CURRENCY ARRANGEMENT AND GOODS MARKET INTEGRATION: A PRICE BASED APPROACH

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Abstract

This paper empirically studies the effect of instrumental and institutional stabilization of the exchange rate on the integration of goods markets. In contrast to the literature that employs data on the volume of trade, an important novelty of this paper is the use of a 3-dimensional panel of prices of 95 very disaggregated goods (e.g., light bulbs) in 83 cities from around the world from 1990 to 2000. We find that goods market integration is increasing over time and is inversely related to distance, exchange rate variability, and tariff barriers. In addition, the impact of an institutional stabilization of the exchange rate provides a stimulus to goods market integration that goes far beyond an instrumental stabilization. Among the institutional arrangements, long-term currency unions demonstrate greater integration than more recent currency boards. All of them can improve their integration further relative to a U.S. benchmark.

Key Words: hard pegs, currency board, dollarization, market integration.
JEL Classification Codes: F3, F2

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1. Introduction

The launch of the euro – a common currency for twelve European countries – has been accompanied by great fanfare. Foremost among its proponents' claims is that it will be a great promoter of further economic integration. This paper presents a new approach to studying the effect of exchange rate stabilization on goods market integration. Our novelty is to focus on international price dispersion, rather than the trade flows typically examined in this literature. This opens up a fresh channel to assess the differential economic effects of an *instrumental* stabilization of exchange rates – reducing volatility through intervention in the foreign exchange market or via monetary policies, versus *institutional* stabilization of exchange rates – reducing volatility through establishing an explicit currency board or common currency. Our approach is facilitated by a unique cross-country data set on prices of very disaggregated products (e.g., light bulbs and onions) over 1990-2000.

Understanding the size of the economic effect of exchange rate stabilization and monetary regimes is very important for open-economy macroeconomics. For example, Feldstein (1997) stated that the adoption of a single currency in Europe has costs for its member countries (loss of an independent monetary policy) but no big economic benefits. The conclusion is partly based on his reading of the empirical literature that generally reports a small effect of exchange rate stabilization on trade volumes. In contrast, Rose (2000) has recently argued that an adoption of a common currency provides a non-trivial expansion of the volume of trade that goes beyond the effect of reducing exchange rate volatility to zero. These findings, obtained from estimates of a (modified) gravity model of trade volumes, are both statistically and economically significant.

Using trade volumes and a gravity model to study goods market integration is not new *per se*. For example, McCallum (1995), Wei (1996), and Heliwell (1998), each use such a methodology to study the incomplete nature of international goods market integration. But Rose (2000) is the first paper that studies the effect of a common currency on goods market integration (see also Frankel and Rose 2000, Rose and Engel 2000, and Rose and van Wincoop 2001, Glick and Rose 2001 for more recent extensions). According to these studies the existence of a common currency increases bilateral trade by as much as 300% over what is observed between otherwise identical countries.[1] Persson (2001), Tenreyro (2002) and Klein (2002) challenged the empirical robustness of the finding in Rose (2000).

Studies based on the volume of trade have their limitations. A potential problem is that the mapping between the volume of trade and degree of market integration is not necessarily monotonic unless special assumptions are adopted. For example, as Wei (1996) pointed out, if the products of two countries are highly substitutable (e.g., red cars by country 1 and blue cars by country 2), then a small cost of trade could lead to a large reduction in trade volume. In this example the elimination of the small trade barrier (such as adopting a common currency) could lead to a large increase in trade volumes with relatively little change in welfare. In other words, depending on the relative elasticity of substitution between the goods of the countries in question, it is possible for a country pair with a larger increase in trade volume (from a currency

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[1]That is, Rose and his co-authors control for a wide variety of additional country specific variables, such as common language, colonial ties, contiguity, etc.

union, for example) to have a smaller change in the degree of integration (and welfare) than another pair with a smaller increase in trade volume.

One cannot rule out the possibility that the membership in currency unions and the elastility of substitution may be correlated. For example, a pair of countries are more likely to share a common currency when they are both former colonies of a common metropolitan country. Given the similarity in the endownment and production structure, the elasticity of substitution between the goods in these countries may be higher than a random pair of countries in the world. The welfare effect of a given change in trade volume for them may be smaller as well.

In this paper, we adopt a price-based approach – estimating changes in goods market integration by changes in the dispersion of prices of 95 very disaggregated goods (e.g., light bulbs, and soap) among 72 countries in the world. The data, from the *Economist Intelligence Unit*, is the most extensive set available in terms of the scope of country and goods coverage from a single source. Assimilation by a single source insures greater comparability of the goods across international locations. Unlike the potentially ambiguous effect of a change in the volume of trade, a reduction in the dispersion of the prices of identical goods represents an unambiguous improvement in integration.

Of course, using price data *per se* in empirical research is not new either. In an early study, Richardson (1978) finds that Canadian and United States prices are only weakly related. More recently, Rogers and Jenkins (1995) study Law of One Price (LOP) deviations, and are able to detect mean reversion in less than one-sixth of the 54 disaggregated products they study. Parsley and Wei (1996) find fairly rapid convergence of price differences within the United

States, while Parsley and Wei (2001) find enormous market segmentation between the U.S. and Japan, though it is declining over time. Crucini et al. (2001), find sometimes large, (more than 50%) deviations across European cities, but on average (across 1800 goods and services) these deviations are zero. Finally, using three years of the data used in this study, Rogers (2001) examines convergence to the law of one price within Europe. What is new in this paper is our adoption of price data to study the effect of the monetary regime and exchange rate stabilization on the progress of goods market integration. As far as we know, this paper is the first that uses this methodology on this topic.

In this paper, we make a conceptual distinction between institutional versus instrumental stabilization of the exchange rate. The former refers to reducing volatility through dollarization, adoption of a currency board, or via another common currency. The latter refers to reducing volatility through intervention in the foreign exchange market or via monetary policies, i.e., any arrangement other than institutional stabilization. Institutionalized stabilization implies a greater degree of commitment and a much lower probability of reversal in the future. By removing one more layer of uncertainty, it is conceivable that an institutionalized stabilization can provide a greater stimulus to goods market integration than merely reducing exchange rate volatility to zero via an instrumental stabilization. How big the extra stimulus is, must be determined by an empirical analysis.

We exploit both time series and cross-sectional variation available in the panel of local currency price data from the *Economist Intelligence Unit.* In particular, we study all (unique) bilateral price comparisons the data allow. Thus, in this study, we go beyond previous studies using two country, or at most intra-continental, price comparisons only.

Our main findings can be briefly summarized. First, reducing nominal exchange rate variability reduces relative price variability. Secondly, an economically stronger effect (by an order of magnitude) comes from participating in a hard peg – such as a currency union or explicitly abandoning the domestic currency and adopting a foreign currency. The largest institutional effects come through political and economic integration. Relative to the U.S. benchmark, European goods market integration still has further to go. Our results suggest that further political and economic integration can lead to substantial additional reductions in price dispersion.

The next section discusses the *EIU* data set in more detail, along with other data and sources we consult, and some basic patterns of the data. In section 3, we present the statistical evidence systematically, which is the heart of our analysis. Section 4 draws our conclusions.

2. Data and Basic Patterns

Data

The primary data set we employ contains standardized price comparisons for over 160 goods and services for up to 122 cities compiled by the *Economist Intelligence Unit*. The data comes from the *Worldwide Cost of Living Survey*, and is designed for use by human resource managers in the design of compensation policies. The data set is described in more detail at http://eiu.e-numerate.com/asp/wcol_HelpWhatIsWCOL.asp. Many of the goods in the data set appear twice – differing by the type of establishment where the price was recorded. That is for many goods in the data set there are two prices: one from a 'high-priced outlet' and one from a supermarket. Our focus in this study is on traded goods; and among traded goods we selected supermarket prices when there was a choice between two prices.

Additionally, not all goods and cities are available in each time period. Since we are interested in both cross-sectional and time series variation, we dropped goods and cities with 'large' numbers of missing observations. Our rule was to drop goods where data was available for less than 16 (of the 122) cities. We generally wanted all goods to be available for the entire sample, and among the potential traded goods, hence we dropped goods with over 30% missing observations. Finally, we kept only one city per country (with the exception of the United States, which we use as a separate benchmark). The end result is a panel of 95 goods and 83 cities. Appendix Tables 1 and 2 list the goods and cities included.

In addition to the price data, we use data on tariff rates, from Table 6.6 of the World Bank publication *World Development Indicators* available on the World Bank web site. For each country the tariff data are available for two years – once in the early 1990s and once for the late 1990s. We use the first reported value in our bilateral tariff rate calculations for the years 1990-95. Similarly, we use the most recent value for the years 1996-2000. The precise variable definitions are discussed below. For this study we selected the columns "simple mean tariff" and "weighted mean tariff" (page 336-39). Additionally, we use monthly exchange rates and money supplies from the April 2001 IFS CD for all countries except Taiwan, where the data was taken from the CEIC data base provided by the Hong Kong Institute for Monetary Research.

Some Examples of Percentage Price Differences

Let $P(i,k,t)$ be the U.S. dollar price of good k in city i at time t. For a given city pair *(i,j)* and a given good k at a time t, we define the common currency percentage price difference as:

$$Q(ij,k,t) = \ln P(i,k,t) - \ln P(j,k,t). \tag{1}$$

As noted above, we study all bilateral price comparisons the data allow. There are 3403 city pairs (=(83x82)/2) – each with 11 (annual) time periods. Thus, for each of the 95 prices, the vector of price deviations will contain 37,433 (3403x11) observations without missing values. Since for any given city-pair or time period $Q(ij,k,t)$ may be positive or negative, we first focus on absolute percentage price deviations.

As an illustration of the basic features of the data, Table 1 presents the percentage price dispersion (in absolute value) for three selected products among several city pairs. We make no claim that these are representative. They serve to only give a flavor of the data set and to presage some of the features we want to highlight.

The city pair Asuncion and Taipei is the farthest apart in our sample. The price difference for light bulbs and onions is also the biggest among the examples in Table 1 (though this need not be true for all the other products). A key issue that we will examine more formally is whether a reduction in exchange rate volatility would lead to a reduction in the segmentation of the goods market. Paris and Vienna have now belonged to a single currency union (euro) since the beginning of 1999. Comparing the price difference between the two cities in the pre-euro period versus the entire period, one observes a modest decline for the gap in the prices for light bulbs and onions. [Again, this need not be true for every product.]

Among the examples in Table 1, the price difference between Chicago and Houston (two cities in the United States) is the smallest.

The evidence in Table 1 is suggestive. Exchange rate stabilization, particularly institutionalized stabilization, appears to stimulate goods market integration. Of course, Table 1 is anecdotal, since only two products are exhibited out of 95 goods in our sample. A more systematic approach is required, which is what we turn to next.

3. Statistical Analysis

Empirical Methodology

It is tempting to measure goods market integration between two locations by some average of price dispersion across goods. However, this would not be appropriate. The existence of a non-zero price dispersion, i.e., deviation from the law of one price, implies the existence of cost for arbitrage. The logic of no-arbitrage imposes two inequality constraints on the prices of an identical good, k, in two different locations, i and j. Intuitively, any particular realization of the common currency price differential, $Q(ij,k,t) = \ln P(i,k,t) - \ln P(j,k,t)$, can be either positive or negative without triggering arbitrage as long as $|Q(ij,k,t)|$ is less than the cost of arbitrage. In other words, the existence of arbitrage costs implies only an inequality constraint, that $Q(ij,k,t)$ must fall within a range – not that it must equal zero.[2] Within this range, any dispersion in price is consistent with no arbitrage. For each of the 95 goods in our

[2] A more formal discussion is presented in O'Connell and Wei (2000).

data set, the realization of the price dispersion for a particular good can be any value in this range.

Hence, the appropriate strategy to measure goods market integration would be to gauge the width of the no-arbitrage zone, which may vary across location pairs and time periods. In particular, any reduction to barriers to arbitrage (i.e., movements toward market integration) should reduce the no-arbitrage range. In addition to consider transportation cost and tariff on international trade, this paper will examine whether exchange rate volatility and currency arrangements may act as additional barriers to arbitrage.

As a start, we gauge the degree of market integration, or the width of the no-arbitrage zone by the standard deviation of the empirical distribution of the percentage price dispersion, $Q(ij,k,t)$, over the 95 products. We recognize the possibility that the magnitude of the deviation from the law-of-one-price may depend on the type of the product. Hence, prior to calculating standard deviation, we remove the good-specific mean of the deviation at time *t*. More precisely, let Q*(k, t) denote the average price dispersion for product k in year t over all city pairs. Define

$$q(ij, k, t) \equiv Q(ij, k, t) - Q^*(k, t).$$

Our measure of the barriers to arbitrage – or the deviation from perfect market integration – for city-pair ij in year t is the standard deviation q(ij, k, t) over all 95 products. Note that we do not use the difference between max{q(ij, k, t)} and min{q(ij, k, t)} as a measure of integration as we do not want our measure to be driven by a few outliers. For the purpose of the subsequent analysis, we only need to measure the barriers to arbitrage for a particular pair of locations relative to another pair. Our maintained assumption is that the standard deviation measure adopted here is proportional to the true range of no-arbitrage across time and across different pairs of locations.

To ensure that our analysis does not depend on a particular measure of barriers to arbitrage, we will also examine two alternative ways to gauge the degree of market integration. The first alternative is the inter-quartile range, or the difference between the 75th and 25th quartiles in the empirical distribution of q(ij, k, t) over the 95 products for a given city-pair and time period. This metric would further limit the influence of possible outliers. The second alternative is to use the standard deviation of absolute percentage price differences, |q(ij, k, t)|.

Table 2 presents some summary data grouped by institutional arrangements. It is obvious that most of the bilateral city-pairs in the sample are not part of an institutional exchange rate arrangement – indeed only 4.5% are members. In columns 2 through 4, the average dispersion, distance and exchange rate variability are reported. Distance is calculated using the great circle formula using each city's latitude and longitude data obtained from the United Nation's web site http://www.un.org/Depts/unsd/demog/ctry.htm. Exchange rate variability is defined as the standard deviation of changes in the monthly bilateral exchange rate (between the city-pairs involved) during each year. In Table 2 we can detect a positive correlation between average variability of relative prices and distance. The correlation with exchange rate variability is less obvious since Hard Peg city-pairs – with the second largest relative price variability, are on average quite far apart.

Figure 1 presents another, admittedly anecdotal, look at the data. In the figure, we compare two types of inter-city price dispersion: intra-national and international, for three city-pairs only.[3] The city-pairs are (1) Chicago-Houston (1496 kilometers apart), (2) Chicago-Paris (6655 kilometers apart), and (3) Paris-Vienna (1034 kilometers apart). Dispersion is clearly lower for intra-national city-pairs and a slight downward trend is apparent in this figure as well.

Figure 2 presents the same data averaged over all city-pairs on a year-by-year basis. The downward trend is apparent in this figure as well. As striking as these figures are, we do not yet know what factors influence dispersion across city-pairs and over time. Moreover we do not know whether the intra-national/international findings are representative since only three of the more than three thousand city-pairs are included in Figure 1.

Basic Regressions

We begin our formal investigation of factors influencing goods market integration by estimating equation 3 below.

$$\begin{aligned} V\left(q(ij,t)\right) = {} & \hat{a}_1 \ln(dist_{ij}) + \hat{a}_1 \ln(dist_{ij})^2 + \hat{a}_3(xrvol_{ij}) + \hat{a}_4 HPeg + \hat{a}_5 CFA + \hat{a}_6 US + \hat{a}_7 Euro \\ & + \hat{a}_8 Language + \hat{a}_9 Hyperinflation + \hat{a}_{10} Tariff_{ij} + city and time dummies + \mathring{a}_{ij,t} \end{aligned} \tag{3}$$

For convenience we measure the left hand side variable in percentage terms. In equation 3, *HPeg*, *CFA*, *US*, *Euro* are dummy variables that take the value 1 if the observation for the dependent variable involves cities that are both part of the same institutional arrangement. The language dummy takes the value 1 if the city pair shares a common language (either official or primary business language), and zero otherwise. The data was taken from the *CIA World*

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[3] In the figure we continue to focus on q(ij,t). That is, good specific effects have been removed.

Factbook (http://www.cia.gov/cia/publications/factbook/ indexgeo.html). We also add a dummy for hyper-inflationary episodes/countries. The episodes were: Argentina (1992), Peru (1991), Mexico (1993), Uruguay (1993), Brazil (1993-4), and Poland (1995). We include both the log of the distance between cities i and j, and the log distance squared in the regression to account for possible non-linearity in the relationship. Tariff is defined (initially) as the sum of the two average tariff rates in countries i and j, unless the two cities are both in the same free trade area or customs union (such as within the United States, or within the European Union). In these cases the value for tariff is set equal to zero. Later, we consider two alternative definitions of tariff for robustness.

Table 3 presents the benchmark regression results. According to column 1, dispersion of relative prices increases with distance, consistent with the interpretation that distance is a proxy for transportation cost, and the effect is concave, i.e., distance increases dispersion, but at a declining rate. Increased exchange rate variability is also associated with increased relative price variability. In particular reducing monthly exchange rate variability from the sample average to zero reduces price dispersion by 0.26 percent (=.067*3.82). However, participating in a hard peg – such as a currency board or adopting another currency reduces price dispersion by 3.21 percent – an order of magnitude more than simply reducing exchange rate variability. This seems to indicate that a hard peg confers more than simply exchange rate stability. The point estimate on the CFA dummy is positive, however it is not statistically significant. The estimate for the 'Euro' dummy also implies a relatively large reduction in price dispersion. It is in fact greater than that on the "Hard Peg" dummy (the χ^2 statistic from a formal test is significant at the 10% level), which suggests that the Euro is already having a noticeable impact. According to the estimates in Table 3, sharing a common language (or a common colonial past) – and all that that implies – reduces price dispersion significantly. Finally, Hyperinflationary episodes are clearly separable from other data points, and represent periods of much higher price dispersion.

The strongest effect (statistically and economically) on price dispersion comes from being in the U.S., an effect we attribute to the higher levels of political and economic integration within the United States. The additional reduction in price dispersion associated with intra-U.S. cities is about three times larger than simply participating in a hard peg.

We can also express the economic effects of an institutional stabilization in terms of equivalent tariff reduction. According to the point estimates in the first column of Table 3, the effect of the euro on European goods market integration – in excess of reducing exchange rate volatility to zero – is equivalent to reducing the tariff rate in each country by 5 percentage points [=4.30/(0.43*2)]. The average external tariff rate of the developed countries is about 4 percent. So these estimates suggest that the extra stimulus to goods market integration resulting from implementing a common currency (like the euro) is of the same order of magnitude as eliminating tariffs among the European countries under its common market program of the 1990s. In other words, the economic effect is not trivial.

As a comparison, for a random pair of countries, reducing exchange rate volatility from the world average (0.067) to zero is equivalent to a tariff rate reduction of only 0.3 percentage points [3.82*0.067/(0.43*2)]. Finally, the economic and political union of the United States has the biggest stimulus on goods market integration. Belonging to such a union provides a reduction in goods price dispersion (in excess of reducing exchange rate volatility to zero) that is similar to a reduction in tariffs by 12 percentage points [=10.14/(0.43*2)].

In sum, the evidence presented in Table 3 points to four conclusions. First, reducing nominal exchange rate variability reduces relative price variability. Secondly, an economically stronger effect (by an order of magnitude) comes from participating in a hard peg – such as a currency union or explicitly abandoning the domestic currency and adopting a foreign currency. Thirdly, there is important heterogeneity in terms of the effect of different currency arrangements. In particular, membership in the CFA currency bloc does not confer any extra degree of integration in the goods market. As far as promoting goods trade is concerned, the CFA is a currency union in name only. Finally, the largest effects on integration come through political and economic integration. We next turn to robustness and sensitivity analysis.

Extensions and Robustness Checks

We consider a host of extensions and sensitivity analyses. We first consider (a) some additional explanatory variables, and (b) some re-definitions of explanatory variables. Next we examine (c) different measures of the left-hand-side variable, namely, price dispersion. Finally, we consider (d) alternative specifications, including adding city-pair-specific random effects.

We begin with adding a measure of labor cost. This data was obtained from the *Economist Intelligence Unit* as well. The first is the absolute value of the wage difference between the cities. According to Column 2 in Table 3, increasing the absolute percentage difference in wage rates between the two cities raises price dispersion. In order to investigate a possible non-linear relationship we entered the absolute wage difference squared as well. In the final column of the table we see that wage differences appear to be reflected in price dispersion, though the effect is not linear.

Next we turn to two different alternative definitions of the tariff variable in the regression. In Table 3 the tariff variable is the sum of the two cities trade-weighted average tariff rates. In column 1 of Table 4, we substitute instead the sum of the simple average tariff rates. This change has virtually no effect on the magnitudes or statistical significance of the other variables in the equation, and the coefficient on the new tariff definition is only slightly smaller than that on the weighted-average tariff. The coefficient on the CFA dummy remains statistically insignificant. In Columns 2 through 4, tariff is redefined as the maximum of the two tariff rates between the two cities. The same qualitative conclusion applies.

Next, in column 3 we add the standard deviation of the wage difference – defined as the standard deviation of the absolute wage difference over the entire period. According to the parameter estimate, higher variability is associated with greater price dispersion. In the final column, we eliminate extreme observations of the dependent variable and re-estimate. Note that doing this lowers the fit of the equation and the statistical significance of the Hyperinflation dummy disappears. Apparently, the outliers closely approximate the hyperinflationary periods. The size of the "Euro" effect becomes slightly larger than that for the 'Hard peg', and the impact of exchange rate variability is smaller than before. However, none of the basic conclusions from Table 3 are changed.

In Table 5 we investigate the robustness of our results to an alternative definition of the left-hand-side variable. Specifically, we measure the dispersion in prices by the inter-quartile range of the percentage price difference between any two cities over the 95 goods, or the difference between the 75th percentile and the 25th percentile of the distribution of percentage price differences. We proceed as before, sequentially adding variables as we move through the columns in the table. Again, all the previous conclusions hold.

In Table 6, a third way to measure price dispersion is adopted – by using the standard deviation of the absolute differences in prices in percentage term. In Table 1 we presented some summary statistics on the average size of price differences across various groupings of city-pairs. Since positive and negative differences would tend to cancel each other out, the simple average would misrepresent the true extent of price differences.[4] Thus for comparability with Table 1, we re-estimate the equations with the standard deviation of absolute percentage price differences as the dependent variable. Once again, our conclusions remain substantively unaffected by this re-definition of the dependent variable. The main exception is that the CFA dummy now enters with a negative coefficient, and the effect of tariffs appears somewhat smaller than before. As before, the effects of joining the Euro appear larger than for other Hard-pegs, and represent an additional reduction of price dispersion beyond reductions in nominal exchange rate variability alone. Finally, the effect of going still further, i.e., to complete political and economic union, remains the largest institutional effect limiting price dispersion.

Because exchange rate variability is potentially endogenous, we also implement an instrumental variable estimation. The monetary theory of exchange rate determination indicates that the relative money supplies of the two countries in question is an important determinant of their exchange rate. On the other hand, it seems unlikely that a country would change its money supply just to influence the dispersion of its tradable goods prices with

[4] In principle, given that our focus is on the dispersion in prices, the tendency for positive and negative values to cancel should not be a concern (since dispersion is measured *around* the mean).

another country. Therefore, on an ex ante basis, changes in the relative money supply could be a good instrument for changes in the exchange rate. Thus, we instrument the nominal exchange rate variability with the contemporaneous and lagged variability in relative money supplies. Variability of both exchange rates and money supplies is computed as the standard deviation of monthly changes in logs of each variable during the year. Table 7 presents these results. Virtually the only change in this table from the previous results is that the coefficients on exchange rate variability have risen. According to Equation 4, (from the regression omitting extreme observations on the dependent variable), reducing exchange rate variability from the sample average to zero reduces price dispersion by 0.61 percent – twice as large as that reported in Table 3. Even with this larger effect of reducing exchange rate variability, all other conclusions – including the relative ranking of effects – remain as previously stated. In another iteration of instrumental variable estimation, we included a lagged value of exchange rate variability in the instrument set. Though we do not report these results here to save space, our conclusions are essentially the same as before.

To consider possible non-linear effects of exchange rate volatility on price dispersion, we include the square of exchange rate variability as an additional regressor. These results are reported in Table 8. The evidence suggests that the effect of exchange rate volatility on price dispersion is positive but concave: higher exchange rate volatility is associated with greater price dispersion, but the incremental effect gets smaller as volatility increases. Based on the estimates in this table, the effect of reducing exchange rate volatility from the sample average to zero is larger than before, but still much smaller than a hard peg.

So far, we use city fixed effects and year fixed effects to capture factors that may affect the dispersion in prices between cities that are not otherwise in the list of regressors. In Table 9, we add city-pair specific random effects to the regressions, in addition to the city and year fixed effects. These results are broadly similar to the previous tables. The primary exception is in the estimate for the Euro. It is generally much smaller than that for the Hard Peg dummy, and the Euro dummy looses its statistical significance in all equations. However, the coefficient on Hard Peg is statistically significant in each of the three specifications. The U.S. dummy remains highly statistically significant and economically dominates the other institutional arrangement effects.

In Table 10, we consider some alternative institutional classifications and controls for trade blocs. Among the Hard Peg arrangements that are studied in the sample, two of the country pairs – the Panama-US pair and the Belgium-Luxembourg pair – stand out by their long history. In the first column of Table 11 we replace our Hard Peg dummy with a separate dummy for long-term pegs (Panama-US, and Belgium-Luxembourg), and more recent currency boards (Hong Kong-US, and Argentina-US). Both these new dummies are statistically significant. The point estimate on long-term currency unions is roughly twice that for (more recent) Currency Boards. As we include more regressors (in columns 2-3) the estimate of reduction in price dispersion attributable to Long-term pegs declines a bit (from -7.1 in column 1 to -5.7 percent in column 3), but the distinction between Long-term pegs and Currency Boards remains; the effect of long-term pegs on price dispersion is always above that for more recent currency boards.

We have been focusing on the differential effects of institutional versus instrumental stabilization of exchange rate volatility on the goods market integration. As an analogy, we can also examine whether formation of a trade bloc could have a different effect on goods market integration than a mere reduction in tariff rates. The idea is that a trade bloc implies a greater degree of commitment to maintaining low tariff (and non-tariff) barriers to trade on imports from member countries, i.e., reductions in tariffs are less likely to be reversed. To investigate this possibility, in column 2 of Table 10 we add controls for all the prominent trade blocs in Europe and in the Americas. These are: the European Union (EU), the European Free Trade Association (EFTA), the Central European Free Trade Area (CEFTA), the North American Free Trade Agreement (NAFTA), and Mercado Comun del Sur (MERCOSUR).

The coefficients on all of the trade blocs are negative, consistent with the interpretation that an institutionalized reduction in trade barriers (through the formation of a trade bloc) would promote greater integration in the goods market than merely reducing trade barriers through a unilateral trade liberalization. The coefficients on four of the five trade blocs (i.e., except CEFTA) are statistically significant. Other conclusions are similar as before. Specifically, a reduction in exchange rate volatility promotes goods market integration in the form of a reduction in the range of price dispersion. A currency board arrangement promotes goods market integration to an extent much greater than merely reducing the exchange rate volatility to zero. Long-term currency unions such as the Panama's adoption of the U.S. dollar or the Belgium-Luxembourg currency union offer an even greater stimulus to goods market integration than a currency board. The degree of market integration associated with a long-term, political and economic union as the United States is the highest of all – i.e., the dispersion of prices for identical goods is the smallest. Another interesting observation is that, once one takes into account the fact that the European Union confers a high degree of goods market integration, the launching of Euro so far has not generated a noticeable further integration. Time could change this. In the final column, we again eliminate outliers and a statistically significant effect of the Euro reappears, though it is much smaller than before. Also, statistical significance disappears for the Mercosur trade bloc dummy.

So far, we have not included city-pair fixed effects in the regressions (though city and year fixed effects have been included). This is because many variables of central interest to us, such as most of the currency arrangements, have virtually no time variation in our sample. The inclusion of the country-pair fixed effects would impede our ability to estimate these parameters of interest. However, if we restrict our interest to estimating the effect of exchange rate volatility, we could potentially include them. There are altogether 3403 city pairs (=83X82/2) in the sample. In Table 11, we include these city-pair fixed effects together with the 11 year dummies. The coefficient on the exchange rate variable is still positive and statistically significant at the one percent level. On the other hand, the size of the point estimates (between 1.3 and 3.4) is somewhat smaller than in the previous tables.

A surprise in Column 3 is that a greater absolute wage difference is associated with lower price dispersion. However, the estimates for nominal exchange rate variability, high inflation episodes, and tariffs are unaffected by these additional wage variables. In the final column, we remove the outliers (the top and bottom 1% of the observations in terms of the range of price dispersion) on the dependent variable. In this specification, the sign on the wage variables reverts to that reported in earlier tables. Overall, Table 11 confirms one of our main findings - namely, reducing nominal exchange rate variability lowers price dispersion. This effect is not driven by any omitted, city-pair-specific factor.

4. Conclusions

This paper empirically examines the effect of exchange rate and monetary arrangement on the integration of goods markets. The methodological innovation is to use the range of price dispersion of identical goods rather than volume of trade as a measure of market integration, and to use a 3-dimensional panel of 95 very disaggregated prices (e.g., light bulbs) from 83 cities from around the world to construct the price dispersion measure.

We compare observed prices of these products for 3403 city-pairs for the eleven-year period 1990-2000. We find that goods market integration is increasing over time and is inversely related to distance, exchange rate variability, and tariff barriers. Economically however, the impact of adopting a hard peg (currency board or currency union) is much larger than merely reducing exchange rate volatility to zero. Long-term currency union has a greater impact than more recent currency boards. However, relative to the U.S. benchmark, all existing currency boards or unions such as Euro still have further to go to improve the integration of their goods market.

We have subjected our basic results to numerous sensitivity tests and found them fundamentally robust to different definitions of the dependent and independent variables, different specifications, the exclusion of extreme values, and to different estimation methodologies. In the future, a useful work would be to combine the price-based approach in this paper with the quantity-based approach in the literature.

Table 1: Percentage Price Deviations in Absolute Value (averaged over all years)

Asuncion-Taipei	
Light Bulbs	65.4
Onions	115.0
Paris-Vienna (1990-1998, pre-euro)	
Light Bulbs	13.4
Onions	45.3
Paris-Vienna	
Light Bulbs	11.4
Onions	40.1
Chicago-Houston	
Light Bulbs	8.9
Onions	42.7

Table 2: Dispersion and its Determinants: Averages across city pairs and time

	Observations	$V(q(ij,t))^4$	Distance	$V(s(ij,t))^5$	Tarriff[6]
All City Pairs	36531	6.38	8215	0.67	22.3
Hard Peg City Pairs[1]	454	5.76	8602	0.01	9.8
US Only City Pairs	975	3.78	2681	0.00	0.0
CFA City Pairs[2]	110	6.29	3139	0.27	41.9
Euro City Pairs[3]	110	4.19	1273	0.00	0.0
Euro City Pairs (pre-Euro)	495	4.37	1273	0.13	0.0

[1]Hard Peg city-pairs are defined as city-pairs involving price comparisons between two cities maintaining a peg to the same currency. The Hard Peg classification includes three groups of bilateral pairs: (a) pairs that involve Buenos Aires (post 1992), Hong Kong, and Panama City, (b) bilateral pairs between those cities in (a) and U.S. cities, and (c) Brussels and Luxembourg.

[2]CFA city-pairs are defined as city-pairs involving price comparisons between two of the following cities: Abidjan, Dakar, Douala, Libreville, and Paris.

[3]Euro city-pairs are defined as city-pairs involving price comparisons between two of the following cities (post 1998): Amsterdam, Berlin, Brussels, Dublin, Helsinki, Lisbon, Luxembourg, Madrid, Paris, Rome, and Vienna.

[4]This column reports the average across relevant city-pair groupings (and time) of the dispersion of (de-meaned) percentage price differences.

[5]This column reports the average across relevant city-pair groupings (and time) of the variability of (defined as changes in log monthly) bilateral nominal exchange rates.

[6]Tariff is defined as the sum of the two individual tariff rates in countries i and j, unless the two cities are both in the United States, or they are both in the European Union. In these cases the value for tariff is set equal to zero.

Table 3: Benchmark Regression Results

	Equation 1	Equation 2	Equation 3
Log Distance	13.63	14.01	13.17
	(1.30)	(1.32)	(1.31)
Log Distance Squared	-0.67	-0.70	-0.65
	(0.08)	(0.08)	(0.08)
Nominal Exchange Rate Variability	3.82	3.03	4.59
	(0.50)	(0.52)	(0.50)
Hard Peg	-3.21	-2.13	-1.62
	(0.45)	(0.45)	(0.45)
CFA	0.34	0.79	0.63
	(1.33)	(1.33)	(1.31)
U.S.	-10.14	-9.53	-9.20
	(0.31)	(0.33)	(0.33)
Euro	-4.30	-3.76	-3.04
	(0.48)	(0.48)	(0.47)
Sum of Weighted Avg. Tariff	0.43	0.38	0.40
	(0.01)	(0.01)	(0.01)
Common Language	-1.98	-1.48	-1.10
	(0.19)	(0.19)	(0.19)
Absolute Wage Difference		0.48	3.03
		(0.07)	(0.20)
Absolute Wage Difference Squared			-0.23
			(0.02)
Year dummies?	yes	yes	yes
City dummies?	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes
Adjusted R^2	.73	.78	.78
Number of Observations	27199	21675	21675

Robust standard errors are in parenthesis. All equations include city and time fixed effects.

Table 4: Alternative Tariff Definitions, and Omitting Extreme Values

	Equation 1	Equation 2	Equation 3	Equation 4
Log Distance	13.98	14.21	14.28	11.67
	(1.31)	(1.30)	(1.30)	(0.98)
Log Distance Squared	-0.71	-0.72	-0.73	-0.56
	(0.08)	(0.08)	(0.08)	(0.06)
Nominal Exchange Rate Variability	4.45	4.37	4.43	2.52
	(0.50)	(0.50)	(0.50)	(0.29)
Hard Peg	-1.80	-2.18	-2.19	-1.97
	(0.45)	(0.45)	(0.43)	(0.42)
CFA	0.98	1.90	2.28	2.01
	(1.15)	(1.26)	(1.26)	(1.22)
U.S.	-9.09	-9.83	-9.58	-7.93
	(0.34)	(0.32)	(0.33)	(0.27)
Euro	-3.23	-3.57	-3.27	-3.75
	(0.47)	(0.47)	(0.47)	(0.44)
Common Language	-1.23	-1.19	-1.43	-0.86
	(0.19)	(0.19)	(0.20)	(0.13)
Absolute Wage Difference	3.03	2.89	2.82	3.29
	(0.20)	(0.20)	(0.20)	(0.12)
Absolute Wage Difference Squared	-0.23	-0.22	-0.24	-0.25
	(0.02)	(0.02)	(0.02)	(0.01)
Standard Deviation of Wage Difference			1.13	0.64
			(0.15)	(0.06)
Sum of Equal Weighted Tariff	0.33			
	(0.01)			
Maximum of the Two Tariffs		0.38	0.38	0.37
		(0.01)	(0.01)	(0.01)
Year dummies?	yes	yes	yes	yes
City dummies?	yes	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes	yes
Adjusted R^2	.78	.78	.78	.61
Number of Observations	21675	21654	21654	21189

Robust standard errors are in parenthesis. All equations include city and time fixed effects. The final column - designated Equation 4 - reports results from estimation with extreme observations on the dependent variable (above the 99^{th} percentile and below the 1^{st} percentile) dropped.

Table 5: Measuring Price Dispersion by the Inter-quartile Range of q

	Equation 1	Equation 2	Equation 3	Equation 4
Log Distance	18.56	16.04	15.80	12.73
	(2.16)	(2.17)	(2.16)	(1.55)
Log Distance Squared	-0.84	-0.71	-0.69	-0.51
	(0.14)	(0.14)	(0.14)	(0.10)
Nominal Exchange Rate Variability	4.34	3.85	3.81	4.91
	(0.80)	(0.74)	(0.743	(0.54)
Hard Peg	-5.45	-2.97	-2.89	-2.52
	(0.86)	(0.86)	(0.89)	(0.76)
CFA	3.47	4.26	3.68	3.13
	(1.91)	(1.91)	(1.91)	(1.83)
U.S.	-17.43	-16.44	-16.65	-14.28
	(0.53)	(0.55)	(0.56)	(0.41)
Euro	-7.22	-5.73	-6.04	-4.87
	(0.78)	(0.77)	(0.77)	(0.72)
Common Language	-1.51	-1.41	-1.10	0.04
	(0.33)	(0.34)	(0.34)	(0.22)
Sum of the Two Tariffs	0.43	0.38	0.40	0.46
	(0.01)	(0.02)	(0.01)	(0.01)
Absolute Wage Difference		4.75	4.86	4.96
		(0.31)	(0.30)	(0.20)
Absolute Wage Difference Squared		-0.33	-0.30	-0.36
		(0.03)	(0.03)	(0.02)
Standard Deviation of Wage Difference			-1.49	0.22
			(0.30)	(0.11)
Year dummies?	yes	yes	yes	yes
City dummies?	yes	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes	yes
Adjusted R^2	.31	.39	.40	.52
Number of Observations	27344	21740	21740	21319

Robust standard errors are in parenthesis. All equations include city and time fixed effects. The final column - designated Equation 4 - reports results from estimation with extreme observations on the dependent variable (above the 99^{th} percentile and below the 1^{st} percentile) dropped.

Table 6: Measuring Price Dispersion by Standard Deviation of |q|

	Equation 1	Equation 2	Equation 3	Equation 4
Log Distance	11.55	10.91	9.65	7.48
	(1.34)	(1.25)	(1.22)	(0.91)
Log Distance Squared	-0.62	-0.57	-0.50	-0.36
	(0.08)	(0.08)	(0.08)	(0.06)
Nominal Exchange	6.44	3.58	2.80	1.21
Rate Variability	(0.62)	(0.53)	(0.49)	(0.29)
Hard Peg	-4.61	-2.62	-1.85	-1.86
	(0.47)	(0.38)	(0.36)	(0.35)
CFA	-2.38	-1.51	-1.65	-1.89
	(1.14)	(1.00)	(0.95)	(0.93)
U.S.	-6.40	-5.48	-4.92	-3.72
	(0.30)	(0.30)	(0.30)	(0.24)
Euro	-3.72	-4.47	-3.30	-3.48
	(0.50)	(0.44)	(0.42)	(0.41)
Common Language	-3.68	-2.70	-2.16	-1.71
	(0.20)	(0.19)	(0.19)	(0.13)
Weighted Avg. Tariff	0.35	0.27	0.29	0.29
	(0.01)	(0.01)	(0.01)	(0.01)
Absolute Wage		2.76	6.71	7.01
Difference		(0.19)	(0.20)	(0.12)
Absolute Wage		-0.37	-0.36	-0.37
Difference Squared		(0.02)	(0.02)	(0.01)
Standard Deviation of			0.27	0.09
Wage Difference			(0.15)	(0.05)
Year dummies?	yes	yes	yes	yes
City dummies?	yes	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes	yes
Adjusted R^2	.67	.77	.78	.61
Number of Observations	27199	21675	21675	21218

Robust standard errors are in parenthesis. All equations include city and time fixed effects. The final column - designated Equation 4 - reports results from estimation with extreme observations on the dependent variable (above the 99th percentile and below the 1st percentile) dropped.

Table 7: Instrumental Variable Estimation

	Equation 1	Equation 2	Equation 3	Equation 4
Log Distance	14.76	14.38	14.54	11.45
	(1.40)	(1.40)	(1.40)	(1.01)
Log Distance Squared	-0.75	-0.73	-0.74	-0.54
	(0.09)	(0.09)	(0.09)	(0.06)
Nominal Exchange Rate Variability	8.53	10.77	9.53	8.74
	(2.00)	(1.82)	(1.80)	(1.58)
Hard Peg	-3.10	-1.79	-1.80	-1.54
	(0.47)	(0.46)	(0.44)	(0.43)
CFA	0.29	0.58	0.91	0.60
	(1.47)	(1.43)	(1.41)	(1.38)
U.S.	-9.98	-9.10	-9.01	-7.03
	(0.33)	(0.35)	(0.35)	(0.28)
Euro	-5.06	-4.19	-4.01	-4.09
	(0.49)	(0.48)	(0.48)	(0.43)
Common Language	-2.06	-1.27	-1.46	-0.81
	(0.20)	(0.20)	(0.21)	(0.13)
Sum of the Two Tariffs	0.44	0.40	0.39	0.39
	(0.01)	(0.01)	(0.01)	(0.01)
Absolute Wage Difference		2.98	2.95	3.45
		(0.26)	(0.26)	(0.14)
Absolute Wage Difference Squared		-0.21	-0.22	-0.24
		(0.02)	(0.02)	(0.01)
Standard Deviation of Wage Difference			0.83	0.38
			(0.16)	(0.06)
Year dummies?	yes	yes	yes	yes
City dummies?	yes	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes	yes
Adjusted R^2	.73	.79	.79	.60
Number of Observations	24444	19415	19415	18952

Robust standard errors are in parenthesis. All equations include city and time fixed effects. The final column - designated Equation 4 - reports results from estimation with extreme observations on the dependent variable (above the 99^{th} percentile and below the 1^{st} percentile) dropped.

Table 10: Non-linear Effects of Exchange Rate Variability

	Equation 1	Equation 2	Equation 3	Equation 4
Log Distance	13.22	12.73	13.05	10.46
	(1.30)	(1.30)	(1.30)	(0.97)
Log Distance Squared	-0.66	-0.63	-0.65	-0.48
	(0.08)	(0.08)	(0.08)	(0.06)
Nominal Exchange Rate Variability	19.92	17.38	17.93	8.64
	(1.53)	(1.81)	(1.76)	(0.98)
Nominal Exchange Rate Variability Squared	-9.50	-7.49	-7.78	-3.46
	(0.88)	(0.99)	(0.97)	(0.51)
Hard Peg	-2.53	-1.12	-1.15	-1.18
	(0.46)	(0.45)	(0.44)	(0.42)
CFA	0.52	0.80	1.07	0.73
	(1.34)	(1.31)	(1.30)	(1.27)
U.S.	-9.81	-8.98	-8.81	-7.26
	(0.31)	(0.33)	(0.33)	(0.27)
Euro	-3.36	-2.30	-2.06	-2.94
	(0.49)	(0.48)	(0.49)	(0.45)
Common Language	-1.88	-1.12	-1.20	-0.68
	(0.19)	(0.18)	(0.19)	(0.13)
Sum of the Two Tariffs	0.43	0.40	0.39	0.38
	(0.01)	(0.01)	(0.01)	(0.01)
Absolute Wage Difference		2.95	2.77	3.36
		(0.19)	(0.20)	(0.12)
Absolute Wage Difference Squared		-0.22	-0.23	-0.25
		(0.02)	(0.02)	(0.01)
Standard Deviation of Wage Difference			0.81	0.33
			(0.15)	(0.06)
Year dummies?	yes	yes	yes	yes
City dummies?	yes	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes	yes
Adjusted R^2	.73	.78	.78	.61
Number of Observations	27199	21675	21675	21201

Robust standard errors are in parenthesis. All equations include city and time fixed effects. The final column - designated Equation 4 - reports results from estimation with extreme observations on the dependent variable (above the 99^{th} percentile and below the 1^{st} percentile) dropped.

Table 9: Adding City-Pair Random Effects

	Equation 1	Equation 2	Equation 3
Log Distance	15.76	17.24	17.13
	(3.00)	(3.09)	(3.04)
Log Distance Squared	-0.79	-0.89	-0.89
	(0.18)	(0.19)	(0.19)
Nominal Exchange Rate Variability	3.30	3.56	3.58
	(0.39)	(0.40)	(0.40)
Hard Peg	-3.82	-3.25	-3.26
	(1.47)	(1.41)	(1.40)
CFA	1.73	1.47	2.05
	(3.53)	(3.53)	(3.48)
U.S.	-12.59	-11.90	-11.46
	(1.05)	(1.06)	(1.04)
Euro	-0.13	-0.41	-0.35
	(1.19)	(1.07)	(1.07)
Common Language	-1.80	-1.59	-1.94
	(0.40)	(0.41)	(0.41)
Sum of the Two Tariffs	0.24	0.24	0.24
	(0.01)	(0.01)	(0.01)
Absolute Wage Difference		-0.17	-0.18
		(0.15)	(0.15)
Absolute Wage Difference Squared		-0.001	-0.01
		(0.01)	(0.01)
Standard Deviation of Wage Difference			1.31
			(0.17)
Year dummies?	yes	yes	yes
City dummies?	yes	yes	yes
City-pair random effects?	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes
Adjusted R^2	.81	.86	.86
Number of Observations	27199	21675	21675

Robust standard errors are in parenthesis. All equations include city and time fixed effects.

Table 10: Long-term Currency Unions and Trade Blocs

	Equation 1	Equation 2	Equation 3
Log Distance	10.29	10.16	8.40
	(1.29)	(1.28)	(1.00)
Log Distance Squared	-0.51	-0.50	-0.37
	(0.08)	(0.08)	(0.06)
Nominal Exchange	3.80	3.71	2.34
Rate Variability	(0.50)	(0.50)	(0.28)
CFA	-0.40	-0.39	-0.28
	(1.31)	(1.31)	(1.28)
U.S.	-11.48	-11.59	-9.50
	(0.35)	(0.35)	(0.28)
Euro	-4.25	-0.38	-1.63
	(0.48)	(0.48)	(0.48)
Common Language	-2.00	-2.10	-1.19
	(0.19)	(0.19)	(0.13)
Sum of the Two Tariffs	0.41	0.41	0.40
	(0.01)	(0.01)	(.01)
Long-Term Currency Union	-6.13	-6.19	-5.70
	(0.98)	(0.97)	(0.65)
Currency Board	-3.02	-3.05	-3.18
	(0.47)	(0.47)	(0.43)
European Union		-5.85	-4.48
		(0.38)	(0.29)
EFTA		-6.73	-5.85
		(1.45)	(1.34)
CEFTA		-3.77	-7.02
		(5.36)	(3.26)
NAFTA		-4.40	-3.51
		(0.51)	(0.47)
Mercosur		-2.09	-1.14
		(1.26)	(1.10)
Time and City Dummies?	Yes	Yes	Yes
Hyperinflation Dummies?	Yes	Yes	Yes
Adjusted R^2	.73	.73	.54
Number of Observations	27199	26664	26664

Robust standard errors are in parenthesis. All equations include city and time fixed effects. The final column - designated Equation 3 - reports results from estimation with extreme observations on the dependent variable (above the 99th percentile and below the 1st percentile) dropped.

Table 11: City-pair Fixed Effects

	Equation 1	Equation 2	Equation 3	Equation 4
Nominal Exchange Rate Variability	2.51 (0.33)	3.29 (0.40)	3.37 (0.41)	1.28 (0.20)
Sum of the Two Tariffs		0.10 (0.01)	0.13 (0.01)	0.10 (0.01)
Absolute Wage Difference			-1.73 (0.17)	1.56 (0.09)
Absolute Wage Difference Squared			0.11 (0.01)	-0.09 (0.01)
Time fixed effects?	yes	yes	yes	yes
City-pair fixed effects?	yes	yes	yes	yes
Hyperinflation dummy?	yes	yes	yes	yes
Removing extreme values?	no	no	no	yes
Adjusted R^2	.80	.79	.84	.84
Number of Observations	36292	27199	27165	21210

Robust standard errors are in parenthesis. All equations include city-pair and time fixed effects. The final column - designated Equation 4 - reports results from estimation with extreme observations on the dependent variable (above the 99^{th} percentile and below the 1^{st} percentile) dropped.

Appendix Table 1: Prices Studied

1. Apples (1 kg) (supermarket)
2. Aspirin (100 tablets) (supermarket)
3. Bacon (1 kg) (supermarket)
4. Bananas (1 kg) (supermarket)
5. Batteries (two, size D/LR20) (supermarket)
6. Beef: filet mignon (1 kg) (supermarket)
7. Beef: ground or minced (1 kg) (supermarket)
8. Beef: roast (1 kg) (supermarket)
9. Beef: steak, entrecote (1 kg) (supermarket)
10. Beef: stewing, shoulder (1 kg) (supermarket)
11. Beer, local brand (1 l) (supermarket)
12. Beer, top quality (330 ml) (supermarket)
13. Butter, 500 g (supermarket)
14. Carrots (1 kg) (supermarket)
15. Cheese, imported (500 g) (supermarket)
16. Chicken: fresh (1 kg) (supermarket)
17. Chicken: frozen (1 kg) (supermarket)
18. Cigarette, local brand (pack of 20) (supermarket)
19. Cigarettes, Marlboro (pack of 20) (supermarket)
20. Coca-Cola (1 l) (supermarket)
21. Cocoa (250 g) (supermarket)
22. Cognac, French VSOP (700 ml) (supermarket)
23. Cornflakes (375 g) (supermarket)
24. Dishwashing liquid (750 ml) (supermarket)
25. Drinking chocolate (500 g) (supermarket)
26. Eggs (12) (supermarket)
27. Facial tissues (box of 100) (supermarket)
28. Flour, white (1 kg) (supermarket)
29. Fresh fish (1 kg) (supermarket)
30. Frozen fish fingers (1 kg) (supermarket)
31. Gin, Gilbey's or equivalent (700 ml) (supermarket)
32. Ground coffee (500 g) (supermarket)
33. Ham: whole (1 kg) (supermarket)
34. Hand lotion (125 ml) (supermarket)
35. Insect-killer spray (330 g) (supermarket)
36. Instant coffee (125 g) (supermarket)
37. Lamb: chops (1 kg) (supermarket)
38. Lamb: leg (1 kg) (supermarket)
39. Lamb: Stewing (1 kg) (supermarket)
40. Laundry detergent (3 l) (supermarket)
41. Lemons (1 kg) (supermarket)
42. Lettuce (one) (supermarket)
43. Light bulbs (two, 60 watts) (supermarket)
44. Lipstick (deluxe type) (supermarket)
45. Liqueur, Cointreau (700 ml) (supermarket)
46. Milk, pasteurised (1 l) (supermarket)
47. Mineral water (1 l) (supermarket)
48. Olive oil (1 l) (supermarket)
49. Onions (1 kg) (supermarket)
50. Orange juice (1 l) (supermarket)
51. Oranges (1 kg) (supermarket)
52. Peaches, canned (500 g) (supermarket)
53. Peanut or corn oil (1 l) (supermarket)
54. Peas, canned (250 g) (supermarket)
55. Pork: chops (1 kg) (supermarket)
56. Pork: loin (1 kg) (supermarket)
57. Potatoes (2 kg) (supermarket)
58. Razor blades (five pieces) (supermarket)
59. Scotch whisky, 6 years old (700 ml) (supermarket)
60. Sliced pineapples, canned (500 g) (supermarket)
61. Soap (100 g) (supermarket)
62. Spaghetti (1 kg) (supermarket)
63. Sugar, white (1 kg) (supermarket)
64. Tea bags (25 bags) (supermarket)
65. Toilet tissue (two rolls) (supermarket)
66. Tomatoes (1 kg) (supermarket)
67. Tomatoes, canned (250 g) (supermarket)
68. Tonic water (200 ml) (supermarket)
69. Toothpaste with fluoride (120 g) (supermarket)
70. Vermouth, Martini & Rossi (1 l) (supermarket)
71. White bread, 1 kg (supermarket)
72. White rice, 1 kg (supermarket)
73. Wine, common table (1 l) (supermarket)
74. Wine, fine quality (700 ml) (supermarket)
75. Wine, superior quality (700 ml) (supermarket)
76. Yoghurt, natural (150 g) (supermarket)
77. Boy's dress trousers (chain store)
78. Boy's jacket, smart (chain store)
79. Business shirt, white (chain store)
80. Business suit, two piece, medium weight (chain store)
81. Child's jeans (chain store)
82. Child's shoes, dress wear (chain store)
83. Child's shoes, sportswear (chain store)
84. Cost of six tennis balls e.g., Dunlop, Wilson (average)
85. Dress, ready to wear, daytime (chain store)
86. Fast food snack: hamburger, fries and drink (average)
87. Frying pan (Teflon or good equivalent) (supermarket)
88. International foreign daily newspaper (average)
89. Kodak colour film (36 exposures) (average)
90. Men’s raincoat, Burberry type (chain store)
91. Men's shoes, business wear (chain store)
92. Socks, wool mixture (chain store)
93. Tights, panty hose (chain store)
94. Women's cardigan sweater (chain store)
95. Women's shoes, town (chain store)

Appendix Table 2: Cities Included

1	Abidjan	Cote d Ivoire	43	Lisbon	Portugal
2	Abu Dhabi	UAE	44	London	United Kingdom
3	Amman	Jordan	45	Los Angeles	United States
4	Amsterdam	Netherlands	46	Luxembourg	Luxembourg
5	Asuncion	Paraguay	47	Madrid	Spain
6	Athens	Greece	48	Manila	Philippines
7	Atlanta	United States	49	Mexico City	Mexico
8	Auckland	New Zealand	50	Miami	United States
9	Bahrain	Bahrain	51	Montevideo	Uruguay
10	Bangkok	Thailand	52	Moscow	Russia
11	Beijing	China,P.R.	53	Mumbai	India
12	Berlin	Germany	54	Nairobi	Kenya
13	Bogota	Colombia	55	New York	United States
14	Boston	United States	56	Oslo	Norway
15	Brussels	Belgium	57	Panama City	Panama
16	Budapest	Hungary	58	Paris	France
17	Buenos Aires	Argentina	59	Pittsburgh	United States
18	Cairo	Egypt	60	Port Moresby	Papua New Guinea
19	Caracas	Venezuela	61	Prague	Czech Republic
20	Casablanca	Morocco	62	Quito	Ecuador
21	Chicago	United States	63	Riyadh	Saudi Arabia
22	Cleveland	United States	64	Rome	Italy
23	Colombo	Sri Lanka	65	San Francisco	United States
24	Copenhagen	Denmark	66	San Jose	Costa Rica
25	Dakar	Senegal	67	Santiago	Chile
26	Detroit	United States	68	Sao Paulo	Brazil
27	Douala	Cameroon	69	Seattle	United States
28	Dublin	Ireland	70	Seoul	South Korea
29	Guatemala City	Guatemala	71	Singapore	Singapore
30	Helsinki	Finland	72	Stockholm	Sweden
31	Hong Kong	Hong Kong	73	Sydney	Australia
32	Honolulu	United States	74	Taipei	Taiwan
33	Houston	United States	75	Tehran	Iran
34	Istanbul	Turkey	76	Tel Aviv	Israel
35	Jakarta	Indonesia	77	Tokyo	Japan
36	Johannesburg	South Africa	78	Toronto	Canada
37	Karachi	Pakistan	79	Tunis	Tunisia
38	Kuala Lumpur	Malaysia	80	Vienna	Austria
39	Kuwait	Kuwait	81	Warsaw	Poland
40	Lagos	Nigeria	82	Washington DC	United States
41	Libreville	Gabon	83	Zurich	Switzerland
42	Lima	Peru			

Figure 1: Intercity Price Comparisons

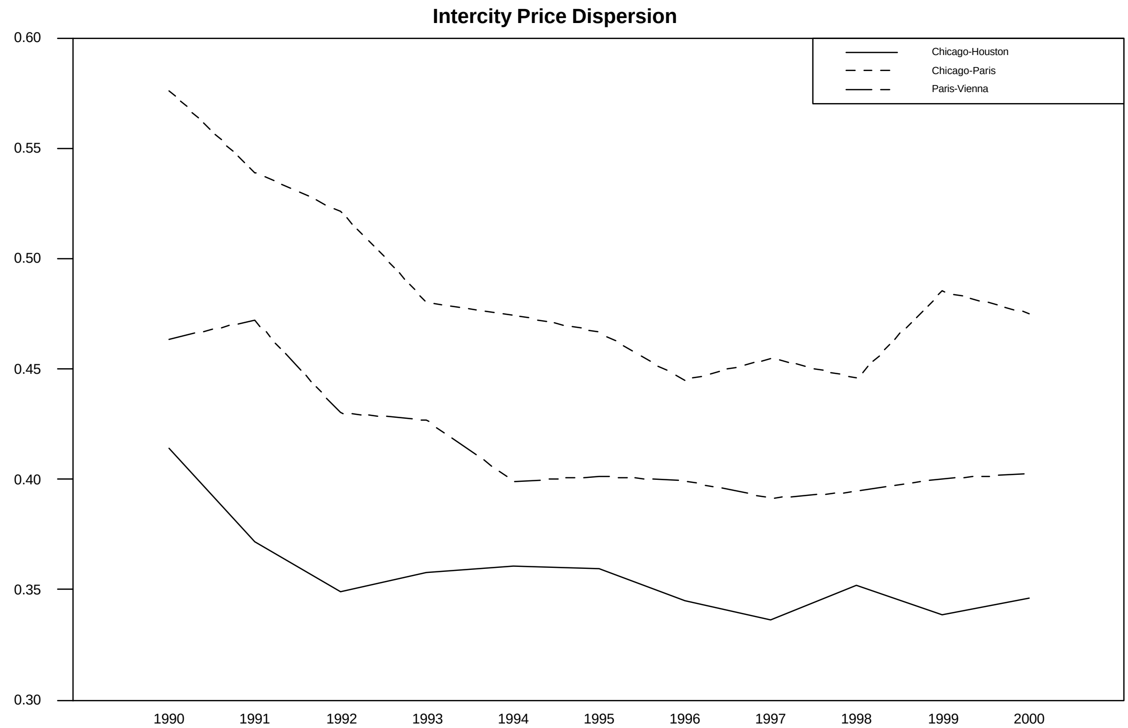
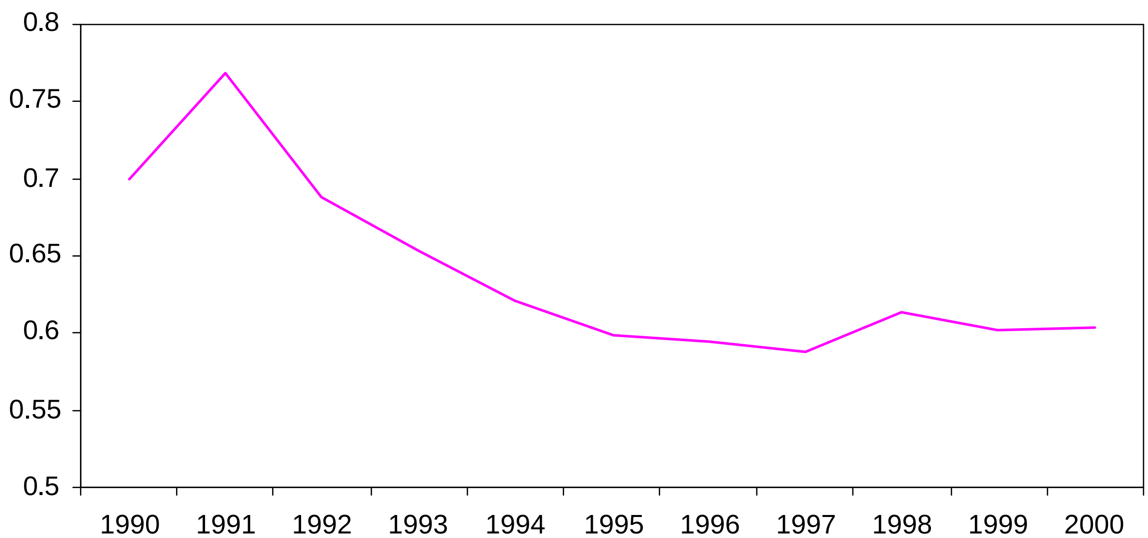


Figure 2: Dispersion averaged over all city-pairs



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