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The global, national, regional and local factors that shape price-setting behavior are complex, even for a relatively simple product that's neither easily tradable nor wholly nontradable.

The Big Mac: A Global-to-Local Look at Pricing

by Anthony Landry

Readily tradable goods—oil, chemicals, metals and agricultural commodities, for example—tend to sell at world prices. Nontradable goods and services—housing, cab rides and such personal services as haircuts—are largely insulated from global competition, and their prices can vary from place to place.

Whether goods are tradable, nontradable or somewhere in between influences the international transmission of price fluctuations. Rising prices in tradables are highly likely to spill across borders, while rising prices in nontradables are not. A better understanding of factors that determine prices should help the Federal Reserve and other central banks incorporate foreign price movements into monetary policy decisions.

That brings us to the Big Mac and what it can teach us about pricing. McDonald's iconic hamburger is a tiny bit of the world economy, but it's



Most explanations of international price gaps focus on factors that enable price discrimination to persist.

the ingredients of the Big Mac are the same wherever it's sold.¹ Other global products could be used for a prop in this exercise—a Coca-Cola, a Starbucks coffee, an iPod—but, over the years, the Big Mac Index has been a quick guide to prices in many countries.

In July, *The Economist* presented Big Mac prices in local currencies and U.S. dollars for 45 countries, showing a range from \$1.70 in Malaysia to \$7.88 in Norway.² The U.S. fell into the middle of the pack, with an average Big Mac price of \$2.99 (see abbreviated list, Table 1). These differences are typical of the price disparities *The Economist* has found over more than two decades.

Why do Big Mac prices vary from one nation to another, even when

adjusted for exchange rates? Most explanations of international price gaps focus on factors that enable price discrimination to persist. Markets don't bid these price differences away because of the high costs to arbitrage, the profit from buying in lower price markets and selling in higher price ones.

One of these factors is the cost of moving goods across borders. The Big Mac itself isn't tradable, but many of its ingredients are. Transportation costs for frozen beef patties, cooking oil, special sauce, sesame-seed buns and other tradable Big Mac ingredients can create price gaps across countries. The added costs aren't trivial. A 2001 study, for example, found that transportation raised import prices 7 percent for

often used as a rough gauge of relative prices across countries.

Since 1986, *The Economist* magazine has been publishing a Big Mac Index, comparing the hamburger's international prices. The index shows how much Big Mac prices vary from one country to the next. What's less well known is the extent to which Big Mac prices diverge across the U.S., regions, Texas and even Dallas. The reasons for the disparities help us sort out how international, national, regional and local factors shape prices—at least for one product.

World Prices

The Economist concocted the Big Mac Index with a sly wink and didactic purpose—"to make exchange-rate theory more digestible." The Big Mac stood in for the market baskets of goods and services that economists use to measure purchasing power parity, an alternative to market exchange rates for comparing output or consumption in different countries.

The attractive feature of the Big Mac as an indicator is its uniform composition. With few exceptions,

Table 1

Big Mac Prices Vary Across the World

Country	Price in local currency	Exchange rate	Price in US\$
Malaysia	5.50	3.20	1.70
China	12.50	6.83	1.83
Thailand	62.00	33.40	1.86
Pakistan	140.00	70.90	1.97
Indonesia	18,700.00	9,152.00	2.04
South Africa	16.90	7.56	2.24
Egypt	13.00	5.31	2.45
Russia	59.00	23.20	2.54
Japan	280.00	106.80	2.62
Saudi Arabia	10.00	3.75	2.67
U.S.	2.99	n.a.	2.99
Chile	1,550.00	494.00	3.13
South Korea	3,200.00	1,018.00	3.14
Mexico	32.00	10.20	3.15
Australia	3.45	1.03	3.36
Poland	7.00	2.03	3.45
Argentina	11.00	3.02	3.64
Canada	4.09	1.00	4.08
Turkey	5.15	1.19	4.32
Britain	2.29	2.00	4.57
Brazil	7.50	1.58	4.73
Euro area	3.37	1.59	5.34
Switzerland	6.50	1.02	6.36
Norway	40.00	5.08	7.88

NOTES: Chart reflects a sampling of the 45 countries surveyed and includes the highest and lowest Big Mac prices. Big Mac prices are taken from *The Economist*, July 26, 2008. The U.S. price is an average of the prices sampled for this article.

SOURCES: *The Economist*; Federal Reserve Bank of Dallas.



meat, 6 percent for dairy products and 16 percent for vegetables.³

The costs imposed by tariffs, quotas and other trade barriers can contribute to price disparities between countries. Tariffs directly affect import prices but only indirectly affect import quantities through price increases' dampening impact on consumer demand. Quotas, on the other hand, directly restrict import quantities but only indirectly affect import prices by creating artificial scarcity.

Nearly all governments have restricted imports to protect important domestic industries from international competition. Agricultural trade faces many barriers designed to benefit domestic farmers, and quotas and tariffs hamper McDonald's beef imports in many parts of the world.⁴

However, transportation costs and trade barriers only impact the Big Mac's traded components. By one estimate, just 6 percent of the Big Mac's price comes from the cost of its ingredients.⁵ This implies that, at most, 18 cents of a \$2.99 U.S. Big Mac can be directly tied to factors that influence the cost of tradable goods.

The remaining costs come from the nontraded inputs used in making Big Macs—such as rents and wages, which vary widely from one country to another. These differences in operating costs show up in Big Mac prices.

In 1964, Bela Balassa and Paul Samuelson suggested that prices of nontraded goods and services are higher in rich countries.⁶ Interestingly, their reasoning begins with the tradable sectors, which are more productive in rich countries than in poor ones. Tradables' higher productivity influences rents and wages in all sectors as firms in both tradable and non-tradable sectors bid up the prices for real estate and workers.

Simply put, nontraded inputs raise prices in rich countries relative to poor ones. Looking at the relationship between prices and income provides a test for the Balassa–Samuelson proposition. For our purposes, this can be

done with a regression analysis for Big Mac prices and per capita income for countries in *The Economist's* Big Mac survey (*Chart 1*). For the most part, the Balassa–Samuelson explanation holds: The analysis shows that Big Mac prices are higher in countries with higher per capita incomes.

In economic terms, Big Macs aren't exceptional. International transportation costs, trade barriers and income disparities help explain why so many other goods and services sell at different prices in different countries. None of these factors are likely to go away any time soon, so we can expect international prices will continue to vary. For the Big Mac, though, that's not the end of the story.

U.S. Prices

If price deviations were solely due to international transportation costs, trade barriers and income disparities, Big Macs should sell at a constant price within the U.S.

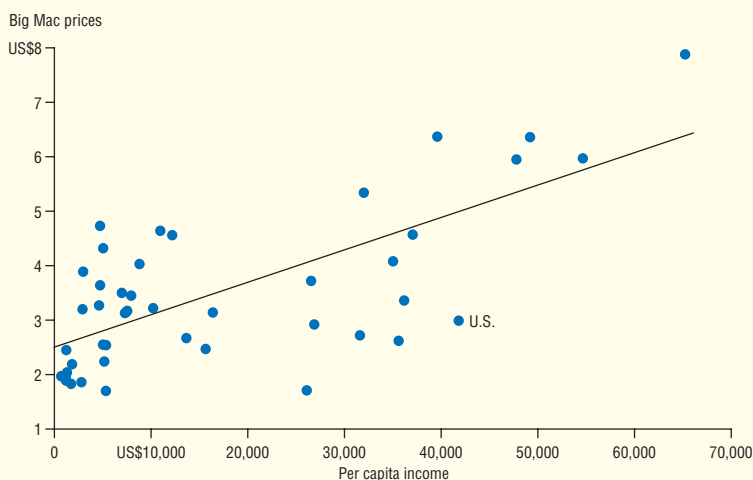
That isn't the case.

No U.S. magazine prints a counterpart to *The Economist's* Big Mac

International transportation costs, trade barriers and income disparities help explain why so many other goods and services sell at different prices in different countries.

Chart 1

Rich Countries Pay More for Big Macs



NOTE: The *t* statistic for the coefficient of per capita income is 6.66.

SOURCES: *The Economist*, July 26, 2008; Federal Reserve Bank of Dallas; World Development Indicators, World Bank, 2005.



Index, so we collected Big Mac prices for 150 McDonald's across the U.S. during the week of April 20, 2008. The restaurants represent a range of locations, including airports, suburbs and downtowns, shopping malls and service roads. They're grouped into four regions—Northeast, Midwest, South and West.

Even within the U.S., Big Mac prices show large disparities. The cheapest was \$2.24, recorded in Adel, Ga., while the most expensive was \$3.84, found in downtown

Philadelphia (*Table 2*). By region, the average ranges from \$2.77 in the South to \$3.22 in the Northeast.

Big Mac prices at 12 locations across Texas and at 12 Dallas-area restaurants echo the theme of price disparities (*Table 3*). A Fort Worth Big Mac was a bargain at \$2.35. Just 30 miles to the east in Dallas, the hamburger was the most expensive in the state, averaging \$2.96.

But the Dallas area wasn't a bastion of price conformity. Instead of eating at Love Field Airport after arriving

Even within the U.S., Big Mac prices show large disparities. The cheapest was \$2.24, recorded in Adel, Ga., while the most expensive was \$3.84, found in downtown Philadelphia.

Table 2
Big Mac Prices Vary Across the U.S.

Northeast	Price	Midwest	Price
Catonsville, MD	\$2.79	Edinburgh, IN	\$2.45
Newark Airport, NJ	2.89	Bloomington, IN	2.49
Albany, NY	2.91	Akron, OH	2.60
Dover, DE	2.95	Edmore, MI	2.69
Baltimore, MD	2.99	Canfield, OH	2.79
Bangor, ME	2.99	Champaign, IL	2.95
Concord, NH	3.19	Detroit, MI	2.99
Washington, DC	3.29	Duluth, MN	2.99
Boston, MA	3.49	Carey, OH	3.00
Bronx, NY	3.49	North Branch, MN	3.10
Brentwood, NY	3.79	Minn./St. Paul Airport, MN	3.29
Philadelphia, PA	3.84	Chicago, IL	3.40
Average	\$3.22	Average	\$2.90
South	Price	West	Price
Adel, GA	\$2.24	Alameda, CA	\$2.60
Aiken, SC	2.49	Rock Spring, WY	2.79
Atlanta, GA	2.49	Boise, ID	2.80
Raleigh, NC	2.58	Las Vegas, NV	2.89
Goldsboro, NC	2.65	Los Angeles, CA	2.99
Ashland, KY	2.69	Albuquerque, NM	3.09
Houston, TX	2.79	Colorado Springs, CO	3.09
Alexandria, KY	2.85	Fargo, ND	3.10
Winchester, TN	2.89	Anaheim, CA	3.11
Lawrence, KS	2.99	Fresno, CA	3.23
Alexandria, VA	3.19	Anchorage, AK	3.49
Abingdon, VA	3.39	Auburn, WA	3.60
Average	\$2.77	Average	\$3.07

SOURCE: Federal Reserve Bank of Dallas (data collected week of April 20, 2008).



in Dallas, you could drive 15 miles to the east and save 60 cents—or nearly 25 percent—by ordering a Big Mac in the suburb of Mesquite.

Overall, price gaps remain as we move from nations to regions, the state and the Dallas area, but the differences diminish as the geographical area shrinks (*Chart 2*). The standard deviation, a common measure of the spread in a statistical series, can be used to summarize the range of prices.

Big Mac prices' standard deviation is more than four times larger at the global level than in the U.S. This suggests that international transportation costs, trade barriers and income differences largely influence Big Mac prices between countries. A series of studies have shown that this observation holds across a range of goods.⁷

The standard deviation is almost twice as big in the U.S. as in Dallas, suggesting that half of the price dispersion observed across the U.S. arises between neighboring locations. Because transportation costs are lower and trade barriers are absent in the domestic economy, other factors must be the source of U.S. price disparities.

One explanation reflects the Balassa-Samuelson argument for Big Mac price differences across countries: Wages, rents and other nontradable factors that influence production costs vary significantly from one place to another. To be more specific, it's cheaper to operate in largely rural Adel, Ga., than in downtown Philadelphia, where McDonald's restaurants compete for space with banks, retailers and other businesses.

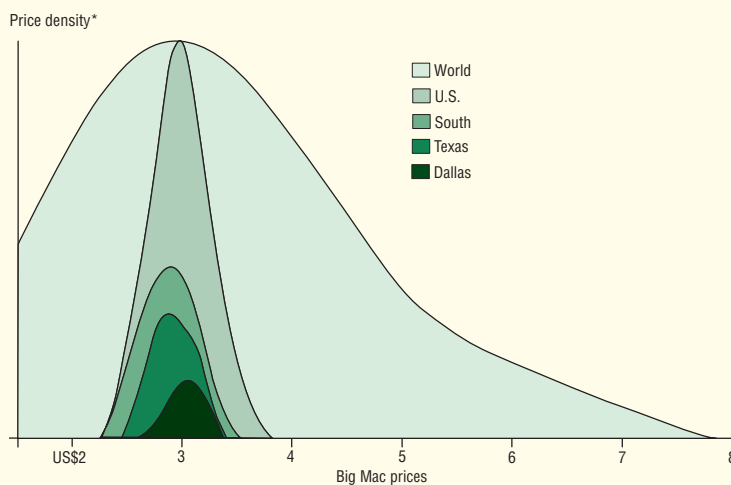
A regression analysis for Big Mac prices at our 150 U.S. locations and per capita incomes in their counties provides a test for the Balassa-Samuelson explanation. It shows the same pattern as international prices: Big Macs cost more where per capita incomes are higher (*Chart 3*). The lowest price was in Adel, where surrounding Cook County has a per capita income of \$20,133 a year, one of the lowest in our survey. The highest

Table 3
Big Mac Prices Vary Across Texas

Texas	Price	Dallas area	Price
Fort Worth	\$2.35	Grapevine	\$2.56
El Paso	2.69	Mesquite	2.59
Lubbock	2.69	Richardson	2.79
Waco	2.69	Galleria	2.89
Amarillo	2.70	North Dallas	2.89
Houston	2.79	Allen	2.99
San Antonio	2.79	DeSoto	2.99
Tyler	2.79	Downtown	3.09
Austin	2.80	Greenville Avenue	3.09
Corpus Christi	2.80	DFW Airport	3.19
Alamo	2.81	Ennis	3.19
Dallas	2.96	Love Field Airport	3.19
Average	\$2.74	Average	\$2.96

NOTE: The Dallas price is an average of the locations sampled for this article.
SOURCE: Federal Reserve Bank of Dallas (data collected week of April 20, 2008).

Chart 2
Big Mac Price Gap Narrows from Global to Local



Region	Average	Standard deviation	Standard deviation relative to U.S.
World	US\$3.48	1.43	4.66
U.S.	2.99	.31	1.00
Northeast	3.22	.30	.98
South	2.77	.28	.92
West	3.07	.25	.82
Midwest	2.90	.23	.75
Texas	2.74	.21	.69
Dallas	2.96	.19	.62

*Frequency of observations at a given price (not drawn to scale).
SOURCES: *The Economist*; Federal Reserve Bank of Dallas.



price was in Philadelphia County, with a per capita income of \$32,676.

Although the Balassa–Samuelson explanation works well at the national level, price gaps persist even when looking at per capita income for a single county. The red dots in Chart 3 display Big Mac prices in Dallas, DeSoto, Mesquite and Richardson, all within Dallas County. They range from \$2.59 in Mesquite to \$3.19 at Love Field Airport.

Can the price difference between Love Field and Mesquite be location-specific? Yes. The cost of doing business can vary even over relatively short distances and influence price-setting behavior.

Operating costs such as rent can differ due to that age-old real estate mantra—location, location, location. At the same time, consumer demand and local competition can affect the ability to raise prices and increase profit margins. For example, it's easier to price discriminate in airport locations, where the concourse McDonald's may be the only option for travelers between

flights, than in the suburbs, where competing fast-food outlets may be just a few blocks down the road.

Law of One Price

One of the building blocks of international economics is the Law of One Price. It states that identical goods should be sold everywhere at the same price when converted to a common currency. (See box titled “A Primer on the Law of One Price and Purchasing Power Parity.”)

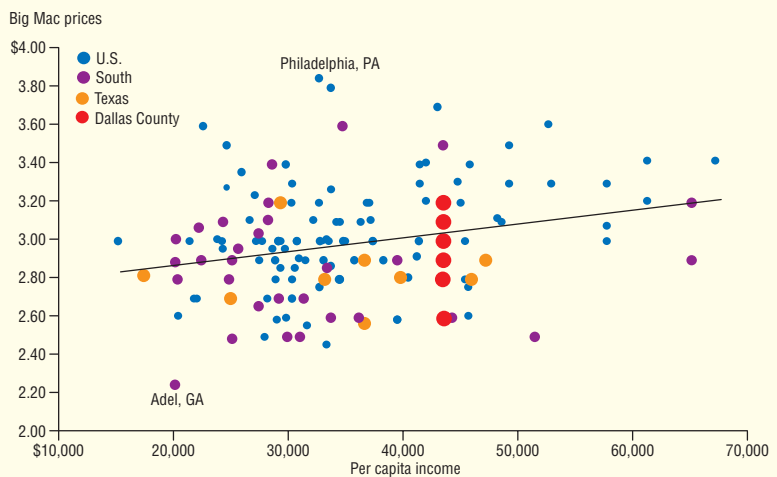
Big Mac prices show that the Law of One Price doesn't hold across countries, regions of the same country, states of the same region, cities of the same state and locations of the same city.

Thus, observing the sale of identical goods at different prices in different countries doesn't tell us all we need to know about currency and border barriers because prices vary substantially across locations in the same country.

Transportation costs and trade barriers explain some price differences

The cost of doing business can vary even over relatively short distances and influence price-setting behavior. At the same time, consumer demand and local competition can affect the ability to raise prices and increase profit margins.

Chart 3
Income Matters in the U.S., Too



NOTES: The *t* statistic for the coefficient of per capita income is 3.07. The nation's highest price was in Philadelphia (\$3.84), while its lowest was in Adel, Ga. (\$2.24).

SOURCES: Federal Reserve Bank of Dallas (data collected week of April 20, 2008); Bureau of Economic Analysis (2006).

A Primer on the Law of One Price and Purchasing Power Parity

Many economists use a simple idea to understand how prices are determined across countries: the Law of One Price.

The law says identical goods should have identical prices in different locations. It rests on the assumption that sellers will seek out the highest possible prices and buyers the lowest ones. Any differences that arise are quickly eliminated by arbitrage, the simultaneous buying at a low price and selling at a higher one.

The law holds reasonably well for globally traded commodities, such as oil, chemicals, metals and some crops. These goods typically operate with single bid and offer prices. However, commodity markets are the exception rather than the rule: The law doesn't seem to apply to many everyday goods and services—including the Big Mac.

Three assumptions support the Law of One Price: Goods must be tradable, transportation and distribution costs must be negligible and markets must be competitive.

When one or more of these assumptions is violated, goods markets become segmented and the location of the good influences its price. The Big Mac provides a good example, with its wide range of prices across countries and even cities.

Because individuals consume more than one good, economists often look at a broader measure of international price comparison, called purchasing power parity.

This concept is a simple application of the Law of One Price to a basket of goods and services. Purchasing power parity states that countries' price levels must be equal once expressed in a common currency—in essence, imposing the Law of One Price.

across countries. In addition, some of the remaining differences can be attributable to income disparities, both across and within countries. So where do the remaining price differences come from? They come from location-specific characteristics, not all of them easy to identify.⁸

The global, national, regional and local factors that shape price-setting behavior are complex, even for a relatively simple product that's neither easily tradable nor wholly nontradable. The Big Mac illustrates the magnitude of the price variations that can occur and suggests how difficult it is to dismantle the international dimension in prices.

Nevertheless, an appreciation of international price-setting behavior is the first step toward understanding how price fluctuations are transmitted across countries. This information is necessary for the proper functioning of monetary policy.

Landry is a research economist for the Federal Reserve Bank of Dallas' Globalization and Monetary Policy Institute.

Notes

¹ For example, in the U.S., the Big Mac has 540 kilocalories, 29 grams of fat and 25 grams of protein. In Australia, however, the hamburger is smaller, with 480 kcal and 25.5 grams of fat but a similar amount of protein at 25.1 grams. The Mexican hamburger tops the scales at 600 kcal, 33 grams of fat and 25 grams of protein.

² Big Mac prices are menu prices and may include value-added taxes.

³ See "Toward a Geography of Trade Costs," by David Hummels, Working Paper, Purdue University, September 2001.

⁴ U.S. quotas apply to imported beef from all countries except Canada and Mexico.

⁵ "Burgeronomics: The Economics of the Big Mac Standard," by Li Lian Ong, *Journal of International Money and Finance*, vol. 16, December 1997, pp. 865–78.

⁶ "The Purchasing-Power Parity Doctrine: A Reappraisal," by Bela Balassa, *Journal of Political Economy*, vol. 72, December 1964, pp. 584–96, and "Theoretical Notes on Trade Problems," by Paul A. Samuelson, *Review of Economics and Statistics*, vol. 46, May 1964, pp. 145–54.

An appreciation of international price-setting behavior is the first step toward understanding how price fluctuations are transmitted across countries. This information is necessary for the proper functioning of monetary policy.

⁷ See "How Wide Is the Border?" by Charles Engel and John H. Rogers, *American Economic Review*, vol. 86, December 1996, pp. 1112–25. More recently, see "Understanding International Price Differences Using Barcode Data," by Christian Broda and David E. Weinstein, NBER Working Paper No. 14017, May 2008, and "Microeconomic Sources of Real Exchange Rate Variability," by Mario J. Crucini, Vanderbilt University, and Chris Telmer, Carnegie Mellon University, Working Paper, April 2007.

⁸ For more about the Big Mac Index and Law of One Price, see "Burgernomics: A Big Mac™ Guide to Purchasing Power Parity," by Michael R. Pakko and Patricia S. Pollard, Federal Reserve Bank of St. Louis *Review*, November/December 2003. Another source on Law of One Price is "The Purchasing Power Parity Puzzle," by Kenneth Rogoff, *Journal of Economic Literature*, vol. 34, June 1996, pp. 647–68.



A New View of Globalization

Globalization is increasingly changing how nations interact in the economic sphere. In 2007, the Federal Reserve Bank of Dallas created the Globalization and Monetary Policy Institute to explore the deepening economic integration among countries and better define the forces that shape the world economy. The institute is particularly interested in furthering our understanding of how these changes alter the environment in which monetary policy decisions must be made. Read more about the mission of the institute, the influential people behind it and current research at <http://dallasfed.org/institute/index.cfm>.

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