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Balassa-Samuelson Effect in Transition Economies: The Case of Slovenia

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Abstract

Paper presents a first-hand examination of the Balassa-Samuelson effect in Slovenia. Different measures of real exchange rate are presented in order to provide arguments for the Balassa-Samuelson effect estimation using *external* real exchange rate measure. It is argued that on average one percent increase in productivity differential between labor productivities in industry and services appreciated *external* real exchange rate by almost 1.5 percent in the period from 1993:1 to 2001:2. At the same time, one percent increase in productivity differential caused about 1.7 percent increase in CPI. The results are in line with other studies on real exchange rate behavior in transition economies.

Keywords: transition economies, real exchange rate, Balassa-Samuelson effect
JEL Classification Codes: F31, F41, P22, P24

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1. Introduction

The historical overview on the exchange rate modeling points out the theoretical and empirical problems associated with each approach to the real exchange rate determination. Each of the known approaches to the modeling of the real exchange rate carries its own strengths and weaknesses. Generally, one could abstract from details emerging from different approaches to the empirical testing of the long-run equilibrium real exchange rates and summarize the empirical evidence on different models of real exchange rates in the following two groups of arguments. First, evidence on average suggests that the real exchange rate is not a random walk as evidenced on earlier empirical work may have implied (Meese and Rogoff, 1983), and that shocks to the real exchange rate damp out over time, albeit very slowly. In this light, the real exchange rate fluctuates and may exhibit large and sustained deviations from its estimated mean as long as the deviations revert to the mean. The estimated mean is regarded as a purchasing power value, although the estimates may be far from the mean of unity required under purchasing power parity. And second, evidence shows that real exchange rates tend to be lower[1] in rich countries than in poor countries, and that relatively fast growing countries experience real exchange rate appreciations. Historically, the technological process has been higher in the tradable goods production than in the non-traded goods sector. Moreover, the tradable goods productivity bias seems to be more pronounced in high-income countries. An increase in productivity of the tradables production bids up wages in the entire economy. Producers of non-tradables are only able to meet the higher wages if there is an increase in the relative price of the non-tradable goods ensuing a higher general price level since the price of tradable goods is determined in world markets. This phenomenon is best known as the Balassa-Samuelson effect. Empirical studies on exchange rate behavior in transition economies indeed support this view[2].

The aim of this paper is to empirically test the Balassa-Samuelson effect in Slovenia. For that reason, two main definitions of real exchange rate are described in Section 2. It is shown that both definitions are linked in a way which enable one to directly estimate the Balassa-Samuelson effect using the *external* measure of the real exchange rate. Empirical confirmation of the existence of the Balassa-Samuelson effect in 19 transition economies is presented in Section 3. Section 4 presents a first-hand estimation of the effect in Slovenia in period from 1993:1 to 2001:2. It is argued that part of the real exchange rate appreciation in Slovenia could be attributed to an increase in productivity differential between labor productivity in industry and services. Section 5 concludes.

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[1] The real exchange rate appreciation represents a decrease in the real exchange rate index.

[2] See Halpern and Wyplosz (1996, 2001); Krajnyak and Zettelmeyer (1998); Richards and Tersman (1996); Jazbec (2001); and Coricelli and Jazbec (2001).

2. Real Exchange Rate Definitions

It is argued that in spite of different initial conditions and approaches to macroeconomic stabilization across transition economies, once the structural reforms had begun, most economies have experienced similar paths of output development and macroeconomic performance. Following the same line of argument, one could argue that the relative price development should exhibit similar, if not the same, pattern in transition economies. The evidence on almost all transition economies indeed reflects a continuous appreciation of the real exchange rate after initial devaluation of domestic currencies initiated by price liberalization. Since the real exchange rate is a function of a number of fundamental real variables, which change over time, the most intriguing question is to determine which actual exchange rates are in line with their fundamentals. In an attempt to provide an answer to this question, two main approaches to the real exchange rate modeling can be widely recognized (Clark, 1996). The first one characterizes the equilibrium exchange rate as a desirable real exchange rate consistent with an ideal macroeconomic performance establishing internal and external balance. The internal balance is defined as the level of economic activity that keeps the inflation rate constant, while the external position is balanced if the external current account can be regarded not only as sustainable, but also as appropriate based on desired levels of savings and investment. In this sense, *desirable real exchange rate* is a normative measure. On the other hand, *natural real exchange rate* is a positive concept, which involves the specification and estimation of an equation that explains the actual movements of the real exchange rate in terms of changes in economic fundamentals. A distinctive characteristic of both definitions is characterization of the fundamentals that are believed to determine the real exchange rate. While the first concept attempts to find desirable and potential economic variables, the second concept simply concentrates on the actual movements of the determinants of the real exchange rate. The concept of an equilibrium real exchange rate is especially delicate in transition economies. As these economies are going through massive structural changes whose dynamics directly affect the determination of the fundamentals and consequently, the real exchange rate, it would be too ambitious to define the equilibrium real exchange rate for the transition economies. For that reason, the notion of the actual real exchange rate is used in what follows.

The most common notion of currency value is the bilateral exchange rate quoted by foreign exchange traders or reported in the newspaper. This nominal exchange rate is the number of units of one currency offered in exchange of a unit of another. A nominal bilateral exchange rate is required to translate cash flows in one unit of account into its equivalent in another unit. If the nominal exchange rate is relatively easy to define, then the real exchange rate is a rather vague concept both in conceptual and empirical terms. In international economic literature, several alternative definitions of the real exchange rate are used. These definitions reflect two main approaches. The real exchange rate is defined either (1) in *internal terms* as the ratio of the domestic price of tradable to non-tradable goods within a single country or (2) in *external terms* as the nominal exchange rate adjusted for price level differences between countries (Hinkle and Nsengiyumva, 1999).

The first concept of *internal* real exchange rate was popularized by the work of Dornbusch (1988) and Frenkel and Mussa (1985), who defined the real exchange rate as the relative price of tradable to non-tradable goods. Dornbusch (1988) demonstrated that if the domestic price of non-traded goods is given, then the attainment of the equilibrium relative price requires the adjustment of the domestic price of traded goods. Given the Law of One Price, this requires an adjustment of the exchange rate. Thus, changes in the relative price of tradable goods in terms of non-tradable goods can be associated with a rate of exchange between currencies. In turn, given the prices of non-tradable goods abroad, all movements in the relative price of tradable goods can be associated with the change in the real value of the currency. The original idea of the relative price of tradable in terms of non-tradable goods goes back to Salter (1959) and Swan (1960) and has evolved from the theoretical models of a dependent economy. It captures the internal relative price incentive in a particular economy for producing or consuming tradable as opposed to non-tradable goods. The real exchange rate in this case is an indicator of domestic resource allocation incentives in the home economy. This approach is usually widely used for analytical purposes in developing countries. The exports in these countries are predominantly primary products subject to the Law of One Price, and the export volume is determined by the supply offered on the world market at a world price rather than by the demand at a quoted price (Williamson, 1994). In such an economy, the relative price of non-traded goods determines the incentive to produce exports.

The second concept of the *external* real exchange rate follows a more traditional approach to the real exchange rate, which relies on the Purchasing Power Parity (PPP) doctrine. According to this approach, the real exchange rate corresponds to the deviation from PPP between foreign and domestic price levels. This approach enables the comparison of the relative value of currencies by measuring the relative prices of foreign and domestic consumption or production baskets. Under certain restrictive conditions, the two approaches gain the same results. These conditions, however, not always meet so that in practice, the two forms of the real exchange rate diverge. Changes in the productivity of the traded goods sector and the terms of trade are believed to be the principal sources of divergence (Dwyer and Lowe, 1993). Within each of these two broad real exchange rate concepts, there are several alternative formulations derived from different analytical approaches (Hinkle and Nsengiyumva, 1999). There are at least three primary versions of the *external* real exchange rate. They are mainly distinguished by the different price indices they used. These measures of the real exchange rate are based alternatively on the PPP theory, which uses domestic and foreign country Consumer Price Indices; on the Mundell-Fleming or aggregate production cost real exchange rate, which uses the GDP deflators; and on the Law of One Price and competitiveness in the pricing of internationally traded goods, which can be constructed using relative unit labor costs in manufacturing, wholesale prices, manufacturing sector deflators, or export unit values (Montiel and Hinkle, 1999). Similarly, there are several different definitions of the *internal* real exchange rate based on two-, three-, or multi-good models. The existence of multiple concepts and alternative measures of the real exchange rate raises questions concerning the theoretical and empirical relationship among these, the interpretation of differences in their behavior, and the appropriate measure to use in given circumstances (Clark and MacDonald, 1998; Montiel and Hinkle, 1999).

Problems encountered in the measurement of both concepts of the real exchange rate are usually associated with the multiplicity of theories underlying the real exchange rate definition and with difficulties involved with the use of alternative price or cost indices. Any survey on the modeling and estimating the real exchange rate, therefore, necessarily offers a biased view on the subject. Any view may easily be questioned on the grounds of different approaches to a growing literature on real exchange rate economics. To reduce the subjectivity of the approach, only the basic concepts within both approaches to the real exchange rate modeling are presented in what follows. In so doing, the clarity of the real exchange rate definitions is hopefully established.

2.1. Real Exchange Rate as the Relative Price of Tradable to Non-Tradable Goods

If E is the nominal exchange rate defined as units of domestic currency per unit of foreign currency, P_T^f is the world price of tradables in terms of foreign currency, and P_N is the price of non-tradable goods, the real exchange rate, e, can be identified as:

(1) $$e = \frac{EP_T{}^f}{P_N}.$$

Assuming that the Law of One Price holds, $P_T = EP_T{}^f$, expression (1) is written as:

(2) $$e = \frac{P_T}{P_N}.$$

The Law of One Price defines tradable goods as those goods whose prices are determined entirely by prices abroad and the nominal exchange rate. In this formulation, all other goods are implicitly non-traded in the sense that their prices are determined by other factors besides international prices. Expression (2) summarizes incentives that guide resource allocation across the tradable goods and non-tradable goods sectors. An increase of e defined as (2) represents depreciation. An increase in the real exchange rate makes the production of traded goods relatively more profitable, inducing resources to move out of the non-tradable to tradable sector. Additionally, the real exchange rate as defined in (2) provides an approximation of the degree of competitiveness of the country’s tradable sector and measures the cost of domestic production of the tradables. A decline in the real exchange rate reflects the fact that there has been a decrease in the domestic cost of producing tradable goods. If there are no changes in the world price of tradables, this decline in the real exchange rate represents an improvement of the country's degree of international competitiveness. Finally, the above expression might reflect the composition of the non-tradable goods' consumption in the total consumption. Given both the tradable goods price and the supply of non-tradables, a decline of the real exchange rate reflects the fact that there is an increase in consumption of non-tradable goods and vice versa.

The above definition, however, generally suffers from three problems (De Grauwe, 1996). First, it ignores the impact of the changes in the nominal exchange rate. Second, it is not clear whether the price of tradables, P_T, should include the issue of exchange rate controls on international trade. The presence of such exchange rate controls raises the question of whether to define a real exchange rate inclusive or exclusive of them (Edwards, 1994). And third, it is empirically questionable whether the Law of One Price for tradables holds continuously. Apart from the absence of transportation costs, the validity of the Law of One Price demands perfect markets, perfect competition, and free entry. This is manifestly not the case in practice, even if there are always market forces working in that direction. Empirical research indicates that prices of similar goods in various countries tend to move in the same direction, but are not identical (Obstfeld, 1985; Micossi and Milesi-Ferretti, 1994; De Gregorio, Giovannini, and Wolf, 1994). Even if theoretical concepts of the real exchange rate measured as the relative price of tradables in terms of non-tradable goods are reasonably straightforward, their empirical measurement raises difficult practical problems particularly in finding operational counterparts for the required price indices of tradable and non-tradable goods (De Gregorio, Giovannini, and Krueger, 1993; Hinkle and Nsengiyumva, 1999). In constructing the price indices required for calculating the real exchange rate, one major conceptual issue is how to actually classify goods as tradable and non-tradable. In principle, tradable goods consist of all goods that enter international trade as exports or imports. Tradables do not actually have to be traded but only be capable of being exported or imported. Tradability of a certain good is usually established by the ratio of exports or imports - or even the sum of exports and imports - over the total production of that good. De Gregorio, Giovannini, and Wolf (1994) take any good whose ratio of exports to its total volume of production is greater than 10 percent as a tradable good. On this criterion, the agriculture, mining, manufacturing, and transportation sectors are classified as tradable and all other sectors as non-tradable (Chinn, 1997). On the other hand, however, only a few goods and services are totally non-tradable with respect to the real exchange rate index. Additionally, even if the tradability of a good is established, the data required for calculating the real exchange rate are often not available. At most, national income statistics provide value-added GDP data measured by sectors, which classify as data for the purpose of calculating the implicit price deflators for different sectors of the economy. This method of calculating the real exchange rate has, however, two major shortcomings (Hinkle and Nsengiyumva, 1999). The first results from the conceptual difficulties of classifying the different sectors of production as tradable and non-tradable sectors. This is particularly difficult in many transition economies, which lack tracking of long time series and were exposed to structural changes that transformed previously non-traded sectors to the traded sectors. The second shortcoming stems form the high level of aggregation of the data on GDP by sector of origin. This problem is widely associated with services, which mainly include public administration and government, whose prices could not be taken as market determined. Generally, however, there is no consensus on which appropriate qualitative dividing line to use in classifying sectors as tradable and non-tradable. Mostly, it is the matter of a qualitative judgment about which production sectors should be classified as tradables based on the extent of actual or potential participation in foreign trade. The various criteria used in the empirical literature still remain arbitrary and are not necessarily appropriate for all countries.

2.2. Real Exchange Rate as Deviation from Purchasing Power Parity (PPP)

A more traditional concept of the real exchange rate relies on the Purchasing Power Parity (PPP) doctrine. The PPP doctrine is basically a notion that the exchange rate between the currencies of any pair of countries should equilibrate to a ratio of aggregate price indices for the two countries multiplied by an appropriate constant scale factor, or that the percentage change in the exchange rate should equal the difference between the percentage rates of inflation in the two countries. As a parity or arbitrage condition that characterizes the equilibrium relationship between an exchange rate and a ratio of price indices, PPP does not necessarily imply that causation simply runs in one direction, although in using the PPP assumption as a building block for the exchange rate determination models, it has in general been assumed that causation runs from changes in exogenous variables through changes in the ratio of price indices to changes in the exchange rate (Isard, 1987).

Accordingly, the bilateral real exchange rate, e, is equal to the bilateral nominal exchange rate, E, multiplied by the ratio between the foreign price level, P^f, and the domestic price level, P. Denoting the deviation from PPP by e_{PPP}, we have:

$$(3) \qquad e_{PPP} = \frac{EP^f}{P}.$$

Expression (3) defines the deviation from the PPP view of the real exchange rate for a particular country. The bilateral real exchange rate is the simplest and easiest to calculate of all other measures of the real exchange rate indices. The term appreciation is used to refer to an increase in the value of the home relative to foreign currency. Graphically, an appreciation corresponds to a decrease in the real exchange rate index, e, defined in (3). Although this definition of the real exchange rate has been widely used in literature, it suffers from two major measurement problems. First, proxies for the ratio between foreign and domestic price levels have to be chosen. Should the Wholesale Price Index (WPI), which contains mainly tradable goods prices in the two countries, be used? Or, should the Consumer Price Index (CPI), which contains a large share of non-tradable goods prices in the two countries, be used? Second, it is unclear which nominal exchange rate, E, is the most appropriate. Should a nominal bilateral exchange rate with respect to the foreign currency be used? Or should one use a nominal multilateral rate that considers the variability of the exchange rates of a large number of foreign trade partners? In that case, which country weights and averaging method for computing the multilateral real exchange rate should be used?

The multilateral or real effective exchange rate is used when multiple trading partners are considered. Sometimes, the term 'effective' is used to describe the exchange rate index, which includes the effects of tariffs, subsidies, and other charges on the domestic costs of imports and domestic prices of exports (Hinkle and Nsengiyumva, 1999). The multilateral real exchange rate index is defined as a weighted version of equation (3) where appropriate weights, g_i, for each foreign countries, i = 1,...,N, are used. The sum of weights must equal one. The multilateral real exchange rate can be calculated either as a geometric or arithmetic average. Although the arithmetic average is easier to calculate, the geometric averaging technique is usually used because it has certain properties of symmetry and consistency that an arithmetic index does not. The geometric multilateral real exchange rate, $e_{PPP}{}^{m}$, is defined as the following:

(4)
$$e_{PPP}{}^{m} = \prod_{i=1}^{N} (E_i P_i{}^{f})^{gi} (\frac{1}{P}).$$

Practical calculations of the multilateral real exchange rate involve many techniques, which in general provide mathematically equivalent results; however, in general, they use different statistical information as by-products. These methods decompose the components of the multilateral real exchange rate index differently and proved supplementary empirical information useful in analyzing the evolution of the exchange rate indices (Brodsky, 1982). In addition to problems related to calculations of the bilateral real exchange rate, the multilateral exchange rate involves problems of the choice of an appropriate weighting scheme and possible adjustments for shares of trade represented in calculations (Hinkle and Nsengiyumva, 1999). It is again the extent of qualitative judgements that matters in determining which approach one should take in calculating the multilateral real exchange rate.

If the Law of One Price holds for traded goods, it is possible to calculate any of the various concepts of the real exchange rate indices from given values of the others. However, empirically, the Law of One Price holds at best only loosely for traded goods, and measurement errors affect the accuracy of all the empirical real exchange rate measures. Edwards (1989) provides an interesting point discussing the problems related to the definitions of the real exchange rates as expressed in equations (2) and (3). Assume that the price indices, P^f and P, for foreign and home country, respectively, are geometric weighted averages of tradable and non-tradable prices:

(5) $P^f = P_N^{f\ \alpha} P_T^{f\ 1-\alpha}$ for foreign country, and

(6) $P^f = P_N^{\ \beta} P_T^{\ 1-\beta}$ for home country.

Assume further that the country in question is a small country and that the Law of One Price holds for tradable goods. Log-differentiating equations (2), (3), (5), and (6), and combining them gives the relation between percentage changes in the real exchange rate, e, and the PPP real exchange rate, e_{PPP}, as follows[3]:

(7) $$\dot{e} = \frac{1}{\beta}\dot{e}_{PPP} + \frac{\alpha}{\beta}(\dot{P}_T^f - \dot{P}_N^f).$$

Expression (7) shows that, in general, changes in the two definitions of the real exchange rate will differ. Moreover, changes in the two definitions of the real exchange rate can even go in the opposite direction, depending on the behavior of foreign relative prices $(\dot{P}_T^f - \dot{P}_N^f)$. Relative prices in the domestic economy may move differently from those abroad due to various shocks. Generally, two main sources of shock are considered: productivity growth in the traded goods sector and changes in the terms of trade. However, even if the foreign relative price of tradables in terms of non-tradable goods does not change, the change in domestic relative price of tradables will be proportional to the change in the *external* exchange rate, e_{PPP}. Since β, the share of the non-tradable sector in the home economy, is positive but less than one, the change in the domestic relative price of tradables in terms of non-tradables, e, will be larger than the change in its *external* real exchange rate. If, for example, e_{PPP} depreciates because of foreign inflation or a devaluation, the relative price of tradables will depreciate by more through the effect of the Law of One Price on the prices of traded goods, which changes by the full amount on the devaluation or foreign price increase. The opposite holds for an appreciation of the *external* real exchange rate. Also, one can show that a depreciation of the foreign relative price of a tradable good can cause an appreciation of the *external* domestic real exchange rate even though its domestic relative price of tradables in terms of non-tradables has depreciated. To see this effect, equation (7) is solved for the *external* real exchange rate index, e_{PPP}, as the following:

(8) $$\dot{e}_{PPP} = \beta\dot{e} - \alpha(\dot{P}_T^f - \dot{P}_N^f).$$

It is even possible in some circumstances for the domestic *external*, e_{PPP}, and *internal*, e, real exchange rate to move in opposite directions. Such a situation will occur if the change in the foreign

[3] Dot over a variable represents the percentage change of the variable.

relative price of tradable goods is greater than the change in domestic *internal* real exchange rate. Furthermore, the larger is the share of non-tradables abroad relative to a share in the home country, and the greater is the change in the foreign relative price of tradable goods, the likelihood of such contrary movements in a country's *external* and *internal* real exchange rates will be greater. Moreover, taxes and administered price effects may create a further divergence between the *external* and *internal* domestic real exchange rates. These findings are especially important when the determination and development of the real exchange rate in transition economies are analyzed.

Identification of such economic fundamentals is central to the proper interpretation of movements in the real exchange rates and, therefore, the efficacy of any attempt by policy-makers to effect changes in them. Since inconsistencies in the data may pose serious analytical problems in some cases, the best practice would typically involve constructing and analyzing several measures of the real exchange rate indices. All *external* indices of real exchange rate measures contain the nominal exchange rate. Movements in nominal exchange rates tend to be much larger than those in the various measures of the relative domestic and foreign prices because nominal exchange rates respond quickly to monetary as well as real shocks to the economy. It is true, however, that over the longer term, changes in fundamental determinants, especially productivities in different sectors and terms of trade, cause the different measures of the real exchange rates to diverge significantly. On the other hand, exchange rate regimes seemed not to play any direct role in explaining output performance and real exchange rate behavior in transition economies. The fixed exchange rate regime was used mainly to better contain the inflationary pressure, and as such, it affected the real output growth only indirectly through better inflation performance (Fisher and Sahay, 2000).

3. Balassa-Samuelson Effect in Transition Economies

Recent studies on real exchange rate behaviour in transition economies support the argument to use the productivity approach to explain the trend appreciation of the real exchange rate in transition economies (especially Halpern and Wyplosz, 1996, 2001). There is vast potential for gains in productivity in transition economies both through more efficient use of existing resources and technologies and through upgrading technology. However, this approach should also take into account the initial conditions in transition economies at the beginning of reforms, as they significantly determined the macroeconomic policies and structural changes implied by the overall stance of the economies in those times. Decades of central planning have resulted in distorted structures of these economies. Industries had become overwhelming in the composition of output due to the emphasis of central planners on material production, while services were largely neglected. The structure of the economy was reflected in distorted price levels as empirical studies on price development in transition economies indicate. Transition and the introduction of market-determined prices along the other market-enhanced reforms have brought about massive changes in output, employment and, last but not least, in relative prices. To analyse structural changes in transition economies, it is therefore useful to use the approaches that take into account the real changes in the fundamentals rather than models with established patterns of developments in market economies. As such, the productivity approach to the real exchange rate determination serves as a natural candidate for analysing the real exchange rate in transition economies.

To explain the price differential, assume that there is an economy-wide wage that is equal to the marginal product of labour in each sector. To the extent that there are differences in productivity between countries, wages will differ as well. In less-developed countries, productivity is generally lower than in more developed countries. While this applies to both sectors of the economy, there is evidence that the productivity gap is larger for tradables than it is for non-tradables. Also, the scope for productivity gain is more limited in non-tradables than in tradables. Because of this, the price of non-tradables will typically be lower in less-developed countries than in industrial countries. Since the overall price level is a weighted average of the price levels of tradable and non-tradable goods, the general price level will be lower in less-developed countries, with the difference being a function of the proportion of goods that are non-tradable, and the price differential for non-tradables (Richards and Tersman, 1996).

3.1. Simple Theoretical Framework to Account for Balassa-Samuelson Effect in Transition Economies[4]

The real wage is an increasing function of the targeted real wage determined by pre-transition levels, and positive shocks to the demand for labour determined by productivity parameters in both sectors of the economy and government consumption. The more distorted is the pre-transition equilibrium wage (the higher is the equilibrium wage determined by the central plan's objective to produce more of the industrial good relative to services), the higher is the pressure of the union to negotiate for higher wages once transition starts. It is established that the nominal wage is an increasing function of the real wage determined by the pre-transition structural parameter, η, which takes into account a distorted measure of the transition economy, productivity parameters, and government consumption. The nominal wage is, therefore, determined as follows:

$$W = W(\omega(\eta), a_T, a_N, G), \tag{9}$$

where W is the nominal wage; $\omega(\eta)$ represents the average real wage depending on the structural parameter, η; a_T and a_N represent the technology parameters specific to the production of tradable and non-tradable goods, respectively; and G stands for real government consumption of non-tradable goods.

[4] See Jazbec (2001), and Coricelli and Jazbec (2001) for a full derivation of the model of real exchange rate determination in transition economies.

All variables enter the nominal wage equation with positive signs as expected. The only indeterminacy may arise from the sign of a_N, which can take either a positive or negative value. However, it is assumed that an increase in non-tradable sector productivity in transition economies increases demand for labour to satisfy private sector demand in the tradable and non-tradable sectors by less than the increase in tradable sector productivity. The nominal wage equation is one of the most important equations in this framework since the real economy parameters enter the real exchange rate measure via the nominal wage equation. It is assumed that the price of tradables is determined in the world market and, therefore, is given exogenously to a transition economy. For this reason, the price of tradables could be normalised to 1 in order to provide the following expression for the real exchange rate measure:

$$(10) \qquad \frac{1}{P_N} = \frac{\Phi - 1}{\Phi}\left(\frac{a_N}{W(\omega(\eta), a_T, a_N, G)}\right),$$

where P_N is the price index for non-tradable goods and Φ is share of non-tradable goods consumption in total private consumption.

The real exchange rate measured as the relative price of tradables in terms of non-tradable goods, therefore, negatively depends on the productivity differential, the share of non-tradable consumption in total private consumption, and real government consumption. The parameter that measures the extent of structural misalignment inherited from the central plan, η, enters the real exchange rate equation with a positive sign. The regression equation used in the next section is presented as follows:

$$(11) \qquad \log(P_T/P_N)_{i,t} = \alpha_{oi} - \alpha_1 \log(a_T - a_N)_{i,t} - \alpha_2 share_{i,t} - \alpha_3 govreal_{i,t} + \alpha_4 lab_{i,t} + \varepsilon_{i,t},$$

where $(P_T/P_N)_{i,t}$ is the relative price of tradables in terms of non-tradable goods; $(a_T - a_N)_{i,t}$ is the productivity differential between tradable and non-tradable goods production and is measured in terms of labour productivity in both sectors; $share_{i,t}$ represents the share of non-tradable consumption in total private consumption; $govreal_{i,t}$ is the share of government consumption in GDP measured in constant prices; and $lab_{i,t}$ represents the structural misalignment variable. It is proxied for by the ratio between labour employed in the tradable sector versus labour employed in the non-tradable sector. The sign of all coefficients is negative except the sign on the structural variable, which enters the equation with a positive sign. This constitutes the positive correlation between the real exchange rate and the labour employed in the tradable sector relative to the non-tradable sector. For this reason, the structural variable proxied for by the labour ratio represents the parameter that measures the rigidity of the labour market to structural changes in the economy. As for the rest of the story, this rigidity is assumed to be exogenously determined in the economy and thus independent of all other right-hand side variables in equation (11).

This is a relatively stringent assumption on the structure of a transition economy, and its validity can be seriously questioned.

3.2. Data

Data used to construct price indices, productivity measures, demand variables, and structural parameters cover 19 transition economies[5]. Each transition economy is observed from the start of its most serious stabilisation attempt as defined by Fisher, Sahay, and Vegh (1996). This implies that the relative price of tradables in terms of non-tradables is set to 1 in the year of the most serious stabilisation attempt. The implicit GDP deflator for industry in each country represents the price of tradables. Analogously, the implicit GDP deflator for services defines the price of non-tradables. The criterion for the period of observation was the year after which the relative price of tradables in terms of non-tradables started to consistently decline. However, this criterion has not been followed in all cases[6]. Different periods of observation were examined and compared to each other. For all countries, the period of observation ends in 1998. The longest series runs from 1990 to 1998, while the shortest covers the period from 1995 to 1998. The whole sample includes 122 observations.

For the purpose of analysis, two sectors were distinguished: tradable and non-tradable. While theoretical literature on real exchange rates relies upon the division of commodities into tradables and non-tradables, it is almost impossible to construct these two groups of commodities in reality. An obvious benchmark for tradability should be the extent to which the particular good is actually traded. For example, the sector is defined as tradable if more than 10 percent of total production is exported. In general, one would label manufactures as tradables and services as non-tradables. However, this is quite impossible at this stage in transition economies. In what follows, the tradable sector is represented by the industry sector, which includes manufacturing; gas, electricity, and water; mining and quarrying; and construction. The reason that all other sub-sectors besides manufacturing were included in the measure for the tradable sector was that for some countries sectoral data and data on international trade flows were not available. To ensure consistency, all tradable sectors in different countries include gas, electricity, water, mining and quarrying, and the construction sector although one could doubt their tradability. A more substantial problem arises from the inclusion of non-market services into the variable representing the non-tradable sector. However, the reasons for the inclusion of non-market services into the total services sector are the same as for the construction of the tradable sector variable. It is believed that, on average, these complications fade away although in specific cases they could represent the main reason for the different behavior of relative prices, as argued later.

[5] Armenia, Azerbaijan, Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia, Ukraine, and Uzbekistan.

[6] Exceptions are Belarus, Romania, and Russia where the relative price of tradables has indeed increased. For these cases, the beginning of the observed period starts after the initial depreciation.

The independent variable is the relative price of tradables in terms of the price of non-tradable goods. The implicit sectoral GDP deflators for industry and services are used to proxy for the price indices in these two sectors. The relative price takes value 1 at the beginning of transition and enters the regressions in logarithms.

Data on the right-hand side of equation (11) fall into the following categories:

- *Productivity measure*. This variable is solely represented by the productivity differential between labour productivity in the production of tradable goods and labour productivity in the production of non-tradables ($((a_T - a_N)_{i,t})$). The productivity differential measures the extent of the Balassa-Samuelson effect on the real exchange rate. The rationale for using labour productivity instead of total factor productivity (TFP), which would theoretically follow from the specification of production function, is merely determined by the data availability. To construct the TFP measure, one would need reliable data on capital stock in transition economies, which is quite impossible since there are problems related to the physical extent of capital stock as much as to pricing of capital in these economies. This problem is especially relevant in measuring the capital stock in the service sector. For the time being, it is assumed that labour productivity would consistently represent the effect of the productivity differential on the real exchange rate measure. The labour productivity variable was constructed from the sectoral GDP figures measured in constant prices divided by the labour employed in that sector. In the case of the non-tradable productivity variable, problems arise mainly from the inclusion of government services into the total services sector. On the other hand, tradable sector productivity suffers from the broader definition of the tradable sector. Usually, one would consider the tradable sector to be mainly represented by manufacturing. In the case of transition economy data, this sophistication was relatively impossible. The productivity measures in both sectors, therefore, reflect the complications of data availability rather than conceptual issues. Data on sectoral GDP in constant prices were gathered from national accounts collected by World Bank desk economists. Labour data were obtained from ILO publications and from EBRD desk economists. The productivity differential variable enters equation (11) in logarithms.

- *Demand variables*. These variables consist of the share of non-tradable consumption in total private consumption ($share_{i,t}$) and real government consumption measured in percent of GDP ($govreal_{i,t}$). The share of non-tradable consumption in total private consumption is believed to measure the shift of private consumption from tradables to non-tradables. It is expected that this variable should have a substantial impact on the relative prices in transition economies since product variety as much as the liberalisation of economies have greatly improved since the beginning of transition. One possible explanation of the increased effect of private demand for non-tradables on the real exchange could be found in a surge of capital flows into the region. Some of the capital inflows were directed to private consumption. Consequently, the price of non-tradable goods increased and caused the appreciation of the relative price of tradables. The change in the share of non-tradable consumption in total private consumption should, therefore, negatively affect the relative price of tradables in terms of non-tradables. Government consumption is assumed to fall only on non-tradable goods. Therefore, the private consumption of non-tradables is equal to value added in services minus government consumption. Total private consumption is the sum of non-tradable and tradable consumption. The latter is equal to value added in tradable goods plus the deficit in the trade balance. De Gregorio, Giovannini, and Krueger (1993) argue that the nominal government expenditure over nominal GDP is by construction correlated with the real exchange rate. For this reason, real government consumption over real GDP is used to construct the real government consumption measure ($govreal_{i,t}$).

- *Structural variable*. As follows from the model, the preference of central plans in the pre-transition period for the industry sector meant a larger number of workers in industry compared to employment in services. Once transition started, the number of workers in industry declined while employment in services increased. To capture this effect, the structural variable ($lab_{i,t}$) was constructed by dividing the number of workers employed in industry by the number of workers employed in services. The same line of argument for constructing this variable is relevant as in the case of constructing the tradable and non-tradable sectors. As transition progresses, the structural variable should decline and positively affect the relative price of tradables in terms of non-tradable goods. The reasons for a decline of the labour ratio throughout the transition process should be attributed to the structural changes in the transition economies, and thus exogenous to other right-hand side variables in the regression equation (11). To impose the latter, the structural variable ($lab_{i,t}$) was instrumentalised by the structural reform index constructed by De Melo, Gelb, and Denizer (1996)[7], and total credit to the private sector (EBRD Transition Report, 1999). Also, the structural reform index itself was used in a few regressions to avoid possible mis-specification of the instrumental variable. However, the results do not differ significantly. Empirical work on growth in transition economies is mainly driven by the search for an appropriate set of variables to distinguish transition economies from their developed counterparts, and that would more thoroughly explain the output behaviour in the region. In the case of exchange rate behaviour, this argument is even more pronounced.

Due to potential endogeneity, the structural variable approximated by the ratio between labour employed in the tradable sector and labour employed in the non-tradable sector was instrumentalised by the structural reform index and credit to the private sector in transition economies. In a few regressions only the structural reform index was used. The results, however, did not change substantially. The structural reform index was originally constructed by de Melo, Gelb, and Denizer (1996) and covered the period from 1990 to 1996. The updates from 1996 are constructed on the basis of the EBRD Transition Reports (1997, 1998) and presented in Havrylyshyn et al. (2000). The structural reform index is a weighted average of three sub-indices: the index of internal liberalisation, which scores price liberalisation and the dismantling of trading monopolies in domestic markets; the index of external liberalisation, which measures the removal of trade controls and quotas, moderation of tariff rates, and

[7] The updated structural reform index is presented in Havrylyshyn et al. (2000).

foreign exchange restrictions; and the index of private sector conditions, which measures the progress in privatisation and financial sector reforms (de Melo, Gelb, and Denizer, 1996; Berg et al., 1999).

3.3. Summary of Empirical Results

Regression equation (12) reproduces the results for the full sample of 19 economies, each observed in time since the beginning of the transition process. Coefficient estimates are reported with standard errors adjusted for heteroscedasticiy in parenthesis. Superscripts indicate their possible insignificance at a 5 percent level[8] of confidence. Country-specific dummies (not reported) are significant in most of the specifications. The results of the basic equation (12) produce the earlier findings that the productivity differential, the share of non-tradable consumption in total private consumption, and real government consumption negatively affect the real exchange rate, thus contributing to the real appreciation. The labor ratio between labor employed in tradables to labor employed in non-tradable goods production enters the regression with a positive sign as predicted by the model. This suggests that the delay in structural reforms – relatively high values of the labor ratio variable at the beginning of transition relative to its end values – in general tends to act as a restraining force on the real exchange rate.

$$\log(P_T/P_N) = \text{country dummy} - \underset{(0.169)}{0.868} \log(a_T - a_N)^* - \underset{(0.219)}{1.656}\ \text{share}^* - \underset{(0.379)}{0.749}\ \text{govreal}^* + \underset{(0.202)}{0.644}\ \text{lab}^* \tag{12}$$

R^2(adj.) = 0.853
N = 122

The results are fully consistent with the view that structural reforms in transition economies contributed to the real appreciation trend observed in the region from the beginning of transition. Since all regressions[9] are run in transition time, the results indicate that we can still expect further appreciation of the real exchange rate in those economies that started with transition later. As indicated in regression equation (12), the productivity differential used to measure the Balassa-Samuelson effect had a pronounced effect on appreciation of the real exchange rate in transition economies in period prior to

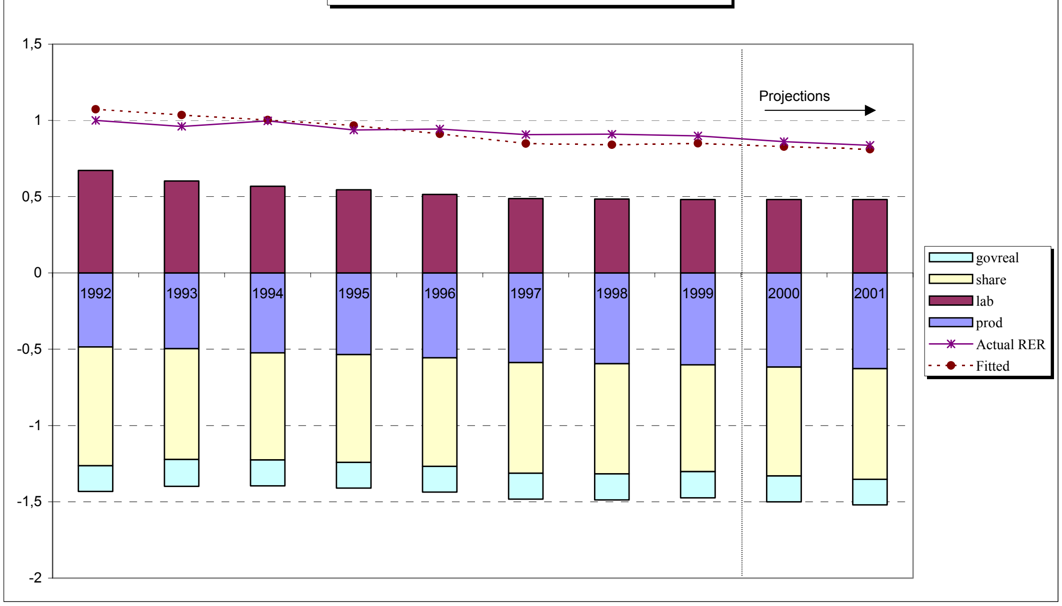
[8] Tests on whether a coefficient differs significantly from zero in the expected direction are based on one tailed t-tests and a 5 percent confidence interval which, for an infinite number of degrees of freedom, involves an absolute value of t greater than 1.98.
[9] Several regressions were run by adding region specific dummies to distinguish possible effects across transition economies included in the sample. Results confirm those presented by equation (12). For the whole description of econometric results see Jazbec (2001).

1999. One percent increase in productivity differential has on average contributed to almost 0.9 percent appreciation of the real exchange rate measured in terms of relative prices. This result is in line according to Balassa-Samuelson effect, which states that prices of tradables are determined in the world market and therefore equalized across countries. Prices of non-tradables are assumed to be determined domestically based on the domestic wage and productivity levels. To the extent that productivity in the two sectors within the country grows at different rates, it is likely that there will be offsetting movements in the relative price of tradables in terms of non-tradables. If the trend growth of productivity in the tradable goods sector exceeds that of the non-tradable goods sector, there will be a tendency for the relative price of tradables to decline over time.

4. The Case of Slovenia

Econometric results derived from estimation of equation (12) can be used to graphically account for a development of the real exchange rate in Slovenia presented in Figure 1. For each time period, summing the product of each right-hand side coefficient and the corresponding data for each variable. Stacked columns represent the level of real exchange rate in each year. The portions of columns correspond to actual contributions that each variable had to the level of the real exchange rate in each year of the transition process. The sum of all portions of a column and country-specific constants add up to the fitted value for the real exchange rate level in the respective year. Nonetheless, it is the dynamics of the contribution of each set of variables that is interesting in explaining the determination of the real exchange rate in Slovenia.

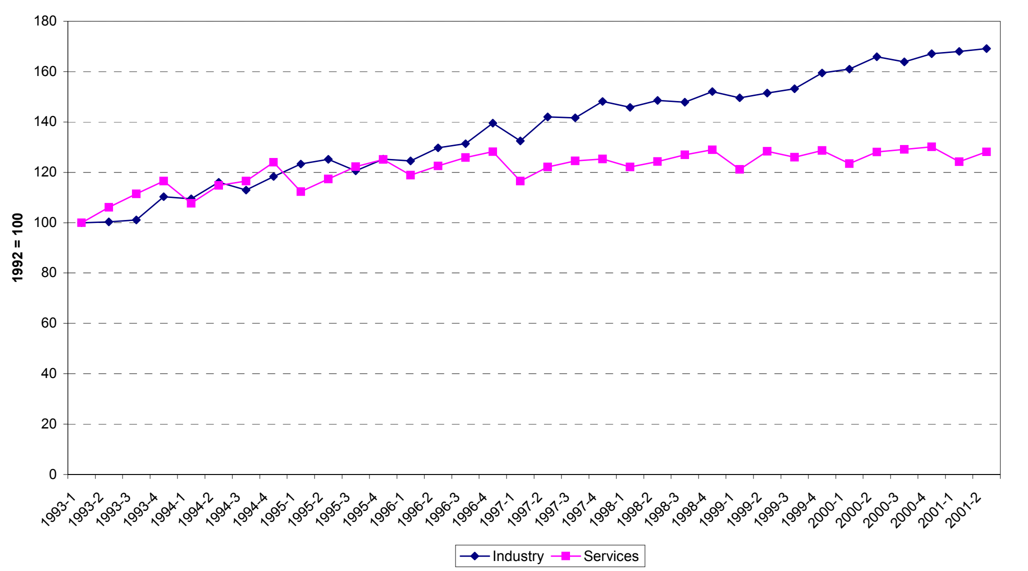
Figure 1: Accounting for Real Exchange Rate in Slovenia



Source: Author's calculations.

As the effect of demand variables represented by the share of non-tradable consumption in total private consumption and government consumption has remained relatively unaltered, the main determinants of the level of real exchange rate in Slovenia were structural changes and productivity differential. In the period from 1992 to 1996, the structural changes proxied by labor shifts from industry to services were the most influential factor determining the level of real exchange rate. From 1996 onwards, the productivity differential between labor productivity in industry and services has started to effect the real exchange rate substantially. The plot of quarterly labor productivity measures in industry and services presented in Figure 2 supports this line of argument.

Figure 2: Labor Productivity in Industry and Services



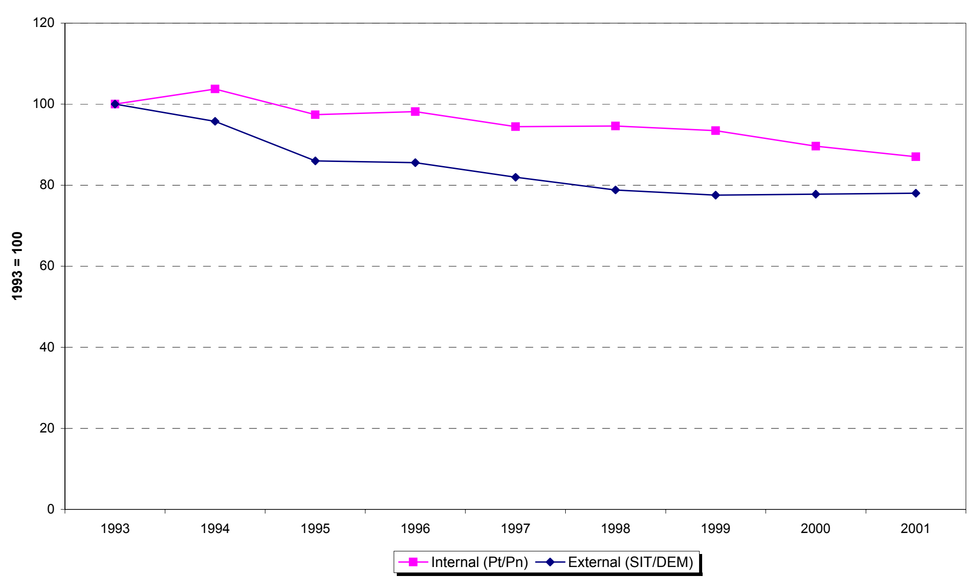
Source: Bank of Slovenia.

The structural changes caused the increase of labor productivity in both sectors before 1996. Thereafter labor productivity in industry has been increasing faster than in services. For that reason, the productivity differential believed to cause the real exchange rate appreciation via Balassa-Samuelson effect has started to affect the level of real exchange rate relatively more than the extent of structural reforms which has diminished in recent years.

As pointed out in Section 2, different definitions of the real exchange rate may disguise the real determinants of real exchange rate. While the concept of *internal* exchange rate defined as the relative price of tradables in terms of non-tradables was used in Section 3 to determine the real exchange rate in transition economies, it is instructive to replicate the exercise using the concept of *external* exchange rate.

Figure 3 presents both measures of the real exchange rate in Slovenia. While *internal* exchange rate is represented by a ratio between industry and services GDP deflators, the *external* real exchange rate represents nominal exchange rate for DEM expressed in tolars corrected for by German and Slovenian Consumer Price Indexes (CPI). As expected, measures differ significantly and point out the differences of using *external* and *internal* concept of real exchange rate as indicated by equation (8) in Section 2. In recent years, both measures of real exchange rate have started to converge slowly. The reasons for the observed development are yet to explore, however, one potential source of convergence may be the pronounced effect of further price liberalization in Slovenia where the share of administered prices in the economy has declined from over 20 percent to less than 15 percent. Also, a change in share of non-tradables in the CPI is likely to contribute to a further decline in differences in both measures of the real exchange rate. Part of the converging differences in both measures of the real exchange rate could also be explained by sterilized intervention of the Bank of Slovenia that followed the policy of quasi-targeting of exchange rate in the observed period. More importantly, looking at the productivity developments in industry and services presented in Figure 2, it seems that the Balassa-Samuelson effect contributed substantially to a lower level of *internal* real exchange rate with respect to the initial level at the beginning of transition.

Figure 3: Different Measures of Real Exchange Rate



Source: Bank of Slovenia and World Bank Database.

To test the Balassa-Samuelson effect in the period from the first quarter of 1993 to the second quarter of 2001, bivariate VAR models were tested. Data comprise of quarterly *external* real exchange rate calculated as nominal exchange rate for DEM corrected for by German and Slovenian CPI, and quarterly labor productivities in industry and services. Taking into account the concerns regarding data construction expressed in Section 2, it is assumed that labor productivities are good approximation for total factor productivities in Slovenia. As for the definitions of tradable and non-tradable sectors, the most general approach was considered. In so doing, the industry sector represents tradable sector, and all services – market and non-market services - comprise non-tradable sector. As follows from equation (8), both measures of real exchange rate are linked in a way, which allows one to directly estimate the effect of productivity differential on real exchange rate level using the *external* measure of the real exchange rate[10].

Tables 1 and 2 reproduce basic econometric results for cointegrated VAR models used to estimate the extent of the Balassa-Samuelson effect in period from 1993:1 to 2001:2. Table 1 presents results of VAR analysis using *external* real exchange rate and productivity differential. Table 2 presents results for the CPI and productivity differential. In both cases one cointegrating vector was identified. Also specification tests - not shown here - show no sign of model mis-specification. All series were estimated in natural logarithms. Both VAR models were estimated with one lag as identified by specification tests.

Table 1: *External* Real Exchange Rate and Productivity Differential

Cointegration Analysis	**Real Exchange Rate**	**Productivity Differential**
β coefficient	1.4651	1.0000
Std. Error	*0.31774*	*0.0000*

Choice of Rank			
Eigenvalues	Real	Complex	Modulus
	0.9617	0.0000	0.9617
	0.7795	0.0000	0.7795

Table 2: Consumer Price Index (CPI) and Productivity Differential

Cointegration Analysis	**CPI**	**Productivity Differential**
β coefficient	-1.7371	1.0000
Std. Error	*0.12817*	*0.0000*

Choice of Rank			
Eigenvalues	Real	Complex	Modulus
	0.9588	0.0000	0.9588
	0.5392	0.0000	0.5392

Source: Author's calculations.

[10] For a derivation of the Balassa-Samuelson effect see Obstfeld and Rogoff (1996), Chapter 4. Also see Jazbec (2001), and Coricelli and Jazbec (2001).

Results from Tables 1 and 2 confirm the Balassa-Samuelson effect in Slovenia. A coefficient on the *external* real exchange rate from Table 1 suggests that one percent increase of productivity differential causes 1.4651 percent appreciation of *external* real exchange rate. To test the robustness of the results, cointegrated VAR model for the CPI and productivity differential was estimated. Results in Table 2 show that one percent increase of productivity differential causes 1.7371 percent increase of the CPI. If the theoretical considerations for the existence of the Balassa-Samuelson effect are correct, than the results for the Slovenian case follow the line of argument usually employed for the transition economies. The estimated Balassa-Samuelson effect for the transition economies is found to be around 2 to 3 % per year (Halpern and Wyplosz, 2001; several IMF transition country studies). As Slovenia is the most developed transition economy regarding the GDP per capita, and in addition to the conclusions from growth models which state that better developed countries grow at slower pace than less developed counterparts, than the results obtained for the Slovenian case confirm the theoretical framework for the Balassa-Samuelson effect.

However, the words of caution should apply here, especially with respect to data construction and its short interval of observation. First, data aggregation should more strictly follow a tradability approach with respect to the international competitiveness. MacDonald and Ricci (2001) present a model with further disaggregation of the economy factoring out a distribution sector. They believe that part of the Balassa-Samuelson effect should be contributed to the size and effectiveness of the distribution sector in the economy. In the case of Slovenia, the most general approach to data aggregation was used due to lack of sufficient data. For that reason, tradable and non-tradable sectors were represented by industry and services, respectively. Second, instead of labor productivities one should use total factor productivities to estimate the Balassa-Samuelson effect. However, in case of transition economies total factor productivities may be biased due to inappropriate capital valuation. Third, further research activities should be cast on the measure of the real exchange rate which would best present the productivity approach to the determination of the real exchange rate. Part of this problem was identified in Section 2. The correct transmission channel from productivity differential to relative price levels has to be identified to fully encompass the Balassa-Samuelson effect. Consequently, the reasons for diverging *internal* and *external* real exchange rates should be more thoroughly examined. And finally, although no structural breaks and seasonal components were identified in examined time series their shortness prevents more serious econometric work in order to fully grasp the Balassa-Samuelson effect in Slovenia.

5. Concluding Remarks

The existence of the Balassa-Samuelson effect in transition economies calls for serious research in order to determine its extent and longevity. Problems associated with its determination stem from theoretical interpretations of the real exchange rate measures and appropriate data generation. As theoretical problems were quickly presented in the paper, further work should be done regarding the most appropriate data series used to fully grasp the Balassa-Samuelson effect. In so doing, policy advice will be more adequate and useful.

Nonetheless, empirical results of the presented models in the paper generally confirm the existence of the Balassa-Samuelson effect in Slovenia. Its size varies around 1.5 percent per year based on one percent increase of the productivity differential between labor productivity in industry and services. The size of the effect falls in lower margin estimated in other studies on real exchange rate behavior in transition economies. Although further work on its estimation should be done, the first-hand estimation of the Balassa-Samuelson effect in Slovenia could provide a general framework for the exchange rate policy with respect to the fulfillment of the EMU requirements. As an increase in tradable productivity is the main determinant of economic growth – assuming that non-tradable productivity is more or less the same across countries – relatively higher growth than the average of the EU would necessarily reflect in more appreciated real exchange rate. The scope for real appreciation because of one percent higher relative growth should therefore be about 1.5 percent if estimated models are well-specified. The mentioned caveats about theoretical considerations and data problems should necessarily be taken into account when interpreting this figure.

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