



# Economic Letter

## Consumer Price Differences Persist Among Eight Texas Cities

by Michele Ca'Zorzi, Alexander Chudik and Chi-Young Choi

**ABSTRACT:** The differences in what consumers pay for a given product in eight Texas cities increased considerably in the 2000s—Dallas being by far the most expensive city in the sample. A strong price adjustment mechanism, however, ensures that the relative price between any two Texas locations tended to rapidly revert to its mean value.

**W**hat an item costs in various geographic locations has attracted economists' attention for decades.

One theory—the law of one price—states that the same good should cost the same across different geographic locations. Any departure from a common price should be short-lived.

This theory is typically refuted empirically when it comes to markets for consumer goods and services; overwhelming evidence suggests that price differences can persist for long periods.

Texas provides an interesting location to view how this price mechanism works. Drawing on data for eight cities from 1985 to 2009 collected by the American Chamber of Commerce Researchers Association, it appears that the degree of price dispersion among metropolitan areas has increased over time. Moreover, the magnitude of price differences varies across the types of goods or services, and Dallas is the most expensive city in the sample.<sup>1</sup>

The dataset allows us also to investigate whether the “strong” or “weak” form of the law of one price holds. The strong version clearly fails for Texas cities, since the prices of the same product differ considerably; however, the weak version holds. It postulates that the relative price—the price of a given good in one

city relative to the price of the same good in another city—should revert to some mean or normal level over time.

This mean level could differ from an identical price because of structural factors, such as differences in the scarcity of land or in income levels. It helps to justify why goods and especially services are more expensive in some locations.

Analysis of the Texas city data suggests that relative prices for all the product categories rapidly revert to their mean. The speed of such convergence of relative prices may be explained by the nature of products (goods that are easily traded and more homogenous converge faster) and by geographic distance.

### Consumer Price Data

Quarterly price data for Abilene, Amarillo, Dallas, Houston, Lubbock, Odessa, San Antonio and Waco cover 45 individual product categories in each location from 1985 to 2009. Product categories encompass a range of goods and services, including apartment rents, and are generally narrowly defined, such as “one dozen Grade A large eggs” or “adult teeth cleaning.”

This dataset has been used in a number of academic publications.<sup>2</sup> It allows economists to study price dispersion of relatively narrowly defined products across different geographic locations.

This would not be possible with the consumer price index data collected by the Bureau of Labor Statistics, which publishes price indexes only. They are indicative of the price changes over time and cannot be used to investigate the level or dispersion of prices across cities.

## Differences Increase Over Time

Price dispersion is clearly visible on a daily basis—for example, among gas stations. The incentive to buy from a location with cheaper prices should ensure equalization of prices over time. However, the search for a cheaper price is costly (in terms of time and effort), while the products offered by different sellers/producers are not exactly identical. These factors could contribute to price differences persisting. It is therefore not surprising that price dispersion can prevail within cities as well as from city to city.

There are different ways of measuring price dispersion. The simplest is to compute, for each product category and time period, a Texas average price (given by the simple average of the individual prices in the eight cities).

Using the Texas average as a benchmark, we compute the price deviation (in percent) for each city and each prod-

uct. A simple price dispersion measure for each product is then obtained by averaging the absolute value of such percentage price deviations across quarters (Chart 1).

The smallest amount of dispersion—about 3 percent on average—is observed for gasoline (defined as one gallon of regular unleaded gasoline, national brand, including all taxes). This is to be expected since gasoline is tradable and a rather homogenous product category.

On the other hand, the largest price differences of about 13 percent are for the bowling category (defined as price per line, Saturday evening nonleague rate). The dispersion of prices is highly product-specific and in many cases quite large.

Instead of only looking at the price differences for a given product category, it is worth also investigating whether price dispersion has changed over time. To this end, Chart 2 shows, for every quarter in the sample, the average of absolute deviations of prices across all products. The price dispersion was fairly constant prior to the 2000s, where it hovered around 7.5 percent, but it subsequently increased, reaching about 10 percent.

## Dallas, Houston Most Expensive

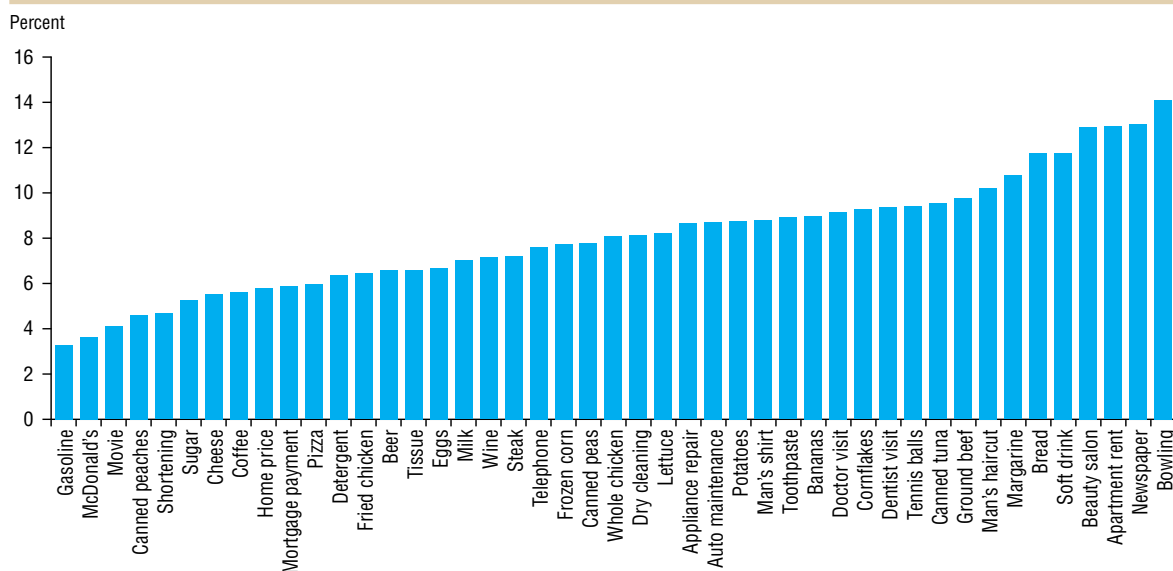
Various factors can affect the distribution of prices across cities. The Balassa-Samuelson hypothesis suggests that price differences might persist if the movement of labor is not fully flexible across locations (and therefore wages need not equalize across locations).<sup>3</sup> Additionally, consumer product categories contain elements that are not tradable, such as local distribution costs.

As a result, locations with higher income (wages) will have systematically higher consumer prices. The differences in the average prices of the goods and services surveyed may therefore reflect differences in income levels by city. Idiosyncratic factors other than income also could contribute to price differences. Some examples are market structure, population density and city size.

Simple (equally weighted) averages of price deviations of individual product categories from the benchmark Texas average are shown in Chart 3 for each of the eight sample cities. Dallas is the most expensive city, followed by Houston. These are the two largest cities (with highest incomes) in the sample; thus, the findings appear intuitive. This chart also divides the sample into two subperiods

Chart 1

Average Price Difference in Eight Texas Cities Varies by Product



NOTES: This chart shows average price dispersion (computed for 1985–2009) for individual product categories in the American Chamber of Commerce Researchers Association database for eight Texas cities. Price dispersion is a simple average of the price deviations (in percent, absolute values) of individual cities from the Texas average.

SOURCES: American Chamber of Commerce Researchers Association; authors' calculations.

(1985–97 and 1998–2009). The price differences between Dallas and other cities became more pronounced in the second half of the sample, where the average price of the 45 goods or services surveyed was about 8 percent more expensive in Dallas.<sup>4</sup> Mainly tradable products drive Dallas' price increase relative to other Texas cities in the second half of the sample period.

## Rapid Price Convergence

Although price differences persist across cities, *relative* prices of a given product between two locations may fluctuate around a mean. This weak form of the law of one price is also referred to as a weak form of purchasing power parity—the idea that identical goods in two countries with two currencies should cost the same.

What interests economists most is not whether a pricing rule holds but at what speeds relative prices converge to their means, following a shock. The speed of convergence is usually measured by the so-called half-life statistic, an estimate of the time needed for 50 percent of the deviations of relative prices from their mean to dissipate in the absence of any new economic shocks. Estimates of half-life statistics over the full sample are shown in Chart 4.<sup>5</sup>

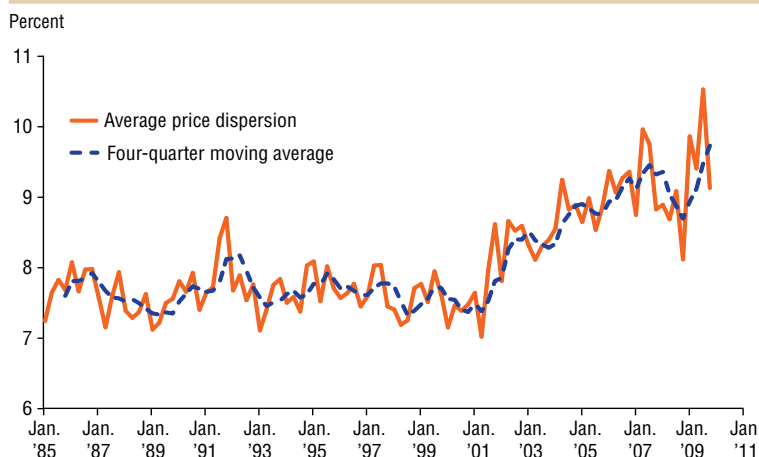
The speed is very fast—the half-life statistics are less than one quarter in most product categories and, in all but one category, less than two quarters. The speeds of convergence are generally slower for products that are less tradable in nature, such as various services.

## Persistent Differences

Price differences across Texas cities may be large and persistent. There is, however, evidence of an important price adjustment mechanism: *relative* consumer prices between different cities in Texas rapidly revert to a mean difference. These findings are broadly in line with the evidence on consumer prices in the scholarly literature where a number of different intranational datasets are scrutinized.

Future research may attempt to understand what is driving the higher degree of price dispersion among Texas cities in the 2000s.

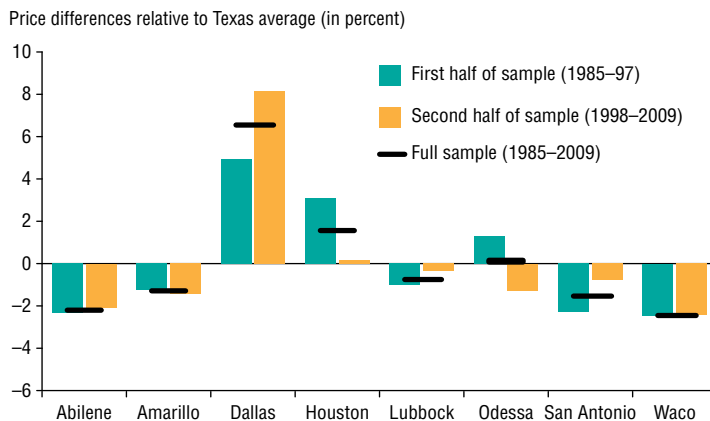
**Chart 2** Price Dispersion Increases Over Time



NOTE: Price dispersion for a given good or service (across the 45 product categories) is defined as the average of the price deviations (in percent) of individual cities from the Texas average.

SOURCES: American Chamber of Commerce Researchers Association; authors' calculations.

**Chart 3** Dallas Price Differences Increase Most in Recent Period



NOTE: This chart shows average (across products and time) of price differences of individual products relative to the Texas average.

SOURCES: American Chamber of Commerce Researchers Association; authors' calculations.

Additionally, the marked increase in Dallas prices relative to Houston in the second half of the sample period appears somewhat puzzling. This development is driven mainly by products that are tradable and cannot be easily justified by differences in income, population growth or other idiosyncratic factors.

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## NOTES

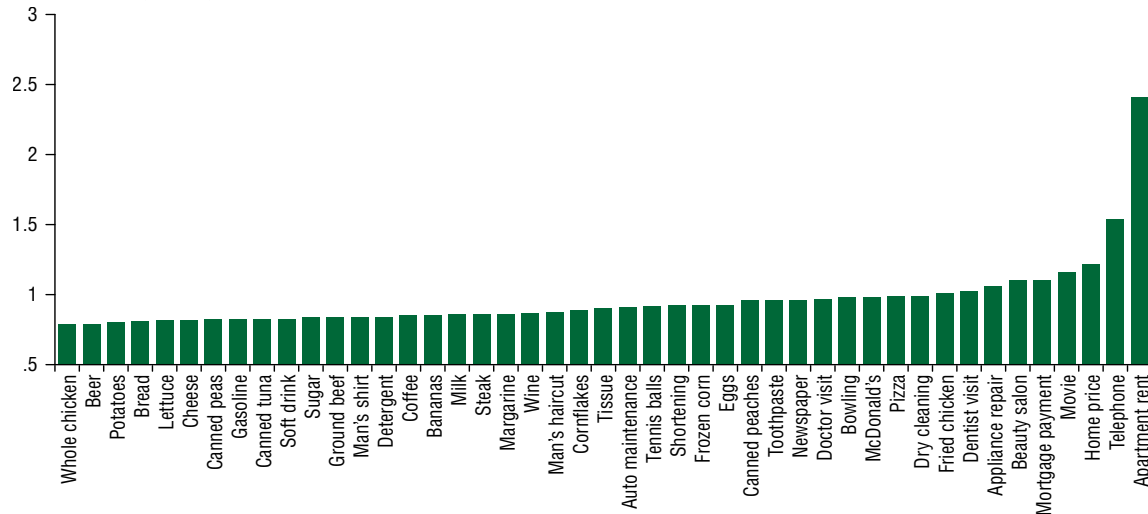
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<sup>1</sup> Specifically, the dataset comes from the American Chamber of Commerce Researchers Association's

## Chart 4

### Speed of Convergence Is Fast, But Varies Across Products

Half-life statistics (quarters)



NOTES: For each of the eight Texas cities, the speed of convergence is given by the half-life statistics of relative prices of the chosen city and an aggregate of the remaining cities. The half life is an estimate of the time needed for 50 percent of the deviations of relative prices from their mean to dissipate absent a new shock.

SOURCES: American Chamber of Commerce Researchers Association; authors' calculations.

retail price survey publication "Cost of Living Index."

<sup>2</sup> More detailed description of this dataset can be found, for instance, in the following publications: "Convergence to the Law of One Price Without Trade Barriers or Currency Fluctuations," by David C. Parsley and Shang-Jin Wei, *Quarterly Journal of Economics*, vol. 111, no. 4, 1996, pp. 1211–36; "The Bigger They Are, the Harder They Fall: Retail Price Differences Across U.S. Cities," by Paul G.J. O'Connell and Shang-Jin Wei, *Journal of International Economics*, vol. 56, no. 1, 2002, pp. 21–53; and "Does Distance Reflect More than Transport Costs?" by Chi-Young Choi and Horag Choi, *Economics Letters*, vol. 125, no. 1, 2014, pp.82–86.

<sup>3</sup> The Balassa–Samuelson effect refers to an economic model that justifies the observation that consumer price levels in locations with higher income are systematically higher. The Balassa–Samuelson effect is attributed to two papers: "The Purchasing Power Parity Doctrine: a Reappraisal," by Bela Balassa, *Journal of Political Economy*, vol. 72, no. 6, 1964, pp. 584–96; and "Theoretical Notes on Trade Problems," by Paul A. Samuelson, *Review of Economics and Statistics*, vol. 46, no. 2, 1964, pp. 145–154.

<sup>4</sup> Chart 3 does not weigh the price differences across products by the share of the income expenditures of households, and therefore it does not quantify the

differences in the cost of living of households.

<sup>5</sup> The speed of convergence estimated seems to be fairly constant over time. Estimates of the half-life statistics are very similar when splitting the full sample into two subsamples (before and after second quarter 1997, the middle point). The aggregation methodology for the remaining cities is explained in more detail in "Spatial Considerations on the PPP Debate," by Michele Ca' Zorzi and Alexander Chudik, Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper no. 138, January 2013.

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