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Borderplex Panel Evidence on Restaurant Price and Exchange Rate Dynamics

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Borderplex Panel Evidence on Restaurant Price and Exchange Rate Dynamics*

Thomas M. Fullerton, Jr. and André Varella Mollick

Abstract
This paper examines prices for 32 identical menu items sold by restaurant franchises operating on both sides of the border between El Paso in the U.S. and Ciudad Juárez in Mexico from July 1997 to June 2008. The relationship between real exchange rate (RER) volatility and the degree of price convergence is examined within a panel data context. The city-pair and goods selected provide a unique experiment in which distance, tradability, and industry considerations are set aside and the extent of RER volatility is the only factor to influence price convergence. We find non-monotonic relationships between mean reversion and RER volatility: very fast adjustments for *both* low and high volatility panels of goods (between 1 and 2 months) and slower half-lives (between 3 and 4 months) at moderate levels of uncertainty. These figures are, however, substantially smaller than the 6 or 7 months reported in previous research for general U.S.-Mexico goods, suggesting the very strong price convergence observed along the U.S.-Mexican border.

Keywords
Half-Lives, PPP, Real Exchange Rates, USA-Mexico Border Region, Volatility.

JEL Categories
F31, Foreign Exchange; M21, Business Economics.

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Introduction

This study examines the small differences in the prices of identical goods (converted to the same currency) when locations are separated only by national boundaries such as those observed for major cities across the U.S.-Mexico border. Cross-border menu data for 32 food items over a monthly 11-year time span for established restaurant franchises located on both sides of the border between El Paso, Texas, and Ciudad Juárez, Mexico are analyzed. This geographical area has been looked at recently by Fullerton et al. (2009b) in an effort that builds upon evidence reported in earlier empirical studies (Fullerton and Coronado, 2001; Blanco-González and Fullerton, 2006). One common component in each of these previous studies is that the goods are analyzed individually within a time series context. We suggest that the deployment of panel data techniques may allow joint exploitation of the information content of all the goods as a means for increasing sample power. Panel estimators may also permit general conjectures to be made with respect to the various restaurant products included in the sample.

There are several factors that make the United States - Mexico border region an interesting location for investigating price differentials of identical goods. First, distance is not an issue because border cities are geographically adjacent to each other and dual currency payments occur on both sides of the international boundary (Fullerton et al., 2009b). Given that, the principal source of price divergence is likely to

come from currency fluctuations. Along those lines, Engel and Rogers (2001) document violations of the law of one price across cities in the United States and the role that distance plays. Second, substantial migration and economic growth occur along the border with Mexico. That raises the question of whether fast growing cities in one side of the border have measurable spillover effects on sister cities located on the opposite side (Hanson, 2001; Mollick et al., 2006; Fullerton et al., 2007). If so, closer integration resulting from employment and output flows across the border should help reduce the duration and magnitude of any deviations from parity resulting from spot exchange rate changes.

A third reason that the border provides an interesting setting for the analysis of price differentials is that the examination of exchange rate volatility in an environment in which distance is not a factor provides important methodological advantages. Neither tradability nor industry considerations are important issues in this case. The restaurant menu items are all similar in the degree of tradable versus non-tradable components (Kim, 2004; Crucini and Shintani, 2008). Also, the analysis is for a single sector and differs from the industry-based approach required by Yan et al. (2007). These factors combine to make the unique data sample of goods prices from the two cities particularly interesting because they are separated only by a national boundary. That may permit greater isolation of the exchange rate volatility forces on the degree of mean reversion to price convergence.

The PPP hypothesis suggests that the nominal exchange rate (s) depends on relative price levels (p-p*). While a long-run relationship must exist between these series, several factors preclude the relationship from always holding exactly. They include price measurement errors, sample size constraints, systematic trends in traded and/or non-traded goods sectors, barriers to trade, and transaction costs (Taylor and Sarno, 1998; Taylor and Taylor, 2004). Structural change and non-linearity provide additional possibilities of why domestic and foreign prices may not converge to PPP-based rules (Lothian and Taylor, 2008; Sheng and Xu, 2011). Imbs et al. (2005) rely on the heterogeneity of goods to explain the particularly long deviations from PPP. The measure of persistence typically employed in these studies is the half-life, defined as the number of periods required for the deviation from PPP to be reduced by one half, all other things equal.

Rogoff (1996) argues that deviations from PPP can be attributed to transitory disturbances, such as financial and monetary shocks. These shocks put pressure on nominal exchange rates and may induce real exchange rate variability under nominal price stickiness. While PPP is compatible with pronounced short-term volatility in real exchange rates, it also implies that deviations should be transitory during periods when wages and prices are sticky. It is an open question of how short the time to converge is for goods transacted in border-city pairs. Blanco-González and Fullerton (2006), employing data for July 1997 to December 2002, report relatively quick adjustments for the relative prices for eight separate menu items (with half-lives of six goods varying between 0.7 months and 3.1 months, one with seven months, and one with 19 months). The larger and more extensive sample in Fullerton et al. (2009b) with 32 goods for July 1997 to June 2008 confirms these findings and reports small half-lives in general, with one good, only, requiring about 41 months for convergence.

The estimates in those studies suggest that deviation half-lives for goods traded in city pairs along the border between Mexico and the United States are substantially shorter than those for other currencies against the dollar. The "remarkable consensus" noted in Rogoff (1996) indicates that PPP half-life deviations generally last for between 3 and 5 years for long-run prices quoted for industrial economy currencies. In contrast, Cheung and Lai (2000) employ panels of developing country data that yield half-life estimates of less than three years. With notable oil price effects at play on the real exchange rate in Norway, Akram (2006) reports PPP convergence between 1970 and 2003 to be relatively rapid, with a deviation half-life from parity of approximately 1.5 years.

Neither economic theory nor prior empirical work provide a straightforward answer to the question of whether RER volatility will lead mean reversion to PPP levels to be faster or slower (Taylor and McMahon, 1988; Lothian and Taylor, 1997; Sarno and Taylor, 2002). The reason is that higher variance may have positive effects as in a mean-variance framework. Some panel based studies touch upon volatility and the degree of convergence to PPP levels. Imbs et al. (2003), for example, have shown for 13 industrial countries over 1975-1996 that half-lives vary positively with the degree of nominal exchange rate volatility. Volatility, by reflecting the extent of uncertainty, limits arbitrage opportunities and mean-reversion to PPP. The analysis estimates half-lives as influenced by distance, exchange rate volatility, the tradability of the goods, and the degree of competition. Distance to the U.S. and exchange rate volatility turn out to be important determinants of half-lives. Alba and Papell (2007) also document for a panel of 84 countries over

January 1976 to December 2002 that the evidence of PPP is stronger for countries characterized by moderate exchange rate volatility. Papell (2006) finds support for long-run PPP over the post-1973 floating exchange rate period, with the results influenced by international business cycles as well as structural change.

Chortareas and Kapetanios (2009) report panel results that indicate that half-lives are substantially shorter than those of the prevailing consensus. In addition to larger numbers of observations, Caporale and Cerrato (2006) list various advantages of a panel approach relative to time series data. The latter include a reduced likelihood of multicollinearity when explanatory variables vary in time *and* space. Panel data also tend to be more informative about long-run behavior than time series. Additionally, panel data sets may alleviate spurious regression problems. Wagner (2008) discusses potential advantages associated with panel approaches and reports empirical findings that run counter to the PPP hypothesis using monthly European currency data from 1980 through 2004.

Mollick (2009) provides evidence that stronger adjustment to PPP levels is observed in currency panels during economic crises. Crises, such as the currency crisis of mid-1997 in Asian countries, may induce countries to implement policy reforms, thus accelerating the adjustment between nominal exchange rates and prices. Using Mexican and U.S. price levels at various levels of aggregation over a 13-year period, Robertson et al. (2009) highlight the importance of testing PPP with the most disaggregated data possible, preferably at the individual goods level. Although tradable and non-tradable goods show little distinction in convergence rates, their estimated half-lives indicate rapid convergence especially during the December 1994 Mexican peso crisis.

Employing the sample of 32 identical goods sold on both sides of the U.S.-Mexican border, a two-step panel data method is implemented in this paper in order to gain statistical power. First, with the half-lives calculated individually for each good, an idea of which goods have faster or slower price convergence is obtained. Second, panels of goods in which price convergence is relatively fast and relatively slow are formed. Next, panels of goods in which there is more volatility or less volatility, defined as the ratio between each good's standard deviation to the mean, are also formed.

This paper adopts a disaggregated goods approach to examine a city-pair sample for a set of goods that provides a unique experiment in which distance, tradability, and industry considerations are set aside and the extent of RER variability is the only factor to influence price convergence in the two markets. Nominal exchange rates and prices transacted in both currencies form the sample for 32 goods sold in restaurant franchises that straddle the international border between El Paso, Texas and Ciudad Juárez, Mexico. Monthly observations for these variables over the July 1997 to June 2008 period are utilized to explore the relationship between real exchange rate (RER) volatility and the degree of price convergence in a panel data context. Empirical results can be briefly summarized as follows. The relationship between mean reversion and RER volatility for these goods traded along the border is found to be non-monotonic: low deviations from the law of one price are found under *both* low and high volatility panels (between 1 and 2 months); and more pronounced deviations are observed at moderate levels of uncertainty (between 3 and 4 months).

Subsequent sections are as follows. Section 2 describes the empirical methodologies. Section 3 summarizes the data employed. Section 4 contains principal findings. Section 5 concludes the paper and discusses possible future extensions.

Analytical Framework and Methodology

While Hausmann et al. (2006) argue that real exchange rates of developing countries are approximately three times more volatile than the RER of industrial economies, less work is available on sample variability and convergence to the law of one price itself. If there is information available regarding RER volatility, will mean reversion be faster or slower? Economic theory does not provide a straightforward answer to this question because higher variance may have positive effects as in a mean-variance framework. In the present context, the question becomes whether high or low variance implies higher or lower speed of convergence to theoretical levels implied by arbitrage conditions in the goods market.

One way to quantify this issue in the time series domain is to use the half-lives of real exchange rates. Empirical tests of long-run PPP are based on deviations from parity as:

$$q_{it} \equiv s_t - p_{it} + p^*_{it} \qquad (1),$$

where: s is the logarithm of the nominal exchange rate (domestic price of foreign currency), p is the logarithm of domestic prices, p* is the logarithm of foreign prices, and "i" indexes the goods(Taylor, 1988; Lothian and Taylor,

1996). Froot and Rogoff (1995) survey the three stages of PPP tests. If the three individual series are I (1) and there is a cointegrating vector representing a linear combination of them, there is evidence in favor of long-run PPP.

In this paper, the real exchange rate definition in (1) is used. All series of real exchange rates (q) are first tested for a unit root using the ADF test, as in the "Stage 2 of PPP tests" of Froot and Rogoff (1995). In that procedure, rejections of the unit root of non-stationary series imply mean reversion to PPP. For long-run PPP, the real exchange rate is stationary and the unit root null is rejected in:

$$\Delta q_{it} = \alpha_0 + \alpha_1 t + \beta_0 q_{it-1} + \sum_{j=1}^{k} \beta_j \Delta q_{it-j} + \nu_{it} \qquad (2),$$

where: α_0 is a constant; t is the time trend which captures deterministic components; q_{it} is the real exchange rate for good "i"; Δq_{it} is the first-difference of q_{it}; α_1 and the β's are parameters to estimate; and ν_{it} is the stochastic disturbance with white-noise properties. The null hypothesis of a unit root is represented by $\beta_0 = 0$ and the ADF statistic is the value associated with the t-ratio on the β_0 coefficient. The optimal lag-length (k) in this paper is determined by the sequential procedure suggested by Ng and Perron (1995), using k-max = 6 lags, which are enough to take care of serial correlation in the data. Selecting k in this manner yields the desired white-noise properties for ν_t.

The unit root null hypothesis of the procedure above is tested against the alternative of a stationary autoregressive (AR) model. In order to estimate the speed of convergence to PPP, the first-order autoregressive model on q_t is adopted under the assumption of independent identically distributed (i.i.d.) normal errors:

$$q_{it} = \alpha_0 + \alpha_1 q_{it-1} + \nu_t \qquad (3),$$

where the autoregressive parameter α_1 lies in the interval [-1, 1]. The half-life (HL) measures the time it takes for a deviation from PPP to dissipate by 50 percent and is calculated by HL = ABS [ln (0.5)/ln (α_1)]. Survey papers on long-horizon data, such as: Froot and Rogoff (1995) and Rogoff (1996), report a consensus HL of a shock to the real exchange rate as lasting between 3 and 5 years. This slow speed of reversion to PPP is difficult to reconcile with observed large short-run volatility of real exchange rates.

A problem with (3), however, is the presence of serial correlation. The AR (p) model may be used to remedy this, incorporating lagged first-differences to account for serial correlation. The AR (p) model, for t = 1, …, T, with a fixed effects term for goods, becomes:

$$q_{it} = \alpha_0 + \alpha_1 q_{it-1} + \alpha_{2it} + \sum_{j=1}^{k} \beta_j \Delta q_{it-j} + \nu_{it} \qquad (4),$$

where: α_{2it} captures a fixed effects term for goods, and the general-to-specific lag selection procedure suggested by Ng and Perron (1995) is used, with maximum lag set at k = 6 and 5 percent as the significance criterion for the last k term. For the HL calculation, the standard measure for AR (1) processes is HL ≡ [ln (0.5)/ln (α_1)]. Allowing, however, for the more flexible dynamics proposed by Rossi (2005) requires employment of a correction factor, b (1) = 1 - $\Sigma\beta_j$ (j = 1 to k) in the ADF-type regression above. The b (1) correction factor enters the calculation of the HL as: h* ≡max {ln (0.5 b (1))/ ln (α_1), 0}, which differs from h_a ≡ max {ln (0.5)/ln (α_1), 0}. The 95 percent confidence intervals for h* (respectively, h^*_l, and h^*_h) are calculated using a delta method approximation: $h_a \pm 1.96\sigma_{\alpha 1}$ {(ln (0.5)/(α_1)) [ln (α_1)]$^{-2}$}, where $\sigma_{\alpha 1}$ is the estimate of the standard deviation of α_1. Since the HL cannot be negative, a lower bound of zero is imposed.

After classifying panels by volatility categories, panel data versions of (4) are estimated using the feasible generalized least squares (FGLS) fixed-effects model. Because the residuals are not cross-section heteroscedastic and contemporaneously correlated, a variance-covariance matrix with no-weights for robust computation of standard errors is employed. Heterogeneity is taken into account via a common effects correction of the panel estimates (Imbs et al., 2005). The latter is carried out by adding to (4) cross-sectional averages to control for common shocks in the errors across all goods included in the panel:

$$q_{it} = \alpha_0 + \alpha_1 q_{it-1} + \alpha_{2it} + \sum_{j=1}^{k} \beta_j \Delta q_{it-j} + \sum_{h=0}^{h} \phi_{jh} \Delta q^{cs}_{it-h} + \nu_{it} \quad (5),$$

where q^{cs} is the cross-sectional average of q_{it}. The cross-sectional averages q^{cs} control for common shocks in the errors. The common rationale for using the panel unit root tests is increased power through both time series and cross-sectional dimensions.

Data and Panels

Table 1 reports descriptive statistics for all 32 goods in the sample, described in detail in Fullerton et al. (2009b). The real exchange rate is defined as shown in (1) and the means, under this approach, can be very close to zero. Examples include the McDonald's Quarter Pounder with Cheese at 0.011 and the McDonald's Small Fries at 0.010. This is different from the approach used in other studies that rely on deviations from the law of one price, written as DLOP = 100*(sP* - P)/P. The latter approach captures the same information as the RER shown in (1). For the 32 good sample used here, the correlation coefficients between the RER of the series measured as in (1) and the DLOP utilized elsewhere (Asplund and Friberg, 2001; Fullerton et al., 2009a) are very close to one. The lowest correlation coefficients are 0.961 for MCD5 and fall between 0.971 and 0.973 for the goods CC3, CC4, and CC5.

The standard deviations (SD) of the RER defined using (1), however, can be fairly large. Given that, the SD/mean ratio is used to classify each good as high, medium, or low volatility. In the last column Table 1, the symbols H, L, M stands for High, Low, and Medium, respectively. High volatility is defined for ratios where $|SD/Mean| \geq 1.5$; Medium volatility is defined for $1 < |SD/Mean| < 1.5$; and Low volatility is for $|SD/Mean| \leq 1$. This partition yields a fairly symmetric distribution of goods across the 3 classifications with 12 goods in the High volatility category; 12 in the Low volatility category; and 8 in the Medium volatility category.

Of course, those volatility classifications may be regarded as somewhat arbitrary. Accordingly, the sample was also partitioned using an alternative alignment of the |SD/Mean| ratio categories. The alternative panels were defined with the low RER volatility panel as $|SD/Mean| \leq 0.5$ and the medium RER volatility panel as $0.5 < |SD/Mean| < 1.5$. Under those classifications, the low volatility panel included 7 goods and the medium RER volatility panel included those 13 goods. Under this formation of panels, the results on the speed of convergence in the half-lives are qualitatively the same as those using the alignment discussed above. Some of those results are reported below and the full set of alternative panel results is available upon request from the authors.

Results

Individual Estimates of HLs

Prior to panel estimation, unit root tests are conducted on all of the real exchange rates for each good. These results are available upon request. As in prior studies, autoregressive models provide the alternative hypothesis for the unit root test procedure (Froot and Rogoff, 1995). In order to verify the appropriate number of additional regressors to include such that the final estimation is devoid of serial correlation problems as in Murray and Papell (2002), extensive lag searches are conducted with a maximum of 6 lags of differenced terms.

When the deterministic trend is included as in equation (2), the half life decreases for 24 of the menu items, increases for 6 goods, and remains the same for 2 goods. In some cases, the reduction is substantial. Examples include reductions from about 16 months to slightly over 4 months for Wendy's Combo #2, and from approximately 9 months to about 2.5 months for Wendy's Spicy Chicken sandwich. Overall, the implied half-lives are short, with no more than 5 months when the time trend is included and 16 months or less without the time trend. In the last column of Table 1 we report "Yes" or "No" for the statistical significance of the time trend in individual regressions. The sum of "Yes" counts for significant time trend coefficients in individual AR (p)-type RER regressions in (4) yields 15 out of a total of 32 goods. This suggests that in half of the goods some sort of differential productivity growth between tradables and non-tradables seems to exist (Obstfeld, 1993).

Panel Half-Lives

Panel unit root tests are also performed over the whole set of menu items in Table 2. In all cases, standard panel unit root tests for real exchange rates - such as the LLC test for a common AR structure and the IPS test for different AR coefficients - reject the unit root in levels. In a panel data context, all of the RERs are stationary, which makes them suitable for empirical representation by stationary AR processes.

Specification tests were conducted to decide between fixed effects or random effects. The null that the random effects model was true was rejected in all cases and for all subsamples. We will report both models for comparison purposes but will

be discussing in more detail the estimates of FE under robust standard errors. Table 3 contains the half-life estimates for the largest pool of 32 goods. Four sets of estimates are provided. Fixed effects and random effects model outcomes are shown in columns (1) and (2), while robust fixed effects and random effects models appear in columns (3) and (4) when robust standard errors are allowed for in the variance-covariance matrix. The inclusion of time trends was also employed in some specifications. Finally, also reported are estimates of equation (5) proposed by Imbs et al. (2005) in which cross-sectional averages control for common shocks in the errors.

Based on the FE model with robust standard errors in column (3), the estimated α_1 in Table 3 varies from 0.767 (without the trend) to 0.764 (with the trend), implying mean reversion of about 2.6 months in both cases. The introduction of panel averages reduces the corresponding half-lives from 2.15 to 2.1 months (with trend). Implying very rapid adjustment to equilibrium, the results in Table 3 can be taken as benchmarks upon which to compare subsequent panels. Yet a couple of conclusions emerge: i) because of the very large number of panel observations (over 4,000), the time trend coefficient does not have much impact on the half-life; and ii) the cross-sectional averages reduce more significantly the estimates of the half-life.

We next examine the link between (sample) RER volatility and speed of mean reversion or convergence to law of one price. In order to check whether volatility plays a role in the process of convergence to PPP levels, additional panels are assembled to allow comparing high volatility goods to low volatility goods. In Table 4, for highly volatile q series (those in which the ratio of the standard deviation with respect to the mean is greater than or equal to 1.5), the robust estimators imply half-lives of 2.19 or 2.12 months and 1.90 or 1.29 when allowing for cross-sectional averages. Compared to the benchmark results in Table 3 of a half-life of about 2 months, the sub-sample of high volatility goods in the upper panel of Table 5 implies lower estimates of half-lives. This suggests that a lower half-life (faster convergence) is associated with more sample RER volatility.

In the lower part of Table 4 for low volatility q series (those in which the standard deviation ratio with respect to the mean is less than 1), the robust estimators imply half-lives of 2.21 or 2.06 in the upper part of the table, and only 1.61 or 1.59 months in the lower part of the table after allowing for cross-sectional averages. As before, this suggests that less volatility also implies a quicker half-life compared to the full sample of all 32 goods. Lower deviations from the real exchange rate mean are thus also associated with a rapid pace of price convergence (i.e., HL of 2 months or even lower).

In Table 5, for goods with medium volatility (those in which the standard deviation ratio with respect to the mean lies between 0.5 and 1), the robust estimators imply half-lives of 3.95 or 3.93 months in the upper part of the table. In the lower half of Table 5, the robust estimators imply half-lives of 3.31 or 3.13 months after allowing for cross-sectional averages. Contrary to the panels with high and low volatility menu items, higher half-lives of greater than 3 months are observed in all specifications for goods with moderate RER volatility. This suggests that moderate levels of uncertainty are associated with lower degrees of mean reversion and longer half-lives. In other words, the relationship between mean reversion and exchange rate volatility for franchise restaurant goods sold along the U.S.-Mexico border is non-monotonic: lower duration when deviations from the law of one price occur under low- and high-levels of uncertainty and lengthier deviations observed for moderate levels of uncertainty.

Changing the definition of volatility used for panel construction yields highly similar results (not reported here). For low volatility q series (alternatively defined as those in which $|SD/mean| \leq 0.5$), the robust estimators imply half-lives of 2.15 or 1.27 months, and very low 1.03 or 0.89 month half-lives when allowing for cross-sectional averages. As before, this suggests that less volatility implies more quickly dissipating deviations from RER equilibria. For goods with medium volatility (those for which $0.5 \leq |SD/mean| \leq 1.5$), the robust estimators imply half-lives of 3.02 or 2.31 months, and 2.60 or 2.14 months after allowing for cross-sectional averages. This confirms the previous findings for the panels above where moderate levels of uncertainty are associated with lower degree of mean reversion (longer half-lives).

Conclusion

Recent research in Berger et al. (2009) investigates potential determinants of volatility in foreign exchange markets using information flows associated with trading activities. While very high frequency data are not equally available for goods and services markets, it is interesting to explore whether sample volatility implies faster or slower tendency to convergence to the law of one price. Robertson et al. (2009) document, for example, rapid price convergence for U.S.-Mexico goods during the Mexican peso crisis.

This paper builds on this idea and investigates whether volatility can help explain the persistence of deviations from long-run PPP equilibrium in border-city pairs. In the geographic context of this research, and within the particular sample of this study, neither distance, nor industry (pricing) considerations, nor tradability play roles in the process. Instead, homogeneous goods are compared and the only varying factors are the respective sets of prices in the two markets and nominal exchange rates.

Nominal exchange rates and prices in both currencies of 32 identical goods transacted in restaurants along the U.S.-Mexico border in the city-pair of El Paso and Ciudad Juárez are examined over the July 1997 to June 2008 period. We find non-monotonic relationships: Deviations from the law of one price of small duration are found under *both* low and high volatility panels (between 1 and 2 months). Longer lasting deviations are observed at moderate levels of uncertainty (between 3 and 4 months). These figures are all, however, substantially smaller than the 6 or 7 months reported by Robertson et al. (2009) for general U.S.-Mexico goods, which suggest very strong price convergence along the U.S.-Mexican border.

References

Akram, Q.F., 2006. PPP in the Medium Run: The Case of Norway. *Journal of Macroeconomics* 28, 700-719.

Alba, J., Papell, D., 2007. Purchasing Power Parity and Country Characteristics: Evidence from Panel Data Sets, *Journal of Development Economics* 83, 240-251.

Asplund, M., Friberg, R., 2001. The Law of One Price in Scandinavian Duty-Free Stores, *American Economic Review* 91, 1072-1083.

Berger, D., Chaboud, A., Hjalmarsson, E., 2009. What Drives Volatility Persistence in the Foreign Exchange Market? *Journal of Financial Economics* 94, 192-213.

Blanco-González, L., and Fullerton, T.M., Jr. 2006. Borderplex Menu Evidence for the Law of One Price, *Economics Letters* 90, 28-33.

Caporale, G., Cerrato, M., 2006. Panel Data Tests of PPP: A Critical Overview, *Applied Financial Economics* 16, 73-91.

Cheung, Y.W., Lai, K.S., 2000. On Cross-Country Differences in the Persistence of Real Exchange Rates, *Journal of International Economics* 50, 375-397.

Chortareas, G., Kapetanios, G., 2009. Getting PPP Right: Identifying Mean-Reverting Real Exchange Rates in Panels, *Journal of Banking and Finance* 33, 390-404.

Crucini, M., Shintani, M., 2008. Persistence in Law of One Price Deviations: Evidence from Micro-data, *Journal of Monetary Economics* 55, 629-644.

Engel, C., Rogers, J., 2001. Violating the Law of One Price: Should we Make a Federal Case out of it? *Journal of Money, Credit, and Banking* 33 (1), 1-15.

Froot, K., Rogoff, K., 1995. Perspectives on PPP and Long-Run Real Exchange Rates, in: Grossman, G., Rogoff, K. (Eds.), *Handbook of International Economics*, Volume 3, North-Holland, Amsterdam, 1647-1688.

Fullerton, T.M., Jr., Coronado, R. 2001. Restaurant Prices and the Mexican Peso, *Southern Economic Journal* 68, 145-155.

Fullerton, T.M., Jr., Molina, A.L., Jr., Ibarreche, S. 2007. Borderplex Economic Growth: Chicken, Egg, or Scrambled? *International Journal of Business & Economics Perspectives* 2, 124-143.

Fullerton, T.M., Jr., Molina, A.L., Jr. and Pisani, M.J. 2009a. Peso Acceptance Patterns in El Paso," *Pennsylvania Geographer* (*Special Issue on Borders & Boundaries*) 47, 91-102.

Fullerton, T.M., Jr., Fierro, K.P., Villalobos, E., 2009b. Cross-Border Restaurant Price and Exchange Rate Interactions, *North American Journal of Economics and Finance* 20, 281-288.

Hanson, G. 2001. U.S.-Mexico Integration and Regional Economies: Evidence from Border-City Pairs," *Journal of Urban Economics* 50, 259-287.

Hausmann, R., Panizza, U., Rigobon, R., 2006. The Long-Run Volatility Puzzle of the Real Exchange Rate, *Journal of International Money and Finance* 25, 93-124.

Imbs, J., Muntaz, H., Ravn, M.O., Rey, H., 2005. PPP Strikes Back: Aggregation and the Real Exchange Rate, *Quarterly Journal of Economics* 120 (1), 1-43.

Imbs, J., Muntaz, H., Ravn, M.O., Rey, H., 2003. Nonlinearities and Real Exchange Rate Dynamics, *Journal of the European Economic Association* 1 (2-3), 639-649.

Kim, J., 2004. Half-lives of Deviations from PPP: Contrasting Traded and Non-traded Components of Consumption Baskets, *Review of International Economics* 12 (1), 162-168.

Lothian, J.R., Taylor, M.P., 1996. Real Exchange Rate Behavior: The Recent Float from the Perspective of the Past Two Centuries, *Journal of Political Economy* 104, 488-509.

Lothian, J.R., Taylor, M.P., 1997. Real Exchange Rate Behavior, *Journal of International Money and Finance* 16, 945-954.

Lothian, J.R., Taylor, M.P., 2008. Real Exchange Rates over the Past Two Centuries: How Important is the Harrod-Balassa-Samuelson Effect? *Economic Journal* 118, 1742-1763.

Mollick, A.V., 2009. Crisis and Volatility in Asian versus Latin American Real Exchange Rates: 1976 to 2006, *Économie Internationale (International Economics)* 117, 5-29.

Mollick, A.V., Cortez Rayas, A., Olivas Moncisvais, R. 2006. Local Labor Markets in U.S.-Mexican Border Cities and the Impact of Maquiladora Production, *Annals of Regional Science* 40, 95-116.

Murray, C., Papell, D., 2002. The Purchasing Power Parity Persistence Paradigm, *Journal of International Economics* 56, 1-19.

Ng, S., Perron, P., 1995. Unit Root Test in ARMA models with Data Dependent Methods for the Selection of the Truncation Lag, *Journal of the American Statistical Association* 90, 268-281.

Obstfeld, M., 1993. Model Trending Real Exchange Rates. NBER Working Paper C93-011.

Papell, D., 2006. The Panel Purchasing Power Parity Puzzle, *Journal of Money, Credit, and Banking* 38 (2), 447-467.

Robertson, R., Kumar, A., Dutkowsky, D., 2009. Purchasing Power Parity and Aggregation Bias for a Developing Country: The Case of Mexico, *Journal of Development Economics* 90, 237-243.

Rogoff, K., 1996. The Purchasing-Power-Parity Puzzle, *Journal of Economic Literature* 34, 647-668.

Rossi, B., 2005. Confidence Intervals for Half-Life Deviations from Purchasing Power Parity, *Journal of Business and Economic Statistics* 23, 432-442.

Sarno, L., Taylor, M.P., 2002. Purchasing Power Parity and the Real Exchange Rate, *IMF Staff Papers* 49, 65-105.

Sheng, Y., Xu, X.P., 2011. Real Exchange Rate, Productivity, and Labor Market Frictions, *Journal of International Money and Finance* 30, 587-603.

Taylor, M.P, 1988. An Empirical Examination of Long-Run Purchasing Power Parity Using Cointegration Techniques, *Applied Economics* 20, 1369-1381.

Taylor, M.P., McMahon, P.C., 1988. Long-Run Purchasing Power Parity in the 1920s, *European Economic Review* 32, 179-197.

Taylor, M.P., Sarno, L., 1998. The Behavior of Real Exchange Rates during the Post-Bretton Woods Period, *Journal of International Economics* 46, 281-312.

Taylor, A.M., Taylor, M.P., 2004. The Purchasing Power Parity Debate, *Journal of Economic Perspectives* 18 (4), 135-158.

Wagner, M., 2008. On PPP, Unit Roots and Panels, *Empirical Economics* 35, 229-249.

Yan, B., Bernard, A., Warren, P., 2007. Industry Characteristics and the Law of One Price, *North American Journal of Economics and Finance* 18, 93-105.

Table 1. Real Exchange Rate (RER) descriptive statistics.

Items	Mean	Stand. Dev. (SD)	Skewness	Kurtosis	SD / Mean	RER Vola-tility	Sig. time trend coef.
Burger King Whopper	-0.089	0.147	-0.881	5.338	-1.652	H	No
Burger King Whopper Value Meal	-0.110	0.090	0.097	2.145	-0.824	L	Yes
Burger King Double Whopper	0.103	0.098	0.772	3.393	0.959	L	Yes
Burger King Large Fries	0.117	0.154	0.275	3.269	1.310	M	Yes
Church's Chicken 2 Pc. Dark Combo	0.086	0.257	0.039	2.453	2.998	H	No
Church's Chicken 3 Pc. Mixed Combo	0.180	0.163	-0.394	3.283	0.904	L	Yes
Church's Chicken 1 Dozen Biscuits	-0.330	0.309	2.139	8.165	-0.936	L	No
Church's Chicken Large Cole Slaw	0.292	0.309	0.002	3.262	1.057	M	Yes
Church's Chicken Lg. Mash Potatoes	0.280	0.315	0.117	3.029	1.127	M	Yes
KFC Large Cole Slaw	0.385	0.137	-0.260	5.227	0.356	L	No
KFC Large Mashed Potato	0.388	0.139	-0.279	5.082	0.357	L	No
McDonald's Big Mac Sandwich	-0.057	0.199	-1.860	7.930	-3.481	H	Yes
McDonald's Qtr. Pounder w/Cheese	0.011	0.165	0.713	13.86	15.510	H	No
McDonald's Large Fries	0.026	0.154	0.822	3.509	5.803	H	No
McDonald's Small Fries	0.010	0.177	-0.140	3.332	18.119	H	No
McDonald's Cheeseburger	-0.058	0.213	1.729	9.987	-3.651	H	Yes
Peter Piper Pizza XL Werx Pizza	0.467	0.129	0.648	3.043	1.318	M	No
Peter Piper Pizza Large 1- item Pizza	0.424	0.103	0.864	3.532	-2.263	H	No
Peter Piper Pizza XL 1-topping Pizza	0.461	0.129	0.299	3.478	-7.762	H	Yes
Pizza Hut Pizza Supreme Medium	0.414	0.100	0.429	3.508	0.275	L	No
Pizza Hut Pizza Supreme Large	0.360	0.159	0.066	2.706	0.244	L	No
Pizza Hut Meat Lover's Medium	0.283	0.164	0.261	2.639	0.280	L	No
Pizza Hut Meat Lover's Large	0.056	0.074	-0.565	3.722	0.242	L	Yes
Pizza Hut Extra Topping for Medium	-0.041	0.094	-0.271	2.797	0.443	L	No
Pizza Hut Extra Topping for Large	-0.011	0.087	-0.964	5.242	0.581	L	No
Taco Tote Charbroiled Potato	0.131	0.192	0.228	3.886	1.461	M	No
Taco Tote Frijoles Charros	0.141	0.172	0.310	4.354	1.214	M	Yes
Wendy's Baked Potato	-0.098	0.132	-1.074	5.181	-1.347	M	No
Wendy's Spicy Chicken Sandwich	0.071	0.170	0.823	3.174	2.390	H	Yes
Wendy's Chicken Salad	0.091	0.146	0.875	2.907	1.594	H	Yes
Wendy's Combo #2	0.044	0.117	0.039	2.667	2.673	H	Yes
Wendy's Big Bacon Classic Sandwich	0.080	0.120	-0.093	5.842	1.494	M	Yes

Notes:
H, L, and M stand for High, Low, and Medium, respectively.
RER Volatility is classified according to the SD/Mean ratio in absolute value (|SD/Mean|).
High volatility is $|SD/Mean| \geq 1.5$;
Medium volatility is $1 < |SD/Mean| < 1.5$;
Low volatility is $|SD/Mean| \leq 1$.
As reported in the last column, the total number of "Yes" counts for significant time trend coefficients in individual RER AR(p) regressions is 15 out of 32 total goods.

Table 2. Panel Unit Root Test Results and Half-lives.

Levin-Lin-Chu Test									
	T stat	N	T	S_N	μ_{mt}	σ_{mt}	Z		
No Trend	-17.5	32	4178	1.02	-0.52	0.769	-9.20		
Trend	-22.1	32	4178	1.02	-0.56	0.677	-12.8		

Im, Pesaran and Shin test			
	T-barNT	Z	*p* value
No Trend	-3.567	-13.401	0.000
Trend	-4.189	-14.704	0.000

Estimated half-lives				
	Levin, Lin & Chu		Im, Pesaran, and Shin	
	1-ρ	Half life	1-ρ	Half life
No Trend	-0.152	4.2	-0.314	1.8
Trend	-0.229	2.7	-0.236	2.6

Notes:
In both tests, the unit root forms the null hypothesis.

Table 3. Estimated half-lives: real exchange rates – all 32 goods.

$$q_{it} = \alpha + \beta q_{it-1} + \varepsilon$$
$$q_{it} = \alpha + \beta q_{it-1} + \gamma trend + \varepsilon$$
$$q_{it} = \alpha + \beta q_{it-1} + \tau\, avg(q_t) + \varepsilon$$
$$q_{it} = \alpha + \beta q_{it-1} + \tau\, avg(q_t) + \gamma trend + \varepsilon$$

	FE	RE	FE (Robust)	RE (Robust)
No trend β (s.e) **Implied half-life**	 .686*** (.011) 1.84	 .740*** (.010) 2.30	 .767*** (.032) 2.62	 .899*** (.010) 6.50
With trend β (s.e) **Implied half-life**	 .764*** (.010) 2.57	 .898*** (.007) 6.44	 .764*** (.033) 2.57	 .898*** (.010) 6.44
No trend and panel average β (s.e) **Implied half-life**	 .657*** (.011) 1.65	 .715*** (.010) 2.07	 .724*** (.036) 2.15	 .888*** (.011) 5.89
With trend and panel average β (s.e) **Implied half-life**	 .724*** (.010) 2.1	 .889*** (.007) 5.9	 .724*** (.036) 2.1	 .889*** (.011) 5.9

Notes:
FE and RE used regressions with AR(1) disturbances.
FE(vce) and RE(vce) used GLS regression models.
Estimations with two lags were also implemented, but for three or more lags convergence was not achieved.
avg(q_t) is RER panel average as explained in equation (5) in the text.

Table 4. Estimated half-lives: real exchange rates – subsamples of high and low q volatility.

high q volatility (SD/Mean≥ 1.5) 12 goods	**FE**	**RE**	**FE (Robust)**	**RE (Robust)**
No trend β (s.e) **Implied half-life**	.584*** (.021) 1.29	.603*** (.020) 1.37	.729*** (.065) 2.19	.757*** (.037) 2.49
With trend β (s.e) **Implied half-life**	.721*** (.018) 2.12	.751*** (.017) 2.42	.721*** (.062) 2.12	.751*** (.039) 2.42
No trend and panel average β (s.e) **Implied half-life**	.560*** (.021) 1.20	.579*** (.020) 1.27	.695*** (.059) 1.90	.728*** (.039) 2.19
With trend and panel average β (s.e) **Implied half-life**	.694*** (.018) 1.90	.728*** (.017) 2.19	.694*** (.059) 1.29	.728*** (.040) 2.19
low q volatility (SD/Mean≤ 1) 12 goods	**FE**	**RE**	**FE (Robust)**	**RE (Robust)**
No trend β (s.e) **Implied half-life**	.700*** (.018) 1.95	.806*** (.015) 3.21	.731*** (.023) 2.21	.923*** (.013) 8.68
With trend β (s.e) **Implied half-life**	.714*** (.018) 2.06	.922*** (.010) 8.55	.714*** (.022) 2.06	.922*** (.013) 8.56
No trend and panel average β (s.e) **Implied half-life**	.621*** (.019) 1.45	.758*** (.016) 2.51	.651*** (.032) 1.61	.916*** (.013) 7.86
With trend and panel average β (s.e) **Implied half-life**	.647*** (.019) 1.59	.916*** (.010) 7.87	.648*** (.033) 1.59	.916*** (.013) 7.87

Notes: FE and RE used regressions with AR (1) disturbances. FE(vce) and RE(vce) used GLS regression models. Estimations with two lags were also implemented, but for three or more lags convergence was not achieved. **avg(q_t)** is RER panel average as explained in equation (5) in the text.

Table 5. Estimated half-lives: real exchange rate (q) – subsample medium q volatility (.5< SD/Mean < 1) 8 goods.

	FE	RE	FE (Robust)	RE (Robust)
No trend β (s.e) **Implied half-life**	 .786*** (.019) 2.88	 .799*** (.019) 3.09	 .839*** (.035) 3.95	 .885*** (.020) 5.67
With trend β (s.e) **Implied half-life**	 .838*** (.017) 3.93	 .884*** (.015) 5.65	 .838*** (.032) 3.93	 .884*** (.020) 5.65
No trend and panel average β (s.e) **Implied half-life**	 .764*** (.019) 2.58	 .774*** (.019) 2.71	 .811*** (.048) 3.31	 .868*** (.021) 4.90
With trend and panel average β (s.e) **Implied half-life**	 .802*** (.018) 3.13	 .863*** (.015) 4.70	 .802*** (.039) 3.13	 .863*** (.021) 4.70

Notes:
FE and RE used regressions with AR(1) disturbances.
FE(vce) and RE(vce) used GLS regression models.
Estimations with two lags were also implemented, but for three or more lags convergence was not achieved.
avg(q_t) is RER panel average as explained in equation (5) in the text.

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Professor Barraza is an award winning economist who has taught at several universities in Mexico and has published in academic research journals in Mexico, Europe, and the United States. Dr. Barraza currently serves as Research Provost at UACJ. Professor Fullerton has authored econometric studies published in academic research journals of North America, Europe, South America, Asia, Africa, and Australia. Dr. Fullerton has delivered economics lectures in Canada, Colombia, Ecuador, Finland, Germany, Japan, Korea, Mexico, the United Kingdom, the United States, and Venezuela.

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Professor Calderón is an award winning economist who has taught and published in Mexico, France, and the United States. Dr. Calderón spent a year as a Fulbright Scholar at the University of Texas at El Paso. Professor Fullerton has published research articles in North America, Europe, Africa, South America, and Asia. The author of several econometric forecasts regarding impacts of the Brady Initiative for Debt Relief in Latin America, Dr. Fullerton has delivered economics lectures in Canada, Colombia, Ecuador, Finland, Germany, Japan, Korea, Mexico, the United States, and Venezuela.

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