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Abstract

This paper analyses changes in price levels and real income in European countries on the basis of data from the International Comparison Project (ICP) and estimates the potential pressures on prices ensuing from the convergence process. Regression results for determinants of price levels indicate the importance of the Balassa-Samuelson effect for an explanation of observed differences in price levels across countries. A particular emphasis is put on the position of Croatia in international comparisons by using disaggregated data collected within the ICP. The paper suggests that a relatively high level of Croatian prices could be an advantage in the EU integration process due to lesser needs for future corrections of the exchange rate and prices. The presented regression estimate of factors of price level convergence indicates that over the next few years Croatia, among all European transition countries, may experience the least upward pressure on the general price level.

JEL: E31, F15, P22

Key words: price level, convergence, Balassa-Samuelson effect, transition

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1 Introduction

An analysis of macroeconomic phenomena in the transition countries has over the past few years been enriched by analyses of effects of their integration into the EU. One of especially interesting areas is research of real and nominal convergence and their dependency. Debates have been heating up on effects that integration into the EU will have on the price level in the new EU members, with attempts to asses the degree of price level convergence and its impact on future developments in inflation and real exchange rates. Following this line of research, this paper analyses past experience in convergence of price levels and real income in European countries based on the data collected within the International Comparison Project (ICP). The paper focuses on the position of Croatia in international comparisons of price levels and factors that influenced its observed position. It also estimates the pressures on future real exchange rate developments, which will arise in the convergence process.

Most studies on price convergence in Europe show that this trend has indeed been quite pronounced. The European Central Bank (1999) reports that inflation dispersion among euro area countries is almost equal to inflation dispersion among US cities. Using a panel data set of EU consumer prices between 1975 and 1995, Sosvilla-Rivero and Gil-Pareja (2002) conclude that there is a process of price level convergence among the EU countries, which is especially evident with regard to tradables, whereas they failed to confirm such trend with regard to nontradables and goods subject to special taxes or regulation. On the basis of prices of numerous individual goods and services, Rogers (2001) points to a fall in price dispersion in Europe in the 1990-1991 period. Price dispersion of tradables in the euro area in 1999 was close to price dispersion among US cities. With regard to the speed of convergence, it is estimated that approximately ten years is necessary to reduce the initial difference in price levels by half. A similar speed of price level convergence was confirmed by Cecchetti, Mark and Sonora (2000) on panel data set for 19 US cities. They conclude that their estimate for the half-life of convergence across American cities of approximately 9 years could be an upper bound of the rates for the euro area countries.

On the other hand, some studies failed to clearly confirm the existence of price convergence. Lutz (2003) finds weak or insignificant price level convergence in the period following the introduction of the common currency in the euro area. Although this analysis refers to a relatively short period, it indicates that there are still

significant obstacles to EU market integration. A number of European Commission papers deals exactly with obstacles to internal market integration and their impact on price dispersion (European Commission, 2002; European Commission, 2002a; EC Internal Market DG, 2002). Due to existing obstacles, a common conclusion is that there is still room for further price convergence in the EU.

A large part of empirical literature refers to testing the Balassa-Samuelson effect in the transition countries and identifying potential problems it may create for the new EU members with regard to adherence to the Maastricht criteria. Most recent empirical studies show that this effect has been relatively weak. In their empirical estimate, Mihaljek and Klau (2003) indicate that the impact of the Balassa-Samuelson effect on inflation in the transition countries could be moderate (from 0.1 to 2 percentage points, depending on the country) and that it should not be a restricting factor in meeting the nominal convergence criteria.

Recent literature on price convergence has focused either on the EU member states or on the candidate countries. Since until recently Croatia has not been a formal EU candidate, it has been mostly excluded from these analyses. This paper will attempt to fill in this gap and pay special attention to data and estimates for Croatia, by considering its price level relative to that in other transition countries and the EU. With regard to data sources, previous studies based their estimates mostly on developments in CPI inflation or the real exchange rate. This paper will use the ICP data for benchmark years 1993, 1996 and 1999.[1]

This paper is divided into eight sections. Following this introduction, the second section specifies data sources. The third section presents the main findings of international comparisons of price levels and real incomes. The fourth section contains the results of a regression estimate of determinants of the price level in Europe, including an estimate of the importance of the Balassa-Samuelson effect for an explanation of cross-country differences in price levels. On the basis of disaggregated data, the fifth section deals with price dispersion across countries and considers the similarity of the structure of relative prices in the transition countries relative to the EU. The sixth section provides an estimate of the impact of the price convergence process on real exchange rate developments in 34 European countries. The seventh section describes the potential pressures on Croatian prices by groups of products. The eighth section concludes with implications of price convergence for monetary policy in Croatia.

1 Some other recent studies also used these data. Čihak and Holub (2001, 2003) used the ICP data to analyse price level convergence in the transition countries, with special emphasis on the Czech Republic. Ahec-Šonje and Nestić (1999) and Nestić (2000) used the ICP data to analyse the determinants of the price level in Croatia.

2 Data Sources

The main source of data used to compare price levels, the PPP exchange rate and real GDP is the International Comparison Project (ICP), conducted under the auspices of the United Nations, as well as its European version - the European Comparison Programme (ECP), conducted in cooperation with Eurostat and the OECD. The main, detailed information on prices and GDP are collected every three years. Thus, we used data for benchmark years 1993, 1996 and 1999 (UN, 1997; CBS, 1999; OECD, 1999, 2002).

For their purposes, various international organisations and agencies (World Bank, Eurostat, OECD) prepare annual extrapolations on the basis of much smaller data collections. However, official comparable data for Croatia exist only for benchmark years and within a limited group of countries, i.e. those countries with which Croatia is directly compared within the ECP. Calculations and comparisons with more countries, as well as all subsequent data processing are left to the OECD or Eurostat (for example, Eurostat, 2002, 2003a, 2003b). Since Croatia is not in the focus of interest of these organisations, a lot of data processing is not yet being made. For the purposes of this paper, the author used a working version of the 2000 OECD comparison (UNECE, 2003). Still, in order to use disaggregated data and include as many countries as possible, the major part of this paper uses detailed data for the benchmark year 1999 (OECD, 2002).

Since particular terms within the International Comparison Project are specific, their explanations are given in Box 1. In a regression analysis of price levels, in addition to the ICP data on the price level and real income, used were statistical data on tax burden, government expenditure, labour productivity and employment by activity, whose sources are described in Appendix I.

3 International Comparisons of Real Incomes and the General Price Levels

According to the 2000 data, Croatia had real GDP at the level of around 36% of the EU-15 average (Table 1). Real GDP in the acceding countries relative to the EU was some 10 percentage points higher than in Croatia, whereas the price level was lower. However, the average level of prices and income in these countries is still below 50% of the EU average, which indicates a wide gap regarding price levels and income between the EU-15 countries and the new EU members. This gap is even wider with regard to the transition countries outside the first wave of EU enlargement, especially the countries of the former Commonwealth of Independent States (CIS).

If one's attention is pointed to a somewhat narrower expenditure aggregate, for example, the volume of actual individual consumption or the volume of final household consumption, one can discern that there are certain differences compared with the results based on GDP comparisons. With regard to the level of real

Box 1

Basic Terms Used in International Comparisons of Price Levels and Real Expenditures

Purchasing Power Parity (PPP) is a currency conversion rate that equalises the level of prices in a country with the level of prices in another, benchmark country. Prices that are compared and PPP that results from that comparison may refer to individual products or, after an appropriate aggregation process, to groups of goods, broader consumption aggregates or total GDP.

The national price level (comparative price level index, CPLI) is the ratio of the PPP exchange rate to the current (official, market) exchange rate. The price level is usually expressed in relative terms, in relation to a benchmark country or a group of countries; e.g. the Croatian price level relative to the Austrian or the EU price level. A reciprocal value of the national price level, i.e. the ratio of the market exchange rate to the PPP exchange rate is, by definition, the level of the real exchange rate.

Real GDP is GDP converted to a selected international currency by means of the PPP rate. It can be expressed in absolute amounts, e.g. in international dollars, or in relative terms, in relation to a selected country (USA, Austria) or a group of countries (EU). A relative indicator is also referred to as the volume index for GDP.

Actual individual consumption is a concept of individual consumption preferred in the ICP. It comprises household final consumption expenditure (a standard concept of the System of National Accounts) increased by the value of goods and services for individual consumption provided by the government without charge or at a reduced price (e.g. education, health care). The latter goods and services, although provided by the government, are consumed individually, so that their final beneficiary can be identified and the value of this consumption can be measured.

Final household consumption expenditure is a concept of individual consumption from the System of National Accounts that refers to household expenditure for final consumption. It does not include consumption of goods and services, which are not paid by households, but are provided by the government.

Actual collective consumption is a concept of government consumption used in the ICP that includes only that part of government consumption for which it is impossible to identify a final beneficiary. Thus, it includes services related to defence, public safety, government administration, and the like, whereas government services related to public education, health, etc., which are consumed individually, are included in actual individual consumption.

household consumption, Croatia is close to the average of the countries that became EU members in 2004.

Table 1 Price Level Indices and per Capita Volume Indices for Consumption and GDP (EU-15 = 100), 2000

	Per capita volume			Price level		
	GDP	Actual individual consumption	Final household consumption expenditure	GDP	Actual individual consumption	Final household consumption expenditure
Croatia	36	44	42[a]	56	55	60[a]
EU-15	100	100	100	100	100	100
EFTA 3	130	110	113	128	134	133
Acceding countries[b]	45	46	43	48	46	51
Candidate countries[c]	33	35	34	49	51	57
CIS + Mongolia	21	18	–	28	27	–

Note: [a] Author's estimate based on OECD (2002); [b] Countries that became EU members in 2004, excluding Malta; [c] Includes all the acceding and candidate countries (Bulgaria, Romania and Turkey).
Sources: UNECE (2003), Eurostat (2002), author's calculations.

A more detailed insight into the level of real per capita income and the price level in the transition countries, with changes that occurred between 1993 and 2000, may be obtained from Table 2. One may observe that Croatia experienced a relatively rapid increase in its real income compared with the EU average in this period, whereas its relative price level somewhat declined. In other transition countries the levels of prices and income moved mostly in the same direction. Hence, it may be said that the "disproportion" between the levels of income and prices in Croatia, as compared with other transition countries, has decreased over the last ten years.

Some other tendencies may be also observed from Table 2:

a) The coefficient of variation in both the price level and real per capita income fell between 1993 and 2000 in the EU and acceding countries, which indicates relatively strong convergence within these two groups of countries.[2] Also, although the EU countries and the former acceding countries are viewed as one group (enlarged EU), a fall in dispersion is fairly obvious, more so with regard to the price level than the real income level.
b) Although there is no real income convergence in the large group of the transition countries (except among the acceding countries themselves), rather

2 Although the conclusion on price level convergence within the EU-15 is rather unquestionable from a long-term perspective, developments over the last years are not so clear, despite the introduction of the common currency in the twelve EU countries. The Eurostat data on dispersion of price levels (Structural Indicators: Price convergence between EU Member States, available at http//europa.eu.int/comm/eurostat/public/datashop) indicate that after 1997 there has been no significant decline in price level divergence. A similar conclusion is made by Lutz (2003) for the euro area countries following the introduction of the common currency.

strong price level convergence has continued. Dispersion of price levels was lower among the transition countries than in the enlarged EU (EU including acceding countries) in 2000.

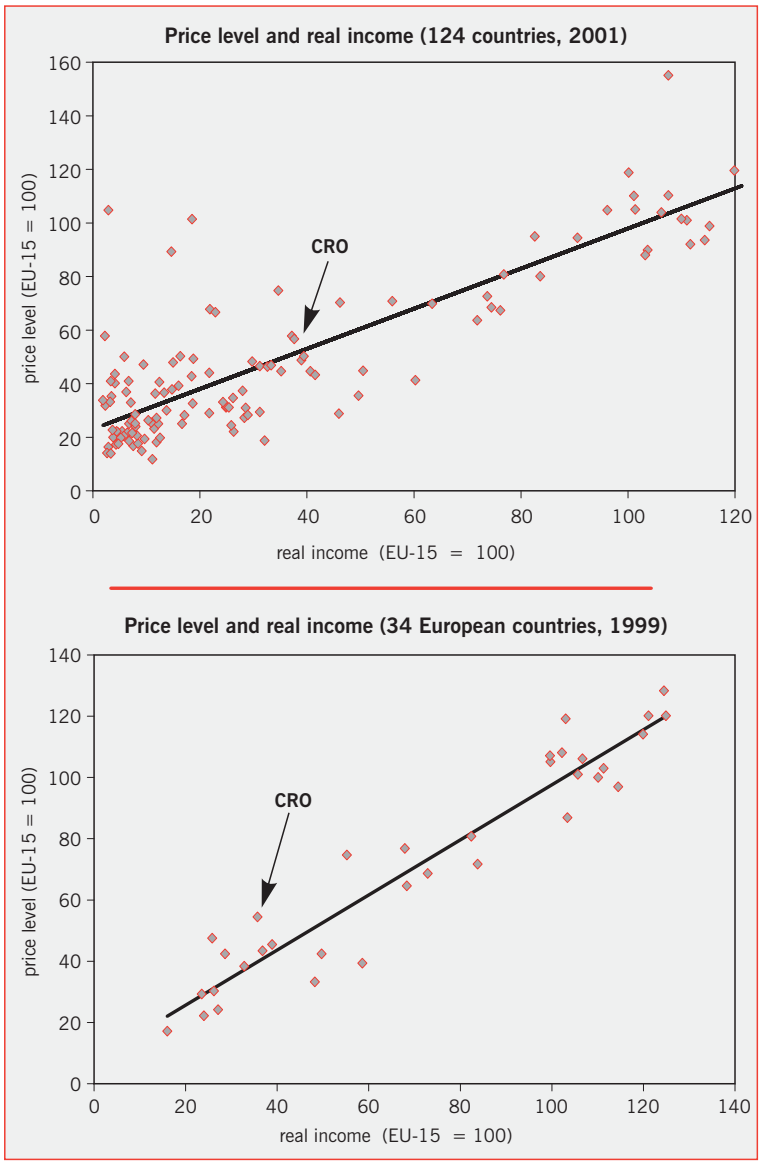
c) The difference in real income between the acceding countries and other transition countries has been growing, with the latter countries being further away from the EU average in 2000 than in 1996.

Table 2 Real GDP per Capita and the National Price Level in the Transition Countries (EU-15 = 100), 1993, 1996 and 2000

Country	Real GDP per capita			National price level		
	1993	1996	2000	1993	1996	2000
Acceding countries						
Czech Republic	49	65	56	34	37	43
Estonia	22	34	40	27	38	45
Latvia	18	26	31	26	35	47
Lithuania	21	29	36	19	32	43
Hungary	35	47	49	59	41	44
Poland	27	34	40	45	44	50
Slovak Republic	37	45	46	34	34	38
Slovenia	54	67	67	65	61	65
Candidate countries						
Bulgaria	24	25	25	29	20	29
Romania	22	34	23	29	20	34
Other Europian transition countries						
Belarus	29	26	19	7	22	25
Croatia	22	32	36	61	60	56
Macedonia	-	21	27	–	46	32
Moldova	13	11	6	13	19	27
Russia	29	34	29	24	37	29
Ukraine	19	17	16	17	22	18
Group statistical indicators EU 14 (EU 15 excluding Luksembourg)						
Coefficient of variation	0.18	0.16	0.16	0.17	0.17	0.15
Acceding countries						
Average (unweighted)	33	43	46	38	40	47
Coefficient of variation	0.40	0.36	0.25	0.42	0.23	0.17
EU-14 and acceding countries						
Average (unweighted)	73	78	80	77	78	80
Coefficient of variation	0.48	0.40	0.38	0.44	0.42	0.36
Candidate countries and other European transition countries						
Average (unweighted)	23	25	23	26	31	31
Coefficient of variation	0.25	0.33	0.40	0.68	0.50	0.36
European transition countries – total[a]						
Average (unweighted)	28	34	34	33	36	39
Coefficient of variation	0.40	0.45	0.46	0.54	0.37	0.32

[a] Note: Includes the acceding and candidate countries, and other European transition countries.
Sources: UN (1997), OECD (1999), CBS (1999), UNECE (2003), and author's calculation.

Figure 1 Relationship between the Price Level and Real per Capita Income



Sources: World Bank (2003), OECD (2002) and author's calculation.

Convergence of national price levels to average EU prices is obviously a process still in progress in the transition countries, as well as within the EU itself. However, regardless of the observed tendencies, there is still a fairly clear and positive correlation of real income and price levels. This correlation can be seen in Figure 1 for a broader group of countries (124), as an illustration of a long ago observed world-wide empirical regularity, and for a narrower group of European countries (34), as an illustration of the thesis that, irrespective of relatively high economic integration of the area, real income remains an important determinant of the price level. Still, a rather large dispersion of price levels at the lower end of distribution of real incomes is observed in a broader group of countries, whereas

this dispersion is smaller in 34 European countries. The Croatia's deviation from the trend is smaller when viewed in the context of a broader group of countries than in the context of only 34 European countries. In both cases, given its real income level, the Croatian price level is somewhat higher than the expectation based on a simple linear correlation of income and prices.

4 Regression Analysis of the National Price Levels

Relationship between the price level and income, as well as between the price level and other potential determinants of the price level can be formally tested by cross-country regressions. This section presents the results of such an analysis: first, by considering the relationship between the price level and real GDP, then by including other factors influencing the price level, and finally by estimating the Balassa-Samuelson effect.

4.1 Relationship between the National Price Level and Real Income

A strong and significant positive relationship between real income and the price level could be found in international data comparisons.[3] The relation is not sensitive to a sample of countries being observed, which is confirmed by regression results shown in Table 3 that were obtained by the ordinary least squares method (OLS). It follows from the regression that real income itself can explain a large part of variations in price levels across countries. Real income and a constant explain almost three-quarters of variations in price levels of a worldwide sample of 124 countries in 2001. Judging by a relation shown in equation (1), Croatia has only a slightly higher price level than expected, which is evidenced by the regression residual of some 5% of the EU price level. However, it can be speculated that some specific factors are driving this relation in the transition countries, so that a dummy variable for these countries is entered. It proved to be statistically significant. Allowing for the fact that Croatia is a transition country, it follows that its price level is much higher than expected (a residual of 16 index points (EU-15 = 100) in equation (2) from Table 3).

Similar results were obtained by using two other data sets – one that includes OECD members and the transition countries of Europe and Middle Asia in 2000 (a total of 53 countries) – equations (3) and (4), and the other that considers 34 European countries in 1999 – equations (5) and (6). By narrowing the sample, we observe a stronger relationship of the price level and income, but also a greater regression residual for Croatia.

3 A theoretical explanation of this relation follows from a reduced version of the Balassa-Samuelson hypothesis (see Appendix II), as well as some other models, like the model of relative factor abundance (Bhagwati, 1984) or models that examine differences in income elasticity of consumption (Bergstrand, 1991).

These results can be compared with the regression results for 1996. For a group of countries that was almost identical to the one considered in estimating equation (5), which in 1996 included 33 European countries (compared with available data for 1999, Malta and Cyprus are left out, and Albania is included), similar coefficients were obtained (a slope coefficient of 0.92 with a constant of 6.47) and adjusted R^2 of 0.89.[4] Still, in this regression for 1996, a residual for Croatia stood at a high of 23, whereas it was around 15 in the regression for 1999. The regression estimate may be repeated with the 2000 data. If a sample of countries observed in equation (3) is limited to the same 34 European countries as in 1999, a cross-country regression of price levels on real per capita income gives a residual of 12.8 for Croatia, i.e. almost half less than in the regression for 1996. This may indicate that faster Croatian economic growth as compared with the EU average, aided by relatively low inflation and a stable exchange rate, has gradually brought Croatian prices to a level that corresponds to its real income level.

Table 3 Cross-country Regression of the Price Level on Real GDP

Equation number:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dependent variable	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**
Constant	23.06 (2.08)	25.83 (2.14)	19.27 (3.55)	43.25 (7.90)	7.68 (3.84)	26.40 (7.47)
Real GDP	0.75	0.74	0.81	0.59	0.90	0.73
	(0.04)	(0.04)	(0.05)	(0.08)	(0.05)	(0.07)
Dummy for transition countries	–	–13.08 (3.71)	–	–22.00 (6.61)	–	–15.50 (5.47)
Adjusted R^2	0.72	0.75	0.85	0.87	0.92	0.93
F-statistics	321.8	182.2	292.2	180.5	256.4	221.3
Residual for Croatia	5.4	16.1	7.7	13.7	14.7	15.5
Number of observations	124	124	53	53	34	34
Year	2001	2001	2000	2000	1999	1999
Data source	WB WDI (2003)	WB WDI (2003)	UNECE (2003)	UNECE (2003)	OECD (2002)	OECD (2002)

Note: Standard errors are given in brackets.
Source: Author's calculation.

4 A regression estimate was obtained on the basis of data derived from OECD (1999) and CBS (1999).

A comparison of regression results for 1996 and 1999 indicates that most countries that had relatively high regression residuals (whether positive or negative) in 1996, were in the same situation in 1999. For example, Finland, Sweden, Switzerland and Turkey had a "too high" price level, and Italy, the Czech Republic, Hungary and the Slovak Republic had a "too low" price level. This shows that there are certain structural factors that influence a more persistent deviation of the actual price level from the expected level, where expectations are based on a regression relation with the real income level.

4.2 Structural Factors Influencing the Price Level

In search of factors that have systematically affected the price level, we tried to include additional explanatory variables in price level regressions. In the selection of these variables we were guided by previous research findings (e.g. Clague, 1986, 1988; Kleiman, 1993; Ahec-Šonje and Nestić, 1998, and Nestić, 2000). The results are presented in Table 4.

Out of a considerable number of additional variables that entered regressions, only two of them proved to be significant in the equations for 1999: tax burden (the GDP share of general government tax revenues) and government expenditure (the GDP share of general government consumption).[5] It seems that total tax burden is a stronger determinant of the price level in developed market economies than in the transition economies. In regressions for a sample of 34 European countries, the variable of the tax burden has the expected positive sign, but is not significant at usual levels. However, if a dummy for the transition countries is introduced into the regression, the significance of the coefficient with the variable of the tax burden increases. A positive relationship is expected, with a greater tax burden implying also a higher price level. A 1-percentage point increase of the GDP share of the tax burden is expected to increase the price level by 0.6 index points compared with average EU prices (EU-15 = 100).

A similar conclusion about the impact of the government sector on prices may be obtained by observing the relationship between government consumption and the price level. This relationship is even more obvious because the coefficient of government expenditure is significant at the level of 1% even without introducing a dummy for the transition countries, and larger than the coefficient of tax burden. However, in a regression that includes government expenditure, we did not have reliable data on expenditure at the general government level for Switzerland and Turkey, so we excluded these two countries from the sample, which impeded

5 A theoretical justification for the inclusion of tax burden in the regression may be found in models that show that in a situation when tax burden is shifted to final consumers, and monetary policy accommodates accordingly, prices of final products increase. On the other side, the impact of government consumption on prices is manifested either as an increase in taxes needed to finance the government or as (assumed) greater inefficiency of the government to provide services compared with the private sector. Both lead to higher prices of final products. See, for example, Kleiman (1993) for more details.

Table 4 Cross-country Regression of the Price Level, 1999

Equation number:	(7)	(8)	(9)	(10)	(11)
Dependent variable:	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**
Constant	–1.70 (11.06)	12.05 (9.66)	–21.54 (9.82)	–1.65 (11.12)	–1.80 (5.79)
Real GDP	0.87 (0.05)	0.63 (0.08)	0.87 (0.04)	0.63 (0.07)	–
Tax burden	0.31 (0.35)	0.61 (0.33)	–	–	–
Government expenditure	–	–	0.70 (0.26)	0.83 (0.24)	–
Dummy for transition countries	–	–18.80 (4.93)	–	–18.68 (4.93)	–
Labour productivity (real GDP per employee)	–	–	–	–	0.97 (0.08)
R^2	0.92	0.94	0.93	0.95	0.84
F-statistics	240.0	198.0	355.9	249.2	147.8
Residual for Croatia	11.4	11.8	5.0	5.3	–
Number of observations	34	34	32	32	28

Note: White's heteroskedasticity robust standard errors are given in brackets.
Source: Author's calculation.

direct comparison of tax-included vs. expenditure-included regressions. In regressions of price levels on real income, Switzerland and Turkey proved to be untypical countries since both of them have a higher than expected price level given their real income level (according to regression results in equation (5)). Hence, their exclusion provides more statistically significant estimates. In all these equations, deviations for Croatia were less than in the "benchmark" equation number (5). In case when, in addition to the income level, the equation includes also the volume of government expenditure as an independent variable, a regression residual for Croatia is positive, albeit significantly smaller, and the actual price level in that case exceeds regression expectations by some 5 index points (EU-15 = 100). Thus, it may be said that relatively large government expenditure in Croatia is one of the factors explaining a comparatively high price level in Croatia.

Ahec-Šonje and Nestić (1999) and Nestić (2000), using a similar sample of countries (the OECD and European transition countries), and on the basis of ICP data for 1993 and 1996 found that a country's size (i.e. population number) and openness of an economy have a significant impact on the price level. In this study

conducted on a sample of 34 selected European countries for 1999, these two variables did not prove to be significant regardless of various definitions of the country's size and openness that we applied. With regard to the variable of economic openness it can thus be speculated that the process of trade integration in Europe has recently reached the level at which mere openness does no longer have a significant influence on national price level differences.

Broda (2002) showed that a choice of the exchange rate regime might be important for a country's price level.[6] By using data on *de facto* exchange rate regimes (Levy Yeyati and Sturzenegger, 2002) in a sample of European countries in cross-country regressions for 1999 we failed to confirm this relationship.

If one accepts the assumption that supply determines international differences in price levels then, in accordance with a reduced version of the Balassa-Samuelson hypothesis, labour productivity, i.e. the level of real GDP per employee, should be a better determinant of the price level than real per capita income. However, an estimate of equation (11), which includes real GDP per employee as an explanatory variable, resulted in a lower coefficient of determination than the estimate of a similar equation (5), which includes real GDP per capita as an explanatory variable. Still, a coefficient with the variable of labour productivity is very significant and relatively close to one, which implies that cross-country differences in aggregate labour productivity are clearly reflected in price level differences.[7]

4.3 Balassa-Samuelson Hypothesis and the Price Level

To test the Balassa-Samuelson hypothesis in a theoretically more appropriate way than the simple relation between the price level and aggregate productivity implied in equation (11), it is necessary to go beyond aggregates and consider productivity by sectors. Balassa (1964) and Samuelson (1964) pointed that the difference in labour productivity between the tradable and nontradable sectors, which varies across countries, is the force that drives relative prices across these countries. Under certain assumptions (see Appendix II), it can be shown that higher relative labour productivity (productivity in the tradable sector relative to productivity in the nontradable sector) will lead to a higher general price level. This can be formally written as:

6 A theoretical explanation of this relationship stems from general equilibrium models that show that goods prices are determined under the influence of monetary authorities' reactions to real shocks, and these reactions depend on the exchange rate regime (see, for example, Obstfeld and Rogoff, 2000). Thus, in countries without a flexible exchange rate, monetary authorities cannot absorb real shocks and avoid changes in employment. In that case, employees can seek higher wages to compensate for greater employment uncertainty. Higher wages then lead to higher price levels. In addition to the channel of wages, higher prices in countries with a fixed exchange rate regime may be directly set by producers in cases when they are faced with rigid prices, and hence use higher prices to protect themselves in situations of greater fluctuations in production.

7 In this case, comparable data on the productivity level were not available for Croatia. For all countries, these data were taken from the Eurostat base of structural indicators.

$$CPLI = \frac{\left(\frac{A_T}{A_{NT}}\right)^{1-\alpha}}{\left(\frac{A_T^*}{A_{NT}^*}\right)^{1-\alpha^*}}, \qquad (1)$$

where *CPLI* is the comparative price level index, A_T is productivity in the tradable sector (T) and A_{NT} is productivity in the nontradable sector (NT), α is a share of tradables in consumption, whereas * denotes variables of a foreign economy.[8]

The assumed dependency of the price level on relative labour productivity (T/NT) was tested in a way similar to other determinants of the price level, on the 1999 cross-country data for a sample of 27 European countries for which reliable data on productivity could be collected.[9] This analytical exercise is aimed at establishing whether the Balassa-Samuelson hypothesis can be used to explain international differences in price levels. In the context of regression estimates, we wanted to determine whether it was possible to obtain reasonable estimates of coefficients of relative labour productivity. The expected positive sign and significant regression estimates could confirm the importance of the Balassa-Samuelson hypothesis for an explanation of price level differences.

Figure 2 Price Level and Labour Productivity Ratio T/NT

Note: Circles denote the countries in transition. The straight line presents an estimate of the linear correlation of the labour productivity ratio to the price level. A labour productivity ratio is a ratio between productivity in the tradable sector (T) and productivity in the nontradable sector (NT).
Source: Author's calculation.

8 One should notice that the Balassa-Samuelson effect is here expressed in terms of "level", i.e. as a determinant of the price "level". In the literature this effect is much more often considered in terms of "rate of change", where it is expected that countries in which relative productivity (T/NT) grows faster will experience a higher inflation rate, i.e. appreciation of the real exchange rate.

9 Data sources are described in Appendix I.

As an introduction, Figure 2 shows the correlation of the price level and the labour productivity ratio (T/NT).[10] This illustration suggests that this correlation is fairly strong. A higher labour productivity ratio T/NT is correlated to a higher price level. The transition countries usually have a lower productivity ratio than other European countries, but also a lower level of prices. Norway and Ireland are the two countries with the highest productivity ratios. Norway has strong oil production, a tradable industry having high labour productivity (high value-added per employee), which results in a high productivity ratio. Situation is similar in Ireland, whose high-tech sector is highly developed and characterised by a high value added per employee. Therefore, there is high productivity in the tradable sector and a high productivity ratio.

Results of regression estimates of the correlation of relative productivity and the price level are given in Table 5. Differences in relative productivity $[(A_T / A_{NT})^{1-\alpha} / (A^*_T / A^*_{NT})^{1-\alpha^*}]$ themselves explain somewhat more than half of variations in price levels, and the coefficient is, as expected, positive and significant (equation (12)). This estimate supports the hypothesis that the supply side of an economy considerably influences the price level, i.e. it shows that the Balassa-Samuelson hypothesis could be important for an explanation of cross-country variability in price levels. It is true that the explanatory power of relative productivity is lower than that of real

Table 5 Cross-country Regressions of the Price Level on Relative Productivity, 1999

Equation number:	(12)	(13)	(14)	(15)
Dependent variable:	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**	**Price level (EU-15 = 100)**
Constant	–31.77 (21.36)	–90.14 (22.33)	44.11 (16.08)	–4.27 (12.64)
Relative productivity[a]	1.15 (0.22)	0.99 (0.18)	0.53 (0.15)	0.47 (0.11)
Tax burden	–	1.88 (0.60)	–	1.36 (0.31)
Dummy for transition countries	–	–	–46.57 (5.86)	–42.82 (4.47)
R^2	0.52	0.65	0.85	0.92
F-statistics	27.0	36.7	83,0	188.6
Residual for Croatia	–26.3	–35.8	4.5	4.9
Number of observations	27	27	27	27

Notes: [a] Relative productivity is defined as: $[(A_T / A_{NT})^{1-\alpha} / (A^*_T / A^*_{NT})^{1-\alpha^*}]$.
Estimates of White's heteroskedasticity robust standard errors are given in brackets.
Source: Author's calculation.

10 For reasons of simplicity, the productivity ratio, which is shown on x axis of Figure 2, is not divided by the productivity ratio in a foreign economy (in this case, the EU), nor is it weighted by the share of nontradables, as would be suggested by a consistent implementation of the Balassa-Samuelson effect shown in equation (1). Later, in regression estimates, all these elements of relative productivity are included.

income (which can be discerned by comparing coefficients of determination in equations (5) and (12)). However, real income itself comprises various factors influencing the price level, whereas relative productivity as a variable isolates the impact of the "true" Balassa-Samuelson effect on the price level.

Since relative productivity shows the impact of the supply side on the price level, an adequate indicator of prices should in that case be producer (basic) prices. However, in international comparisons, and so in the ICP as well, observed are consumer prices of final products. Hence, a more complete explanation of observed differences in price levels could be done by the inclusion of a variable that should approximate the difference between producer and consumer prices. For this purpose, we used the variable of the tax burden or, more precisely, the GDP share of general government tax revenues. An estimate of equation (13) shows a combined impact of relative productivity and tax burden on the price level. Coefficients with both variables are expectedly positive and significant at the level of 1%. Relative productivity and the tax burden together explain almost two-thirds of variations in price levels across European countries. Thus, for example, a relatively small tax burden in Ireland can partly account for its moderate price level, regardless of a high labour productivity ratio (T/NT).

Figure 2 indicates that a somewhat specific influence of relative productivity on prices may be present in the transition countries. It seems that the observed positive correlation of productivity and prices is achieved at a somewhat lower level than in European market economies. Hence, in regression estimates we introduced a dummy variable for the transition countries (equations (14) and (15)). In both cases, the dummy proved to be significant, with a negative sign, whereas the significance of other variables remained at the level of 1% (except for the constant in equation (15)). However, the value of the coefficient of relative productivity decreased by almost half, so that the dummy for the transition countries pointed to a somewhat different impact of relative productivity on the price level in advanced European countries. Since most of these countries are the EU-15 members, one may speculate that the impact of the common economic area reduced the impact of differences in relative productivity on the price level.

The productivity ratio T/NT in Croatia is higher than in other transition countries (Figure 2).[11] This indicates that relative productivity could be one of the factors that explain a higher level of Croatian prices compared with other transition countries. This is confirmed by relatively low residuals for Croatia in regressions (14) and (15).

11 In addition to Croatia, the sample of the transition countries includes Bulgaria, the Czech Republic, Estonia, Hungary, Macedonia, Poland, the Slovak Republic, Slovenia and Romania.

5 Level and Dispersion of Prices by Groups of Goods and Services

In this section attention will be more directed to the price structure by countries. A comparison of prices by groups of goods can provide additional information relevant to estimate the nature of potential price level convergence, i.e. the need to adjust relative prices.

Table 6 Dispersion of Price Levels by Groups of Goods and Services for the EU and Transition Countries, 1999

	EU-15		Transition countries[a]	
	Average (EU-15 = 100)	Coefficient of variation	Average (EU-15 = 100)	Coefficient of variation
Gross domestic product	100	0.15	38	0.34
Actual individual consumption	100	0.16	41	0.42
Food and non-alcoholic beverages	100	0.11	56	0.29
Alcoholic beverages and tobacco	100	0.31	48	0.30
Clothing and footwear	100	0.11	55	0.32
Housing fuel and power	100	0.25	24	0.56
Furnishings, household equipment and routine maintenance	100	0.13	52	0.24
Health care	100	0.18	24	0.45
Transport	100	0.16	55	0.26
Communications	100	0.29	57	0.82
Recreation and culture	100	0.14	43	0.34
Education	100	0.26	18	0.61
Hotels and restaurants	100	0.26	47	0.28
Miscellaneous goods and services	100	0.17	36	0.33
Actual collective consumption	100	0.22	24	0.52
Gross fixed capital formation	100	0.13	56	0.27
Construction	100	0.23	43	0.38
Machinery and equipment	100	0.09	76	0.13
Total goods	100	0.12	55	0.24
Total services	100	0.19	25	0.46
Relative price ratio: services/goods	1.00	0.13	0.51	0.23

Note: [a] Includes the ten transition countries – candidates for EU membership in 1999, as well as Croatia, Macedonia, Russia and Ukraine.
Source: Author's calculation based on OECD (2002).

Table 6 shows price levels and coefficients of variation in prices by main expenditure categories for the EU-15 and 14 European transition countries. With regard to consumer products, the lowest price dispersion across countries

(measured by the coefficient of variation) is recorded in food and non-alcoholic beverages, clothing and footwear, and furnishings and household equipment. This holds true for both the EU and transition countries, irrespective of the fact that the price level of these products is somewhat lower in the transition countries than in the EU-15, but also higher than the average price level calculated for all goods and services, i.e. total GDP. Since these are mostly products that are internationally traded, it can be concluded that there is a stronger tendency towards cross-country equalisation of their prices largely because of international trade. On the other hand, higher price dispersion is present with regard to goods whose tradability is limited (education, health care, housing) or goods whose prices are subject to substantial government regulation (alcoholic beverages and tobacco, and communications). With regard to hotels and restaurants, there is relatively high price dispersion across the EU-15, whereas it is relatively small in the transition countries. It is obvious that in some transition countries the services of this sector are highly tradable, which leads to price equalisation in the broader region.

A clear illustration of differences in levels and dispersion of prices that arise from the degree of international tradability of goods may be obtained by comparing data on actual collective consumption with data on machinery and equipment. In the transition countries, the price level of machinery and equipment is some three-quarters of that in the EU-15, with relatively low price dispersion across countries. On the other hand, prices in the public services sector exhibit strong variations and amount to only a quarter of the EU-15 average. A similar difference is discernible between prices of goods and prices of services. The classification of products into goods and services is similar to that into tradables and nontradables. Therefore, it is not surprising that price dispersion across countries is smaller with regard to goods and their price level is more equal than that of services. Goods prices in the transition countries were at the level of 55% of the EU average in 1999, whereas services prices were at the level of only 25% of the EU average.

Price levels of individual groups of goods and services are in part nation specific. This can be exemplified by comparing prices in Croatia and Austria (Table 7). In three benchmark years (1993, 1996 and 1999) within the ICP Project, Croatian prices were directly compared with Austrian prices, so that there are somewhat more detailed data in that case.

Both at the total GDP level and the level of actual individual consumption, Croatian prices are around half of Austrian prices. This result is strongly affected by relatively low prices of goods and services that are generally not tradable. Thus, the largest price difference between Croatia and Austria exists with regard to housing rents (including imputed rents), maintenance of the house, health care and education. Prices of most other Croatian products are much closer to the Austrian level. Prices of goods with a higher degree of tradability (like food and beverages, transport equipment, clothing and footwear) amount to 70% and more of the Austrian price level. Prices of newspapers, books and stationery as

Table 7 Croatian Price Levels by Groups of Goods and Services (Austria = 100)

	1993	1996	1999
Actual individual consumption	48	51	53
Bread and cereals	46	69	80
Meat	70	86	68
Fish	54	71	55
Milk, cheese and eggs	59	93	96
Oils and fats	88	92	86
Fruit, potatoes and vegetables	70	88	75
Other foods	79	99	76
Non-alcoholic beverages	94	119	102
Alcoholic beverages	64	106	88
Tobacco	38	54	56
Clothing, including repairs	61	89	72
Footwear, including repairs	57	87	62
Housing rentals	19	17	24
Maintenance of the house, including services	48	45	28
Electricity, gas and other fuels	75	80	72
Furniture	96	92	66
Household appliances and repairs	79	74	73
Other household goods and services	79	85	74
Pharmaceutical products, medical and health services	57	43	38
Personal transport equipment	101	100	92
Operation of transport equipment	45	50	60
Transport services	41	64	58
Communications	36	20	43
Recreational equipment, including maintenance	88	98	85
Recreational and cultural services	18	59	46
Newspapers, books and stationery	63	118	126
Education	29	22	37
Restaurants and hotels	37	55	65
Miscellaneous goods and services	53	77	57
GDP	55	55	54

Sources: UN (1997), OECD (1999), CBS (1999), UNECE (2001), author's calculation.

well as non-alcoholic beverages were higher in Croatia than in Austria in 1999. In the former case, one could speculate that a relatively small and (due to the language) closed market is the main reason behind high prices in Croatia. However, taxes could also have an impact on prices. Croatia has a relatively high VAT rate on publications and there are excise taxes on non-alcoholic beverages, which are not applied in Austria. It seems that a separate analysis should be made for each group of products.[12]

With regard to a major part of goods and services used for individual consumption, the Croatian price level (compared with the Austrian price level) was lower in 1999 than in 1996. Relative price growth was recorded in groups that are either nontradable (bread, milk, housing rents, operation of transport equipment, newspapers, education), or are subject to considerable administrative regulation (or deregulation in Austria) or have a favourable market position, which supported price growth compared to Austria (communications and tourism-related services like hotels and restaurants).

Regardless of many differences between Croatian and Austrian prices, Croatia is a transition country whose prices are most like average EU prices. This is confirmed by the price similarity index for actual individual consumption (Table 8).[13] Among all transition countries, the price structure most alike the EU-15 price structure is present in Slovenia, Croatia and Poland. Furthermore, the similarity index of Croatian relative prices is almost equal to the price similarity index for Portugal. This could imply that the structure of nominal demand in Croatia is relatively well adjusted to the demand structure in the EU, which is probably one of the reasons behind a relatively high price level in Croatia relative to that in other transition countries.[14]

The process of European integration has left its trace on the price similarity. The similarity of national relative prices with the EU average was greater in 1999 than in 1996. This is also true for poorer EU-15 countries (Greece, Portugal and Spain) and for the transition countries that were in these years included in the process of enlarging the EU. Price convergence is not reflected only in equalisation of the price level, but also in the price structure convergence, i.e. adjustment of relative prices. The convergence of the price structure was almost negligible in Turkey.

If Croatia is selected as a benchmark country to consider the price similarity, then the greatest similarity is observed with Slovenia and Poland, whereas the

12 This is stressed by the European Commission (2002a) and EC Internal Market DG (2002) in case of price dispersion within the EU. It is shown that a relatively high price dispersion is present with regard to the same types of consumer goods, even with regard to the branded goods, i.e. completely identical products. It is stated that these differences cannot be explained by differences in income or wage levels, but by numerous other factors, from various competitive pressures on national markets, culture, climate, local preferences and technical barriers to transport costs. In addition, producers themselves use the option to segment the market due to different regulations on advertising, urban planning, franchising, and the like. These various factors affect each product and brand in a different way so that one should separately consider the situation in each market in order to gain a complete understanding of price differences.

13 A price similarity index for each pair of countries is measured by a correlation coefficient obtained from a regression of relative price levels at the level of individual goods in the first country relative to the corresponding relative price levels in the second country. The relative price level is the ratio of PPP for a specific product and PPP at the GDP level. In that case, a relative price indicates whether the price level for a certain good is higher or lower relative to the general price level in the country.

14 See Nestić (2000) for empirical arguments supporting this thesis.

Table 8 Price Similarity Indices for Actual Individual Consumption

	Similarity index with EU-15		Similarity index with Croatia
	1996	1999	1999
EU-15	1.00	1.00	0.92
Greece	0.95	0.96	0.94
Portugal	0.90	0.93	0.93
Spain	0.94	0.98	0.92
Acceding countries			
Czech Republic	0.83	0.90	0.93
Cyprus	-	0.94	0.93
Estonia	-	0.89	0.92
Latvia	-	0.82	0.88
Lithuania	-	0.87	0.93
Hungary	0.94	0.89	0.93
Malta	-	0.86	0.78
Poland	0.85	0.92	0.96
Slovak Republic	0.79	0.87	0.93
Slovenia	0.92	0.96	0.96
Candidate countries			
Bulgaria	–	0.78	0.82
Romania	–	0.81	0.86
Turkey	0.86	0.87	0.90
Croatia	–	0.92	1.00

Sources: OECD (1999) and OECD (2002).

similarity with the less advanced EU-15 countries is almost equal to that with the Czech Republic, Hungary or the Slovak Republic. These findings point that price level convergence, as part of the EU integration process, should not generate severe shocks in Croatia, at least not greater than those observed in the transition countries that joined the EU in 2004.

6 Potential Pressures towards Price Convergence in the EU Integration Process

As the above analysis shows, there is a rather strong tendency towards convergence of price levels in the transition countries to the EU price average and towards lower dispersion of price levels across the transition countries themselves. This tendency has been present over recent years even when real convergence was weak or completely missing. A question arises of how much room is left for further price level convergence in the European transition countries and what does it depend on?

Considering the factors that may influence the process of price level convergence, especially in the transition countries, two factors come to the foreground. One is the initial price level and the other is productivity growth. The lower the initial price level, the stronger price convergence during integration into a common economic area can be expected.[15] This process is usually accompanied by an almost identical process of real convergence. Higher economic growth (real income growth) should lead to higher price growth. However, recent experience of the transition countries shows that price level convergence can appear without real convergence. This is certainly the result of historical inheritance, i.e. certain structural factors, with the price level in most of these countries being set "too low" relative to the income level in the early stages of transition. Thus, we come to the third potential factor of convergence, the initial deviation from the expected price level (where expectations are based on the income level). A deviation from expectations may be caused by transition factors that are expected to disappear or at least become sharply reduced over time, especially bearing in mind the accelerated process of integration and harmonisation of European economic systems. If the deviation is high because the initial price level was severely "too low", price convergence could be faster than in the situation where the initial price level was near the one expected.

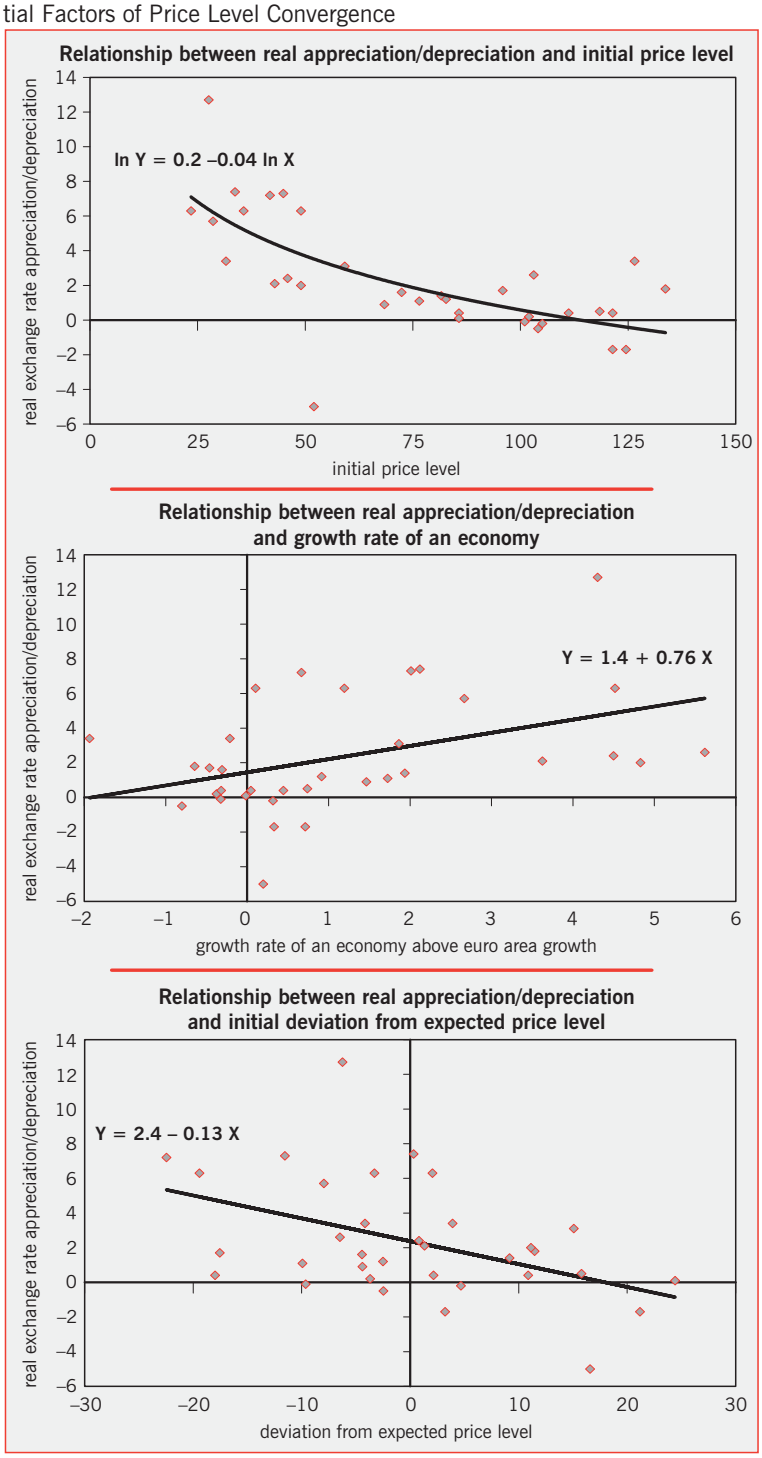
The impact of these three factors on developments in price levels of European countries may be illustrated by a simple analytical exercise, first by a graphical presentation and then by a formal estimate.

A change in the real exchange rate in the 2000-2002 period was selected as an indicator of changes in the price level.[16] As factors that may influence appreciation/depreciation of the real exchange rate, we considered the initial price level of individual consumption expenditure (data for 1999), the average GDP growth rate (in the 2000-2002 period), whereas a residual from a regression of the price

15 The relationship between the initial difference in price levels between two areas that are in the process of integration and subsequent inflation rates may be derived from a formal model (see, for example, Maier and Cavelaars, 2003).

16 The national price level and the real exchange rate level are actually identical variables, but in an inverse expression. Hence, the change in the price level relative to a benchmark foreign economy is identical to the change in the real exchange rate relative to the currency of that foreign economy.

Figure 3 Relationship between Real Exchange Rate Changes and Potential Factors of Price Level Convergence



Note: Appreciation/depreciation of the real exchange rate refers to the average annual change in the real exchange rate of the domestic currency relative to the euro in the 2000-2002 period. It is calculated for each country as a change in the nominal exchange rate of the domestic currency against the euro adjusted for inflation differential (domestic CPI inflation less HICP inflation in the euro area). Positive values of exchange rate changes denote real appreciation and negative values denote depreciation. The growth rate of an economy above euro area growth is the average annual rate in the 2000-2002 period. The initial price level refers to the price level of final household consumption expenditure in 1999, with the price level in the euro area equal to 100. A deviation from the expected price level is a residual in a regression of prices of final household consumption expenditure on the real GDP level for 1999.

level of individual consumption expenditure on real GDP for 1999 was chosen as an indicator of a deviation of the initial price level from expectations. The relationship between the real exchange rate and each of the potential factors of convergence is presented in Figure 3.

The upper part of Figure 3 shows that there could indeed be some systematic relationship between real exchange rate changes and the initial price level and that it probably is not linear. The lower the price level of individual consumption in the initial year (1999), the more often was it accompanied by relatively high appreciation of the real exchange rate in the subsequent period (2000-2002). The middle part of Figure 3 shows that higher growth rates in a certain way correlate with real exchange rate appreciation. The lower part of Figure 3 shows that an initially lower-than-expected price level could be connected with stronger appreciation pressures.

The graphical analysis suggests that there could be some kind of systematic relationship between changes in the real exchange rate and the three observed factors. The relationship could be expressed more formally in the form of a regression model. For the purposes of this analytical exercise we simply combined all three convergence factors together in the cross-country regression model in which the change in the real exchange rate was a dependent variable.

In regression estimates of various model specifications it was shown that the initial price level is significant regardless of the functional form (in terms of both levels and logarithms). A variable of the initial deviation from expectations was in most cases significant at the level of up to 10%. However, economic growth was usually insignificant. This might be connected with its rather high (negative) correlation with the initial income level and thus also with the initial price level. It seems that both variables, real economic growth and the initial price level, to a large extent exert the same influence on the price level (the real exchange rate level), which is the effect of real convergence. Although our primary intention was that the initial price level as a variable take the effect of eliminating trade barriers and growing trade integration, the fact is that trade integration and real convergence are rather strongly correlated. Therefore, it is difficult to separate the price effect of trade integration from the price effect of real convergence. A specification that would include both variables, i.e. the initial price level and economic growth, would have a multicolinearity problem. In our preferred estimation, the variable of economic growth was left out, whereas the initial price level was included. This variable was intended to encompass the effects of both integration and real convergence. The variable of the initial deviation from the expected price level was intended to capture the integration tendency of reducing the disproportion between price levels and income.

In cross-country regressions, estimates were also influenced by certain untypical values of variables. In 2001, Turkey went through a crisis that significantly disturbed its macroeconomic parameters. On the other hand, due to oil price growth, Russia had a large foreign trade surplus and strong exchange rate appreciation, which was far above convergence expectations. For these reasons, dummy variables were introduced for these two countries.

A preferred estimation of changes in the real exchange rate can thus be expressed by the following equation:

$$\ln R = \underset{}{0.181} - \underset{(0.03)}{0.037 \ln CPLI} - \underset{(0.006)}{0.037 \ln RES} - \underset{(0.022)}{0.079\, TR} + \underset{(0.005)}{0.061\, RUS} \qquad (2)$$
$$\underset{(0.006)}{}$$

$$R^2 = 0.795 \; ; \; N = 34$$

where *R* is the average rate of changes in the real exchange rate against the euro in the 2000-2002 period (a positive sign denotes real appreciation), *CPLI* is the comparative price level index in 1999 (euro area = 100), *RES* is the residual of a regression of prices of final household consumption expenditures on real GDP, *TR* and *RUS* are dummy variables for Turkey and Russia, respectively, and ln denotes the natural logarithm operator. The estimate is performed by the simple ordinary least squares method (OLS) with estimates of White's heteroskedasticity robust standard errors whose values are given in brackets below parameter estimates. The sample consisted of 34 European countries, the same as in the preceding sections.

Signs of coefficients in equation (2) are in line with expectations. A high initial price level leads to subsequent depreciation pressures, and vice versa, a low initial price level leads us to expect appreciation. An initially higher-than-expected price level (a positive initial deviation) creates pressures that lead to exchange rate depreciation.

Equation (2) reflects the pattern of real exchange rate developments in European countries in the 2000-2002 period quite well. Therefore, we may attempt to estimate future real exchange rate developments based on the observed pattern. To obtain an estimate that would be more appropriate to the situation following 2002, we applied more recent values for independent variables together with regression coefficients from equation (2). Thus we introduced a new initial price level, as well as new data on deviations from expectations, which refer to 2002.[17] Thus, if experience of real exchange rate adjustment (price level convergence) in the 34 observed European countries in the 2000-2002 period is repeated in a similar manner in the following few years, then our estimates of exchange rate changes could provide a rough estimate of the magnitude of future pressures on the exchange rate. Results for the European transition countries are given in Table 9.

Based on this estimate, Croatia and Slovenia could experience the weakest pressure towards real exchange rate appreciation (averaging somewhat over 2% a year) over the next few years, whereas the Slovak Republic could bear relatively

17 Data sources for the price level of individual consumption expenditures and real income for the EU-15, EFTA and candidate countries for 2002 are preliminary Eurostat estimates (Eurostat, 2003a, 2003b), whereas the data for Croatia, as well as estimates of deviations from regression expectations are the result of author's calculation.

Table 9 Regression Expectations of Real Exchange Rate Changes in the European Transition Countries, Short-term Forecast, average annual rate, in %

Country	Expected appreciation	Country	Expected appreciation
Czech Republic	4.0	Estonia	2.9
Hungary	3.6	Latvia	3.4
Poland	2.8	Lithuania	3.4
Slovak Republic	4.7	Romania	4.5
Bulgaria	4.3	Slovenia	2.4
Croatia	2.3		

Source: Author's calculation.

strong pressure (almost 5% a year). A relatively high initial price level of individual consumption products in Croatia (which, according to estimates, amounted to 62% of the price level in the euro area in 2002) does not create the need for strong further price level growth relative to the EU, which would be realised by real exchange rate appreciation. The initially "too high" price level relative to real income in Croatia acts in the reverse direction, thus easing appreciation pressure that results from trade integration and real convergence.

The estimated level of pressure on the real exchange rate seems relatively high, especially when compared to the estimates of the Balassa-Samuelson effect for the transition countries, which show an effect below 2%. It is true that our estimate in this case includes more factors of convergence, regardless of their ultimate source (labour productivity, income growth, harmonisation of the economic structure and the like). Also, the convergence process generally implies stronger adjustments at the beginning of the period, whereas such pressures become weaker as one moves closer to the target level.

Experience of countries that previously joined the EU could provide a comparative illustration of the speed of price level adjustment. In 1985, just before it joined the EU, Portugal had an aggregate price level of some 55% of the EU-10 average (the unweighted average of national price levels in the EU countries). Some ten years after, in 1996, the level of Portuguese prices went up to 70% of the average for the same group of countries.[18] As for the price level of goods and services for individual consumption in the same period, it grew from 60% to some 74% of the EU price level.[19] Adjustment of the Spanish price level was only somewhat more moderate, from around 75% to 85% of the average price level in the EU-10 in the 1985-1996 period. In the 1996-2000 period, the Portuguese general price level went up from 68% to 72% of the EU-15 price level, whereas the

18 Presented results are calculated by using data on the comparative price level from OECD Main Economic Indictors, various editions. Although such mechanical aggregation of national price levels is somewhat imprecise, it still provides a good illustration of the process.

19 The data on the price level in 1985 are taken from European Commission (2003), whereas the data for 1996 were obtained by conversion of data in OECD (1999). It is interesting to note that the present Croatian price level of products for individual consumption relative to that of the EU-15 is approximately equal to the Portuguese price level relative to that of the EU-10 immediately before it joined the EU.

Spanish price level even declined in relative terms. Therefore, it seems that in an early and intensive stage of integration into the EU, which will be soon experienced by the new EU members, price adjustment could be rather strong. Average annual appreciation of 2% (lower limit in our estimate) over a ten-year period would increase the price level from some 60% to 73% of the euro area average, which is exactly the ratio of relative price growth of individual consumption goods and services experienced by Portugal in the 1986-1996 period. As integration processes in Europe have strongly intensified over the last years, there is reason to expect that real exchange rate appreciation will exceed 2%. Therefore, it seems that the estimate based on equation (2) provides reasonable results.

However, considerable changes in relative price levels may occur even with a lower rate of real appreciation calculated by using the consumer price index (CPI). In the CPI of the transition countries, services have been relatively underrepresented as compared to their actual share in individual consumption, as is suggested by national accounts data.[20] Since it is expected that parallel to income growth, prices of nontradables (especially services) will grow the most, their smaller weight in the CPI will lead to lower inflation reported, and hence to lower real exchange rate appreciation. A detailed international comparison of prices, like the one in the ICP, will *ex post* rightly discover that there was a strong increase in the comparative price level.

Finally, rapid economic growth in a transition country could accelerate real convergence and thereby also price level convergence, whereas in a country with poor economic growth, price convergence may slow down or be completely missing. Hence, economic growth, although not formally introduced into the presented regression equation, is an extremely important convergence factor.[21]

7 Potential Upward Pressures on Croatian Prices by Groups of Goods and Services

The empirical exercise above provides a framework for expectations regarding pressures towards exchange rate appreciation or inflation growth at the aggregate level. In that way some diverse developments by individual groups of goods and services remain hidden. In order to examine the impact of price convergence at the disaggregated level, a reasoning similar to the above analysis at the aggregate level can be applied. But, in this case we did not repeat the formal estimate of equation (2) at the level of groups of goods and services, but only presented the

20 See, for example, Egert (2003) on the case of Estonia.

21 An estimate of an equation that uses the initial income level instead of the initial price level as an independent variable also provides statistically significant results for convergence estimates, which is not surprising having in mind the strong correlation of the price and real income levels.

basic elements needed for an assessment of upward pressures on prices on whose basis certain conclusions will be verbally drawn.

Table 10 comprises the results of a cross-country regression estimate of the relationship between the price level for each considered product and the real GDP level. The sample consists of 34 European countries. The larger the slope coefficient deriving from this estimate, the higher expected responsiveness of prices to aggregate income growth. It can be seen that this coefficient is higher for goods with a lower degree of tradability. The obtained coefficient of determination is relatively high for all goods and services, except communications, tobacco and alcohol. Since administrative regulation applied to these "excepted" goods and services is strong and varies from country to country, it is clear that their prices are weakly correlated with real income. This also means that future price developments could be strongly influenced by administrative factors.

Regression residuals for Croatia are positive for all goods and services, except communications, which means that in 1999 Croatia had a "too high" price level of all these goods and services given its income level and regularity in European countries that has been observed in the regression estimate. In terms of convergence, this means that future upward pressures on these prices will be lower, i.e. that these prices have already come relatively close to the EU price level. The last column of Table 10 shows the price level in Croatia relative to the EU.

In 1999, the Croatian level of consumer goods prices was at some 77% of the EU price level. Although it was lower than the price level in all individual EU-15 countries, the Croatian price level, together with the Slovenian price level, was considerably above that of other transition countries. Hence, strong upward pressures on prices are not to be expected in the consumer goods sector except perhaps with regard to goods whose prices are subject to administrative regulation, like tobacco products or alcoholic beverages.

In the transition countries that joined the EU in 2004 there is considerable concern about future developments in food prices. It seems that this concern should not be especially marked in case of Croatia, at least when we observe the group "food and non-alcoholic beverages" as a whole. Croatian prices of this group of goods have already reached some 80% of the EU price level, with food prices being evidently higher-than-expected considering the Croatian real income level (see residual of 24). A similar argument holds for clothing and footwear. Therefore, the room for future increases in prices of these goods as a result of the integration process is limited. Moreover, with stronger integration into the EU and greater competitive pressures, there is potential for pressures towards a relative decline in these prices.

It seems that there is room for price increases in the product group covering housing, fuel and power due to a low initial price level and their high dependency on income growth. However, this is a heterogeneous group where it is hard to estimate which individual goods and services could experience price growth.

Prices of education and health care strongly depend on the income level. This is understandable because prices of these, mostly public, services are set on the

Table 10 Cross-country Regression of the Price Level of Expenditure Items on Real GDP Level, 1999

Expenditure item	Regression estimate				Price level in Croatia (EU-15 = 100)
	Constant	Slope coefficient	Adjusted R^2	Residual for Croatia	
Food and non-alcoholic beverages	28.61	0.78	0.81	24	81
Alcoholic beverages and tobacco	(18.56)	0.88	0.58	11	61
Clothing and footwear	30.82	0.67	0.76	20	75
Housing, fuel and power	(–10.25)	1.07	0.83	4	32
Furnishings, household equipment and routine maintenance	28.40	0.70	0.86	20	74
Health care	(–10.72)	1.10	0.86	14	43
Transport	31.37	0.72	0.80	15	72
Communications	(32.32)	0.67	0.28	–4	52
Recreation and culture	15.85	0.86	0.86	26	72
Education	–20.69	1.14	0.89	18	38
Hotels and restaurants	(19.14)	0.90	0.68	10	61
Miscellaneous goods and services	(5.93)	0.90	0.87	18	56
Consumer goods	31.57	0.71	0.87	20	77
Consumer services	(–4.75)	1.04	0.86	10	42
Final household consumption expenditure	12.72	0.88	0.88	15	59
Actual collective consumption	–12.68	1.06	0.92	17	42
Machinery and equipment	65.43	0.36	0.70	1	79

Note: Estimates of the constant and slope coefficient are significant at the level of 1%, except those given in brackets.
Source: Author's estimates.

basis of costs, in which wages play a considerable role. In estimating future price developments in these activities, a major role will be played by wage developments. Relatively high wage growth will be speedily transferred to higher prices. The same argument could be repeated for most services, whose prices in Croatia have a certain potential for further rise. Their initial level is relatively low, below 50% of the EU price level of these consumer services. Moreover, as these prices are relatively strongly correlated with income, any income growth could be reflected on the increase in prices.

8 Concluding Remarks

International comparisons show that the national price level in Croatia is somewhat higher than in other transition countries (apart from Slovenia), although it is still markedly below the EU average. This relatively high price level could in a way be an advantage in the EU integration process due to lower pressures for corrections of both the exchange rate and inflation. Therefore, the effect of convergence to the EU on the aggregate price level could be relatively small in case of Croatia. Since the structure of Croatian prices is relatively similar to that of the EU, structural shocks regarding prices should be of limited scope. Hence, convergence of price levels and inflation rates could be relatively painless in Croatia. This puts monetary policy in a relatively favourable position due to moderate pressures on aggregate price growth.

However, an increase in prices that might stem from the EU integration process is not evenly divided by product groups. Pressure mechanisms with regard to products whose price growth is expected to be the strongest are mostly beyond the control of the monetary authorities. For example, growth in prices of services, i.e. nontradables, could be the outcome of the Balassa-Samuelson effect, which is basically a real and not a monetary phenomenon. Considerable price growth of these products can be the result of excessive wage growth, which stresses the role that wage policy would have in a possible need to ease inflationary pressures. Possible growth of administrative prices is also beyond the control of the monetary authorities.

The current position of the monetary authorities in Croatia is relatively favourable because there is no publicly declared commitment with respect to the inflation rate, exchange rate or some other parameter of monetary policy. Even in case of relatively strong appreciation of the real exchange rate, of some 2-3% a year, which should be the upper limit for Croatia in the next years according to our estimates, these pressures could be absorbed by moderate changes in the nominal exchange rate and/or inflation differential relative to EU inflation without losing credibility. Since the Maastricht criteria are not relevant for Croatia in these years, possibly higher inflation rates than these criteria allow (inflation higher by 1.5% than inflation in the three EU countries with the lowest inflation rate) will have no consequences. By the time Croatia joins the EU, price convergence will probably be so far along that appreciation pressures on the exchange rate will be considerably lower. With attained credibility of monetary policy, the lack of an explicit obligation concerning target values of the exchange or inflation rates seems to be an advantage. If target values are to be set, especially if the inflation target is defined in broader terms, i.e. in terms of consumer prices instead of core inflation, factors of price convergence presented in this paper should be taken into account. This especially refers to prices of certain groups of goods and services that may be exposed to stronger upward pressures and that are outside the control of monetary policy.

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Appendix I

Data Description

Price Level and Real GDP per Capita

Data on the comparable price level and real income, both at the aggregate level and at the level of individual groups of products, are derived from the ICP and statistical processing of these data by international organisations. The 2000 data (section 3) were collected from Eurostat (2002) and UNECE (2003) and the 2001 data (section 4) were derived from World Bank (2003). The detailed data for 1999 were used in the major part of the paper (sections 4-7), whose sources are OECD (2002) and UNECE (2001). Data for benchmark years 1993 and 1996 were collected and combined from several sources, among which are UN (1997), OECD (1999) and CBS (1999).

Government Expenditure

A variable of government expenditure (section 4) refers to the GDP share of general government consumption expenditure in 1999, and the data sources are OECD (2002a) for OECD countries, EBRD (2003) for the transition countries and national statistics.

Tax Burden

A variable of the tax burden (section 4) refers to the GDP share of general government tax revenues in 1999, and the data sources are OECD (2002a) for OECD countries and Mitra and Stern (2003) for the transition countries.

Real GDP per Employee (Labour Productivity)

Real GDP per employee (labour productivity) refers to GDP per employee in PPP terms, expressed relative to the EU-15 (EU-15 = 100). These data are used in section 4 and are collected from the Eurostat database available at http://europa/eu/int/comm/eurostat/public/datashop.

Relative Productivity

Data on relative productivity for each country (section 4) are calculated as $[(A_T / A_{NT})^{1-\alpha} / (A^*_T / A^*_{NT})^{1-\alpha^*}]$, where A_T is labour productivity in the tradable sector, A_{NT} is labour productivity in the nontradable sector, α is a share of tradables in consumption, whereas * denotes a foreign economy, in this case the EU-15. The classification of economic activities by tradable or non-tradable sector, explanation and description of variables are provided below.

Classification by Tradable or Non-Tradable Sector:

Tradable sector: manufacturing, including mining, quarrying, and electricity, gas and water supply (categories C to E according to the NACE, Rev. 1 and ISIC, Rev. 3).

Nontradable sector: construction, wholesale and retail trade and repair services, hotels and restaurants, transport, storage and communication, financial intermediation, real estate, renting and business activities (categories G – K).

Not classified: agriculture, hunting and forestry, and fishing (categories A – B) and services connected to public administration and defence, education, health care and other service activities (categories L – Q).

Explanation:

This classification by tradable or non-tradable sector at a rather high level of aggregation of economic activities arises from the intention to capture as many countries as possible. For example, for several OECD countries, data on gross value added and employment by activity were available only grouped into six main levels (National Accounts of OECD Countries – Main Aggregates), whereas there were no data on lower levels of aggregation (National Accounts of OECD Countries – Detailed Tables). Thus, manufacturing, which is classified in the tradable sector, within main categories includes mining and quarrying, and energy supply. However, in most countries energy supply is a nontradable good. Similarly, community, social and personal services are not classified, although they could be regarded as nontradables. However, since they are grouped together with public services, they have not been classified. We also attempted an analysis on the basis of disaggregated data (at the level of 17 categories) on a smaller sample of countries, with energy supply included in nontradables, the same as community, social and personal service activities. Final results did not considerably differ from those obtained by the described classification, but results by countries showed much larger fluctuations. Agricultural products have not been classified due to restrictions and a strong administrative impact on their international trade. Public administration, defence and health care have not been classified due to considerable problems in the calculation of productivity and international differences in the coverage of public sector employment.

Description of Variables:

Gross value added by activity is expressed in current basic prices, according to the data from the production side of GDP.

Employment by activity was, whenever possible, taken from national accounts statistics. If it was not possible, as in most transition countries outside the OECD, data were taken from the Labour Force Survey or other sources considered reliable. Employment figures for Croatia were taken from administrative sources, as the sum of persons employed in legal entities, crafts and trades and free-lances. Possible underestimate of employment in agriculture, which is the result of using administrative sources, will have no effect in this case since agriculture as an activity has not been classified.

GDP Share of tradables (α) is a share of gross value added of the tradable sector in total gross value added of an economy less gross value added of not classified activities.

Data Sources:

Data on gross value added, employment and the structure of an economy by sector refer to 1999 and were collected from OECD (2003), WIIW (2003) and national statistical offices.

Inflation, Exchange Rate, Economic Growth

Data on annual rates of CPI inflation, changes in exchange rates and economic growth rates by countries (section 6) were taken from EBRD (2003) and web pages of the European Central Bank, Eurostat and national statistics. A variable of changes in the real exchange rate of the domestic currency refers to the annual average of changes in the real exchange rate of that currency against the euro in the 2000-2002 period. It is calculated as the difference between domestic inflation measured by the annual growth rate of consumer prices and inflation measured by the annual growth rate of the HICP in the euro area adjusted for exchange rate changes. Positive values of exchange rate changes denote real appreciation, and negative values denote depreciation. Economic growth is the average annual GDP growth rate in the 2000-2002 period.

Appendix II

A Simple Formal Illustration of the Balassa-Samuelson Effect

In explaining international differences in price levels and identifying the reasons for a persistent deviation from the law of one price, Balassa (1964) and Samuelson (1964) pointed to the importance of differences in labour productivity between sectors that produce internationally tradable goods (tradables) and sectors that produce non-tradable goods (nontradables). Labour productivity usually grows faster in the tradable sector. In conditions of free trade, and according to the law of one price, prices of tradables become equal in all countries. This mechanism does not work for prices of nontradables. In the beginning, the consequence of faster productivity growth in the tradable sector is relatively faster wage growth in that sector. As it is assumed that labour is perfectly mobile within a national economy, this creates the pressure to equalise wages in both sectors. Finally, wage growth also occurs in the nontradable sector, which can be supported only by an increase in prices of nontradables. In case there are two economies, in an economy with higher productivity in the tradable sector than in the nontradable sector, the price level in the nontradable sector will grow (prices in the tradable sector are equal in both economies), which will result in a higher general price level if a share of the nontradable sector is approximately equal in both economies. More developed economies have usually exhibited their superior productivity in the tradable sector. The difference in productivity between developed and less-developed countries has been much smaller with regard to nontradables. The price level of nontradables has been higher in more advanced countries so that their aggregate price level has also been higher.

For a formal illustration of the described characteristics of the Balassa-Samuelson effect one may consider a simplified model of a small open economy with two sectors that characterise production functions with one factor – labour. In that case, production functions for the tradable sector (denoted by index T) and the nontradable sector (denoted by index NT) are:[22]

$$Y_T = A_T L_T \qquad \text{(A 1)}$$

$$Y_{NT} = A_{NT} L_{NT} \qquad \text{(A 1a)}$$

where Y is production, A denotes technology, i.e. labour productivity, whereas L denotes labour. The following profit functions hold for both sectors:

$$G_T = P_T Y_T - W L_T \qquad \text{(A 2)}$$

$$G_{NT} = P_{NT} Y_{NT} - W L_{NT} \qquad \text{(A 2a)}$$

22 A presentation in the same spirit can be found in Čihak and Holub (2001).

where G is profit, W is a wage, and P is a price of a final good. Equations (A 1) and (A 1a) may be substituted into (A 2) and (A 2a), and the maximisation of profit, which implies that a marginal product of labour must be equal to the wage, provides the following expression:

$$\frac{\partial G_T}{\partial L_T} = P_T A_T = W \tag{A 3}$$

$$\frac{\partial G_{NT}}{\partial L_{NT}} = P_{NT} A_{NT} = W \tag{A 3a}$$

Assuming perfect labour mobility among sectors within an economy, it arises that wages in both sectors must be equal. Hence,

$$\frac{P_{NT}}{P_T} = \frac{A_T}{A_{NT}} \tag{A 4}$$

Thus, the ratio of prices in the nontradable and tradable sectors is completely predetermined by the production side of an economy and depends on the inverted ratio of productivity in these two sectors.

An aggregate price level (P) can be expressed in the form of a geometric average:

$$P = (P_T)^{\alpha}(P_{NT})^{1-\alpha} \tag{A 5}$$

where α is a share of tradables in total consumption. After substituting (A 4) into (A 5), an aggregate price level can be written as

$$P = P_T\left(\frac{A_T}{A_{NT}}\right)^{1-\alpha} \tag{A 6}$$

It is now possible to introduce a foreign economy whose price level, with identical assumptions, is:

$$P^* = P_T^*\left(\frac{A_T^*}{A_{NT}^*}\right)^{1-\alpha^*} \tag{A 7}$$

where the asterisk denotes a foreign economy.

In order to bring prices in different currencies to the common denominator and then compare them, domestic prices can be divided by the nominal exchange rate (E), which is expressed in units of the domestic currency per unit of the foreign currency. The comparative price level index (CPLI), i.e. the price level in the domestic economy relative to the price level in a benchmark foreign economy is:

$$CPLI = \frac{PPP}{E} = \frac{P}{E\,P^{*}} \tag{A 8}$$

where PPP, purchasing power parity is, by definition, the ratio of the price level in the national economy to the price level in a foreign economy. Equations (A 6) and (A 7) can be substituted into the expression for a relative price level, so that:

$$CPLI = \frac{P_T}{E\,P_T^{*}} \frac{\left(\frac{A_T}{A_{NT}}\right)^{1-\alpha}}{\left(\frac{A_T^{*}}{A_{NT}^{*}}\right)^{1-\alpha^{*}}} \tag{A 9}$$

Assuming that the law of one price holds, the first term of the right-hand side takes the value of 1, and the Balassa-Samuelson hypothesis in terms of levels becomes:

$$CPLI = \frac{\left(\frac{A_T}{A_{NT}}\right)^{1-\alpha}}{\left(\frac{A_T^{*}}{A_{NT}^{*}}\right)^{1-\alpha^{*}}} \tag{A 10}$$

This expression clearly connects the price level with the relative labour productivity ratio between the domestic and foreign economies. Simplification of the model is often done after additional assumptions are introduced. Thus, it is assumed that the share of nontradables in consumption (1-α) is equal in the domestic and foreign economies. Expression (A 10) can then be written as:

$$CPLI = \left(\frac{A_T}{A_T^{*}}\right)^{1-\alpha} \left(\frac{A_{NT}^{*}}{A_{NT}}\right)^{1-\alpha} \tag{A 11}$$

It is sometimes assumed that productivity in the nontradable sector is equal in the country and abroad (or it is assumed that the difference in productivity is negligibly small compared to the difference existing in the tradable sector). In that case, a relative price level is a function of the tradable sector productivity ratio:

$$CPLI = \left(\frac{A_T}{A_T^{*}}\right)^{1-\alpha} \tag{A 12}$$

Even more simplified variants of the former equation are tested in practice, like:

$$\text{CPLI} = g\left(\frac{\text{Y}/\text{L}}{\text{Y}^*/\text{L}^*}\right) = h\left(\frac{\text{Y}/\text{N}}{\text{Y}^*/\text{N}^*}\right) \qquad \text{(A 13)}$$

where it is assumed that there is a strong positive correlation among productivity in the tradable sector, total productivity in an economy (Y/L) and output per capita (Y/N). In cases when analytical exercises are carried out including total productivity, without explicitly introducing productivity in the tradable and nontradable sectors, they cannot be regarded as tests of the Balassa-Samuelson hypothesis. The positive correlation of the price level and aggregate productivity (or per capita national income) may be also derived from some other models, like the model of relative factor abundance (Bhagwati, 1984) or models that point to differences in income elasticity of consumption (Bergstrand, 1991).

The Balassa-Samuelson effect is much more often considered in terms of rates of change. In that case, the factors of changes in relative price levels or changes in the real exchange rate (appreciation or depreciation) are considered. The change in the real exchange rate in accordance with the Balassa-Samuelson hypothesis, analogous to equation (A 10), can be regarded as:

$$\Delta r = \Delta e + \Delta p^* - \Delta p = (1-\alpha^*)(\Delta a_T^* - \Delta a_{NT}^*) - (1-\alpha)(\Delta a_T - \Delta a_{NT}) \qquad \text{(A 14)}$$

where lower letters denote variables expressed as logarithms, r is the real exchange rate, and Δ is the first difference operator.[23] Assuming that the growth rate of productivity in the nontradable sector is equal in the domestic and foreign economies and assuming that the shares of tradables in the country and abroad are equal, equation (A 14) can be simplified to:

$$\Delta r = -(1-\alpha)(\Delta a_T - \Delta a_T^*) \qquad \text{(A 15)}$$

This is exactly the form of equation that has been often tested in empirical examinations. Its left-hand side denotes changes in the real effective exchange rate based on consumer prices, whereas its right-hand side, which includes differences in productivity growth in the tradable sector, has sometimes been supplemented by other factors outside the Balassa-Samuelson model.

23 For a formal derivation of the Balassa-Samuelson effect in terms of rates of change, starting from the production function with two factors, labour and capital see, for example, Mihaljek and Klau (2003).

The following Working Papers have been published :

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