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Balassa-Samuelson Meets South Eastern Europe, the CIS and Turkey: A Close Encounter of the Third Kind?

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Abstract

This paper investigates the importance of the Balassa-Samuelson effect for two acceding countries (Bulgaria and Romania), two accession countries (Croatia and Turkey) and two CIS countries (Russia and Ukraine). The paper first studies the basic assumptions of the Balassa-Samuelson effect using yearly data, and then undertakes an econometric analysis of the assumptions on the basis of monthly data. The results suggest that for most of the countries, there is either amplification or attenuation, implying that any increase in the open sector's productivity feeds onto changes in the relative price of non-tradables either imperfectly or in an over-proportionate manner. With these results as a background, the size of the Balassa-Samuelson effect is derived. For this purpose, a number of different sectoral classification schemes are used to group sectors into open and closed sectors, which makes a difference for some of the countries. The Balassa-Samuelson effect is found to play only a limited role for inflation and real exchange rate determination, and it seems to be roughly in line with earlier findings for the eight new EU member states of Central and Eastern Europe.

JEL Classification: E31, O11, P17

Keywords: Balassa-Samuelson effect, productivity, inflation, real exchange rate, transition, South Eastern Europe, CIS, Turkey

1. Introduction

The prospect of joining the EU and the actual accession of eight countries from Central and Eastern Europe to the European Union in May 2004 have triggered a lot of research related to the Balassa-Samuelson (B-S) effect. A first round of studies, mainly from the late 1990s and early 2000s, suggested that one of the major determinants of high inflation observed at that time in the CEECs was the Balassa-Samuelson effect. Sinn and Reutter (2001) came up with figures up to 6.7% inflation a year due to the B-S effect, and Golinelli and Orsi (2002) and Rosati (2002) followed suit, reporting numbers of the same order of magnitude. The straightforward policy consequence of these results was, as forcefully argued in Buiter and Grafe (2002) and Szapáry (2003), that countries then at the door of the EU were expected to be unable to fulfil the Maastricht criterion on inflation and exchange rate stability because of high structural inflation fuelled by rapid economic catching-up.

A second wave of studies watered down these results considerably and pointed out that the B-S effect may not be all that important for the new EU member states

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after all.[2] For instance, Kovács (2002), Flek et al. (2002), Burgess et al. (2003), Égert et al. (2003) and Mihaljek and Klau (2004) estimated the inflation differential towards the EU-15 to vary, on average, from 0% to 1% a year, with 2% being the highest figure.

Having said this, however, there are very few papers, which analyze the importance of the B-S effect for countries other than the eight new EU member states of Central and Eastern Europe. As a matter of fact, countries involved in future enlargement of the EU and the CIS are badly neglected in the literature in that no country-specific investigation was carried out for them. Most of the time, these countries are included in a panel and very general conclusions are advanced for the panel as a whole[3]. An exception is Nenovsky and Dimitrova (2002) who looked at the case of Bulgaria, but used a brief time span of only five years or so, and Égert et al. (2003) and Dubravko and Klau (2004) who analyze Croatia.

This motivates us to take a closer look at this group of countries. More specifically, we analyze the case of two acceding countries (Bulgaria and Romania), two accession countries (Croatia and Turkey[4]) and two CIS countries (Russia and Ukraine). These are indeed the countries for which data are readily available, on the basis of which not only a narrative analysis but also an econometric investigation can be carried out. In this paper, we use both annual and monthly data and investigate the basic assumptions of the B-S hypothesis. In a next step, we move on to put a figure to the size of the long-term inflation, the inflation differential and the real appreciation to be driven by the B-S effect.

The remainder of the paper is structured as follows: Section 2 briefly sketches out the theoretical background. Section 3 describes the data and the econometric method used in the paper. Section 4 provides some preliminary look at yearly data and reports the estimation results for the basic assumptions. Section 5 investigates the magnitude of the B-S effect both on domestic inflation and the inflation differential. Finally, Section 6 gives some concluding remarks.

2. Theoretical Background

It is a well-understood fact that purchasing power parity (PPP) in its absolute version does not hold true for transitional and developing countries because these countries' currencies are undervalued in terms of PPP. According to PPP, the exchange rate given by the ratio of domestic and foreign absolute price levels should be equal to the nominal exchange rate which can be observed on the foreign exchange market. In other words, the real exchange rate, which is given as $E/(P/P^*) = EP^*/P$, should equal 1. With the exchange rate being defined as domestic currency units expressed in terms of one unit of foreign currency, a real exchange rate higher than one implies undervaluation, which can be clearly observed vis-à-vis the euro for all of the countries under study. This is shown in Table 1 below. The largest undervaluation is found in

[2] Égert, Halpern and MacDonald (2004) provide an overview of other factors affecting the real exchange rate in transition economies (initial undervaluation, the appreciation of the open sector's real exchange rate, regulated prices).

[3] See e.g. Halpern and Wyplosz (1997, 2001), Krajnyák and Zettelmeyer (1998), Begg et al. (1999), DeBroeck and Sløk (2001), Dobrinsky (2003) and Fischer (2004)

[4] Although Turkey is not a transition economy, we also analyse this country for two reasons. First, the EU opened accession negotiations in autumn 2005 with Turkey. Second, Turkey can be also viewed as a catching-up country. This is why it is a worthwhile undertaking to analyse the B-S effect in this country as well.

Ukraine, whereas the Croatian currency appears to be the least undervalued one among the countries under study.

Table 1. Deviation from absolute Purchasing Power Parity vis-à-vis the euro

	1993	1996	1999	2002	2003
BULGARIA	4.21	4.90	3.45	3.03	3.04
CROATIA	2.15	1.65	1.83	1.73	1.75
ROMANIA	4.23	4.20	3.34	2.86	2.90
RUSSIA	6.80	2.77	4.35	2.82	2.94
UKRAINE	8.48	4.46	5.72	4.90	5.62
TURKEY	NA.	2.29	2.14	2.16	2.00

Note: Figures in the table are obtained as EP/P, where E is the actual nominal exchange rate, and P and P* are the absolute domestic and foreign price levels.*
Source: Author's calculations based on data obtained from the WIIW's Annual Database. The data for Turkey is obtained from NewCronos/Eurostat.

The reason for this undervaluation in terms of PPP can be usually traced back to the traditional Balassa-Samuelson argument: the less developed country is usually less productive in producing tradable goods. The price level in the open sector is given by the PPP condition. At the same time, the level of productivity in the open sector, usually lower in the less developed country, determines the price level in the closed sector through inter-sectoral wage linkages. Hence, the price level in the sheltered sector, and subsequently the overall price level, will be below that prevailing in the more developed country. As a result, the observed nominal exchange rate given by PPP in the open sector appears to be weaker, i.e. higher than the exchange rate given by PPP. Notice, however, that this undervaluation in PPP terms is an equilibrium undervaluation if it reflects a difference between productivity levels.

Over time, however, this gap between actual and PPP-given exchange rates tends to disappear provided the developing country exhibits high productivity gains in the open sector. According to the relative version of the Balassa-Samuelson effect, an increase in productivity of the open sector exceeding that in the closed sector (dual productivity henceforth) may go in tandem with increases in real wages in the open sector without any loss in competitiveness given that relative PPP holds in the open sector ($\Delta(E \cdot P^* / P)$ is stable over time). Assuming wage equalization between the open and the market-based sheltered sectors, prices in the closed sector will increase. This productivity-driven inflation in market-based non-tradables then results in higher overall inflation and a positive inflation differential, which in turn causes the real exchange rate to appreciate.

This relationship can be worked out in a formal way by using a two-sector neo-classical framework with perfect capital mobility and with the interest rate assumed exogenous, which leads to the standard equation (1):

$$\hat{p}^{NT} - \hat{p}^{T} = \frac{\delta}{\gamma}\hat{a}^{T} - \hat{a}^{NT} \qquad (1)$$

where circumflexes (^) stand for growth rates and small letters indicate variables taken in natural logarithms. δ and γ denote the share of labour in the open and closed sectors, respectively with $\delta + \gamma = 1$. $\hat{p}^{NT} - \hat{p}^{T}$ represents the growth rate of the relative

price of non-tradable goods and $\hat{a}^T - \hat{a}^{NT}$ is the sectoral difference of growth rates of total factor productivity. It seems more appropriate, however, to derive Eq. (1) on the basis of average labour productivity (as opposed to total factor productivity) and in levels (as opposed to growth rates).

$$\frac{P^{NT}}{P^T} = \frac{\gamma}{\delta} \cdot \frac{Y^T / L^T}{Y^{NT} / L^{NT}} \tag{2}$$

where Y and L denote output and labour and Y/L is average labour productivity (ALP). Transforming equation (2) into logarithms leads to:

$$p^{NT} - p^T = \text{const} + (alp^T - alp^{NT}) \tag{3}$$

where const is a constant term containing $\log(\gamma)$ and $\log(\delta)$. Eq. (3) can be easily extended to model the inflation differential and the real exchange rate of a given country.[5] Eq. (3) has the major advantage over Eq.(1) that labour productivity can be used on its own right rather than as a proxy for total factor productivity.

3. Data Issues and Estimation Techniques

3.1 Data

Both annual and monthly data are used to compute average labour productivity figures. Yearly data available until the mid-1990s are usually based on old national accounts standards. From the mid-1990s on, national accounts data are available in new NACE[6] format. To cover the whole period, the NACE sectors are grouped so as to match sectors with the old standard. Exceptions are Romania and Russia. For Romania, NACE data are readily available for the entire period,[7] while for Russia, only data based on old national accounts standards are available.[8]

Annual data are obtained from the annual database of the Vienna Institute for Comparative Economic Studies (wiiw). The database contains sectoral data broken down into five sectors for Bulgaria, Croatia, Russia and Ukraine from 1991 onwards. For Bulgaria and Croatia, a 15-sector disaggregation is available from 1996, in accordance with the NACE classification. Such disaggregated data are available for Romania and Turkey for the whole period. For a detailed description of the data, see Appendix 2.

In this context, an important issue is related to how sectors are classified into open and closed sectors. We follow a twofold rule for separating sectors into open and closed sectors in that we consider a sector to belonging to the open sector (i) if goods in this sector are potentially subject to good arbitrage leading to price equalization across countries, and (ii) if the sector is governed by market forces. This yields a classification

[5] See e.g. Égert, Halpern and MacDonald (2004).

[6] Nomenclature générale des activités économiques dans les Communautés européennes (NACE))

[7] It should be noted that some doubt arises regarding the reliability of such data starting in 1991.

[8] For Romania, data in NACE format cover 1991 to 2003. For Russia, data are available only in the old format, from 1991 to 2003. Bulgaria: old: 1991–1996, NACE: 1996–2003; Croatia: old: 1991–1995, NACE: 1995–2003; Ukraine, old: 1991–2000, NACE: 2001–2003.

which is in contrast for instance with MacDonald and Wójcik (2004) and Mihaljek and Klau (2004), who argue that tourism, trade and transportation can also be considered open sector.[9] This is the reason why we also check how sensitive the results are for classifying those sectors as open sectors.

For the old SNA classification,[10] three classifications for the open sector are used including respectively (1) industry, (2) agriculture and industry, and (3) agriculture, industry, transport and telecommunications. The rest is considered as belonging to the closed sector, except for agriculture, which, if not included in the open sector, is once used as part of the open sector and once is excluded because of the potentially highly distorting effects of agricultural subsidies. This yields a total of six combinations between open and closed sectors (see appendix Table 1).

Average labour productivity is obtained as sectoral real value added divided by employment (PROD_E) or the number of employees (PROD_M). Real wages are calculated as the nominal wage in the open sector divided by the producer price index (PPI). As the PPI is highly distorted by oil prices in the case of Russia, the CPI is used additionally for this country.

For the new NACE classification,[11] the following five measures are used for the open sector: (a) manufacturing, (b) industry, (c) industry and agriculture, (d) industry, transport and telecommunications, and hotels and restaurants and finally (e) agriculture, industry, transport and telecommunications, and hotels and restaurants. Regarding the closed sector, five alternative measures are considered: (1) the remaining market-based sectors, (2) the remaining market-based sectors plus real estates, (1) and (2) augmented with agriculture if not used in the open sector, (3) market-based sectors and non-market based sectors (education, health, public administration and other communal services) and (4) a measure of (3) completed with agriculture. This yields a total of 18 combinations between open and closed sectors (see appendix Table 2). [12]

For monthly data, average labour productivity in industry is obtained using industrial production and data on employment in industry. In this case, changes in productivity in the closed sector are assumed to be zero as no data is available on a monthly basis. Real wages are obtained as gross or net monthly wages (depending on data availability) divided by the PPI. .[13]

For the relative price of market non-tradables, three measures are employed: (1) the services in the CPI to goods in the CPI ratio, (2) the services in the CPI to the PPI

[9] However, these sectors cannot be viewed as open sectors because, notwithstanding the relatively high share of exports, prices there are determined by domestic factors.

[10] The old classification provides data on six sectors: (1) agriculture, (2) industry, (3) construction, (4) transport and telecommunications, (5) trade, (6) others.

[11] The NACE classification contains the following sectoral breakdown: (1) agriculture (including hunting, forestry and fishing), (2) mining and quarrying, (3) manufacturing, (4) electricity, gas and water supply, (5) construction, (6) wholesale and retail trade, (7) hotels and restaurants, (8) transport, storage and telecommunications, (9) financial intermediation, (10) real estate, renting and business activities, (11) public administration and defence and compulsory social security, (12) education, (13) health and social work, and (14) other community, social and personal services activities.

[12] It should be mentioned that productivity figures may be biased downward for Russia and Ukraine because from 1995 to 1998, huge numbers of employees were forced to take unpaid leaves. As a result, they are included in the statistics even if they did not contribute to output.

[13] For more details on data sources, see appendix 2. Data from national sources are preferred except if longer time series were available from the OECD or the IMF databases. The time span differs in function of the data availability of the different time series. The longest possible time span is always used.

ratio, and (3) the CPI-to-PPI ratio. Time series for services and goods in the CPI are obtained from the Main Economic Database of the OECD. As the OECD has ceased to publish these series for Bulgaria, Croatia, Romania and Ukraine, the series for these countries stop at the end of 2001 or 2002.

We use data in levels as the series are constructed as cumulated indices, which are normalised to the first observation (e.g. 1993=100). This implies that they have no cross-sectional meaning across sectors and countries. We do not know whether productivity is higher in the open than in the closed sector, or which country has the highest productivity level. What we know is the cumulated change from the first observation. Such data do not allow for testing the absolute version but only the relative version of the B-S effect.

For the estimations, the data are transformed in logarithms. Finally, it should be noted that dummy variables are included for Bulgaria to capture the financial crisis in 1997 and for Russia and Ukraine covering 1998 to capture the Russian crisis. The dummy variables take the value of 1 from 1996:07 to 1997:12 for Bulgaria and from 1998:01 to 1999:12 for Russia and Ukraine, and is zero otherwise.

3.2 Estimation Techniques

Given that Eq. (3) defines the data in levels and because the data turn out to be nonstationary in levels, the cointegration technique is employed in this paper. The dynamic ordinary least squares (DOLS) of Stock and Watson (1993) and the bounds testing approach based on the auto-regressive distributed lag (ARDL) model of Pesaran et al. (2001) are used. DOLS incorporates lags and leads of the regressors in first differences and thus accounts for the endogeneity of the regressors and for the serial correlation in the residuals:

$$Y_t = \beta_0 + \sum_{i=1}^{n} \beta_i X_{i,t} + \sum_{i=1}^{n} \sum_{j=-k_1}^{k_2} \gamma_{i,j} \Delta X_{i,t-j} + \varepsilon_t \qquad (4)$$

where k_1 and k_2 denote, respectively, leads and lags. The length of leads and lags is determined primarily on the basis of the Schwarz information criterion. The maximum lag length is set to 6. The presence of cointegration is assessed upon stationarity of the residuals ε_t obtained from the long-term relationship, in the vein of the Engle-Granger approach by testing for unit roots in the residuals of the long-run relationship derived using DOLS as in equation (5). The critical values derived by MacKinnon(1991) for this purpose are used.

$$Y_t = \beta_0 + \sum_{i=1}^{n} \beta_i X_{i,t} + \varepsilon_t \qquad (5)$$

The bounds testing approach uses the error correction form of the ARDL model given in Eq. (6); where the dependent variable in first differences is regressed on the lagged values of the dependent and independent variables in levels and first differences.

$$\Delta Y_t = \beta_0 + \rho(Y_{t-1} + \sum_{i=1}^{n} \beta_i X_{i,t-1}) + \sum_{j=1}^{l_1} \eta_j \Delta Y_{t-j} + \sum_{i=1}^{n} \sum_{j=0}^{l_2} \gamma_{i,j} \Delta X_{i,t-j} + \varepsilon_t \qquad (6)$$

The optimal lag length is obtained relying on the Schwarz information criterion by setting the maximum lag length at 6. To detect the presence of cointegrating relationships, Pesaran et al. (2001) employ the so-called bounds testing approach. Using conventional F-tests, the null of $H_0 : \rho = \beta_1 = ... = \beta_n = 0$ is tested against the alternative hypothesis of $H_1 : \rho \neq 0, \beta_1 \neq 0, ..., \beta_n \neq 0$. Pesaran et al. (2001) tabulate two sets of critical values, one for the case when all variables are I(1), i.e. upper bound critical values and another one when all variables are I(0), i.e. lower bound critical values. Critical values are provided for five different models, of which model (3) with unrestricted intercept and no trend will be used in our study. If the test statistic is higher than the upper bound critical value, the null of no cointegration is rejected in favour of the presence of cointegration. On the other hand, an F-statistic lower than the lower bound critical value implies the absence of cointegration. In the event that the calculated F-statistic lies between the two critical values, there is no clear indication of the absence or existence of a cointegrating relationship.

Although the number of observations (up to 160) ensures that the standard critical values can be used with confidence for the cointegration tests, we also run OLS regressions for first differenced data, which seems important if the cointegration relationships are not too robust or even inexistent[14]. This is tantamount to testing Eq. (1), with average labour productivity being used as a proxy for total factor productivity.

4. Basic Assumptions

The first step is to investigate whether or not the four basic assumptions which are needed for the B-S effect to hold are verified:

1. Real wages are linked to productivity in the open sector;
2. Nominal wages tend to equalize across sectors;
3. Dual productivity is linked to the relative price of market-based non-tradable goods; and
4. PPP holds for the open sector.

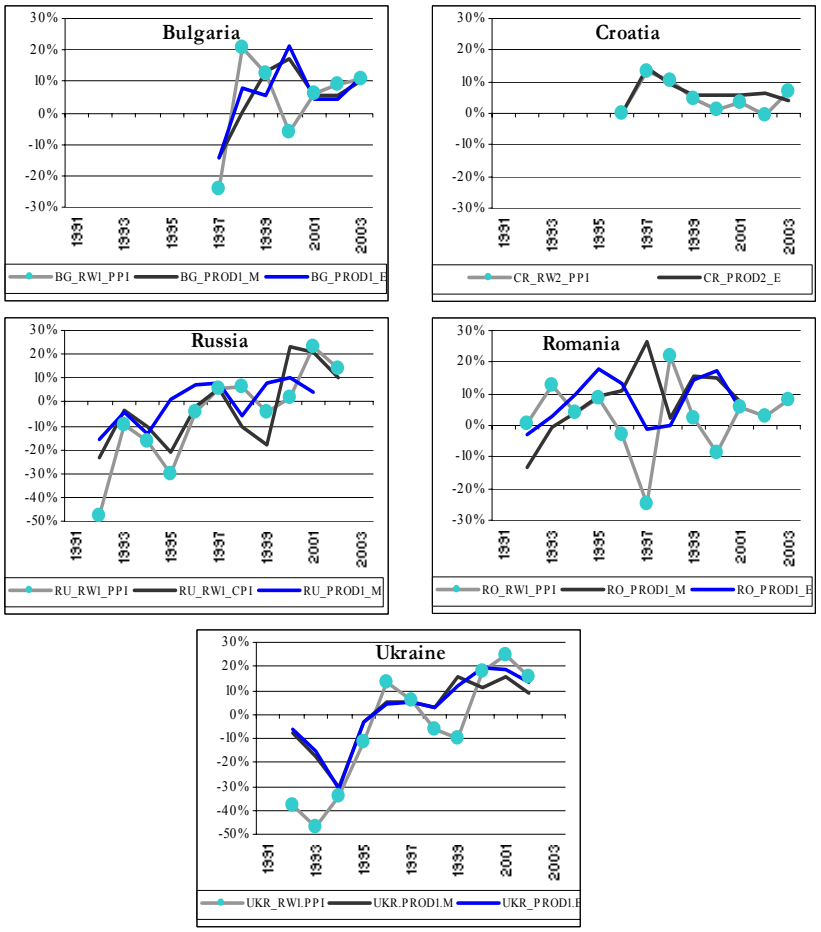
4.1 First Glance Evidence from Yearly Data

The first two assumptions can be judged upon by applying ocular econometrics to annual data obtained from national accounts. Growth rates of average labour productivity and real wages in the open sector are depicted in Figure 1 below.[15] Generally speaking, productivity and real wages broadly grew hand in hand, perhaps with the exception of Romania. However, in Croatia wages rose more slowly than productivity from 2000 to 2002. In Bulgaria, Russia and Ukraine, we can observe periods during which productivity increased faster than real wages followed by periods when the opposite happened.

[14] In the context of the Balassa-Samuelson effect, Wagner and Hlouskova (2004) have shown recently that the null of no cointegration usually cannot be rejected on the basis of bootstrapped critical values for small panels. Lojschova (2003) and Mihaljek and Klau (2004) analyse the Balassa-Samuelson effect for Central and Eastern European countries using first differenced data.

[15] Wage data based on national accounts are not available for Turkey.

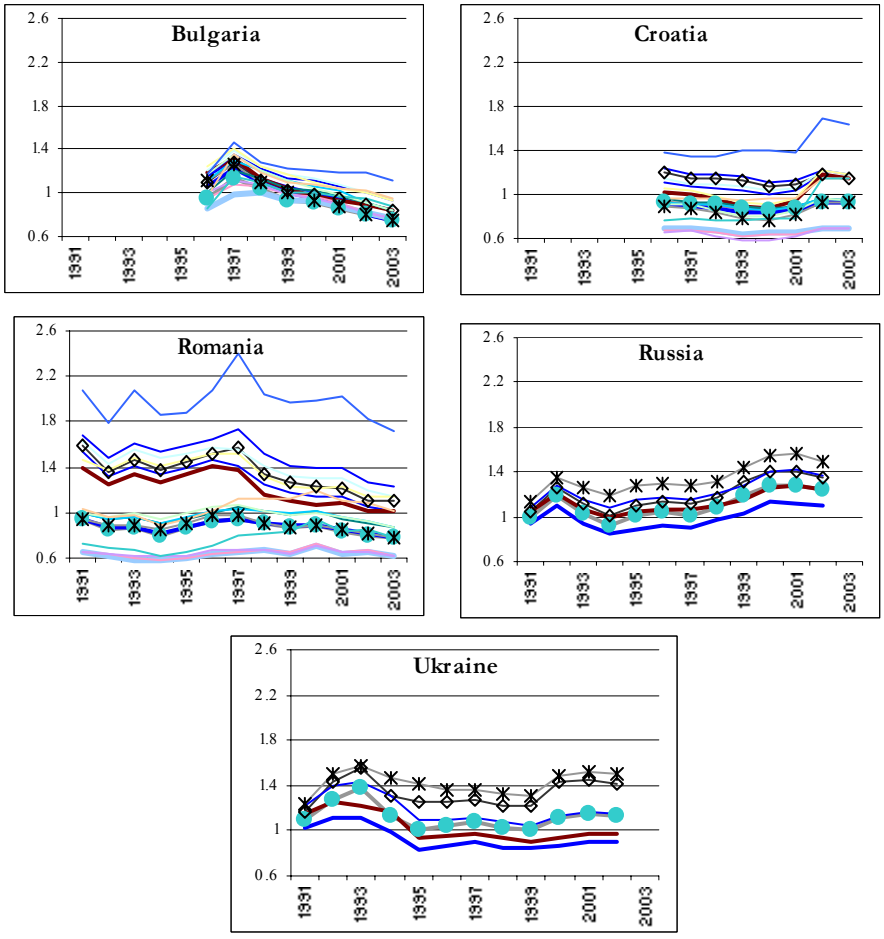
Figure 1. Real Wages and Productivity Growth in the Open Sector



Note: RWI_PPI and RWI_CPI are the PPI and CPI deflated nominal wage in the open sector. PROD_M and PROD_E denote average labour productivity in the open sector using data on employment (M) and on employees (E). The open sector includes industry (PROD1) or industry and agriculture (PROD2).

As far as wage equalization is concerned, the ratio of the nominal wage in the open sector to the nominal wage in the closed sector corresponding to the dual productivity differentials described above are shown in Figure 2. For Bulgaria, the ratio decreased steadily over the period under study implying that nominal wages grew faster in the closed sector than in the open sector (amplification of the B-S effect). The opposite can be observed for Russia where the ratio is on the rise (attenuation of the B-S effect). Regarding Croatia and Ukraine, jump-like changes can be observed on Figure 2. Finally, the ratio is fairly stable for Romania provided agriculture is excluded from the analysis.

Figure 2. Wage Equalization across Sectors



4.2 Basic Assumptions: Econometric Evidence from Monthly Data

Using monthly data instead of annual data allows a more rigorous examination of the assumptions underlying the B-S model, which can be formulated econometrically as follows:

1. Productivity in the open sector is cointegrated with real wages in the open sector, with the estimated long-term coefficient being equal to 1;
2. The sectoral wage ratio is difference stationary;
3. Dual productivity is cointegrated with the relative price of market-based nontradable goods, with the estimated long-term coefficient being equal to 1; and
4. The tradable price-based real exchange rate is difference stationary.

The results reported in Table 2 indicate the existence of a long-run relationship between gross monthly real wages and productivity in the open sector for Bulgaria from 1991 to 2004 and for the sub-period running from 1998 to 2004. The coefficient estimate is very low for DOLS and is insignificant when using the ARDL approach for the whole period. The estimated coefficients are somewhat higher (about 0.5), but still considerably below unity for the period from 1998 to 2004 (following the financial crisis in 1997).

Table 2 Cointegration Tests between Productivity and Real Gross Wages, Monthly Data

		DOLS	ARDL	1ST DIFF
BULGARIA	LAG	(2,1)	ARDL (1,0)	
1991:01-2004:03	COINT	-3.883** (0)	6.549**	
	ECT	-0.177***	-0.218***	
	CONST	0.256***	0.287***	0.001
	β_1	0.078***	0.029	0.35**
	DUMMY	-0.295***	-0.319***	-0.014
BULGARIA	LAG	(0,1)	(2,6)	
1998:01-2004:03	COINT	-3.251* (6), A	0.951	
	ECT	-0.102*	-0.133**	
	CONST	0.075***	0.065	0.001
	β_1	0.438***	0.564*	0.003
CROATIA	LAG	(0,1)	(4,0)	
1994:01-2004:03	COINT	-2.509 (3)	9.896**	
	ECT	-0.133***	-0.108***	
	CONST	0.576***	0.714***	0.009***
	β_1	2.082***	1.16*	-0.503**
CROATIA	LAG	(6,1)	(3,5)	
1998:01-2004:03	COINT	-2.16 (2)	5.988**	
	ECT	-0.315***	-0.282***	
	CONST	0.699***	0.695***	0.004
	β_1	1.142***	1.371***	-0.497**
ROMANIA	LAG	(0,0)	(3,0)	
1994:01-2004:03	COINT	-3.762** (3), A	7.861**	
	ECT	-0.14***	-0.185***	
	CONST	-0.02	0.07	-0.002
	β_1	0.039	-0.023	0.317***
RUSSIA	LAG	(6,0)	(1,5)	
1994:01-2004:03	COINT	-2.265 (0)	6.328**	
	ECT	-0.062***	-0.076***	
	CONST	-0.374***	-0.426***	0
	β_1	0.916***	1.274***	-0.012
	DUMMY	-0.062**	-0.053	-0.002
UKRAINE	LAG	(5,6)	(1,0)	
1996:01-2004:03	COINT	-1.022 (0)	3.708	
	ECT	-0.066**	-0.055**	
	CONST	0.099***	0.09	0.009***
	β_1	0.514***	0.776**	0.226**
	DUMMY	-0.076***	-0.304***	-0.016***
TURKEY	LAG	(0,3)	(3,0)	
1988:03-2004:03	COINT	-3.495** (1)	2.007	
	ECT	-0.017	-0.026**	
	CONST	-0.127***	-0.219*	0.004*
	β_1	1.915***	-0.322	0.001

*Notes: Cointegrating vector X=[RWAGE,PROD]; β'=[1, β1]; expected sign =[1,+]; DOLS and ARDL denote the Dynamic OLS and the Autoregressive Distributed Lags estimations and 1st DIFF is the estimation for the first differenced series. LAG shows the lag structure of the DOLS and ARDL models. "A" (Akaike) indicates if not the Schwarz information criterion is used for this purpose. The row COINT contains residual-based cointegration tests for the DOLS approach (with the lag length in parentheses), and test statistics from the bounds testing approach for ARDL. In the row ECT are reported the error correction terms. *, ** and *** denote that the null hypothesis is rejected at the 10%, 5% and 1% levels, respectively. The dummy variables take the value of 1 for 1996:07 to 1997:12 for Bulgaria and for 1998:01 to 1999:12 for Russia and Ukraine.*

Regarding Russia, robust cointegration can be found only when a dummy is used to capture the post-Russian crisis period, while the tests provide only weak

evidence for cointegration for the case of Ukraine[16]. For Russia, the estimated coefficient that links productivity to real wages is positive and is close to unity whereas coefficient estimates for Ukraine range from 0.5 to 0.8. Turning now to Turkey, no clear cointegration could be established. The coefficient is not significant for ARDL, the estimated coefficients is 1.9 for DOLS.[17]

As noted earlier, OLS regressions are also run for first-differenced data. The estimated coefficient on productivity is either insignificant or is negatively signed. The only exception is Romania, where it is 0.3 and highly significant.

The sectoral wage ratio is defined as the ratio of nominal gross wages in industry to those in the whole economy. According to test results reported in Table 3, the Augmented Dickey Fuller (ADF), the Phillips-Perron (PP) and the Elliott-Rothenberg-Stock (ERS) point optimal unit root tests are unable to reject the presence of a unit root, while the Kwiatowski-Phillips-Schmidt-Shin (KPSS) test mostly rejects stationarity for the whole sample and for a shorter period, i.e. 1996 to 2004, used for the sake of comparability across countries. The only country for which there is some (mixed) evidence for difference stationarity is Russia. Note also that the wage ratios based on both gross and net monthly wages exhibit trend stationarity for the subperiod. In sum, with the exception of Russia, all series either have a unit root or are trend stationary, implying the first and/or second moments to be unstable over time.

Table 3 Unit Root Tests for the Sectoral Wage Ratio, Monthly Data

	ADF	PP	KPSS	ERS
BULGARIA: GROSS MONTHLY WAGES				
1991:01-2004:03	1.13 (5)	-2.23 (6)	0.39*** (10)	8.39 (5)
1996:01-2004:03	-0.99 (4)	-1.42 (6)	1.13*** (7)	10.50 (4)
CROATIA: GROSS MONTHLY WAGES				
1994:01-2004:03	-1.93 (2)	-2.27 (3)	0.71*** (9)	38.50 (2)
1996:01-2004:03	-1.69 (2)	-2.14 (5)	0.39* (7)	53.30 (2)
ROMANIA: NET MONTHLY WAGES				
1991:04-2004:03	-3.01** (1)	-3.57** (4)	0.35* (9)	24.73 (1)
1996:01-2004:03	-1.26 (1)	-1.93 (4)	1.08*** (7)	6.40 (1)
RUSSIA: GROSS MONTHLY WAGES				
1992:01-2004:03	-1.35 (12)	-4.88*** (7)	0.99*** (9)	13.37 (12)
1996:01-2004:03	-5.21*** (2)	-5.17*** (4)	0.64** (7)	17.83 (2)
UKRAINE: GROSS MONTHLY WAGES				
1996:01-2004:03	-1.21 (1)	-0.98 (3)	1.04*** (7)	79.59 (1)

*Notes: ADF, PP; KPPS and ERS are the Augmented Dickey-Fuller, the Phillips-Perron, the Kwiatowski-Phillips-Schmidt-Shin and the Elliott-Rothenberg-Stock point optimal unit root tests, respectively, for the case including only a constant. In parentheses is the lag length chosen using the Schwarz information criterion for the ADF and ERS tests, and the Newey West kernel estimator for the PP and KPSS tests. *, ** and *** denote the rejection of the null hypothesis. For the ADF, PP and ERS tests, the null hypothesis is the presence of a unit root, whereas for the KPSS tests, the null hypothesis is stationarity.*

[16] Formal cointegration tests cannot reject the null of no cointegration but the error correction terms are negative and statistically significant)

[17] It should be noted that for Croatia and Romania, the tests are also carried out using net wages. For Romania, Russia, Ukraine and Turkey, the sub-period from 1998 to 2004 is also analysed. As the results do not change quantitatively, they are not reported here.

Table 4a Cointegration Tests between Productivity and Relative Prices, Monthly Data

Cointegrating vector X=[SERVGOODS/SERVPPI,PROD]; β'=[1, β1]; expected sign =[1,+]

	SERVGOODS			SERVPPI		
	DOLS	ARDL	1ST DIFF	DOLS	ARDL	1ST DIFF
BULGARIA	1995:01 – 2002:09			1991:12 – 2002:09		
LAG	(0,0)	(1,0)		(0,3)	(1,0)	
COINT	-4.297** (0)	0.802		-3.666** (0)	0.1	
ECT	-0.345***	-0.293***		-0.133***	-0.141***	
CONST	0.166***	0.238**	0.009	0.092***	0.209***	0.011
β_1	1.089***	0.974***	0.801**	1.004***	0.804**	0.234
DUMMY	-0.221***	-0.313***	-0.022	-0.242***	-0.228*	-0.008
CROATIA	1997:01 – 2002: 09			1997:01 – 2002: 09		
LAG	(6,0)	(1,0)		(6,0)	(1,0)	
COINT	-1.882 (0)	1.425		-1.499 (0)	2.774	
ECT	-0.087***	-0.068**		-0.068***	-0.057***	
CONST	0.015**	-0.01	0.003**	0.073***	0.067	0.004***
β_1	1.158***	1.781***	0.068	1.432***	1.853**	-0.131
ROMANIA	1994:01 – 2002:08			1994:01 – 2002:08		
LAG	(0,0)	(1,0)		(0,0)	(3,0)	
COINT	-1.812 (0)	-4.27		-1.261 (0)	0.549	
ECT	-0.003	-0.006		0.002	-0.003	
CONST	-0.846***	3.310	0.009***	-0.981***	11.307	0.008***
β_1	0.937***	-1.030	-0.167***	0.969***	-6.029	-0.037
RUSSIA	1993:01 – 2004:03			1993:01 – 2004:03		
LAG	(6,0)	(5,0)		(6,3)	(5,0)	
COINT	-3.913** (3)	31.807**		-4.184** (3)	82.313**	
ECT	-0.052***	-0.051***		-0.054***	-0.043***	
CONST	1.758***	1.907***	0.019***	1.397***	1.587***	0.016***
β_1	0.921***	0.966**	-0.269	0.924***	0.882***	-0.374
UKRAINE	1994:01 – 2001:12			1994:12 – 2001:12		
LAG	(6,3)	(1,1)		(0,0)	(2,0)	
COINT	-3.64** (0)	4.158a		-5.95** (1)	4.408a	
ECT	-0.068***	-0.064***		-0.104***	-0.072***	
CONST	0.067	0.431***	0.017*	0.163***	0.466***	0.019***
β_1	0.09	-1.057	-0.112	0.554***	-0.193	-0.387
TURKEY	1994:01 – 2004:03			1994:01 – 2004:03		
LAG	(0,0)	(1,0)		(0,0)	(1,0)	
COINT	-1.857 (2)	-2.032		-3.44** (0)	-1.217	
ECT	-0.156***	-0.096*		-0.098**	-0.119***	
CONST	0.204***	0.205	0.004	0.138***	0.119	0.003
β_1	0.681	-0.492	-0.421**	1.346***	0.314	-0.231

Note: as for Table 2. The dummy for Bulgaria is defined as in Table 2.

Next, the relationship between dual productivity and the relative price of market non-tradables is investigated using monthly data. In Table 4a, we can observe that productivity and relative prices based on service prices (SERVGOODS or SERVPPI) appear cointegrated in a robust manner only for Russia. For Bulgaria, Turkey and Ukraine, the results are less robust, while no cointegration is found for Croatia and Romania. The long-run coefficient is close to unity for Bulgaria and Russia. The estimates are mostly insignificant for Turkey and Ukraine.

The CPI-to-PPI ratio (CPIPPI) rescues Croatia as there seems to be a positive relationship for Croatia (as opposed to the no-cointegration finding for SERVGOODS and SERVPPI) but not Romania where the relation is negative. For the remaining countries, the estimated coefficients reported in Table 4b are lower as compared to the results presented in Tabel 4a. This is not surprising as the CPI-to-PPI ratio can be viewed as (services and goods)/goods while the two other variables are constructed as services/goods. Finally, the OLS estimates of the first different data are systematically insignificant or have the wrong sign.

Table 4b Cointegration Tests between Productivity and Relative Prices, Monthly Data

Cointegrating vector X=[CPIPPI,PROD]; β'=[1, β1]; expected sign =[1,+]

	DOLS	ARDL	1ST DIFF	DOLS	ARDL	1ST DIFF
	BULGARIA 1991:12 – 2004:03			RUSSIA 1993:01 – 2004:03		
LAG	(0,0)	(1,0)		(0,0)	(1,0)	
COINT	-3.675** (0)	5.058*		-1.918 (1)	-2.096	
ECT	-0.059***	-0.058***		-0.033	-0.039*	
CONST	-0.195***	0.053	0.008***	-0.126***	-0.109	0
β_1	0.489***	-0.014	-0.182**	0.157***	0.073	-0.155
DUMMY	0.112***	0.067	0			
	CROATIA 1992:01 – 2004:03			UKRAINE 1994:12 – 2004:03		
LAG	(6,6)	(6,0)		(0,0)	(2,0)	
COINT	-3.95** (3)	50.524**		-3.054 (1)	1.299	
ECT	-0.098***	-0.061*		-0.05*	-0.05**	
CONST	0.012***	0.063***	0.002	0.046***	0.088*	0.002
β_1	0.716***	0.445	-0.106	0.176***	0.071	-0.062
	ROMANIA 1994:01 – 2004:03			TURKEY 1985:03 – 2004:03		
LAG	(0,0)	(1,0)		(6,0)	(3,0)	
COINT	-2.407 (1)	-1.142		-4.414** (1)	2.22	
ECT	-0.063**	-0.075**		-0.079***	-0.062***	
CONST	0.039	0.101	-0.001	0.104***	0.136***	0.002
β_1	-0.073***	-0.125	0.057	0.948***	0.900**	-0.05*

Notes: As for Table 2. The dummy for Bulgaria is defined as in Table 2.

Finally, unit root tests including a constant are reported in Table 5, from which it can be seen that the PPI-based real exchange rate is clearly not difference stationary in levels for Bulgaria, Croatia, Romania and Ukraine. For Russia, the null of a unit root cannot be rejected by the ADF, PP and ERS tests, and the KPSS test is not able to reject the null of stationarity. The opposite happens to be the case for Turkey, where the ADF, PP and ERS tests suggest difference stationary. However, the KPSS test indicates nonstationarity. Thus, it is fair to say that PPP does not hold for the open sector for most of the countries.

Table 5 Unit Root Tests for the PPI-Based Real Exchange Rates, Monthly Data

		ADF	PP	KPSS	ERS
BULGARIA	1993:01-2004:03	-2.084 (0)	-1.992 (2)	0.979*** (9)	-3.104* (3)
CROATIA	1993:01-2004:03	-1.337 (1)	-1.290 (3)	0.764*** (9)	7.719 (1)
ROMANIA	1994:01-2004:03	-1.686 (0)	-1.592 (6)	1.025*** (9)	15.797 (0)
RUSSIA	1994:01-2004:03	-1.854 (1)	-2.078 (6)	0.169 (9)	11.840 (1)
UKRAINE	1996:01-2004:03	-1.088 (2)	-1.052 (2)	0.845** (7)	20.567 (2)
TURKEY	1985:01-2004:03	-3.138** (0)	-3.376** (2)	0.412* (11)	3.750* (0)

Note: As for Table 3.

All in all, there is mixed evidence regarding the functioning of the basic assumptions. First, increases in productivity are connected to increases in real wages in the open sector roughly proportionately only in Croatia and Russia. The effect of productivity on real wages is well below 1 in Bulgaria but has increased over time, and ranges from 0.5 to 0.8 for Ukraine. Although the long-run coefficients are statistically insignificant for Romania, the OLS regression run on first differenced data rescues the relationship with a coefficient of 0.3. By contrast, changes in productivity in the open sector lead to disproportionately large changes in real wages in Turkey.

Second, a proportionate wage equalization between the open and closed sectors can be verified to a limited extent only for Russia.

Second, a proportionate wage equalization between the open and closed sectors can be verified to a limited extent only for Russia.

Third, notwithstanding the mixed evidence on real wages and nominal wage equalization, the service-based relative price is found to be linked reasonably well to dual productivity with a coefficient in the neighbourhood of 1 for Bulgaria and Russia. The coefficient is higher than 1 for Turkey and considerably lower than 1 for Ukraine. No cointegration could be detected for Romania.

Maeso-Fernandez et al. (2005) argue that an initial undervaluation and the ensuing adjustment towards equilibrium of the real exchange rate of transition economies lead to an upward bias of the slope coefficients because the observed real exchange rate in the phase of convergence towards its equilibrium level, rather than the equilibrium exchange rate, is regressed on the fundamentals. The same problem arises in the context of the relative price of non-tradables given that increases in relative prices might only reflect an adjustment process if non-tradable prices were not in line with the fundamentals at the beginning of the transition process. Such an adjustment would yield coefficient estimates higher than 1. The fact that the only country for which the coefficient exceeds unity is Turkey, a non-transitional economy, possibly suggests the absence of an initial undershooting of relative prices for our set of countries for most of the period studied here. This makes us think that possible undershootings might have been quickly eliminated during the early 1990s.

Overall, the results indicate that the B-S effect works reasonably well in Bulgaria and Russia and also possibly for Croatia, whereas it is attenuated in Ukraine and is amplified in Turkey. For Romania, sand seems to block the mechanism at some point. Another question is, however, the influence of the B-S effect on overall inflation, an issue which is addressed in the next section. Fourth, relative PPP is rejected for the real exchange rate of the open sector for all economies, perhaps with the exception of Turkey, which implies that the B-S effect will not be able to explain the entirety of real exchange rate movements.[18]

5. A Simple Accounting Framework

5.1 Inflation Rates due to the Balassa-Samuelson Effect

We now set out to analyze the size of the inflation to be attributed to the B-S effect ($P^{B\text{-}S}$). For this purpose, let us consider the following equation:

$$P^{B\text{-}S} = (1-\alpha)\beta_1(PROD^T - PROD^{NT}) \qquad (7)$$

where $(1-\alpha)$ is the share of non-tradables in the consumer basket, β_1 conceptually corresponds to the estimated coefficient from Tables 4a and 4b, which connects the relative price of non-tradables to productivity, and which, ideally, should

[18] If relative PPP were verified for the open sector, then the B-S effect could explain real exchange rate movements based on the CPI. By contrast, if relative PPP cannot be verified, the B-S effect will provide an explanation for changes in the difference between the (CPI-based) overall real exchange rate and the real exchange rate of the open sector.

be 1. PROD is the average labour productivity in the tradable (T) and non-tradable (NT) sectors.

Average annual growth rates of the different measures of dual productivity are computed for the countries under consideration using annual data from national accounts for two periods, 1991–2001/2003 and 1996–2001/2003. For Turkey, the series start in 1970. This is why two additional periods are considered for this country, namely 1970–2003 and 1970–1990. In addition, average annual growth rates are computed using monthly industrial production-based productivity measures.[19]

The results are displayed in Tables 6a to 6d. Several observations deserve attention. First, whether average labour productivity is calculated on the basis of sectoral employment or employee data may matter. This is especially the case for Bulgaria for DIFF3 to DIFF6 (Table 6a) and for Romania for DIFF23, 25 and DIFF31–33 (Table 6b). The second observation is that how the sectors are classified into open and closed sectors may have a large impact. An example is Bulgaria, where dual productivity is negative when transport and telecommunications are taken as a closed sector, but it becomes highly positive when the same sector is considered an open sector. The opposite is true for Ukraine. However, some countries such as Croatia and Russia are less influenced by the choice of sectoral classification.

Table 6a Average Growth Rates of Dual Productivity, Old Classification

			DIFF1	DIFF2	DIFF3	DIFF4	DIFF5	DIFF6
BULGARIA	EMPLOYEE	1991-2003	-4.44%	-5.60%	0.47%	4.11%	-3.76%	9.66%
		1996-2003	-2.62%	-4.03%	1.73%	15.06%	0.33%	15.80%
	EMPLOYMENT	1991-2003	-4.82%	-3.94%	-5.02%	7.51%	9.05%	5.51%
		1996-2003	-7.40%	-7.10%	-6.87%	5.48%	4.82%	5.58%
CROATIA	EMPLOYEE	1991-2002	-0.10%	-0.29%	0.16%	0.57%	0.14%	0.72%
		1996-2002	4.11%	3.37%	3.92%	4.87%	3.42%	4.81%
RUSSIA	EMPLOYMENT	1991-2001	5.83%	3.36%	7.11%	5.20%	2.21%	6.43%
		1996-2001	5.00%	2.90%	5.81%	5.46%	2.99%	6.31%
UKRAINE	EMPLOYEE	1991-2002	1.40%	2.93%	-0.06%	-2.61%	-0.18%	-3.18%
		1996-2002	-4.11%	-3.24%	-3.48%	-9.68%	-7.94%	-8.69%
	EMPLOYMENT	1991-2002	4.94%	3.95%	4.01%	0.98%	0.91%	0.78%
		1996-2002	0.69%	4.77%	-3.36%	-7.06%	2.17%	-9.98%

Note: EMPLOYEE refers to average labour productivity measured by means of the number of employees in the sectors. EMPLOYMENT denotes productivity figures computed on the basis of sectoral employment data.

The productivity growth rates derived on the basis of industrial production (see monthly dataset) reported in Table 6d are broadly in line with data based on national accounts for Croatia, Russia and Turkey and to a lesser extent for Ukraine. By contrast, for Bulgaria and Romania, the reported figures based on industrial production are considerably higher than national accounts-based data when only manufacturing or industry is taken as the open sector. Nevertheless, they are comparable with the figures obtained when some service sectors are also included in the open sector (DIFF32, 33 for Romania and DIFF41 and 5 for Bulgaria).

[19] The same periods were considered here as for the national accounts-based data. For Croatia, Romania and Russia, data for 2003 (not available from national accounts) are also shown for comparison purposes.

Table 6b Average Growth Rates of Dual Productivity, New Classification

	BULGARIA		ROMANIA			
	EMPLOYEES	EMPLOYMENT	EMPLOYEES		EMPLOYMENT	
	1996-2003	1996-2003	1991-2002	1996-2002	1991-2002	1996-2002
DIFF11	-0.86%	-1.33%	3.40%	4.63%	3.69%	10.80%
DIFF12	-2.98%	-1.06%	-0.63%	-1.62%	5.66%	12.93%
DIFF13	-0.86%	-1.33%	0.60%	1.30%	0.97%	7.15%
DIFF14	-2.98%	-1.06%	-1.29%	-1.77%	2.62%	8.40%
DIFF15	-0.86%	-1.33%	1.06%	1.49%	1.10%	7.27%
DIFF16	-2.98%	-1.06%	-0.77%	-1.30%	2.44%	8.28%
DIFF21	-0.57%	-1.01%	1.63%	1.73%	-2.88%	0.93%
DIFF22	-2.73%	-0.73%	-1.37%	-2.31%	-2.19%	1.05%
DIFF23	-0.57%	-1.01%	5.43%	10.52%	-0.68%	6.09%
DIFF24	-2.73%	-0.73%	0.59%	2.23%	-0.44%	5.25%
DIFF25	-0.57%	-1.01%	5.81%	10.64%	-0.53%	6.28%
DIFF26	-2.73%	-0.73%	1.22%	2.94%	-0.34%	5.56%
DIFF31	2.56%	-1.02%	4.74%	6.50%	-2.98%	0.03%
DIFF32	2.56%	-1.02%	9.64%	17.41%	-0.81%	5.20%
DIFF33	2.56%	-1.02%	10.13%	17.70%	-0.66%	5.39%
DIFF41	13.57%	10.35%	2.49%	1.20%	-0.90%	1.21%
DIFF42	1.20%	6.30%	-2.05%	-4.11%	0.17%	1.74%
DIFF5	16.51%	9.50%	5.15%	5.33%	-1.27%	0.59%

Note: As for Table 6a

Table 6c Average Growth Rates of Dual Productivity, New Classification, Turkey

	DIFF11	DIFF12	DIFF13	DIFF21	DIFF22	DIFF31	DIFF32	DIFF33	DIFF41
	EMPLOYMENT								
1970-2003	1.66%	1.36%	1.56%	1.47%	1.47%	3.53%	1.10%	1.10%	3.55%
1970-1990	1.09%	1.28%	1.59%	0.44%	0.44%	2.31%	1.75%	1.75%	1.93%
1991-2003	1.12%	0.25%	0.28%	2.11%	2.11%	2.70%	-0.80%	-0.80%	3.46%
1996-2003	1.81%	0.35%	0.44%	3.70%	3.70%	0.94%	-2.36%	-2.36%	2.05%
1994-2001	0.40%	-0.29%	-0.40%	1.52%	1.52%	0.01%	-1.71%	-1.71%	0.67%

Note: As for Table 6a

Table 6d Average Growth Rates of Dual Productivity, Industrial Production

BULGARIA	1992-2003 9.0%	RUSSIA	1996-2001 5.5%
	1996-2003 7.7%		1996-2003 6.8%
CROATIA	1993-2002 3.2%		
	1993-2003 3.2%	UKRAINE	1996-2002 9.7%
	1996-2002 3.0%		
	1996-2003 3.0%	TURKEY	1991-2003 2.5%
ROMANIA	1996-2002 9.2%		1996-2003 0.7%
	1996-2003 9.3%		1994-2001 -0.5%

Note: Average yearly growth rates are derived from monthly series according to the practice of Eurostat. The average cumulated series for year t (average of 12 months) is divided by the average cumulated series for year t-1.

The inflation rate that can be associated with the B-S effect is quantified relying on Eq. 7. Table 7 reports the composition of the harmonized CPI for Bulgaria and Romania. It turns out that the share of services is slightly above 30% whereas the share of market-based services is about 15% to 20%. As the countries studied here are at a comparable level of development, 20% can be thought of as a reasonable estimate for the share of market-based non-tradables for the other countries. Of the calculated dual productivity measures, we select those for which the open sector is constructed using

manufacturing, or if not available, industry, and for which the closed sector includes the rest except for health, education, public administration and other community services. Agriculture once is part of the closed sector (DIFF2, DIFF14, DIFF12), and is excluded from the analysis once (DIFF1, DIFF13, DIFF11). The coefficient β_1 is restricted to 1, which seems reasonable for Bulgaria and Russia. Because this coefficient is lower than 1 (or not significant) for the remaining countries, the reported figures could be viewed as upper-bound (or very optimistic) estimates.

Table 7 The Share of Different Groups of Items in the HICP (in percent) in 2002

	NMS10	BULGARIA	ROMANIA
GOODS, of which	28.1	21.1	20.8
Durable	7.9	2.2	1.5
Semi-durable	10.5	6.6	9.0
Non-durable	9.7	12.4	10.2
ENERGY	4.7	4.2	4.7
FOOD, of which	29.9	43.4	46.3
Alcohol&tobacco	6.7	4.5	5.2
SERVICES	48.9	34.0	32.0
of which regulated	15.3	18.0	16.8

Source: Author's own calculations based on disaggregated HICP data drawn from NewCronos/Eurostat. NMS10 stands for the ten new EU member states.

Table 8 The Contribution of the Balassa-Samuelson Effect to Average Annual CPI in Percentage Points

		DIFF1_Old	DIFF2_Old		IND_PROD	Observed CPI	
						Period average	2003
BULGARIA	1991-2003	-0.96%	-0.79%	1992-2003	1.79%	145.2%	
	1996-2003	-1.48%	-1.42%	1996-2003	1.54%	153.4%	2.3%
CROATIA	1991-2002	-0.02%	-0.06%	1992-2002	0.63%	203.0%	
	1996-2002	0.82%	0.67%	1996-2002	0.60%	4.3%	1.8%
RUSSIA	1991-2001	1.17%	0.67%			292.3%	
	1996-2001	1.00%	0.58%	1996-2001	1.11%	36.4%	13.6%
UKRAINE	1991-2002	0.99%	0.79%			675.9%	
	1996-2002	0.14%	0.95%	1996-2002	1.94%	24.3%	5.2%
		DIFF13_New	DIFF14_New				
BULGARIA	1996-2003	-0.27%	-0.21%	1996-2003	1.54%	153.4%	
ROMANIA	1991-2002	0.19%	0.52%			100.6%	
	1996-2002	1.43%	1.68%	1996-2002	1.84%	57.3%	15.3%
		DIFF11_TK	DIFF12_TK				
TURKEY	1970-2003	0.33%	0.27%			50.4%	
	1970-1990	0.22%	0.26%			39.2%	
	1991-2003	0.22%	0.05%	1991-2003	0.50%	68.6%	
	1996-2003	0.36%	0.07%	1996-2003	0.14%	61.9%	
	1994-2001	0.08%	-0.06%	1994-2001	-0.10%	77.4%	25.3%
EURO AREA		NAT. ACC.			IND_PROD		
	1991-2003	0.25%			1.00%		
	1996-2003				0.80%		

Source: Average annual inflation is computed based on data drawn from WIIW and from the OECD Economic Outlook for Turkey. IND_PROD refers to average labour productivity obtained on the basis of industrial production.
Note: For the industrial production-based figures, the same periods are shown as for the national account-based data mainly for the sake of full comparability. The extension of the period till 2003 for Croatia, Romania and Russia would not change too much (see Table 6d).

Results in Table 8 indicate that the B-S effect may be negative for Bulgaria irrespective of the period considered and for Croatia for 1991–2002 when using data based on national accounts. However, industrial production-based figures indicate a positive effect. This is mainly because such figures do not take account of productivity increases in services. However, if productivity increases in services, as is the case for the

other countries, results based on national accounts and industrial production are fairly similar. Nevertheless, the effect rises to about 0.8 percentage point in Croatia for the period of 1996–2002. Table 8 also indicates a 1.1 percentage point average annual contribution to inflation of the B-S effect in Russia and Ukraine. The effect fluctuates around 0.2 percentage point in Turkey. Finally, the effect strengthens pretty much for the second half of the period studied in Romania, as it hovers around 1.9 percentage points. Moreover, when comparing these figures to the average inflation rates of the observed period, Croatia is the only country for which the B-S effect has an important effect from 1996–2002, as it explains roughly up to one-fifth of the observed inflation. The amplitude of the B-S effect is broadly in line with findings for the eight new EU Member States in Central and Eastern Europe.

5.2 Equilibrium Real Appreciation due to the Balassa-Samuelson Effect

What remains to be done is to derive an estimate for the B-S effect for the foreign benchmark in order to be able to assess the appreciation of the real exchange rate, which could be explained by the dual productivity differential. For this purpose, we use the average of three studies known to us which provide the needed figure for Germany, which is taken as a proxy for the euro area during the 1990s: 0.25%.[20] For the industrial production-based productivity measure, the two figures which can be obtained using equation (1) are 1.2% for 1992–2003 and 1.0% for 1996–2003.[21] When adjusting the figures reported in Table 8 appropriately, the equilibrium exchange rate appreciates in Romania, Russia and Ukraine, while the direction of a change in the equilibrium exchange rate hinges on whether or not national accounts or industrial production-based data are used in Bulgaria, Croatia and Turkey. However, using data obtained from national accounts seems more appropriate for measuring the B-S effect. This would imply an equilibrium depreciation in Bulgaria, an equilibrium appreciation in Croatia and a constant equilibrium exchange rate in Turkey.[22]

6. Concluding Remarks

In this paper, we investigated the importance of the Balassa-Samuelson effect in three South Eastern European countries (Bulgaria, Croatia and Romania), in two CIS countries (Russia and Ukraine) and in Turkey. The econometric analysis of the basic assumptions of the B-S effect reveals that for most of the countries, the pass-through from productivity gains in the open sector to the relative price of non-tradable goods is not proportionate because (a) real wages are not proportionately linked to productivity in the open sector, (b) the wage equalization process across sectors is far to be perfect, and (c) the relative price of non-tradables rises quicker or slower than productivity gains even when taking account for the imperfect functioning of the two other assumptions. We can observe either an attenuation effect (Ukraine), implying that productivity gains do not fully feed into non-tradable prices or an amplification for Turkey. Examples for quasi proportionate pass-through are Bulgaria and Russia. The cointegration results are not very robust for most of the countries. However, the use of data in first differences

[20] For Germany, Swagel (1999), Lommatzsch and Tober (2004) and Égert et al. (2003) estimated the size of the B-S effect as 0.00% (1990–1996), 0.10% (1995–2002) and 0.55% (1995–2000), respectively.

[21] The share of non-tradables in the CPI is set to 40%.

[22] See Égert (2005) for a detailed discussion of real exchange rate movements due to other factors for the same set of countries.

does not seem to be of much help as the estimates are usually insignificant or have the bad sign.

Notwithstanding the shaky nature of the pass-through from productivity to relative prices, we attempted to work out the size of the Balassa-Samuelson effect for domestic inflation, the inflation differential vis-à-vis the euro area. The amplitude of the B-S effect is broadly in line with findings for the eight new EU Member States in Central and Eastern Europe. Or, to put it another way, the Balassa-Samuelson effect is found to play only a limited role for overall inflation and real exchange rate determination, perhaps with the exemption of Croatia. This is another blow to the supporters of the overwhelming Balassa-Samuelson effect. It is indeed high time to start considering other factors that could help explain inflation differentials for transition economies.

Good candidates would be external factors such as the exchange rate pass-through or the influence of oil price shocks, cyclical factors and differences in growth rates or other elements of the price convergence process such as catching-up in tradable and regulated/administered prices, and the distribution sector. Lastly, and very importantly, inflation inertia and the credibility of the economic policy implemented in the aftermath of high or hyperinflation should also be also analyzed for the countries studied in the paper.

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Appendix 1 Classification of Sectors

Table 1. The classification of sectors, old standards

	OPEN	CLOSED
DIFF1_O	B	C+D+E
DIFF2_O	B	C+D+E+A
DIFF3_O	B+A	C+D+E
DIFF4_O	B+D	C+E
DIFF5_O	B+D	C+E+A
DIFF6_O	B+D+A	C+E

Note: A: Agriculture; B: Industry; C: Construction; D: Transport&Telecommunication; E: Trade

Table 2. The classification of sectors, 15-sectoral NACE standards

	OPEN	CLOSED	
DIFF11_N	D	F+G+H+I+J	
DIFF12_N	D	F+G+H+I+J+(A+B)	
DIFF13_N	D	F+G+H+I+J+K (market)	
DIFF14_N	D	F+G+H+I+J+K+(A+B)	
DIFF15_N	D	F+G+H+I+J+K+(L+M+O) (all)	
DIFF16_N	D	F+G+H+I+J+K+(L+M+O)+ (A+B)	
DIFF21_N	C+D+E	F+G+H+I+J	=DIFF1_O
DIFF22_N	C+D+E	F+G+H+I+J+(A+B)	=DIFF2_O
DIFF23_N	C+D+E	F+G+H+I+J+K (market)	
DIFF24_N	C+D+E	F+G+H+I+J+K+(A+B)	
DIFF25_N	C+D+E	F+G+H+I+J+K+(L+M+O) (all)	
DIFF26_N	C+D+E	F+G+H+I+J+K+(L+M+O)+ (A+B)	
DIFF31_N	C+D+E+(A+B)	F+G+H+I+J	=DIFF3_O
DIFF32_N	C+D+E+(A+B)	F+G+H+I+J+K (market)	
DIFF33_N	C+D+E+(A+B)	F+G+H+I+J+K+(L+M+O) (all)	
DIFF41_N	C+D+E+(H+I)	F+G+J	=DIFF4_O
DIFF42_N	C+D+E+(H+I)	F+G+J+(A+B)	=DIFF5_O
DIFF5_N	C+D+E+(H+I)+ (A+B)	F+G+J	=DIFF6_O

A= agriculture, hunting, forestry, B= fishing, C= mining and quarrying, D= manufacturing, E= electricity, gas and water supply, F= construction, G= wholesale and retail trade, H= hotels and restaurants, I= transport, storage, telecommunication, J= financial intermediation, K= real estate, renting and business activities, L= public administration and defence, compulsory social security, M= education, N= health and social work, O= other community, social and personal services activities

Table 3. The classification of sectors, 6-sectoral NACE standards, Turkey

	OPEN	CLOSED	
DIFF11_TK	(C+D+E)	F+(G+H+I)+(J+K)	=DIFF21_N
DIFF12_TK	(C+D+E)	F+(G+H+I)+(J+K)+(A+B)	=DIFF22_N
DIFF13_TK	(C+D+E)	F+(G+H+I)+(J+K)+(A+B)+(L+M+O)	=DIFF25_N
DIFF21_TK	(C+D+E)+(A+B)	F+(G+H+I)+(J+K)	=DIFF31_N
DIFF22_TK	(C+D+E)+(A+B)	F+(G+H+I)+(J+K)+ (L+M+O)	=DIFF33_N
DIFF31_TK	(C+D+E)+(G+H+I)	F+(J+K)	≈ DIFF41_N
DIFF32_TK	(C+D+E)+(G+H+I)	F+(J+K)+(A+B)	≈ DIFF42_N
DIFF33_TK	(C+D+E)+(G+H+I)	F+(J+K)+(A+B)+(L+M+O)	
DIFF4_TK	(C+D+E)+(G+H+I)+(A+B)	F+(J+K)	=DIFF5_N

Note: As for Table 4b. Only 6 sectoral disaggregation is available: (A+B); (C+D+E); F; (G+H+I); (J+K); (L+M+O)

Appendix 2 Data Sources

Annual Data

Sectoral Value Added, Constant Prices

Bulgaria, Croatia, Romania, Russia, Ukraine: wiiw Annual Database (via WIFO Database)

Turkey: OECD National Accounts Database (via WIFO Database)

Sectoral Empoyment/Employees

Bulgaria, Croatia, Romania, Russia, Ukraine: wiiw Annual Database (via WIFO Database)

Turkey: Central Bank of the Republic of Turkey

Sectoral Nominal Wages

Bulgaria, Croatia, Romania, Russia, Ukraine: wiiw Annual Database (via WIFO Database)

Monthly Data

Services in the CPI, Goods in the CPI

Bulgaria, Romania, Russia, Ukraine: Main Economic Indicators, OECD (via Datastream, Bulgaria: BLOCP071F, BLOCCPSVF (services), BLOCP034F (goods); Romania: RMOCP071 (services), RMOCP027 (goods), Russia: RSOCP072F (services), RSOCP034F, Ukraine: UROCP071F (services), UROCP024F (food))

Croatia: Croatian Central Bureau of Statistics (CTCPIS..F (services), CTCPIG..F (goods))

Turkey: State Institute of Statistics, Turkey (via Datastream, TKCPSERVF, TKCPGOODF)

CPI, PPI

Bulgaria, Croatia, Romania, Russia, Ukraine: wiiw Monthly Database

Turkey: CPI: IFS/IMF (TKI64..F), WPI: State Institute of Statistics, Turkey (TKPROPRCF)

Euro area: Eurostat (EMCONPRCF, EMESPPIIF)

Wages in Industry, in the Whole Economy

Bulgaria, Croatia, Romania, Russia, Ukraine: wiiw Monthly Database

Turkey: Central Bank of the Republic of Turkey

Nominal Exchange Rate against the Euro and the U.S. Dollar

Bulgaria, Croatia, Romania, Russia, Ukraine: wiiw Monthly Database

Turkey: Datastream (U.S. dollar: TKUSDSP, euro: TKEUROS, Deutsche mark: TKDEMSP)

Industrial Production

Bulgaria, Croatia, Romania, Ukraine: wiiw Monthly Database; for Bulgaria and Ukraine, the index series were obtained using two series of industrial production (real, same month previous year=100 and previous month=100)

Russia: Main Economic Indicators, OECD (Datastream, RSOPRX35G)

Turkey (Manufacturing): State Institute of Statistics, Turkey(TKOPR038G)

Euro area: Eurostat (Datastream, EMESINPRG)

Employment in Industry

Bulgaria, Croatia, Romania, Ukraine: wiiw Monthly Database

Russia: IFS/IMF (Datastream, RSI67…F)

Turkey: Central Bank of the Republic of Turkey

Euro area: Eurostat (Datastream, EMEBEMQ6%)

Wages in Industry and in the Whole Economy

Bulgaria, Croatia, Romania, Russia, Ukraine: wiiw Monthly Database