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Testing the Existence of the Balassa-Samuelson Effect in the Southeast European Countries

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Abstract

The aim of this study is to test the existence of the Balassa-Samuelson (BS) effect in the Southeast Europe. The effect, which represents one of the main theoretical explanations for a prolonged period of deviation from the relative purchasing power parity, should be of significant interest to countries from this region, as they all seek to join the European Union and, ultimately, the Economic and Monetary Union of the EU (EMU). In order to test the existence of the BS effect in the region, panels of real exchange rates and GDP per employee of four potential EMU members are tested for cointegration. These two variables were chosen as the best available proxies for the price level and productivity, both of which are used to develop the analytical framework of the BS effect. Rejection of the Balassa-Samuelson hypothesis in this study has multiple implications, most important of which are discussed and closely examined in the discussion section. The paper also provides some recommendations on what should be done in any further studies on the Balassa-Samuelson effect in the region. Proliferation of such studies can be expected as these countries start the process of joining the EMU.

Keywords: Balassa-Samuelson effect, purchasing power parity, real exchange rate, productivity, inflation

1.0 Introduction

In 1964, Bella Balassa and Paul Samuelson published in two separate papers what is now known as the theory of the Balassa-Samuelson (BS) effect. The effect has become popular in recent decades, and was revisited many times in both theoretical and empirical papers. Much of its recent popularity comes from new frontiers opened by invention of econometric methods and tools that have made it possible to test the existence of the effect empirically. A less technical, but also prominent reason for the continuing interest in the effect has been the creation of the Economic and Monetary Union of the European Union (EMU) with accession criteria that does not address the magnitude of a productivity-induced inflation in its individual applicant countries (Tica, Družić, 2007).

In their seminal papers, Balassa and Samuelson observed that countries with higher real income per capita growth tend to have higher inflation rates. It is theorized that this situation is a result of unequal productivity in tradable (industry) and non-tradable (service) sectors of the economy. Namely, in the world of free trade, productivity in the production of tradable goods will necessarily rise as a result of increased supply and demand. This will drive up wages in the tradable sector. However, mobility of labor across sectors will push up the wages in the non-tradable sector

as well. Considering that the increase of these wages is not caused by real changes in non-tradable sector productivity, costs and prices in the non-tradable sector will increase and thus cause persistently high inflation. Inflation will stay high throughout the period of high productivity growth.

Testing the influence of the Balassa-Samuelson effect is particularly important in European countries seeking to join the Eurozone. This is because the convergence criteria for joining the Eurozone include a requirement of maintaining an inflation rate close to that of the best performers in the Eurozone, as well as a stable exchange rate against the euro. The convergence criteria do not, however, recognise that not all inflation is pathological: if it is caused by the productivity growth in the tradable sector, it should not be limited by the national economic policy (Padoa-Schioppa, 2003). Therefore, if a country faces inflation caused by the BS effect, it could be forced to introduce restrictive monetary and fiscal policies in order to stay within the allowed targets. This would in turn slow down economic growth and lead to job loss, both of which are not caused by any real, structural problem in the economy (Mihaljek, Klau, 2008). Considering that countries of the Southeast Europe all seek to join the European Union and ultimately the Eurozone, it is important that the BS effect is studied and its extent tested in order to predict policy moves that will have to be made in the accession process, as well as to make projections of economic conditions that will prevail in the medium-term. Finally, proving unequivocally that the Balassa-Samuelson effect is a significant determinant of inflation in candidate countries could lead to adjustments in the European convergence criteria to account for its effects.

Given that all countries in the Southeast Europe, while joining the European Union and the Eurozone have to fulfil, among others, the converge criteria, a prominent question arises as the main research question of this paper:

Q: Does Balassa-Samuelson effect exist as statistically significant in the Southeast Europe?

The BS theory is a topic of a large number of theoretical and empirical papers. After Balassa's first empirical test of the theory using cross-sectional analysis, it took more than a decade for researchers to further develop and expand the model. After the 1980's and development of more diverse econometric techniques, researchers started testing the BS effect using increasingly sophisticated approaches, while primarily utilising time series analysis for individual countries. Many of the papers testing the BS effect, however, only weakly proved the existence of the BS effect, and in some it was even proven as insignificant. Panel data techniques developed in the late 1990's and 2000's offered a new way to improve the empirical models of the theory, and they have been used to successfully prove the existence of the BS effect in different regions. Among them, Eggert, Drine, Rault, Lommatzsch (2002) perform a thorough study of tradability of significant sectors before testing the Balassa-Samuelson model using panel data and time series tests on a sample of Central European and Eastern European countries. Performing sectorial research of this kind is, however, beyond the scope of this paper.

To test the existence of the Balassa-Samuelson effect in the Southeast Europe in this paper, a log-log model is developed. The real exchange rate is used as a proxy for the price level and GDP per employee as a proxy for productivity. Drine, Rault (2003) show that these two variables can serve as suitable proxies in cases when other, more refined data is not available. The sample for testing the BS effect includes Croatia, Serbia, Macedonia and Albania.

To test, and ultimately prove the main hypothesis, a cointegration test proposed by Pedroni (1995, 1997, 1999) is run to test for cointegration of RER and GDP per employee. The panel unit-root test developed by Im, Pesaran, Shin (2003) is run beforehand to test for stationarity of variables. The paper continues by analysing the most important aspects of empirical studies relevant to development of the main hypothesis. The literature review is followed by the analytical and methodological development of the BS effect into a testable econometric model. This section is followed by the results of the research performed and discussion of their meaning. The results are

also compared to those reached by other researchers in similar studies. Finally, the paper concludes with an overview of the main findings and their implications.

2.0 LITERATURE REVIEW AND DEVELOPMENT OF HYPOTHESES

Literature on the Balassa-Samuelson effect over the years grew to an extensive list of papers and scientific articles. After the initial papers by Balassa and Samuelson were published in the 1960's, it took almost two decades for research on this topic to expand and gain momentum. When it did, however, it spread into a multitude of different techniques and econometric methods, as researchers tried to develop and test all aspects of the theoretical framework. These developments also reflected improved econometric tools available to test time series and later, panel-data samples.

Given that papers written on the topic of the Balassa-Samuelson effect almost without exception test the existence of the Effect on a specific sample as the main hypothesis, the literature review in this section is performed from a methodological point of view in order to select the method fitting to the available data and develop a testable hypothesis.

The BS effect was rigorously defined in mathematical terms only in the last few decades, most prominently by Rogoff (1992), who put the BS effect in the general equilibrium framework. However, empirical tests of the effect had been conducted ever since Balassa and Samuelson published their papers 1964. In all of those, researchers utilised different econometric methods to test the existence of the BS effect in real-world economies.

The first empirical test of the BS effect was conducted by Balassa himself in 1964. Balassa used OLS to test price and income levels in a cross-section sample of 12 countries. Other researchers in the 60's and 70's used the same method and similar technique on different samples. In the 1980's, Hsies (1982) applied instrumental variables in his tests. The 80's also saw the emergence of new methods and, importantly, cointegration tests. As such, Edison and Klovland (1987) tested the model using the E/G cointegration technique, developed by Engle and Granger in 1987. Throughout much of the 90's, the preferred technique became the Zellner's SUR (seemingly unrelated regressions). Tests with cointegration remained relatively rare until 1996, when Bahmani-Oskooee and Hay-Jae Rhee familiarized researchers with the Johansen's and Juselius' technique. This technique was soon adopted and used in half a dozen other papers published between 1996 and 2002. Overall, however, both the E/G and Johansen's and Julius' techniques remained almost equally used. In 2000's, the ARDL technique (autoregressive distributed lag) also started to be used, such as in De Broeck, Slok (2001).

These techniques are not the only ones used, however. In fact, empirical papers have dispersed into many other different techniques and approaches as well. For example, the fully modified OLS and the generalised least squares were used (e.g. Drine, Rault, 2002). Chinn (1997, 2000), Taylor, Sarno (2001) used nonlinear techniques. Finally, dynamic OLS and the method of moments were used.

It is worth mentioning that even though many new techniques were developed and used, the OLS remained quite frequent in empirical studies. It was used with all types of data – in cross-section, time series and panel data analyses – in as many as thirty different papers published after 1990 (Tica, Družić, 2007).

2.1. Variables

Empirical tests of the BS effect have mostly included variables for price level and productivity. The choice of suitable proxies, however, was much less straightforward.

Early empirical papers usually used purchasing power parity as the dependent, and GNP as the independent variable. Balassa (1964) used the ratio of PPP and nominal exchange rate as the price level proxy, which was adopted in most papers published in 1960's and 1970's. Later developments in econometric tests meant that researchers could include many different variables in their papers. The original Balassa's test was adjusted by David (1972) to show variables in relative terms, using a

reference country. Officer (1976) was the first who experimented with the use of productivity ratio between tradable and nontradable sectors. He also used three productivity proxies instead of one. However, even with these changes, he was unable to unequivocally prove the effect.

After Officer's failure, researchers turned to then-new time series tests. The HBS model for time-series analysis was first properly defined by Marston (1990). He combined the work of Officer and Hsieh in that the independent variable was productivity ratio, and the dependent was real exchange rate in relative terms. Marston included his own ratio of sector prices as the dependent variable. At the time, stationarity tests were not able to prove that real relative exch. rates are stationary, so they were assumed to be random walk processes. The introduction of a different dependent variable was therefore seen as a solution which enabled the BS model to be estimated.

2.2. Tradable and Non-tradable Sectors

While the theory of Balassa and Samuelson assumes that commodities can be precisely divided into tradable or non-tradable ones, in reality this distinction is not so obvious. Namely, most goods and services are tradable to some degree, depending on transportation costs, transaction costs etc. This inability to precisely categorise a good as tradable or non-tradable requires a carefully structured definition of the two categories.

While there is no general agreement, most research simply assumes that all manufactured goods are tradable and all services are non-tradable. This division was first used by Officer (1976) and proliferated in later studies. This simplest division was amended and adjusted in individual papers, however. One of the issues in categorisation was classifying agriculture – some papers classified it as a part of the tradable sector, while others omitted it altogether. Energy and water are also problematic; they too were put either in tradable sector or excluded from the analyses completely. Furthermore, the choice of proxy for tradable sector is almost equally distributed between industry and manufacturing. Overall, just as the theoretical explanations did not converge in their classification of sectors, neither did the empirical research. In fact, empirical testing of tradability itself is limited to a small number of papers.

The most prominent empirical analysis of tradability was conducted by De Gregorio, Wolf and Giovannini (1994). In their research, the authors defined a tradable sector as the one in which more than 10% of its production is exported. This threshold can of course be changed, and is subjective. The results of this research (with the 10% threshold) show that agriculture is part of the tradable sector. Transportation and manufacturing are also tradables. Other services were found as non-tradables, and they constitute cca 50% of the GDP (Idem). Even though this research gave a relatively stable framework for division of sectors, its results were not widely adopted, and heterogeneous sector division remained a characteristic of the BS testing.

The lack of agreement on setting the rule for dividing tradables and non-tradables was less about empirical, or, for that matter, theoretical disagreement, and more about the available data. Testing the BS model includes the use of data that is hard to get by even in developed countries, not to mention the less developed regions of the world – sectorial output, prices and employment are just some of the needed information. Because of that, researchers are forced to make a clear-cut division without much evidence to support it.

2.3. The Issue of Productivity Proxy

Unlike the issue of tradability, the issue of productivity proxy is not purely a matter of empirical disagreement: its controversy is also a theoretical issue.

The choice of productivity proxy was narrowed down to either the TFP – total factor productivity or the average labour productivity. DeGregorio, Wolf and Giovannini (1994) choose the TFP because the average productivity has larger swings in times of recessions, which makes it an unreliable indicator in the long run. However, the argument is strong for the average labour productivity as well. The fact that data used to generate TFP figures is less reliable than that used for

calculating average productivity is just one of TFP's issues - employment and value added are more closely watched and measured than sectorial capital stocks.

Even though it seems that more researchers select TFP as a better proxy, the majority of them use average productivity in empirical testing due to availability and reliability of data (Coricelli, Jazbec, 2001). Only six papers published between 1987 and 2008 used TFP as a proxy for productivity.

2.4. The Main Hypothesis

With all these considerations in mind, the availability of data stays the primary constraint in choosing the best proxies and techniques in testing the BS effect. Data available for countries included in the sample used in this paper is limited, firstly because most of the studied countries started publishing standardised macroeconomic figures only in the second half of the 1990's, and secondly because these figures rarely include sectorial analyses. In Bosnia and Herzegovina, for example, labour productivity is estimated only occasionally, with the last productivity figures available for 2014.

As Drine, Rault (2003) show, however, these problems are alleviated by panel data analysis techniques. The authors used new panel tests to test, and successfully prove the BS effect in a number of regions with limited data availability. Given the similarity of situation these authors faced in their research with that in this paper, a similar testable form of the main hypothesis is developed. The main hypothesis is then:

H1: The Balassa-Samuelson effect exists as statistically significant in the Southeast Europe.

In a testable form, the main hypothesis can be restated as:

In countries of the Southeast Europe, the real exchange rate level is positively correlated with the development degree of the economy due to differential productivity growth between tradable and non-tradable sectors.

3.0 METHODOLOGY

3.1. Analytical Framework

To test the existence of the Balassa-Samuelson (BS) effect in the Southeastern Europe, the BS framework first has to be analytically developed. The analytical form of the BS theory was first developed by Rogoff (1992), who put it into a general equilibrium framework. The analytical form of the model used in this paper is based on Rogoff's work (1992, 1996), as well as the Drine's and Rault's (2002).

In order to develop a proper analytical form of the BS model, let us assume a small open economy in which firms are homogenous, and produce two products: one which is traded in the global market without trade barriers and another traded only within the country. Considering the existing evidence that goods are mostly tradable, whereas services are not, it can be assumed that production of the tradable good includes both capital and labour input, while the non-tradable product requires only labour input (services are assumed to be more labour-intensive). In the economy, market conditions are perfectly competitive, which means that factor compensations are determined by their marginal productivity. Mobility of labour across sectors means that pay is equal. Supply of labour is constant and tradable goods are used as a unit of account.

Obstfeld and Rogoff (1996) concluded that without price and wage stickiness, supply side is the only determinant of the equilibrium real exchange rate (RER). Thus, the set of assumptions made here implies that a general equilibrium analysis can be substituted by a partial equilibrium model which does not include the demand side, focusing only on determinants of supply in the exchange market.

3.1.1. *Firm Behaviour*

If technology and capital are under constraints, the firm's intertemporal profits will be maximised as:

$$Max \int_0^{\infty} (y_e(k, l_e) + py_n(l_n) - wl - i)e_{-rt}dt \quad (1)$$

$$k = i - \delta k \quad (2)$$

where:

y_e is production of tradable goods
y_n is production on non-tradable goods
p is relative price of non-tradables to tradables
i is investment
w are wages
k is capital
l is labour supply (l = le + ln)

3.1.2. *Equilibrium*

$$\frac{\partial y_e}{\partial k} = r \quad (3)$$

$$p\frac{\partial y_n}{\partial l_n} = \frac{\partial y_e}{\partial l_e} = w \quad (4)$$

$$\lambda = 1 \quad (5)$$

From these it is derived that:

$$\frac{\partial y_e / \partial l_e}{\partial y_n / l_n} = p \quad (6)$$

In Cobb-Douglas functions, it is:

$$p = \frac{\alpha\theta_e}{\beta\theta_n} \quad (7)$$

where:

α, β are production-labour elasticities for tradable and non-tradable sectors
θe, θn are average labour productivities for tradable and non-tradable sectors.

From equation (7) it follows that the relative price is a function of the productivity ratio between tradable and non-tradable sectors. In line with the BS hypothesis, the equation shows that a relative increase in productivity of the tradable sector to productivity of the non-tradable sector leads to a real exchange rate appreciation (Drine, Rault, 2002).

The link between GDP per capita (later used as a proxy for the level of development) and exchange rate has to be established as well.

In terms of tradable goods, the production of the economy is:

$$y=y\_e+py\_n \quad (8)$$

which, in Cobb-Douglas case is:

$$y=\alpha\theta\_e\ l\_e+p\beta\theta\_n\ l\_n \quad (9)$$

with α and β being labour elasticities in tradable and non-tradable sector, respectively.
From (7) and (9), a new relationship is derived:

$$y/l=p\theta\_n \quad (10)$$

Therefore, the relative price is directly proportional to per capita production.

The real exchange rate (e) is represented by a nominal exchange rate quoted to a certain index. If E represents the nominal exchange rate, P represents a domestic price index and P* represents a foreign price index, it is

$$e = \frac{P}{EP^*} \qquad (11)$$

With the assumption that there are only two goods in the consumers' basket, the price index is:

$$P = P_e^{\varepsilon} P_n^{1-\varepsilon} \text{ and } P^* = (P_e^*)^{\mu}(P_n^*)^{1-\mu} \quad (12)$$

If PPP is verified for the tradable sector, from equations (11) and (12) it follows that:

$$\log(e) = (1-\varepsilon)\log(P) - (1-\mu)\log(P^*) \qquad (13)$$

and plugging the above expressions into (13), it follows that:

$$\log(e) = -(1-\varepsilon)Q_n + (1-\varepsilon)log\frac{y}{l} - \log(P^*) \qquad (14)$$

The last equations show that RER (real exchange rate) is determined by the productivity of the economy. Since the products of the non-tradable sector are not traded, the productivity of the sector does not depend on the exchange market. Furthermore, since production in this sector is not capital-intensive and relies on non-reproducible factors, productivity movements can be assumed to be exogenous (Roldos, 1995 in Drine, Rault, 2002).

3.2. Econometric Methodology

With the equations developed above, an equation testable for cointegration can now be written as:

$$\log(e_{i,t}) = \alpha + \beta t + \gamma \log(y_{i,t}) + \varepsilon_{i,t} \qquad (15)$$

Suitable proxies are chosen based on the considerations presented in the literature review: the real exchange rate (RERt) as the independent variable, and the GDP per employee as the dependent variable to yield the model used in econometric tests:

$$\log(RER_{i,t}) = \alpha + \beta t + \gamma \log(GDP_{i,t}) + \varepsilon_{i,t} \qquad (16)$$

The trend variable t reflects a long-term movement of the productivity in the non-tradable sector, with β expected to be negative. γ is expected to be positive, as an increase in RER implies an appreciation. The constant is expected to be negative. Since a small open economy is assumed to exist, foreign prices are exogenous. No other variables (some of which are mentioned in the literature review) are included in order to derive the most parsimonious form of the model for the available data.

3.2.1 *Panel Unit Root Tests*

There are multiple tests for testing unit roots in panels. Quah (1994) developed standard normal asymptotic distributions for homogenous panels. A more general set of conditions was taken by Levin and Lin (1993), who added heterogeneous fixed effect and trend. Their test, however, was shown not to be able to correct serial correlation and had significant size distortions in smaller samples. The test utilised in this paper, on the other hand, has proven more powerful in testing small samples. Developed by Im, Pesaran, Shin (1997, with later modifications), this test (IPS test) uses mean values of multiple unit-root statistics. It allows specifying the AR coefficient more generally using a group mean statistic (Drine, Rault, 2002).

The IPS test proposes two statistics: Lbar – a maximum likelihood statistic, and tb – a student statistic. They are based on ADF (Augmented Dickey-Fuller) regressions; ergo, serial correlation is solved automatically. Drine, Rault (2002) show, using Monte Carlo simulations, that tb is more powerful than Lbar statistic, which is the reason it will be used in this paper.

The statistic is expressed as:

$$t_b = \frac{\sqrt{N}(t_{NT} - E(t_T))}{\sqrt{Var(t_T)}}$$

where $t_{NT} = \frac{1}{N}\sum_{i=1}^{N} t_{iT}$ represents the average of individual t-stat values for a conventional time series unit-root analysis. E(tT) and Var(tT) are mean and variance of tiT, with H0 of series integrated with order one, N→∞. tb statistic asymptotically follows the standard normal distribution under the hypothesis on non-stationarity (Idem).

3.2.2 *Panel Cointegration Tests*

A problem for many researchers using time-series cointegration tests in their papers is the limited time span for which data is available. These tests generally have low power for shorter time series, which is a problem faced by practitioners even when data is available for the whole post-WWII period. In the sample used in this paper, however, the situation is even harder: countries in the sample did not even exist before the 1990's, and even then, it took until the early 2000's for them to start reporting standardised macroeconomic parameters. Pedroni than proposed that the limitations made by short time spans be overcome by using cross-sectional relationships of parameters for different countries. In his papers (1995, 1997, 1999), Pedroni managed to avoid a traditional problem of many previous panel tests, which is their inflexibility to heterogeneity of individual time series in the panel. His panel cointegration tests include parameters that are allowed to fluctuate for individual members of the sample, and therefore take into account heterogeneity of individual time series.

The Pedroni's panel cointegration test used in this paper has seven different statistics for which the author derived individual asymptotic distributions. These statistics are divided into two groups: the Within dimension ("panel" dimension) with four, and Between dimension ("group" dimension) with three statistics. The asymptotic distribution for all seven statistics is:

$$t_b = \frac{\chi_{NT} - \mu\sqrt{N}}{\sqrt{v}} \rightarrow N(0,1)$$

Whereas all seven statistics work well with longer time series (with more than 100 observations), not all are equally powerful when working with T<20. Pedroni (1997) used Monte Carlo simulations to show that the best statistic in this case is the group t-stat (ZBT), followed by the panel rho-stat and panel t-stat. The author also gives critical values for each of the statistics, depending on the number of regressors included, as well as inclusion of trend variables and constants.

3.3 Sources of Data

To test the BS hypothesis, the four tested countries are selected for the 1997-2016 period. In other words, the panel dataset is constructed with 4 cross-section units and a 19-year sample. Cross section units (countries) and data length are selected according to data availability. The beginning period was taken as such due to the conclusion of other authors that the BS effect cannot be properly observed in the period of economic turbulence, which lasted throughout the studied countries in the early 1990's. The real GDP data set is taken from The World Bank database and it uses 2011 as the base year. The nominal exchange rate data are also extracted from The World Bank (ILO database). To calculate the real exchange rate, the CPI data set is taken from the IMF-IFS via TWB database which uses 2010 as the base year (2010=100). Therefore, a necessary adjustment in the base year was made to bring the real variables to the same base year.

4.0 RESULTS AND DISCUSSION

4.1 Results

This section presents results of unit root and panel cointegration tests described in the previous section. Using EViews 9 software, the tests are run on a sample of 4 countries from the Southeast Europe: Croatia, Serbia, Albania and FYR Macedonia. The panel sample includes annual values of the real exchange rate (base year 2011) and GDP per employee (constant 2011 USD) over a period of 1997-2016. Earlier years are not included as fluctuations of the exchange rates were influenced by a number of exogenous factors whose effects cannot be isolated (the region was affected by war and the break-up of Yugoslavia).

Using panel techniques, the estimated equation is:

$$\log(RER_{i,t}) = \alpha + \beta t + \gamma \log(GDP_{i,t}) + \varepsilon_{i,t}$$

where RER is the real exchange rate calculated as a ratio of domestic CPI and US CPI, deflated by the nominal exchange rate. An increase in RER therefore represents appreciation.

4.1.1 *Unit Root Test Results*

Theoretically, a process can be I(0), I(1) or I(2). As noted by Drine, Rault (2002) and Lothian, Taylor (2008), RER and real GDP are well explained as I(1) processes in most samples. That assumption is supported in this paper by the findings of the Im, Pesaran, Shin test of unit root on the log(RER) and log(GDP_per_employee) series, which finds that both series have a unit root in the sample used in this paper (as shown in Table 1). To confirm that both series are indeed I(1) processes, variables are differenced and the new series tested for unit root. The IPS tests show that the newly generated differenced variables are I(0), which is in line with the assumption that level series have one unit root.

Variable	Level				First difference			
	Constant		Constant and trend		Constant		Constant and trend	
	W-stat	P	W-stat	P	W-stat	P	W-stat	P
log_RER	-0,71562	0,2371	1,36590	0,914	-4,93650	0,00000	3,75639	0,0001
log_GDP_per_employee	-1,71072	0,0436	2,48530	0,9935	-3,31096	0,0005	-3,02764	0,0012

Table 1. Results of Im, Pesaran, Shin (IPS) test for unit root /H_0: Unit root/

4.1.2 *Cointegration Test Results*

After the RER and GDP_per_employee variables have been shown to be I(1) processes, they were tested for cointegration. The Pedroni test for panel cointegration was used. The results of that test are shown in Table 2.

Variables: log(RER), log(GDP_per_employee)		
	Statistic	Probability
panel v-stat	2,763228	0,0029
panel rho-stat	0,364839	0,6424
panel PP-stat	-0,093071	0,4629
panel ADF-stat	-0,298598	0,3826
group rho-stat	1,088295	0,8618
group PP-stat	0,059883	0,5239
group ADF-stat	**-0,910361**	**0,1813**

Table 2. Results of Pedroni test for panel cointegration /H0: No cointegration/

While all 7 statistics were proven to be robust indicators of panel cointegration in samples with many observations, cointegration in short samples (T<20) is best measured by the group ADF-stat, followed by panel rho-stat and panel ADF-stat. Given the values of all three of these statistics, Ho of no cointegration is accepted. Accepting Ho indicates that **the Balassa-Samuelson effect does not exist in the tested sample**, as RER and GDP per employee variables are not cointegrated.

To further prove that no cointegration exists between the two variables, the residuals series from the initial equation was tested for stationarity. The results of the test are shown in Table 3.

Variable	Level	
	IPS W-stat	Probability
Error_Panel	0,15934	0,5633

Table 3. Results of Im, Pesaran, Shin (IPS) test for unit root in residuals /H0: Unit root/

Given that the null hypothesis of unit root is accepted at 5% level, i.e. residuals series is not stationary, it is further proven that RER and GDP_per_employee series are not cointegrated.

4.2. Discussion

Overall, the Balassa-Samuelson hypothesis has proven to be quite resistive to strong empirical proofs. In more than a third of all empirical papers published on the topic of the BS effect, researchers failed to prove that the BS effect is statistically significant in their sample. There are multiple possible reasons for these failures, from the evident possibility that the BS theory itself does not hold, to issues of econometric tests still not being able to correctly estimate the magnitude of the Effect. Many of these reasons could affect results in this paper as well.

4.2.1 *Effects of Data Availability on Results*

The most prominent source of problems is the available data. Firstly, most macroeconomic parameters are available only for the period after WWII, even for the most developed countries. In some parts of the world, where the BS effect is theoretically predicted to be the most pronounced, i.e. countries and regions with high productivity growth, the data goes back only for a short period of time, either because those countries became independent only recently (such as those included in the sample used in this paper), or because they changed economic systems (many of them shifted from the socialist to the capitalist system). Data for the countries studied in this paper is affected by both of these reasons – not only were all of them created after the break-up of Yugoslavia in the early 1990's, but they also shifted from the socialist, state-controlled economic system, to the capitalist, privately managed economy. Given that most of these countries faced significant internal imbalances in the early years of their independence, the time horizon of reliable, usable data is even shorter. Considering that panel cointegration tests show significant weaknesses with samples of short time horizons, the results of the Pedroni cointegration test reported in this paper are likely to be affected. Even though the group ADF stat shows highest power in samples with less than 30 period observations, data in this sample is not available even for that period of time.

Another serious issue in assessing the existence and magnitude of the Balassa-Samuelson effect is a lack of refined macroeconomic indicators for countries studied in this paper. Labour productivity measures are estimated without a regular time interval, and reported growth rates depend on different methodologies used by different agencies. It is not uncommon that agencies from one country report different values of the same macroeconomic indicators.

Studies on tradability of individual sectors which provide data needed for a more thorough research on the topic of the BS effect are not performed, as they require in-depth analysis and teamwork of many researchers. Considering a very low level of investment into R&D in many developing countries, such teams often do not exist at all. Even if they did, however, they would be

faced with significant problems of disparity of data on trade coming from different sources. One such example is the reported value of trade between Bosnia and Herzegovina and Croatia – while reported Bosnian imports from Croatia in 2015 were 0.9 billion USD, Croatian exports to Bosnia were reported to be 1.2 billion USD (Domljan, 2017). Discrepancies of this kind are present in the whole region studied in this paper. The effects of tradability differentials are significant in testing the Balassa-Samuelson effect. While the model tested in this paper represents the most parsimonious form of the BS model given the available data, it could be expanded to include individual variables for the most significant sectors.

As Asea, Mendoza (1994) note, results of the BS effect tests are especially sensitive to tradability of agriculture. Such an importance stems from the borderline nature of agriculture in terms of tradability. It is tradable in a sense that agricultural products are important exports for the developing countries, including those studied in this sample (especially in Serbia and FYR Macedonia who are among the biggest agricultural producers in the region). On the other hand, agriculture is sheltered in all of these countries by heavy subsidies on the production – not only is it directly subsidized by extending grants and low-interest loans to agricultural producers, but it is also supported by imposing price ceilings on inputs used in agricultural production (e.g. farmers are allowed to use subsidized diesel). This sheltering of agriculture can be traced to national security considerations and strong farmers' lobbies in all countries. Which side prevails is often left to be judged by researchers, so it is not a surprise that agriculture appears on both sides of the economy – it is classified as tradable in studies of DeGregorio, Wolf (1994); Chinn, Johnston (1997); Duval (2001); MacDonald, Ricci (2001), and as nontradable in studies by DeGregorio, Giovannini, Krueger (1994); Wu (1996); Swagel (1999), Kovacz (2001). A thorough study by Egert et al (2002) into the Balassa-Samuelson effect in the Central and Eastern Europe found that prices of agricultural products move together with prices of other tradables, but that productivity does not grow at the same rate as in other tradable sectors. This distorts the results of cointegration tests, and possibly affects the conclusion on the existence of the effect altogether.

4.2.2. *Effects of Price Index on Results*

Consumer price index used in calculation of the real exchange rate has certain implications on what RER figures include. The CPI includes some of the non-tradable services whose prices are regulated in all of the countries studied in the sample. For example, electricity and water supply are mostly provided by state-owned companies which set their prices in accordance with governments' decisions, rather than market conditions. For this reason, prices in these sectors cannot increase when they are expected to based on the market conditions, but are rather held artificially low by the producers. The problem of regulated prices is further amplified by the fact that reported CPI figures on services sometimes include, and sometimes do not include services with regulated prices, depending on individual country's methodology.

Given the fact that non-tradable services account for more than a half of GDP, but at the same time usually weigh only 25-30% of price indices (CPI in particular), using CPI as a measure of inflation can show that productivity and price level are not cointegrated. As shown by Egert et al. (2002), however, not even the use of the producer price index (PPI) instead of CPI can guarantee that any cointegrating vectors will be shown as present. Nevertheless, some of the potential ways to change the price index used to calculate the real exchange rate are discussed in the section on robustness of results reported in this paper.

4.2.3 *Implications of the Results on Joining the EMU*

All the countries in the sample studied in this paper seek to join the European Union and consequently the Economic and Monetary Union of the EU, as membership in the EMU comes hand in hand with joining the EU. Given that it can take years for a country to join the Eurozone after joining the European Union, implications of the rejection of the Balassa-Samuelson effect are

important in that they can show whether or not countries should try to join the EMU sooner or later. In some cases, it is even possible that a country should not seek to join the EMU at all, which can be achieved by postponing the additional reforms needed to join the EMU.

Positive or negative effects of joining the EMU will depend on whether the country seeking to join it belongs to the optimum currency area (OCA) of euro. OCA shows how responsive a country's economy is to asymmetric shocks that occur in the currency union. When a country is shown to have synchronised economic cycles to those of the Eurozone, it is a good candidate for joining the EMU. The OCA criterion also shows if a country would be able to sustain shocks without an independent monetary policy (Schadler et al, 2005).

One of the necessary conditions for a country to be a part of the OCA is that relative PPP is shown to hold, i.e. that the real exchange rate is constant in equilibrium. Deviations from the equilibrium would cause internal and external imbalances that would return the real exchange rate back to the equilibrium (Akram, 2003 in Findreng, 2014). In terms of the tests carried out in this paper, for the relative PPP to hold, RER series would have to be mean-reverting. Given that they are shown not to be stationary, relative PPP is shown not to hold in any of the countries in the sample (individual ADF tests show high probabilities of a unit root in each country's RER). One of the possible explanations of failure of relative PPP is the Balassa-Samuelson effect.

Had the Balassa-Samuelson effect been proven in the sample, it would mean that RER is mean-reverting around a trend, which would suggest that these countries faced the same economic cycles. The trend would suggest that the relative PPP could hold in the long run, once the Balassa-Samuelson effect is diminished after all countries reach the productivity equilibrium. Rejection of the BS hypothesis, however, suggests that productivity and real exchange rates are not even cointegrated, which implies that failure of the relative PPP does not occur because of the BS effect, but rather because of some other factors. In fact, this conclusion is similar to that of Egert et al. (2002), who, even after collecting data on tradability of individual sectors, found that the Balassa-Samuelson effect has only limited effect on appreciation of real exchange rates. While their study did not include all the countries from the sample used in this paper, the similarity of the region studied in their paper (Central and Eastern Europe) allows for their findings to be useful in explaining the results of this research as well.

The results of the research presented in this paper show that, even if some countries in the sample meet the necessary preconditions to benefit from joining the EMU, not all of them do. In order to test whether or not a country should join the Eurozone, the pair of its currency and the euro have to be tested for cointegration. In a similar research, Findreng (2014) examines cointegration of exchange rates of Germany and the countries included in the sample used in this paper. He finds mixed results, with some pairs being integrated to the same order, and some not. After including a trend to account for the Balassa-Samuelson effect, the author still does not reach a robust conclusion on which countries should, and which should not join the Eurozone. Similarly to this paper, he also finds that the BS effect seems not to exist in the region.

Nevertheless, it can be stated that, even if some of the countries from the sample joined the European Union (as Croatia already did), their monetary authorities should not give up control just yet – they should follow the actions of the ECB closely, but giving up monetary control altogether could lead them to higher inflation rates than in other EMU countries. That inflation might not be caused by the Balassa-Samuelson effect, but until all the reasons are fully examined, giving up monetary control could be a dangerous decision.

4.2.4. *Robustness of Results*

Robustness of results reported in this paper could be improved by changing the price index used to calculate the real exchange rate values, and by adding sectorial variables for productivity for both the tradable and the non-tradable sector.

The best index that could be used for calculation of the real exchange rate without further adjustments would be the GDP deflator. Using the GDP deflator would alleviate problems of different weights of tradables and non-tradables in the price index compared to their value in the total output of the economy. GDP deflator, however, is rarely used to report official inflation figures in countries studied in the sample. For that reason, CPI and PPI are the more popular choice.

To assess whether or not CPI alone is the best base for calculation of the real exchange rate, it should be compared to other possible base values. The one which is often used to compare prices of tradables and non-tradables is the ratio CPI/PPI. Its use can be traced to the structure of the two indices: the CPI includes both non-tradables and tradables, whereas PPI includes almost exclusively tradables. However, even if this rough distinction can be used in studies of effects with greater magnitudes, the Balassa-Samuelson effect is sensitive to the fact that the CPI includes items which cannot be easily identified as either tradable or non-tradable. The benefits of this ratio are also limited because non-tradable services are not equally important in developing countries as they are in the developed world. This means that any productivity gain will increase the CPI only by a fraction of the gain itself, and that fraction will depend on the weight of services in the CPI (Egert et al, 2002).

The ratio of services included in the CPI to CPI is a second option to improve the base used for calculation of RER.This ratio removes the problem of weights in the CPI, but the problem of prices regulated by forces other than market forces of demand and supply is not solved. It is especially exacerbated by the fact that available databases rarely have information on whether or not the regulated prices are considered as services in calculation of sectorial price levels.

The last possible way to change the base value used to calculate RER is to use the ratio of services in CPI to PPI. This base, however, does not allow for isolation of the effect of service price changes on the overall inflation.

The problem with all of these measures, including variables for sectorial productivities, is that they are not readily available in open-access databases. Data is either not available or not sufficiently refined. All of that would not be a problem if other empirical studies found that their calculation had a significant effect on the end result, that is, on figures showing whether the BS effect exists or not. As shown in Egert et al. (2002), however, the BS effect is not necessarily robustly proven even when all of these adjustments are made. Nevertheless, including some of the alternatives listed in this section would increase the robustness of the findings presented earlier.

5.0 CONCLUSION

This paper examined the existence of the Balassa-Samuelson effect in the Southeast Europe. While that existence is not proven in the paper, the Balassa-Samuelson theorem stays one of the most prominent explanations of the long-run divergence from the relative purchasing power parity.

The ultimate proof of the Balassa-Samuelson (BS) effect, however, has remained just as elusive as the proof of the PPP – more than a third of all papers published on the BS effect fail to show its existence in the tested samples. This occurs regardless of the methodology used, but some approaches did achieve better results than others. The approach used in this paper was to make a panel of the real exchange rates and of the GDP per employee for four countries from the studied region, and test them for cointegration. The tests proven that both panels are not stationary, but Pedroni's panel cointegration test failed to show cointegrating vectors between the two variables. Such a model was developed as the most parsimonious form of the BS effect given the available data. The model was structured in line with models tested in several other empirical papers in regions with similar data availability problems.

Data needed to test the existence of the Balassa-Samuelson effect at the same time represents a possible cause of failure to prove the BS effect in this paper and an opportunity for further research on the topic in the region of the Southeast Europe. The problem of a short time horizon, which seriously affects the power of econometric tests cannot be solved, as the countries in the region gained their independence only recently. However, some of the difficulties presented by a short time

horizon could be alleviated by developing a more sophisticated model in terms of the choice of variables and base measures used to calculate the real exchange rates. While the countries studied in the research presented in this paper do not publish such refined indicators needed to develop a more complex form of the BS model, that data can be derived from the available official indicators. A team of researchers could try to calculate sectorial productivity using the available data on number of employees by sector and the value of that sector's output. The total factor productivity, if calculated correctly and based on reliable data, could perform much better as the productivity proxy. Researchers could also calculate different deflators used to derive the real exchange rate and in that way improve some of the shortcomings of the CPI used in this paper. Among these would be the CPI/PPI ratio, CPI services/CPI ratio and CPI services/PPI ratio.

Finally, it could be of use to disaggregate data used in testing the Balassa-Samuelson theorem. Even though the aggregate indicators utilised in this paper were used by Balassa himself, they lack distinction between tradable and non-tradable sector productivity. Such an analysis on disaggregate data could show different slope coefficients for the tradable and non-tradable sectors.

The utility of these additions, however, remains questionable. While they would improve the robustness of tests of the Balassa-Samuelson effect, it is not highly likely that they would lead to proving the existence of the effect itself, as shown by the failure of Egert et al. (2002) and Heston et al. (1994) to prove the existence of the BS effect even when all data was available. There could be several reasons why the BS effect is not statistically significant in the Southeast Europe. One is that the real exchange rates in the region are affected by forces other than the BS effect. This argument could hold, because significant barriers to entry in the industrial sector still persist in the region. Such barriers are not explicitly imposed by law, but large bureaucracies and complicated procedures act as major impediments to full market competition in the traded sector of the economy. As such, industry in the region remains sheltered to a certain extent, which is unusual compared to other parts of Europe. Due to this sheltering, it has not yet experienced full productivity gains driven by competition; ergo, the Balassa-Samuelson effect, which could lead to up to 2% inflation (as it did in the Czech Republic and Slovakia), did not show significant influence on the economies of the Southeast Europe.

The most important implication of the tests carried out in this paper is that countries in the Southeast Europe should not easily give up their monetary control by joining the Economic and Monetary Union of the European Union (EMU). Since the relative PPP is rejected in all countries, as the real exchange rate is shown not to be stationary, it is questionable whether or not they are a part of the optimum currency area of euro. Joining the Eurozone could prove to be a less-than beneficial move for these countries, as they would enter the currency area with economies not completely aligned with economic cycles of the region of the Southeast Europe. This would mean that monetary policy set by the European Central Bank would not necessarily match the needed monetary approach for countries in this region, as the ECB tends to shape its policy according to the needs of the core EU countries. The mismatch of monetary actions and steps needed to prevent a complete spill over of economic shocks in the EU core to the region could only exacerbate problems in the Southeast Europe: these economies are fragile anyhow, and their inability to use monetary policy in response to shifts in economic fundamentals could be a major reason for prolonged periods of crises. Combined with slow political processes, cumbersome procedures and innate time lags in effects of the fiscal policy, countries could be left with no instruments to fight off even the slightest of shocks. The rejection of the Balassa-Samuelson effect only enforces the conclusion that countries in the Southeast Europe fundamentally deviate from economic cycles of the core EU countries. As such, those causes should be fully examined before any of those countries starts the process of joining the EMU.

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