Burgernomics: A Big Mac™ Guide to Purchasing Power Parity

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One of the foundations of international economics is the theory of purchasing power parity (PPP), which states that price levels in any two countries should be identical after converting prices into a common currency. As a theoretical proposition, PPP has long served as the basis for theories of international price determination and the conditions under which international markets adjust to attain long-term equilibrium. As an empirical matter, however, PPP has been a more elusive concept.

Applications and empirical tests of PPP often refer to a broad "market basket" of goods that is intended to be representative of consumer spending patterns. For example, a data set known as the Penn World Tables (PWT) constructs measures of PPP for countries around the world using benchmark surveys that include hundreds of individual items that encompass all of the expenditure components of a nation's gross domestic product.

Many of the principles and limitations of the theory of PPP can be illustrated using a less comprehensive collection of goods. Since 1986, *The Economist* has published an annual tongue-in-cheek comparison of the prices of the McDonald's Big Mac™ sandwich in various countries around the world, evaluating prevailing exchange rates on the basis of international price differences.[1] A similar index has also been developed by the financial firm UBS, as part of a general comparison of prices and incomes around the globe.[2] These lighthearted studies of international hamburger prices have predictably been popular examples of the principles of PPP and have even given serious scholars food for thought.[3]

The attractive feature of the Big Mac as an indicator of PPP is its uniform composition. With few exceptions, the component ingredients of the Big Mac are the same everywhere around the globe. (See the boxed insert, "Two All Chicken Patties?") For that reason, the Big Mac serves as a convenient market basket of goods through which the purchasing power of different currencies can be compared. As with broader measures, however, the Big Mac standard often fails to meet the demanding tests of PPP. In this article, we review the fundamental theory of PPP and describe some of the reasons why it might not be expected to hold as a practical matter. Throughout, we use the Big Mac data as an illustrative example. In the process, we also demonstrate the value of the Big Mac sandwich as a palatable measure of PPP.

THE LAW OF ONE PRICE AND PPP

A strong version of the PPP theory has as its foundation the *law of one price*. Abstracting from complicating factors such as transportation costs, taxes, and tariffs, the law of one price states that any good that is traded on world markets will sell for the same price in every country engaged in trade, when prices are expressed in a common currency.

For instance, consider the price of sesame seeds—one of the basic ingredients of the Big Mac—in Britain and the United States. Letting $p_{ss}^{£}$ and $p_{ss}^{\$}$ represent the prices of sesame seeds in Britain (in pounds) and the United States (in dollars), respectively, then the law of one price can be expressed as follows:

$$p_{ss}^{£} = e \times p_{ss}^{\$}, \tag{1}$$

where e is the pound/dollar exchange rate. If sesame seeds cost $6 per bushel in the United States and the pound/dollar exchange rate is 0.5, then the law of one price states that the price of sesame seeds in Britain should be £3. If sesame seeds sold for a price higher than £3, an astute trader could buy sesame seeds in the United States and sell them in Britain at a profit. This type of activity—known as *arbitrage*—

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[1] Big Mac™ is a registered trademark of the McDonald's Corporation.

[2] The UBS survey is published only every three years. For the most recent version, see UBS (2003).

[3] See Click (1996), Cumby (1997), Lan (2001), Ong (2003), and Parsley and Wei (2003).

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TWO ALL CHICKEN PATTIES?

The Big Mac was created in 1967 by Jim Delligatti, a McDonald's franchise owner in Pennsylvania. In 1968 the Big Mac was launched in McDonald's restaurants throughout the United States, and it is now possible to purchase the sandwich in 120 countries around the globe. In each of these countries, the Big Mac is generally made according to the same recipe—two all beef patties, special sauce, lettuce, cheese, pickles, onions on a sesame seed bun.

In India, however, where no beef products are sold at McDonald's, the recipe for the Big Mac was altered. One can consume the "Maharaja Mac" with chicken patties replacing the beef patties. India, where the Maharaja Mac has been available since 1996, is not included in the Big Mac survey.

In Islamic countries the Big Mac is made with halal beef, and in Israel the Big Mac is made with kosher beef, even though the inclusion of cheese in the recipe makes it a non-kosher sandwich. Although it is possible to purchase a Big Mac in a kosher McDonald's, the lack of cheese would exclude it from the survey.

The first McDonald's outside the United States was opened in Canada in 1967. The most recent country in which one can satisfy a craving for a Big Mac is Mauritius, located in the Indian Ocean off the coast of southern Africa. The world's busiest McDonald's is located on Pushkin Square in Moscow. It seats 700 customers, has 27 cash registers, and serves 40,000 customers per day.[1]

[1] Information based on McDonald's press releases. See < www.media.mcdonalds.com/secured/news/russia/russia.html > and < www.licenseenews.com/news/news167.html > .

would tend to drive the price of sesame seeds higher in the United States and lower in Britain, with the process continuing until the law of one price prevailed.

Absolute PPP

The law of one price generalizes to PPP under special circumstances. Consider price indices (consumer price indices, for example) for the United States and Britain, which are constructed by combining the prices of several different commodities. Typically, these indices are weighted averages of the individual prices. If the same goods are included in each index and if the price indices are constructed identically, then, according to the law of one price, the overall price levels $P^{\$}$ and $P^{£}$ will be related in the same way as each of the individual commodities:

$$P^* = e \times P^{\$}, \tag{2}$$

where P^* is the price level measured in the foreign currency and e is the foreign currency price of a dollar (foreign currency units per dollar). If PPP holds, then equation (2) can be rewritten as

$$\frac{P^*}{P^{\$}} \times \frac{1}{e} = 1. \tag{3}$$

The expression on the left-hand side of equation (3) is referred to as the real exchange rate—the exchange rate adjusted by relative price levels.

The conditions under which the law of one price generalizes to yield PPP—as summarized in equation (2)—are clearly quite restrictive. For the law of one price to directly imply PPP, the same goods must be included in the price indices for each country.[4] Consequently, testing the absolute version of PPP requires careful construction of price indices so that a *common* market basket of goods is measured. One example of such a comparison is embodied in the PWT data set, which is based on the United Nations International Comparisons Program.[5] The PWT presents price measures that are based on a common market basket of approximately 150 detailed categories of goods.

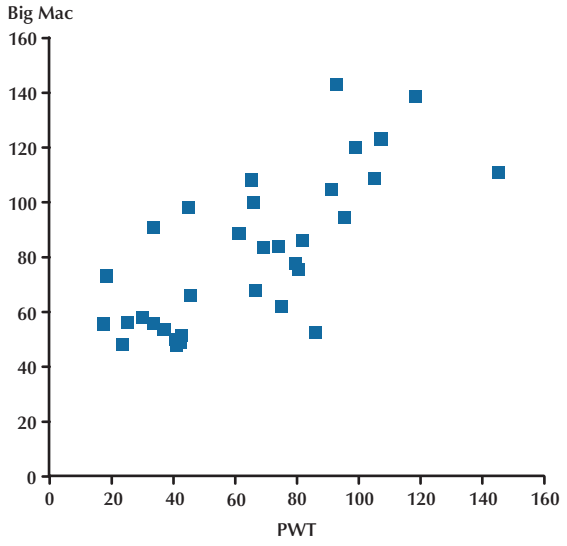
The first column of Table 1 shows a measure of PPP for various countries (relative to the United States) based on the PWT for 2000, the latest year for which data are available. The figures reported in Table 1 are constructed by multiplying equation (3) by 100, so a value equal to 100 means that PPP holds. In this case the dollar-equivalent prices in the country under consideration are the same as the prices in the United States. A value greater than 100 means that dollar-equivalent prices in the country under consideration are higher than prices in the

[4] The same base year must also be used for the price indices.

[5] The data used in this paper are from the PWT version 6.1; see Heston, Summers, and Aten (2002). The data are available at < pwt.econ.upenn.edu > .

Figure 1

PPP from the PWT and Big Mac (2000)



United States. We can interpret this as the U.S. dollar having lower purchasing power in that country relative to the United States or as the local currency being overvalued relative to the dollar. A value of less than 100 indicates that dollar-equivalent prices are lower than prices in the United States—the local currency is undervalued.[6] Clearly, absolute PPP does not hold strictly for the currencies of countries reported in Table 1.

Another common market basket of goods is the ingredients that make up the Big Mac sandwich. Sold in 120 countries around the world, the Big Mac is a standardized bundle of goods. (See the boxed insert, "A New Jingle?") Most of the ingredients that go into a Big Mac are individually traded on international markets, so we might expect that the law of one price would hold, at least approximately. The second column of Table 1 shows indicators of PPP based on Big Mac prices in 2000. Note that a similar pattern emerges for the Big Mac measure as for the PWT measure of PPP. (The correlation between these two price measures is 0.73.) The positive relationship between PWT price indices and Big Mac prices is illustrated by the scatterplot in Figure 1. There are only four countries for which the two price measures indicate differing qualitative conclusions regarding overvaluation or undervaluation. The currencies of Britain, France, Israel, and South Korea were undervalued based on the PWT data and overvalued based on the Big Mac data. The Argentine peso was undervalued based on the PWT but was at parity based on the Big Mac data.

A total of 481 individual observations, collected over the 18-year period 1986-2003, are available

[6] The terms *overvalued* and *undervalued* refer to the value of the currency relative to the value implied by PPP.

Table 1

Indicators of PPP, 2000

Country	PWT	Big Mac
Argentina	66	100
Australia	75	61
Brazil	45	66
Britain	98	120
Canada	79	77
Chile	45	98
China	23	48
Colombia	33	91
Czech Republic	33	55
Denmark	107	123
France	91	104
Germany	95	94
Greece	69	83
Hong Kong	86	52
Hungary	42	48
Indonesia	18	73
Israel	92	143
Italy	81	86
Japan	145	111
Malaysia	41	47
Mexico	61	88
New Zealand	66	67
Philippines	25	56
Poland	42	51
Russia	17	55
Singapore	80	75
South Africa	37	53
South Korea	65	108
Spain	74	83
Sweden	105	108
Switzerland	118	138
Thailand	30	58
Turkey	40	50

A NEW JINGLE?

To aficionados of classic television commercials, the ingredients of a Big Mac sandwich are indelibly etched into memory in the form of a jingle. In terms of the United Nations' Standard International Trade Classifications (SITC), Revision 3, the jingle might sound a little different:

Ingredient	SITC code	SITC description
All beef patties	011.12	Meat of bovine animals, fresh or chilled, boneless
Special sauce	098.49	Other sauces and preparations therefor; mixed condiments and mixed seasonings
Lettuce	054.54	Lettuce and chicory (including endive), fresh or chilled
Cheese	024.20	Processed cheese, not grated or powdered
Pickles	056.71	Vegetables, fruit, nuts, and other edible parts of plants, prepared or preserved by vinegar or acetic acid
Onions	054.51	Onions and shallots, fresh or chilled
Sesame-seed bun	222.50 046.10	Sesame (Sesamum) seeds Flour of wheat or of meslin

from *The Economist* Big Mac surveys.[7] Among these observations only 8.7 percent show deviations of 5 percent or less from PPP, and only 17.9 percent of the observations show deviations of 10 percent or less. These statistics indicate that, for most observations, there are significant deviations from PPP. For example, the data indicate that in 2003 the Danish krone was overvalued by 51 percent against the U.S. dollar, whereas the Swiss franc was overvalued by 70 percent against the dollar. In contrast, in 2003 the Chinese yuan was undervalued by 56 percent against the U.S. dollar and the Thai baht was undervalued by 49 percent against the U.S. dollar.

Figure 2 provides a graphical analysis of absolute PPP over time for selected countries, comparing actual exchange rates (relative to the U.S. dollar) with the ratio of countries' Big Mac prices relative to Big Mac prices in the United States.[8] The latter measures the exchange rate implied by Big Mac PPP. If the exchange rate implied by PPP (the price ratio) is above the actual exchange rate, e, then in order for PPP to hold, the foreign currency price of a dollar must rise—that is, the foreign currency must depreciate. In this case the foreign currency is overvalued relative to the dollar.[9] If the exchange rate implied by PPP is below the actual exchange rate, then in order for PPP to hold, the foreign currency price of a dollar must fall—that is, the foreign currency must appreciate. In this case the foreign currency is undervalued relative to the dollar.

Figure 2 demonstrates not only that departures from PPP are common, but also that for most currencies the direction of the deviation is maintained throughout the sample period. Currencies that have been consistently undervalued include the Australian dollar, the Czech koruna, the Hungarian forint, the Hong Kong dollar, and the Thai baht. The Danish krone has been consistently overvalued, as has the British pound since 1989.

After accounting for average levels of overvaluation and undervaluation, there is evidence of convergence toward PPP. Figure 3 shows the average deviation of the dollar from PPP, based on averages of the data in each annual survey. The dollar was undervalued on average from 1986 through the first half of the 1990s. Gradually this deviation from PPP declined and by 1997 the dollar reached parity. After 1997 the dollar became overvalued, reaching a peak

[7] The full data set is available at <research.stlouisfed.org/publications/review>.

[8] Throughout this article, we evaluate PPP relationships between foreign currencies and the U.S. dollar. Conceptually, however, the Big Mac data can be used to determine whether or not PPP holds between any two currencies in the survey. As an example, the boxed insert "The Big Mac and the Euro Area" discusses PPP relationships using the German mark as the base currency.

[9] For a country that fixes the value of its currency against the U.S. dollar, an overvalued currency is often seen as an indicator of an unsustainable exchange rate. The boxed insert "Currency Crises and the Big Mac" explores the usefulness of the Big Mac index as a currency crisis indicator.

Figure 2

Absolute Purchasing Power Parity

Currency Units/U.S. $

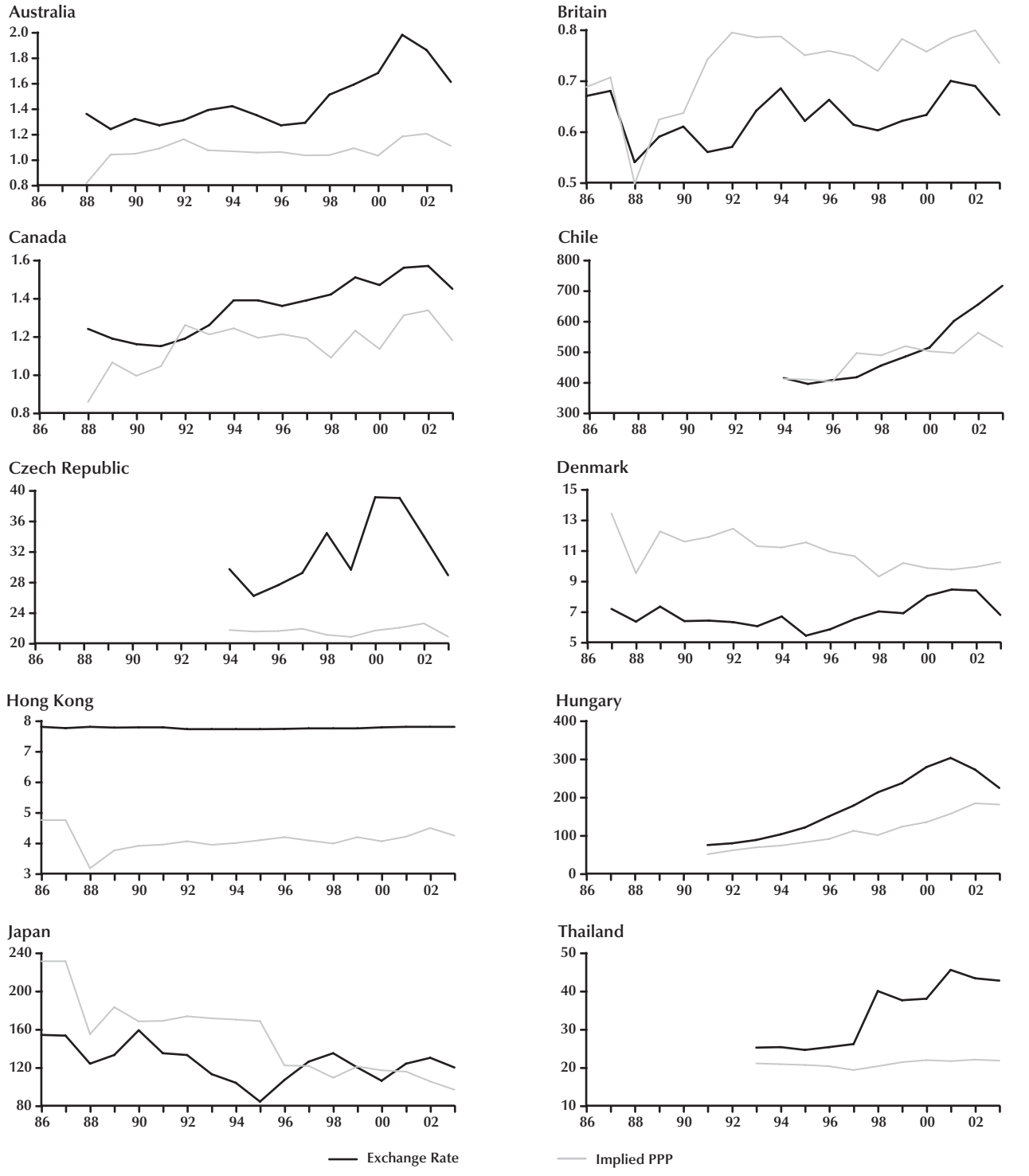
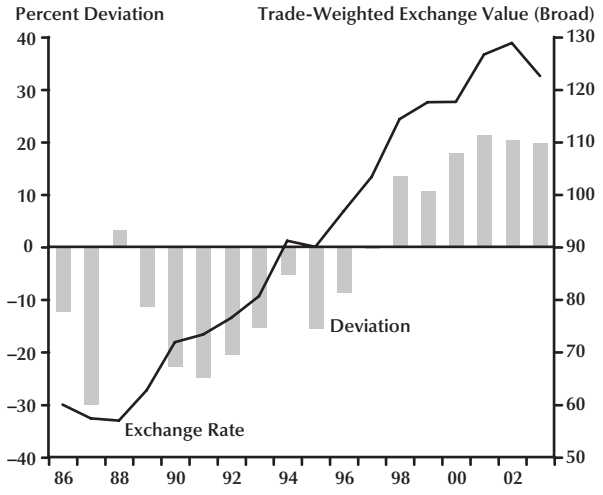


Figure 3

Average Deviation of U.S. $ from PPP



of 22 percent in the 2001 survey. The actual value of the dollar relative to a broad set of currencies follows the deviation of the dollar from PPP. As the figure shows, the value of the dollar rose throughout the 1990s, peaking in 2002.

In an econometric study of PPP using Big Mac price data, Cumby (1997) found statistical evidence that deviations from PPP are, in fact, temporary. He found that the adjustment toward PPP tends to take place through both exchange rates and local currency prices.

Relative PPP

Another condition for the law of one price to generalize to PPP is that weights assigned to the goods in the price indices must be the same across countries. Usually, these weights are based on actual consumption or production shares. So, for example, if more lettuce per capita is consumed in the United States and more pickles per capita are consumed in Britain, then the price of lettuce will be relatively more important in a U.S. price index, whereas the price of pickles will be more important in a British index. Even if lettuce and pickle prices are always identical in the two countries, a rise in the world price of pickles will have a larger impact on the British price index than on the U.S. index.

Most studies of PPP, therefore, are based on relative PPP, which does not require either the same basket of goods or the same weights applied to these goods in the price index. This relative version of PPP states that changes in price levels will be related to changes in exchange rates. Specifically, equation (2) can be transformed to express a relationship in growth rates as follows:

$$(4) \qquad \%\Delta e = \%\Delta P^{*} - \%\Delta P^{\$}.$$

Equation (4) says that the percentage change in the exchange rate between two countries is equal to the difference in their inflation rates. For example, if U.S. inflation is 5 percent per year while inflation in Britain is 3 percent per year, then the relative version of PPP states that the dollar will depreciate by 2 percent per year. Relative PPP is a less strict condition than absolute PPP, requiring only that deviations from PPP not worsen.

Measures of relative PPP in relation to the U.S. dollar for selected countries are presented in Figure 4, which shows a measure of the difference between the Big Mac inflation differential ($\%\Delta P^{*} - \%\Delta P^{\$}$) and the change in the exchange rate ($\%\Delta e$). We would not necessarily think that relative PPP would hold on a year-to-year basis, but it is more likely to be observable in terms of an average relationship over many years. Consequently, relative PPP is suggested by the measures shown in Figure 4 whenever the spread between the inflation differential and the exchange rate change tends to center on zero, rather than to exhibit persistent deviations away from zero. For several countries, this appears to be the case. For example, the currencies of Australia, Britain, Canada, and Hong Kong all appear to have approximately maintained relative PPP against the dollar since 1991—despite the fact that absolute PPP clearly has not held for these currencies (see Figure 2). On the other hand, the Japanese yen and Danish krone have shown less evidence of maintaining relative PPP against the dollar.

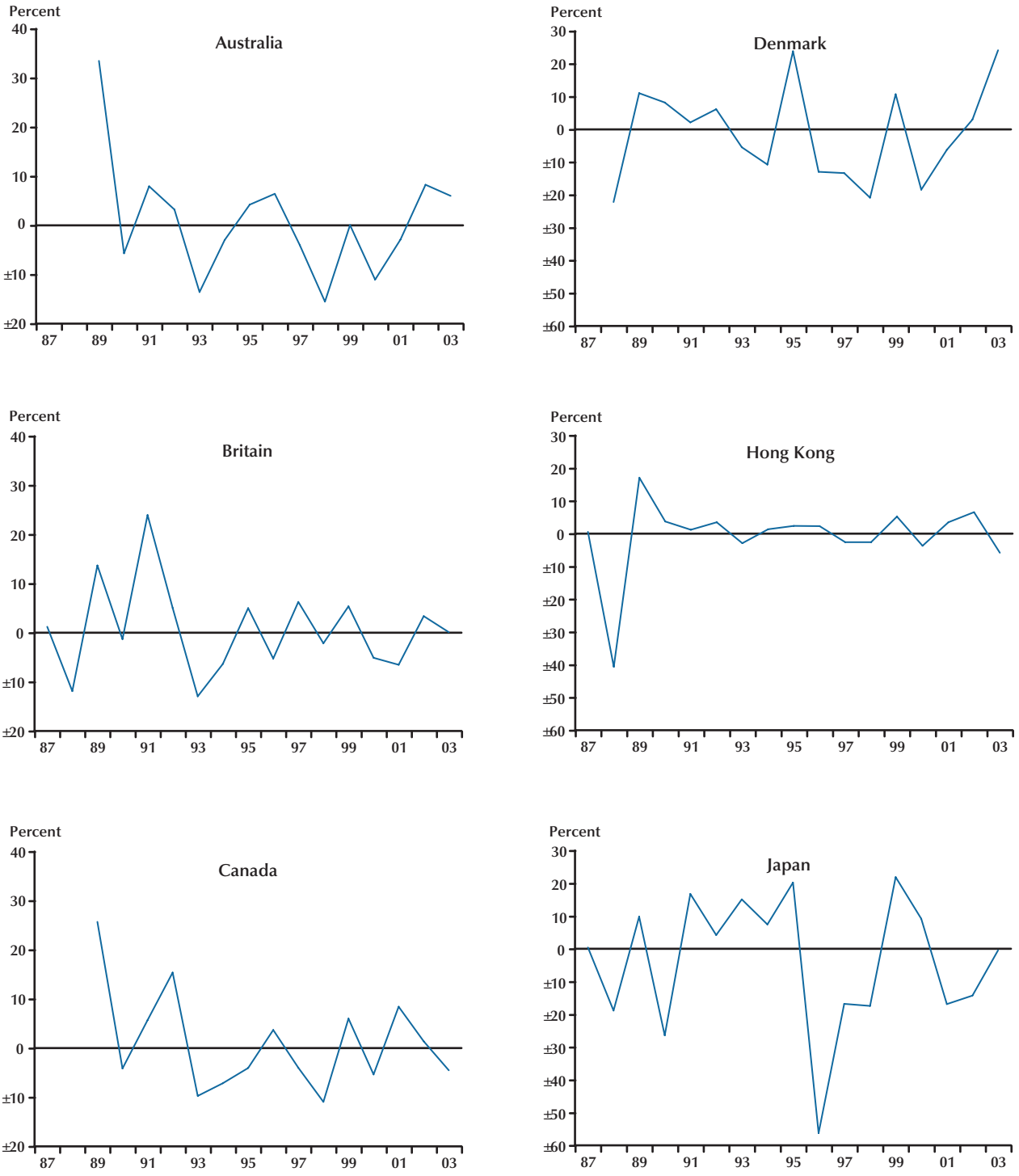
As a long-run test, relative PPP is somewhat difficult to evaluate for the Big Mac because data are limited for many countries and there are only a few years of observations. The data suggest, however, that PPP does not generally hold in the short run, for either the absolute or the relative versions of the theory. Furthermore, for many currencies, deviations from PPP against the U.S. dollar appear to be sustained over a period of several years. The next section provides some explanations for these deviations from PPP.

WHY DOES PPP FAIL?

In 2002 it cost $2.49 to buy a Big Mac in the United States, $3.80 in Switzerland, and $1.27 in

Figure 4

Relative PPP
(Inflation Differential Less Exchange Rate Change)



China. Thus a Big Mac devotee could buy one and a half of the sandwiches in the United States for every one he could purchase in Switzerland. He could buy only one-half a Big Mac in the United States for every one he could enjoy in China.

One wouldn't expect Swiss and U.S. consumers to import Big Macs from China to take advantage of the lower prices—a Big Mac sandwich shipped halfway across the globe would probably not arrive in a very appetizing form. Nevertheless, because the components of a Big Mac are traded on world markets, the law of one price suggests that prices of the components should be the same in all markets.

If the Big Mac is no more than the sum of its ingredients, then trade should equalize the price of a Big Mac across borders; or, at the least, differences between prices should narrow over time. Instead, the dollar price of a Big Mac in the three countries diverged by even more in 2003 than in 2002. In 2003 it cost $1.20 to buy a Big Mac in China, $2.71 to buy a Big Mac in the United States, and $4.60 to buy a Big Mac in Switzerland.

How do we explain these deviations from PPP? Once again, the Big Mac can serve as a useful example of why there tend to be systematic departures from PPP. We consider three main explanations: the existence of barriers to trade, the inclusion of non-traded elements in the cost of a Big Mac, and pricing to market.

Barriers to Trade

One simple reason why PPP, at least in the absolute sense, fails to hold is that it is costly to move goods across borders. Transportation costs, government-imposed trade barriers, and taxes all limit the extent to which differences in prices across countries will result in the international movement of goods.

Transportation Costs. Although the cost of shipping the sesame seeds needed for the Big Mac buns may be minimal, shipping perishable ingredients such as beef, cheese, and lettuce is more costly. Transportation costs, therefore, may drive a wedge between the prices of the same good in different markets.

In 2002, a Big Mac cost $2.38 in the euro area, 11 cents less than the price in the United States. Although this price difference appears to violate PPP, shipments of Big Macs (or, more appropriately, the ingredients of a Big Mac) from the euro area to the United States would not necessarily occur. Only if the cost of shipping a Big Mac was less than 11 cents (or 5 percent) would trade occur. As a result, we might expect absolute PPP to hold only approximately, with prices diverging within a range determined by the transport costs.[10] Hummels (2001) estimates that transportation costs add 7 percent to the price of U.S. imports of meat, 6 percent to the import price of dairy products, and 16 percent to the import price of vegetables.

Trade Restrictions. A more important factor than the presence of natural barriers to trade is the existence of tariffs and other legal restrictions on trade. Nearly every country restricts the importation of agricultural goods through the use of tariffs and/or quotas in order to protect its domestic farm sector. Tariffs, which represent a tax on imported goods, and quotas, which limit the amount of a good that can be imported, both raise the price of imports.

In one of the early works on PPP, Cassel (1921) noted the effects of trade restrictions, stating, "If trade between two countries is more hampered in one direction than in the other, the value of the money of the country whose export is relatively more restricted will fall, in the other country, beneath the purchasing power parity."[11] Cassel emphasized the effect of export restrictions on PPP because these restrictions were used extensively during World War I. He noted, however, that import restrictions have the opposite effect. Thus, given two countries, the one with the greater restrictions on imports will see its currency overvalued on a PPP basis. If there were no other factors causing deviations from PPP, the Big Mac data would tell us which countries had high agricultural barriers to trade relative to the United States. That is, countries with high barriers to trade relative to the United States would have overvalued currencies relative to the dollar, whereas those with lower trade barriers than the United States would have undervalued currencies.

Both Japan and Korea maintained high barriers to the importation of beef for many years in the Big Mac survey period. Until 1991 Japan imposed both quotas and tariffs on imports of beef. In 1991 the quota was replaced with a tariff (a process known as tariffication). The tariff was gradually reduced from 70 percent in 1991 to 38.5 percent in 2000.[12]

[10] Parsley and Wei (2001) and Wei and Parsley (1995) find that transportation costs are an important factor in explaining deviations from PPP in the member countries of the Organization for Economic Cooperation and Development.

[11] Cassel (1921, p. 39).

[12] See Dyck (1998).

From 1989 through 1994 Korea imposed a 30 percent tariff on beef imports in addition to imposing quantitative restrictions. In 1995 Korea began replacing its beef quota with a tariff. In 2001 the import quota was eliminated and the tariff rate was set at 41.2 percent. The tariff will decline to 40 percent by 2004. These trade barriers place a significant wedge between the price of beef in world markets and the domestic price of beef in Japan and Korea. These high barriers to trade may partly explain why the Japanese yen and the Korean won were overvalued against the dollar until the late 1990s.

The United States is not without its own restrictions on beef imports. The U.S. limits the amount of beef that can be imported duty-free from all countries except Canada and Mexico. Imports beyond the quota limit face a 26.4 percent tariff rate. In April 2002, McDonald's began buying some imported beef from Australia and New Zealand for its U.S. operations. The quota, however, limits the extent to which McDonald's can use imported beef to offset hamburger price pressures.[13] In addition, the higher barriers to trade in beef in the United States may partly explain why the U.S. dollar has been consistently overvalued relative to the Australian and New Zealand dollars.

Taxes. An additional factor that may help explain the deviations from PPP is tax differences across countries. The Big Mac prices reported by *The Economist* are inclusive of sales or value added taxes. Thus, holding all other factors constant, countries with higher taxes on a Big Mac relative to the United States would appear to have overvalued currencies relative to the dollar. Changes in tax rates can also give rise to apparent shifts in Big Mac parities. For example, in 1991 Canada imposed the Goods and Services Tax, a national 7 percent sales tax. Between 1990 and 1991, the price of a Big Mac rose from C$2.19 to C$2.35. As a result, the Canadian dollar moved from being undervalued by 14 percent against the U.S. dollar to being undervalued by only 9 percent. It would be misleading, however, to say that the United States and Canada were brought closer to PPP by the imposition of this new tax.

[13] Australia and New Zealand may export 378,214 and 213,402 metric tons of beef, respectively, to the U.S. duty free (United States International Trade Commission, 2003, Chap. 2). According to *AgJournal* (2002) Australia reached this limit in 2001 (the year prior to McDonald's decision to purchase imported beef) and New Zealand met 97 percent of its quota.

Non-Traded Goods

According to the theory of PPP, if there are no barriers to trade, then the dollar price of a good should be the same in the United States, Hungary, and Japan. The price of a Big Mac in any country, however, reflects more than the price of its ingredients. To sell its products, McDonald's has to buy or lease space for a restaurant and purchase utilities to heat, cool, and light the restaurant, as well as to run everything from the grills to the cash registers. Real estate and utilities are examples of what economists call non-traded goods. Though the title to a piece of property, for example, can be traded, the location of the property cannot be traded. Thus, although it may be cheaper to rent space for a restaurant in Beijing than in San Francisco, it is useless to do so if one wants to serve lunch to customers in San Francisco. To the extent that rent and utilities determine the cost of a Big Mac, deviations from PPP may simply reflect these cost differences across countries.

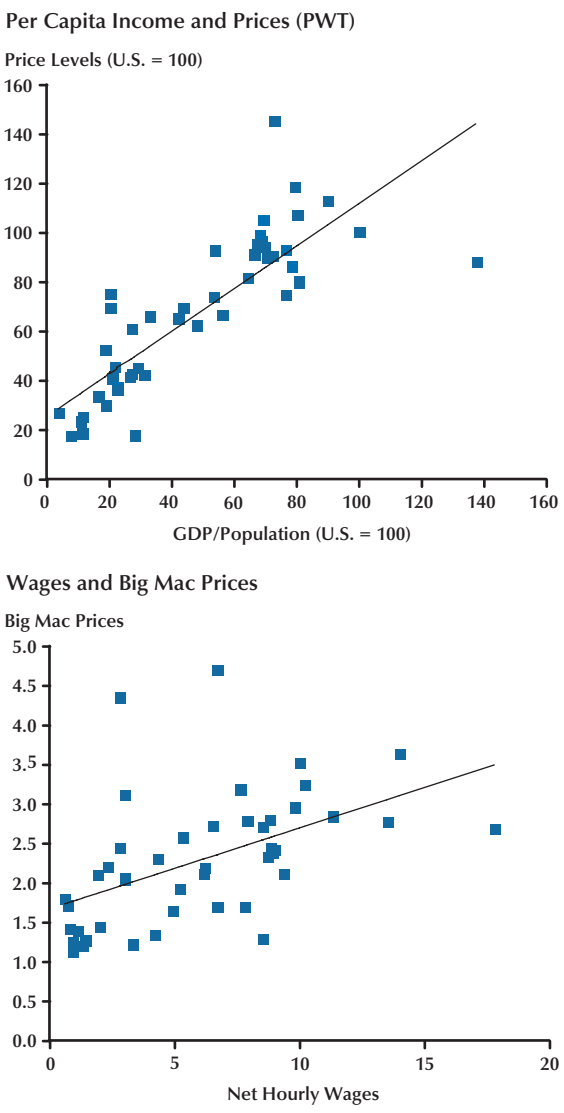
The price of a Big Mac also reflects a service component—that is, the cost of preparing the Big Mac and serving the customer. These aspects require the use of workers, who in economic terminology are also non-traded goods. McDonald's workers, like all workers, are restricted in their ability to move across borders to take advantage of wage differentials. Ong (1997) estimates that non-traded goods (wages, rent, etc.) account for 94 percent of the price of a Big Mac.

Productivity. Balassa (1964) and Samuelson (1964) formalized the idea that non-traded goods systematically affect the deviation from PPP because of differences in productivity across countries and sectors. They argued that because non-tradables are included in price indices (such as the Big Mac index), high-income countries will have overvalued currencies relative to low-income countries.[14] The Balassa-Samuelson argument is based on the idea, supported empirically, that per capita income levels broadly reflect differences in labor productivity. Thus high-income countries have more productive labor forces than low-income countries. Furthermore, the differences in productivity are greatest in the traded goods sector. The higher productivity in the traded goods sector in high-income countries

[14] Some studies such as Engel (1999) find that convergence to PPP does not occur even if one looks at only traded goods. Obstfeld and Rogoff (2000) argue that this is because even traded goods have a large non-traded component.

Figure 5

Income and Prices



is reflected in higher wages in all sectors, as firms in both the non-traded and traded goods sectors compete for workers. The higher wages paid to service sector workers in high-income countries relative to low-income countries results in higher prices for services in the former. The higher prices for services translate into higher price levels in high-income countries, even if prices for traded goods are identical across countries. Thus the currencies of these countries will appear overvalued relative to the currencies of low-income countries.

Turning to Big Macs, it is unlikely that there are large differences in the productivity of workers cooking burgers regardless of the country of location of the McDonald's.[15] There are, however, large differences in the wages earned by these workers. For example, according to a study by Ashenfelter and Jurajda (2001), a typical McDonald's crew worker in the United States earned $6.50 per hour in 2000 while his or her counterpart in China earned $0.42 per hour and a similar McDonald's worker in Poland earned $1.15 per hour. This difference in wage costs may partly explain why the yuan and the zloty have been consistently undervalued against the dollar as measured by Big Mac prices.

In fact, according to the Balassa-Samuelson theory, holding all other things constant, the dollar should be overvalued against the currencies of low-income countries. Table 2 divides the Big Mac survey countries into groups based on the International Monetary Fund's development classification. The currencies of the developing countries, with the exception of the Latin American countries, follow the prediction of the Balassa-Samuelson theory. These currencies have been constantly undervalued against the U.S. dollar. The behavior of the Latin American currencies, however, has been mixed. The currencies of the countries in transition (the former Communist countries) have generally been undervalued relative to the U.S. dollar, as expected.

The Balassa-Samuelson theory is less useful in explaining differences across countries with more similar per capita incomes. As shown in the bottom half of Table 2, the U.S. dollar has been consistently overvalued against the currencies of five other advanced economies—Canada, Hong Kong, Singapore, Australia, and New Zealand.[16] The U.S. dollar has been almost always undervalued against the currencies of Britain, Denmark, Sweden, and Switzerland.

More generally, we would expect to see a positive relationship between price levels and per capita income when comparing countries. Figure 5 plots two measures of this relationship. The upper panel uses the data from the PWT data for 2000 to compare PPP price levels with per capita gross domestic product—both relative to the United States.[17] The

[15] This requires that the training, the technology used to produce Big Macs, and the working conditions are similar across countries.

[16] Curiously, the currency unit for all of these countries is a "dollar."

[17] The upward sloping line in the graph is the fitted line from the following regression: $p = 20.9 + 0.90 \times pcgdp$, where p is the relative PPP price level and $pcgdp$ is the relative per capita gross domestic product. The t-statistic for $pcdgp$ is 11.64.

Table 2

Currency Valuation

		Local currency relative to the U.S. dollar		
	Data period	Undervalued	Overvalued	Parity
Developing countries				
Asia				
China	92-03	92-03		
Indonesia	95, 98-03	95, 98-03		
Malaysia	93-03	93-03		
Philippines	98-03	98-03		
Thailand	93-03	93-03		
Latin America				
Argentina	92-03	98, 01-03	92-97, 99	00
Brazil	92-03	92, 94, 99-03	93, 95-98	
Chile	94-03	96, 00-03	95, 97-99	94
Colombia	99-03	99-01, 03	02	
Mexico	93-03	95-03	94	93
Peru	98, 01-03	98, 01, 03		02
Venezuela	92, 98-99, 02-03	03	92, 98-99, 02	
Other				
Saudi Arabia	98-03	98-03		
South Africa	96-03	96-03		
Turkey	99-03	99-01, 03	02	
Countries in transition				
Czech Republic	94-03	94-03		
Hungary	91-03	91-03		
Poland	94-03	94-03		
Russia	90-03	92-03	90-91	
Advanced economies				
Major economies				
Britain	86-03	88	86-87, 89-03	
Canada	86, 88-03	86, 88-91, 93-03	92	
Euro area	99-03	00-02	99, 03	
France	86-01	01	86-00	
Germany	86-01	00-01	86-99	
Italy	87-01	98, 00-01	87-97, 99	
Japan	86-03	97-98, 01-03	86-96, 00	99
Newly industrialized Asian economies				
Hong Kong	86-03	86-03		
Singapore	86-92, 94-03	86-91, 94-03	92	
South Korea	89-03	98, 01-02	89-97, 99-00	03
Taiwan	94-03	98-03	94-97	
Other advanced economies				
Australia	86, 88-03	86, 88-03		
Austria	94-98		94-98	
Belgium	86-98		86-98	
Denmark	87-03		87-03	
Ireland	86-93	88-90	87, 92	86, 91, 93
Israel	95-02		95-01	02
Netherlands	86-99		86-99	
New Zealand	95-03	95-03		
Spain	86, 88-01	98, 00-01	86, 88-97	99
Sweden	86, 88-03	01	86, 88-00, 02-03	
Switzerland	93-03		93-03	

THE BIG MAC AND THE EURO AREA

On January 1, 1999, 11 of the 15 members of the European Union adopted a common monetary policy, conducted by the European Central Bank, and a common currency, the euro. The figure examines the deviations from PPP relative to the German mark for three of the euro area countries and the three European Union countries that remain outside the euro area.[1]

As the upper panel of the figure indicates, deviations from PPP for the three prospective euro area members (France, Italy, and Spain) had declined substantially by 1997. Although there was some convergence with respect to the three nonmember countries (Britain, Denmark, and Sweden, as shown in the bottom panel), it is less obvious, particularly for Denmark.

The adoption of a common monetary policy had little noticeable effect on reducing deviations from PPP for the euro area members. There is scant evidence of further convergence for the euro area members after the starting date. One possible explanation is that monetary policies had converged in the years prior to the formation of the European Central Bank.

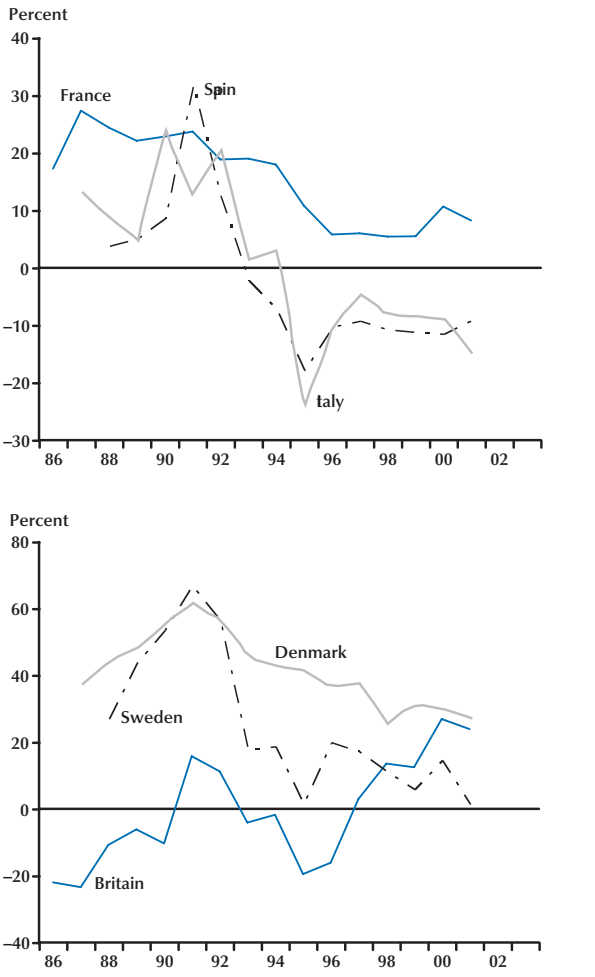
Although the euro was created in 1999, it did not exist as a physical currency until January 1, 2002. After this point, prices for Big Macs throughout the euro area were posted in euros. For European Big Mac aficionados, this should have made it easier to determine the best place to have a Big Mac attack. Unfortunately for the study of burgernomics, it is not possible to determine if the existence of euro pricing has led to convergence, because starting with the 2002 survey *The Economist* no longer reports prices for individual euro area countries.

Euroskeptics in Britain can look to the Big Mac to support their country's continued absence from the euro area. The pound continues to be overvalued by 20 percent or more against the mark (and the euro). Interestingly, the Swedish krona moved close to parity with the mark by 2001; however, in the past two years it too has diverged sharply from parity.

[1] Greece became the twelfth member of the euro area in 2001.

Figure B1

Deviation from PPP - Relative to German Mark



lower panel presents a similar comparison, plotting the relative hamburger prices against relative average net earnings for the same set of countries, using the UBS (2000) data.[18] As we might expect from a bundle of goods that includes both tradable and non-tradable components, the relationship between Big Mac prices and incomes closely parallels the relationship that exists for more inclusive measures of the overall price level. Using a more formal analysis, Click (1996) reaches the same conclusion. Deviations from PPP are driven by the Balassa-

[18] The upward sloping line in the graph is the fitted line from this regression: $pbm = 1.67 + 0.10 \times wage$, where *pbm* is the relative Big Mac price and *wage* is relative wage rate. The t-statistic for *wage* is 3.82.

Samuelson effect. He concludes, "the Big Mac simply costs more where income is higher."

Government Expenditures. Another explanation for why relative prices might deviate from the exchange rate considers differences in government expenditures across countries. Governments typically spend relatively more on non-traded goods than does the private sector (households and businesses). Suppose government spending (as a share of output) in the United States increases relative to government spending in other countries. The price of non-traded goods in the United States will rise as will the overall price level. If PPP held prior to this increase in spending, the dollar now will be overvalued relative to its PPP level. Studies have found that government spending does result in deviations from PPP, at least among the high-income economies.[19]

Current Account Deficits. Another role for non-traded goods in explaining deviations from PPP comes through the current account. Krugman (1990) argued that, as a country runs a current account deficit, its spending on traded goods increases relative to other countries. This results in a decline in the relative price of non-tradable goods in the deficit country. Thus, if PPP had held prior to the current account deficit, the country's currency would now be undervalued.[20]

Pricing to Market

The inclusion of non-traded goods in price indices is often considered the primary explanation for deviations from PPP. This is because, in the absence of barriers to trade, which for most goods are not substantial, the law of one price states that the price of tradable goods will be the same in all countries.[21] Another fundamental requirement for PPP to hold is that markets are perfectly competitive. If imperfect competition exists—so that firms have market power—then even in the absence of barriers to trade, goods prices may not be equal across countries. Some economists have argued that differences in tradable goods prices account for much of the deviation from PPP.

Differences in traded goods prices across countries can occur if firms are able to price to market—that is, charge different prices in different countries.[22] Economic theory states that a firm will maximize profits by varying prices in accordance with the elasticity of demand for a product. The elasticity of demand indicates how the quantity demanded of a product changes when the price changes. If the price of a good increases by 10 percent and the quantity demanded falls by less than 10 percent, the demand for this product is said to be inelastic. If the price increases by 10 percent and the quantity demanded falls by more than 10 percent, the demand for this product is elastic. Sales revenue rises following an increase in the price of a good whose demand is inelastic and falls following an increase in the price of a product whose demand is elastic. A firm would be able to maximize revenue, and hence profits, by pricing to market—charging a higher price for its product in a country where demand is inelastic relative to a country where demand is more elastic.

Firms that price to market in international markets may limit exchange rate pass-through—the extent to which changes in the exchange rate result in changes in import prices. If exchange rate pass-through was complete, the 14 percent rise in the Australian dollar against the U.S. dollar between 2002 and 2003 should have resulted in a 14 percent decline in the price of Australian beef sold in the United States. Incomplete exchange rate pass-through means that the price of imported goods does not rise (fall) by as much as the rise (fall) in the value of the foreign currency. When exchange rate pass-through is incomplete, then a wedge occurs between the prices of a good in the domestic and foreign markets, expressed in a common currency.[23] In countries where demand is relatively elastic, a firm may limit pass-through to maintain market share when the local currency depreciates and to increase its profit margin when the local currency appreciates.

The ability of a firm to price to market depends on the ease with which goods can be resold across countries. For example, because of differences in safety and pollution standards, as well as warranty restrictions, it is difficult for individuals to resell automobiles across borders. For other products, a

[19] Froot and Rogoff (1995) give a summary of this literature.

[20] There is, however, no consensus among economists on the role of the current account in explaining deviations from PPP. See Rogoff (1996) for more details.

[21] Obstfeld and Rogoff (2000), however, argue that trade costs are the key determinant of deviations from PPP.

[22] See, for example, Dornbusch (1987) and Krugman (1987).

[23] Feenstra and Kendall (1997) find that incomplete pass-through is a significant source of deviations from PPP in the floating exchange rate period.

firm may allow only authorized wholesalers to distribute its product in a country to prevent the importation of its product from a country with lower prices.

Clearly the Big Mac cannot be easily resold across borders. However, all of its components are easily resold. Thus, it would be fairly easy for someone to purchase the ingredients necessary to create a Big Mac (despite the secret recipe for the special sauce) and sell a competing sandwich. Although in some markets, most notably the United States, the Big Mac has close substitutes, in many countries the Big Mac has few substitutes. Perhaps this is because a Big Mac is more than the sum of its ingredients. People choose to frequent McDonald's for more than the burgers, and these factors may be reflected in price differences across borders.

Indeed, the typical American view of McDonald's as a place to get a fast, cheap meal does not hold throughout the world. In much of East Asia "'fast' refers to the delivery of food, not its consumption" (Watson, 2000, p. 130). According to Bak (1997), young Koreans view McDonald's as a place to socialize, without the high price of a typical café. Likewise, in many developing countries the Big Mac is not an inexpensive meal option. The $1.38 price of a Big Mac in Bangkok in 2003 may have looked like a bargain to an American accustomed to paying twice that much at home for the sandwich. For a typical Thai consumer, however, the Big Mac cost over three-quarters of his or her hourly wage. Table 3 shows, in a sample of countries, how long a worker must work to purchase a Big Mac. Using this criterion the cheapest Big Macs in 2003 were in Japan, where it took a worker only 10 minutes to afford a Big Mac. A worker in the Philippines could afford less than a bite after that amount of time working. It took nearly 2 hours for a worker in the Philippines to purchase a Big Mac.

How then can McDonald's flourish in low-income countries? Perhaps it is because

> …wherever McDonald's takes root, the core product—at least during the initial phase of operation—is not really the food but the experience of eating in a cheerful, air-conditioned, child-friendly restaurant that offers the revolutionary innovation of clean toilets.[24] (Watson, 2000, p. 122)

Yan (1997) argues that McDonald's in China attracts young urban professionals who see eating there as a way to connect with the outside world. For those who visit Beijing from the Chinese countryside, McDonald's is viewed as a tourist stop. Watson (2000) notes that these rural visitors bring their Big Mac boxes home as souvenirs. These factors may be reflected in the price differences of a Big Mac around the world.

CONCLUSION

Although the theory of PPP serves as a useful benchmark for thinking about long-term equilibrium in foreign exchange markets, it generally does poorly as a predictive tool. A great deal of research effort has been put into tests of PPP and in constructing price measures for consistent bundles of commodities across countries. It is interesting to find that the simple collection of items comprising the Big Mac sandwich does just as well (or just as poorly) at demonstrating the principles and pitfalls of PPP as do more sophisticated measures.

This is perhaps not surprising when we consider that the Big Mac is a composite of tradable commodities and non-tradable service content. Its ingredients are subject to various tariffs and nontariff trade barriers in countries around the world. Finally, though it may have close rivals in some markets, the Big Mac itself is produced by only one company; hence we might expect to find elements of imperfect competition. That many of its basic ingredients are tradable goods would lead us to believe that Big Mac prices around the world should be driven to equality by arbitrage. Its other characteristics make the Big Mac a good example of why the theory of PPP generally fails to hold except under special circumstances.

Even within the United States the price of a Big Mac varies across cities. The U.S. price of a Big Mac in *The Economist* survey is based on the average price in Atlanta, Chicago, New York, and San Francisco. Although *The Economist* does not publish data on individual U.S. cities, an example of the range of U.S. prices can be gleaned from the most recent UBS survey of prices and earnings. The survey covers four U.S. cities: Chicago, Miami, Los Angeles, and New York. The price of a Big Mac in 2003 ranged from $2.03 in Miami to $3.04 in New York. Although

[24] Although friendly service may be the expectation in the United States, it is not so universally. Watson (1997) notes that in some cultures consumers are suspicious of clerks who smile on the job. When McDonald's opened in Moscow in 1990, customers waiting outside were told, "The employees inside will smile at you. This does not mean that they are laughing at you. We smile because we are happy to serve you" (Watson, 1997).

Table 3

Working for a Big Mac

	Big Mac price U.S. $	Net hourly wage U.S. $	Minutes of work to buy a Big Mac
Argentina	1.42	1.70	50
Australia	1.86	7.80	14
Brazil	1.48	2.05	43
Britain	3.14	12.30	15
Canada	2.21	9.35	14
Chile	1.96	2.80	42
China	1.20	2.40	30
Colombia	2.13	1.90	67
Czech Republic	1.96	2.40	49
Denmark	4.09	14.40	17
Euro area	2.98	9.59	19
Hong Kong	1.47	7.00	13
Hungary	2.19	3.00	44
Indonesia	1.84	1.50	74
Japan	2.18	13.60	10
Malaysia	1.33	3.10	26
Mexico	2.18	2.00	65
New Zealand	2.22	6.80	20
Peru	2.28	2.20	62
Philippines	2.24	1.20	112
Poland	1.62	2.20	44
Russia	1.32	2.60	30
Singapore	1.85	5.40	21
South Africa	1.85	3.90	28
South Korea	2.70	5.90	27
Sweden	3.60	10.90	20
Switzerland	4.60	17.80	16
Taiwan	2.01	6.90	17
Thailand	1.38	1.70	49
Turkey	2.34	3.20	44
United States	2.71	14.30	11
Venezuela	2.32	2.10	66

NOTE: Wages are based on a weighted average of 12 professions.

Wage data for Brazil, Canada, Germany, Italy, and Spain are based on averages of wages in two cities in each country. Wage data for Switzerland and the United States are averages of wages in four cities. Wage data for the euro area is an average of wages in 15 cities in the region.

SOURCE: Big Mac prices, *The Economist* (April 26, 2003); net wages, UBS (2003).

CURRENCY CRISES AND THE BIG MAC

Over the past ten years, currency crises have struck various countries in the Big Mac database whose currencies were pegged to the U.S. dollar. These crises have spawned a host of studies to determine their causes. Some economists have argued that an overvalued currency is a good predictor of a currency crisis. Although there are more sophisticated ways to determine whether a currency is overvalued, PPP is often used as a guide.[1]

We use the Big Mac survey to examine the predictability of five recent currency crises—the Mexican crisis (1994), the Asian crisis (1997), the Russian crisis (1998), the Brazilian crisis (1999), and the Argentine crisis (2002).[2] The table on the next page shows the exchange rate, Big Mac prices, and the PPP measure for each currency relative to the dollar prior to the crisis and in the first survey after the crisis. Based on these data, the Big Mac appears to be a poor predictor of a currency crisis.

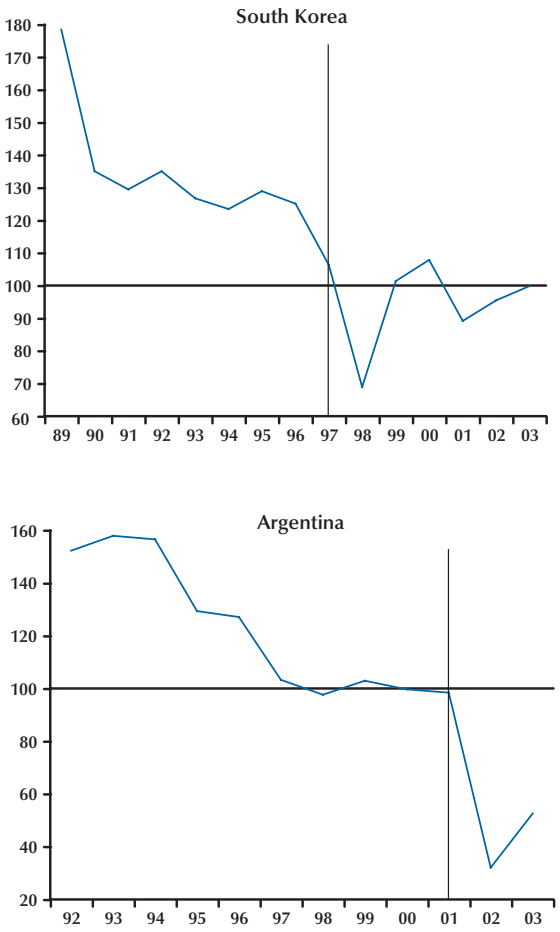
In only four countries was the local currency above parity. In none of these cases was there evidence of a strongly overvalued currency; the overvaluation ranged from 2 to 6 percent. In Korea's case, as shown in the top panel of the figure, the won had been substantially overvalued in the early 1990s, but was moving close to parity prior to the crisis. In contrast, in four other countries the local currency was substantially below parity, with the undervaluation ranging from 14 to 36 percent.[3] In the remaining case, Argentina, the currency was only 2 percent below parity.

Argentina is a particularly interesting case study. In mid-1991 Argentina adopted a fixed exchange rate, setting the value of the peso at one U.S. dollar. Initially, the peso was highly overvalued against the dollar, as shown in the figure, as the price of a Big Mac was much higher than in the United States. By 1997, however, Big Mac prices in the two countries had converged. The peso remained close to parity with the dollar through the 2001 survey.[4] In January 2002 the exchange

Continued on p. 25

Figure B2

PPP and Currency Crises



NOTE: The vertical line indicates the survey prior to the currency crisis.

[1] See Chinn (2000) for a discussion of these methods.

[2] Indonesia and the Philippines are excluded from our analysis of the Asian crisis because these countries were not in the Big Mac survey in 1997.

[3] Conversely, Chinn (1999) argues that the Thai baht and Malaysian ringgit were overvalued based on PPP estimates, while the Korean won and Taiwan dollar were undervalued.

[4] Perry and Servén (2003) argue that the Argentine peso was overvalued by 40 percent prior to the crisis.

Continued from p. 24
rate peg was broken and the peso fell sharply against the dollar. Between the 2001 and 2002 Big Mac surveys, the dollar had risen by over 100 percent against the peso. Despite the change in the exchange rate, the peso price of a Big Mac in Argentina remained unchanged. As a result, on a PPP basis the peso was undervalued by 68 percent against the dollar. By the 2003 survey, the peso price rose sharply, to 4.10 pesos, moderating the extent of the undervaluation.

The slow adjustment of goods prices despite large movements in the exchange rate is typical. As the table shows, in three of the nine countries, Big Mac prices were unchanged in the surveys immediately following the currency crisis. Only in the survey following the Russian crisis was the change in the local price of a Big Mac of similar magnitude to the change in the exchange rate. Across all nine countries the average rise in the foreign exchange value of the dollar was 58 percent, while the average rise in the local currency price of a Big Mac was 27 percent.

Currency Crises and the Big Mac

	Survey prior to crisis				Survey after crisis			
Country	Exchange rate	U.S. price Big Mac	Local price Big Mac	PPP	Exchange rate	U.S. price Big Mac	Local price Big Mac	PPP
Mexico	3.36	2.30	8.1	105	6.37	2.32	10.9	74
Thailand	26.1	2.42	46.7	74	40	2.56	52	51
Malaysia	2.5	2.42	3.87	64	3.72	2.56	4.3	45
Singapore	1.44	2.42	3	86	1.62	2.56	3	72
South Korea	894	2.42	2300	106	1474	2.56	2600	69
Taiwan	27.6	2.42	68	102	33	2.56	68	80
Russia	5.999	2.56	12	78	24.7	2.43	33.5	56
Brazil	1.14	2.56	3.1	106	1.73	2.43	2.95	70
Argentina	1.0	2.54	2.5	98	3.13	2.49	2.5	32

NOTE: The exchange rate is the local-currency price of the U.S. dollar. The U.S. price of a Big Mac is in dollars. The local price of a Big Mac is in local currency.

SOURCE: *The Economist,* various issues.

tariff barriers are nonexistent between Miami and New York, other factors that result in deviations from PPP across borders do exist—transportation costs and differences in sales taxes, prices of nontraded goods (wages, rents, and utilities), and competitive conditions.

Nevertheless, the $1.01 difference in high and low Big Mac prices across these U.S. cities is less than the range of differences for Big Mac prices across countries. A series of recent studies have shown that this observation holds across a range of goods.[25] There is still much to be learned about the role of international borders in driving deviations from PPP.

[25] See, for example, Cecchetti, Mark, and Sonora (2002), Crucini and Shintani (2002), Engel and Rogers (1996 and 2001), and Parsley and Wei (1996).

REFERENCES

Ashenfelter, Orley and Jurajda, Štěpán. "Cross-Country Comparisons of Wage Rates: The Big Mac Index." Unpublished manuscript, Princeton University and CERGE-EI/Charles University, October 2001.

AgJournal. "New Zealand Has Beef with Labels." 17 May 2002; < http://www.agjournal.com/story.cfm?story_id = 1981 > .

Bak, Sangmee. "McDonald's in Seoul: Food Choices, Identity, and Nationalism," in James L. Watson, editor, *Golden Arches East: McDonald's in East Asia*. Stanford: Stanford University Press, 1997.

Balassa, Bela. "The Purchasing-Power Parity Doctrine: A

Reappraisal." *Journal of Political Economy*, December 1964, *72*(6), pp. 584-96.

Cassel, Gustav. *The World's Monetary Problems*. London: Constable and Company, 1921.

Cecchetti, Stephen G.; Mark, Nelson C. and Sonora, Robert J. "Price Index Convergence Among United States Cities." *International Economic Review*, November 2002, *43*(4), pp. 1081-99.

Chinn, Menzie D. "Three Measures of East Asian Currency Overvaluation." *Contemporary Economic Policy*, April 2000, *18*(2), pp. 205-14.

_____. "Measuring Misalignment—Purchasing Power Parity and East Asian Currencies in the 1990s." IMF Working Paper No. 99/120, International Monetary Fund, September 1999.

Click, Reid W. "Contrarian MacParity." *Economics Letters*, November 1996, *53*(2), pp. 209-12.

Crucini, Mario J. and Shintani, Mototsugu. "Persistence in Law-of-One-Price Deviations: Evidence from Micro-Data." Working Paper No. 02-W22, Vanderbilt University, December 2002.

Cumby, Robert E. "Forecasting Exchange Rates and Relative Prices with the Hamburger Standard: Is What You Want What You Get With McParity?" Unpublished manuscript, Georgetown University, May 1997.

Dornbusch, Rudiger. "Exchange Rates and Prices." *American Economic Review*, March 1987, *77*(1), pp. 93-106.

Dyck, John. "U.S.-Japan Agreements on Beef Imports: A Case of Successful Bilateral Negotiations," in Mary E. Burfisher and Elizabeth A. Jones, eds., *Regional Trade Agreements and U.S. Agriculture*. Chap. 9. Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture, Agricultural Economics Report No. 771, November 1998.

Economist, various issues, 1986-2003.

Engel, Charles. "Accounting for U.S. Real Exchange Rate Changes." *Journal of Political Economy*, June 1999, *107*(3), pp. 507-38.

_____ and Rogers, John H. "Violating the Law of One Price: Should We Make a Federal Case Out of It?" *Journal of Money, Credit, and Banking*, February 2001, *33*(1), pp. 1-15.

_____ and _____. "How Wide Is the Border?" *American Economic Review*, December 1996, *86*(5), pp. 1112-25.

Feenstra, Robert C. and Kendall, Jon D. "Pass-through of Exchange Rates and Purchasing Power Parity." *Journal of International Economics*, August 1997, *43*(1/2), pp. 237-61.

Froot, Kenneth A. and Rogoff, Kenneth. "Perspectives on PPP and Long-Run Real Exchange Rates," in Gene Grossman and Kenneth Rogoff, eds., *Handbook of International Economics*. Volume 3. Amsterdam: North Holland Press, 1995.

Heston, Alan; Summers, Robert and Aten, Bettina. *Penn World Table Version 6.1*. Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002.

Hummels, David. "Toward a Geography of Trade Costs." Unpublished manuscript, Purdue University, September 2001.

Krugman, Paul R. "Equilibrium Exchange Rates," in William H. Branson, Jacob A. Frenkel, and Morris Goldstein, eds., *International Policy Coordination and Exchange Rate Fluctuations*. Chicago: University of Chicago Press, 1990, pp. 159-87.

_____. "Pricing to Market when the Exchange Rate Changes," in Sven W. Arndt and J. David Richardson, eds., *Real-Financial Linkages among Open Economies*. Cambridge, MA: MIT Press, 1987, pp. 49-70.

Lan, Yihui. "The Long-Run Value of Currencies: A Big Mac Perspective." Unpublished manuscript, University of Western Australia, September 2001.

Obstfeld, Maurice and Rogoff, Kenneth. "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?" NBER Working Paper 7777, National Bureau of Economic Research, July 2000.

Ong, Li Lian. *The Big Mac Index: Applications of Purchasing Power Parity*. New York: Palgrave MacMilan, 2003.

_____. "Burgernomics: The Economics of the Big Mac Standard." *Journal of International Money and Finance*, December 1997, *16*(6), pp. 865-78.

Pakko, Michael R. and Pollard, Patricia S. "For Here or To Go? Purchasing Power Parity and the Big Mac." Federal Reserve Bank of St. Louis *Review*, January/February 1996, *78*(1), pp. 3-22.

Parsley, David C. and Wei, Shang-Jin. "Convergence to the Law of One Price without Trade Barriers or Currency Fluctuations." *Quarterly Journal of Economics*, November 1996, *111*(4), pp. 1211-36.

_____ and _____. "Explaining the Border Effect: The Role of Exchange Rate Variability, Shipping Costs, and Geography." *Journal of International Economics*, October 2001, *55*(1), pp. 87-105.

_____ and _____. "The Micro-Foundations of Big Mac Real Exchange Rates." Unpublished manuscript, May 2003.

Perry, Guillermo and Servén, Luis. "The Anatomy of a Multiple Crisis: Why Was Argentina Special and What Can We Learn From It?" Policy Research Working Paper 3081, World Bank, June 2003.

Rogoff, Kenneth. "The Purchasing Power Parity Puzzle." *Journal of Economic Literature*, June 1996, *34*(2) pp. 647-68.

Samuelson, Paul A. "Theoretical Notes on Trade Problems." *Review of Economics and Statistics*, May 1964, *46*(2), pp. 145-54.

UBS. *Prices and Earnings Around the Globe*. 2000 and 2003 Editions. Zurich: UBS, 2000, 2003.

United States International Trade Commission. *Harmonized Tariff Schedule of the United States*. Revision 2. 2003.

Watson, James L. "China's Big Mac Attack." *Foreign Affairs*, May/June 2000, *79*(3), pp. 120-34.

_____, ed. *Golden Arches East: McDonald's in East Asia*. Stanford: Stanford University Press, 1997.

Wei, Shang-Jin and Parsley, David C. "Purchasing Power Dis-Parity During the Floating Rate Period: Exchange Rate Volatility, Trade Barriers and Other Culprits." NBER Working Paper 5032, National Bureau of Economic Research, February 1995.

Yan, Yunxiang. "McDonald's in Beijing: The Localization of Americana," in James L. Watson, ed., *Golden Arches East: McDonald's in East Asia*. Stanford: Stanford University Press, 1997.