THE LATIN AMERICAN DOLLAR STANDARD IN THE POST-CRISIS ERA

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ABSTRACT

This paper examines the extent to which there is currently a "dollar standard" in Latin America by empirically looking at the time series relationships between local currencies and the major global currencies using daily data over the period 2003-2006. The results indicate that three countries in the Andes – Ecuador (which is officially dollarized), Bolivia, and Peru – are on practically perfect dollar standards and might find additional financial integration fairly practicable. Four more countries – Guyana, Uruguay, Argentina, and Paraguay – are nearly on a dollar standard and might easily move closer to dollarization. Guyana, Uruguay, and Paraguay have economies substantially smaller than that of Ecuador, which has already officially dollarized, and might find similar full dollarization relatively easy. Argentina, although having abandoned its currency board mechanism, seems to be engineering (or at least allowing) a persistent, though imperfect, link to the dollar. Mexico and Colombia are on a partial dollar standard, but exhibit influence from other currencies as well (the yen and the pound for Mexico, and the yen and the euro for Colombia). Four additional currencies investigated – Chile, Brazil, Canada, and Venezuela – are further from a dollar standard but are certainly not completely independent of the dollar either.

Introduction

Monetary integration has been the subject of considerable attention over the past few decades. European monetary integration has been the primary focus, as studies proliferated before, during, and after the creation of the euro. Asian monetary integration has been discussed more recently at both the policy level and in the academic literature. West African and Southern African states have been examining the possibility of adopting common currencies, and six Middle Eastern oil-producing countries are moving toward a currency union. By contrast, Latin American monetary integration is a relatively new area of consideration, although is related to several strands of research on monetary policy in the region.

This paper examines monetary integration in Latin America specifically by considering the role of the U.S. dollar in the region. In contrast to Europe, where integration was a multilateral effort culminating in the creation of a supranational currency, Latin American monetary integration is more likely occurring through a back-door method in which separate countries explicitly or implicitly adopt a dollar standard limiting domestic monetary policy.

The presumption that multilateral efforts to promote monetary integration in Latin America are irrelevant *is* somewhat debatable. Mercosur (consisting of Argentina, Brazil, Paraguay, Uruguay, and, since July 2006, Venezuela) has occasionally expressed an interest in monetary unification and its own common currency, and the issue has received academic attention (e.g., see Eichengreen, 1998).[1] Similarly, the Cartegena

[1] Eichengreen (1998) finds that Mercosur countries (without Venezuela) had unusually variable exchange rates and discusses the need to reduce exchange rate variability in the

Agreement establishing the Andean Community (consisting of Bolivia, Colombia, Ecuador, Peru, and Venezuela) calls for "harmonization of exchange rate, monetary, financial and fiscal policies." In reality, neither Mercosur nor the Andean Community has made any real progress toward monetary integration.

Very little academic work has broadly examined monetary integration throughout Latin America. One exception is Larraín and Tavares (2003), which studies the Mercosur and Andean countries plus Chile and Mexico and concludes that Latin America displays a low level of regional integration relative to bilateral levels of integration with the U.S. The implication of this is that adoption of the U.S. dollar is more appropriate than creation of a regional currency. We thus take this as a point of departure for our current investigation.

This paper considers all of the countries of Mercosur and the Andean Community, and more, but considers them separately and only considers whether they are close to a dollar standard. The focus is mainly on the countries in South America, plus Mexico, during a post-crisis era from January 1, 2003 through December 31, 2006 in order to investigate the current situation. This period is important because the major crises associated with Latin America were largely finished by the end of 2002. Argentina surrendered its 1:1 fixed exchange rate peg to the dollar and defaulted on its sovereign debt during the first half of 2002. These problems spilled over to Uruguay, and the

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region. However, he also firmly asserts that a dollar standard would not be feasible: "Pegging each of the Mercosur currencies to a common external numeraire like the U.S. dollar is an extremely indirect way of solving the problem of intra-Mercosur exchange-rate variability. It forecloses not just intra-Mercosur exchange rate changes as an instrument of adjustment but also, in effect, changes in the exchange rate vis-à-vis the rest of the world. This is such a Byzantine solution to Mercosur's exchange rate problem that we can safely ignore it (p. 24)."

government floated the Uruguayan peso in June. By August, Uruguay received a rescue package from the IMF to stabilize its financial situation. Hence, we begin our study in January 2003, by which time the major elements of crisis were over.[2] The choice of countries is driven partially by the availability of daily data in Datastream for the period from January 1, 2003 through December 31, 2006. All countries on the South American continent have data available except Suriname.[3] Data for Central American and Caribbean countries are not available for the entire time period so are unfortunately excluded from the analysis.

Canada is included in the empirical analysis as an additional benchmark for comparison. Monetary integration in North America has occasionally been the subject of attention. For example, Chriszt (2000) examines the pros and cons of monetary unification (including dollarization) in North America, and finds that "Canada appears much more suited for joining the United States in a single currency arrangement than does Mexico (p. 29)." Similarly, Buiter (1999) addresses North American Monetary Union (NAMU) particularly by considering the pros and cons for Canada of monetary union between Canada and the U.S. He finds that the economic arguments do favor a symmetric monetary union between Canada and the U.S., although the political arguments against monetary union are overwhelming. On the other hand, Mundell (2000) recommends dollarization for Canada, to capture the benefits of having the same money as the U.S. "Trade between Canada and the United States would soar and Canada's standard of living would converge toward that of the United States (p. 15)."

[2] Note that we avoid the question as to whether there is ever really a post-crisis era in Latin America.
[3] Additionally, French Guiana is part of France and its currency is thus the euro.

Mundell (2000) also points out that, “The case for dollarization rests not just on the gains from monetary integration but also on the fact that American monetary policy is better than Canada’s (p.15).” Because this debate is germane for the discussion of a Latin American dollar standard, Canada appears in our analysis as an honorary Latin American country.

Once more than one country adopts a pure dollar standard, exchange rates between the countries are fixed and monetary policies are de facto integrated. This paper thus addresses the question, “to what extent is there monetary integration in Latin America?” by examining the behavior of exchange rates in the region. More directly, we ask whether there is a “dollar standard” in Latin America by looking at the time series relationships between local currencies and the major global currencies.

The empirical approach to this question is not entirely new, as some authors have considered monetary integration in Asia using insights adopted in this paper. For example, Frankel and Wei (1994) and McKinnon and Schnabl (2004) use regression analysis to detect the influence of various foreign currencies on particular Asian currencies. This paper seeks to apply the same inquiry to Latin America – and, to the author’s knowledge, is the first paper to do so. In addition, the paper considers modern time series analysis more seriously, although the most appropriate analysis turns out to be the simplest regression approach.

The empirical results suggest that there are three categories of countries for a Latin American dollar standard. Three countries – Ecuador, Bolivia, and Peru – are on a practically perfect dollar standard. Four more countries – Guyana, Uruguay, Argentina, and Paraguay – are nearly on a dollar standard. Two countries -- Mexico and Colombia -

- are on a partial dollar standard, but exhibit influence from other currencies as well (the yen and the pound for Mexico, and the yen and the euro for Colombia). Four additional countries investigated – Chile, Brazil, Canada, and Venezuela – are further from a dollar standard but are certainly not completely independent of the dollar either.

This paper is organized into four sections. After this introduction, the second section provides a concise discussion of the issues drawing on the existing literature. The third section then presents the empirical analysis, including discussion of the methodology and the results of the investigation. The final section offers concluding remarks.

Discussion of the Issue

Two areas of the literature on monetary policy have a direct relationship to the investigation of whether there is a "dollar standard" in Latin America. The topic is usually considered within the contexts of optimum currency areas and dollarization, both of which are considered below.

Optimum Currency Areas and Anchor Currencies

The subject of monetary integration in Latin America is part of the larger topic of optimum currency areas, as monetary integration might be a direct consequence of being an optimal currency area. This paper does not address the question of whether Latin America is an optimal currency area, but instead has a more modest objective of simply determining the extent of monetary integration in Latin America by examining the behavior of exchange rates. For an overview of research on whether Latin America is an optimum currency area based on the traditional Mundell (1961) criteria, see Temprano-Arroyo (2003). Moreover, see Larraín and Tavares (2003) for investigation of the issue as to whether Latin America is an optimum currency area in itself or part of an optimum currency area with the U.S.

As an extension of the traditional optimum currency area literature, recent research has reconsidered optimum currency areas within the context of anchor currencies. Alesina, Barro, and Tenreyro (2003) investigate optimal currency areas by identifying countries that would logically be anchored to the dollar, the euro, or the yen. The empirical analysis focuses on data for three factors over the period 1960-1997: trade intensity with respect to GDP; inflation and price co-movements; and output co-movements. With respect to Latin American countries, they suggest that there is a "fairly clear dollar area including Canada, Mexico, most of Central America, and parts of South America (excluding Argentina and Brazil) (p. 332)".[4]

A brief summary of results in Alesina, Barro, and Tenreyro (2003) for Canada, Mexico, and South American countries (which constitute the countries examined later in this paper) is presented in Table 1. Canada is extremely tied to the U.S. in all three dimensions, and the Canadian dollar would thus be logically anchored to the U.S. dollar. Mexico is quite close to the U.S. based on strong values for trade share and comovement of prices, but not with respect to comovement of output (which is much weaker anyway). Argentina is likely part of the euro bloc based on all three dimensions, though Alesina, Barro, and Tenreyro point out that "Argentina has been largely closed to international trade, and its output and price co-movements are not high with any of the three potential

[4] They also suggest that the dollar zone includes some Asian countries, such as Hong Kong and Singapore.

anchors (p. 331)." As a result, "Argentina does not appear to be an obvious member of a currency union with the euro or the U.S. dollar." Alesina, Barro, and Tenreyro (2003) also suggest that Brazil is likely part of a euro bloc by virtue of its high comovement of output with the European countries, although its trade and price comovements are marginally higher with the U.S. The only other country receiving definitive attention is Ecuador, which Alesina, Barro, and Tenreyro point out is much closer to the dollar than the euro. Based on the summary table, the same might be said about Guyana, Venezuela, and Bolivia. Alesina, Barro, and Tenreyro (2003) also note that Chile and Uruguay have higher exports to Europe, but larger co-movements with the U.S., so choice of anchor is not clear.

Official and Financial Dollarization

In addition to considering the choice of an anchor currency based on fundamental factors (such as the trade intensity, price and inflation comovements, and output comovements), a second perspective begins with the premise that the dollar is the most important global currency, and has been for a long time.[5] As such, it is the most attractive substitute for local currencies when they become dysfunctional. As currency substitution progresses, references to "dollarization" increase. The term "dollarization" can mean anything from, at one extreme, official adoption of the U.S. dollar by the sovereign government, to unofficial use of the dollar within the economy.

[5] A survey of currency trading in April 2004 by the Bank for International Settlements (2005) revealed that the U.S. dollar is used in 89% of global currency trades, while the euro is used in 37%, the yen is used in 20%, the pound is used in 17%, and the Swiss franc is used in 6%. Because two currencies are used in each transaction, percentages sum to 200%. Hence, the dollar is used in nearly 45% of all foreign exchange transactions, and is the clear leader among global currencies.

Historically, the U.S. dollar has been very important in the economies of Latin America. High inflation and political risk have caused many people in Latin America to hold dollars instead of local currencies, and in some countries the dollar is even a regular medium of exchange. The choice of the dollar is likely due not only to the dollar's role as the pre-eminent global currency, but also to the geographic proximity of Latin America to the U.S. relative to Europe or Japan.

Ecuador presents a case of the most extreme dollarization. In 2000, the government officially adopted the U.S. dollar and withdrew the local currency, the sucre, from circulation as a response to an ongoing economic crisis (including a banking crisis) and hyperinflation. Dollarization brought major benefits in terms of stabilizing prices, and by most accounts contributed to growth. This official dollarization has been maintained, making Ecuador the poster child for the dollar standard in Latin America.[6] The Central Bank of Ecuador maintains some monetary functions, but has clearly given up monetary policy in the traditional sense. The primary functions of the Central Bank are: to administer provision of U.S. dollar notes; to manage reserves that back coins in circulation, bonds issued by the central bank, and government and multilateral deposits; to maintain a reserve to provide short-term liquidity to banks (as a limited version of a central bank's usual role as lender of last resort); and to compile statistics and conduct economic research.[7] The recent official dollarization in Ecuador has fomented more

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[6] Panama has actually been dollarized since independence from Colombia in 1904. Although the official currency of Panama is the balboa, it is pegged 1:1 to the U.S. dollar and the only bills circulating are U.S. dollars. For more on Panama, see Goldfajn and Olivares (2001). El Salvador officially dollarized in 2004 by withdrawing the colon from circulation, after pegging to the dollar in 1994 and gradually phasing out the colon.
[7] Some other functions that might be appropriately undertaken by a central bank are not part of the Central Bank of Ecuador's responsibilities. For example, there is a separate

debate on the issues, ranging from estimation of the benefits and costs to evaluations of its success and assessments of the potential for dollarization in other coutries.

The literature on official dollarization is wide-ranging, but typically centers on discussion of its benefits and costs in different countries. The main benefits are: (1) transaction costs of exchanging the local currency for dollars are eliminated; (2) foreign exchange risk against the dollar is eliminated; (3) the country imports the U.S. level of price stability; (4) the country is more integrated with global financial markets (and possibly enjoys lower interest rates on borrowing); and (5) the possibility of foreign exchange and financial crises is greatly reduced. In addition, dollarization may encourage fiscal discipline and stimulate economic growth.[8] The main costs are: (1) loss of independent monetary and exchange rate policy; (2) loss of seigniorage revenues from having a domestic currency; and (3) reduction in the ability of the central bank to serve as lender of last resort to the domestic banking system. For more on benefits and costs, see Antinolfi and Keister (2001).

Several countries have experienced financial dollarization. In Peru, Bolivia, and Uruguay, the U.S. dollar is legal tender and residents are permitted to hold dollar deposits or take dollar loans in their home countries. This has led to more attention to the management of monetary policy in dollarized economies, particularly focusing on the

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superintendent of banks so the Central Bank does not supervise or regulate banks, and the deposit guarantee system not administered by the Central Bank of Ecuador. However, the Central Bank does manage a large network of museums and libraries, and is responsible for most archeological and cultural research in the country.

[8] With respect to growth, however, Edwards and Magendzo (2006) find that growth of GDP per capita has not been statistically different in dollarized and in non-dollarized countries, but that volatility has been higher in dollarized countries than in non-dollarized countries.

risks of dollarization in the banking system. See, for example, Baliño, Bennett, and Borensztein (1999) and Cayazzo, García Pascual, Gutierrez, and Heysen (2006).

Arteta (2002, 2003) uses the most extensive database created to-date of both deposit dollarization and credit dollarization in the banking systems of 96 countries over the 1980s and 1990s to examine the impact of exchange rate policy on currency mismatches between deposits and credits, and to consider whether financially dollarized countries are more prone to costly crises. Arteta's sample includes most of the Latin American countries examined in this paper, which is a powerful indication of the extent of financial dollarization in the region.[9]

In countries not experiencing financial dollarization, the dollar is nevertheless often a preferred store of value despite the fact that it is not legal tender. Many people hold dollars in the form of currency, and many hold dollars in bank accounts in the U.S. because they cannot hold dollars in the local banking system.

Empirical Investigation

This section empirically considers the extent to which Latin American currencies are anchored to the dollar. Whereas Alesina, Barro, an Tenreyro (2003) consider what currencies would logically be anchored to the dollar, we consider the degree to which they *are* anchored to the dollar. Even in countries experiencing financial dollarization, the degree to which their currency is anchored to the dollar is still an open question.

Preliminary Investigation

[9] Arteta's sample includes all thirteen countries studied in this paper except Ecuador, Brazil, Guyana, and Canada.

Countries that are following a dollar standard should have relatively low currency volatility against the dollar as evidence of the link. As a preliminary investigation, Table 2 offers a comparison of the standard deviations of percentage changes in currencies against the dollar. The standard deviations are annualized from daily data over the period January 1, 2003 – December 30, 2006. Panel A reports four major global currencies which will be used later in the analysis but also provide a useful benchmark for comparing the Latin American currencies: the euro, the pound, the yen, and the Swiss franc. For these four currencies, the annual standard deviation of percentage changes in exchange rates ranges from 8.65 percentage points to 10.34 percentage points.

Panel B in Table 2 reports the Latin American currencies. For these 13 currencies, the standard deviation ranges from 0 (for the Ecuadorian sucre) to 37.28 for the Venezuelan bolivar. In addition to the Ecuadorian sucre, there are three currencies with standard deviations clearly below the range of the major currencies: the Bolivian boliviano, the Peruvian sol, and the Guyanese dollar have standard deviations in the range of 0.66 to 4.74. These are therefore the prime candidates for inclusion in the dollar standard. Three other currencies have standard deviations below, but very close, to the range of the major currencies: the Colombian, Mexican, and Uruguayan pesos. Only the Brazilian real and the Venezuelan Bolivar are clearly above the range of the major global currencies.

As the purpose of looking at the links of Latin American currencies to the dollar is to consider monetary integration, it is natural to consider the correlations of currencies as an indicator of monetary integration. Perhaps surprisingly, the correlation coefficients among the 12 currencies (against the U.S. dollar) other than the Ecuadorian sucre are very low, averaging just 0.05. The highest correlations are among Mexico, Chile, and Brazil, and are reported in Panel A of Table 3. The average for these three is just 0.44, suggesting that the Mexican peso, the Chilean peso, and Brazilian real are only partially "the same currency". Panel B of Table 3 presents the standard deviations of these currencies against each other and against the U.S. dollar. There is not much evidence that Latin American currencies are any more stable against each other than they are against the U.S. dollar.

Methodology

This paper adapts the perspective of Frankel and Wei (1994) and McKinnon and Schnabl (2004) to examine the behavior of exchange rates. The main insight is that researchers may detect the influence of various foreign currencies on a particular local currency by using an "outside" currency – the Swiss franc – as a numeraire for measuring exchange rate volatility. The method has been applied to East Asian currencies to assess the influence of the dollar, the yen, and the Deutschemark. For our investigation of Latin America during the period 2003-2006, we use the euro instead of the Deutschemark, and we furthermore include the British pound in order to evaluate its influence as a world currency.[10]

We work with daily data in order to consider the immediate ties between local currencies and external global currencies. Such analysis is designed to uncover high-frequency "pegging," either through central bank intervention or through fundamental

[10] The dollar, yen, euro, and pound are the four currencies in the International Monetary Fund's SDR basket. In addition, the pound is nearly as important as the yen based on trading in the foreign exchange markets; see footnote 5.

market linkages. However, there may also be a long-run relationship achieved through short-term adjustment processes, so we tackle the question from the perspective of modern time series analysis. In this regard, we consider a methodology involving three steps.

In the first step, we consider the univariate time series properties of the data in logarithmic terms. We principally consider Augmented Dickey-Fuller (ADF) unit root tests, although we also examine Phillips-Perron tests to confirm the conclusions. We follow the procedures outlined in Enders (2004, pp. 213-214) and carefully examine the serial correlation coefficient (?). If this step reveals that the series are stationary in (log) levels, or I(0), we will proceed to estimate the relationship between local currencies and global currencies using classical least squares regressions of the data in levels. If this step reveals that the series are stationary in differences (of logs), or I(1), we proceed to the second step.

In the second step, we consider the multivariate time series properties by investigating whether the five exchange rate series – that are separately I(1) – are cointegrated. With all series I(1), there may be one (or more) linear combination(s) of the series that is (are) stationary. We use the Johansen trace test statistics ($?_{trace}$) to test for cointegration, starting from the hypothesis that there are no cointegrating vectors ($r = 0$). We specifically focus on the small-sample-corrected trace test statistic.[11]

In the third step, we examine the relationship between each Latin American currency and the four global currencies. If a Latin American currency is cointegrated with the four global currencies, we examine the coefficients in the cointegrating vector(s)

[11] The results were obtained using the software *CATS in RATS*, version 2, by J.G. Dennis, H. Hansen, S. Johansen, and K. Juselius, Estima 2005.

and the properties of the vector error correction process. If a Latin American currency is not cointegrated with the global currencies, we run a classical least squares regression using data in first differences and consider the coefficients estimated that way.

The methodology may be illustrated using SDR exchange rates. The SDR (Special Drawing Right) is a virtual "basket" currency issued by the IMF, and the basket consists of specific amounts of major global currencies. For the period 2001-2005, the basket contained $0.5770, €0.4260, ¥21.0, and £0.0984.[12] Our methodology can be applied to recover the weights on each currency in the basket using exchange rates quoted as SDR/SF, $/SF, €/SF, ¥/SF, and £/SF. Since our data begins in 2003, we consider only the period 2003-2005, thus stopping when the SDR was redefined.

First, we examine the univariate time series properties. Using the log of the SDR/SF exchange rate, the Augmented Dickey-Fuller tests (which happen not to require lags of the dependent variable) are t_μ = -2.585 (significant only at the 90% level, and with ? = 0.983) and t = -0.087 (which is not significant, with ? = 1.000).[13] We therefore conclude that the series is nonstationary in levels. For the differenced series, t = -29.794 (which is significant at all levels) and we thus conclude that the series is stationary in differences. Hence, the log of the SDR/SF exchange rate is I(1). Similarly, the four major currencies against the SF are found to be I(1) in logs. We suppress discussion of these tests here, but such discussion would be nearly identical to the discussion for the period 2003-2006 contained below (with reference to Table 4).

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[12] The SDR is regularly redefined, and since January 1, 2006 has contained $0.6320, €0.4100, ¥18.4, and £0.0903.

[13] The drift term is significant at the 95% level but not at the 99% level, so there is some room for discretion in favoring t_μ or t. Prior tests conclusively rejected the hypothesis of a trend term in the equation.

Second, we consider the multivariate time series properties by investigating whether the five exchange rate series are cointegrated. The Johansen test of the hypothesis that there are no cointegrating vectors (r = 0) is $?_{trace}$ = 78.502, which is not significant at any level. We thus conclude that the series are not cointegrated. The test was calculated using the most general model allowing for linear trends in the variables and a constant in the cointegrating space, along with four lags of the dependent variables. The trend terms seem to be required, but primarily just for the ¥/SF exchange rate. However, the model without the trend terms produces $?_{trace}$ = 74.909 (not significant the 95% level but significant at the 90% level) and the same conclusion that the series are not cointegrated. Similarly, models considering different lag lengths reach the same conclusion: the $?_{trace}$ statistics for 1 through 6 lags are, respectively, 87.678*, 79.735, 77.410, 78.502, 80.626, and 86.403* (none are significant at the 95% level but asterisks indicate significance at the 90% level for 1 and 6 lags). We are thus very confident in the conclusion that the five series are not cointegrated.

Third, and given the absence of cointegration, the relationship between the SDR and the four global currencies is appropriately estimated using the first differences of the series in a classical least squares regression. The result is (with robust standard errors in parentheses):

$$(?S_{LC/SF})_t = \underset{(.0003)}{0.0001} + \underset{(.001)}{0.396}(?S_{\$/SF})_t + \underset{(.001)}{0.131}(?S_{YEN/SF})_t$$

$$+ \underset{(.002)}{0.348}(?S_{€/SF})_t + \underset{(.001)}{0.121}(?S_{£/SF})_t + u_t$$

$$\text{adjusted } R^2 = 1.00 \qquad \text{D-W} = 2.33$$

The coefficients represent the average weights over this time period: 39.6% on the dollar, 13.1% on the yen, 34.8% on the euro, and 12.1% on the pound, for a total of

99.7%. We cannot reject the hypothesis that the coefficients sum to unity at the 95% level [$?^2(1) = 4.23$], although we could at the 99% level. We can, however, reject the hypothesis that the coefficient on the dollar is unity [$?^2(1) = 454,298$] and the joint hypothesis that the coefficient on the dollar is unity and the coefficients on the other currencies are zero [$?^2(4) = 497,430$]. We thus conclude that the IMF is not anchoring the SDR exclusively to the dollar, which is clearly not a surprise. [Nevertheless, the partial R^2, indicating the proportion of the variation in (changes in) the SDR that is explained by the (changes in) the dollar given the coefficient of 0.396, is high, at 0.835.]

At this point, a synopsis of some of the results in McKinnon and Schnabl (2004) provides an additional context in which to evaluate the upcoming results for Latin America. For the post-crisis period in Asia, McKinnon and Schnabl use the period from January 1999 through December 2003. They report (in footnote 6) that "tests did not yield any evidence for any cointegrating vector between the four exchange rates (p.360)", and thus proceed with a least-squares regression using differenced data. For nine countries (China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand), regression $\overline{R}^2$ values range from 0.32 to 1.00. Coefficients on the dollar range from 0.75 to 1.00 and are all statistically significant. Although many coefficients on the yen and the DM are statistically significant, they are all smaller than the coefficient on dollar, ranging from 0.00 to 0.21. The inescapable conclusion is that East Asian countries were on a dollar standard during this period.

Time Series Properties

Table 4 presents Augmented Dickey-Fuller (ADF) unit root tests for the currency series under consideration. We start by allowing for a drift and a trend in each series, along with lags of the variable under consideration. However, all 16 series reject the hypothesis that a trend is present, so we concentrate only on cases without a trend included. The focus is on the t_μ and t ADF tests for the cases with drift and without drift, respectively. In all instances, the tests do not require lags of the variable (and in this regard are really just Dickey-Fuller tests).

Statistics for the dollar, yen, euro, and pound are shown in Panel A of Table 4. The four currencies (in natural logs) have autocorrelation (?) coefficients ranging from 0.978 to 0.991 when the drift term is included, and the ADF t_μ tests fail to reject the hypothesis that the coefficient is unity (except for the euro at the 90% level). Thus, we thus proceed to test for the presence of the drift. We cannot reject the hypothesis of no drift in the dollar, yen, and pound, so we present ADF t tests excluding the drift and conclude that we cannot reject the hypothesis that the coefficient is unity. For the euro, the hypothesis that the series does not contain a drift is rejected at the 95% level but not at the 99% level, thus leaving some discretion in the way to proceed. Retaining the drift, t_μ essentially indicates that ?=1 (except at the 90% level). Eliminating the drift, t indicates that ?=1. Hence, we comfortably conclude that all four currencies contain unit roots, and the data are thus nonstationary in levels. ADF t tests on the first differences of the series clearly indicate that the differenced series are stationary, thus leading to the conclusion that the series are I(1).

The results of the univariate time series statistics are similar for the Latin American currencies, as shown in Panel B of Table 4. The autocorrelation coefficients are very high and range from 0.977 (for the Guyanese dollar) to 0.997 (for the Brazilian real) and nearly all ADF t_μ tests fail to reject the hypothesis that the coefficient is unity. The only exception is for the Peruvian sol, which rejects the hypothesis at the 95% level but not at the 99% level. Again, we proceed to test for the presence of the drift. We cannot reject the hypothesis of no drift in the any of the Latin American currencies, except for the Peruvian sol. We thus present ADF t tests excluding the drift and conclude that we cannot reject the hypothesis that the coefficient is unity (except for the Canadian dollar at the 90% level) for any of the Latin American currencies except the Peruvian sol. In the case of the Peruvian sol, the hypothesis that the series does not contain a drift is rejected at the 95% level but not at the 99% level, thus again leaving some discretion in the way to proceed. Retaining the drift, t_μ indicates that ??1 except at the 99% level, although the estimated coefficient ?=0.982 seems very close to 1 and visual inspection of a plot of the series does not suggest the presence of anything peculiar. Eliminating the drift, t indicates that ?=1 at any level. Hence, we conclude that all Latin American series contain unit roots, and are thus nonstationary in levels. ADF t tests on the first differences indicate that the differenced series are stationary, leading to the conclusion that the Latin American currencies are I(1).

Table 5 presents the Johansen trace test statistics. The tests are calculated using the most general model allowing for linear time trends in the variables and a constant in the cointegrating space, along with four lags of the dependent variables. The hypothesis that there are no cointegrating vectors (r = 0) cannot be rejected at the 95% level in eleven of the twelve cases (although the same would be true in nine of twelve cases at the 90% level). Nearly all Latin American currencies are clearly not cointegrated with the major global currencies. Only Bolivia seems to have a cointegrating vector with the major global currencies because the ?$_{trace}$ statistic indicates that, at the 99% level, we can reject the hypothesis that there are no cointegrating vectors and we cannot reject the hypothesis that there is one cointegrating vector.

Results

This section considers the influence of the major global currencies on the Latin American currencies. Based on the results in Table 5, we first consider the coefficients in a cointegrating vector for Bolivia, the only Latin American currency unambiguously exhibiting cointegration with the global currencies. We then proceed to examine the other currencies using differenced data in least-squares regression.

The ?$_{trace}$ statistics for Bolivia indicate that there is one cointegrating vector among the five currencies considered. The vector, normalized around (the log of) the boliviano/SF exchange rate, $S_{Boliviano/SF}$, is (with standard errors in parentheses):

$$S_{Boliviano/SF} = \underset{(.104)}{1.305}\, S_{\$/SF} + \underset{(.179)}{0.259}\, S_{¥/SF} - \underset{(.350)}{0.855}\, S_{€/SF} + \underset{(.249)}{0.239}\, S_{£/SF} - \underset{(.003)}{0.010}\, TREND$$

The long-run relationship thus indicates a strong relationship between the dollar and the boliviano, possibly even more than 1:1. In addition, there seems to be an inverse relationship between the euro and the boliviano. There is also a downward trend, corresponding to boliviano appreciation.

To help interpret the results, we consider two hypothesis tests. The first is the simple test that the coefficient on $S_{\$/SF}$ in the cointegrating vector is unity. The test statistic is $?^2(1) = 1.219$ (with the Bartlett correction for small samples), and we cannot reject the hypothesis that the coefficient is unity. The second is a test of the joint hypothesis that the coefficient on $S_{\$/SF}$ is unity and that the coefficients on $S_{¥/SF}$, $S_{€/SF}$, and $S_{£/SF}$ are all zeros. The test statistic is $?^2(4) = 8.182$ (with Bartlett correction), and we cannot reject the joint hypothesis at the 95% level (although we can reject at the 90% level). The boliviano is thus most likely cointegrated with the dollar, with a cointegrating vector (1,-1,?) where ? is the trend. In the long run, the boliviano moves 1:1 with the dollar, allowing for a trend.

We thus briefly consider the two-variable model corresponding to the conclusion that the boliviano is cointegrated with the dollar and a vector (1,-1,?). When the model is estmated, $?_{trace} = 45.938$ for the hypothesis that r=0, so we reject the hypothesis of no cointegration at the 99% level. The test of the hypothesis that r=1 produces $?_{trace} = 5.018$, and we cannot reject at any level. Hence, there is one cointegrating vector, and it is estimated to be:

$$\underset{}{S_{Boliviano/SF}} = \underset{(.092)}{1.303}\, S_{\$/SF} - \underset{(.0015)}{0.0044}\, TREND$$

In this equation, we reject the hypothesis that the coefficient on $S_{\$/SF}$ in the cointegrating vector is unity [$?^2(1) = 4.35$ with Bartlett correction] at the 95% level (but not at the 99% level). Hence, the coefficient is likely a little above unity, and the boliviano is mostly on a dollar standard. The trend suggests that the boliviano is appreciating approximately (0.0044×261=) 1.1% per year (against the SF).

Based on the results in Table 5, we examine the influence of the dollar, the yen, the euro, and the pound, on the other Latin American currencies using differenced data in a least-squares regression. Specifically, we estimate the equation:

$$(?S_{LC/SF})_t = ß_0 + ß_1(?S_{\$/SF})_t + ß_2(?S_{YEN/SF})_t + ß_3(?S_{€/SF})_t + ß_4(?S_{£/SF})_t + u_t \qquad (1)$$

where the exchange rates are all expressed against the Swiss franc and u_t is the error term. This is exactly the methodology of Frankel and Wei (1994) and McKinnon and Schnabl (2004). As explained in McKinnon and Schnabl (2004, p. 344), the coefficients represent the weights of the respective currencies in a currency basket determining the behavior of the local currency. If a currency is closely linked to one of the currencies appearing on the right-hand side of equation (1), the corresponding coefficient will be close to unity. If a coefficient is close to zero, there is no stabilization against that particular currency. A high $\overline{R}^2$ coefficient, particularly close to unity, indicates that local currency exchange rates against the Swiss franc can be almost fully explained by fluctuations in major currencies against the Swiss franc. Equations are estimated using the methodology of White to obtain heteroscedasticity-consistent standard errors and covariances.

Table 6 presents summary statistics for the independent variables. For each of the four series, we cannot reject the hypothesis that the mean is zero, suggesting that all currencies have been relatively stable and have not experienced consistent appreciation or depreciation over the period. The correlation coefficients reveal that the four currencies are moderately positively correlated, in the range from 0.33 to 0.58, but not so highly correlated as to create a problem with multicollinearity.

The regression results for the Latin American countries are presented in Table 7. We include Bolivia in this analysis in order to compare the results from the cointegration methodology to the results from the classical least squares methodology using data in difference. The $\overline{R}^2$ values range from 0.07 for Venezuela to 1.00 for Bolivia and nearly all coefficients are sensible. Only one country – Bolivia – has a statistically significant intercept, which in fact suggests an annual depreciation of the boliviano at 1.6%. On the whole, the results for Bolovia in Table 7 are nearly identical to the results from the cointegration methodology, suggesting that differencing the data doesn't do too much harm in the empirical investigation.

Among the coefficients on the independent variables in Table 7, the coefficients on the $/SF exchange rate are obviously the most important: all 12 are statistically significant at the 99% confidence level. In addition, a smattering of other coefficients are significant. Six coefficients on the ¥/SF exchange rate are significant at the 95% level (and two more are significant at the 90% level). Five coefficients on the €/SF exchange rate are significant at the 95% level, although one – for Paraguay – is negative and should be regarded with suspicion. Three coefficients on the £/SF exchange rate are significant at the 95% level (and three more are significant at the 90% level).

The final three columns present various hypothesis tests. The first is a test of the hypothesis that the coefficient on the $/SF exchange rate change is unity, since a country operating under a dollar standard would be expected to have $ß_1 = 1$. This is a $?^2$ test (with one degree of freedom) since equations are estimated using the method of White to correct for heteroscedasticity among the residuals. Adherence to a dollar standard might imply not only that $ß_1 = 1$ but also that the coefficients on all other currencies are equal to zero. The penultimate column in Table 7 thus presents a test of the joint hypothesis that $ß_1 = 1$ and $ß_2=ß_3=ß_4=0$. This is a $?^2$ test with four degrees of freedom. For six countries, the both the hypothesis $ß_1 = 1$ and the joint hypotheses that $ß_1 = 1$ and $ß_2=ß_3=ß_4=0$ cannot be rejected: Argentina, Bolivia, Paraguay, Peru, Uruguay, and Venezuela. These results suggest that these six countries might indeed adhere to a dollar standard.

To consider a slightly different perspective on these coefficients, the last column of Table 7 reports a test of the hypothesis that the weights on the currencies sum to unity: $ß_1 + ß_2 + ß_3 + ß_4 = 1$. For five of the six countries for which the hypothesis that $ß_1 = 1$ and the joint hypothesis that $ß_1 = 1$ and $ß_2=ß_3=ß_4=0$ cannot be rejected, the hypothesis that $ß_1 + ß_2 + ß_3 + ß_4 = 1$ cannot be rejected either. The only surprise exception is Paraguay, which has coefficients that sum to 0.787 due mostly to a coefficient of 1.001 on the dollar and -0.280 on the euro. It thus seems that we should discount the negative coefficient – the only statistically significant one in the table – and consider Paraguay as part of the dollar bloc based on the results of the joint hypothesis test.

From the above, it seems that the dollar bloc in Latin America consists of six countries: Argentina, Bolivia, Paraguay, Peru, Uruguay, and Venezuela. However, the variation in $\overline{R}^2$ suggests that some countries are on a tighter dollar standard than others. For countries like Bolivia and Peru with very high $\overline{R}^2$, the case for a dollar standard is very strong. In contrast, for a country like Venezuela where $\overline{R}^2$ is very low (just 0.07), the statistical hypotheses cannot be rejected because the regression fit is very poor. The other countries have $\overline{R}^2$ in the moderate range of 0.55 to 0.66 and require additional examination.

Some other countries, for which the hypothesis that $ß_1 = 1$ and the joint hypothesis that $ß_1 = 1$ and $ß_2=ß_3=ß_4=0$ can be rejected, are also close to a dollar standard even if there is some influence from another currency (or two). The test of the hypothesis that $ß_1 + ß_2 + ß_3 + ß_4 = 1$ helps us interpret some of these situations. Guyana, for example, seems to be on a standard that is approximately 90% the dollar and 9% the pound, with a high $\overline{R}^2 = 0.81$. Thus, it might be appropriate to consider Guyana as nearly on a dollar standard. (It also makes sense that Guyana is partly on a pound standard, as Guyana is a former British colony and is a member of the Commonwealth of Nations.)

Mexico seems to be on a standard that's approximately 88% the dollar, 7% the yen, and 14% the pound (for a total slightly above 100% although we cannot reject the hypothesis that the coefficients sum to unity at the 95% level) with a moderate $\overline{R}^2 = 0.62$. It might be appropriate to consider Mexico as just a little further away from a dollar standard, or on a partial dollar standard.

Colombia might be next in line, with a standard that 80% the dollar, 12% the yen, and 32% the euro (for a puzzling total of 124% and the conclusion that we can reject the hypothesis that the coefficients sum to unity), and a moderate $\overline{R}^2 = 0.63$. Thus, like Mexico, Colombia is on a partial dollar standard.

Clearly, both the estimate of ß$_1$ and its contribution to the fit of the regression are important in determining whether a country adheres to a dollar standard. To aid our analysis, we calculate the partial R^2 attributable to the influence of the dollar:

$$\overline{\overline{R^2}} \; ? \; 1 ? \; e'e / \tilde{y}'\tilde{y}$$

where $e \; ? \; ?S_{LC/SF} \; ? \; ?_1 ?S_{\$/SF}$ and $\tilde{y}$ is the demeaned $?S_{LC/SF}$ series. This represents the proportion of the variation in the dependent variable, $?S_{LC/SF}$, that is explained by the variation in $?S_{\$/SF}$ and the estimated coefficient ß$_1$. These partial R^2 values are reported in Table 8. Note that they are all fairly close to the $\overline{R}^2$ values reported in Table 7, reflecting the importance of the dollar in the overall analysis.

To help determine whether a country adheres to a dollar standard, Figure 1 plots the $\overline{\overline{R}}^2$ value against the estimated coefficient ß$_1$. Ecuador is included in this figure, at the point (1,1). Bolivia is very close by, at (1.004,0.996). Peru is also close, at (0.977,0.918). These three countries are on a practically perfect dollar standard.

To evaluate the degree of dollar standard in each country, we calculate the distance of each point from the perfect dollar standard of (1,1) using the formula for the radius of a circle: $\sqrt{(?_1 ? 1)^2 ? (\overline{\overline{R}}^2 ? 1)^2}$. These distances are presented in Table 8 in ascending order. Ecuador is exactly at (1,1) so its distance is exactly zero. Bolivia is shown very close to zero, and Peru is only a little further away.

Six countries that we have discussed before are nearly on a dollar standard. Moving outward from (1,1), Guyana is next, followed by Uruguay. Subsequently, Mexico, Argentina, Colombia, and Paraguay are clustered together.

The furthest point from (1,1) is Venezuela, (0.818, 0.065) by virtue of its low $\overline{R}^2$. It seems logical not to conclude that Venezuela is on a dollar standard despite its high ß$_1$ coefficient and an inability to reject the joint hypotheses of ß$_1$ = 1 and ß$_2$=ß$_3$=ß$_4$=0.

Canada, Brazil, and Chile are the next furthest points from (1,1), at (0.448,0.369), (0.676,0.317), (0.597,0.424), respectively, so it seems logical not to conclude that they are on a dollar standard either. This conclusion is consistent with the earlier finding that we can reject the hypothesis that ß$_1$ = 1 and ß$_2$=ß$_3$=ß$_4$=0 for all three countries. The Canadian dollar seems to be based on a basket of dollars, yen, and euros, and is fairly well-behaved because we cannot reject the hypothesis that the weights sum to unity. The Brazilian real seems to be based on a basket of dollars, yen, and euros also, but the weights puzzlingly sum to more than unity and we can reject the hypothesis that the weights sum to unity. For Brazil, in fact, the coefficient on the euro (0.736) is higher than the coefficient on the dollar (0.676).[14] The hypothesis that Brazil's coefficient on the euro is unity cannot be rejected, suggesting that Brazil is on a euro standard rather than a dollar standard.[15] The Chilean peso seems to be based on a combination of the dollar, the yen, the euro, and the pound (and, in fact, the weights once again sum to more than unity and we can reject the hypothesis that the weights sum to unity).

Conclusion

This paper finds a thriving "dollar standard" in Latin America. Examining the time series relationships between local currencies and the major global currencies using daily data over the period 2003-2006, we find three categories of countries participating in the dollar standard.

First, three countries in the Andes are on a practically perfect dollar standard and might find additional financial integration fairly practicable. Ecuador has been officially dollarized since 2000. Bolivia and Peru have experienced a considerable amount of financial dollarization, and statistical analysis suggests that changes in the values of the Bolivian boliviano and the Peruvian nuevo sol perfectly reflect changes in the value of the dollar. These three countries, which also happen to share borders, might reasonably be considered to be a solid dollar bloc in Latin America.

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[14] Temprano-Arroyo (2003) points out that, "Brazil's low level of dollarization, the closed nature of its economy and its strong trade connections with Europe all argue against official dollarization in Brazil and in favor of maintaining its flexible exchange rate regime (p. 414)."

[15] The test statistic for the hypothesis $ß_3 = 1$ is $?^2(1) = 2.80$ and is significant only at the 90% level. The joint hypotheses that $ß_3 = 1$ and $ß_1=ß_2=ß_4=0$ can be rejected; $?^2(4) = 351.46$.

Second, four more countries are nearly on a dollar standard. Three of these countries are very small economies – Guyana, Paraguay, and Uruguay -- so it might not be too surprising that they are closely connected to the dollar as the major global currency. Guyana has a GDP of $0.83 billion, Paraguay has a GDP of $7.70 billion, and Uruguay has a GDP of $14.30 billion. These are the smallest GDPs of the countries in the sample, although Bolivia is actually smaller than Uruguay with a GDP of $10.22 billion. They are all smaller than Ecuador, which has a GDP of $32.57 billion, suggesting that these small countries might find dollarization relatively easy (as it has been already accomplished in Ecuador). The fourth country in this category is Argentina. Although Argentina abandoned its 1:1 exchange rate against the dollar and its currency board mechanism, the Argentine peso seems to be persistently, though imperfectly, linked to the dollar.

Third, two more countries are on a partial dollar standard, but exhibit influence from other countries as well. The Mexican peso has a strong link to the dollar, but also is significantly influenced by the yen and the pound. The Colombian peso also has a strong link to the dollar, but is significantly influenced by the yen and the euro.

Four additional countries investigated are further from a dollar standard but are certainly not completely independent of the dollar either. The Brazilian real appears to be on a euro standard rather than a dollar standard, although a better description might be that the currency is based on a basket of euros, dollars, and yen. Similarly, the Canadian dollar seems to be based on a basket of dollars (45%), euros (42%), and yen (9%). These are the two largest countries in the sample (Brazil's GDP is $944 billion and Canada's GDP is $1 trillion), so perhaps it is not surprising that their currencies are not linked exclusively to the U.S. dollar. The Chilean peso seems to be based on a basket of the dollar, the euro, the pound, and the yen. The Venezuelan bolivar seems to move one-to-one with the movements in the dollar, or perhaps a little bit less, but the coefficient is so imprecisely estimated (an $\overline{R}^2$ of just 0.07) that it seems logical not to conclude that Venezuela is on a dollar standard.

Taken together, these results suggest that the dollar standard is alive and well in Latin America. In turn, the propensity for regional financial integration -- indeed, the propensity for additional integration with the global financial markets -- is fairly high.

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Table 1
Best Currency Anchor for Selected Latin American Countries
Alesina, Barro, and Tenreyro (2003) Results Based on Three Criteria

Country	Trade/GDP Ratio	Co-Movement of Prices	Co-Movement of Output
Canada	dollar	**dollar**	dollar
Mexico	**dollar**	**dollar**	euro/yen
Argentina	Euro	euro	euro
Bolivia	dollar	**dollar**	dollar
Brazil	dollar	dollar	**euro**
Chile	Euro	dollar	dollar
Colombia	dollar	**dollar**	**euro**
Ecuador	**dollar**	**dollar**	euro
Guyana	**dollar**	**dollar**	euro
Paraguay	Euro	dollar	euro
Peru	dollar	euro	euro
Uruguay	euro	euro	dollar/euro
Venezuela	**dollar**	**dollar**	euro

Note: Bold indicates a high magnitude for the difference between the currency listed and next-ranked alternative.
Source: Alesina, Barro, and Tenreyro (2003), Tables 13 and 14.

Table 2
Standard Deviations of Currencies Against the U.S. Dollar
Annualized from Daily Data, January 1, 2003 – December 30, 2006

Panel A
Major Global Currencies

Currency	Standard Deviation
British Pound	8.65
Japanese Yen	9.01
Euro	9.17
Swiss Franc	10.34

Panel B
Major Latin American Currencies

Currency	Standard Deviation
Ecuadorian Sucre	0
Bolivian Boliviano	0.66
Peruvian Sol	3.08
Guyanese Dollar	4.74
Colombian Peso	7.68
Mexican Peso	7.93
Uruguayan Peso	7.95
Canadian Dollar	8.68
Argentine Peso	8.80
Paraguayan Guarani	9.26
Chilean Peso	9.39
Brazilian Real	13.14
Venezuelan Bolivar	37.28

Note: The number of observations for each series is 1,042. The annualized standard deviation is the standard deviation of the daily data multiplied by $\sqrt{261}$.

Table 3
Analysis of Correlations Among Latin American Currencies
January 1, 2003 – December 30, 2006

Panel A
Correlation Coefficients of Exchange Rates Against the U.S. Dollar

	Chilean Peso	Brazilian Real
Brazilian Real	0.49	---
Mexican Peso	0.43	0.41

Panel B
Standard Deviations of Currencies Against the U.S. Dollar and Against Each Other

	U.S. Dollar	Chilean Peso	Brazilian Real	Mexican Peso
Chilean Peso	9.39	---	11.86	9.31
Brazilian Real	13.14	11.86	---	12.29
Mexican Peso	7.93	9.31	12.29	---

Note: The number of observations for each series is 1,042. The annualized standard deviation is the standard deviation of the daily data multiplied by $\sqrt{261}$.

Table 4
Augmented Dickey-Fuller Unit Root Tests
Currencies Against the Swiss Franc, January 1, 2003 to December 30, 2006
(in natural logs; 1043 observations)

Panel A
Major Global Currencies

Exchange Rate	Levels				Differences	
	With Drift		Without Drift		Without Drift	
	?	t_μ	?	t	?	t
U.S. Dollar	0.990	-2.481	0.999	-1.071	-0.043	-33.722***
Japanese Yen	0.978	-1.782	1.000	0.695	-0.003	-32.340***
European Euro	0.991	-2.734*	1.000	1.497	0.041	-30.951***
U.K. Pound	0.978	-2.265	1.000	0.450	-0.019	-32.905***

Panel B
Major Latin American Currencies

Exchange Rate	Levels				Differences	
	With Drift		Without Drift		Without Drift	
	?	t_μ	?	t	?	t
Argentine Peso	0.981	-2.208	1.000	-0.034	0.038	-31.078***
Bolivian Boliviano	0.993	-2.273	1.000	0.831	-0.041	-33.668***
Brazilian Real	0.997	-1.347	0.999	-1.416	0.022	-31.596***
Canadian Dollar	0.995	-2.053	0.995	-1.899*	0.030	-31.400***
Chilean Peso	0.996	-1.501	1.000	-0.735	0.007	-32.101***
Colombian Peso	0.989	-1.449	1.000	-0.508	0.003	-32.275***
Guyanese Dollar	0.977	-2.072	1.000	0.863	-0.032	-33.364***
Mexican Peso	0.991	-2.421	1.000	0.547	-0.061	-34.412***
Paraguayan Guarani	0.991	-2.019	1.000	0.743	0.026	-31.514***
Peruvian Sol	0.982	-3.116**	1.000	0.018	-0.042	-33.730***
Uruguayan Peso	0.995	-1.610	1.000	0.021	0.024	-31.525***
Venezuelan Bolivar	0.994	-2.134	1.000	1.226	-0.043	-33.662***

Note:
* significant at the 90% level;
** significant at the 95% level;
*** significant at the 99% level

Table 5
Johansen Cointegration Tests of Latin American Currencies with the Dollar, Yen, Euro, and Pound Currencies Against the Swiss Franc, January 1, 2003 to December 30, 2006
(in natural logs; 1043 observations)

	?trace				
Exchange Rate	r=0	r=1	r=2	r=3	r=4
Argentine Peso	79.916	50.503	24.970	10.991	4.111
Bolivian Boliviano	118.140***	51.848	33.586	14.127	7.346
Brazilian Real	86.419*	46.982	23.002	9.407	3.405
Canadian Dollar	81.679	50.269	23.431	8.498	2.797
Chilean Peso	74.285	45.832	21.310	9.551	2.771
Colombian Peso	68.199	38.812	23.308	10.502	2.472
Guyanese Dollar	76.915	45.413	24.021	10.992	4.280
Mexican Peso	75.552	44.512	25.578	12.195	4.517
Paraguayan Guarani	78.406	45.486	25.402	11.506	2.141
Peruvian Sol	73.903	38.774	21.156	8.638	2.380
Uruguayan Peso	87.055*	41.179	22.537	8.800	1.608
Venezuelan Bolivar	79.424	45.046	25.500	12.699	4.501

Notes: * significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level

Table 6
Summary Statistics for Independent Variables
January 1, 2003 – December 30, 2006

Variable	Mean		Standard Deviation		Correlations			
	daily	annualized	daily	annualized	? $S_{\$/SF}$	? $S_{YEN/SF}$	? $S_{€/SF}$	? $S_{£/SF}$
? $S_{\$/SF}$	0.012	3.12	0.640	10.34	1.00			
? $S_{YEN/SF}$	0.012	3.22	0.561	9.08	0.58	1.00		
? $S_{€/SF}$	-0.010	-2.60	0.199	3.22	0.50	0.33	1.00	
? $S_{£/SF}$	-0.007	-1.77	0.421	6.80	0.56	0.42	0.47	1.00

Note: The number of observations for each series is 1,042. The annualized mean is the mean of the daily data multiplied by 261. The annualized standard deviation is the standard deviation of the daily data multiplied by $\sqrt{261}$.

Table 7
Regressions of ?S$_{LC/SF}$ = ß$_0$ + ß$_1$(?S$_{\$/SF}$) + ß$_2$(?S$_{YEN/SF}$) + ß$_3$(?S$_{€/SF}$) + ß$_4$(?S$_{£/SF}$) + u$_t$
January 1, 2003 – December 30, 2006

Currency	ß$_0$	ß$_1$	ß$_2$	ß$_3$	ß$_4$	$\overline{R}^2$ D-W	?^{2}(1) test of ß$_1$ = 1	?^{2}(4) test ß$_1$ = 1 and ß$_2$=ß$_3$=ß$_4$=0	?^{2}(1) test of ß$_1$+ß$_2$+ß$_3$+ß$_4$ = 1
Argentine Peso	-0.009 (.017)	0.966*** (.034)	0.062* (.036)	0.006 (.109)	-0.016 (.056)	0.57 1.83	0.98	3.23	0.029
Bolivian Boliviano	0.006*** (.001)	1.004*** (.003)	-0.003 (.003)	-0.006 (.007)	-0.003 (.004)	1.00 2.00	1.25	2.09	1.545
Brazilian Real	-0.040 (.025)	0.676*** (.058)	0.225*** (.057)	0.736*** (.158)	0.029 (.075)	0.37 1.86	30.64***	45.65***	22.583***
Canadian Dollar	-0.019 (.014)	0.448*** (.033)	0.088*** (.032)	0.421*** (.084)	0.079 (.044)	0.42 1.97	286.25***	359.88***	0.235
Chilean Peso	-0.020 (.017)	0.597*** (.044)	0.143*** (.039)	0.457*** (.109)	0.212*** (.057)	0.49 1.98	84.30***	87.29***	17.970***
Colombian Peso	-0.019 (.014)	0.803*** (.036)	0.120*** (.034)	0.324*** (.088)	0.079* (.047)	0.63 1.86	30.44***	41.31***	20.183***
Guyanese Dollar	0.008 (.009)	0.899*** (.018)	0.016 (.018)	-0.034 (.032)	0.092*** (.021)	0.81 2.48	30.76***	36.16***	0.888
Mexican Peso	0.006 (.015)	0.867*** (.038)	0.068** (.033)	0.110 (.105)	0.141** (.056)	0.62 2.05	12.42***	17.82***	3.809*
Paraguayan Guarani	-0.033* (.018)	1.001*** (.034)	0.020 (.037)	-0.280** (.128)	0.085* (.049)	0.55 1.94	0.00	6.25	4.495*
Peruvian Sol	-0.009 (.006)	0.977*** (.014)	0.023** (.012)	-0.008 (.032)	0.025* (.015)	0.92 2.15	2.70	7.23	0.509
Uruguayan Peso	-0.010 (.015)	1.039*** (.029)	0.000 (.032)	-0.002 (.088)	0.057 (.060)	0.66 1.89	1.77	6.23	1.309
Venezuelan Bolivar	0.081 (.069)	0.818*** (.123)	0.292* (.171)	-0.303 (.377)	0.144 (.173)	0.07 2.10	2.08	4.67	0.043

Note: The number of observations in each equation is 1,042.
* significant at the 90% level; ** significant at the 95% level; *** significant at the 99% level

Table 8

Partial R^2 (denoted $\overline{\overline{R^2}}$) and Distance of $(?_1, \overline{\overline{R^2}})$ from (1,1)
Based on Regressions Reported in Table 7

Country	$\overline{\overline{R^2}}$	Distance
Ecuador	1.0000	0.0000
Bolivia	0.9959	0.0057
Peru	0.9176	0.0855
Guyana	0.8082	0.2168
Uruguay	0.6562	0.3460
Mexico	0.6093	0.4127
Argentina	0.5754	0.4260
Colombia	0.6044	0.4419
Paraguay	0.5435	0.4565
Chile	0.4239	0.7031
Brazil	0.3171	0.7559
Canada	0.3688	0.8385
Venezuela	0.0647	0.9528

Note: The distance is calculated using the formula for the radius of a circle:
$\sqrt{(?_1 ? 1)^2 ? (\overline{\overline{R^2}} ? 1)^2}$.

Figure 1

Distance from a Perfect Dollar Standard Based on $ß_1$ and $\overline{\overline{R^2}}$