) that as a country’s degree of dollarization increases, it does not lose its channel to adjust the real exchange rate through nominal devaluations. I did find a positive (but not significant) cross-country relationship between the speed of adjustment and dollarization and the level of inflation. In addition, in a very long time period of 20 years, pass-through estimates for an expanded sample of Latin American countries are close to one (although only 3 out of 16 are statistically insignificant different from one) making Purchasing Power Parity (PPP) a surprisingly reasonable benchmark.

The results of this paper suggest that the degree of dollarization and the degree of dollar indexation are not necessarily the same or even correlated. The prices of non-tradables are set by real determinants inside the country just as theory would suggest. An example may clarify the issue. Prices in the high-end real estate market in Mexico are quoted in dollars. Yet when a devaluation occurs and economic activity in the country falls, property prices in dollars are adjusted downwards to clear demand. Thus, even a perfectly “dollarized” market will not adjust fully and instantaneously.

⁴ In a paper describing the Mexican stabilization experience Cordoba (1991) highlights the lack of indexation to past inflation or the nominal exchange rate in Mexico and warns of the effects in countries with indexation.

⁵ Dornbusch (1988) although the same studies were quick to point relative prices showed large deviations

⁶ Where the author is part of this “conventional” wisdom.

⁷The quote above is one of many examples from missions to partially dollarized countries but these IMF reports are confidential precluding making specific references.

The rest of the paper is organized as follows: Section 2 discusses some basic theory and the transmission mechanisms of nominal exchange rate movements into the domestic price level. Section three and the estimation process. Section 3 discusses the data, the estimation process and the results. And Section 4 presents some conclusions.

2. Basic Definitions and Transmission Mechanisms

The theory for the determination of exchange rate pass-through is not new. This sections merely cites the most relevant work. The point of departure for the study of pass-through is the law of one price and the Purchasing Power Parity (PPP) literature. Dornbusch (1988) in the New Palgrave presents an excellent definition and a review of the literature. From the beginning it became clear that there were various reasons why the law of one price and the PPP would not hold. “Most of the time, PPP does not hold in any interesting sense. Certainly the notion that the equilibrium exchange rate is such that a dollar should buy the same basket of goods in the United States and Japan would only hold in an extraordinary world. What is really interesting about PPP are the systematic directions in which the literature has documented divergences from PPP.”⁸ The purpose of this section is to briefly (re-)state the transmission mechanisms and the theoretical reasons for deviations from PPP.

The strong version of PPP states that their price levels determine the exchange rate between two countries in any period of time. Therefore, if PPP holds, exchange rate fluctuations translate into proportional movements in the domestic price level; i.e. pass-through is equal to one. PPP requires two restrictive assumptions: (i) That there is instantaneous costless, and frictionless arbitrage. (ii) That the same goods enter the basket of goods with the same weight in every country. Surely neither of the above can hold all the time leading to the weak or relative version of PPP where the law of one price holds up to a constant. It has also come to be known as the inflation theory of exchange rates suggesting changes in the exchange rate between two countries are determined by the difference of their inflation levels. (i.e. $\hat{\epsilon} = \hat{P} - \hat{P}^*$). The weak version eliminates the requirement that arbitrage is costless but it does require that it does occur at a constant cost. This will clearly not be the case if there are quantitative restrictions in place or if there are modifications in trade policy. More importantly, the determination of domestic inflation may use different shares of goods in their respective baskets and certainly non-traded groups are not the same and cannot be arbitrated.

The literature has identified different types of “structural” and “transitory” deviations from PPP although pinpointing the source of the deviations has proved to be difficult. The most important structural deviation from strong and weak version of PPP arises from differences in productivities or differences in productivity changes respectively. The phenomenon was first noted by Ricardo who noted that real prices of home goods are high “in countries where manufactures flourish.”⁹ The mechanism, now called the Balassa-Samuelson effect, assumes the law of one price applies to tradables. An increase in productivity in the traded sector puts upward pressure on the nominal wage. Without a commensurate increase productivity in the

⁸ Dornbusch, R., *Exchange Rates and Prices* Introduction to Part III.

⁹ As quoted in Dornbusch 1988.

home goods sector, non-tradable prices increase.¹⁰ Thus a country who is “catching” because it has greater increases in productivity will have observe an appreciation of its domestic price level when measured in a common currency; i.e. its real exchange rate will appreciate. The phenomenon has been documented in country cross-sections and long-term time series. Other structural deviations from PPP can arise because of supply shocks, permanent Terms of Trade (TOT) shocks, changes tastes between traded and non traded goods, or changes in commercial policy.¹¹ Countries in Latin America were subject to most, if not all, of the above.

Transitory deviations from PPP beyond those caused by transportation and information costs which make arbitrage difficult on a continuous basis arise because of sticky prices and wages compared to exchange rates. The literature has theoretically justified slow adjusting domestic prices and wages for many reasons. The implications have been explored extensively. Indeed slow adjusting prices are implicit in the standard Mundell-Fleming model of international macroeconomics. The question that the empirical section addresses is the size and duration of these temporary deviations.

There is one notable type of shock which does create a deviation from PPP even if the domestic price indexes have different shares and goods in their baskets: namely, a monetary shock when the conditions for homogeneity postulate of monetary theory exist. In this case, a change in the money supply will lead to a proportionate change in all prices including the exchange rate. This type of shock is important because of the high inflation levels in Latin America. During high inflation, increases the spiral increases in the money supply and the price level can dwarf real shocks and offer support for PPP.

There is a long history of empirical evidence on PPP both in support and against it. Dornbusch 1988 presents a review of the empirical evidence until that date. Most developments since then have concentrated on expanding the data set using more narrowly defined goods and improving the econometric techniques. The evidence from both looking at inflation differentials and at narrowly defined manufactured goods leaves little doubt that they have been large and persistent.

If the evidence for PPP has been so time dependent and inconclusive, why is this exercise relevant for Latin American countries at this point. The answer has to do with investigating the way the transmission mechanisms of monetary policy have changed with dollarization. Monetary policy can cave real effects by changing relative prices of tradable and non-tradable and by changing the cost of money in the asset markets. Moreover, the approach is to estimate the degree of exchange rate pass-through without attempting to pass-judgment on the theory of PPP. In particular, the empirical estimates test whether this transmission mechanisms has been affected by the dollarization of financial assets. Looking at pass-through rather than at a version of PPP or even the real exchange rate is the right approach of looking at the transmission mechanisms of nominal devaluations into the price level because one needs not be concerned about the factors that can upset PPP.

¹⁰ The result was re-stated by Harrod in the 1930s, Balassa in the 1960s, Samuelson who formalized in the 1960s, and more recently in the Dornbusch-Fischer-Samuelson (1977) framework.

¹¹ A good reference for a formal exposition of the mechanisms is Dornbusch Macroeconomics (1980).

Transmission Mechanisms

The transmission mechanisms of fluctuations of the nominal exchange rate into the domestic price level are standard ones and will not be formally developed: (i) Fluctuations in the nominal exchange rate change the price of imports which directly affect the overall price index. For a small country with perfect competition at home and abroad, the change in the price of imports should be one for one. However, Dornbusch (1987) showed that if there is oligopolistic competition, and/or import and domestic goods are imperfect substitutes, exchange rate pass-through can be less than one as firms strategically modify their pricing behavior and consumers change their pattern of consumption to increase or decrease imported goods.¹² Although the market structure models are in partial equilibrium, they provide insight into the way segmented markets of traded goods can systematically deviate from PPP. Using a Cournot setting, he finds that import share and lower concentration increase the degree of pass-through. In two types of models of imperfect substitutes he shows that pass-through falls as product differentiation increases. A body of literature arose in the 1980s to explain the pricing to market behavior during the pronounced dollar appreciation and depreciations. The arguments centered on imperfect competition in the form of sunk costs to entry (Baldwin and Krugman a,b, and c), and market share (Froot and Klemperer 1989, see Knetter 1992 for a good review of this literature). Although Latin American Countries are becoming more important to the United States, I assume these effects are small and temporary.

(ii) Besides the direct effect that fluctuations of import prices has on the domestic consumption basket, imports have an indirect effect on the domestic price level when they are used as inputs. The higher the use of imported goods as inputs or intermediate goods, the higher the effect on the domestic price level.

(iii) A third way in which nominal exchange rate fluctuations can affect the price level is through “dollar indexation” as discussed before. The higher the proportion of contracts denominated in dollars, the higher the degree of pass-through into the domestic price level. Specifically, this work will estimate if dollarization has affected the degree of dollar indexation in partially dollarized economies.

The main factor affecting the speed of adjustment of the domestic price index is the level of inflation. The higher the level of inflation, the more often economic agents will change their prices. Therefore, a nominal exchange rate shock will be transmitted faster through the channels outlined above. The extreme case is in a hyperinflation when prices are adjusted daily or even more often.

3. *Estimation Process and Results*

Data

I collected data for 16 countries in Latin America. The data set for each country consists of monthly series from 1980-2000 of the Consumer Price Index as a measure of the domestic price level; the nominal dollar exchange rate; and the United States PPI and the G7 PPI as

¹² See Dornbusch (1987) for a formal presentation.

measures of international prices. The exchange rate data came from the IFS. The consumer price indexes were obtained either from the IFS or directly from national sources. Monthly data provided the appropriate time frame to look at price fluctuations and eliminating the high variance that typically accompanies more frequent observations of the exchange rate.

The domestic price series for most countries during this period reflect a high degree of instability to the point many countries resorted to eliminating zeroes from their currencies to make transactions easier. In general, at the beginning of the 1980s, the inflation was moderate but rising for most countries in the sample. Inflation typically rose out of control at some point during the 1980s. Finally, some type of stabilization plan was implemented as early as the early 1980s as in Chile and Bolivia and as late as 1994 in Brazil. The international price series exhibited a relatively steady upward trend. Thus, most of the variance of the explanatory variables comes from fluctuations in the nominal exchange rate.

Although conceptually one would want to use the nominal effective exchange rate instead of the dollar exchange rate, using the nominal exchange rate makes the process considerably more cumbersome, the data is less reliable, and it is not clear that much is gained. For Central American countries and Mexico the dollar nominal exchange rate and the nominal effective exchange rate are very close. The issue is relevant only for South American countries where the United States is not the main trading partner. The process is cumbersome because the weights of the nominal effective exchange rate change with trade patterns. More importantly, instead of using the U.S. or the G7 PPI as an index of international prices, one would have to construct an index of international export prices using the price levels of trading partners.¹³ For example, if Peru and Bolivia devalue their currency concurrently with respect to the dollar, then the nominal effective exchange rate will not be affected for this bilateral trade relationship. The international price level faced by either of these countries will change as their export prices change due to the bilateral devaluation. The problem is that most countries do not have export prices forcing the use of an imperfect measure such as the WPI. Two further reasons justify using the nominal dollar exchange rate and the U.S. or G7 PPI: (i) It gave all the countries a common world price which is what one would expect from traded commodities. Given that all of these countries are small, their influence on the price of tradables should be small. (ii) Following McKinnon's (a, b, and c) argument for Asia, a case could be made, that countries in Latin America use the dollar as a standard and that international trade in this region is heavily dollar indexed. (iii) In the very long run, for most countries in the sample dollar exchange rate devaluations translated into almost full pass-through of the domestic price level indicating that in the end the price of tradables in dollars can be assumed to be given.

The measure of dollarization used in this study is the amount of banking liabilities which are in dollars as a share of total banking assets or M4, between 1990 and 2000; i.e. the percentage of savings in dollars. Given the large efforts to prevent exchange rate exposure in banks, using banking assets or liabilities as a percentage of a broad measure of money does not make a difference. For the purposes of this study, the appropriate measure is the level of dollar indexation in the form of the share of contracts that are conducted in dollars. However, that data is not available. Moreover, this is the conventional measure of dollarization and since a primary

¹³ Obviously the weights to construct the international price index for country X have to be the same as those used for the nominal effective exchange rate.

purpose of this work is to evaluate whether dollarization (as defined by policy makers) indeed implies that a nominal exchange rate fluctuation translates into a faster and closer to proportional increase of the domestic prices.

The reason for choosing the 1980-00 time-period is that it was important to have a long enough time horizon. Many countries in this Latin American experienced pronounced appreciations and reversals that lasted a few years. For example, Mexico's appreciations and reversal cycles last six years, Chile experienced a continuous depreciation from the outset of the debt cycle in 1982 until roughly the middle of 1988, before a steady appreciation since then. Ignoring the 1980s might provide lead to the wrong conclusions.

Estimation Process

The point of departure for the estimation process is the weak version of PPP. In logs this translates into:

$$p_{i,t} = \alpha_i + \phi_i(e_{i,t} p_t^*) \quad (2)$$

where $p_{i,t}$ is the domestic price level for country i at time t . α_i is the mark up constant for country i , $e_{i,t}$ is the nominal exchange rate of country i in “pesos” per dollar, p_t^* is the international price level, and ϕ_i is the estimated coefficient of pass-through for country i .

The first estimation problem encountered is that, not surprisingly, all of the series were non-stationary and contained a unit root making conventional estimation methods inappropriate.¹⁴ The simplest alternative is to difference the data and test for stationarity. The problem is that the regression estimates loose “long term memory” and the long-run equilibrium properties embedded in the original series.

In this case, the long run equilibrium properties of series are exactly the law of one price and PPP. The earlier discussion suggests that temporary deviations are expected for various reasons but that there should be a stable underlying long run relationship between the domestic and the international price level when measured in a common currency. Therefore, the theory behind the joint behavior of the series naturally suggests a cointegration framework to estimate equation 2. The estimation method does not impose PPP or the law of one price. Rather it allows temporary deviations while it estimates a long run relationship between the variables (if it exists), which may or may not be consistent with PPP and the law of one price. (See the discussion below).

For all the countries, the series of domestic prices and international prices measured in domestic currency failed to reject a cointegration vector at the 5% significance level using a Johansen Test both for the 1980-00 and for the 1990-00 period. (The results of the tests are available upon request). The cointegration relation allowed for trends in the series and a constant because nominal variables were used but it did not allow a trend in the cointegration relationship.

¹⁴ Nelson and Plosser (1982) first put forth the argument. See Gonzalez (1999) for a brief non-technical description of the issues. See Hamilton for a formal treatment of the subject.

From an economic standpoint, the failure to reject this simple form of the cointegration merely states that there is in fact a “long-term stable relationship” between the domestic and the international price level when measured in a common currency. The result is conceptually consistent but does not impose or by itself imply PPP. However, the stable long run relationship does imply that temporary deviations do “cancel out”¹⁵ and that as such, only the permanent structural deviations from PPP discussed in Section 2 need to be considered; i.e. permanent or secular TOT shocks, trade liberalization, and most importantly, productivity differentials.

Econometrically, the existence of cointegration implies that the errors from the cointegrating regression are stationary, that there will not be any spurious regression results and that one can use an Error Correction Model of the form

$$\Delta p_{i,t} = \mu_i + \phi_i \Delta f + (1 - \delta)(p_{i,t-1} - f_{i,t-1}) + \text{laggeddiff} + \varepsilon_{i,t} \quad (3)$$

where $f_{i,t} = e_{i,t} p_t^*$, ϕ_i is the long run pass-through coefficient for country i , and $(1 - \delta)$ is the speed of adjustment will have stationary residuals. The speed of adjustment term is the coefficient of the error correction term and can be interpreted as the disequilibrium response to shocks. The ECM described above is the appropriate estimation tool for various reasons. First, it provides an out of equilibrium response of the series that reveals how quickly the series return to equilibrium. Since, all of these countries are small and will not affect the world price (measured as the U.S. or G7 PPI) then the speed of adjustment really does measure how fast the domestic price level of each country returns to its “long term stable relationship” with the international price level.

And second, it estimates the “long term stable” relationship between the domestic and the international price levels without imposing PPP or any other relationship on the data.¹⁶ The ECM will allow the long-term stable relationship to be one to one corroborating PPP or different from one because of any of the structural theoretical arguments put forth in Section 2. The estimation process allows long-term appreciating or depreciating trends due to permanent changes in the determinants of the real exchange rate: productivity differentials working through the Balassa-Samuelson effect, secular TOT shocks, permanent trade liberalizations. In fact, I argue that in general an ECM is a better way of obtaining relevant information from the PPP relationship. The literature has concentrated on testing whether PPP holds in the strictest sense. Yet, there are many theoretically sound and practical realities that cause this relationship to fail hold in predictable ways. This estimation process allows for these real shocks to occur but at the same time preserves the fact that there is an underlying reason for the domestic and the international price series to return to their long run relationship.

One can say PPP holds only when the pass-through coefficient ϕ_i is equal to one. The result implies that, at least in the long run, nominal exchange rate movements¹⁷ are reflected in

¹⁵ This is not to say that each type of temporary shock cancels itself out, but that the set of temporary set cancel each other out in the aggregate.

¹⁶ The existence of a stable long-term relationship was already established through the cointegration test.

¹⁷ Strictly speaking, movements in the international price level. However, as discussed before most of the variance comes from fluctuations in the nominal exchange rate.

proportional increases in the domestic prices level. Given the restrictive theoretical assumptions discussed before the emergence of PPP is quite remarkable. It implies that aggregation issues do not play a systematic role. Moreover, it implies that the structural reasons for deviations from PPP in the aggregate cancelled each other out. For example, it is possible for a country to have a positive productivity differential (to be “catching-up”) that was offset by adverse TOT shocks and trade liberalization. In our estimation process we cannot tell either of the underlying issues at work and the estimate is simply consistent with PPP.

A pass-through coefficient ϕ_i lower than 1, implies movements in the nominal exchange rate (times the international price level) translated on average into less than proportional increases in the domestic price level; i.e. on average the real exchange rate depreciated during the period. Permanent equilibrium real depreciations in the real exchange rate arise because of a permanent an adverse TOT shock, trade liberalization, and most importantly because productivity in the home country increased at a slower pace than the reference country. As discussed before, since these effects are not being studied separately one can only conclude that in the aggregate the result was the domestic price index depreciated even though it is quite possible that the one or more of the determinants of the real exchange rate had an appreciating pressure. An exercise since 1930 for England vs. the U.S. would exhibit this result.

Conversely, a pass-through coefficient ϕ larger than one implies that country i experienced a real appreciation of its currency on average. The reasoning is exactly as above and it would arise in a world where convergence dominated the other effects. A post war exercise for Japan would show this result strongly.

The out of equilibrium coefficient δ_i allows us to calculate the speed at which the domestic price level of each country returns to its “stable long term relationship” with the world price level. A lower speed of adjustment in country i implies that the domestic price level in that country takes a longer time to return to its “long term relationship with the price level” and that the relationship between the domestic and the international price level is “not as tight.” A slow speed of adjustment also makes the estimated long-term relationship a poor predictor of the nominal exchange rate in the short term. Long periods of adjustment can also result in changes to the real economy if there are non-convexities like the ones explored in the 1980s U.S. pass-through literature.

Exchange Rate Pass-through Results

The first step was to estimate pass-through in the very long run using equation (3). A likelihood ratio test was performed to determine the optimal lag length. Although for some of the cases two lags were enough to render the residuals white noise, for some of the countries the dynamics were not completely captured by a two lag Vector Error Correction (VEC). For uniformity, all of the VEC were estimated with three lags.

Table 1 shows the long run pass-through coefficients from 1980-00. The results show that in the very long run, 20 years, PPP is not a bad benchmark to predict exchange rates in Latin America in the very long term. On one hand, out of 16 countries, only Chile, Colombia, the Dominican Republic and Paraguay, have coefficients that are more than 20% off the PPP

benchmark of one. On the other hand, in strict terms, only Brazil, El Salvador and Nicaragua follow PPP with estimates that are not statistically significantly different from one. Part of the reason is that estimates are very precise with an average standard error of 3 percent of the value of the coefficient.

Table 1: Long Run Pass-Through 1980-00		
	Pass-through Coefficient	Standard Error
Bolivia	0.96	0.01
Brazil	1.00	0.01
Chile	0.68	0.05
Colombia	0.75	0.06
Costa Rica	0.93	0.02
Dominican Republic	1.37	0.06
Ecuador	0.93	0.01
El Salvador	1.07	0.07
Guatemala	0.87	0.05
Honduras	0.87	0.05
Mexico	0.94	0.01
Nicaragua	1.01	0.02
Paraguay	0.78	0.01
Peru	1.06	0.01
Uruguay	0.99	0.01
Venezuela	1.13	0.07
Regional Average	0.97	0.03

The plots of the real exchange rate shown in the Appendix indicate that despite this apparent convergence towards PPP, the real exchange rates fluctuate ostensibly in the region. The first point to note is that during the early 1980s most Latin American countries observed large real depreciations of their currencies. Most countries have not seen that level of appreciation of the exchange rate since. The second gross generalization is that real exchange rates tend to appreciate gradually and with abrupt reversions. The time periods between corrections vary by country with some lasting a few years. Thus it is important to insure that the estimation period includes at least a complete cycle.

For most of the countries in the sample, pass-through was less than one indicating that domestic basket of goods lost value compared to the international basket when measured in a common currency. Only the Dominican Republic, El Salvador and Venezuela observed sustained appreciations of their currency during this time period. Real exchange rate plots in the appendix corroborate the regression results. The overall depreciation can be explained because of the large unsustainable collective appreciation leading up to the debt crisis, or to any of the structural arguments put forth above. However, as the plots show and as the regression results argue below post stabilization performance has been dominated by a “catch up” reflected in sustained albeit gradual real appreciations.

Table 2 shows pass-through coefficients using the same methodology splitting the time period into two, from 1980-90 and from 1990-2000.¹⁸ Ideally, one would like to choose the time periods individually for each country to insure that a complete appreciation and reversal cycle was included. For uniformity, a decade was deemed long enough.

Estimates are more dispersed than in the 1980-00 regressions and there is heterogeneity in the point estimates both within and across countries. The average standard error of the 1980s and the 1990s is five and ten times larger than in the 20-year regression respectively. Econometrically, the cutting the time period in half had a strong detrimental effect on the precision of the estimates. Economically, the larger standard error in the 1990s implies that the variance of the real exchange rates increased. On one hand, the result is counterintuitive given the number of countries that implemented price stabilization plans. On the other it implies that pure monetary disturbances, which are the only ones for which PPP hold with less restrictions, played a smaller role in the 1990s.

	1980-90		1990-2000	
	Coefficient	Standard Error	Coefficient	Standard Error
Bolivia	0.95	0.01	0.92	0.55
Brazil	0.82	0.05	0.92	0.04
Chile	0.64	0.03	1.27	0.30
Colombia	0.72	0.12	1.10	2.20
Costa Rica	1.09	0.08	1.19	0.52
Dominican Republic	1.34	0.18	1.35	0.16
Ecuador	1.16	0.15	1.20	0.04
El Salvador	1.30	0.17	4.08	1.75
Guatemala	0.71	0.02	1.01	0.13
Honduras	1.67	0.28	1.08	0.05
Mexico	0.93	0.01	0.94	0.02
Nicaragua	0.72	0.12	0.48	0.52
Paraguay	0.69	0.04	0.71	0.11
Peru	1.19	1.16	0.49	0.30
Uruguay	0.91	0.10	1.10	0.23
Venezuela	0.44	0.09	1.20	0.02
Average*	0.97	0.16	0.95	0.34

*Not including El Salvador
Nicaragua since 1992

Surprisingly, even for as long a time period as a decade, pass-through coefficients are quite different from one. Looking at the evidence across countries, only Colombia in the first

¹⁸ It is reassuring to know that the estimates of pass-through obtained here coincide with estimates elsewhere in the literature. Hausman, Panizza, and Stein (2000) find estimates of pass-through for Colombia, Mexico, and Peru that are remarkably close and estimates for Paraguay and Guatemala which are within 10 percent. More over, the Mexican estimate is consistent with an exercise performed by Garce-Diaz when the same time period was used.

decade is consistent with PPP.¹⁹ During the 1990s, seven countries are consistent with PPP: Bolivia, Chile, Colombia, Costa Rica, Guatemala, Nicaragua, and Uruguay while Brazil and Mexico have point estimates that are close to one. However, in half of the sample, the point estimates differ from one by more 20%. Had there not been convergence to one in the 20-year sample, the evidence would be interpreted as simply another example that PPP does not hold. However, the given the 20-year result, the dispersion decade results combined with the speed of adjustment discussion below indicate that temporary deviations from the long run relationship between the domestic and the international price can take a long time.

For within country estimates, four countries in the sample have statistically different pass-through estimates between the 1980s and the 1990s: Chile, Venezuela, Guatemala, El Salvador, and Honduras. For the first three the pattern follows a deep depreciation in the aftermath of the debt crisis and a sustained recovery in the 1990s. The rest of the countries have estimates that are not statistically different from each other. The result could mean stability in the exchange real exchange rate but as the plots in the Appendix show, most of the time it simply means that the reversal took place within the estimation period, as in Mexico.

The results for Mexico and Brazil present an interesting contrast. Mexico exhibited a constant coefficient in both decades that is close to one. Brazil's pass-through estimate increased from 0.82 to 0.92 reaching a level similar to Mexico's despite drastically different measures of openness. Part of the explanation is that although both countries had important departures from PPP, the reversals occurred within a decade making the pass-through estimate converge. Furthermore, pass-through estimates remained constant despite the fact that the inflation average was substantially different between countries and decades indicating that inflation does not affect the degree of pass-through into domestic prices although as argued before and documented below, it may affect the speed of adjustment.

The results for the Central American Countries are a puzzle. Pass-through estimates deviate wildly from PPP. On one hand, this is not what one would expect from small countries with most of their trade with the United States. On the other, most of these countries are primary commodity producing countries subject to large TOT shocks and restricted access to capital markets to smooth out the shocks. In addition, their tradable sector is small making the transmission channel into domestic prices small.

Table 3 shows "half-life" duration of shocks. i.e. how long does it take for a the domestic price level to absorb half of the shock. The adjustment process slowed down in the 1990s compared to the 1980s. The average half-life increased from 21 months to 35 months. As argued in section 2, higher rates of inflation are associated with more frequent price changes and the average inflation rate in the region during the 1980s was higher.

¹⁹ Although Costa Rica, Ecuador and Peru 95 percent confidence intervals are within 0.01 of including the PPP benchmark value of 1.

	1980s	1990s
Bolivia	9	34
Brazil	19	14
Chile	13	48
Colombia	30	85
Costa Rica	11	69
Dominican Republic	46	24
Ecuador	30	69
El Salvador	80	73
Guatemala	14	17
Honduras	100	80
Mexico	13	22
Nicaragua	25	10
Paraguay	17	23
Peru	4	5
Uruguay	34	23
Venezuela	19	75
Region Average ²⁰	21	35

Table 4 alternate presentation shows the tremendous heterogeneity in the estimates of the speed of adjustment. On one hand, in Peru half of the shock is transmitted in to the domestic price level in four or five months while in Honduras it takes eight years! Although not entirely convincing, the results are consistent with other results in the literature.²¹ Nevertheless, an avenue for further research is to refine the estimation process and investigate if the speed of adjustment results is robust because the cross-country results are not intuitive. For example, Peru’s quick translation of exchange rate movements into the domestic price level is contrasted with Bolivia’s 2-3 years half-life despite the fact that both countries have a similar degree of openness, level of inflation in the 1990s and, as will be discussed below, similar dollarization rations. The main difference could only be explained by the fact the end of the hyperinflation in Peru came in 1992 in contrast with Bolivia, which came in 1986, and the dollar indexation memory in Peru has maintained a quick transmission mechanism. If that were the case one would expect the speed of adjustment in Peru to fall in the future.

²⁰ The average excludes El Salvador and Honduras.

²¹ Housman et al (2000) estimated half-lives that were consistent with those estimated here for the countries that overlapped. For example, they found that in Germany, the half-life was 130 months. Over 10 years long.

<i>Pass-through half-life</i>	<i>1980s</i>	<i>1990s</i>
Less than 6 months	Peru	Peru
6 months-year	Bolivia, Costa Rica	Nicaragua
1-2 years	Brazil, Chile, Guatemala, Mexico, Paraguay, Venezuela	Brazil, Dominican Republic, Guatemala, Mexico, Nicaragua, Paraguay, Uruguay
2-3 years	Colombia, Ecuador, Nicaragua, Uruguay	Bolivia
More than 3 years	Dominican Republic, El Salvador, Honduras	Chile, Colombia, Costa Rica, Ecuador, El Salvador, Honduras, Venezuela

Once again the Central American Countries present a puzzle. On one hand Guatemala, and Nicaragua have half-lives between 1-2 years. On the other, Costa Rica, El Salvador and Honduras have half-lives of over three years. A possible explanation is that most disturbances to the price level are not monetary but due to TOT shocks.

Exchange Rate Pass-through and Dollarization Within and Across Countries

Figures 1 a) and b) present plots for the degree of dollarization in 11 countries in Latin America. For expositional purposes only, the sample was divided into high and low dollarization countries. In one end, Bolivia and Uruguay exhibit dollarization ratios of over 80% by the end of the decade. Peru and Nicaragua increased their dollarization ratio from about around 30% in 1990 to about 70% by the end of the decade. And on the other end, Mexico and other Central American countries had low fairly constant dollarization ratios while Brazil and Venezuela have a zero degree of dollarization by this definition.

Modeling the driving forces behind dollarization is left as a future venue of research but there are two casual observations: (i) The degree of dollarization presents a high degree of stationarity, and apparent irreversibility. Only Mexico and Chile exhibit sustained reductions in the dollarization ratio, albeit small declines at low levels. Thus, once a country's banking or monetary aggregates become dollarized, it appears to be difficult to reverse the dollarization process. It may be that authorities have not actively tried to reverse the situation but if they have, efforts have been unsuccessful. (ii) Dollarization appears to increase as a result of extreme price stability and a stabilization program that liberalized the financial sector enough to permit savings in dollars. Unfortunately, the data for Bolivia was not available since 1986 when dollar bank accounts were first allowed but the fact remains that by 1990 the dollarization ratio was 80%. Moreover, the pattern in the early 1990s for Peru suggests that dollarization increases after extreme price stability but after liberalization in the financial sector. Ecuador's meteoric rise since the middle 1990s also arises from the instability in the price level at first and then because of the deliberate move towards dollarization. It is interesting that the as of 1999 there were still a

significant proportion of savings in the domestic currency. The rise in dollarization ratio in Paraguay coincides first with the opening of the capital account and the financial sector, and second with the loss in price stability and banking failures.

Figure 1a: Low Dollarization Latin American Economies

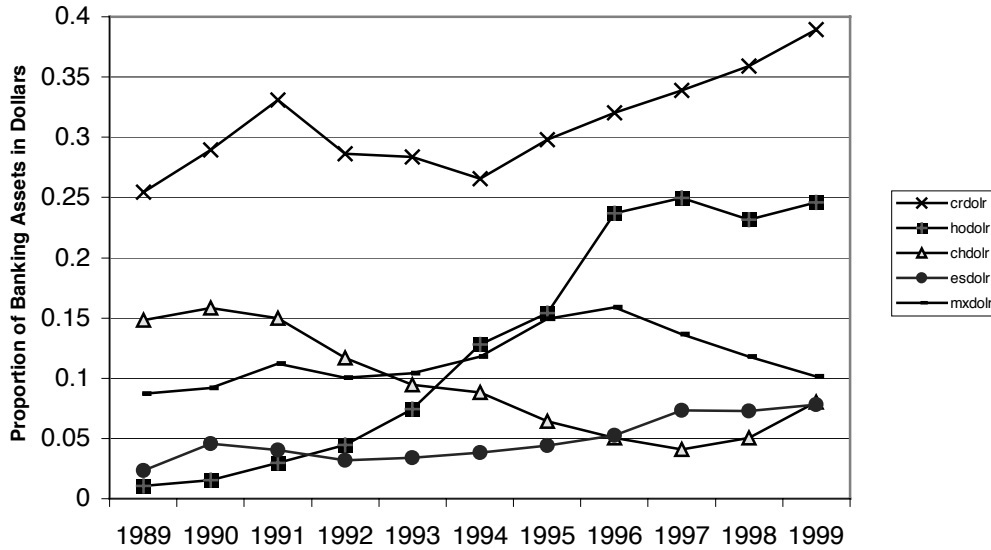


Figure1b: Highly Dollarized Latin American Economies

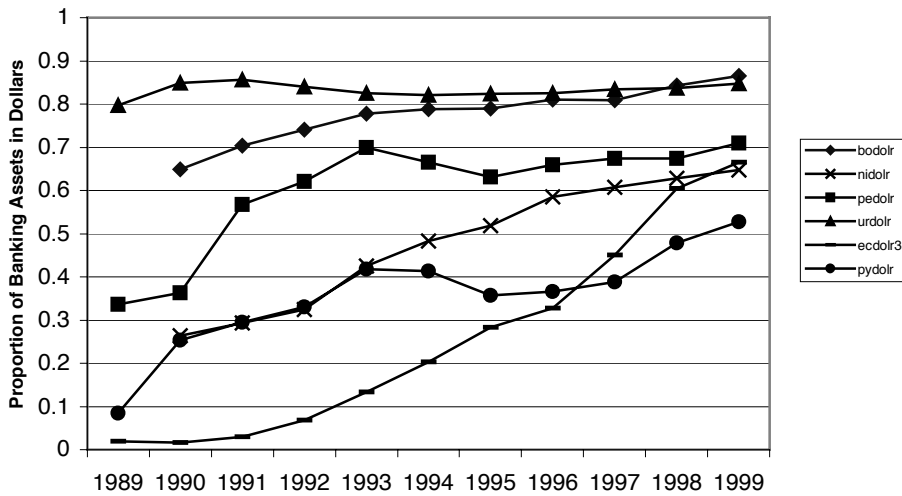
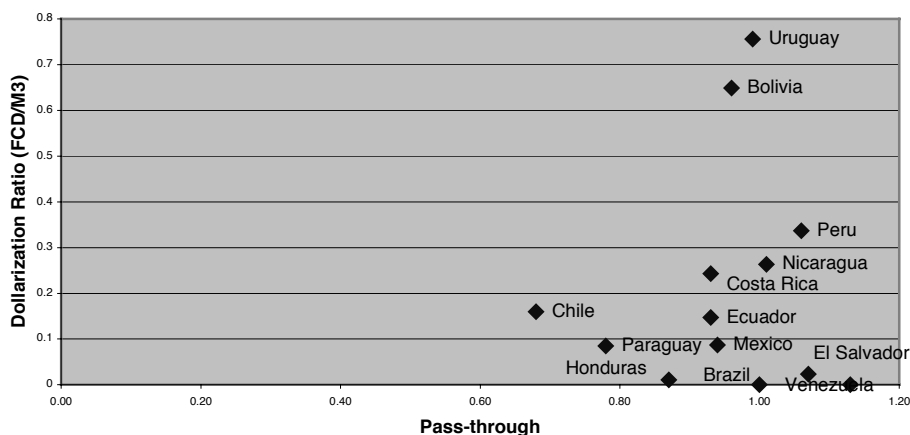


Figure 2 shows long run exchange rate pass-through from 1980-00 vs the dollarization ratio in 1990, the middle of the period. As discussed above, long run pass-through tends to center around one and from the plot the degree of pass-through appears to be independent of the degree of dollarization. There appears to be more pass-through variance in countries with lower dollarization ratios but that may be due to the fact the country sample has few highly dollarized economies at the beginning of the 1990s.

Figure 2: Exchange Rate Pass-through 1980-00 vs Dollarization Ratio



Figures 3a,b present estimates of pass-through in the 1980s and in the 1990s vs the dollarization ratio at the beginning and at the end of the decade respectively. In both time periods the relationship between dollarization and pass-through is not significant. During the 1980s, there is no obvious pattern. During the 1990s, if anything the plot suggests a negative relationship between pass-through and dollarization because highly dollarized economies tended to have lower pass-through. Moreover, the dollarization ratio explains very little of the variance of pass-through evidence by low R-squared. The plots suggest that the degree of dollarization as measured here does not play a significant role in the transmission mechanism of nominal exchange rate fluctuations into the price level; i.e. dollarization as conventionally measured is not the same as the dollar indexation phenomenon which occurred in many of these countries during high inflation.

Figure 3a: Pass-through 1980-90 vs Dollarization Ratio (1990)

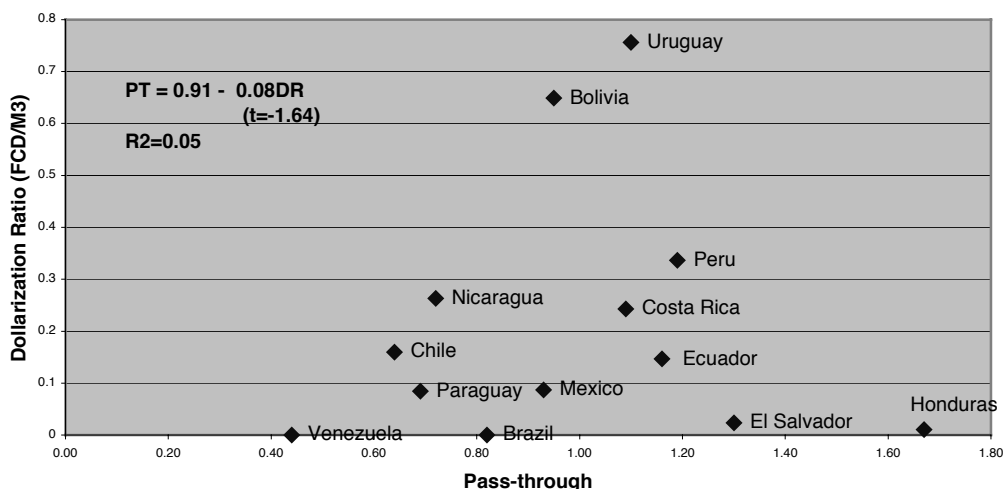
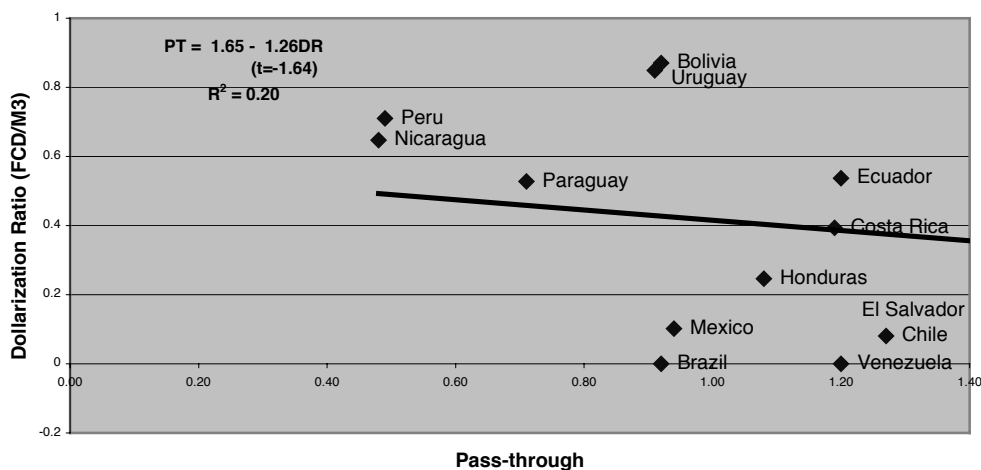


Figure 3b: Pass-through 1990-00 vs. Dollarization Ratio 2000



In short, in countries with a higher degree of dollarization a nominal devaluation does not necessarily translate more fully into an increase in the price level. Therefore, a more dollarized economy does not have a lesser ability to adjust its exchange rate through nominal devaluations than a less dollarized economy. The important question is whether as a country becomes increasingly dollarized, does exchange rate pass-through increase and the authorities lose their ability to adjust the real exchange rate through nominal exchange rate devaluations? The answer cannot be derived from the plots but it will be dealt with in the regression analysis.

Figures 4a,b shows a plot of the speed of adjustment vs the dollarization ratio. The relationship is positive but, not significant.²² Again, the dollarization ratio explains a small fraction of the variance of the speed of adjustment. The bi-polar distribution of the speed of adjustment is odd and as discussed before the slow speed of adjustment for Central American Countries is a puzzle. Brazil and Mexico are notable outliers with quick responses and low dollarization ratios. The explanation, particularly for Mexico, could be that the degree of dollarization measured here understates the prevalence of dollar indexation, which arises because of strong links with, and the fact that anecdotal evidence suggests that many citizens hold accounts in the United States. The faster speed of adjustment means that nominal disturbances are shorter lived, but not that they are different in magnitude.

²² The negative slopes indicate that a higher dollarization ratio is (weakly) correlated with a faster speed of adjustment.

Figure 4a: Speed of Adjustment 1980-90 and the Dollarization Ratio

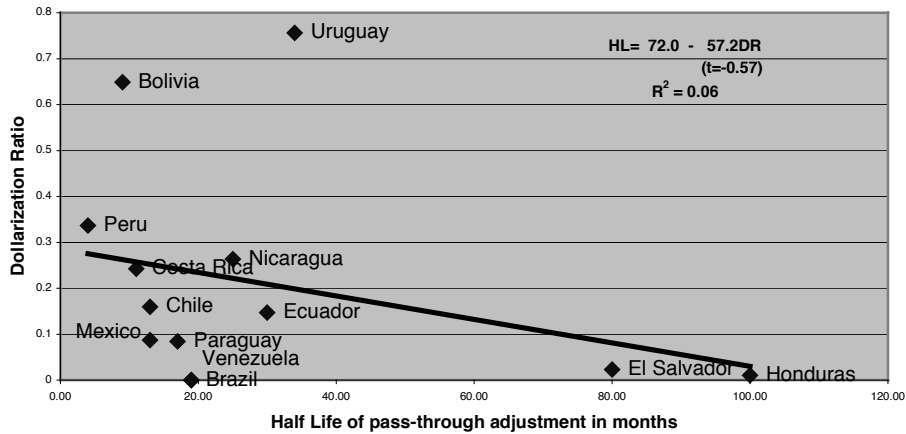
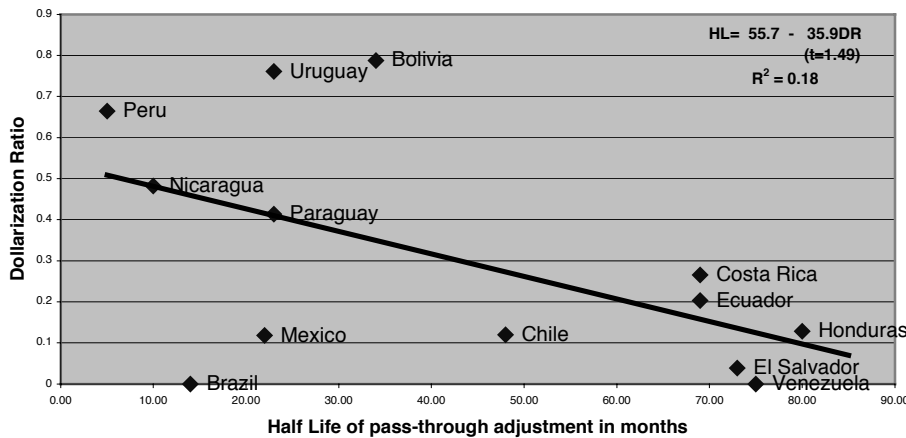


Figure 4b: Speed of Adjustment 1990-00 and the Dollarization Ratio



A Simple Panel Regression Analysis

I constructed yearly pass-through coefficients with a geometric distributed lag/Vector Auto Regression with one lag. This technique was chosen over an error correction vector because the time period is too short to assume cointegration. Using a VAR permits ignoring the other factors that affect the domestic price level without creating an omitted variable bias.

The price setting process for each country is given by:

$$p_{i,t} = \lambda_i + \phi_i \sum_{j=0}^{\infty} \delta_i^j f_{i,t-j} + \varepsilon_{i,t} \quad (4)$$

where $1 - \delta_i$ is the factor by which the impact of an exchange rate (international price) shock diminishes every month. I follow the standard procedure to estimate these types of equations to obtain:²³

$$p_{it} = \alpha_i + \phi_i f_{i,t} + \delta_i p_{i,t-1} + v_{it} \quad (5)$$

where

$$\alpha_i = \lambda_i (1 - \delta_i) \quad \text{and} \quad v_{it} = \varepsilon_{it} - \delta \varepsilon_{it}$$

I estimated equation 5 for each country between 1990-00 to obtain 10 yearly pass-through coefficients for each of the 11 countries. The pass-through coefficients from equation 5 can be interpreted as the effects of a nominal exchange rate fluctuation on the domestic price level in any given year. The coefficient is not the long-run relationship of the domestic and the international price levels but the yearly contemporary effect. Therefore, to some degree the yearly pass-through coefficient embodies both the level and the speed of adjustment; i.e. a country with high pass-through but a slow speed of adjustment will be estimated as having a low coefficient.

The conceptual discussion and the graphical discussion above suggested that exchange rate pass-through could depend on the degree of dollar indexation (measure by the dollarization ratio), and the level of inflation. Therefore, the next step was to use the estimated exchange rate pass-through coefficients from equation 5 as dependent variables to construct a balanced panel of 11 countries for 10 years from 1990-2000 resulting in a total of 109 observations. The panel regression took the form

$$\phi_{i,t} = \mu_i + \beta_{i,t} Dollr_{i,t} + \theta_i \pi_{i,t} + \zeta_{i,t} \quad (6)$$

where $Dollr_{i,t}$ and $\pi_{i,t}$ are the yearly dollarization ratios and the inflation rates respectively.

Table 5 presents the pooled and within estimators of the panel regression. The pooled, cross-country results corroborate the plots in Figures 3 and 4 a) and b). There is no significant relationship between dollarization and exchange rate pass-through across countries. With and without yearly inflation the coefficient is positive but insignificant. Thus, countries with a higher degree of dollarization do not necessarily have a higher pass-through and they can still influence their real exchange rate through nominal devaluations.

The discussion suggested that inflation should increase the speed of adjustment and thus the yearly pass-through coefficients. With more frequent price revisions, higher inflation would be expected to be associated with a faster speed of adjustment of the domestic price level to nominal exchange rate shocks. However, the point estimate was negative although insignificant. As a whole the both of the explanatory variables explain only a fifth of the variance of the pass-through coefficients indicating that there are other more important variables.

²³ One multiplies an expression for $p_{i,t-1}$ times δ and subtracts it from the $p_{i,t}$ expression. In the resulting equation I ignored the second-order term.

Table 5: Panel Regressions of Yearly Pass-through				
<i>Pooled Results</i>				
	Dollarization	Inflation	R-sq	Obs#
	0.199 (1.27)	-1.53 (2.12)	0.19	99
	0.050 (1.22)		0.18	99
<i>Within Estimators: R-squared=0.36</i>				
Bolivia	-0.55 (2.99)	10.6 (14.4)		
Costa Rica	-4.32 (3.9)	4.10 (12.7)		
Ecuador	-2.87 (2.34)	-11.9 (26.0)		
El Salvador	-8.8* (2.9)	6.82 (5.5)		
Honduras	4.54 (3.36)	-4.2 (3.8)		
Mexico	0.20 (1.6)	-2.1 (1.6)		
Nicaragua	0.72 (0.87)	-0.18 (.92)		
Paraguay	0.62 (4.21)	1.37 (8.7)		
Peru	-0.92 (1.48)	11.7 (11.4)		
Uruguay	10.2 (12.8)	2.82 (8.21)		
Standard Errors in Parenthesis				

The within-country dollarization estimators similarly present ambiguous results. Except for El Salvador, all of the coefficients are insignificant at the 95 confidence level. For half of the countries, greater dollarization is associated with a lower pass-through: Bolivia, Costa Rica, Ecuador, El Salvador, and Peru. For the other half, increased dollarization is associated with higher pass-through supporting the higher dollarization increased dollar indexation hypothesis: Honduras, Mexico, Nicaragua, Paraguay, and Uruguay.

The ambiguity of the within estimates indicate that as a country becomes more dollarized pass-through does not increase and thus it does not systematically lose its ability to adjust its real exchange rate through nominal devaluations.

The within country inflation results also yield insignificant coefficients. Six of the ten countries have positive coefficients (Bolivia, Costa Rica, El Salvador, Paraguay, Peru, and Uruguay) giving support to the higher inflation implies higher dollar indexation hypothesis. But there are four with a negative relationship (Ecuador and Honduras, Nicaragua and Mexico). The drawback of only having dollarization data for the 1990s is that most of the countries in the

sample were not experiencing high inflations. The ambiguous results suggest that for moderate levels of inflation, dollar indexation does not play a major role. However, one cannot reject the hypothesis that for high levels of inflation, the mechanism does not play a more prominent role.

This is a case where the lack of a relationship is an important result. It would have been surprising to find a significant relation in the regression analysis after the graphical motivation presented before. The evidence suggests that the degree to which nominal exchange rate movements translate into proportional fluctuations in the domestic price level is independent of the dollarization ratio and the inflation level for moderate levels of inflation.

4. Conclusions

The purpose of this paper was to test if the “conventional wisdom” belief that as a country became more dollarized nominal exchange rate devaluations translated more fully and faster into increases in the domestic price level. The question was important for partially dollarized economies because the answer would shed light on their ability to influence the real exchange rate through the nominal exchange rate fluctuations.

The work finds no relationship between dollarization and the degree of pass-through of the nominal exchange rate into domestic inflation for a wide sample of Latin American countries. I use the ratio of dollar deposits in the banking system as a measure of dollarization, and an ECM to estimate exchange rate pass-through. The relationship is ambiguous both in the 1980s and in the 1990s. In a simple regression analysis, yearly pass-through coefficients were constructed to create a panel regression of pass-through on dollarization and inflation. The cross country coefficient was positive but insignificant indicating. Similarly, the cross-country inflation coefficient was also negative and insignificant. Within estimates were always insignificant and split between positive and negative.

The plots and the panel results point towards two important results: (i) A higher degree of dollarization between countries does not lead higher pass-through. Therefore, more dollarized economies do not necessarily have a lesser ability to influence their real exchange rate through nominal exchange rate movements. (ii) Within the same country, an increase in dollarization does not hinder a country’s ability to adjust its exchange rate through nominal fluctuations. Higher dollarization does not necessarily mean higher dollar indexation as commonly believed. The determination of the price index is not determined by the unit of accounting but by internal market conditions. Perhaps the reason the belief has perpetrated is because there is no good measure of dollar indexation.

The paper finds a more consistent although not statistically significant positive relationship between dollarization and the speed of adjustment. In more dollarized economies, the domestic price level tends to adjust faster to nominal exchange rate fluctuations even though as discussed above, the magnitude of the pass-through is unaffected by the degree of dollarization; i.e. the faster speed of adjustment means that nominal disturbances are shorter lived, but not that they are different in magnitude.

In the course of the estimation process, I found that for many Latin American countries in the very long run (20 years), pass-through is close to one implying that PPP is not a bad benchmark in the determination of the real and therefore the nominal exchange rate. Nevertheless, there have been pronounced and long lived deviations from any this arbitrarily chosen 20-year average. Surprisingly, decade long pass-through can be different from one and different from decade to decade for some of these countries corroborating that the deviations from the “stable long-term” relationship between the domestic and the international price indexes can be substantial in magnitude and duration. The fact that PPP is a good benchmark simply states that in the aggregate, the structural disturbances canceled each other out not that PPP was a dominant force.

There are two venues for further research on this topic. (i) Formalizing exchange rate pass-through in an economy where agents’ savings are in dollars. Thus the substitution effects of a nominal devaluation are as in the standard model but the income effects of a devaluation work in the opposite direction. (ii) Expand the empirical effort to use tradable and non tradable price indexes, and include other variables suggested by the theory to explain pass-through both within and across countries.

BIBLIOGRAPHY (particularly incomplete)

Baldwin, Richard, "Hysterisis in Import Prices: The Beachhead Effect," *The American Economic Review*, September 1988, Vol 78, 773-785

--- "Some Empirical Evidence on Hysterisis in Aggregate U.S. Import Prices," NBER Working Paper 2483, Jan 1988

--- and Krugman Paul, "The Persistence of the U.S. Trade Deficit," *Brookings Papers on Economic Activity*, 1:1987, 1-55

--- and Krugman Paul, "Persistent Trade Effects of Large Exchange Rate Shocks," *Quarterly Journal of Economics*, November 1989, Vol 104, 635-654

Córdoba, José, "Diez Lecciones de la reforma económica de México," Presentado en el Banco Europeo de Reconstrucción y Desarrollo, y publicado en *Nexos* (1991).

Dornbusch, R. "Purchasing Power Parity" *The New Palgrave: A Dictionary of Economics* (New York: Stockton Press, 1988) as reproduced in *Dornbusch Exchange Rates and Inflation*, MIT Press, Cambridge MA.

----- "Exchange Rates and Prices" *American Economic Review*, vol 77, no. 1 (March 1987), pp. 93-106. As reproduced in *Dornbusch Exchange Rates and Inflation*, MIT Press, Cambridge MA.

--- with Fischer S., and Samuelson P., "Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods." *American Economic Review*, Vol 67, No5, December 1977.

Froot, K., and Klemperer, Paul., "Exchange Rate Pass-through when Market Share Matters" *The American Economic Review*, September 1989, Vol 79. 637-654

Gonzalez, Jose Antonio "Regímenes Comerciales y el traspaso del tipo de cambio: Hay un enigma Mexicano? *El Trimestre Económico*, Enero-Marzo 1998, Vol 65, No 257.

Hausmann, R., Panizza U., and Stein E., "Why do Countries Float the Way They Float?" Research Department, Interamerican Development Bank, March 2000.

Garcés-Díaz Daniel (1999) *Determinacion del Nivel de Precios y la Dinámica Inflacionari en México*, Banco de Mexico, Documento de Investigacion Económica.

Knetter, M., "Price Discriminaion by U.S. and German Exporters," *The American Economic Review*, March 1989, Vol 79, 198-210.

---- "International Comparisons of Pricing-to-Market Behavior," *The American Economic Review*, Jun 1993, Vol 83, 473-486.

---- “Exchange Rates and Corporate Pricing Strategies,” NBER Working Paper #4151, August 1992.

Krugman, P “Pricing to Market when Exchange Rate Matters” NBER Working Paper No 1926, May.

Okun, A., “Prices and Quantities, Brookings (as cited in Dornbusch a)

Vegh, Carlos A. “Stopping High Inflation: An Analytical Overview: in Great Inflation of the 20th Century: Theories, Policies and Evidence, Sklos, Pierre editor. Aldershot, U.K. and Brookfield, Vt.