

Big Mac Index, purchasing power parity and commercial arbitrage

1. The Big Mac Index

In a playful exercise to test the purchasing power parity theory, the weekly magazine *The Economist* has been publishing, since 1986, an analysis of the parity exchange rate based on considering the Big Mac as the basket of goods of the purchasing power parity theory.

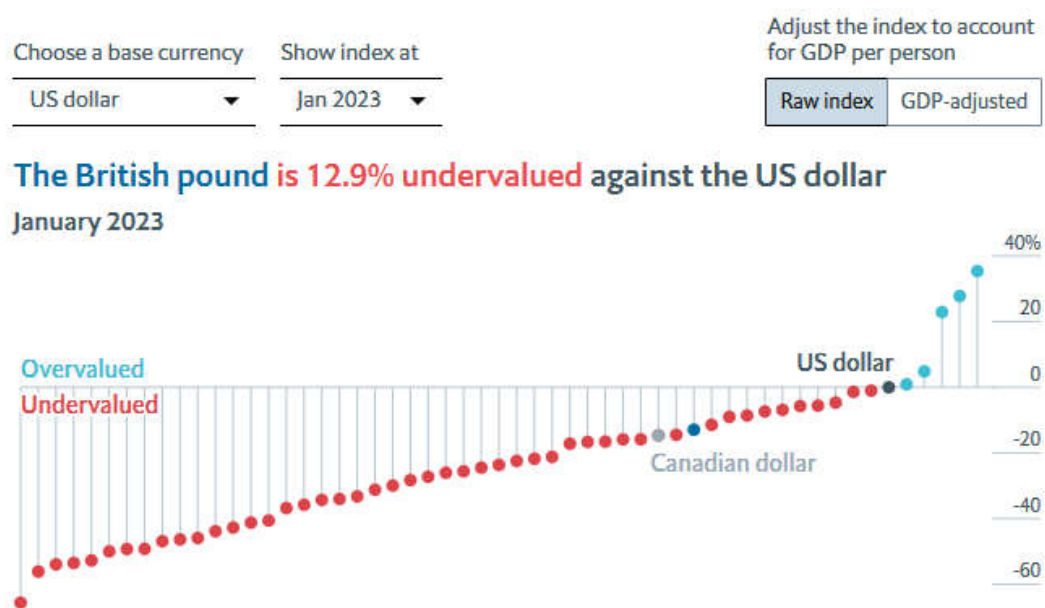
Approximately every semester (January and July of each year) the following is published:

- the price of the Big Mac in the countries where it is sold (in the case of the Eurozone and other large countries, such as the US, an average is calculated);
- the value of the parity rate implied by the prices of the Big Mac;
- the value of the market exchange rate on the day the data is collected;
- the prediction of the evolution of the exchange rate by comparing the two previous values (if the market exchange rate is higher than the parity, then the currency is overvalued, so assuming the eventual fulfilment of the purchasing power parity of Big Macs should lead to a depreciation of the currency).

<https://www.economist.com/big-mac-index>

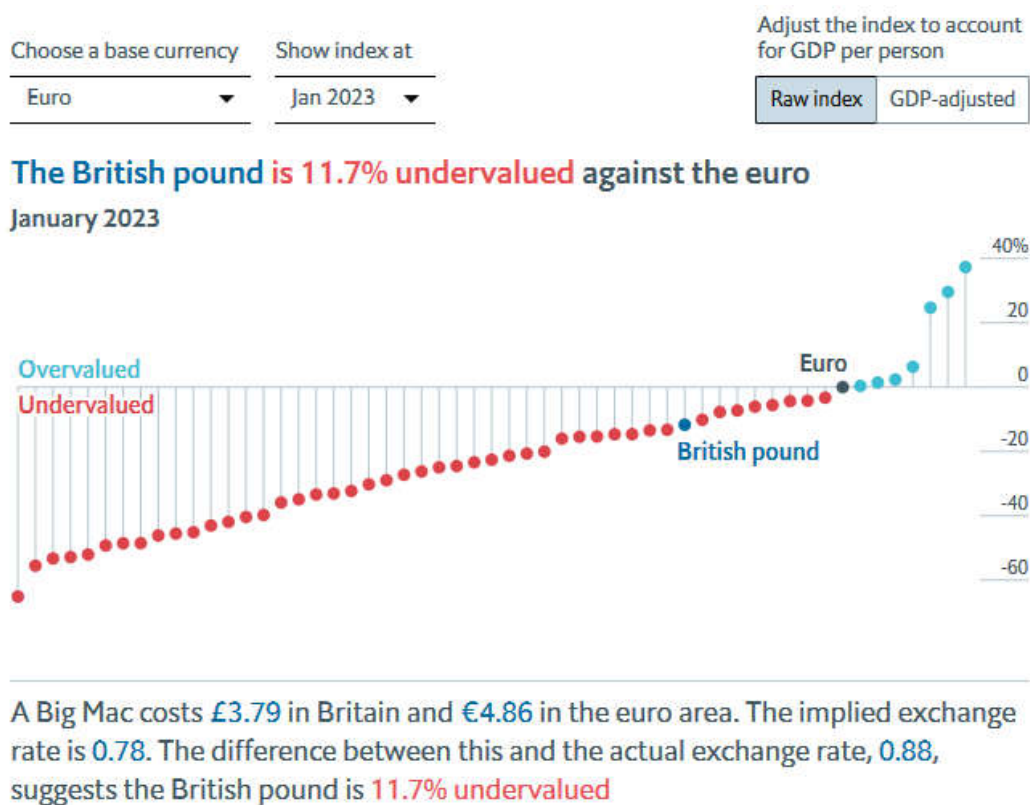
2. The Big Mac Index in January 2023

Find below the January 2023 analysis of the relationship between the British pound and the US dollar. The conclusion is that the pound is undervalued (in terms of the Big Mac standard) against the dollar by about 13%. This means that the same amount of pounds can buy 13% fewer Big Macs in the US than in the UK.



A Big Mac costs £3.79 in Britain and US\$5.36 in the United States. The implied exchange rate is 0.71. The difference between this and the actual exchange rate, 0.81, suggests the British pound is 12.9% undervalued

The January 2023 analysis of the relationship between the British pound and the euro is as follows.



3. Interpretation of the analysis of the pound and the euro

According to the previous chart, the Big Mac price $p_{\text{£}}$ in the UK is £3.79/BM. The Big Mac price $p_{\text{€}}$ in the eurozone is €4.86/BM. The Big Mac purchasing power parity exchange rate is the exchange rate that makes it possible to purchase, with the same amount of pounds or euros, the same number of Big Macs in the UK and in the eurozone.

The formula of the Big Mac parity rate (in £/€ units) is

$$e_{BMP} = \frac{p_{\text{£}}}{p_{\text{€}}}$$

The units of $p_{\text{£}}$ are £/BM. The units of $p_{\text{€}}$ are €/BM. As the BM units are cancellable, the Big Mac parity rate is measured in £/€. Specifically:

$$e_{BMP} = \frac{p_{\text{£}}}{p_{\text{€}}} = \frac{3.79}{4.86} = 0.779 \frac{\text{£}}{\text{€}}$$

In the magazine analysis the number has been rounded to 0.78. This value is compared with the effective (market) exchange rate: 0.88 £/€.

The comparison shows that the euro is overvalued (and the pound undervalued) relative to its Big Mac parity value. According to this parity value, the euro buys the same number of Big Macs in the eurozone and the UK with exchange rate 0.78 pounds per euro. In the currency market, more pounds are obtained per euro: 0.88. As a result, the euro has more power to buy Big Macs

in the UK than in the eurozone (and, symmetrically, the pound has fewer in the eurozone than in the UK).

Specifically, a Big Mac in the UK could be sold to get its price in pounds: 3.79 £. With the market exchange rate 0.88 £/€, these pounds buy $3.79/0.88 = €4.306$. Given the €4.86/BM price in the eurozone, €4.30 only purchases 0.886 Big Macs.

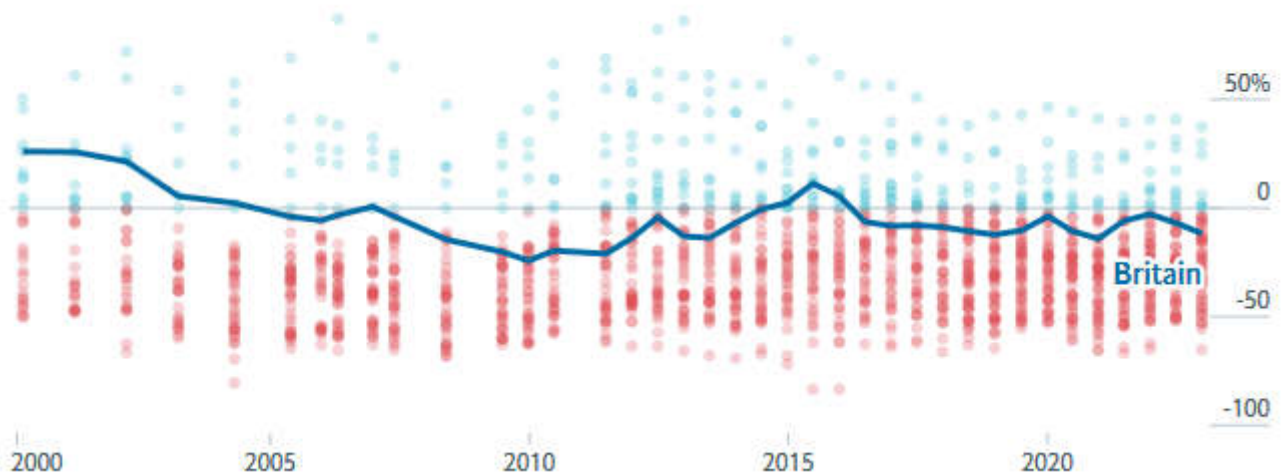
Thus, in the exchange of Big Macs for Big Macs going from the UK to the eurozone, about 12% has been lost. This suggests that the pound is undervalued against the euro by about 12%.

4. Forecasting the evolution of exchange rates

A theory of purchasing power parity for Big Macs would claim that the market exchange rate should tend to its parity value. In the case of the pound and the euro, since the pound was then undervalued (it could buy fewer Big Macs abroad than the euro), the prediction is that it must eventually appreciate against the euro.

The Economist website shows the following evolution of the exchange rate between the pound and the euro between 2000 and 2023. An interesting exercise would be to compare this evolution with that of the effective (market) exchange rate and evaluate the degree of accuracy (or error) of the prediction. The Big Mac Index data history can be obtained for free at <https://github.com/TheEconomist/big-mac-data>.

2000-2023



5. Commercial arbitrage

Under certain conditions (without transport costs, tariffs, transaction costs, etc.) the convergence of the market exchange rate to the parity exchange rate can be justified. One mechanism that generates convergence is commercial arbitrage: buying and selling goods to take advantage of price discrepancies and obtain a secure profit.

Considering again the January 2024 Big Mac data:

$$p_{\text{£}} = 3.79 \text{ £/BM}$$

$$p_{\text{€}} = 4.86 \text{ €/BM}$$

$$e = 0.88 \text{ £/€}.$$

The basis of all arbitrage is to buy low and sell high. To determine where the Big Mac is cheap, the Big Mac price in both economies must be expressed in the same currency.

Using the pound, the price Big Macs in the UK is

$$p_E^{\text{UK}} = 3.79 \text{ £/BM}.$$

In euros, the price in the eurozone is $p_€ = 4.86 \text{ €/BM}$. The exchange rate is needed to express this price in pounds: the price of a Big Mac in the eurozone is $p_€ \cdot e$ (multiplying the price in euros by the pound/euro exchange rate converts euros into pounds). Therefore, the price of Big Macs in pounds in the eurozone is

$$p_E^{\text{EU}} = p_€ \cdot e = 4.86 \frac{\text{€}}{\text{BM}} \cdot 0.88 \frac{\text{£}}{\text{€}} = 4.2768 \frac{\text{£}}{\text{BM}}.$$

The above implies that the Big Mac is cheaper in the UK than in the eurozone:

$$p_E^{\text{UK}} < p_E^{\text{EU}}.$$

This inequality can be expressed equivalently as

$$p_E < p_€ \cdot e.$$

The aim is to verify that commercial arbitrage (Big Mac arbitrage) eliminates the inequality. Specifically, arbitrage will

- raise p_E
- reduce $p_€$
- reduce e

British arbitrageurs (since they already have pounds) will first buy the Big Mac in the UK (where they are cheap). Theoretically, this purchase will tend to rise p_E (due to the increased demand for Big Macs). The Big Macs bought in the UK will be sold in the eurozone (here enters the assumption of zero or negligible transport costs and the like).

The sale of Big Macs in the eurozone increases their supply and puts downward pressure on their price $p_€$. Finally, the British buy pounds in the foreign exchange market and pay with the euros from the sale of Big Macs in the eurozone. This tends to depreciate the euro against the pound and, consequently, tends to reduce e (given that e is quoted in £/€).

As for European arbitrageurs, the first step would be to exchange euros for pounds (which would also cause a decrease in e); the second, to buy Big Macs in the UK with pounds (thus contributing to an increase in p_E); and the third, to sell the Big Macs purchased in the UK to the eurozone (which would put downward pressure on $p_€$).

In short, both British and European arbitrageurs would move prices ($\uparrow p_E, \downarrow p_€$) and the exchange rate ($\downarrow e$) so that equality $p_E = p_€ \cdot e$ would be achieved.

What if there were an overreaction, in the sense that

$$p_{\text{€}} > p_{\text{€}} \cdot e ?$$

In this case, the reverse situation would occur: the Big Mac would become cheaper in the eurozone. The arbitrage strategy would consist of reversing the operations of the first case: now Big Macs would be bought in the eurozone, sold in the UK and pounds exchanged for euros (and the euro would appreciate with respect to the pound).

6. The Big Mac Index in January 2025

The table below shows the data for constructing the Big Mac index in January 2025 (it is left as an exercise to complete it). For example, the dollar is undervalued in relation to the euro at its parity value for the following reason:

- the price of Big Macs in the US was 5.79 \$/BM ;
- with the market exchange rate of 0.95247 €/\$, \$5.79 was exchanged for €5.5148013 ;
- the price of Big Macs in the eurozone was 5.67 €/BM ;
- but €5.5148013 was not enough to buy a Big Mac in the eurozone;
- the 2.73% of euros that are missing would represent the percentage of undervaluation of the dollar against the euro.

| January 2025 | domestic price Big Mac | exchange rate for \$ | parity rate per \$ | \$ |
|----------------|------------------------|----------------------|--------------------------|-------------|
| USA | \$ 5.79 | \$1 | — | — |
| Eurozone | € 5.67 | € 0.95247 | $5.67 / 5.79 = € 0.9792$ | undervalued |
| China | ¥ 25.5 | ¥ 7.24785 | $25.5 / 5.79 = ¥ 4.404$ | overvalued |
| Switzerland | ₣ 7.2 | ₣ 0.90085 | $7.2 / 5.79 = ₣ 1.2435$ | undervalued |
| United Kingdom | £ 4.59 | £ 0.80164 | | |
| Argentina | ₱ 7300 | ₱ 1050 | | |
| Japan | ¥ 480 | ¥ 154.355 | | |

Equivalently, from the dollar's perspective, the Big Mac parity exchange rate between dollar and euro would be the quotient of the Big Mac prices:

$$e_{BMP \text{ €}/\$} = \frac{p_{\text{€}}}{p_{\$}} = \frac{5.67 \text{ €}}{5.79 \$} = 0.9792 \frac{\text{€}}{\$}$$

Thus, according to the Big Mac parity value, one dollar should be able to buy €0.9792; however, according to the market exchange rate, it can only buy €0.95247.

The final conclusion is that the dollar is undervalued in relation to the euro and, symmetrically, the euro is overvalued in relation to the dollar (the parity rate dictates that it would be necessary to pay 0.9792 euros to obtain one dollar; yet, in the market, it is only necessary to pay 0.95247).

Even for a free trial, *The Economist* Big Mac index website

<https://www.economist.com/interactive/big-mac-index>

now requires to create a free account. In you are interested in the 16 July 2025 update, see <https://www.datapandas.org/ranking/big-mac-index-by-country>. The excerpt below, published on the 17 July 2025, summarizes the main findings of the update.

“The principle of the Big Mac Index is simple. The Economist calculates the price of a Big Mac—a standardized item made of the same ingredients—in countries around the world. Base 100 represents the United States, where a Big Mac costs USD 6.01. By converting the price of a Big Mac in other countries, *The Economist* can assess how undervalued or overvalued various currencies are compared to the dollar.

The Economist explains that the Big Mac index (...) is based on the theory of purchasing-power parity (PPP), the notion that in the long run exchange rates should move towards the rate that would equalise the prices of an identical basket of goods and services in any two countries.

To no one’s surprise, the most overvalued currency based on the Big Mac Index 2025 is Switzerland’s. At CHF 7.20 (approximately USD 9.00 at the exchange rate on July 17), *The Economist* indicates that the Swiss franc is 49.6% overvalued against the US dollar (...)

Of the seven countries with overvalued currencies according to the Big Mac Index, six are in Europe. Besides Switzerland, Norway’s currency is overvalued by 22.1%. It is followed by Sweden (21.8%), Denmark (16.6%), the Euro zone (15.2%), and the UK (13.5%). The only overvalued currency outside of Europe is in Latin America: in Uruguay, a Big Mac costs 315 pesos, making its currency 29.6% overvalued against the US dollar.

All Asian, Latin American, and Middle Eastern currencies fare poorly compared to the US dollar in the Big Mac Index. While the price of a Big Mac is nearly equal to that in the US in Costa Rica and Israel, currency undervaluation can reach extreme levels—down to 57% in Indonesia and 57.9% in Egypt. These two countries have actually the most undervalued currencies according to the index.

Another notable drop in currency exchange rate happens in Japan. The weakening yen means the currency is now down 46.3% against the US dollar. Meanwhile, the currencies of Canada and Mexico—the US’s largest trading partners—remain undervalued by around 10%.”

<https://www.travelmole.com/news/big-mac-index-dollar-valuation-world/>