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APPLE INDICES AS A NEW INFORMAL MEASURE OF PURCHASING POWER PARITY

APPLEOVI INDEKSI KAO NOVI NEFORMALAN NAČIN MJERENJA PARITETA KUPOVNE MOĆI

ABSTRACT: This paper examines the validity of the Purchasing Power Parity (PPP) theory, using 12 different single-product baskets of Apple devices. Given the presented advantages of Apple indices as PPP measurement in comparison to the most prominent informal index- the Big Mac index (BMI), they are therefore pointed out to be more adequate modern measures of PPP. Presented study investigates if the theory holds for different products within the same niche across 37 countries. Furthermore, this paper presents results of cross country ordinary least squares (OLS) regression analysis of the data for 6 different Apple products. Results point out that most-favoured nation (MFN) duty rates and sales taxes together with additional duties and taxes are main factors that affect currency valuation against the U.S. dollar. In contrary to BMI, Apple indices indicate real undervaluation of most of the national currencies against the U.S. dollar and have also shown to be more supportive to the PPP validity than the BMI.

KEY WORDS: Law of one price, Purchasing power parity theory, Apple indices, Big Mac index.

SAŽETAK: Ovaj članak ispituje valjanost teorije pariteta kupovne moći (PPP) koristeći 12 različitih proizvoda iz košarice Appleovih proizvoda. S obzirom na izložene prednosti Appleovih indeksa prilikom mjerenja PPP u usporedbi s najistaknutijim neformalnim indeksom - Big Mac indeksom (BMI), Appleovi indeksi se ističu kao prikladnija modernija verzija mjere pariteta kupovne moći. Predstavljena studija istražuje valjanost navedene tvrdnje koristeći različite proizvode unutar iste niše za 37 zemalja koristeći metodu najmanjih kvadrata (OLS) regresijske analize na podacima za 6 različitih Appleovih proizvoda. Rezultati analize ukazuju da su carinske stope utvrđene po načelu najpovlaštenije države (MFN) i stope poreza na promet zajedno s dodatnim pristojbama i porezima glavni

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čimbenici koji utječu na vrijednost valute prema američkome dolaru. Nasuprot BMI, Apple indeksi ukazuju na realnu podcijenjenost većine nacionalnih valuta prema američkome dolaru i također su pokazali da više podržavaju valjanost PPP-a od BMI-a.

KLJUČNE RIJEČI: zakon jedne cijene, teorija pariteta kupovne moći, Appleovi indeksi, Big Mac indeks.

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1. INTRODUCTION

Purchasing power parity (PPP) theory through aggregating the law of one price (LOP) points out that due to arbitrage between different markets, all identical goods and services should be sold at the same price when converted into a common currency. Following, as proposed by Cassel in 1918, exchange rates should be determined "by the quotient between general levels of prices in two countries" (Balassa, 1964).

PPP rates based on the consumer price index (CPI) are most frequently used by international financial institutions to calculate and report PPP based GDP and GDP per capita in common currency and make comparisons across countries to point out their real economic performances, size of the economy, level of development and wellbeing of their residents. Additionally, companies holding international portfolios use it as international asset allocator, to forecast exchange rates and calculate it in their investments figures (Annaert and De Custer, 1997). On the other side employees of multinational companies use it for planning their expatriate engagements, the same as other potential economic migrants checking the appropriate salary packages in different countries. Making PPP one of the most important denominators in the international economy enabling comparisons among the countries around the globe has given this topic significant amount of research since its foundations made more than 100 years ago.

Differences in consumer preferences across countries and biases towards certain goods, its qualities and contents, makes it hard to find a common basket of comparable goods for CPI calculation of the PPP. Due to that, while striving to compare exactly the same goods to test the theory with its true postulates, several informal single-good basket measures have emerged. The most widely accepted one, published semi-annually by The Economist is the Big Mac index (BMI), celebrating 30 years of publishing. This light-hearted measure of PPP, due to its consistency on different locations and time, was upon its rise praised to be an easy and good way of currency valuation, while afterwards different researches pointed out its several limitations, mostly regarding tradability of the product itself, its ingredients characteristics and the portion of non-tradable elements in its price. Due to fact that McDonald's in Africa operates only in Morocco, Egypt and South Africa, equivalent KFC index has emerged and is being calculated for 20 African countries.[1] Starbucks latte price around the world was also presented by The Economist in 2004 as Starbucks index comparing 16 different markets at the time, but was not so widely accepted and has not been published ever since.[2] Lately introduced informal measure of PPP considering

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[1]   Available at: http://sagaciresearch.com/kfcindex/.

[2]   Available at: http://www.economist.com/node/2361072 .

Apple products prices is calculated by Australian CommSec on yearly basis. It emerged in 2007 as iPod index and afterwards was followed by iPad and iPhone indices.

Although a vast theoretical and empirical literature is present on PPP and as well on the BMI, indices of Apple products still haven't been investigated by the scholars and it is almost not existing. Given the downsides of the BMI which are in common with KFC and mostly with Starbucks index, this study points out advantages of using Apple index based on the prices of 12 different Apple products, as a measure of over/undervaluation of a currency and tests the PPP in the light of this new instrument. While pointing out the main characteristics of Apple products indices in comparison to BMI index, calculation of their figures points out to their contrary findings in the context of 21th century, using dollar, still the most important currency in the foreign trade, as the base currency.

Following the theoretical framework of the underlying theories of LOP and PPP in the second chapter, research overview in the third chapter points out to main findings within the BMI literature. Fourth chapter proposes novel measures of PPP and discusses differences between newly proposed Apple indices and BMI. Fifth chapter gives the results of testing the PPP theory using Apple indices, while putting it against BMI and the last chapter points out main research conclusions.

2. THE LAW OF ONE PRICE AND PURCHASING POWER PARITY THEORY

International trade theory postulates that when assuming absence of transport costs, different trade restrictions, duties and other legal barriers, as well as central bank interventions, arbitrage should ensure that prices of homogeneous products in different countries are on the same level or to say exactly the same when expressed in a common currency units (Isard, 1977). Arbitrage influence is argued to be relevant at least in the long run, equalizing the prices internationally and ensuring that PPP holds and as well as a necessary condition of the determination of exchange rates in the short run (Ardeni, 1989). According to the LOP for any good i following equation should be true:

$$P_i = E \cdot P_i^* \tag{1}$$

P_i in the equation stands for domestic-currency price of the good while E stands for exchange rate defined as the home-currency price of foreign currency and P_i^* is the foreign-currency price of the same good (Rogoff, 1996).

Generalizing the LOP, Cassel was the first to take the PPP theory as a practical empirical theory and give it the name that still holds, although even in 16th century some Salamancan scholars constructed similar discussions. Since Cassel's conceptualization of the PPP theory in 1918 a broad array of different research and empirical studies evolved, engaging many scholars in discussions and research of this topic, giving different perspectives within different historical eras and monetary regimes, from Golden standard, the First and Second World War and Bretton Woods agreement to floating exchange rate regimes. Cassel's definition of PPP is widely known as absolute PPP, which puts national against foreign prices and states that "nominal exchange rate between two currencies should be equal to the ratio of aggregate price levels between the two countries" (Taylor and Taylor, 2004).

$$E_t^B = \frac{P_t^A}{P_t^B} \tag{2}$$

Through generalising the LOP for same goods on national levels with the present arbitrage (Chen et al., 2007) it points out that exchange rates should move towards identical basket of goods and services in all countries (Haidar, 2011). In case the parity does not hold true, arbitrage should channel the converging to parity, and due to that deviations should be minimum. This underlines the connection of countries through prices of tradable goods that are traded between them as one of the doctrine foundations (Officer, 1976).

This widely explored topic reached several empirical findings pointing out that this postulate, in its most strict manner, does not hold in reality. Nevertheless, wide theoretical grounding with these underlying assumptions has developed ever since. In models where traded and non-traded goods are separated, deviations are expected for non-traded goods. Possible high costs of arbitrage and influence of institutional price setting factors make the parity arguable in empirical studies (Ardeni, 1989). Parsley and Wei (1996) as well as several other scholars after them argue that tradable goods including perishable and non perishable goods converge quickly to price parity. Also, Okun et al. (1975) distinct between "customer goods" which are manufactured goods mostly with sticky prices and "auction goods" which are basic commodities with flexible prices.

The PPP can be calculated and applied in different ways. Most common way to calculate it is as an index comparing baskets of goods - consumer price index (CPI). Balassa (1964) pointed out the index number problem, emphasizing the differences in productive endowments and tastes which significantly impact results, as depending on the choice of weights of the chosen goods across different countries. Not all the prices in the economy are included in the CPI. Given the weighted averages of individual prices with different and changing weighs across countries due to varying tastes and consumer preferences makes the cross-country comparisons not absolutely legitimate.

Relative PPP, less strict than the absolute version, states that change in the foreign exchange rate should imply the same change of the consumer prices in both countries at the same time, and moreover that this should be regarded as synonym (Ong, 2003). Ideal base period would be that in which the absolute PPP is true and ratio of prices equals to exchange rate.

$$\%\Delta e = \%\Delta P^* - \%\Delta P^\$ \tag{3}$$

Constant foreign exchange rate implies that the ratio of prices between two countries has not changed. Relative and absolute PPP would be the same only in the case of same inflation (current vs. base period) in both countries.

3. EVOLUTION OF BURGERECONOMICS

PPP has been largely explored field, raising different discussions and opposing evidence, with ebbs and flows over the period, while aiming to assure comparison among national economies and predicting the future exchange rate direction. As Samuelson and Balassa (1964) and other researchers pointed out transport costs and impediments such as

quotas, *ad valorem* tariffs, information costs, taxes and other non-legal barriers exist in the reality, making this theory fail in the short run. According to classical dichotomy, variances in aggregate real exchange rates should be regarded to non - traded goods which do not obey the LOP (Crucini and Landry, 2012). Researchers also pointed out that commodity price arbitrage isn't always the case either in the long run as well, indicating influence of institutional factors on price settings on different markets as well as possible high arbitrage costs (Ardeni, 1989). Besides that, as Krugman pointed out, pricing to market could have a significant impact on similar product prices across countries, when considering products that are not fully opened to arbitrage and with demand not fully elastic, as a way to increase profit. Also non-tradable items, included in tradable products such as wages and utilities, substantially increase prices of many of the tradable products.

Besides the CPI, several informal measurements emerged, reducing the basket of goods to single-good basket representing the national price levels. Research of informal measures of PPP such as BMI, Starbucks index, KFC index and Apple products indices, strives to reveal an easy way of the calculation, at the same time minimizing the CPI methodological problem of consumers' biased tastes.

The BMI compares Big Mac prices across different countries around the world and measures whether currencies are traded at the right exchange rates against the US dollar, which we today call the Raw BMI.[3] Following the PPP, it is argued that nominal currency exchange rate should reflect the fact that hamburgers cost the same everywhere around the world. Due to its consistency over time and countries the Big Mac was praised to be an easy way of currency valuation, while afterwards different researches pointed out to its several limitations, mostly regarding to the fact that the product itself is not tradable but its ingredients, it is perishable and its price contains significant portion of non-tradable elements, such as wages, rents and utilities but also pricing to market in different cultural surroundings. Different studies give diverse cost ponders of the inputs to the final product of the Big Mac. While Pakko and Pollard (1996) and Soo (2016) find out that only 6-7 percent of Big Mac price can be tied to its tradable components, some other studies pointed out that it goes up to 36-45 percent (Parsley and Wei, 2007) of the total cost.

Nevertheless, both numbers are significant and cast doubt on the index in obeying the underlying laws. These non-tradable components affect the overvaluation of currencies in high income countries, what incentivized development of the adjusted BMI. After considering cheaper prices in poor and developing countries in 2011 The Economist introduced the Adjusted BMI, calculating the difference between actual Big Mac prices and predicted prices according to countries GDP per capita and pointing out the level of misfit to exchange rate with taking into account the country's level of development.

Both indices are published on semi-annual basis for 48 countries (and currencies including the EU) and used as suggestive idea of the currency under/overvaluation against the US dollar. Some researches point to the fact that deviations from BM parity are more strongly associated with changes in relative prices than in exchange rates. Cumby's findings implies that although there are substantial variations from the Big Mac Parity, deviations from relative Big Mac Parity are only temporary and last up to one year in comparison to

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[3]   Available at: http://www.economist.com/news/business-and-finance/21639762-our-article-1986-introducing-big-mac-index-origins-hamburger-standard.

the PPP calculations based on the CPI where this happens in 4 to 5 years and in that way this could be a better way of forecasting the future exchange rate (Cumby, 1996).

Besides raw and adjusted BMI, The Economist also used to present GDP per capita expressed in number of Big Macs that each citizen could buy, showing the size of economies. The Big Mac affordability index revealed that the cheap prices of Big Mac do not directly correspond to country's GDP per capita (Atal, 2014).

Besides previously mentioned non-tradable components there are also other components depending on the culture and tastes of the people at each point of sale. McDonald's is in several countries called differently to fit better in the culture and also it sometimes uses different ingredients to customize it to local demand (Pakko and Pollard, 2003). Furthermore, it brings diverse experience across countries and depending on the imperfect competition with no close substitutes (Pakko and Pollard, 1996) and position and strength of the brand on the local market, there could be significant pricing to market possibilities, in case the demand is inelastic. Also, marketing costs built in the burger price, can differ significantly across countries. Although productivity is argued not to be relevant in this case due to workers job description with no significant differences across countries, some researches have shown that less productive countries have undervalued currencies and additionally that countries more opened to trade show less deviations from BMI parity (Da Silva et al., 2004).

4. APPLE INDICES TACKLING THE PPP PUZZLE

Given the 30 years of literature on exploring the BMI, showing its advantages and shortcomings, it could be time for PPP testing in the 21st century to turn to products which are more aligned to the postulates of the authentic PPP theory. More than 20 years after the introduction of BMI, in January 2007, CommSec Australia introduced iPod index as a first Apple index used to indicate evaluation of currencies and its fit to PPP. Next, with the popularization of other Apple products and modern trends, CommSec shifted to iPad and iPhone indices, while still calculating the firstly introduced one. Mentioned Apple indices still haven't been explored widely, both theoretically and empirically. Mazumder (2016) gave an introduction for this topic, but detailed argumentation and testing are yet to be made to show the figures in the comparable periods and on wider scale of products and give a more detailed analysis of Apple indices advantages. Checking the validity of the BMI and Apple indices as measures of PPP are showing the fit with a single good basket and for sure are not to be taken completely true as not reflecting all prices in the economies but could be a good indicator of the under/over valuation of the currency and the future direction of the exchange rate. Comparing these two indices leads to interesting reasoning, pointing out the theoretically more suitable measure of PPP in accordance to its propositions.

As mentioned, back in 1986 Big Mac was chosen to be a suitable measure of currency over/under evaluation due to fact that it is a homogenous good with uniform composition made according to the same recipe defined by UN Standard International Trade Classification (SITC) (Pakko and Pollard, 1996). Sold all around the world and despite the fact that is not a tradable good itself, it fits to the proposition as all of its ingredients although perishable (beef, lettuce, bread, sesame seeds) are tradable (Soo, 2016). On the other side

Apple products are completely tradable, non-perishable goods, manufactured by the same producer in China and Taiwan, shipped and sold with same features across the world. While McDonald's operates on foreign markets mostly through franchising agreements Apple has stores in 20 countries and online stores in 39 countries. All the products are fully tradable goods, with completely identical structure on all selling points globally, easily prone to arbitrage in case of significant pricing to market. While prices of both goods also have non-tradable components such as wages, rents and utilities of restaurants and stores (Haidar, 2011). Big Mac price is considered to contain significantly higher non-trading price component with most of its ingredients locally supplied to avoid trade restrictions. As being a high-tech device, significant share of price is due to physical components of each product, but other tradable goods factors such as duties, tariffs, legal restrictions and taxes surely influence the final price in each country, which is to be examined. Also telecommunication operators bargainings reflecting the market position might influence the price of iPhones significantly, while should not have significant influence on other products indices.

Apple products are regarded to be a status symbol and tough could be more prone to pricing to market. But at the same time pricing to market is harder due to thoughtfully purchasing it as being significantly more expensive than the burger and exploitation of different purchase possibilities from easily getting the product across the border, through different channels as through online stores or through tourist migrations around the world. Due to the price level and specific features, which one uses for a longer period of time, the price is more considered upon purchase, increasing the arbitrage influence on prices. It is easier to detect the transport costs affecting the price, as well as other tradable components such as tariffs, legal restrictions and taxes than in the case of BMI where we do not know from where the exact ingredient comes from. Also Apple indices can be calculated more than twice a year, with the prices around the world available almost daily, in order not to coincide with transitory exchange rate fluctuations that do not reflect exchange rate through the year, what is not taken into account with the BMI (Kitamura and Fujiki, 2004).

5. METHODOLOGY AND DATA

In order to calculate Apple indices, data on prices of Apple's products in national currencies are provided from the Apple Compass web page[4]. Data on actual Exchange rates (currency per U.S. dollar) are provided from the Current and Historical Rate Tables[5] with the date January 1 2017. The sample comprises of 37 countries (including USA as a reference country). Apple implied (real) PPP is calculated using equation 4:

$$E_{Apple}^{PPP} = \frac{P_{Apple}}{P_{Apple}^*} \tag{4}$$

where E_{Apple}^{PPP} is Apple implied PPP exchange rate, P_{Apple} is domestic Apple product price and P_{Apple}^* is US Apple product price. Valuation from Apple indices is calculated using equation 5:

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[4]   Data are available at: https://www.applecompass.com/.
[5]   Available at: http://www.xe.com/currencytables.

$$Valuation_{Apple} = \left(\frac{P_{Apple}}{P^*_{Apple} \cdot E} \right) \cdot 100 \tag{5}$$

Where $Valuation_{Apple}$ is deviation from the absolute PPP and E is nominal actual exchange rate. If nominal exchange rate is equal to the Apple implied PPP exchange rate, the absolute PPP hold. If PPP does not hold, overvaluation or undervaluation of domestic currency against the US dollar occurs. If the price ratio exceeds the nominal exchange rate, domestic currency is overvalued against the US dollar and vice versa. Data on valuation from Big Mac are taken from The Economist page Interactive currency comparison tool[6].

In order to investigate key variables that affect the valuation of national currencies against the dollar, respectively testing the LOP, cross-country regression model is formulated for January 2017. Explanatory variables included in the analysis are distance, GDP, customs and duties and membership in regional economic integrations. Data for regression are calculated or taken from various Internet sources.

Proposed cross country regression model equation is stated as follows:

$$VALUATION = \beta_0 + \beta_1 CUSTOM_j + \beta_2 GDP_j + \beta_3 DISTANCE + \beta_4 EUDummy + \beta_5 NAFTADummy \tag{6}$$

VALUATION - variable denoting the percentage of overvaluation or undervaluation of national currency relative to U.S. dollar. Positive values of variable *VALUATION* denotes percentage of overvaluation while negative values denotes undervaluation of national currency against the U.S. dollar.

$CUSTOM_j$ - variable representing the MFN[7] duty rate, sales taxes and additional duties and taxes of country j.[8]

GDP_j - Gross Domestic Product per capita (in PPP international dollars) of country j.[9]

$DISTANCE_{ij}$ - distance from United States's capital city Washington DC i to j^{ih} country capital city[10].

EUDummy - 1 if j^{ih} country is EU member country, otherwise 0.

NAFTADummy - 1 if j^{ih} country is NAFTA member country, otherwise 0.

Expected signs of regression are positive for variables $CUSTOM_j$ and $DISTANCE_{ij}$ and negative for variables GDP_j, *EUDummy* and *NAFTADummy*. It is expected that higher duty rates, taxes and distance (transportation costs) will increase the price of Apple products and consequently affect on overvaluation of national currencies against the US dollar. On the other side, higher levels of GDP and membership in EU and NAFTA may affect for price of Apple products to slide down.

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[6]   Available at: http://www.economist.com/content/big-mac-index.

[7]   Most favoured nation duty rate is the lowest possible tariff a country can assess on another country.

[8]   Data are available on the page https://www.dutycalculator.com/sales_tax_rates_by_country/. For USA is used minimal sales tax of 0% for some states while for Canada used minimal sales tax for provinces of 5%.

[9]   Data are available on the page https://knoema.com/sijweyg/gdp-per-capita-ranking-2016-data-and-charts.

[10]   Data are available on the page http://www.chemical-ecology.net/java/capitals.htm.

6. RESULTS AND DISCUSSION

In Table 1 (Appendix) are presented Apple products' prices expressed in national currencies. Data are available for 37 countries with USA being the reference country and 12 different Apple products. In Table 2 (Appendix) are calculated Apple products' real exchange rates using equation 4 from the previous chapter. Apple products' absolute parity valuation is calculated using equation 5 and displayed in Table 3 (Appendix). It can be noticed that most of national currencies are under valuated against the U.S. dollar. Apple products' affordability Table 4 (Appendix) represents number of Apple's products that can be bought with country's GDP per capita. Furthermore, Apple product basket represents share of GDP per capita required to buy all 12 Apple's products. It can be noticed that purchase of Apple product basket is the most expensive in Brazil and Philippines with 283.06 percent and 206.53 percent of GDP per capita. On the other side, purchase of Apple products basket is the most affordable in Luxembourg and Singapore with less than 20 percent of GDP per capita.

In order to compare Apple indices and BMI average products' valuation for the observed period is calculated (Table 5 in Appendix). It can be noticed that Apple indices indicate undervaluation of national currencies against the dollar in the amount of 18.58 percent while BMI suggests overvaluation of national currencies against the dollar in the amount of 27.83 percent. Apple indices are shown to be more supportive to the validity of the PPP and LOP than the BMI. They are closest to PPP in 69.44 percent of cases in relation to BMI with 30.56 percent. As mentioned before, the signs of valuation are different between Apple indices and BMI. They have equal signs of valuation in only 13.88 percent of cases.

Since the two indices give opposite results, it raises question what key determinants influence valuation of national currencies. In Figure 1 (Appendix) is presented relationship between Apple products' prices and GDP per capita. It shows no or little correlation between GDP per capita and prices of Apple products. This will be subject to confirmation using cross-country OLS regression analysis. Considering that the Apple products are a tradable good, its price across different countries is affected by customs, duties and other costs. Figure 2 (Appendix) reveals relationship between customs (and duties) and prices of Apple products. It indicates positive correlation between variables, with Brazil being the outlier with the highest percentage of customs imposed to the price of imported good. Other variables included in the cross-country regression analysis, previously mentioned in the methodology and data section, are distance between USA and other countries and membership in regional economic integrations (namely EU and NAFTA)..Results of the cross-country OLS regression analysis for 6 different Apple products are presented in table 6.

Number of observations in all regressions is 37. Adjusted R-squared for all regressions is in the range of 0.7 to 0.8. meaning the variation in the dependant variable is very well explained by its explanatory variables. Dependent variable in regression is VALUATION while independent variables are CUSTOM, GDP, DISTANCE, EU Dummy and NAFTA Dummy. Statistically significant independent variables in all regressions is CUSTOM under 1 percent level of significance. Other independent variables are not significant in the model. Interpretation of regression coefficient b_1, for the iPhone 7 product, is as follows: if CUSTOM increases by 1 percentage point, VALUATION will increase by 1.51 percentage points showing positive correlation between customs and duties imposed and prices of Apple products.

Results of the empirical analysis indicate that BMI and Apple indices give completely different results. While BMI suggests that the most of national currencies are under valuated against the US dollar, Apple indices point to the conclusion that national currencies are over valuated against the dollar. The underlying point could be the fact that Big Mac is a nontradable good while Apple products are tradable internationally. Main determinants affecting Apple indices valuation are customs and duties and other costs opposed to BMI which is mainly influenced by non-tradable determinants.

7. CONCLUSION

This paper examines Apple products as a better solution for testing the PPP theory and approximation of the under/over evaluation of currencies than other light-hearted measures that have emerged until today. Several advantages in respect to BMI are presented, mostly regarded to its tradability, non-perishability, its compact structure and exactly the same features all around the world. Following, Apple products are more easily prone to arbitrage and would be a more proper light-hearted measure of strength of the currencies. Empirical findings point out that Apple product indices across countries show to be closer to parity in approximately 70 percent of presented cases than the BMI. Also, they give the opposing results, indicating overvaluation of dollar in most cases while the BMI points to undervaluation. Cross country OLS regression analysis pointed out to customs and duties as main determinants affecting the price deviations showing that countries level of openness to trade is the main reason for differences in prices across the world.

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Table 1 Apple products' prices (in national currencies)

Country/Product	MacBook Air 13** 256GB	MacBook Pro 15** 256GB SDD, 16 GB	iMac 27** Iris	Mac mini 1TB Fusion Drive, Iris	Mac Pro 256GB SSD, 16GB	iPad Pro 12** 256GB Wi-fi + cellular	iPad Air 2, 128 GB Wi Fi +cellular;	iPad Mini 4 128GB Wifi + cellular	iPhone 7 256 GB	Apple watch series 2, 42mm waterproof	Apple TV 4th gen 64 MB	iPod Touch 128 GB
Australia	1849 AUD	3599 AUD	3599 AUD	1579 AUD	6499 AUD	1949 AUD	889 AUD	989 AUD	1379 AUD	579 AUD	349 AUD	579 AUD
Austria	1349 EUR	2255 EUR	2599 EUR	1099 EUR	4599 EUR	1409 EUR	649 EUR	709 EUR	1119 EUR	449 EUR	229 EUR	469 EUR
Belgium	1349 EUR	2249 EUR	2629 EUR	1099 EUR	4649 EUR	1429 EUR	659 EUR	719 EUR	1129 EUR	469 EUR	229 EUR	449 EUR
Brazil	11499 BRL	18499 BRL	21999 BRL	8799 BRL	36999 BRL	10999 BRL	4199 BRL	5699 BRL	8505 BRL	3149 BRL	1749 BRL	3399 BRL
Canada	1521 CAD	2571 CAD	3149 CAD	1259 CAD	4934 CAD	1710 CAD	786 CAD	839 CAD	1217 CAD	555 CAD	282 CAD	524 CAD
China	8488 CNY	18488 CNY	16988 CNY	7188 CNY	28888 CNY	8888 CNY	4488 CNY	5188 CNY	6988 CNY	3188 CNY	1683 CNY	2988 CNY
Czech Republic	36990 CZK	73990 CZK	69990 CZK	30990 CZK	125990 CZK	38590 CZK	18190 CZK	19590 CZK	27590 CZK	12290 CZK	6490 CZK	12790 CZK
Denmark	10499 DKK	21099 DKK	19999 DKK	8799 DKK	35999 DKK	10899 DKK	5299 DKK	5599 DKK	7599 DKK	3499 DKK	1799 DKK	3499 DKK
Finland	1379 EUR	2299 EUR	2699 EUR	1129 EUR	4699 EUR	1449 EUR	669 EUR	729 EUR	1139 EUR	479 EUR	229 EUR	469 EUR
France	1349 EUR	2249 EUR	2599 EUR	1099 EUR	4599 EUR	1429 EUR	665 EUR	725 EUR	1129 EUR	449 EUR	229 EUR	489 EUR
Germany	1349 EUR	2249 EUR	2599 EUR	1129 EUR	4599 EUR	1419 EUR	659 EUR	717 EUR	1119 EUR	449 EUR	229 EUR	449 EUR
Hong Kong	8988 HKD	18588 HKD	17988 HKD	7588 HKD	31188 HKD	9488 HKD	4888 HKD	5688 HKD	8288 HKD	3088 HKD	1588 HKD	3188 HKD
Hungary	439990 HUF	879990 HUF	849990 HUF	359990 HUF	1469990 HUF	469990 HUF	226990 HUF	241990 HUF	333990 HUF	149990 HUF	76990 HUF	149990 HUF
Ireland	1379 EUR	2299 EUR	2699 EUR	1129 EUR	4699 EUR	1449 EUR	669 EUR	729 EUR	1139 EUR	479 EUR	229 EUR	469 EUR
Italy	1379 EUR	2299 EUR	2629 EUR	1129 EUR	4649 EUR	1429 EUR	659 EUR	719 EUR	1159 EUR	469 EUR	229 EUR	469 EUR
Japan	147744 JPY	257904 JPY	279504 JPY	128304 JPY	506304 JPY	158544 JPY	75384 JPY	85104 JPY	102384 JPY	44064 JPY	26784 JPY	52704 JPY
Luxembourg	1304 EUR	2175 EUR	2542 EUR	1063 EUR	4495 EUR	1382 EUR	637 EUR	695 EUR	1092 EUR	453 EUR	221 EUR	434 EUR
Malaysia	5499 MYR	11999 MYR	10399 MYR	4599 MYR	18599 MYR	5599 MYR	2599 MYR	2899 MYR	4199 MYR	1749 MYR	949 MYR	1599 MYR
Mexico	24999 MXN	55999 MXN	47999 MXN	20799 MXN	83999 MXN	25799 MXN	12499 MXN	13799 MXN	22899 MXN	8999 MXN	3999 MXN	7499 MXN
Netherlands	1349 EUR	2249 EUR	2629 EUR	1129 EUR	4649 EUR	1429 EUR	659 EUR	719 EUR	1129 EUR	469 EUR	229 EUR	449 EUR
New Zealand	2199 NZD	3999 NZD	4199 NZD	1799 NZD	7499 NZD	2179 NZD	1049 NZD	1149 NZD	1599 NZD	649 NZD	399 NZD	679 NZD
Norway	13690 NOK	24990 NOK	25990 NOK	10990 NOK	44990 NOK	13490 NOK	6590 NOK	6790 NOK	9590 NOK	4290 NOK	2249 NOK	3990 NOK
Philippines	59990 PHP	133990 PHP	118990 PHP	49990 PHP	205990 PHP	65990 PHP	32990 PHP	36990 PHP	54257 PHP	22490 PHP	11690 PHP	24990 PHP
Poland	5799 PLN	11999 PLN	10999 PLN	4699 PLN	18999 PLN	5999 PLN	2899 PLN	2999 PLN	4399 PLN	1999 PLN	999 PLN	1999 PLN
Portugal	1380 EUR	2300 EUR	2699 EUR	1134 EUR	4700 EUR	1449 EUR	669 EUR	729 EUR	1139 EUR	479 EUR	229 EUR	489 EUR
Russia	92990 RUB	189990 RUB	189990 RUB	79990 RUB	329990 RUB	106990 RUB	53990 RUB	58990 RUB	74990 RUB	36990 RUB	17990 RUB	34990 RUB
Singapore	1618 SGD	3388 SGD	3388 SGD	1348 SGD	5688 SGD	1898 SGD	888 SGD	1008 SGD	1388 SGD	588 SGD	318 SGD	588 SGD
South Korea	1490000 KRW	2990000 KRW	3090000 KRW	1250000 KRW	4890000 KRW	1550000 KRW	800000 KRW	880000 KRW	1200000 KRW	499000 KRW	243648 KRW	499000 KRW
Spain	1349 EUR	2249 EUR	2629 EUR	1099 EUR	4649 EUR	1409 EUR	649 EUR	709 EUR	1129 EUR	469 EUR	229 EUR	449 EUR
Sweden	13295 SEK	26995 SEK	24995 SEK	10995 SEK	43995 SEK	13695 SEK	6495 SEK	6895 SEK	9695 SEK	4495 SEK	2295 SEK	4495 SEK
Switzerland	1279 CHF	2699 CHF	2599 CHF	1099 CHF	4499 CHF	1399 CHF	699 CHF	799 CHF	999 CHF	449 CHF	229 CHF	449 CHF
Taiwan	38900 TWD	79900 TWD	78900 TWD	31900 TWD	132900 TWD	42900 TWD	20900 TWD	22900 TWD	32500 TWD	13500 TWD	7290 TWD	12990 TWD
Thailand	45900 THB	89900 THB	85900 THB	37900 THB	154900 THB	47900 THB	22400 THB	24900 THB	34500 THB	14900 THB	10500 THB	14500 THB
Turkey	4799 TRY	9499 TRY	9099 TRY	3899 TRY	15999 TRY	4699 TRY	2149 TRY	2349 TRY	4049 TRY	1499 TRY	829 TRY	1399 TRY
United Arab Emirates	4799 AED	9499 AED	9199 AED	3999 AED	15999 AED	4799 AED	2399 AED	2799 AED	3399 AED	1599 AED	799 AED	1599 AED
United Kingdom	999GBP	2349 GBP	1849 GBP	799 GBP	3299 GBP	1019 GBP	529 GBP	579 GBP	799 GBP	399 GBP	169 GBP	329 GBP
United States	1199 USD	2399 USD	2299 USD	999 USD	3999 USD	1229 USD	629 USD	729 USD	849 USD	399 USD	199 USD	399 USD

Source: Apple *Compass*

Table 2 Apple products' real exchange rates (January 2017)

Country / Product	MacBook Air 13** 256GB	MacBook Pro 15** 256GB SDD, 16 GB	iMac 27** Iris	Mac mini 1TB Fusion Drive, Iris	Mac Pro 256GB SSD, 16GB	iPad Pro 12** 256GB Wi-fi + cellular	iPad Air 2, 128 GB Wi Fi +cellular;	iPad Mini 4 128GB Wifi + cellular	iPhone 7 256 GB	Apple watch series 2, 42mm waterproof	Apple TV 4th gen 64 MB	iPod Touch 128 GB
Australia	1.54	1.50	1.57	1.58	1.63	1.59	1.41	1.36	1.62	1.45	1.75	1.45
Austria	1.13	0.94	1.13	1.10	1.15	1.15	1.03	0.97	1.32	1.13	1.15	1.18
Belgium	1.13	0.94	1.14	1.10	1.16	1.16	1.05	0.99	1.33	1.18	1.15	1.13
Brazil	9.59	7.71	9.57	8.81	9.25	8.95	6.68	7.82	10.02	7.89	8.79	8.52
Canada	1.27	1.07	1.37	1.26	1.23	1.39	1.25	1.15	1.43	1.39	1.42	1.31
China	7.08	7.71	7.39	7.20	7.22	7.23	7.23	7.14	8.23	7.99	8.46	7.49
Czech Republic	30.85	30.84	30.44	31.02	31.51	31.40	28.92	26.87	32.50	30.80	32.61	32.06
Denmark	8.76	8.79	8.70	8.81	9.00	8.87	8.42	7.68	8.95	8.77	9.04	8.77
Finland	1.15	0.96	1.17	1.13	1.18	1.18	1.06	1.00	1.34	1.20	1.15	1.18
France	1.13	0.94	1.13	1.10	1.15	1.16	1.06	0.99	1.33	1.13	1.15	1.23
Germany	1.13	0.94	1.13	1.13	1.15	1.15	1.05	0.98	1.32	1.13	1.15	1.13
Hong Kong	7.50	7.75	7.82	7.60	7.80	7.72	7.77	7.80	9.76	7.74	7.98	7.99
Hungary	366.96	366.82	369.72	360.35	367.59	382.42	360.87	331.95	393.39	375.91	386.88	375.91
Ireland	1.15	0.96	1.17	1.13	1.18	1.18	1.06	1.00	1.34	1.20	1.15	1.18
Italy	1.15	0.96	1.14	1.13	1.16	1.16	1.05	0.99	1.37	1.18	1.15	1.18
Japan	123.22	107.50	121.58	128.43	126.61	129.00	119.85	116.74	120,59	110.44	134.59	132.09
Luxembourg	1.09	0.91	1.11	1.06	1.12	1.12	1.01	0.95	1,29	1.14	1.11	1.09
Malaysia	4.59	5.00	4.52	4.60	4.65	4.56	4.13	3.98	4.95	4.38	4.77	4.01
Mexico	20.85	23.34	20.88	20.82	21.01	20.99	19.87	18.93	26.97	22.55	20.10	18.79
Netherlands	1.13	0.94	1.14	1.13	1.16	1.16	1.05	0.99	1.33	1.18	1.15	1.13
New Zealand	1.83	1.67	1.83	1.80	1.88	1.77	1.67	1.58	1.88	1.63	2.01	1.70
Norway	11.42	10.42	11,30	11.00	11.25	10.98	10.48	9.31	11.30	10.75	11.30	10.00
Philippines	50.03	55.85	51.76	50.04	51.51	53.69	52.45	50.74	63.91	56.37	58.74	62.63
Poland	4.84	5.00	4.78	4.70	4.75	4.88	4.61	4.11	5.18	5.01	5.02	5.01
Portugal	1.15	0.96	1.17	1.14	1.18	1.18	1.06	1.00	1.34	1.20	1.15	1.23
Russia	77.56	79.20	82.64	80.07	82.52	87.05	85.83	80.92	88.33	92.71	90.40	87.69
Singapore	1.35	1.41	1.47	1.35	1.42	1.54	1.41	1.38	1.63	1.47	1.60	1.47
South Korea	1242.70	1246.35	1344.06	1251.25	1222.81	1261.19	1271.86	1207.13	1413.43	1250.63	1224.36	1250.63
Spain	1.13	0.94	1.14	1.10	1.16	1.15	1.03	0.97	1.33	1.18	1.15	1.13
Sweden	11.09	11.25	10.87	11.01	11.00	11.14	10.33	9.46	11.42	11.27	11.53	11.27
Switzerland	1.07	1.13	1.13	1.10	1.13	1.14	1.11	1.10	1.18	1.13	1.15	1.13
Taiwan	32.44	33.31	34.32	31.93	33.23	34.91	33.23	31.41	38.28	33.83	36.63	32.56
Thailand	38.28	37.47	37.36	37.94	38.73	38.97	35.61	34.16	40.64	37.34	52.76	36.34
Turkey	4.00	3.96	3.96	3.90	4.00	3.82	3.42	3.22	4.77	3.76	4.17	3.51
United Arab Emirates	4.00	3.96	4.00	4.00	4.00	3.90	3.81	3.84	4.00	4.01	4.02	4.01
United Kingdom	0.83	0.98	0.80	0.80	0.82	0.83	0.84	0.79	0.94	1.00	0.85	0.82
United States	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1,00	1.00	1.00	1.00

Source: Author s' calculations

Table 3 Apple products' absolute parity valuation (deviations in %)

| Country / Product	MacBook Air 13** 256GB	MacBook Pro 15** 256GB SDD, 16 GB	iMac 27** Iris	Mac mini 1TB Fusion Drive, Iris	Mac Pro 256GB SSD, 16GB	iPad Pro 12** 256GB Wi-fi + cellular	iPad Air 2, 128 GB Wi Fi +cellular;	iPad Mini 4 128GB Wifi + cellular	iPhone 7 256 GB	Apple watch series 2, 42mm waterproof	Apple TV 4th gen 64 MB	iPod Touch 128 GB
Australia	13.41	10.33	15.13	16.24	19.52	16.63	3.94	-0.23	19.46	6.72	28.98	6.72
Austria	19.24	-0.38	19.81	16.59	21.88	21.50	9.35	3.07	39.68	19.26	21.95	24.57
Belgium	19.24	-0.65	21.19	16.59	23.20	23.22	11.03	4.52	40.93	24.57	21.95	19.26
Brazil	185.39	129.47	184.75	162.10	175.32	166.32	98.65	132.63	198.10	134.85	161.54	153.50
Canada	-5.63	-20.28	1.90	-6.25	-8.22	3.51	-7.04	-14.38	6.64	3.48	5.42	-2.30
China	2.72	11.82	7.21	4.40	4.81	4.93	3.53	3.26	19.43	15.93	22.71	8.66
Czech Republic	20.93	20.90	19.34	21.60	23.50	23.09	13.36	5.34	27.39	20.74	27.84	25.66
Denmark	24.72	25.27	23.90	25.45	28.22	26.31	19.99	9.39	27.48	24.90	28.76	24.90
Finland	21.89	1.56	24.42	19.77	24.53	24.95	12.72	5.98	42.18	27.23	21.95	24.57
France	19.24	-0.65	19.81	16.59	21.88	23.22	12.04	5.40	40.93	19.26	21.95	29.88
Germany	19.24	-0.65	19.81	19.77	21.88	22.36	11.03	4.23	39.68	19.26	21.95	19.26
Hong Kong	-3.35	-0.10	0.88	-2.07	0.55	-0.47	0.19	0.60	25.86	-0.22	2.88	3.01
Hungary	25.76	25.71	26.71	23.50	25.98	31.06	23.68	13.76	34.82	28.83	32.59	28.83
Ireland	21.89	1.56	24.42	19.77	24.53	24.95	12.72	5.98	42.18	27.23	21.95	24.57
Italy	21.89	1.56	21.19	19.77	23.20	23.22	11.03	4.52	44.67	24.57	21.95	24.57
Japan	10.93	-3.22	9.44	15.62	13.97	16.13	7.89	5.09	8.56	-0.58	21.16	18.91
Luxembourg	15.26	-3.92	17.18	12.77	19.12	19.17	7.33	1.04	36.31	20.32	17.69	15.27
Malaysia	4.18	13.61	2.74	4.57	5.64	3.48	-6.14	-9.67	12.34	-0.43	8.32	-8.97
Mexico	1.69	13.85	1.83	1.55	2.45	2.39	-3.08	-7.68	31.55	10.01	-1.99	-8.33
Netherlands	19.24	-0.65	21.19	19.77	23.20	23.22	11.03	4.52	40.93	24.57	21.95	19.26
New Zealand	29.37	17.58	28.83	27.02	32.27	25.06	17.64	11.18	32.85	14.73	41.43	20.04
Norway	33.30	21.61	31.98	28.43	31.34	28.14	22.31	8.74	31.87	25.52	31.94	16.74
Philippines	0.55	12.24	4.01	0.56	3.52	7.90	5.40	1.97	28.43	13.27	18.05	25.86
Poland	15.65	19.60	14.40	12.47	13.60	16.72	10.21	-1.63	23.90	19.80	20.04	19.80
Portugal	21.98	1.60	24.42	20.30	24.56	24.95	12.72	5.98	42.18	27.23	21.95	29.88
Russia	21.12	23.68	29.06	25.04	28.87	35.95	34.05	26.37	37.94	44.78	41.18	36.95
Singapore	-5.38	-0.98	3.33	-5.39	-0.27	8.28	-1.02	-3.05	14.63	3.33	12.04	3.33
South Korea	5.48	5.79	14.08	6.20	3.79	7.05	7.95	2.46	19.97	6.15	3.92	6.15
Spain	19.24	-0.65	21.19	16.59	23.20	21.50	9.35	3.07	40.93	24.57	21.95	19.26
Sweden	19.89	21.67	17.56	19.00	18.95	20.49	11.65	2.27	23.47	21.81	24.70	21.81
Switzerland	5.47	11.24	11.78	8.77	11.24	12.55	9.88	8.37	16.34	11.27	13.78	11.27
Taiwan	1,69	4.39	7.57	0.09	4.16	9.41	4.15	-1.54	19.98	6.05	14.82	2.04
Thailand	7.70	5.43	5.12	6.74	8.98	9.65	0.19	-3.90	14.33	5.06	48.45	2.24
Turkey	18.80	17.52	17.47	15.84	18.75	13.48	1.41	-4.36	41.55	11.51	23.65	4.07
United Arab Emirates	8.98	7.81	8.95	8.99	8.93	6.32	3.85	4.54	9.01	9.11	9.32	9.11
United Kingdom	3.90	22.10	0.29	-0.26	2.87	3.39	4.88	-0.96	17.36	24.70	5.90	2.82
United States	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: Author s' calculations

Table 4 Apple products' affordability (number of products per capita in one year)

| Country / Product	MacBook Air 13** 256GB	MacBook Pro 15** 256GB SDD, 16 GB	iMac 27** Iris	Mac mini 1TB Fusion Drive, Iris	Mac Pro 256GB SSD, 16GB	iPad Pro 12** 256GB Wi-fi + cellular	iPad Air 2, 128 GB Wi Fi +cellular;	iPad Mini 4 128GB Wifi + cellular	iPhone 7 256 GB	Apple watch series 2, 42mm waterproof	Apple TV 4th gen 64 MB	iPod Touch 128 GB	Apple product basket (as % of GDP pc)
Australia	34.32	21.16	17.63	40.17	9.76	32.56	71.35	64.13	46.00	109.68	182.11	109.68	36.62%
Austria	33.35	19.95	17.31	40.94	9.78	31.93	69.36	63.47	45.97	100.12	196.13	95.90	37.33%
Belgium	31.28	18.76	16.05	38.39	9.07	29.53	64.02	58.67	42.66	89.94	183.94	93.89	40.10%
Brazil	4.05	3.10	2.12	5.29	1.26	4.23	11.09	8.17	5.63	14.78	26.59	13.69	283.06%
Canada	39.83	23.56	19.23	48.12	12.28	35.41	77.07	72.25	49.77	109.06	214.07	115.60	31.94%
China	12.47	7.40	6.23	14.72	3.66	11.90	23.58	20.40	15.14	33.17	62.95	35.38	103.26%
Czech Republic	22.87	13.64	12.09	27.30	6.71	21.91	46.53	43.20	30.65	68.78	130.29	66.18	54.56%
Denmark	31.11	18.67	16.33	37.13	9.08	29.97	61.64	58.33	42.99	93.39	181.33	93.39	40.10%
Finland	28.50	17.09	14.56	34.81	8.36	27.13	58.73	53,88	39.33	81.99	171.36	83.79	43.84%
France	29.54	17.71	15.33	36.26	8.66	27.88	59.95	54.97	40.29	88.67	173.71	81.51	42.34%
Germany	33.58	20.14	17.43	40.12	9.85	31.91	68.74	63.16	46.29	100.82	197.50	100.82	37.15%
Hong Kong	50.17	29.49	25.06	59.40	14.46	47.50	92.21	79.26	62.74	145.97	283.39	141.35	25.77%
Hungary	17.96	10.83	9.30	21.96	5.38	16.82	34.84	32.67	23.66	52.73	102.68	52.73	69.58%
Ireland	47.29	28.36	24.16	57.76	13.88	45.02	97.44	89.40	65.26	136.03	284.32	139.03	26.42%
Italy	24.75	14.85	12.98	30.24	7.34	23.89	51.80	47.47	33.50	72.77	148.83	72.77	50.03%
Japan	29.99	20.64	15.86	34.54	8.75	27.96	58.75	52.07	43.31	100.50	165.51	84.00	41.10%
Luxembourg	73.44	44.05	37.70	90.21	21.32	69.34	150.35	137.75	100.23	211.49	431.93	220.64	17.07%
Malaysia	22.29	14.29	11.68	26.42	6.53	21.70	46.71	41.90	28.94	69.48	127.86	75.86	55.28%
Mexico	15.32	8.33	7.98	18.40	4.56	14.84	30.62	27.74	19.06	42.58	95.76	51.12	82,64%
Netherlands	35.43	21.25	18.18	42.34	10.28	33.45	72.53	66.47	48.33	101.90	208.39	106.37	35.46%
New Zealand	23.29	15.76	12.19	28.46	6.83	23.50	48.83	44.55	32.02	78.95	128.40	75.42	52.04%
Norway	42.18	26.86	22.21	52.54	12.83	42.80	87.61	85.03	60.21	134.56	256.65	144.67	28.43%
Philippines	6.41	3.50	3.23	7.70	1.87	5.83	11.66	10.40	7.09	17.10	32.89	15.39	206.53%
Poland	19.45	11.87	10.26	24.00	5.94	18.80	38.93	37.60	25.64	56.45	113.12	56.45	63.20%
Portugal	19.42	11.65	9.93	23.64	5.70	18.50	40.05	36.75	26.83	55.91	116.87	54.84	64.38%
Russia	16.09	9.18	7.87	18.70	4.53	13.98	27.72	25.35	19.95	40.42	83.15	42.73	82.96%
Singapore	76.45	44.36	36.50	91.76	21.74	65.13	139.33	122.65	89.13	210.34	388.76	210.34	17.39%
South Korea	29.08	18.13	14.02	34.66	8.86	27.96	54.21	49.22	36.11	86.84	178.16	86.84	43.34%
Spain	25.40	15.23	13.03	31.18	7.37	24.32	52.83	48.34	34.65	73.05	149.39	76.26	49.26%
Sweden	33.30	20.12	17.71	40.26	10.06	32.32	68.15	64.18	45.66	98.57	192.55	98.57	36.90%
Switzerland	46.42	27.63	22.85	54.03	13.20	42.44	84.94	74.31	59.44	132.24	259.28	132.24	28.04%
Taiwan	37.78	23.00	18.62	46.08	11.06	34.26	81,55	64.15	45.21	108.86	201.65	113.25	33.79%
Thailand	12.84	7.87	6.86	15.55	3.80	12.30	26.31	23.68	17.07	39.52	56.12	40.67	96.58%
Turkey	16.17	9.66	8.53	19.91	4.85	16.52	36.09	33.04	19.17	51.83	93.57	55.50	75.77%
United Arab Emirates	51.76	31.46	27.00	62.11	15.53	51.76	103.51	88.72	73.11	155.27	310.53	155.27	23.87%
United Kingdom	34.04	17.91	18.40	42.56	10.31	33.37	64.32	58.72	42.56	85.20	201.49	103.44	37.25%
United States	47.78	28.66	24.92	57.35	14.33	46.62	91.09	78.59	67.48	143.59	287.91	143.59	26.06%

Source: Author s' calculations

Figure 1 Apple products' prices and GDP per capita (January 2017)
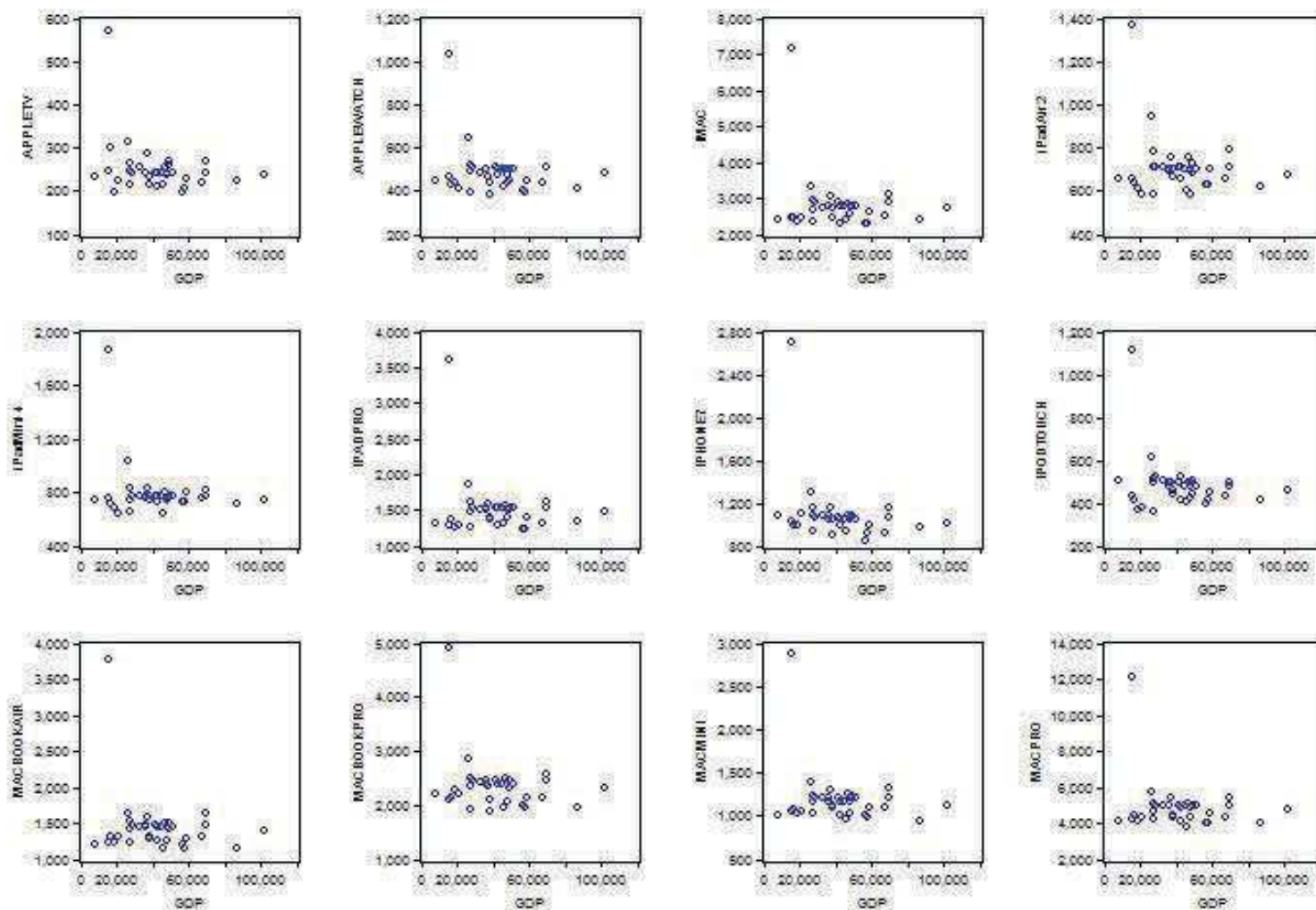
Source: Author s' calculations

Figure 2 Apple products' valuation and customs (January 2017)
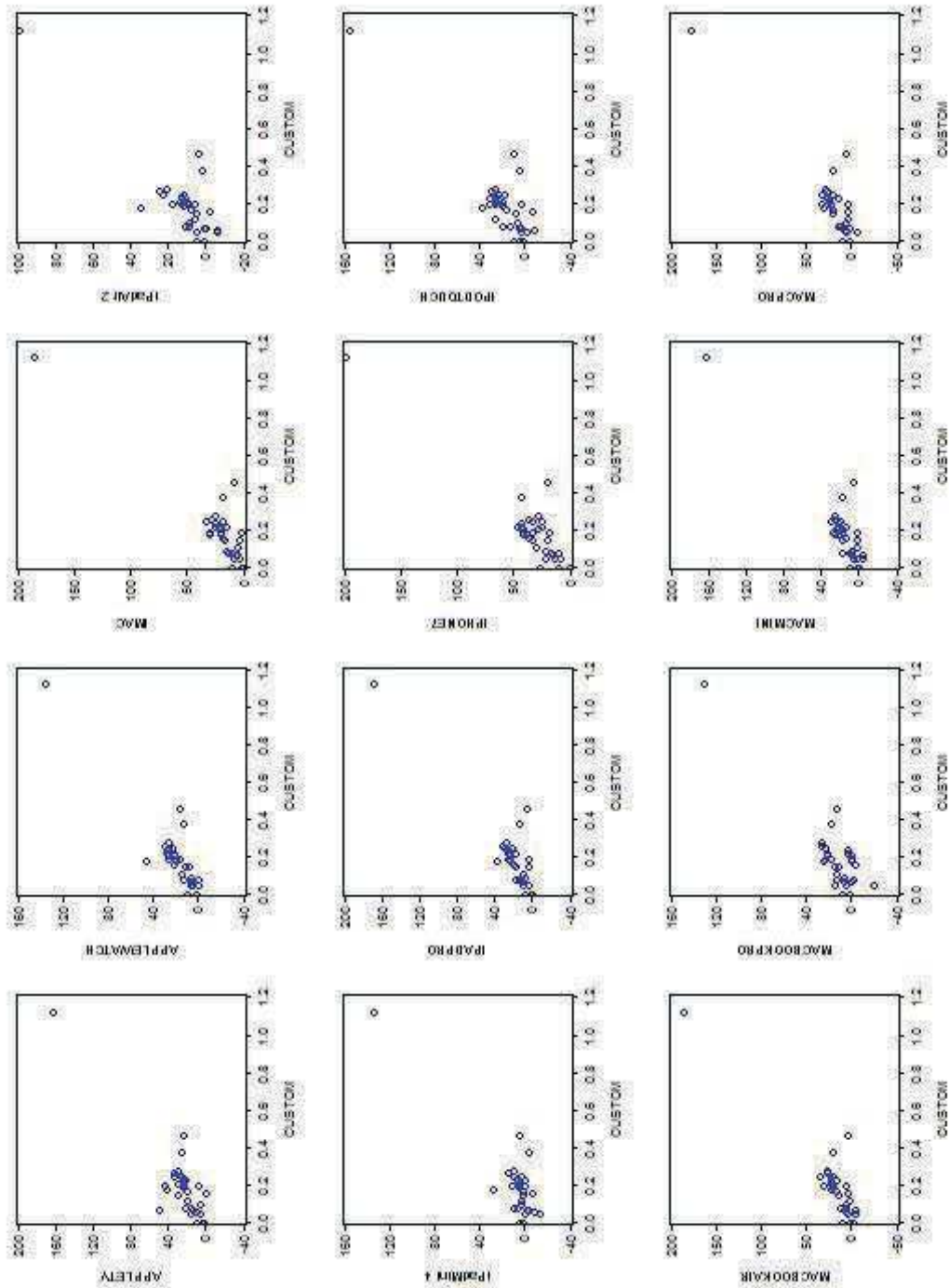
Table 5 Currency valuation comparison between BMI and average Apple index (January 2017)

Country	Average Apple product's valuation (in%)	Big Mac valuation (in%)	Closest to PPP	Equal signs
Australia	13.07	-15.5	Apple	N
Austria	18.04	-29.7	Apple	N
Belgium	18.75	-18.3	BM	N
Brazil	156.89	1.1	BM	Y
Canada	-3.60	-10.9	Apple	Y
China	9.12	-44.1	Apple	N
Czech Republic	20.81	-42.6	Apple	N
Denmark	24.11	-16.5	BM	N
Finland	20.98	-5.9	BM	N
France	19.13	-15.2	BM	N
Germany	18.15	-21.6	Apple	N
Hong Kong	2.31	-51.1	Apple	N
Hungary	26.77	-39.6	Apple	N
Ireland	20.98	-17.2	BM	N
Italy	20.18	-13.1	BM	N
Japan	10.32	-35.6	Apple	N
Luxembourg	14.80	-18.95	Apple	N
Malaysia	2.47	-64.6	Apple	N
Mexico	3.69	-55.9	Apple	N
Netherlands	19.02	-25.3	Apple	N
New Zealand	24.83	-17.3	BM	N
Norway	25.99	12.0	BM	Y
Philippines	10.15	-47.0	Apple	N
Poland	15.38	-54.5	Apple	N
Portugal	21.48	-36.9	Apple	N
Russia	32.08	-57.5	Apple	N
Singapore	2.40	-23.1	Apple	N
South Korea	7.42	-27.3	Apple	N
Spain	18.35	-18.3	BM	N
Sweden	18.61	4.0	BM	Y
Switzerland	11.00	25.5	Apple	Y
Taiwan	6.07	-57.3	Apple	N
Thailand	9.17	-33.9	Apple	N
Turkey	14.97	-45.7	Apple	N
United Arab Emirates	7.91	-30.1	Apple	N
United Kingdom	7.25	-26.3	Apple	N
Average valuation	18.58%	-27.83%	Apple 69.44%, BM 30.56%	Yes 13.88%, No 86.12%

Source: Author s' calculations

Table 6 Cross-country OLS regression for Apple products (January 2017)

Dependant variable VALUATION	Product					
Independent variables	MacBook Air	iPhone7	Apple TV	Apple Watch	iPod Touch	iPad Pro
Constant	-13.56653 (16.51516)	-2.07931 (17.40354)	-3.181729 (15.72860)	8.82965 (11.87814)	3.64979 (16.75501)	-5.91595 (15.65192)
CUSTOM	1.50435*** (0.15094)	1.51896*** (0.15906)	1.22701*** (0.14375)	1.01661*** (0.10856)	1.12531*** (0.15313)	1.29152*** (0.14305)
GDP	0.00018 0.00012	0.00013 (0.00013)	4.29E-05 0.00012	5.86E-05 (9.13E-05)	6.03E-05 (0.00012)	0.00016 (0.00012)
DISTANCE	-0.00032 (0.00108)	-6.24E-05 (0.00113)	0.00055 (0.00103)	-0.00118 (0.00077)	-0.00086 (0.00109)	-0.00041 (0.00102)
EUDummy	-6.57854 (6.71107)	-1.99338 (7.07207)	-7.50432 (6.39144)	-2.69255 (4.82678)	-3.66186 (6.80853)	-5.70905 (6.36028)
NAFTADummy	-5.19208 (14.5016)	-1.14234 (15.2817)	-6.71656 (13.81098)	-12.35160 (10.42997)	-16.44944 (14.71225)	-7.36806 (13.7436)
Adjusted R-squared	0.79793	0.78346	0.75195	0.80732	0.71219	0.76604
S.E. of regression	13.50855	14.23519	12.86518	9.71570	13.70473	12.80246
Prob. (F-statistic)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Mean dependent variable	17.98896	32.26649	23.90953	19.44275	18.46446	20.27153
S.D. dependent variable	30.05138	30.59109	25.83164	22.13385	25.5458	26.46841
Akaike info criterion	8.19191	8.29670	8.09432	7.53275	8.22075	8.08454
Durbin -Watson stat	2.46454	1.93333	2.53024	2.21759	2.43285	2.35661
Observations	37	37	37	37	37	37

Source: Authors' calculations

OLS estimates show White heteroskedasticity- consistent standard errors and covariances; t-statistics in parentheses; significant at the 1 percent level: ***, at the 5 percent level: **, at the 10 percent level: *.