EMPIRICAL STUDY OF PURCHASING POWER PARITY: THE BALASSA-SAMUELSON EFFECT IN INDONESIA

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ABSTRACT

This study empirically investigate the Balassa-Samuelson theory through the analysis of the long-term relationship of the differences effect in productivity on the exchange rate deviation from Purchasing Power Parity (PPP) using the Panel Dynamic Ordinary Least Squares (POLS) method. The data used is panel data with cross-sectional data from 4 of Indonesia's largest trading partners, namely the United States, Japan, Korea, Singapore and the time series data from the year 1967 to 2015. The result is that there is a long-term relationship between differences in productivity to the exchange rate deviation from PPP in Indonesia.

Keywords: Balassa-Samuelson effect, PDOLS, real exchange rate, real GDP per capita, ratio of trade balance to GDP

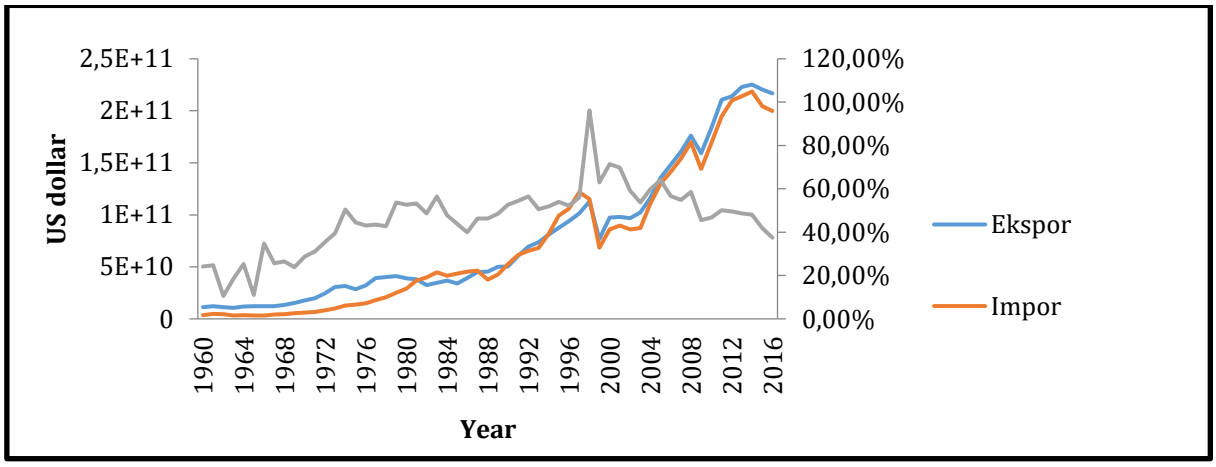
1. Introduction

Purchasing Power Parity (PPP) is a concept regarding the formation of exchange rates. PPP states that the value of exchange rate between currencies of two countries is equal to the ratio of the price levels in those two countries. This shows that the decline in the purchasing power of the domestic people (shown by the increase in domestic commodity prices) is associated with a proportional depreciation of currency values in the foreign exchange market. Conversely, an increase in the purchasing power of domestic people (shown by a decrease in domestic commodity prices) is proportionally related to the appreciation of currency values in the foreign exchange market (Krugman, 2012). Research on PPP has started since the 16th century in Spain. PPP entered Switzerland, France and England in the 19th century pioneered by the Bullionists. Classical economists began to contribute to PPP theory in the 19th century, for example Viner (1937), Schumpeter (1954), Holmes (1967) and Officer (1984).

However, in its development, several researchers found that the PPP hypothesis was empirically inappropriate or not valid. Aizenman (1984) states that the PPP approach cannot be tested satisfyingly without considering transportation costs and commodity arbitrage costs. Therefore, the PPP hypothesis test in the presence of transportation costs will lead to insignificant results. Aizenman (1985) also stated that apart from transportation costs there are other factors that can affect PPP deviation, namely the level of substitution between domestic and foreign commodities.

In further development of PPP theory, Balassa and Samuelson (1964) stated that what affects long-term PPP deviations is international productivity differences and their effects on wages and prices of goods. This assumption is proven by several researchers and the results are significant. Lothian

and Taylor (2008) examined the impact of Ballasa-Samuelson for a period of two centuries in 3 countries, namely America, France and England. The result is that the Ballassa-Samuelson effect significantly affects PPP deviation in the long term. In addition, Chong et al (2012) studied using country group panel data and investigated the Ballasa Samuelson effect in influencing PPP in the long term, the result was that there was an adjustment for PPP deviation in the long term, but in the short term it was not explained in the results. Thus, the Balassa-Samuelson theory has been proven empirically for countries with open economies.

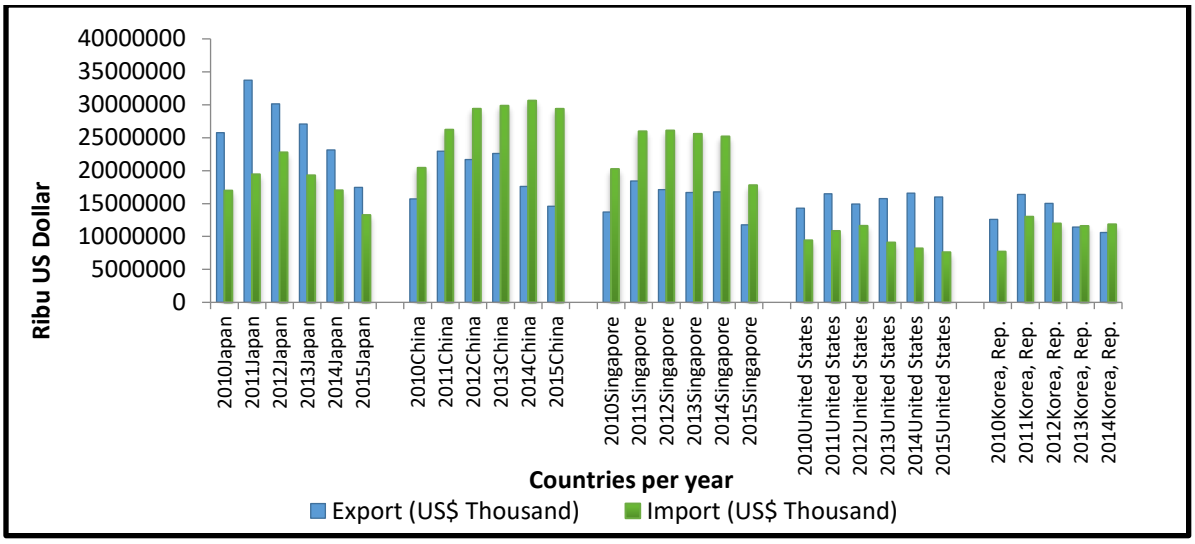


Source: World Bank Data

Figure 1. Export, Import and Trade Percentage to GDP in Indonesia (1960-2016)

Indonesia is an open economy country, this can be seen in Figure 1. Figure 1 shows the total value of Indonesia's exports and imports to the world from 1960 to 2016 as well as the percentage value of trade's contribution to Indonesia's Gross Domestic Product (GDP). The trend of Indonesia's export and import values which have continued to increase since 1960 shows that Indonesia's level of openness to international trade is positive and high. This is supported by the value of the contribution of trade to Indonesia's GDP which has also increased from 1960 to 2015. The existence of economic linkages between Indonesia and the economies of world countries through trade means that it is important to know the impact of these linkages on the domestic economy, especially exchange rates.

To be able to see this, it can be seen through the relationship between Indonesia and its partners in international trade. Figure 2 shows Indonesia's relationship with Indonesia's 5 largest partner countries (Japan, China, Singapore, United States and South Korea) in exports and imports. In 2010-2015 it is seen that Japan is the largest partner in exports followed by China, Singapore, the United States and South Korea. From an import perspective, China is the largest importer to Indonesia, followed by Singapore, Japan, South Korea and the United States. In general, the movement of Indonesia's exports fluctuates as well as imports. When viewed from a trade balance perspective, Indonesia's trade balance with Japan, America and Korea showed positive results, while China and Singapore had negative results as shown by the large value of imports compared to exports.



Source: WITS

Figure 2. Indonesia's export and import value with top 5 trading partner countries (US$ Dollar)

Choosing the 4 largest partner countries in Indonesia, namely Japan, Singapore, United States and South Korea (China is not included due to limited data), we want to investigate the validity of the PPP theory, using the Balassa-Samuelson model which relates to differences in productivity between countries with the assumption that an economy produces two types of goods, namely traded and non-traded. This study analyzes bilateral relations between the two countries starting in 1967-2015 with reference to (Bordo et al. 2017) a measure of the productivity of trade in goods using the difference in per capita income between the country of origin (Indonesia) and partner countries while for measuring the Balassa-Samuelson Effect is using the real exchange rate.

2. Literature Review and Theory

2.1 Literature Review

Lothian (2008) examined the impact of Harrod-Balassa-Samuelson (HBS) on real exchange rates in the United States, Britain and France during the period 1820 to 2001. Tests were conducted for Sterling against the Dollar and Sterling against the Franc. Lothian uses a nonlinear framework, namely the Exponential Smooth Transition Autoregressive model which has been used in previous studies with the same topic. Productivity variables are tested using real per capita GDP proxies. As a result, there is a statistically significant HBS effect for the Sterling real exchange rate against the Dollar. However, there is no statistically significant HBS effect for the Sterling real exchange rate against the Franc. Lothian said that the absence of an HBS effect was due to the parallel relationship between industrial development in England and France.

In line with Lothian's study, Chong et al. (2012) empirically tested the Harrord-Balassa-Samuelson theory in 21 countries around the world during the 1973-2008 period. The method used is the cointegration test. Chong tests whether there is a long-run relationship between productivity and the real exchange rate. Empirically, Chong finds that the HBS hypothesis is not rejected, and there is an adjustment towards equilibrium in the long run.

Bordo et al. (2017) examined the impact of productivity on real exchange rates in the long run (1880 to 1997) in 14 countries using the Group Mean and Panel Dynamics Ordinary Least Squares methods. Bordo tested the Balassa Samuelson effect on various exchange rate regimes, namely the gold standard (1880-1930), world war (1914-1945), Bretton Woods (1946-1971), and controlled floating (1972-1997). The coefficient estimation results show that the magnitude varies between regimes. The coefficient value on the gold standard is small and positive, namely below 0.25; negative coefficient values during the world war era, namely between -0.17 to -0.42; coefficient values range from negative to positive in Bretton Woods, namely -0.33 to 0.12; and positive and high coefficient values in the controlled floating regime, namely 0.2 to 1.18.

2.2 Purchasing Power Parity (PPP)'s Theory

The PPP theory was first discovered in the writings of British economists in the 19th century. PPP was elaborated and reused by an economist from Sweden named Gustav Cassel to estimate the value of the equilibrium exchange rate during the first world war era (20th century) (Krugman, 2012). There are two types of PPP, namely Absolute PPP and Relative PPP.

2.3 Absolute Purchasing Power Parity

The Absolute PPP theory says that the exchange rate equilibrium level between the two countries' currencies is equal to the ratio of the price levels in the two countries (Salvatore, 2013). This can be written in the following equation:

$$E_{Domestic/Foreign} = \frac{P_{Domestic}}{P_{Foreign}}$$

$E_{Domestic/Foreign}$ = exchange rate value between domestic currency against foreign currency
$P_{Domestic}$ = domestic price level
$P_{Foreign}$ = foreign price level

2.4 Relative Purchasing Power Parity

The Relative PPP theory says that the magnitude of changes in exchange rates over a period of time will be proportional to the relative changes in price levels in the two countries during that period (Salvatore, 2013). This can be written in the following equation:

$$E_{Domestic/Foreign} = q_{Domestic/Foreign} \times \frac{P_{Domestic}}{P_{Foreign}}$$

$q_{Domestic/Foreign}$ = real exchange rate value between domestic currency against foreign currency

2.5 Balassa-Samuelson Effect

The theory of Balassa-Samuelson (1964) assumes that the labor force in poor countries are generally less productive than the labor force in rich countries in tradeable sectors (goods can be

traded between countries). However, differences in productivity between countries in the non-tradeable sector are ignored. There is an assumption that the prices of goods traded between countries are the same in all countries, unless labor productivity is lower in the tradable sector in poor countries. This results in relatively lower domestic wages, lower domestic production costs in the non-tradeable sector and relatively lower prices in the non-tradeable sector (Krugman, 2012). The Balassa-Samuelson theory is an argument from an empirical test of the relative theory of PPP which is not proven (Salvatore, 2013).

3. Research Methodology

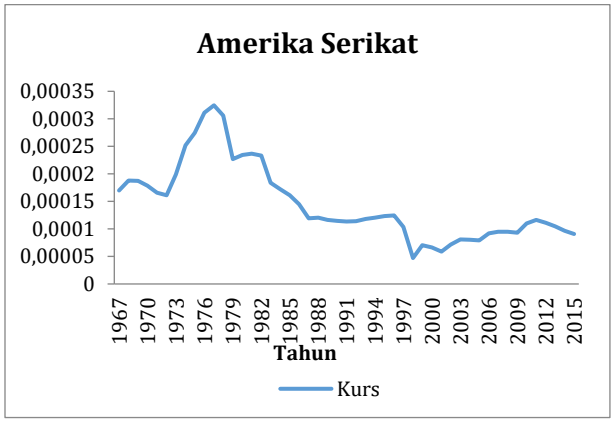
This study uses the panel data long-term relationship analysis method, which is based on the previously discussed theory and literature regarding the Balassa-Samuelson theory. The test used is the panel data cointegration test, testing the long-term relationship between differences in state income and the real exchange rate of the two countries and the trade balance variable as the control variable. Referring to research by Bordo et al. (2017), then the long-term relationship for panel data can be specified as follows:

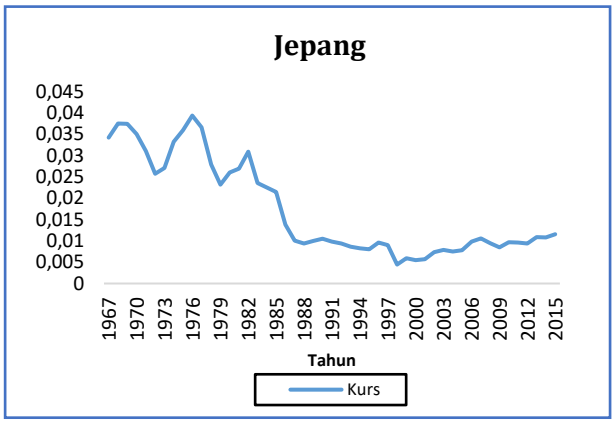
$$\ln q_{ci,t} = \alpha_0' + \alpha_1 \left(lny_{c,t} - lny_{it,t}\right) + lntb_{c,t} + e'_{c,t} \ldots. (1)$$

In estimating we uses Indonesia as the destination country (i), and trading partner countries with the notation c. Where $q_{ci,t}$ is real exchange rate between Indonesia and the trading partner country. $y_{c,t}$ is per capita income of the trading partner country. $y_{i,t}$ is per capita income of Indonesia, $lntb_{c,t}$ is the trade balance between country c and Indonesia; t means t period and last $e_{c,t}$ is error term.

4. Results

Plot is used to show the pattern of the variables q, y-y* and tb in Indonesia's four largest trading partner countries, namely the United States, Japan, Korea and Singapore. The plot can be seen in Figure 3 as follows:



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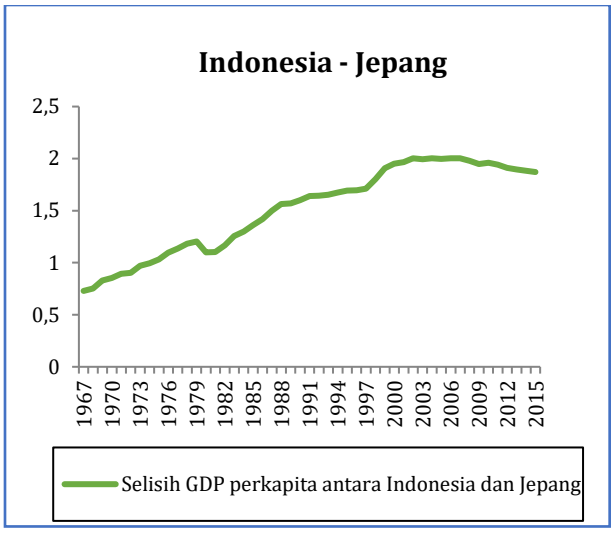
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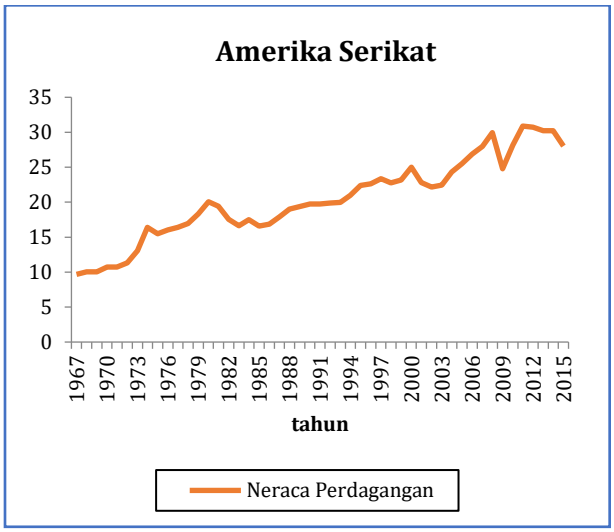
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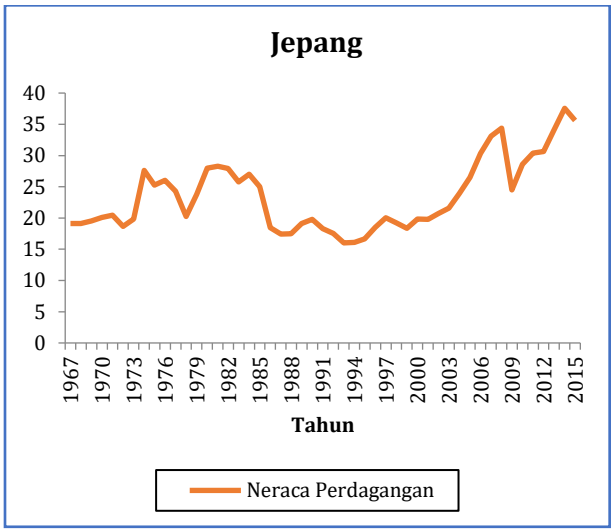
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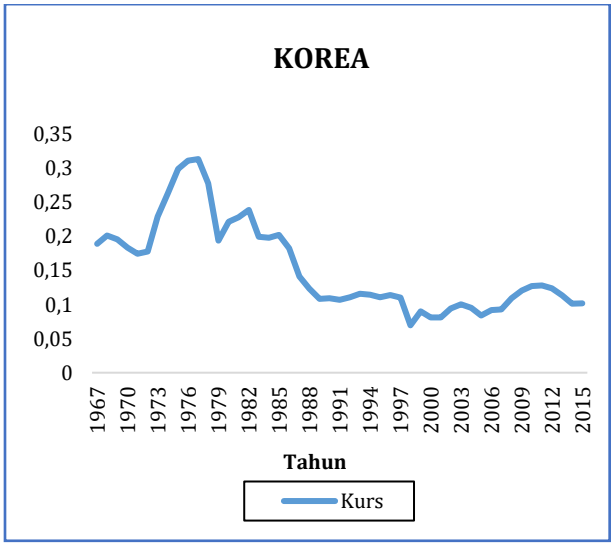
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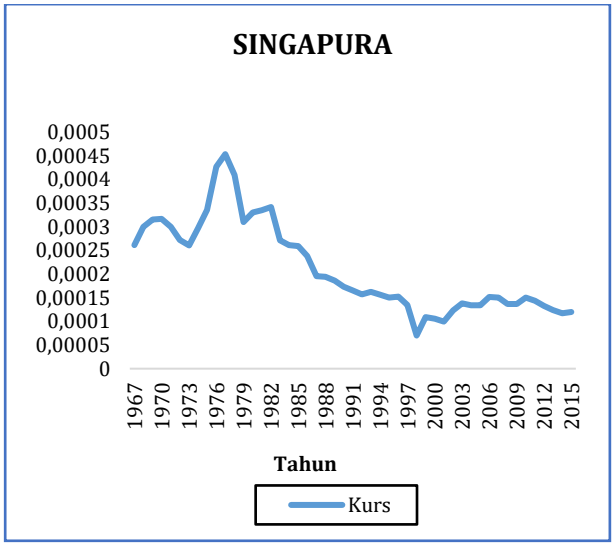
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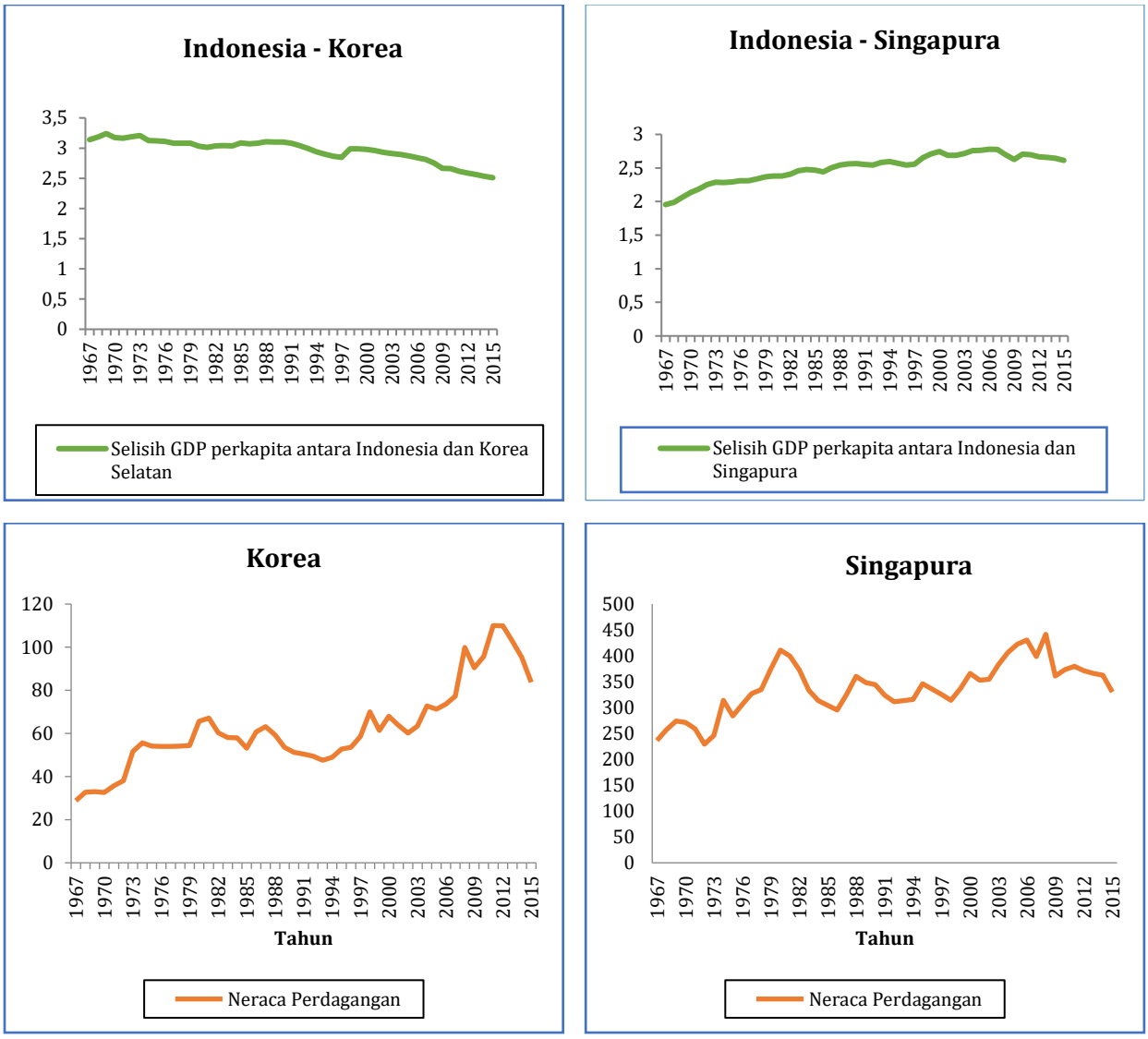

Figure 3. The relative exchange rates of foreign currencies against the Rupiah, the difference in GDP per capita between foreign countries and Indonesia, the ratio of the trade balance between foreign countries and Indonesia to GDP for the period 1967-2015.

The pattern of movement of the real exchange rate of the USD against the Rupiah increased in 1976 and decreased until 2015. The pattern of movement of the exchange rate was not in line with the movement in the difference in productivity between the United States and Indonesia which experienced a downward trend, while the ratio of the trade balance to GDP showed an upward trend.

Movements in the real exchange rate of the Yen against the Rupiah and the ratio of the trade balance between Indonesia and Japan to GDP show an unstable pattern. This can also be seen in the pattern of the real exchange rate of the Won against Indonesia and the ratio of the trade balance between Indonesia and Korea. However, there are differences in the pattern of movement of productivity differences between the two countries. Where Indonesia-Japan shows an increasing trend while Indonesia-Korea shows a decreasing trend. The real exchange rate pattern of the

Singapore Dollar against Indonesia and the ratio of the Indonesia-Singapore trade balance show a trend that tends to be the same as that in Japan.

Figure 3 shows that the pattern of real exchange rate movements with differences in productivity in the four countries has varied trends. So it needs to be tested further about the relationship between the two.

Table 1. Variable unit root test ln(q), lny-lny* and ln(tb) (1967-2015).

				Levin Lin Chu
				Adj-t*
Unit Root Test	**lnq**		t-stat	-0,5982
			ρ-value	0,2749
		trend	t-stat	0,6569
			ρ-value	0,7444
	ln(y-y*)		t-stat	-5,9206*
			ρ-value	0
		trend	t-stat	-0,7562
			ρ-value	0,2248
	lntb		t-stat	-2,0578*
			ρ-value	0,0198
		trend	t-stat	-0,5578
			ρ-value	0,2885

Note: *, **,*** means statistically significant at level 1%, 5%, and 10%

From the estimation results of the stationarity test, it was found that most of the variables were not stationary at α=5%, except for lny-lny* without a trend and lntb without a trend. This shows that the variables ln(q), lny-lny* and ln(tb) can be tested for cointegration. Because the results of the unit root test are not stationary at the level for data that uses constants and trends, it is possible to test the long-term relationship between variables with the estimation results shown in table 2.

Table 2. Cointegration test Panel *Dynamic Ordinary Least Squares* (1967-2015)

Estimator		y-y*	t-stat	tb	t-stat	panel v	pvlue	
PDOLS	costant	0.2931	-1.066	0.6353	8.612	1.48	0.069***	significant
	constant + trend	0.2931	-1.066	0.6353	8.612	-0.03752	0.514	not signifikan

Note: *, **,*** means statistically significant at level 1%, 5%, and 10%

In table 2, we investigate the effect of Ballasa Samuelson on influencing PPP in the long term. It can be seen that the difference in productivity has no significant effect on the exchange rate deviation from PPP in the long run for trend + constant data, whereas without including trends in the analysis it shows that there is a long term relationship, where the difference in productivity has a significant effect on exchange rate deviations at a significant level of 10%. This is in line with Bordo's research. et al (2017), using PDOLS for 14 countries, also provide a long-term relationship at an alpha significance of 10% for estimates using trend.

In addition to analyzing the Balassa-Samuelson theory in the period above, the author also analyzes this theory using differences in the Indonesian exchange rate regime during the 1967-2015 period. The State of Indonesia had 3 exchange rate regimes during that period, namely a fixed exchange rate during 1967-1978, a controlled floating exchange rate during 1979-1997, and a free floating exchange rate during 1998-2015.

Table 3 shows the Levin Lu Chu unit root panel test including trend and without trend in 3 regimes. In the period 1967-1978 (fixed rate), data shows stationary levels for trend analysis and without trend. Even though the trade balance as a control variable is stationary at 1% alpha, because there are 2 variables that are already stationary in the data, it is concluded that either trend or without trend cointegration test cannot be carried out, meaning that there is no long-term relationship between differences in the productivity of foreign countries against Indonesia and the real exchange rate against Indonesia. This indicates that the results support the Balassa-Samuelson theory because this theory applies if exchange rates are floating.

The 1979-1997 period (controlled floating rates) shows that the data is stationary when estimating without a trend, but when including the trend in the analysis, the exchange rate and differences in productivity are not stationary at the level, but are already stationary at the first difference. So that cointegration test can be done. Table 4. shows the cointegration test with the trend for controlled floating exchange rates. The results find that productivity differences do not significantly affect the exchange rate deviation from PPP in the long term or there is no cointegration, so that the Balassa Samuelson effect in influencing PPP in the long term is not fulfilled. This may be due to the existence of exchange rate controls carried out by the government.

Table 3. Variable unit root test ln(q), lny-lny* and ln(tb) (1967-2015).

Levin Lin Chu (Adj-t*)			REZIM					
Uji Unit root :Pada level			**FIX ER**	**Ket**	**Manage Floating ER**	**Ket**	**Floating ER**	**Ket**
Variabel			**1967-1978**		**1979-1997**		**1998-2015**	
lnq	Constant	t-stat	-3.3998	Stasioner	-1.576	Stasioner	-0.1393	Tidak Stasioner
		ρ-value	0.0003*		0.0575*		0.4446	
	Constat +trend	t-stat	-6.5312	Stasioner	0.1985	Tidak Stasioner	0.329	Tidak Stasioner
		ρ-value	0.0000*		0.5787		0.6289	
ln(y-y*)	Constant	t-stat	-2.1992	Stasioner	-2.8672	Stasioner	0.9665	Tidak Stasioner
		ρ-value	0.0139*		0.0021*		0.8331	
	Constat +trend	t-stat	-2.9987	Stasioner	-0.2547	Tidak Stasioner	-1.1296	Tidak Stasioner
		ρ-value	0.0014*		0.3995		0.1293	
lntb	Constant	t-stat	-0.9639	Tidak Stasioner	-2.7751	Stasioner	-0.9156	Tidak Stasioner
		ρ-value	0.1676		0.0028*		0.1799	
	Constat +trend	t-stat	-1.7894	Stasioner	-3.0353	Stasioner	0.0797	Tidak Stasioner
		ρ-value	0.0398*		0.0012*		0.5318	

The 1998-2015 period (free floating exchange rate) resulted that all variables were not stationary at either the estimated level using a trend or without a trend, this indicates that floating exchange rates are proven to apply in the Ballasa-Samuelson theory. Because the data is not stationary at the level but stationary at the first difference, the cointegration test can be carried out. The estimation results are shown in table 5. where Ho is rejected, meaning that differences in productivity do not significantly affect the exchange rate deviation from PPP in the long term or there is no cointegration.

Table 5. Panel *Dynamic Ordinary Least Squares* Cointegration Test for Manage Floating Exchange Rate Regime (1979-1997)

Estimator		y-y*	t-stat	tb	t-stat	Panel v	p value	
	tren + konstan	-0.3433	-84.63	1.024	214.4	0..3217	0.5149	not significant

Note: *, **,*** means statistically significant at level 1%, 5%, and 10%

Table 6. Panel *Dynamic Ordinary Least Squares* Cointegration Test for Free Floating Exchange Rate Regime (1998-2015)

Estimator		y-y*	t-stat	tb	t-stat	Panel v	p value	
PDOLS	nokostan	1.027	3.27E+13	1.626	9.55E+13	1.053	0.14	not significant
	tren + konstan	1.027	3.27E+13	1.626	9.55E+13	-0.6109	0.7293	not significant

Note: *, **,*** means statistically significant at level 1%, 5%, and 10%

5. Conclusion

Based on the results of research and data analysis that has been carried out by researchers, the following conclusion can be obtained: the difference in productivity has no significant effect on the exchange rate deviation from PPP in the long term or there is no cointegration.

References

Aizenman, J. (1984), "Testing Deviations from Purchasing Power Parity (ppp)" NBER Working Paper No 1475

Balassa, Bela, 1964. The purchasing power parity doctrine: a reappraisal. J. Polit. Econ. 72 (6), 584–596.

Chong, Yanping, Jorde, Oscar, Taylor, Alan M., 2012. The Harrod–Balassa–Samuelson hypothesis: real exchange rates and their long-run equilibrium. Int.

Econ. Rev. 53 (2), 609–634.

Holmes, J. (1967), "The Purchasing Power Parity Theory: In Defense of Gustav Kassel as a Modern Theorist," Journal of Political Economy, October. Krugman, 2012. International Economics

Lothian, James R., Taylor, Mark P., 2008. Real exchange rates over the past two centuries: how important are the Harrod-Balassa-Samuelson effects? Econ. J. 118 (October), 1742–1763.
Officer, L. (1984), Purchasing Power Parity and Exchange Rates, JAI Press
Salvatore, 2013 International Economics
Samuelson, Paul A., 1964. Theoretical notes on trade problems. Rev. Econ. Stat. 46 (2), 145–154.
Schumpeter, Joseph A. (1954). History of economic analysis. London: Allen & Unwin. ISBN 9780415108881
Viner, J. (1955), Studies in the Theory of International Trade, George Allen & Unwin.