

Investigating the Determinants of the Big Mac Index: A Panel Data Analysis

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Abstract

Several academics have noted that the Law of One Price (LOOP) and Purchasing Power Parity (PPP) do not apply to most products in the short and long term. Apart from any specific additional expenditures that could lead to various outcomes, it's critical to explore what's underlying it. Our goal is to see if there are any common characteristics that have a substantial impact on valuation. The Big Mac Index, which was created by The Economist in 1986 and is the oldest informal indicator of PPP, will be produced to demonstrate absolute and relative parity valuation of currencies around the world. The primary determinants of the Big Mac index are explored using cross-country panel data analysis on a sample of 19 nations from 2000 to 2016. The analysis revealed that current account factors can explain departures from parity, but other independent variables reflecting primary determinants of the Big Mac index were not significant. Furthermore, the findings of the analysis show that relative PPP does not hold over time.

Keywords: Big-Mac Index; Evaluation; Panel Data

1 Introduction

The Law of One Price is an economic theory that states that the price of identical goods in different markets must be the same after taking the currency exchange into consideration (i.e. if the prices are expressed in the same currency). However, in practice, the law of one price does not always hold true. For example, if the trade of goods involves transaction costs or trade barriers, the law will not work. Purchasing power parity (also referred to as PPP) is an economic theory that compares different countries' currencies through a "basket of goods" approach. According to this concept, two currencies are in equilibrium - known as the currencies being at par - when a basket of goods is priced the same in both countries, taking into account the exchange rates. The Economist magazine's famous Big Mac Index uses the price of McDonald's Big Macs around the world, expressed in a common currency (U.S. dollars), to estimate the extent to which various currencies are over-or under-valued. The Big Mac is a global product, identical across borders, which makes it an interesting one for this purpose.

Noted by several researchers, the Law of One Price (LOOP) and Purchasing Power Parity (PPP) do not stand for most of the products in the short and long run. It is important to investigate what stands behind it, besides some specific additional costs that could lead to different results. Our goal is to check whether there are any general determinants that significantly affect the valuation. Big Mac Index was then calculated to show the absolute parity valuation of currencies around the world. By using a cross-country panel data analysis on the sample of 20 countries in the period from 2000 to 2016, the main determinants of Big Mac are investigated.

2 Research Overview of Big Mac index determinants

Pakko and Pollard explained deviations from PPP considering three main explanations: the existence of barriers to trade, the inclusion of non-traded elements in the cost of a Big Mac production, and pricing to the market [1]. Types of barriers to trade are transportation costs, trade restrictions, and taxes. Transportation costs drive a wedge between the prices of Big Mac ingredients in different places. More important factors are trade restrictions such as the imposition of tariffs and quotas on the trade of agricultural products which increase the price of imports. The price of a Big Mac hamburger is inclusive of sales or value-added taxes so differences in tax systems across countries lead to differences in Big Mac parities. However, the price of Big Mac does not depend only on the price of its ingredients but also on the cost of real estate and utilities

needed in the process of Big Mac production. There is also a service component or wages paid to workers for preparing the meal and serving the customers which also belongs to the non-trading component. However it is also possible that, non-traded goods affect the deviations from PPP due to differences in productivity across countries, there are unlikely large differences in productivity of workers in preparing Big Macs in different locations. Government expenditures and current account imbalances can also explain why Big Mac parities do not hold between countries in various periods [2].

Another reason for PPP not to hold is pricing to market or charging different prices on different markets. Pakko and Pollard [3] explained that in the presence of imperfect competition prices of traded goods may differ. Firms can price to market by limiting exchange-rate pass-through and the ability to price to market depends on safety and pollution standards, warranty restrictions, and other factors that affect the possibility of resold goods across national boundaries. Furthermore, the main methodological limitations of the BMI are demand variability, product comparability, exchange rate predictability, elements non-traceability, transportation costs, trade restriction, taxes, productivity differentials, government expenditures, and current account deficits, and pricing to the market. In explaining the differences in tradable prices across countries, they propose a model of consumer search that generates pricing to the market [4]. O'Brien and de Vargas and Clements and Si highlighted the importance of taking GDP into account when assessing currency valuation. This is done by expressing Big Mac prices as a function of GDP per capita and adjusting for differences in incomes of countries by constructing adjusted BMI. Adjusted BMI accounts for prices being cheaper in poorer countries and vice versa[5] [6]. The aforementioned authors found that adjusted BMI outperforms the Big Mac index in forecasting future currency values.

3 Data

Variables for the panel data were collected from different websites for 19 countries across 2000 - 2016. Big Mac Index [7], affordability, and relative PPP were calculated based on local prices, exchange rates, and gross domestic product per capita[8] for each unit-time period. Features such as current account balance[9], labour compensation[10] and general government balances [11] were directly downloaded from online sources.

The general descriptive stats of the dataset can be seen in table 1

	Big Mac Index	GDP per capita	Current Account Balance	General Government Balance	Labour Compensation Per Capita
count	323	323	323	323	323
mean	-11.244791	26751.162589	0.194638	-1.931168	55.395950
std	31.618102	14134.149260	4.652832	3.267947	7.093040
min	-66.471723	2920.560791	-9.874720	-13.099931	35.892659
25%	-35.404737	13736.832412	-3.122691	-3.948555	51.984254
50%	-15.378084	26407.635205	-0.779443	-1.821951	56.099507
75%	1.441681	37484.643518	3.111119	0.238111	59.624225
max	98.352166	68105.154980	17.474242	7.739158	70.999104

Table 1: Descriptive statistics of variables, 19 countries, 2000-2016

Absolute PPP valuation mean is -11.245 indicating that average absolute PPP valuation is negative meaning undervaluation of national currencies against the USD (as seen on Figure 2). Gross domestic product per capita mean is 26,751.16. Maximum value of GDP per capita was reported for Switzerland in 2016 (68,105.15) while minimum value is 2920.56 (China in 2000). Current account mean is positive (0.19). Highest current account suffice was reported in Russia in 2000 with 17.47 percent while highest current account deficit was present in Hungary in 2005 with -9.874 percent of GDP. On the other side, general government balance mean is negative (-1.93). Highest general government suficit was present in Chile in 2007 with 7.739 percent while highest deficit were recorded in USA with -13.1 percent in 2009. Labour compensation mean is 55.39. Maximum value was present in Switzerland in 2002 (70.99) and minimum value was in Mexico in 2008 (35.892).

Intuitively, it can be expected that higher value of GDP is positively correlated with Big Mac prices, and consequently overvaluation of national currencies against USD. Difference b/w labor wages in different countries may explain why some countries are under/over valued against USD. Moreover, if the nation is an overall lender/borrower in trade from other nations, it can perhaps help explain it's over/under valuation against USD.

4 Methodology

Absolute purchasing power parity valuation represents deviations from purchasing power parity. If deviations are positive, local currency is overvalued against the USD, otherwise local currency is undervalued. Absolute valuation for Big Mac index is calculated using equation 1

$$100 \cdot ((P_{bm}/P_{bm}^*)(1/E)) - 100 \quad (1)$$

where P_{bm} is local price of Big-Mac hamburger in domestic currency, P_{bm}^* is USD price of Big-Mac hamburger in United States while E is nominal exchange rate.

Big Mac affordability is calculated using equation 2. It represents the number of Big Mac hamburgers that can be daily bought with country's GDP per capita. GDP per capita and price of Big Mac in country j have been expressed in USD.

$$BM_{afford} = \frac{GDP_j}{(BM_{price})_j} / 365 \quad (2)$$

Equation 1 and 2 were used to calculate the Big mac index and the big mac affordability in the dataset.

The Explanatory variables utilized in the analysis are gross domestic product, current account, labour compensation, and general government balance. Other variables such as productivity and barriers to trade (transportation costs, trade restriction and taxes) were not included in the analysis. It is unlikely there are larger differences in productivity of workers in baking hamburgers in McDonald's across the world. Furthermore, Big Mac is a non-traded good so barriers to trade should not have effect the final price of a product.

After making all the required calculations in the dataset. Basic analysis were performed that told us that there was no significant auto-correlation observed in the Big Mac Index from the ACF/PACF plots. We also concluded the series to be stationary by performing the Im-Pesaran-Shin unit root test.

Base model was set to be Pooled OLS which is proposed cross-country panel regression model as follows:

$$VALUATION = \beta_0 + \beta_1 \cdot GDP_i + \beta_2 \cdot CA_i + \beta_3 \cdot LABCOMP_i + \beta_4 \cdot GGB_i \quad (3)$$

where,

GDP = Gross Domestic Product per capita (USD constant prices 2010 PPPs) of country i

CA = variable representing current account balance expressed as a percentage of GDP country i

$LABCOMP$ = labour compensation per capita country i

GGB = general government balance expressed as a percentage of GDP country i

Results from the Pooled OLS base model (M0) were then compared with results from two other refined models: Country-wise Fixed Effects (M1) Random Effects (M2). Assumptions of Panel regression were also checked for all models. Finally, Hausman test was conducted to determine the optimal model for the panel regression.

5 Results and Discussions

From figure 1, we can see that the absolute valuation of all 19 currencies across 2000-2016 shows no significant trend or cyclic component.

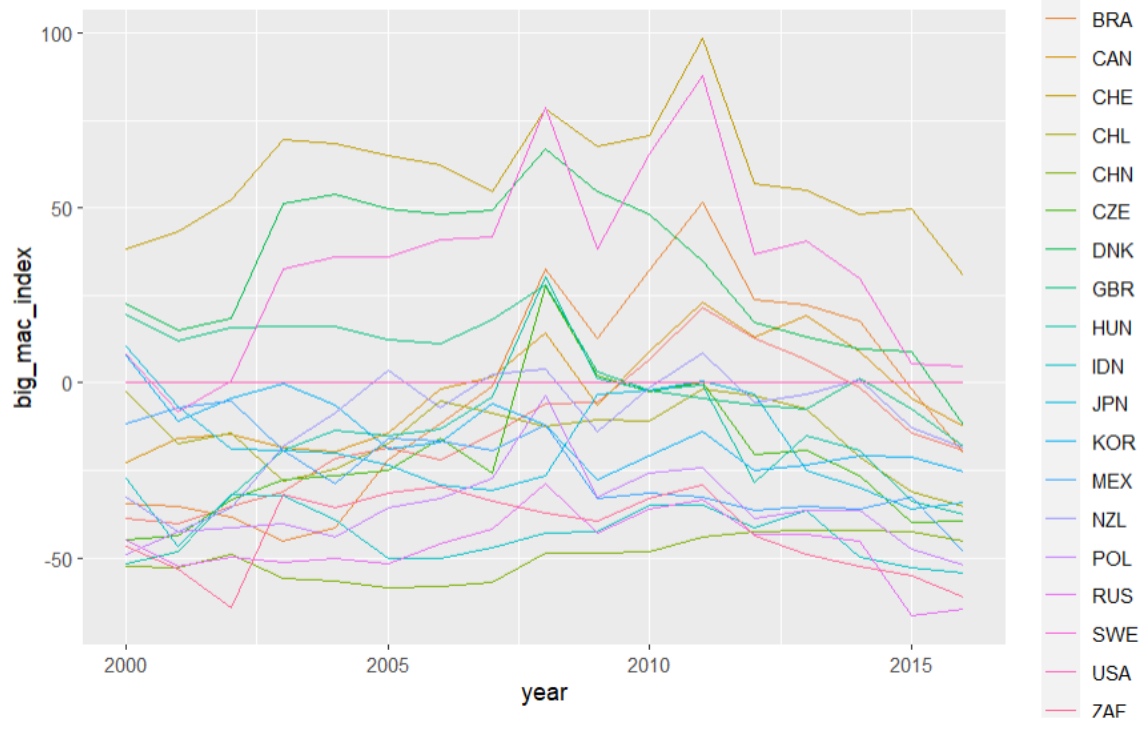


Figure 1: Country's Big Mac absolute valuation, 2000-2016

Figure 2 displays Average annual currencies' absolute valuation relative to USD from 2000 to 2015. Throughout the observed period there can be seen average currencies' absolute undervaluation against the USD except for the year 2008 and 2011 when the valuation is above zero.

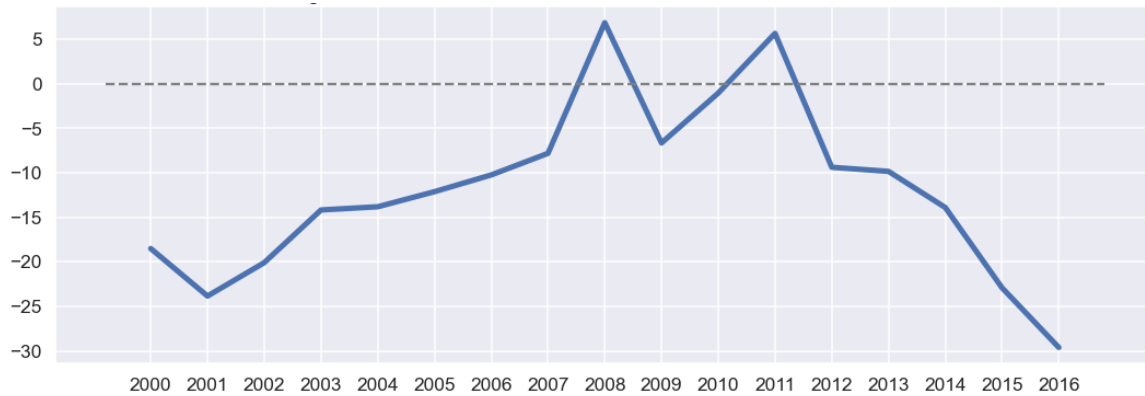


Figure 2: Average annual currencies' absolute valuation relative to USD, 2000 to 2016

The calculation of absolute purchasing power parity valuations for 19 countries from 2000 to 2016 is shown in Table 2 (Appendix). The majority of national currencies were undervalued versus the US dollar, as it can be observed in figure 3. The British pound, Danish krone, Japanese yen, South Korean won, Swedish krona, and Swiss franc were all overvalued versus the US dollar in 2000, while only the Swedish krona and Swiss franc were overvalued in 2016. Table 3 shows the relative purchasing power parity valuations for selected nations from 2001 to 2016, with 2000 as the base year (Appendix). Equation 3 is used to calculate. Figure 3 displays the average country's Big Mac absolute PPP valuation.

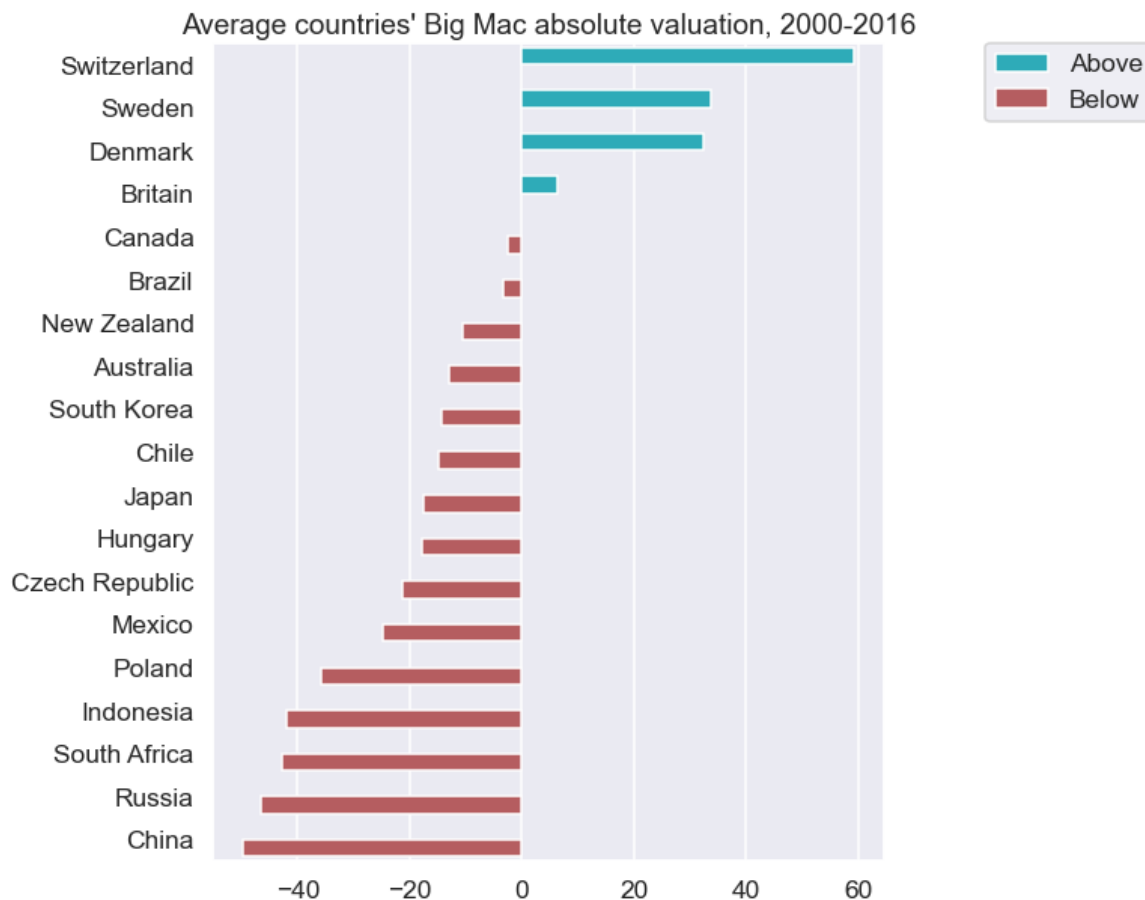


Figure 3: Average country's Big Mac absolute valuation, 2000-2016

In most nations, there has been an average undervaluation of national currencies relative to the US dollar over the studied period. Only the United Kingdom, Denmark, Sweden, and Switzerland had overvaluation.

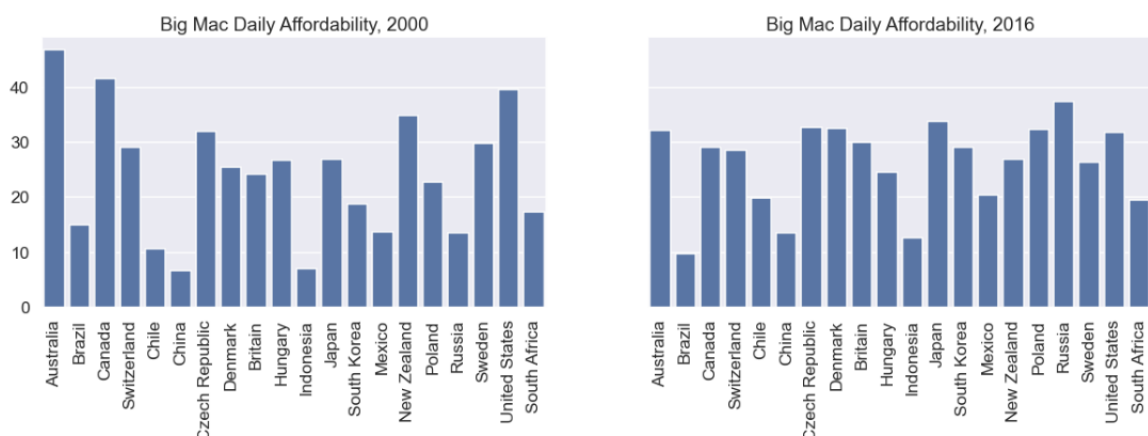


Figure 4: Big Mac affordability, 2000 and 2016

Figure 4 displays Big Mac affordability in years 2000 and 2016. In the year 2000 the most Big Mac hamburgers could be daily bought in Australia (46), Canada (42), United States (40) and New Zealand (35) while customers from China and Indonesia could purchase only 6 Big Macs daily. In the year 2016 alongside Russia (38) and

Japan (34), the most hamburgers is affordable daily in Poland and Australia (32) while Brazil is at the end of the ladder with only 9 hamburgers to purchase daily.

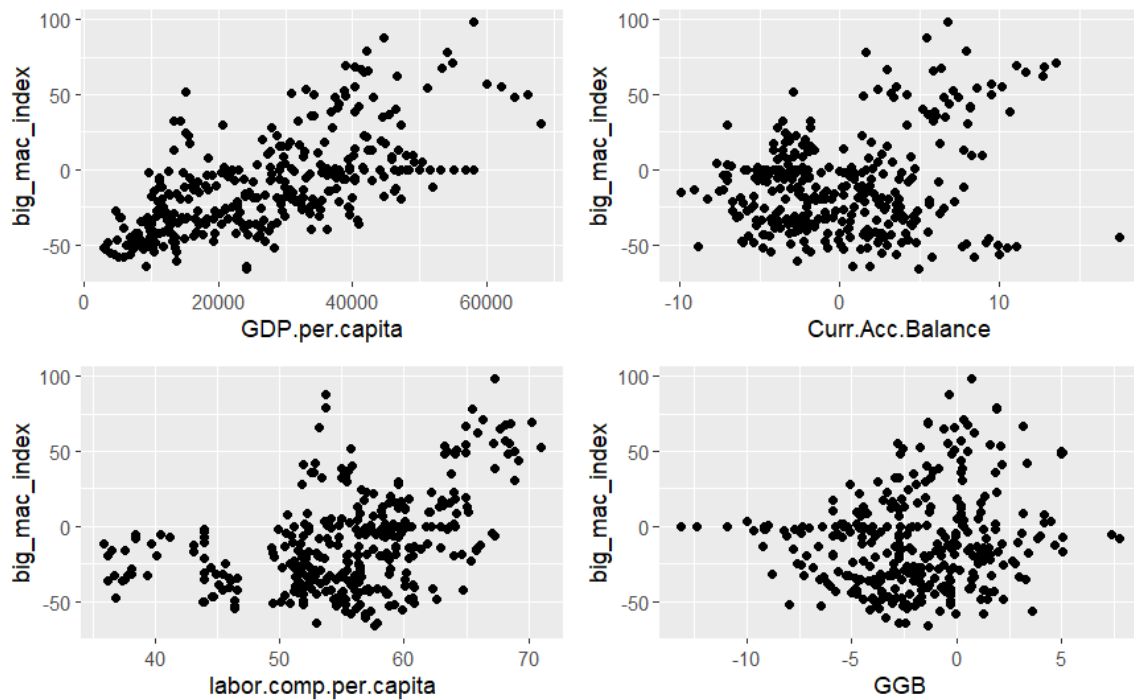


Figure 5: Absolute valuation vs Big Mac determinants graph

Scatter diagram for absolute valuation versus Big Mac determinants (GDP, CA, GGB and LABCOMP) graph is presented in Figure 5. Absolute valuation values are distributed throughout the diagram, making it impossible to draw any definitive conclusions regarding the link between absolute valuation and its determinants.

Since scatterplot didn't produce any insights, so we will look into each segment individually.

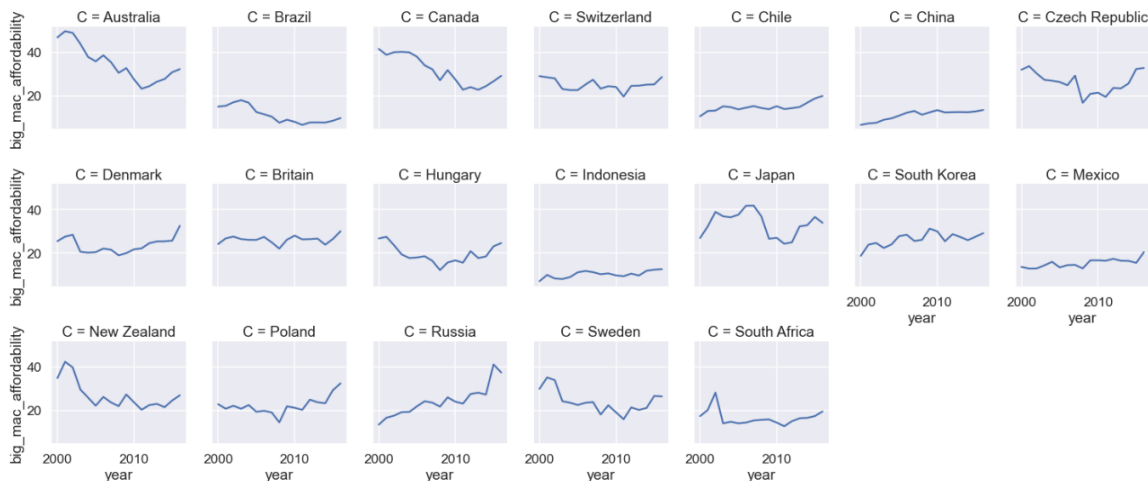


Figure 6: Big Mac daily Affordability, 2000-2016

After observing the figure 7, the Big Mac Daily Affordability tested the prior theory that increase in GDP leads to an increase in prices and hence over-valuation of national currency against USD. While both GDP prices saw an increase over the years, the rate of increase was not consistent that led to purchasing power parity fluctuations.

Panel is balanced with 323 observations. VALUATION is a dependent variable, while LAB COMP, GDP, GGB, and CA are independent variables. Hausman test is used in order to choose between fixed effects and random effects model. The null hypothesis states that preferred model is random effects while the alternative hypothesis states the opposite. The value of Chi-Square statistic for Hausman test is 22.42 with probability of 0.0001653 indicating that fixed effect model is preferable over random effects model.

Forecast: Big Mac Index			
Balanced Panel: n = 19, T = 17			
	Pooled OLS	FE	RE
Controls			
GDP per capita	0.0014*** (0.000)	0.0002 (0.000)	0.0005* (0.000)
Current Account Balance	0.5213 (0.306)	-0.9538*** (0.397)	-0.4928 (0.369)
General Government Deficit	0.8936 (0.457)	0.4838 (0.448)	0.8001 (0.437)
Labor Compensation per capita	0.4336 (0.224)	0.0425 (0.591)	0.9352* (0.427)
Goodness of Fit			
Adjusted R squared	0.4750	0.7480	0.0540
F-statistic	73.97	44.52	5.55
Prob (F-statistic)	0.000	0.000	0.000247
AIC	2959	2739	2734
LM Test	<0.001	0.0036	<0.001
Pearson-corr with response	0.7197	0.4842	0.6855
Number of Observations	323	323	323

Figure 7: Panel Data Regression

The residual errors from both Pooled OLS Regression Model (M0) and Random Effects Model (M2) appeared to be correlated to the response variable to a degree greater than that in Country-wise Fixed Effects Model (M1). Moreover, the Adjusted R² was highest for Country-wise Fixed Effects model. This supported our findings from the Hausman Test.

Considering Country-wise Fixed Effects model (M1) as the preferred model over the rest, statistically significant independent variable in regression was current account balance under 5% level of significance. Other independent variables were not significant in the model under 10% level of significance. It can be concluded that there is no clear evidence in favor of accepting the validity of main determinants of big mac, but further investigations should be made.

6 Conclusion

The purpose of the study was to see if there are any fundamental determinants that have a substantial impact on the Big Mac index's valuation. To begin, absolute and relative purchasing power parity valuations were estimated for 19 nations from 2000 to 2016. The findings of the analysis point to the conclusion that most national currencies were undervalued against the US dollar over the time period studied. A cross-country panel regression model was employed to analyze the major factors of the Big Mac index. Labor compensation, gross domestic product per capita, current account balance, and general government balance were all considered as explanatory factors. The fixed effects model based on the Hausman test was picked as the best option. Statistically significant independent variable in regression was current account balance under 5 percent level of significance. Other independent variables were not significant in the model under 10% of significance. It can be concluded there is no clear evidence in favour of accepting the validity of main determinants of Big Mac index but further investigations should be made.

7 Limitations & Future Works

In "Burgernomics" - a prominent 2003 paper that explores the Big Mac Index and PPP - authors Michael R. Pakko and Patricia S. Pollard cited the following factors to explain why the purchasing power parity theory is not a good reflection of reality.[3]

1. **Transportation Costs:** Goods that are unavailable locally must be imported, resulting in transport costs. These costs include not only fuel but import duties as well. Imported goods will consequently sell at a relatively higher price than identical locally sourced goods.
2. **Tax Differences:** Government sales taxes such as the value-added tax (VAT) can spike prices in one country, relative to another.
3. **Government Intervention:** Tariffs can dramatically augment the price of imported goods, where the same products in other countries will be comparatively cheaper.
4. **Non-Traded Services:** The Big Mac's price factors input costs that are not traded. These factors include such items as insurance, utility costs, and labor costs. Therefore, those expenses are unlikely to be at parity internationally.
5. **Market Competition:** Goods might be deliberately priced higher in a country. In some cases, higher prices are because a company may have a competitive advantage over other sellers. The company may have a monopoly or be part of a cartel of companies that manipulate prices, keeping them artificially high.

While burgers are an interesting measure, they travel badly. So, in 2013, Economist magazine created another index - one that better meets the condition that the product can flow quickly and cheaply across borders. The Geo-Graphics Mini Mac Index compares the price of iPad minis across countries. iPad minis are a global product that, unlike Big Macs, do in fact travel the Earth with their owners. While it's not a perfect measure metric, purchase power parity does allow for the possibility of comparing pricing between countries that have differing currencies.

Acknowledgement

This project is a practical end-to-end implementation of the research paper by Hrvoje JOŠIĆ, Zoran WITTINE, Antea BARIŠIĆ: Faculty of Economics Business at the University of Zagreb, Croatia. [12]

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Appendix

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Australia	-38.579	-40.3484	-35.2248	-31.2415	-21.6301	-18.3948	-21.9023	-14.585	-5.81028	-5.53374	6.821952	21.61683	12.80668	6.480787	-1.51069	-14.1764	-19.4375
Brazil	-34.3408	-35.2821	-38.2144	-45.3105	-41.4444	-21.7744	-11.6951	-0.85095	32.57859	12.6283	32.19268	51.59726	23.979	22.20055	17.67195	-1.88607	-19.9387
Britain	19.60159	12.03543	15.88353	16.02214	16.04138	12.43137	11.256	18.23928	28.02511	3.312997	-2.23408	-4.26477	-6.33753	-7.4193	1.366361	-7.32423	-18.279
Canada	-22.7579	-15.96	-14.8185	-18.5647	-19.708	-14.2072	-1.66096	1.66764	14.16056	-6.13466	9.03937	23.02074	13.2585	19.35828	8.936193	-4.24805	-12.4281
Chile	-2.33618	-17.4604	-14.1605	-27.8484	-24.6866	-17.2595	-5.15816	-8.53245	-12.2261	-10.6378	-10.7733	-1.65218	-3.72251	-7.37282	-21.2934	-30.955	-35.4003
China	-52.3645	-52.9271	-49.0716	-55.88	-56.6883	-58.5403	-58.2352	-56.847	-48.765	-48.7552	-48.3372	-44.0817	-42.6582	-41.9513	-41.9315	-42.5163	-45.1369
Czech Republic	-44.6001	-43.4686	-33.5223	-27.7698	-26.5843	-24.8687	-15.6911	-25.6786	27.67187	1.948713	-2.53495	0.182063	-20.3767	-19.2618	-26.4406	-39.9586	-39.4449
Denmark	22.64375	15.17842	18.61288	51.03027	53.84189	49.53134	48.05984	49.3049	66.71918	54.81602	48.10344	34.86847	17.33573	13.06275	9.62647	9.036203	-12.1301
Hungary	-51.5915	-48.1562	-32.2289	-19.2804	-13.3845	-14.9479	-13.2834	-4.18006	30.097	1.266821	-2.288	-0.59048	-28.4882	-15.0651	-19.0939	-33.709	-37.5633
Indonesia	-27.289	-46.6845	-31.8589	-32.0256	-39.1258	-50.0132	-50.2582	-47.016	-42.7656	-42.6045	-35.0198	-34.9593	-41.1863	-36.5362	-49.8213	-52.7572	-54.4087
Japan	10.50139	-6.65481	-19.0609	-19.4342	-20.0488	-23.4416	-29.3317	-30.7384	-26.6002	-3.16442	-2.06872	0.454013	-3.21544	-24.9713	-29.8329	-36.0825	-34.1326
Mexico	-11.5123	-7.19002	-5.22435	-19.4009	-28.6564	-15.801	-16.5049	-19.2119	-11.8495	-33.0671	-31.6204	-32.5486	-36.5715	-35.418	-36.1351	-32.6271	-48.1372
New Zealand	-32.6079	-42.6185	-35.4561	-18.1143	-8.53659	3.704512	-7.16202	2.496767	4.162482	-13.8036	-1.53563	8.523985	-5.54641	-3.37512	0.950206	-12.7166	-18.5111
Poland	-49.041	-42.3614	-41.3496	-40.2385	-43.8653	-35.8175	-33.0571	-27.2679	-3.47858	-32.5299	-25.654	-24.0918	-38.8332	-36.4883	-36.3672	-47.5302	-51.9358
Russia	-44.7823	-52.32	-49.7992	-51.3532	-50.0595	-51.6802	-46.0291	-41.6126	-28.8676	-42.7748	-36.128	-33.5188	-43.2871	-43.1105	-45.0462	-66.4717	-64.5473
South Africa	-46.642	-53.0271	-64.2607	-31.91	-35.7979	-31.4277	-29.5749	-33.5871	-37.2241	-39.2789	-32.9262	-29.3122	-43.6039	-49.0605	-52.3564	-55.0018	-61.3298
South Korea	7.871762	-10.8602	-4.52608	-0.18753	-6.24908	-18.7475	-17.092	-6.06808	-11.9534	-27.548	-20.6969	-13.8223	-24.8348	-23.3172	-20.7959	-21.2478	-25.3758
Sweden	8.164627	-8.08542	0.401606	32.73514	35.93729	36.16192	40.83333	41.74788	78.56946	38.12318	65.344	87.94228	36.55772	40.49379	29.86484	5.420225	4.916213
Switzerland	38.27045	43.37081	52.4169	69.68783	68.40417	65.03595	62.1589	54.52718	78.12731	67.64682	70.7565	98.35217	56.75354	54.99661	48.31504	49.57632	30.72452

Table 2: Absolute purchasing power parity valuation, 2000-2016

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Australia	1.021867	1.4416	1.346696	1.10354	0.946511	0.729183	0.783967	0.597867	0.084511	0.927309	0.425374	-0.36699	-0.12249	0.110896	0.415478	1.129203	1.429955
Brazil	1.264648	1.88819	1.989902	2.9344	3.512227	3.310951	3.330643	3.153501	2.573902	3.711163	3.338854	3.04801	4.430235	5.529562	6.351501	7.753606	9.178118
Britain	-1.08145	-0.839	-0.87803	-1.13168	-1.45779	-1.53161	-1.53739	-1.91696	-2.22944	-1.36697	-1.25621	-1.46659	-1.36683	-1.40323	-1.88053	-1.50566	-1.10141
Canada	0.885974	1.156861	1.170019	0.96231	0.8349	0.633946	0.431709	0.370794	0.0139	0.518825	0.151513	-0.25856	0.092938	0.136718	0.43523	1.123594	1.467655
Chile	92.46681	92.4929	93.19084	93.20298	93.18773	93.59176	93.79736	94.00104	93.74948	94.42215	94.18238	94.66678	95.15797	95.09962	95.17643	95.30422	95.51216
China	7.920244	7.920244	8.354646	7.920244	8.282574	8.354147	8.321131	8.621151	9.485253	9.484944	9.712772	10.79539	11.32299	11.56022	12.00447	12.25152	13.01023
Czech Republic	34.31979	34.97699	34.9531	34.8806	34.70844	34.59978	36.06313	32.81065	37.04366	38.28039	38.2224	38.53508	39.27832	39.19681	39.2993	39.5647	41.13219
Denmark	17.37206	17.49456	17.47218	18.51826	18.22981	18.14038	18.1003	17.84778	17.2251	18.51202	18.73601	17.91253	19.22979	18.253	18.16113	21.79358	19.70745
Hungary	76.94418	79.69603	81.80903	82.68008	83.72828	83.71387	84.43789	85.15447	86.40981	87.364	87.52133	87.90221	87.69575	89.01695	89.18642	89.4719	89.68875
Indonesia	99.30257	99.31517	99.36834	99.37135	99.37182	99.30932	99.30915	99.36402	99.45722	99.51405	99.53338	99.54651	99.56319	99.63325	99.63493	99.65121	99.66848
Japan	73.91533	74.01752	71.81895	71.77256	71.7352	70.75923	70.7976	73.07999	72.99464	75.36737	75.33785	75.21822	75.20826	75.39338	76.52169	78.07199	78.02479
Mexico	15.44992	16.03169	16.0296	16.92339	17.68632	19.86212	20.14847	20.40455	21.85835	23.01541	22.34817	22.16523	25.0339	24.90389	26.1593	30.72003	29.97586
New Zealand	1.65228	2.06806	1.923607	1.665126	1.626795	1.222252	1.482827	1.149362	1.126215	1.737643	1.285837	0.65509	1.021929	0.985826	0.80082	1.623348	1.781763
Poland	4.000882	4.188839	4.192261	4.403069	4.395196	4.25917	4.138999	4.199186	3.321669	4.824643	5.066003	5.103867	5.951282	5.786611	5.680549	6.294971	6.572991
Russia	27.32189	25.02884	27.15827	28.14303	28.55755	28.53621	30.82545	32.26874	35.5098	38.89644	39.97913	41.31288	42.46219	43.01521	45.72059	48.68384	54.15887
South Africa	7.028178	7.754684	8.031077	10.62287	9.375568	10.40078	10.31085	11.51378	12.57708	13.38046	13.32262	13.87739	14.62793	15.96308	17.54531	18.76309	20.98627
South Korea	96.68685	96.70116	96.80071	96.97927	96.88731	96.05822	96.0542	96.56287	96.87445	97.06896	97.06	97.27623	97.28411	97.34816	97.40675	97.58669	97.66921
Sweden	17.16538	17.47207	18.65079	20.30991	20.04448	20.48355	21.50298	20.98193	22.91672	24.51007	26.20315	27.46641	24.67563	24.67722	24.57989	26.12544	27.41252
Switzerland	2.294062	2.500829	2.356368	1.600621	1.332342	1.175823	1.159487	1.107643	0.132258	0.483576	0.240379	-1.46762	-0.17033	-0.39061	-0.61603	-0.62414	-0.0156

Table 3: Relative purchasing power parity valuation, 2001-2016