



Investigation the Correlation between Purchasing Power Parity, Per Capita Gross Domestic Product and the Price Level Indices with Panel Data Analysis: Evidence from New Zealand, USA, Germany, Canada and Turkey

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Received: 07 August 2018

Accepted: 13 October 2018

DOI: <https://doi.org/10.32479/ijefi.6889>

ABSTRACT

Variables such as an economy purchasing power parity (PPP), per capita real gross domestic product (GDP) and price level index are defined as the most important indicators of wealth. The PPP is a real variable. It shows the goods and services that people can buy with their existing incomes. Per capita income is obtained usually in 1 year period, in a country by dividing the total income to the country's population. Price level indices are indicative of the general price profile of countries. It is suggested in the literature that per capita GDP and price levels are indicators that affect PPP. Acting on this assumption, It is intended to be tested the relationship between PPP and per-capita real GDP and price level indices by using annual data from 2005 to 2016 year for Turkey, Canada, New Zealand, Germany and US economy. Panel data analysis is used for this purpose. According to the results of the research, there is no relation between PPP and real GDP and price levels.

Keywords: USA, Canada, Germany, Turkey, New Zealand, PPP, Per Capita Real Gross Domestic Product, The Price Level Index, Panel Data

JEL Classifications: C4, E01, E31

1. INTRODUCTION

In the literature, the purchasing power parity (PPP) is defined as a variable that removes the price level differences between countries (EUROSTAT, 2016). The PPP expresses the amount of goods and services that individuals can purchase. It is usually specified in US dollars. Thus, on the one hand, the buying power of the inhabitants of the country is measured and on the other hand it is possible to compare with other countries. Similarly, the per capita gross domestic product (GDP) measures the income levels of people living in a country. So in real terms it is an indication of whether the income has increased or not. With the price level index, the exchange values of goods and services subject to purchase and sale are followed. Thus, the purchasing power of money becomes measured.

The level of income per capita along with the capitalist economy has been a sign of economic prosperity. Actually, this is not very realistic. This is a situation that totally represents the average. In a given society, the division of the ages of the various age groups into the number of individuals in the society gives the general average age of the society, but in reality this does not make the oldest member of the society young, nor does the adult in the armed family. The actual person is his or her age, and the person is exposed to the distress that he or she brings to that age. This is the case in the economy. However, in the PPP, the situation is completely different. Because it is a situation that reflects almost all the parts of this society that relate to reality. It is obvious that the income is subjective. One side is very scraped while the other is scarce. However, the price of goods and services is unchanged from the unobservable level of income in which the purchasing power is the same which is high.

Mainly from Turkey in this context, Germany, Canada, New Zealand career, and purchasing power per person with parity using annual data from 2005 to 2016 year for the US economy GDP was asked yield and tested relations between the price level index. Panel data analysis was used in the study. Unit root test was first performed and the series were tested for stationarity and non-stationary series differences were taken and stabilized. The study was carried out using the Hausman test technique. In this context, fixed and random effects models are used. The H_0 hypothesis was accepted by comparing the value of significance level obtained by the Hausman test with the value of the table (0.05). So there is a random effect in our model. The model was estimated with random effects. Accordingly, there was no correlation between the GDP and the real GDP and price level index.

2. LITERATURE REVIEW

Leo and Kanbur (2007) using a statistical model for the 1982–2005 period has examined the course of PPP in Turkey. According to a survey of PPP for the period specified in Turkey it was found to be valid.

Akçay and Filiz (2015) investigated the validity of the PPP theory in the countries defined as G7 in 1995–2012 using panel data technique. At the end of the examination, the PPP theory is reached that it is not valid in the G7 countries.

Pazarlıoğlu and Güloğlu (2007) in the 1987–2005 period inside Turkey, and tested per the monetarist approach using long-term relationship between the US Dollar. Model money supply was made using variables such as relative interest rate, relative income and relative price level. The PPP and the non-guaranteed interest parity are also included in the analysis. As a result of the research, the Monetarist model supports the purchasing power hypothesis and the non-guaranteed interest hypothesis.

Sağlam and Sonmez (2017) tested using the panel data analysis for the BRICT countries of the PPP hypothesis. Nominal exchange rate and consumer price index variables, which are components of real exchange rate in the study, are also included in the analysis. According to this, the PPP hypothesis in BRICT countries is invalidated.

Gilbert and Irving (1954) in their study of the US, Germany, France, Italy and UK economies, the PPP found a positive relationship between the exchange rate and per capita GDP.

Atasoy (2016) the augmented Dickey-Fuller test tested the validity of the PPP over the overall level of prices. Research; Brazil, India, South Africa, Turkey and Indonesia in May 1996–December 2013 was conducted using monthly data. According to the PPP, India, Brazil, South Africa and Turkey it is not available. It only applies in Indonesia. This conclusion implies a long-term relationship between exchange rates and inflation rates in Indonesia.

Basher and Silvestre (2009) the 1918–2005 period tested the relationship between PPP and price changes using annual price data for seventeen US cities. According to the results of the

empirical analysis, the results of qualitative support were obtained between the two variables.

Rawlins (2013) he conducted an empirical analysis of long-term PPP relations between South Africa and the five developed countries that he traded with (USA, UK, France, Germany, Japan). Accordingly, for all countries outside Japan, there is definite weak evidence to support the PPP hypothesis. One of the reasons for this is the view that there may be continuous increases in the overall level of prices in South Africa.

İlter (2016) he tested the relationship with 12 independent variables, dependent on real GDP per capita. In the analysis that one of the independent variables is PPP, there was no correlation between per capita real GDP and PPP.

3. METHOD AND DATA SET

3.1. Method

“Panel data analysis is used” in the study. Unit root test was first performed and the series were tested for stationarity and non-stationary series differences were taken and stabilized. The study was carried out using the Hausman test technique. In this context, fixed and random effects models are used. The hypothesis was determined by comparing the value of significance level obtained by the Hausman test with the value of Table (0.05).

3.2. Panel Data Analysis

The panel analyzes the data models, horizontal section and/or time series effects. These effects can be fixed and/or random. While fixed effects assume the relationship between individual group/time and explanatory variables in the regression equation, random effects are rejected between individual group/time explanatory variables (Park, 2010).

With the fixed effect model, all of the observation values are combined. The horizontal section values are then subtracted from the average. Accordingly, a corrected model estimate is made. By random effects model, a constant term of all horizontal section values is modeled randomly by taking a population (Kutlar, 2017).

In the panel data analysis, when the horizontal section data is analyzed in equal time period, the balanced panel data is analyzed as the unbalanced panel data model when it is examined in different time periods. In general terms the panel data regression equation is as follows (Gujarati, 2004);

$$Y_{it} = \beta_1 + \beta_2 X_{2it} + \beta_3 X_{3it} + u_{it} \quad (1)$$

In the equation, i is the horizontal cross-sectional data, and t is the time-varying data. One of the tests used to determine a suitable model for panel data analysis is the Hausman test. With this test it is determined which of the fixed or random effect models is to be used or not (Karlsson, 2014).

The equation of the fixed effect model is (Oscar, 2007);

$$Y_{it} = \beta_1 X_{it} + \alpha_i + e_{it} \quad (2)$$

- $\alpha_i (i = 1, n)$ is the unknown intersection point for each entity
- Y_{it} , $i =$ horizontal and $t =$ time dependent variable.
- X_{it} represents an independent variable
- β_1 is the coefficient of the independent variable
- The same is the term error (Oscar, 2007).

Random effects models are also described as multilevel or mixed models Clarke et al. (2010). The equation of the model is as follows (Lipps and Kuhn, 2016);

$$Y_{it} = \alpha + \beta_1 x_i + \beta_2 x_i + \alpha_i + \varepsilon_{it} \quad (3)$$

- α_i : Residual piece of stable individual characteristics that can not be observed.

3.3. Data Set

The indicators related to the purchasing power component are (TUIK, 2008);

- Real GDP
- Real GDP per capita
- Volume index
- Volume index per capita
- Price level index (TUIK, 2008).

Per capita income and PPP and price level indices relations: Turkey, USA, Canada, Germany, has asked to be tested by New Zealand career on panel data analysis.

Variables;

- PPP (dependent)
- Reel GDP (per person GDP) (independent)
- Price index (independent).

Panel data analysis was done using Eviews 9.0 package program.

This indicator moving from Turkey, Canada, New Zealand, Germany and the purchasing power per person with parity using annual data from 2005 to 2016 year for the US economy in Real GDP and price levels to test the relationship between It was requested. The data are taken from the Organisation for Economic Co-operation and Development website (Table 1).

4. EMPIRICAL RESULTS

Model Hausman technique. The Hausman technique is a useful tool for predicting the estimation method to be used in the model (Greene, 2012) (Tables 2-4).

Table 1: PPP by Countries, GDP per capita, price level index

PPP values by Country, US Dollars=1.00												
Turkey	0.83	0.84	0.85	0.88	0.90	0.92	0.97	1.02	1.07	1.10	1.20	1.30
Canada	1.21	1.21	1.21	1.23	1.20	1.22	1.24	1.24	1.22	1.23	1.25	1.25
Germany	0.87	0.85	0.84	0.82	0.81	0.80	0.79	0.79	0.77	0.77	0.78	0.78
New Zealand	1.54	1.48	1.51	1.49	1.47	1.50	1.49	1.50	1.45	1.44	1.46	1.47
USA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Real GDP per capita by country PPP, US Dollars=1.00												
Turkey	11.773	13.498	14.713	15.901	15.330	17.281	19.517	20.549	22.314	24.159	25.112	25.655
Canada	36.213	38.010	39.442	40.278	38.791	40.027	41.565	42.145	44.098	45.508	44.627	44.793
Germany	32.414	34.754	37.018	38.663	37.689	39.955	42.693	43.564	45.232	47.092	47.811	48.859
New Zealand	25.590	27.685	29.309	29.782	30.591	31.177	32.667	32.912	36.024	37.036	37.206	38.346
USA	44.237	46.369	47.987	48.330	46.930	48.303	49.719	51.388	52.726	54.651	56.420	57.591
Price level indices by country OECD - Total=100												
Turkey	61	59	63	64	57	60	55	56	57	54	52	51
Canada	98	106	108	109	103	116	119	123	121	115	111	109
Germany	106	106	110	113	110	104	104	100	104	105	97	98
New Zealand	106	96	106	98	90	105	112	119	120	123	114	115
USA	98	100	96	94	98	98	95	99	102	103	113	113

Source: Organisation for Economic Co-operation and Development (OECD), www.oecd.org. PPP: Purchasing power parity

Table 2: Pooled forecast results

Dependent variable: PPP?				
Method: Pooled least squares				
Sample: 2005–2016				
Included observations: 12				
Cross-sections included: 5				
Total pool balanced observations: 60				
Variable	Coefficient	SE	t-Statistic	P
GDP?	-0.011935	0.004883	-2.444194	0.0176
PL?	0.015371	0.001903	8.077375	0.0000
R ²	-0.445814	Mean dependent variable		1.088167
Adjusted R ²	-0.470742	SD dependent variable		0.255525
SE of regression	0.309886	Akaike info criterion		0.527542
Sum squared residual	5.569708	Schwarz criterion		0.597353
Log likelihood	-13.82625	Hannan-Quinn criterion		0.554849
Durbin-Watson stat	0.179430			

PPP: Purchasing power parity

Table 3: Random effect test is required before going to the Hausman test. “Random” results in the “cross-section” section for the random impact test

Dependent variable: PPP?				
Method: Pooled EGLS cross-section random effects				
Sample: 2005–2016				
Included observations: 12				
Cross-sections included: 5				
Total pool balanced observations: 60				
Swamy and Arora estimator of component variances				
Variable	Coefficient	SE	t-Statistic	P
C	1.078452	0.252523	4.270713	0.0001
GDP?	0.005901	0.003629	1.626121	0.1094
PL?	-0.002147	0.002226	-0.964522	0.3389
Random effects cross				
_TURKIYE--C	-0.008534			
_CANADA--C	0.115690			
_GERMANY--C	-0.341674			
_NEW ZEALAND--C	0.391349			
_USA--C	-0.156831			
Effects specification				
Cross-section random			SD	Rho
Idiosyncratic random			0.271655	0.8406
			0.118286	0.1594
	Weighted statistics			
R ²	0.048916	Mean dependent variable		0.135712
Adjusted R ²	0.015544	SD dependent variable		0.119550
SE of regression	0.118617	Sum squared residual		0.801987
F-statistic	1.465794	Durbin-Watson stat		1.078324
P F-statistic	0.239466			
Unweighted statistics				
R ²	-0.182604	Mean dependent variable		1.088167
Sum squared residual	4.555744	Durbin-Watson stat		0.189827

PPP: Purchasing power parity

Table 4: Hausman test results

Correlated random effects - Hausman test pool: POOL01 test cross-section random effects				
Test summary	Chi-square statistic	Chi-square. d.f.	P	
Cross-section random	2.318927	2	0.3137	
Cross-section random effects test comparisons				
Variable	Fixed	Random	Variable different)	P
GDP?	0.006889	0.005901	0.000001	0.3033
PL?	-0.002513	-0.002147	0.000001	0.6135
Cross-section random effects test equation:				
Dependent variable: PPP?				
Method: Panel least squares				
Sample: 2005 2016				
Included observations: 12				
Cross-sections included: 5				
Total pool balanced observations: 60				
Variable	Coefficient	SE	t-Statistic	P
C	1.077416	0.2397393	4.494123	0.0000
GDP?	0.006889	0.003754	1.835290	0.0721
PL?	-0.002513	0.002341	-1.073437	0.2879
Effects specification				
Cross-section fixed idummy variables				
R ²	0.807502	Mean dependent variable		1.088167
Adjusted R ²	0.785710	SD dependent variable		0.255525
SE of regression	0.118286	Akaike info criterion		-1.322136
Sum squared residual	0.741558	Schwarz criterion		-1.077796
Log likelihood	46.66408	Hannan-Quinn criterion		-1.226561
F-statistic	37.05469	Durbin-Watson stat		1.178778

P F-statistic: 0.000000

The probability of output (Prob.) Significance level given in Table 4 and the “Table value 0.05” compared. In our example; Probe. = 0.3137 >0.050, the H0 hypothesis can be accepted. That is to say, there is a random effect. In this case, to predict the model with random effect is necessary. There is no relationship between per capita real GDP and Price Level Index and PPP, as GDP (0.1094) and FD (0.3389) values are >0.05 based on the random effect model result.

5. CONCLUDING REMARKS

New Zealand, Turkey, Canada, Germany and for the US economy the relationship between the purchasing power per person with parity real GDP and price level indices using annual data from 2005 to 2016 year, has been tested using panel data analysis. According to this, there is no relation between PPP and Real GDP and price levels. That may be the reason; PPP is absolute, unchanged person. However, both the real GDP and the prices general level calculations are totally average. Not objective, subjective. In other words, everyone has a simple income of their own and a price level of their goods (inflation). We can compare it to the way we include a 30-year-old 80-year-old whose age is between 21 and 22 and the average age is 21.6. The average age is 23.5. However, this figure does not change the actual ages of the 80-year-old and others. Therefore, this situation must be taken into consideration in order to make the calculations more realistic. Thanks to the developing communication and technology, it can easily be determined how much income and how much is spent. Thus, the consequences can be referred to in terms of the real dimensions of economic prosperity. Accordingly, necessary improvements can be made.

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