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**Marco A. Hernandez Vega**  
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# Real Exchange Rate Variations, Nontraded Goods and Disaggregated CPI Data\*

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**Abstract:** The behavior of the real exchange rate, measuring movements in the relative consumer price indexes between countries, remains a prominent puzzle in international macroeconomics. Two key theories of the real exchange rate differ in the role played by goods not traded internationally. On one hand, the theory of Balassa-Samuelson, on the other hand, models with sticky prices. This study provides new empirical evidence on nontraded goods importance in real exchange volatility by using more highly disaggregated data than used in previous literature on prices and trade between the U.S. and Mexico for the period 2002-2009. The main results suggest that the nontraded component accounts for between 69 and up to 84 percent of the real exchange rate volatility. In addition, the results show that the nontraded component is negatively correlated with the traded component despite both countries being in a flexible exchange rate regime contradicting previous literature. These results generally support the Balassa-Samuelson theory.

**Keywords:** Real exchange rates, Relative prices.

**JEL Classification:** F31.

**Resumen:** El comportamiento del tipo de cambio real, que mide los movimientos en los índices de precios relativos entre países, sigue siendo un enigma importante en la macroeconomía internacional. Existen dos teorías importantes del tipo de cambio real que difieren en el papel de los bienes no comerciados internacionalmente. Por un lado, la teoría de Balassa-Samuelson y por el otro, los modelos de precios rígidos. Este estudio provee nueva evidencia empírica sobre la importancia de los bienes no comerciados en las variaciones del tipo de cambio real utilizando datos más desagregados de precios y comercio internacional que en estudios previos entre Estados Unidos y México para el periodo 2002-2009. Los resultados principales sugieren que los bienes no-comerciados explican entre el 69 y el 84 por ciento de la volatilidad del tipo de cambio real y que el componente de bienes no comerciados está negativamente correlacionado con el componente de comerciados a pesar de que ambos países se encuentran bajo un régimen de tipo de cambio flexible, lo que contrasta con lo sugerido en estudios anteriores. Estos resultados apoyan la teoría de Balassa-Samuelson.

**Palabras Clave:** Tipo de cambio real, Precios relativos.

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# 1 Introduction

Real exchange rate behavior remains a puzzle in international macroeconomics. One leading theory proposed by Balassa and Samuelson (1964) assumes that the Law of One Price (LOP)<sup>1</sup> holds for traded goods, and states that deviations in Purchasing Power Parity (PPP) are caused by movements in nontraded goods. However, some empirical evidence, led by Engel (1999), finds that deviations from LOP for traded goods account for almost all real exchange rate fluctuations. This evidence has given support to the sticky price theory of real exchange rates. This theory assumes that since prices are sticky, fluctuations in the nominal exchange rate lead to PPP deviations through failures in the LOP for traded goods. Therefore, there exist two competing theories of the real exchange rate distinguished by the role of nontraded goods prices.

Engel (1999) notes that, apart from LOP violations, the lack of highly disaggregated data on prices plays a very significant role in PPP deviations and explains how the common way of classifying Consumer Price Index (CPI) components into traded and nontraded goods categories generates a bias towards traded goods. Evidence for this bias has been made very palpable by recent research in trade which has emphasized that not all goods defined as tradable are indeed traded. For example, Crucini et al. (2005) show that, across countries, the international price gap in nontraded goods is higher and more volatile than the price gap for traded goods.

Researchers, like Engel (1999), Chari et al. (2002), Burstein et al. (2006), and Betts and Kehoe (2006), have been trying to minimize the bias towards traded goods in the CPI by adopting different measures for the traded component of the real exchange rate. For instance, Chari et al. (2002), besides using CPI data, they used personal expenditure in durable goods, semi-durables goods, nondurables goods, and services. Burstein et al. (2006) used Imports and Exports price indices, and Betts and Kehoe (2006) used Gross Output Deflator, Personal Consumption Deflator and Producer Price Indexes (PPI).

Nevertheless, almost all of these additional price indexes suffer from the same lack of disaggregation. In the case of the PPI, for example, it includes prices of exported goods and locally produced goods, and these cannot be separated from the data available. Also as Burstein et al. (2006) noted, PPI does not include imported goods prices.

In turn, there has been some evidence contradicting Engel (1999) results, for example, the work of Mendoza (2000) who found that during periods of real exchange rate stability in Mexico, nontraded goods importance in explaining real exchange rate variations can be of up to 70%. Burstein et al. (2005) found that after devaluations nontraded goods importance in real exchange rate variations falls around 30%. In a more recent work, Naknoi (2008) found the same results as in Mendoza (2000) and Burstein et al. (2005) for a sample of European and emerging economies. Moreover, in all these studies the correlation between the traded and nontraded components of the real exchange rate becomes positive in periods where a flexible exchange rate regime is adopted whereas during a fixed exchange rate regime this correlation is negative.

Another attempt to support the role for nontraded goods was made by Betts and Kehoe

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<sup>1</sup>The LOP states that once adjusted by the nominal exchange rate, the prices of identical goods must be the same across countries.

(2006). They constructed a traded goods price measure as the price index of commodities minus food, for the U.S. case, and all goods minus services in Mexico's case. Given their definition of traded goods, it is not surprising that their results suggest that traded goods are more important for explaining real exchange rate variations than nontraded goods, since such a definition is too broad and still suffers from a high bias towards tradable goods. However, what they do find is a high correlation between the real exchange rate and the relative price of nontraded to traded goods between close trade partners.

Finally, in a different study Burstein et al. (2006) gathered quarterly data on nominal exchange rates, CPI and imports and exports prices for 11 developed economies for the period 1971 – 2002, arguing that import and export price indices are a better measure of nontraded goods. Since using these price indices do not offer information about nontraded prices they computed them by subtracting their traded goods measure from CPI data. They found that with import and export price indices the importance of nontraded goods in real exchange volatility is of more than 50%. However, import and export price indices contain information on prices of intermediate goods which mostly are not taken into account in the CPI computation. As Burstein et al. (2006) noted, subtracting a price index that involves intermediate goods prices (Imports and Exports price indices) from an index that consider the prices of final goods (e.g. the CPI) may not be entirely correct.

The main contribution of this paper is the use of more highly disaggregated data on consumer prices and trade between the U.S. and Mexico than any previous empirical analysis in order to work with a more precise measure of the traded and nontraded components of the real exchange rate. For the case of Mexico, when classifying CPI components into traded and nontraded, it is found that from the 202 groups of goods in the Manufacturing category (which are usually consider as traded) 41 groups were not traded between 2002 and 2006. As a result, the prices of these goods were not subject to the arbitrage conditions needed to enforce the law of one price across the border. An additional contribution of this paper is that it suggests a basic approach on how to decompose consumer price indices into traded and nontraded goods taking into account the methodology used by the institutions that elaborate the consumer price index in the U.S. and Mexico.<sup>2</sup>

The results show that computing price indices with the methodology used by US and Mexico statistics institutions (Laspeyres formula), and looking at the variance decomposition statistic (vardec2), the relative price of nontraded to traded goods accounts for 73%, 84% and 87% of the real exchange rate volatility for monthly, quarterly and annual filtered data respectively (using Christiano and Fitzgerald (2003) filter). This is a dramatic increase from the values found in previous works and contradicts previous literature which stated that data frequency does not have an effect in the importance of nontraded goods in the real exchange rate volatility. Second, the relative price of nontraded goods is highly correlated with the bilateral real exchange rate (correlation coefficients of 0.68, 0.74 and 0.87 for monthly, quarterly and annual frequencies respectively). Third, in contrast with the findings of Mendoza (2000), Burstein et al. (2005) and Naknoi (2008) the relative price of nontraded to traded goods is negatively correlated with the relative price of traded goods despite Mexico and

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<sup>2</sup>The Bureau of Labor Statistics (BLS) in the U.S.; for the case of Mexico the CPI was elaborated by Banco the Mexico up to June 2011. From July 2011 the CPI in Mexico is elaborated by Instituto Nacional de Estadística, Geografía e Informática (INEGI).

the U.S. being in a flexible exchange rate regime (correlation coefficient of -0.41, -0.49 and -0.23).<sup>3</sup>

In addition, this work finds that taking into account the methodology used to elaborate the CPI or assuming that the CPI is composed by a geometric average of traded and non-traded goods improves the importance of nontraded goods prices in the real exchange rate volatility. On the other hand, the methodology suggested by Betts and Kehoe (2006) gives a poor performance providing, in some cases, a non significant correlation between nontraded goods and the real exchange rate. Finally, as in Betts and Kehoe (2006) how the data are transformed matters for studying the importance of nontraded goods in real exchange rate volatility.

These results may have a significant implication for the two competing theories of real exchange rate behavior. For the case of Mexico and the US my findings offer evidence against the sticky price theory. On the other hand, my findings offer new support for the Balassa-Samuelson theory.

The next section provides the details of the data on prices and trade used in this analysis. The methodology is described in Section 3. Section 4 shows the results, and Section 5 concludes the study.

## 2 Data

In this work, monthly data on CPI components, as well as annual trade data between the U.S. and Mexico were obtained.

The data for Mexico contain average monthly prices<sup>4</sup> for more than 1000 goods in a sample of 46 cities for the period July 2002 to December 2009. These goods are classified into 315 groups that correspond to the highest disaggregation level used in the computation of the CPI. The data also contain the weights for each of the 315 groups.

Highly disaggregated data for the U.S. were obtained from the "Consumer Price Index Detailed Report" published by the Bureau of Labor Statistics<sup>5</sup> (BLS) for the period July 2002 to December 2009. It contains price indexes for more than 200 detailed expenditure categories plus some special indexes.

Data on imports and exports for the U.S. are available from The Center for International Data at UC Davis. The data contain highly disaggregated information on U.S. imports and exports per country of origin or destination at annual frequency. The data are classified by the Harmonized System, the Standard International Trade Classification, U.S. Standard Industrial Classification, and 6-digit North American Industrial Classification System (NAICS). This last classification is the one used in this work in order to differentiate traded from nontraded goods.

The NAICS classification was created with the purpose of making more direct comparison of business statistics among North American countries (U.S., Mexico and Canada). It also

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<sup>3</sup>Mexico adopted a flexible exchange rate regime on December 1994.

<sup>4</sup>Detailed explanation on how prices are gathered and how the CPI is computed in Mexico is published in Diario Oficial de la Federacion, [www.banxico.org.mx](http://www.banxico.org.mx) and [www.inegi.gob.mx](http://www.inegi.gob.mx).

<sup>5</sup>Details on this publication and CPI elaboration are published in the BLS Handbook of Methods Chapter 17 at [www.bls.gov](http://www.bls.gov).

makes industrial classification among these countries homogeneous up to a certain level. Although NAICS were designed by these countries, there still exist some differences. For instance, NAICS between Mexico and the U.S. are homogeneous only up to the 5-digit level. For the most disaggregated 6-digit level, only about 60% of the industry categories are homogeneous.

Finally, nominal exchange rate data were obtained from the International Financial Statistics (IFS) data set provided by International Monetary Fund. The data obtained consisted of monthly, quarterly, and annual average nominal exchange rate between the U.S. and Mexico for the period 2002 to 2009.

## 2.1 Identifying Traded and Nontraded Goods in the Data

In order to classify the data on consumer prices into traded and nontraded goods it is important, first, to define these categories: A good is *traded* if it is either imported or exported between the U.S. and Mexico. A good is then called *nontraded* if it is neither imported nor exported between these two countries.

Then, in order to perform this classification, it is necessary to match each group in the consumer price index with the closest 6-digit NAICS code. The trade data show that the goods traded between Mexico and the U.S. from 2002 to 2006 corresponded to Agriculture, Forestry, Fishing and Hunting; Mining; Manufacturing; and some unclassified items. Since the consumer price index involves mostly final goods, only the categories Agriculture, Forestry, Fishing and Hunting; and Manufacturing were kept to be matched with CPI data.

From the total groups in the U.S. CPI data it was possible to assign NAICS codes to 63%. In Mexico's case, 77% of the CPI groups were matched with a NAICS code. It must be noted that Mexico's 6-digit NAICS classification does not entirely match the concepts detailed in the U.S. NAICS as mentioned above. Hence, it was necessary to elaborate a concordance table between Mexico's and U.S. NAICS classification. This table allowed the matching of Mexico's CPI groups with the trade data.

The trade data show that more than 8,000 goods were imported and exported between the U.S. and Mexico per year. Each of these is classified by an industry 6-digit NAICS code. Given that the 6-digit disaggregation level of the NAICS is not as high as the concepts in either the trade or the CPI data, it was expected to find a significant amount of repeated codes. For a cleaner matching between trade and the CPI data, the repeated codes were taken out from the trade data set. The result showed that on average there are 405 unique NAICS codes identified with exports from the U.S. to Mexico and an average of 404 unique NAICS codes identified with imports from Mexico for the period 2002 to 2006.

Based on the trade data a dummy variable to identify traded goods for each of the two countries was defined. This dummy variable was equal to one for each CPI component if and only if its NAICS code appeared in the imports, exports or in both data sets. For Mexico's CPI data, of the 242 groups with a NAICS code, 197 appeared in at least one of these data sets, and hence are defined as traded goods. In the same fashion, for the U.S. case, of the 133 groups 112 are identified as traded goods.

All the CPI groups with a NAICS code that did not appear in the trade data were then classified as nontraded goods together with the groups that were not assigned a NAICS code.



As a result, the traded goods category for the U.S. and Mexico contains 112 and 197 CPI groups respectively.

### 3 Methodology

It is common in economics to define the bilateral real exchange rate between country  $i$  and country  $j$  as:

$$RER_{i,j,t} = S_{i,j,t} \frac{P_{i,t}}{P_{j,t}} \quad (1)$$

where  $S_{i,j,t}$  is the nominal exchange rate between country  $i$  and country  $j$  at time  $t$ ; and  $P_{i,t}$  ( $P_{j,t}$ ) is country's  $i$  ( $j$ ) CPI.

In order to calculate the importance of nontraded goods in  $RER$  volatility, it is necessary, first, to classify the goods that form the CPI into two groups, traded and nontraded goods. Second, it is required to know the functional form of the CPI in terms of these two groups. Accomplishing the first of these tasks requires obtaining sufficiently disaggregated data on consumer price indices and bilateral trade between countries  $i$  and  $j$ , which is the main objective of this work. The second task represents another challenge since it is not clear what functional form the CPI has in terms of traded and nontraded goods, as noted by Betts and Kehoe (2006).

#### 3.1 Betts and Kehoe (2006) Solution

To circumvent these obstacles, researchers like Betts and Kehoe (2006) have suggested that it is not necessary to assume any functional form for the CPI, but that the importance of nontraded goods in  $RER$  volatility can be obtained by using just a measure of traded goods prices  $P_{i,t}^T$  and CPI data. Then, multiplying and dividing equation (1) by  $\frac{P_{i,t}^T}{P_{j,t}^T}$  the real exchange rate becomes:

$$RER_{i,j,t} = \left( S_{i,j,t} \frac{P_{i,t}^T}{P_{j,t}^T} \right) * \left[ \left( \frac{P_{j,t}^T}{P_{j,t}} \right) / \left( \frac{P_{i,t}^T}{P_{i,t}} \right) \right] \quad (2)$$

#### 3.2 Geometric Average CPI

On the other hand, researchers like Engel (1999) and Burstein et al. (2006) have assumed that the CPI can be expressed as a geometric average of traded and nontraded goods prices. In other words, if data on traded and nontraded prices are available, it is possible to represent the CPI for any two countries  $i$  and  $j$  as:

$$P_{i,t} = [P_{i,t}^T]^{1-\alpha} [P_{i,t}^N]^\alpha \quad (3)$$

$$P_{j,t} = [P_{j,t}^T]^{1-\beta} [P_{j,t}^N]^\beta \quad (4)$$



where  $\alpha$  and  $\beta$  represent the share of nontraded goods in the CPI of country  $i$  and  $j$  respectively<sup>6</sup>.

Then, under this assumption it is possible to express the real exchange rate between countries  $i$  and  $j$ , equation (1), in terms of traded and nontraded goods prices as follows:

$$RER_{i,j,t} = S_{i,j,t} \frac{[P_{i,t}^T]^{1-\alpha} * [P_{i,t}^N]^\alpha}{[P_{j,t}^T]^{1-\beta} * [P_{j,t}^N]^\beta} \quad (5)$$

As before, multiplying and dividing equation (5) by  $P_{i,t}^T/P_{j,t}^T$  we obtain:

$$RER_{i,j,t} = \left( S_{i,j,t} \frac{P_{i,t}^T}{P_{j,t}^T} \right) * \left[ \left( \frac{P_{i,t}^N}{P_{i,t}^T} \right)^\alpha / \left( \frac{P_{j,t}^N}{P_{j,t}^T} \right)^\beta \right] \quad (6)$$

### 3.3 The Laspeyres Price Index

In the U.S. and Mexico, the CPI is calculated using the Laspeyres formula. The differences are that, in the U.S., elementary price indices are calculated using geometric averages and then, the Laspeyres formula is applied to such indices to generate the aggregate CPI. On the other hand, in Mexico simple price averages are calculated and then the Laspeyres formula is used. In addition, in the case of Mexico's CPI the weight assigned to each good remains fixed throughout all the time that the index is used, whereas in the U.S. these weights are updated every two years<sup>7</sup>.

Then, if there exist  $L$  goods prices composing the CPI of country  $i$ , for example, and to each price a weight  $\omega_\ell$  with  $\sum_{\ell=1}^L \omega_\ell = 1$  is assigned, then the Laspeyres price index is:

$$P_{i,t} = \sum_{\ell=1}^L \omega_\ell \frac{p_{i,\ell,t}}{p_{i,\ell,0}} \quad (7)$$

where  $p_{i,\ell,0}$  is the price of good  $\ell$  in the base year 0.

If  $K$  ( $M$ ) goods in the CPI are traded (nontraded) then we can write the price indices of countries  $i$  and  $j$  as a weighted sum of traded and nontraded goods:

$$P_{i,t} = \rho_T \sum_{k=1}^K \theta_k \frac{p_{i,k,t}}{p_{i,k,0}} + \rho_N \sum_{m=1}^M \theta_m \frac{p_{i,m,t}}{p_{i,m,0}} \quad (8)$$

$$P_{j,t} = \phi_T \sum_{k=1}^K \theta_k \frac{p_{j,k,t}}{p_{j,k,0}} + \phi_N \sum_{m=1}^M \theta_m \frac{p_{j,m,t}}{p_{j,m,0}} \quad (9)$$

<sup>6</sup>Burstein et al. (2006) computed the share of traded goods as a trade-weighted average per country price series. They obtained an average share value of 57%.

<sup>7</sup>BLS publishes the weights in its website and in the Consumer Price Index Detailed Report.

where  $(\rho_T, \rho_N)$  represent the weights that traded and nontraded goods have in the CPI of country  $i$  whereas  $(\phi_T, \phi_N)$  are the weights that traded and nontraded goods have in the CPI of country  $j$ , and  $K + M = L^8$ .

Note that the term  $\sum_{k=1}^K \theta_k \frac{p_{i,k,t}}{p_{i,k,0}}$  is the price index of traded goods and the second term  $\sum_{m=1}^M \theta_m \frac{p_{i,m,t}}{p_{i,m,0}}$  is the price index of nontraded goods in country  $i$  (analogously for country  $j$ ).<sup>9</sup> Then, for both countries the CPI expressed as a function of traded and nontraded goods becomes:

$$P_{i,t} = \rho_T P_{i,t}^T + \rho_N P_{i,t}^N \quad (10)$$

$$P_{j,t} = \phi_T P_{j,t}^T + \phi_N P_{j,t}^N \quad (11)$$

Then, putting equation (10) and (11) into equation (1) and multiplying and dividing by  $\frac{P_{i,t}^T}{P_{j,t}^T}$  we have:

$$RER_{i,j,t} = \left( S_{i,j,t} \frac{P_{i,t}^T}{P_{j,t}^T} \right) * \left[ \left( \rho_T + \rho_N \frac{P_{i,t}^N}{P_{i,t}^T} \right) / \left( \phi_T + \phi_N \frac{P_{j,t}^N}{P_{j,t}^T} \right) \right] \quad (12)$$

These three methods will be implemented for the case of the U.S. and Mexico to analyze the importance of nontraded goods prices to explain  $RER$  volatility. The data suggest that traded goods account for around one third of the total weights in the U.S. and Mexico's consumer price indices. In particular, the weights of traded and nontraded goods in U.S. CPI are:<sup>10</sup>  $\rho_T = 0.29$  and  $\rho_N = 0.71$  respectively. In the same fashion, the weights of traded and nontraded goods in Mexico CPI are  $\phi_T = 0.35$  and  $\phi_N = 0.65$  respectively.

Now, denote the real exchange rate computed by Betts and Kehoe (2006) methodology, equation (2), as  $RER_{BK,t}$ ; denote the real exchange rate computed by assuming a geometric average CPI, equation (6), as  $RER_{GA,t}$ ; and denote the real exchange rate obtained by following the Laspeyres formula to compute the CPI, equation (12), as  $RER_{LP,t}$ . Then, these equations become:

$$RER_{BK,t} = \left( S_{us,mx,t} \frac{P_{us,t}^T}{P_{mx,t}^T} \right) * \left[ \left( \frac{P_{mx,t}^T}{P_{mx,t}} \right) / \left( \frac{P_{us,t}^T}{P_{us,t}} \right) \right] \quad (13)$$

$$RER_{GA,t} = \left( S_{us,mx,t} \frac{P_{us,t}^T}{P_{mx,t}^T} \right) * \left[ \left( \frac{P_{us,t}^N}{P_{us,t}^T} \right)^{0.71} / \left( \frac{P_{mx,t}^N}{P_{mx,t}^T} \right)^{0.65} \right] \quad (14)$$

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<sup>8</sup>where  $\rho_T = \sum_{k=1}^K \omega_k$ ,  $\rho_N = \sum_{m=1}^M \omega_m$ ,  $\theta_k = \frac{\omega_k}{\sum_{k=1}^K \omega_k}$  and  $\theta_m = \frac{\omega_m}{\sum_{m=1}^M \omega_m}$

<sup>9</sup> $\theta_k$  is the weight that traded good  $k$  has in the traded goods price index,  $\theta_m$  is the weight that nontraded good  $m$  has in the nontraded goods price index. Hence,  $\sum_{k=1}^K \theta_k = \sum_{m=1}^M \theta_m = 1$ .

<sup>10</sup>Despite that in the U.S. such weights are updated every two years, the total weights of either traded and nontraded goods in the CPI do not change significantly. Henceforth, the weights used in this analysis correspond to the ones used to compute the U.S. CPI in 2002.

$$RER_{LP,t} = \left( S_{us,mx,t} \frac{P_{us,t}^T}{P_{mx,t}^T} \right) * \left[ \left( 0.29 + 0.71 * \frac{P_{us,t}^N}{P_{us,t}^T} \right) / \left( 0.35 + 0.65 * \frac{P_{mx,t}^N}{P_{mx,t}^T} \right) \right] \quad (15)$$

The first term on the right hand side of equations (13), (14) and (15) is defined either as the bilateral relative price of traded goods or the traded component (RERT). The second term is defined either as the bilateral relative price of nontraded to traded goods or the nontraded component (RERN). Then, taking logarithms of equations (13), (14) and (15) we have<sup>11</sup>:

$$RER_{h,t} = RERT_{h,t} + RERN_{h,t} \quad (16)$$

where  $h = BK, GA, LP$

The  $RER_{h,t}$  data and its components in equation (16) (what would be referred as data in levels) will be transformed as follows: first, by removing a linear trended to directly compare with Betts and Kehoe (2006) results. Second, by filtering the data with the HP filter and with the Christiano and Fitzgerald (2003) asymmetric band pass filter (denominated CF filter hereafter). The CF filter is employed given the advantages it has over the more common HP filter. For instance, the CF filter suppresses both the low frequency and the high frequency components of the data. Also, it is closer to the optimal filter than the HP filter for high frequency data and corrects for disturbances in the tail of the distribution.<sup>12</sup> Lastly, the 1-month, 1-quarter and 1-year changes of the data are obtained.

To find the importance of nontraded goods prices in  $RER$  volatility it is necessary to make use of the statistics computed by Betts and Kehoe (2006):

Sample Correlation:

$$corr(RER_{h,t}, RERN_{h,t}) = \frac{cov(RER_{h,t}, RERN_{h,t})}{[var(RER_{h,t}) * var(RERN_{h,t})]^{\frac{1}{2}}} \quad (17)$$

Ratio of Standard Deviations:

$$\frac{std(RERN_{h,t})}{std(RER_{h,t})} = \left[ \frac{var(RERN_{h,t})}{var(RER_{h,t})} \right]^{\frac{1}{2}} \quad (18)$$

Variance Decompositions:

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<sup>11</sup>Where the subindexes  $us, mx$  have been omitted.

<sup>12</sup>The CF filter is a band pass filter that dominates in optimal criterion the HP filter. The CF filter depends on the time series properties of the data and since it is asymmetric it does not create problems at the beginning or at the end of the sample as the symmetric HP filter. Moreover, the CF filter (as any other band pass filter) corrects for the undesirable high frequency variability leaved by the HP filter. For more details about the CF filter and the HP filter see Canova (2007) and Christiano and Fitzgerald (2003).

$$vardec(RER_{h,t}, RERN_{h,t}) = \frac{var(RERN_{h,t})}{var(RERN_{h,t}) + var(RERT_{h,t})} \quad (19)$$

$$vardec2(RER_{h,t}, RERN_{h,t}) = \frac{var(RERN_{h,t}) + cov(RERN_{h,t}, RERT_{h,t})}{var(RER_{h,t})} \quad (20)$$

Mean Square Error Decomposition of Changes:

$$msedec(RER_{h,t}, RERN_{h,t}) = \frac{mse(RERN_{h,t})}{mse(RERN_{h,t}) + mse(RERT_{h,t})} \quad (21)$$

Equation (19) and (20) indicate how much of the variance of RER can be explained by movements in the nontraded component. The former relative to the overall variance of RER and the latter relative to the variance of the real exchange rate but allocating only half the covariance between traded and nontraded components to movements in the nontraded component. Finally, equation (21) indicates how much the mean square error of changes in the nontraded component explains the mean square error of changes of RER.

## 4 Results

Table 1 contrasts the contribution of the nontraded component in RER volatility using highly disaggregated data on trade and prices against the contribution of the nontraded component using more aggregated data. The first column of Table 1 lists the data transformations and statistics. The second and third columns show Betts and Kehoe (2006) original results and an actualization of those for the period 2002-2009 respectively. Finally, the last column contains the results with highly disaggregated data. The comparison takes place at the annual frequency since Betts and Kehoe (2006) report these results only for the U.S-Mexico's case, also since the sample used in this analysis is smaller the contrast is carried out up to the one-year difference for the case of the mean square error decomposition.

In Betts and Kehoe (2006) original results, the nontraded component has a high correlation with the RER. Nevertheless, for the period 2002 to 2009 this correlation dropped. In particular, columns 2 and 3 in Table 1 highlight the fall in the correlation between RER and the nontraded component for the data in levels and for the one year differenced data (the correlation decreased from 0.64 to -0.30 in the former and from 0.26 to -0.39 in the last). This decay in the correlation between nontraded goods and the real exchange rate implies a deterioration on the importance of the nontraded component in explaining RER variations, as do occurs for the variance decomposition statistic which values fell from 0.33 to 0.16 for the data in levels and from 0.26 to 0.12 for linearly detrended data.

Column 4 shows that using highly disaggregated data considerably increases the contribution of the nontraded component when compared with Betts and Kehoe (2006) updated results. For example, for linearly detrended data column 3 shows a variance decomposition of 0.12 and a mean square error decomposition of the one year differenced data of 0.07 whereas

with highly disaggregated data the values of these statistics are 0.65 and 0.45 respectively. The same occurs when comparing the correlation between RER and the nontraded component. For the data in levels, the correlation coefficient increased from -0.33 with aggregated data to 0.81 with highly disaggregated data. In addition, the ratio of standard deviations suggests that with highly disaggregated data the nontraded component is (depending on the transformation) at least as volatile as the RER whereas with more aggregated data the volatility of the nontraded component is at most half the volatility of RER.

In general, Table 1 shows that the importance of the nontraded component when explaining RER volatility is higher when using highly disaggregated data on prices and trade, even when the nontraded component is computed using a CPI formula that does not directly take into account nontraded goods prices, as in Betts and Kehoe (2006). Hence, a better estimation of the contribution of the nontraded component in RER volatility must be obtained not only with highly disaggregated data on trade and prices but also with a CPI formula that makes use of nontraded goods prices data allowing for a more accurate measure of the nontraded component, such as the ones described in equations (14) y (15).

Table 2 contrast the contribution of the nontraded component in RER volatility for all three CPI formulas. This table is distributed in three blocks and eight columns. The first block shows the importance of the nontraded component in RER variations under Betts and Kehoe (2006) methodology, i.e. leaving out data on nontraded goods prices from the computation of the nontraded component. The second and third blocks show the contribution of nontraded goods in RER volatility with two CPI formulas that incorporate nontraded goods price data on the computation of the nontraded component: the first assumes the CPI is a geometric average of traded and nontraded goods prices, equation (14), the second assumes the CPI follows the Laspeyres formula, equation (15). The first column lists the statistics, columns 2 to 8 show the results for the data transformations mentioned in the previous section.

Looking at the two variance decomposition statistics for the data in levels (column 2), there is no significant difference in the importance of the nontraded component among the three methodologies (albeit these are somewhat higher for the geometric average and the Laspeyres CPI). On the other hand, when the data are transformed (columns 3 to 5) the importance of the nontraded component is higher for the methodologies that take into account nontraded goods prices. For example, in the case of CF filtered data (column 4) the value of the two variance decomposition statistics, under Betts and Kehoe (2006) methodology, are 0.43 and 0.34 respectively; for the geometric average CPI the values of these statistics are 0.61 and 0.69 respectively; and for the Laspeyres CPI the values are 0.64 and 0.73 respectively.

The importance of the nontraded component also rises in the last two blocks of Table 2 when looking at the mean square error decomposition of changes (columns 6 to 8). This statistic varies from 0.30 to 0.37 in the case of Betts and Kehoe (2006) methodology, from 0.34 to 0.52 in the geometric average CPI case and from 0.36 to 0.54 in the Laspeyres CPI.

In turn, the correlation between the nontraded component and the RER is significantly higher under the geometric average and the Laspeyres CPI specification than under Betts and Kehoe (2006) suggested methodology. In the last one, the correlation coefficient varies from -0.12 to 0.39 whereas in the former two, the correlation coefficient varies from 0.30 to 0.63 and from 0.32 to 0.71 respectively.

On the other hand, the ratio of standard deviations suggests that, depending on the transformation, the nontraded component can be as volatile as RER (the range of values for this statistic go from 0.76 up to 1.45).

It is important to note that different transformations provide different values for the two types of variance decomposition regardless of the methodology employed. In general, the CF filtered data deliver the highest values of such statistics, followed by the linear detrended transformation and the HP filtered data.

Table 2 also shows an additional and important result: the traded and nontraded components are negatively correlated, in contrast with the findings of Mendoza (2000) and Naknoi (2008) that under periods of flexible exchange rate regime this correlation is positive.

## 4.1 Frequency Matters

Previous literature has stated that frequency of the data is not important when computing the importance of the nontraded component in RER variations. Nevertheless, such statement is contradicted in this analysis for the U.S.-Mexico case.

Table 3 shows how the importance of the nontraded component increases when using quarterly data.<sup>13</sup> For example, in the case of the Laspeyres CPI specification, both variance decomposition statistics attain higher values than in the monthly case, from 0.59 and up to 0.84 at the quarterly frequency, versus a range of values from 0.53 up to 0.69 in the monthly frequency case. This can also be observed for the mean square error decomposition of changes.

If the same comparison is carried out against annual frequency data, the importance of the nontraded component increases more dramatically. Table 4 shows that the variance decomposition statistics, for both the geometric average and the Laspeyres CPI specification, attain values between 0.71 and up to 0.88. This range of values is not only higher than the range of values obtained with monthly data, but also higher than the values found with quarterly data.

In addition, lower frequency data delivers higher correlation coefficients between the nontraded component and RER for all three methodologies and all data transformations; in particular, for the geometric average and the Laspeyres CPI. In turn, the ratio of standard deviations provides mixed results but in general the values of this statistic maintain the conclusion from Table 2 in that depending on the transformation, the nontraded component can be as volatile as RER.

Also, it is important to note that, as in the monthly case, the correlation between the nontraded and the traded component remains negative and statistically significant different from zero for all three methodologies and all data transformations at quarterly frequencies.<sup>14</sup>

This higher importance of the nontraded component at lower frequencies can be explained by the fact that at lower frequencies, the behavior of the nominal exchange rate becomes more stable reducing the volatility of the traded component respect to the nontraded component.

Finally, this work shows that when assessing the statistical significance of this correlation coefficients, the Betts and Kehoe (2006) methodology performs poorly when compared with

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<sup>13</sup>Table 3 and Table 4 are designed in the same fashion as Table 2.

<sup>14</sup>At annual frequency, this correlation remains negative but not statistically significant, perhaps due to the small sample size, see Table 5.



the other two methodologies, for the U.S.-Mexico case. For instance, Table 5 shows that with Betts and Kehoe (2006) methodology, around half of the correlation coefficients between the nontraded component and RER are not statistically significant different from zero.

## 5 Conclusion

Differentiating goods by tradability is not enough to correctly identify what drives real exchange rate volatility. It is necessary to separate goods between those that are actually traded between two countries from those that are not traded regardless of such nontraded goods being tradable. Here it is shown that, when doing so, nontraded goods are important for real exchange rate variations. However, as Betts and Kehoe (2006) noted, such contribution to the volatility of the real exchange rate varies with the transformation applied to the data. On the other hand, in contradiction with the mentioned authors, this work finds that the importance of nontraded goods also depends on the type of variance decomposition computed and on the frequency of the data. Moreover, the results also depend on the assumptions the researcher makes over how traded and nontraded goods compose the CPI and hence, how they relate to the real exchange rate.

Here, the analysis was performed by following three simple methods. The first was to follow the same logic that Betts and Kehoe (2006) suggested. The second was to assume that each CPI was formed by a weighted geometric average of traded and nontraded goods. Finally, the methodology designed to construct the CPI in the U.S. and Mexico (Laspeyres formula) was followed as close as possible.

The first method finds that the importance of nontraded goods can be up to 43% of the real exchange rate volatility, looking at CF filtered monthly data. Assuming that the CPI is a geometric average of traded and nontraded goods suggests an importance of 0.61 to 0.69 percent in the real exchange rate. Using the Laspeyres formula to compute the CPI implied an importance of nontraded goods of 0.64 to 0.73 in real exchange rate volatility. When looking at the mean square error decomposition of changes, the importance of the nontraded component varies from 0.30 to 0.37 in the case of Betts and Kehoe (2006) methodology, from 0.34 to 0.52 in the geometric average CPI case and from 0.36 to 0.54 in the Laspeyres CPI.

In turn, the correlation between the nontraded component and the RER is significantly higher under the geometric average and the Laspeyres CPI specification than under Betts and Kehoe (2006) suggested methodology. In the last one, the correlation coefficient varies from -0.12 to 0.39 whereas in the former two, the correlation coefficient varies from 0.55 to 0.68.

The results also suggest that lower frequency data increase the effects of nontraded goods in real exchange rate variations. Looking at CF filtered data at quarterly frequency, the first method gives an importance of nontraded goods in real exchange rate volatility of 0.44 and 0.37. The second method shows variance decompositions values of 0.62 and 0.74, and the third method suggests an importance of 0.68 and 0.84. Similarly, at annual frequency, the first method variance decomposition value is of 0.54 each, the second method variance decompositions values are of 0.78 and 0.86 and the third method shows values of 0.79 and 0.87, the same is observed when looking at the mean square error decomposition statistic.

In addition, this analysis shows that the traded and nontraded components are always



negatively correlated, in contrast with the findings of Mendoza (2000) and Naknoi (2008) that under periods of flexible exchange rate regime this correlation is positive. Finally, this work shows that when assessing the statistical significance of this correlation coefficients, the Betts and Kehoe (2006) methodology performs poorly when compared with the other two methodologies, for the U.S.-Mexico case.

In conclusion, with highly disaggregated data and a better classification of goods there is a dramatic increase in the effects of nontraded goods on the volatility of the real exchange rate. This results provide new evidence against the sticky prices theory while they generally support the Balassa-Samuelson theory.

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Table 1: Real Exchange Rate Volatility and Nontraded Goods Prices. Aggregated vs Disaggregated CPI data. Annual Frequency

Data Transformations	Betts and Kehoe 2006		<i>Disaggregated Data</i> 2002-2009
	Aggregated Data		
	1980-2000 <sup>a</sup>	2002-2009 <sup>b</sup>	
<b>Levels</b>			
Correlation nontraded and RER	0.64	-0.33	0.81
Stdev nontraded/Stdev RER	0.55	0.57	1.21
Variance decomposition <sup>c</sup>	0.33	0.16	0.74
<b>Linear Detrend</b>			
Correlation nontraded and RER	0.67	0.21	0.71
Stdev nontraded/Stdev RER	0.46	0.37	1.15
Variance decomposition	0.26	0.12	0.65
<b>1 year changes</b>			
Correlation nontraded and RER	0.26	-0.39	0.56
Stdev nontraded/Stdev RER	0.28	0.28	0.74
Mean square error decomposition <sup>d</sup>	0.08	0.07	0.45

<sup>a</sup> Betts and Kehoe (2006) original results.

<sup>b</sup> Results obtained from updating Betts and Kehoe (2006) data for the period 2002-2009.

<sup>c</sup> This statistic represents the proportion of the variance of the nontraded component relative to the variance of the real exchange rate.

<sup>d</sup> This statistic measures how much of the mean square error decomposition of changes in the real exchange rate is due to changes in the nontraded component.

Table 2: Nontraded Goods Importance in Real Exchange Rate Volatility 2002-2009. Monthly Frequency

	Levels	Linear det	CF filtered <sup>a</sup>	HP filtered <sup>b</sup>	1-Month Change	1-Quarter Change	1-Year Change
<b>Betts and Kehoe Methodology</b>							
Contribution of nontraded component:							
<i>vardec<sup>c</sup></i>	0.52	0.43	0.43	0.35			
<i>vardec2<sup>d</sup></i>	0.58	0.27	0.34	0.06			
<i>msedec<sup>e</sup></i>					0.30	0.30	0.37
<i>Correlation of nontraded and RER</i>							
<i>Stdev nontraded/Stdev RER</i>	0.39	0.22	0.31	0.05	-0.12	-0.11	0.06
	1.45	1.17	1.06	1.02	0.97	0.94	1.06
<i>Correlation of nontraded and traded</i>							
	-0.76	-0.70	-0.62	-0.70	-0.74	-0.75	-0.71
<b>Geometric Average CPI</b>							
Contribution of nontraded component:							
<i>vardec</i>	0.54	0.58	0.61	0.51			
<i>vardec2</i>	0.57	0.65	0.69	0.52			
<i>msedec</i>					0.39	0.34	0.52
<i>Correlation of nontraded and RER</i>							
<i>Stdev nontraded/Stdev RER</i>	0.63	0.63	0.68	0.55	0.33	0.30	0.56
	0.89	1.02	1.01	0.93	0.86	0.77	0.97
<i>Correlation of nontraded and traded</i>							
	-0.31	-0.45	-0.41	-0.41	-0.49	-0.45	-0.44
<b>Laspeyres CPI</b>							
Contribution of nontraded component:							
<i>vardec</i>	0.56	0.60	0.64	0.53			
<i>vardec2</i>	0.59	0.68	0.73	0.55			
<i>msedec</i>					0.40	0.36	0.54
<i>Correlation of nontraded and RER</i>							
<i>Stdev nontraded/Stdev RER</i>	0.66	0.66	0.71	0.58	0.36	0.32	0.58
	0.90	1.03	1.02	0.94	0.88	0.79	0.98
<i>Correlation of nontraded and traded</i>							
	-0.31	-0.45	-0.41	-0.40	-0.49	-0.45	-0.44

<sup>a</sup> Christiano and Fitzgerald filter.

<sup>b</sup> HP filtered data using Ravn and Uhlig (2002) suggested smoothing parameter of 129,600.

<sup>c</sup> The statistic "vardec" represents the proportion of the variance of the nontraded component relative to the overall variance of the real exchange rate.

<sup>d</sup> The statistic "vardec2" represents the proportion of the variance of the nontraded component relative to the variance of the real exchange rate but allocating only half the covariance between the traded and nontraded component to fluctuations in the nontraded component.

<sup>e</sup> The statistic "msedec" measures how much of the mean square error decomposition of changes in the real exchange rate is due to changes in the nontraded component.

Table 3: Nontraded Goods Importance in Real Exchange Rate volatility 2002-2009. Quarterly Frequency

	Levels	Linear det	CF filtered <sup>a</sup>	HP filtered <sup>b</sup>	1-Quarter Change	1-Year Change
<b>Betts and Kehoe Methodology</b>						
Contribution of nontraded component:						
<i>vardec<sup>c</sup></i>	0.54	0.46	0.44	0.38		
<i>vardec2<sup>d</sup></i>	0.74	0.40	0.37	0.17		
<i>mseedec<sup>e</sup></i>					0.32	0.40
<i>Correlation of nontraded and RER</i>						
	0.45	0.30	0.30	0.13	-0.01	0.14
<i>Stdev nontraded/Stdev RER</i>	1.52	1.22	1.12	1.06	0.95	1.08
<i>Correlation of nontraded and traded</i>						
	-0.77	-0.69	-0.65	-0.68	-0.69	-0.69
<b>Geometric Average CPI</b>						
Contribution of nontraded component:						
<i>vardec</i>	0.56	0.61	0.62	0.54		
<i>vardec2</i>	0.60	0.73	0.74	0.58		
<i>mseedec</i>					0.39	0.54
<i>Correlation of nontraded and RER</i>						
	0.65	0.66	0.66	0.57	0.34	0.56
<i>Stdev nontraded/Stdev RER</i>	0.91	1.08	1.09	0.99	0.85	1.04
<i>Correlation of nontraded and traded</i>						
	-0.32	-0.49	-0.49	-0.46	-0.48	-0.50
<b>Laspeyres CPI</b>						
Contribution of nontraded component:						
<i>vardec</i>	0.65	0.66	0.68	0.59		
<i>vardec2</i>	0.74	0.84	0.84	0.68		
<i>mseedec</i>					0.42	0.59
<i>Correlation of nontraded and RER</i>						
	0.73	0.71	0.74	0.64	0.34	0.62
<i>Stdev nontraded/Stdev RER</i>	1.00	1.16	1.12	1.05	0.97	1.10
<i>Correlation of nontraded and traded</i>						
	-0.37	-0.54	-0.50	-0.48	-0.56	-0.52

<sup>a</sup> Christiano and Fitzgerald filter.

<sup>b</sup> HP filtered data using the standard smoothing parameter of 1600.

<sup>c</sup> The statistic "vardec" represents the proportion of the variance of the nontraded component relative to the variance of the real exchange rate.

<sup>d</sup> The statistic "vardec2" represents the proportion of the variance of the nontraded component relative to the variance of the real exchange rate but allocating only half the covariance between the traded and nontraded component to fluctuations in the nontraded component.

<sup>e</sup> The statistic "mseedec" measures how much of the mean square error decomposition of changes in the real exchange rate is due to changes in the nontraded component.

Table 4: Nontraded Goods Importance in Real Exchange Rate volatility 2002-2009. Annual Frequency

	Levels	Linear det	CF filtered <sup>a</sup>	HP filtered <sup>b</sup>	1-Year Change
<b>Betts and Kehoe Methodology</b>					
Contribution of nontraded component:					
<i>vardec</i> <sup>c</sup>	0.74	0.65	0.54	0.52	
<i>vardec2</i> <sup>d</sup>	1.03	0.88	0.54	0.53	
<i>msedec</i> <sup>e</sup>					0.45
<i>Correlation of nontraded and RER</i>	0.81	0.71	0.72	0.68	0.56
<i>Stdev nontraded/Stdev RER</i>	1.21	1.15	0.75	0.77	0.74
<i>Correlation of nontraded and traded</i>	-0.56	-0.53	-0.04	-0.13	-0.21
<b>Geometric Average CPI</b>					
Contribution of nontraded component:					
<i>vardec</i>	0.78	0.80	0.78	0.77	
<i>vardec2</i>	0.87	0.71	0.86	0.87	
<i>msedec</i>					0.69
<i>Correlation of nontraded and RER</i>	0.86	0.94	0.86	0.85	0.75
<i>Stdev nontraded/Stdev RER</i>	0.99	0.77	0.98	1.00	1.12
<i>Correlation of nontraded and traded</i>	-0.26	-0.43	-0.23	-0.29	-0.48
<b>Laspeyres CPI</b>					
Contribution of nontraded component:					
<i>vardec</i>	0.79	0.81	0.79	0.78	
<i>vardec2</i>	0.88	0.72	0.87	0.88	
<i>msedec</i>					0.70
<i>Correlation of nontraded and RER</i>	0.87	0.94	0.87	0.86	0.77
<i>Stdev nontraded/Stdev RER</i>	1.00	0.78	0.98	1.01	1.12
<i>Correlation of nontraded and traded</i>	-0.25	-0.42	-0.23	-0.28	-0.48

<sup>a</sup> Christiano and Fitzgerald filter.

<sup>b</sup> HP filtered data using Ravn and Uhlig (2002) suggested smoothing parameter of 6.5.

<sup>c</sup> The statistic "vardec" represents the proportion of the variance of the nontraded component relative to the variance of the real exchange rate.

<sup>d</sup> The statistic "vardec2" represents the proportion of the variance of the nontraded component relative to the variance of the real exchange rate but allocating only half the covariance between the traded and nontraded component to fluctuations in the nontraded component.

<sup>e</sup> The statistic "msedec" measures how much of the mean square error decomposition of changes in the real exchange rate is due to changes in the nontraded component.

Table 5: Statistical Significance of the Correlation Coefficients 2002-2009

	Levels	Linear det	CF filtered	HP filtered	1-Month Change	1-Quarter Change	1-Year Change
<b>Betts and Kehoe Methodology</b>							
<b>Monthly</b>							
<i>Correlation of nontraded and RER</i>	0.39* (0.10)	0.22* (0.10)	0.31* (0.10)	0.05 (0.11)	-0.12 (0.11)	-0.11 (0.11)	0.06 (0.11)
<i>Correlation of nontraded and traded</i>	-0.76* (0.07)	-0.70* (0.08)	-0.62* (0.08)	-0.70* (0.08)	-0.74* (0.07)	-0.75* (0.07)	-0.71* (0.08)
<b>Quarterly</b>							
<i>Correlation of nontraded and RER</i>	0.45* (0.17)	0.30 (0.18)	0.30 (0.18)	0.13 (0.19)	-0.01 (0.19)	-0.01 (0.19)	0.14 (0.19)
<i>Correlation of nontraded and traded</i>	-0.77* (0.12)	-0.69* (0.14)	-0.65* (0.14)	-0.68* (0.14)	-0.69* (0.14)	-0.69* (0.14)	-0.69* (0.14)
<b>Annual</b>							
<i>Correlation of nontraded and RER</i>	0.81* (0.24)	0.71 (0.29)	0.72* (0.28)	0.68 (0.28)	0.68 (0.28)	0.68 (0.28)	0.56 (0.34)
<i>Correlation of nontraded and traded</i>	-0.56 (0.34)	-0.53 (0.35)	-0.04 (0.41)	-0.13 (0.38)	-0.13 (0.38)	-0.13 (0.38)	-0.21 (0.40)
<b>Geometric Average CPI</b>							
<b>Monthly</b>							
<i>Correlation of nontraded and RER</i>	0.63* (0.08)	0.63* (0.08)	0.68* (0.08)	0.55* (0.09)	0.33* (0.10)	0.30* (0.10)	0.56* (0.09)
<i>Correlation of nontraded and traded</i>	-0.31* (0.10)	-0.45* (0.08)	-0.41* (0.08)	-0.41* (0.10)	-0.49* (0.09)	-0.45* (0.10)	-0.44* (0.10)
<b>Quarterly</b>							
<i>Correlation of nontraded and RER</i>	0.65* (0.14)	0.66* (0.14)	0.66* (0.14)	0.57* (0.16)	0.34 (0.18)	0.34 (0.18)	0.56* (0.16)
<i>Correlation of nontraded and traded</i>	-0.32 (0.18)	-0.49* (0.16)	-0.49* (0.16)	-0.46* (0.17)	-0.48* (0.17)	-0.48* (0.17)	-0.50* (0.16)
<b>Annual</b>							
<i>Correlation of nontraded and RER</i>	0.86* (0.21)	0.94* (0.14)	0.86* (0.21)	0.85* (0.22)	0.34 (0.27)	0.34 (0.27)	0.75* (0.27)
<i>Correlation of nontraded and traded</i>	-0.26 (0.39)	-0.43 (0.37)	-0.23 (0.40)	-0.29 (0.39)	-0.48 (0.36)	-0.48 (0.36)	-0.48 (0.36)
<b>Laspeyres CPI</b>							
<b>Monthly</b>							
<i>Correlation of nontraded and RER</i>	0.66* (0.08)	0.66* (0.08)	0.71* (0.08)	0.58* (0.09)	0.36* (0.10)	0.32* (0.10)	0.58* (0.09)
<i>Correlation of nontraded and traded</i>	-0.31* (0.10)	-0.45* (0.10)	-0.41* (0.10)	-0.40* (0.10)	-0.49* (0.09)	-0.45* (0.10)	-0.44* (0.10)
<b>Quarterly</b>							
<i>Correlation of nontraded and RER</i>	0.73* (0.13)	0.71* (0.13)	0.74* (0.13)	0.64* (0.15)	0.34 (0.18)	0.34 (0.18)	0.62* (0.15)
<i>Correlation of nontraded and traded</i>	-0.37 (0.18)	-0.54* (0.16)	-0.50* (0.16)	-0.48* (0.17)	-0.56* (0.16)	-0.56* (0.16)	-0.52* (0.16)
<b>Annual</b>							
<i>Correlation of nontraded and RER</i>	0.87* (0.20)	0.94* (0.14)	0.87* (0.20)	0.86* (0.20)	0.26 (0.26)	0.26 (0.26)	0.77* (0.26)
<i>Correlation of nontraded and traded</i>	-0.25 (0.39)	-0.42 (0.37)	-0.23 (0.40)	-0.28 (0.37)	-0.48 (0.36)	-0.48 (0.36)	-0.48 (0.36)

\* Coefficients statistically significant different from 0 at 5 percent level, standard errors in parenthesis.