THESIS ON ECONOMICS

# The PPP Deviations Between Estonia and Non-Transitional Countries

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**Declaration:**
I hereby declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology has not been submitted for any degree or examination.

Jaanus Raim


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**Dedication**

To Prof VELLO VENSEL
(1941–

2004)

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**CONTENTS**

## INTRODUCTION

The unexpected dissolution of the Soviet Union and the authorities' sudden change from a socialist to a capitalist paradigm in turn created a very interesting economic situation in the former Soviet Union (FSU) republics, among them Estonia. One of the most interesting problems facing all former Soviet Union republics was the very low price level relative to the non-transitional countries. Probably the FSU republics' price levels were also lower in comparison with the other (non-FSU) transitional countries. At this point, the author was faced with many questions: How low were the price levels? How long they persisted? What were the differences between the FSU and non-FSU transitional countries? What were the differences between the FSU republics themselves? What causes these differences? What is their importance for economic science? Answering these important questions needs the quantitative calculations based on empirical data *versus* focusing on superficial opinions or unsuitable foreign standards. This is where **the topicality and importance of this research** lies − expressing important aspects that should be considered by researchers.

The time period under study is from 1991 to 2000. This was the first transitional decade, during which the unprecedentedly fast price rise in the FSU republics, especially huge in the three Baltic republics (Estonia, Latvia and Lithuania) emerged. Previously, no such studies of a similar scope has been conducted, which makes the topicality aspect even more significant. Estonia is researched in this study as the typical example of a transitional economy among the Baltic republics; which means, that the importance of the current research is applicable not only for Estonia but also for the other Baltic republics. The need for research of the magnitude and causes of the purchasing power parity (PPP) deviations between Estonia and non-transitional economies was already underscored by Dr Urmas Sepp in his presentations and articles (Sepp & Viilmann (1995) and Sepp (1996)). The urgent need to distinguish the former Soviet republics from the other transitional countries was revealed by Ardo Hansson (Hansson (1993)), who explaines the huge differences between the FSU and non-FSU transitional countries partly by the fact that the FSU republics had to transform their economies and to build their states at the same time.

The main motivation for this study is to make advancements in economic science by examining the deviations from purchasing power parity in a small Baltic FSU republic − Estonia. The problems discussed in the thesis create a strong framework for a systematic analysis and evaluation of PPP deviations between transitional and non-transitional countries. There are two main research goals in the thesis:

**The first goal of this study** was to measure the price differences between the former Soviet Union and the remaining countries. The analysis of price differences includes the data of 15 FSU, 13 non-FSU transitional and more than 100 non-transitional countries, ranging from low to high income. The time period under study (1991-2000) is much longer than in the previous quantitative studies. The main point of this analysis is to reveal the FSU republics price levels' undervaluation both in absolute and relative (relative to their income-predicted equilibrium price levels) terms. This, in turn, enables to determine the similarities and differences between different transitional countries (FSU-Commonwealth of Independent States (CIS) republics, FSU-Baltic republics, non-FSU transitional countries) price scenarios.

**The second goal of this study** was to research the causes of the price convergence between Estonia and non-transitional countries. Estonia was selected because of its desirable features; stable nominal exchange rate, early liberalized

foreign exchange market and data availability. The time period under study is at least two years longer than in the previous quantitative studies. This time span was just long enough for revealing the traditional approaches' (both the monetary and the real approaches') inability to explain the price convergence between Estonia as a Baltic FSU republic and non-transitional countries. The main point of the analysis is to prove the existence of the purchasing power parity puzzle between Estonia and non-transitional countries.

Based on these goals, **the research problem in the context of economic science** is on the edge of boundaries of international economics' and economic systems' disciplines. We can conclude that the problem is related to both international economics' and economic systems' fields. From the international economics' aspects, the author has analysed the causes of PPP deviations (open economy macroeconomics). From the economic systems' aspects, the author has analysed the effect that the different economic systems have on price level and income-price relationships. Though, the author has not discussed the connections between the individual peculiarities of (transitional) countries' economic policies and their price levels.

## 1. STRUCTURE OF THE THESIS and MAIN RESEARCH GOALS

The structure of the thesis is as follows. The present thesis consists of six chapters and three essays. The first chapter presents the structure of the thesis and main research goals. The next chapter provides a review of PPP deviations between Estonia and non-transitional countries. Chapter three provides a review of previous literature on PPP and PPP deviations. In chapter four are presented the models and their testing methodologies. The fifth chapter presents choice, sources and calculations of data. The sixth chapter provides a review of main findings and ideas for future research. Following the six chapters of the thesis there are three essays presented on PPP deviations between transitional and non-transitional countries. The thesis concludes with an abstract in Estonian, Curriculum Vitae of the author and list of publications.

The main **motivation for this study** is advancing the economic sciences by examining the deviations from purchasing power parity in a small Baltic FSU republic − Estonia. The problems discussed in the thesis create a strong framework for a systematic analysis and evaluation of PPP deviations between transitional and non-transitional countries. The main research goals in the thesis are:

(1) To measure the price differences between the former Soviet Union and the remaining countries.

> **Hypothesis 1:** The price levels of FSU republics were remarkably lower vis-a-vis remaining countries.
>
> **Hypothesis 2:** The non-FSU transitional countries, the FSU-Baltic republics and the FSU-CIS republics have remarkably different price scenarios.

(2) To research the causes of the price convergence between Estonia and non-transitional countries.

> **Hypothesis 3:** The price convergence between Estonia and non-transitional countries was caused by their income convergence.
>
> **Hypothesis 4:** The price convergence between Estonia and non-transitional countries was caused by their productivity convergence.
>
> **Hypothesis 5:** There is the purchasing power parity puzzle between Estonia and non-transitional countries.

## 2. BACKROUND: THE PPP DEVIATIONS BETWEEN ESTONIA AND NON-TRANSITIONAL COUNTRIES

The period after 1990 was an extremely interesting era in Estonia as well as in the other FSU republics. One of the central issues facing all former Soviet Union republics was the tremendous deviation from the PPP. The huge price differences between the FSU republics and remaining world emerged at the beginning of 1990s − just after liberalization and opening of the former socialist planned economies. The price levels were very low all over the former Soviet Union (including Estonia). The purchasing power of foreign currencies was extremely high both in the FSU consumer goods and services (CPI components) and in the FSU assets, resources and materials (GDP components). Though some resources were relatively cheaper than others; for example, the prices of real estate and labour force wages, which formed less than 1% in comparison with their industrial countries' analogs. The FSU republics' price levels were also many times lower in comparison with the other (non-FSU) transitional countries. The author of the thesis has estimated the Estonian purchasing power of the Finnish wage-earners as following (see Table 1). Finland is used as the representative of industrial countries because it is the Estonian closest industrial neighbour.

Table 1
The Estonian purchasing power of the Finnish average monthly bruto salary 1991-2004)

| | 1991 | 1992 | 1993 | 1994 | 1996 | 1998 | 2000 | 2002 | 2004 |
|---|---|---|---|---|---|---|---|---|---|
| € | 1929 | 1670 | 1414 | 1552 | 1775 | 1899 | 2034 | 2212 | 2382 |
| Estonian electric energy (thousand kWh) | 1828 | 273 | 141 | 107 | 65 | 46 | 42 | 34 | 35 |
| Estonian salaries (average monthly bruto salaries) | 111 | 46 | 21 | 14 | 9,3 | 7,2 | 6,5 | 5,7 | 5,2 |
| Living spaces in Estonian capital city (m² living spaces in Tallinn's suburb) | 34 | 29 | 20 | 12 | 10 | 8,2 | 8,1 | 4,9 | 3,9 |

Note: The average monthly bruto salary of Finland 1991-2004 is expressed in euros, in the Estonian electric energy (thousand kWh), in the Estonian salaries (average monthly bruto salaries) and Estonian capital city's living spaces (m² living spaces in Tallinn's suburb[1]).
Source: Author´s calculations based on data from Eesti Energia (Estonian prices of electric energy for private consumers), Estonian Statistical Office (2005) (Estonian average monthly salaries in Estonian kroons 1992 III quarter until 2004 and roubles 1991 IV quarter until 1992 II quarter), „Äripäev" (1991) (Estonian average monthly salaries in roubles 1991 I-III quarter), Bank of Estonia quotations of foreign currencies (rouble/DEM nominal exchange rates 1991 I quarter until 1992 II quarter), newspapers

[1] The price level of Tallinn suburb living spaces refers to the price level of 2-room apartments (area ca 50m²). The yearly price levels for 1994-2004 are calculated by the author of this thesis as the arithmetic average of monthly price levels; the monthly price levels have got from the real estate pages of the Estonian business newspaper „Äripäev" (these real estate pages appear in the middle of every month already from September 1993). The yearly price level for 1993 is calculated as the arithmetic average of March 1993 (data from „Äripäev" 30.03.1993, p.15) and September 1993 (data from „Äripäev" 13.09.1993, p.15). The yearly price level for 1992 is calculated as the arithmetic average of March 1992 and July 1992 (both data from „Äripäev" 23.03.1993, p.15). The yearly price level for 1991 is calculated as the arithmetic average of the Estonian first (February 18, 1991) (data from „Äripäev" 27.02.-05.03.1991, p.16) and second (October 16, 1991) (data from „Äripäev" 30.10.-01.11.1991, p.9) living spaces' auctions. The Tallinn suburb´s price level for 1993-2004 are calculated as the arithmetic average of the price levels of Õismäe, Mustame, Lasnamäe and Kopli; the price level for 1992 is the price level of Mustamäe; and the price level for 1991 is the price level of living spaces (mostly in Lasnamäe and Mustamäe) sold at the Estonian 18.02.1991 and 16.10.1991 living spaces' auctions.

„Äripäev“ 1991-2004 (average monthly price levels of the Tallinn suburb’s living spaces), Statistical Yearbook of Finland 1999 (FIM/DEM nominal exchange rates 1991-1998), Statistical Yearbook of Finland 2001 (Finnish average monthly salaries in FIMs 1991-1998), Statistical Yearbook of Finland 2004 (Finnish average monthly salaries in euros 1999-2003) and Statistics Finland (2005b) (the rise of Finnish average monthly salary 2003/04).

Table 1 shows how high was the Finnish wage-earners’ Estonian purcasing power at the beginning of 1990s. This was especially unusual taking account the very small cultural and geographical distance between these countries (the distance between Finnish and Estonian capital citys is only 83 km).

The industrial countries wage-earners’ Estonian purchasing power has steadily fallen during the following years (1992-2004) in spite of the stability of their nominal wage levels (in euros). This means that the purchasing power of foreign currencies has fallen as well.

The huge price rise in the former Soviet republics was unprecedented (including the remaining transitional countries). Figure 1 reveals the Estonian average wage levels since the end of 1991. The Estonian wage level is expressed in Deutche Marks (DEM) because the nominal exchange rate of the Estonian domestic currency was pegged to the DEM in a currency board system starting from the 20th of June, 1992.

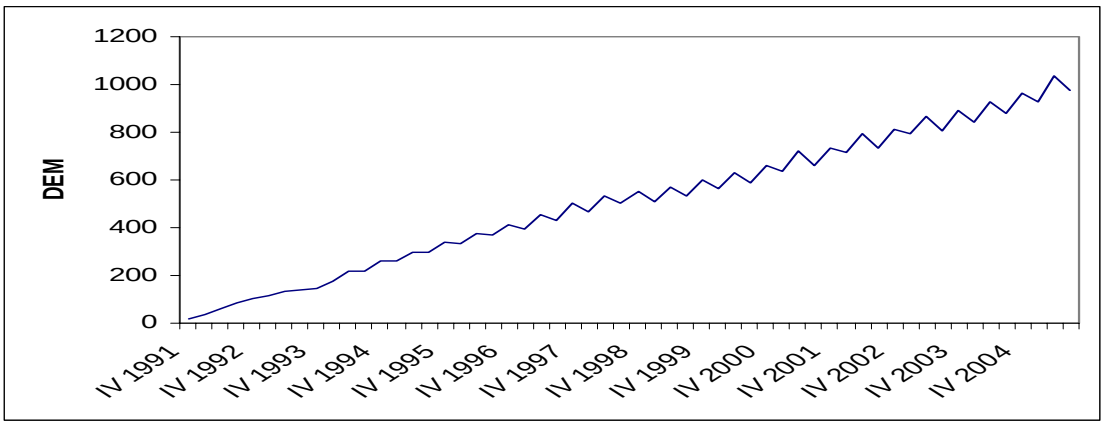


Figure 1. Estonian average monthly gross wage level in DEMs
Source: Author´s calculations based on data from Estonian Statistical Office (2005).

Besides the similarities, there were also some differences between the FSU republics. The phenomenon of hundredfold relative purchasing power of foreign currencies diminished in the Baltic republics (and especially Estonia) somewhat earlier and faster than in the other FSU republics (Commonwealth of Independent States) − probably due to the Baltic republics’ closer foreign contacts and faster liberalization. Estonian price convergence have been a remarkably irreversible process throughout the first transitional decade.

It is worth mentioning that the forces behind the price convergence between Estonia and industrial countries were so strong that the Estonian prices and wages did not relapse even during the years of the Russian economic crises and the following economic recession (1998-1999). In accordance with Tiiu Paas, Raul Eamets, Jaan Masso and Marit Rõõm (2003) the wages increased during the recession remarkably not only in the economic sectors of public administration, education, health and social servises but even in industry, financial intermediation, transport and trade.

Table 2 shows the price levels and convergence of Estonia real estate prices relative to its closest industrial neighbour − Finland.

Table 2
Estonian average real estate price levels relative to Finland[2](%)

| | 1992 | 1994 | 1996 | 1998 | 2000 | 2002 | 2004 |
|---|---|---|---|---|---|---|---|
| Tallinn relative to Helsinki | 3 | 10 | 15 | 16 | 16 | 24 | 28 |
| Estonian small towns relative to Finnish small towns | n.a. | n.a. | 9 | 8 | 8 | 11 | 20 |

Sources: Author´s calculations based on Statistics Finland (2005), Statistics Finland (2001), Statistics Finland (1998), Egert (2003), Raim & Terk (2001) and newspapers"Äripäev" 1992-2004.
n.a. − not available.

The Estonian real exchange rate appreciation has succeeded hand in hand with relative price movements. In general, the wages, real estate and services prices have increased faster than the prices of domestic tradable goods and raw materials. The prices of imported goods have increased less and some of them have even remarkably decreased. Table 3 shows some trend movements in the Estonian prices of energy, living spaces and cars relative to the Estonian average monthly wage. Its numbers reveal the Estonian wages' purchasing power in foreign currencies, electric energy, living spaces and cars during the period 1991-2001.

Table 3
The equivalents of one Estonian average monthly wage (in DEMs, living spaces, energy and cars)

| | 1991 | 1993 | 1995 | 1997 | 1999 | 2001 |
|---|---|---|---|---|---|---|
| DEM | 17 | 150 | 330 | 480 | 620 | 720 |
| Electric energy (thousand kWh) | 29 | 6,3 | 6,8 | 6,4 | 6,6 | 6,4 |
| Living space in Mustamäe (m²) | 0,57 | 0,86 | 1,1 | 1,1 | 1,0 | 0,77 |
| BMW 525 I -90 | 0,0005 | 0,0080 | 0,022 | 0,038 | 0,071 | 0,12 |

Source: Loogma, Terk, Raim & Sirel (2003).

The overwhelming majority of price movements show the gradual diminishing of PPP deviations between Estonia and non-transitional countries, and the Estonian convergence to the industrial countries' price levels and structure. The most significant exception to this rule is the Estonian wage level relative to Estonian real estate price level − which has fallen remarkably after 2000 and is much lower than in the industrial countries. The Estonian real estate prices have converged much closer to their industrial countries' analogues than the Estonian wages.

[2] Tallinn relative price of real estate refers to living spaces (apartments) in Tallinn (the capital city of Estonia) suburb relative to Helsinki (the capital city of Finland) suburb; in satisfactory condition: inhabitable, partly in disrepair, no changes to the subdivision, no improvements to the building made, area ca 50m².
Estonian small towns relative price of real estate refers to living spaces (apartments) in the Estonian towns´ Kuressaare, Rakvere, Paide, Türi, Haapsalu, Viljandi, Kohtla-Järve and Narva arithmetic average price level relative to Finnish towns´(below 50000 inhabitants) Porvoo, Rauma, Kouvola, Hämeenlinna, Seinäjoki, Kokkola, Mikkeli, Kajaani ja Rovaniemi arithmetic average price level.

## 3. LITERATURE: A REVIEW OF THE LITERATURE ON PPP AND PPP DEVIATIONS

The aim of this chapter is to summarize the studies of the PPP and its deviations between countries. There is a vast amount of literature on this topic. The limitation on the presented literature is made by reasons for the need to provide a review of the studies that are related to the present thesis.

The first person who articulated PPP as a practical empirical theory was the Swedish economist Gustav Cassel (1921, 1922). Since then, empirical researches have confirmed that though there are relationships between prices and nominal exchange rates in a very long run, the prices of most goods are not equal in different countries. Therefore, there is a need to explain the causes of PPP deviations. There are two basic approaches to the explanation of PPP deviations: the monetary (or the-sticky-price) approach and the real (or equilibrium) approach.

The monetary approach is developed in Rudiger Dornbush's (1976) overshooting model of nominal and real exchange rate volatility. The essence of Dornbush's model is that the failure of PPP can be attributed to stickiness in nominal prices: as monetary shocks buffet the nominal exchange rate, the real exchange rate also changes in the short run. After Dornbush, there have been many influential researches explaining real exchange rates by monetary (nominal) shocks: Alan C. Stockman (1983), Michael Mussa (1986), William D. Lastrapes (1992), John A. Rogers (1995), Richard Clarida & Jordi Gali (1995), John A. Rogers & Michael A. Jenkins (1995), David H. Papell (1998), and Kenneth Rogoff, Kenneth A. Froot & Michael Kim (2001). The most influential of them have been the seminal article of Clarida & Gali (1995) which identifies all three types of shocks (monetary, supply and demand) simultaneously. The greatest shortcoming of the monetary approach is that it predicts substantial convergence to PPP over one to two years, as nominal prices adjust to a shock.

The real approach stresses the importance of real economical (supply or demand side) shocks. The first and most influential real (supply-side) model of PPP deviations was advanced by Bela Balassa (1964) and Paul A. Samuelson (1964). The essence of Balassa-Samuelson model is that the failure of PPP is caused by the fact that rich countries are relatively more productive in the traded goods sector; nontraded goods tend to be more service intensive and there is thus less room for establishing technological superiority. This higher productivity will have an effect on wages both in the traded goods and nontraded goods sectors (due to intra-country wage equalization), which in turn forces nontraded goods producers to ask higher prices for their products. After Balassa and Samuelson, thousands of researches have explained real exchange rates by relative productivity differentials; the most influential researches of this literature stream are David A. Hsieh (1982), Alan C. Stockman (1987, 1988), Richard C. Marston (1987, 1990), Kenneth Rogoff (1992), Maurice Obstfeld (1993), Jose De Gregorio, Alberto Giovannini & Holger C. Wolf (1994), Menzie Chinn (1997a, 1997b), Jahanara Begum (2000), and Ronald MacDonald & Luca Ricci (2001).

A related supply-side theory that also predicts that rich countries will have higher price levels than poor countries is due to Irving B. Kravis & Robert Lipsey (1983) and Jagdish Bhagwati (1984). This theory is based on the assumption that capital-labour ratios are higher in rich countries because of imperfect capital and labour mobility. With a higher capital-labour ratio, rich countries will have higher

wage rates, forcing nontraded goods producers to ask higher prices (nontradables are labour intensive).

From the demand-side, Jeffrey H. Bergstrand (1991) has demonstrated per capita GDP as a determinant of real exchange rate. According to his model, higher per capita GDP increases nontradables' demand which in turn increases nontradables' price levels, assuming a non-zero slope of the nontradables' supply curve. Furthermore, Bergstrand' s model predicts that per capita GDP determines not only absolute but also relative level of nontradables' demand: an increase in income will result in an increase in the consumption share of nontradables. Before Bergstrand, Irving B. Kravis, Alan Heston & Robert Summers (1983) found the relationship between income and nontradables' price, but they associated income growth solely with supply rather than demand factors. However, De Gregorio, Giovannini & Wolf (1994) regressions confirmed an effect of income growth on nontradables' price even after controlling for productivity differentials, justifying its interpretation as an indicator of demand. The most significant shortcoming of a real approach is that real shocks to productivities, incomes and preferences cannot possibly be volatile enough to explain the immense short-term volatility of real exchange rates.

The shortcomings of both monetary and real approaches have brought about the purchasing power parity puzzle researched deeply in Kenneth Rogoff' s (1996) seminal article on how to reconcile the enormous short-term volatility of real exchange rates with the extremely slow rate at which shocks appear to damp out? Rogoff is left with a conclusion that international goods' markets are still quite segmented. In the follow-up article Maurice Obstfeld & Kenneth Rogoff (2000) have shown that the purchasing power parity puzzle can be substantially resolved if one incorporates cost of trading goods into canonical models of PPP deviations. Trade costs include not only tariffs and transport costs, but also other informal arbitrage barriers related to informational issues like differences in language, legal systems and currencies. Therefore, Obstfeld and Rogoff brought the arbitrage barriers into the system of the causes of PPP deviations as a new different class of shocks. If arbitrage barriers keep the share of traded goods relatively small, then the exchange rate will play a relatively small role in the economy. Correspondingly, very large exchange-rate movements may be required before there is a significant effect on the trade and economy.

Kenneth Rogoff (2001) contended that trade costs also limit capital-market interactions. It is obvious that the causation is also vice versa: international barriers to capital disturb goods' arbitrage (a powerful example is the prohibition of rubles import to the Soviet Union in the early 1990s).

During recent years, economists have shown special interest on the causes of PPP deviations between transitional and non-transitional countries. The canonical models, developed on the basis of non-transitional countries' experiences, are also repeatedly tested in the transitional countries.

There is a growing literature analyzing a cross-country relationship between income and price levels in the transitional countries relative to non-transitional countries. Table 4 presented some empirical studies concerning the FSU republics.

Table 4
The previous studies about the cross-country relationship between income and price levels in the FSU republics vis-a-vis non-transitional economies

| No | Author(s) | Regression sample | The relationship between income levels (x) and price levels (y) | Results about FSU (FSU republics´ actual price levels are lower/higher vis-à-vis their income-predicted price levels) | Results about non-FSU trans. countries (non-FSU trans. countries´ actual price levels are lower/ higher vis-à-vis their income-predicted price levels) |
|---|---|---|---|---|---|
| 1 | **Richards and Tersman (1996)** | 1990 data from 73 countries, that participated in an International Comparison Program (ICP) benchmark study (from all the world) | y = 1,2x + 21,7 (dummy variable for Europe: 12,1; dummy variable for USA: -43,0); $R^2$ = 0,88; USA=100; price level indicator is GDP price level | the actual price levels of the investigated FSU republics (Est, Lva, Ltu) were remarkably *lower* vis-à-vis their income-predicted price levels in 1992-1994 | – |
| 2 | **Coorey, Mecagni and Offerdal (1998)** | from **Richards and Tersman (1996)** | from **Richards and Tersman (1996)**; Austria=100; price level indicator is consumer price level | Est, Rus and Mda lower in 1993 | Cze and Pol lower in 1993 |
| 3 | **Sepp (1996)** | 1993 data from 24 industrial countries | ln y = 0,59ln x + 1,86; $R^2$ = 0,64; EU=100; price level indicator is GDP price level | Est lower in 1993 | – |
| 4a | **Randveer (2000)** | 1996 data from 52 countries (18 European market economies, 10 European non-FSU transitional countries, 15 FSU republics, Japan, Turkey, Mongolia, Israel, New Zealand, Australia, Mexico, USA, Canada) | ln y = 0,69ln x + 1,27; $R^2$ = 0,83; Austria=100; price level indicator is GDP price level | Est lower in 1993, Est equal in 1996, Est higher in 1999 | – |
| 4b | **Randveer (2000)** | 1996 data from 31 countries, which GDP per capita PPP-adjusted was below 70% Austrian level (3 European market economies, 10 European non-FSU transitional countries, 15 FSU republics, Turkey, Mongolia, Mexico) | ln y = 0,53ln x + 1,71; $R^2$ = 0,59; Austria=100; price level indicator is GDP price level | Est lower in 1993, Est equal in 1996, Est higher in 1999 | – |
| 5a | **Cihak and Holub (2001)** | 1999 data from 22 countries (16 European market economies; Czech Republic; Hungary; Poland; Slovak Republic (1996); Slovenia (1996); Russia (1996)) | y = 1,00x - 0,04; $R^2$ = 0,91; Germany=1; price level indicator is consumer price level | Rus higher in 1996 | Svk, Svn lower in 1996; Cze and Hun lower in 1999; Pol higher in 1999 |
| 5b | **Cihak and Holub (2001)** | 1996 data from 33 countries (16 European market economies, 10 European non-FSU transitional countries, 6 European FSU republics (Est, Lva, Ltu, Rus, Blr, Mda)) | y = 0,88x + 0,04; $R^2$ = 0,91; Germany=1; price level indicator is consumer price level | Est, Lva, Ltu, Rus and Mda equal in 1996; Blr lower in 1996 | Cze, Rom, Svk, Bgr, Hun and Svn lower in 1996; Pol and Alb equal in 1996; Hrv and Mkd higher in 1996 |
| 5c | **Cihak and Holub (2001)** | 1998 data from 106 countries (83 market economies, 11 non-FSU transitional countries, 12 FSU republics (Tjk, Kgz, Kaz, Ukr, Geo, Mda, Aze, Arm, Rus, Ltu, Lva, Est)) from all the world | y = 0,99x – 35,68; $R^2$ = 0,70; USA=100; price level indicator is consumer price level | Tjk, Kgz, Kaz, Ukr, Geo, Mda, Aze, Arm, Rus, Ltu, Lva and Est lower in 1998 | Rom, Vnm, Cze, Svk, Hun, Alb, Mng, Svn and Pol lower in 1998; Hrv and Mkd higher in 1998 |
| 6 | **De Broeck and Slok (2001)** | 1999 data from 149 countries (from all the world, no FSU or non-FSU transitional countries) | The relationship between income levels difference from USA income level (dx) and price levels difference from USA price level (dy): log dy = log 0,41dx – 1,86; $R^2$ = 0,63; USA=100; price level indicator is GDP price level | Rus, Est, Ltu, Ukr, Blr, Lva, Kaz, Tkm, Geo, Kgz, Arm, Uzb, Aze, Mda and Tjk lower in 1993.<br>Rus, Est, Ltu, Ukr, Blr, Kaz, Tkm, Geo, Kgz, Arm, Aze, Mda and Tjk lower in 1999; Uzb and Lva equal in 1999. | Rom, Mng, Cze, Alb, Bgr, Svk, Mkd, Hun, Pol and Svn lower in 1993; Hrv higher in 1993.<br>Rom, Svk, Bgr, Cze, Mng, Hun, Mkd and Pol lower in 1999; Svn, Alb and Hrv higher in 1999. |

The most influential research in this field is Mark De Broeck & Torsten Slok (2001), according to which the price levels of FSU republics were undervalued vis-a-vis the non-transitional economies with similar per capita GDP levels throughout the 1990s. The other researches confirmed the FSU republics' undervaluation at the beginning of 1990s. Altough, their findings are contradictory in regards to the second half of the 1990s. Martin Cihak & Tomas Holub (2001, study 5c) found that the FSU republics' price levels were undervalued at the end of the 1990s, but some studies found that the FSU republics were not undervalued any more, and Martti Randveer (2000) and Cihak & Holub (2001, study 5a) reported even slight overvaluation at the end of the 1990s.

There is also an extensive amount of literature that analyzes the Balassa-Samuelson effect between the transitional and non-transitional countries during the 1990s. Though, their results are somewhat contradictory about the Baltic States. Mark De Broeck & Torsten Slok (2001) and Philipp C. Rother (2000) reported no clear evidence of a Balassa-Samuelson effect in Estonia during the 1990s, while Hans W. Sinn & Michael Reutter (2001) and Egert Balazs, Imed Drine, Kirsten Lommatzsch & Christophe Rault (2003) argued that there were a significant contribution of the Balassa-Samuelson effect to inflation differential against Germany during the second half of 1990s. Generally the Balassa-Samuelson effect on the inflation is found to be the stronger, the later is the estimated period. The investigated period (the middle 1990s or the end of the 1990s) matters much more than the choice of the research method or sector classification.

In addition to the canonical models, developed on the basis of non-transitional countries' experiences, some PPP deviations' mechanisms specific to the transitional countries have worked out to explain their undervaluation. Basil Zavoico (1995) argues that the convergence of certain capital-intensive service prices can take place gradually, because the capital stock necessary for providing these services is inherited from the pre-transitional era and is large relative to the PPP-adjusted per capita income of transitional countries. As incomes rise and the capital stock that can be supported by these incomes also rises, the prices of these services would be raised, at first to cover the maintenance costs and then to cover capital costs until they reach a level at which new investment can take place.

Sharmini Coorey, Mauro Mecagni & Erik Offerdal (1996) showed that the nominal exchange rate of transitional countries' currencies can be affected by temporary distortions in asset markets. According to Michael Bruno (1993), with negative real interest rates on bank deposits and no other liquid inflation hedges, foreign exchange can become the most important form of liquid wealth holding and can drive the exchange rate far from its PPP level. According to Laszlo Halpern & Charles Wyplosz (1996) these distortions in asset markets will occur if the long-repressed pent-up demand for foreign assets faces a negligible supply or if the freeing of prices in the presence of a monetary overhang creates the flight from domestic currency. Coorey, Mecagni & Offerdal (1996) also proposed that transitional countries' undervaluation arises when the nominal exchange rate of new currencies (for example the Estonian kroon) is initially set at excessively low levels to minimize risks to competitiveness or international reserves.

Last but not least, according to Jaanus Raim (1999, 2001), there was a systematic mismatch between capital and information owners in the FSU republics. Due to the long-term isolation of these republics, the potential foreign investors lacked information about FSU products, prices, trade conditions and risks − and domestic entrepreneurs lacked capital. As a result, there was little demand for

production factors in the FSU republics in spite of their vary low prices. This situation was even amplified by the George A. Akerlof´s (1970) problem of asymmetrical information: it was extremely hard for local entrepreneurs to sell their business information package to the potential foreign investors, because this information was so multidimensional and complex, that the potential investors were not convinced in its quality without the real experience in local business.

As we can see, the preceding models addressed to the problem of transitional countries' real exchange rate undervaluation are directly connected with the same class of shocks − arbitrage barriers − that was suggested by the results of Obstfeld & Rogoff (2000) for resolving the purchasing power parity puzzle.

## 4. MODELS and METHODOLOGIES

### 4.1. The modifications of the Halpern-Wyplosz transitional countries' stylized fact

The measurement of transitional countries' real exchange rates undervaluation is a disputable issue. There are two major problems in determining the amount of undervaluation. First, the measuring of transitional countries' price levels relative to non-transitional countries (Urmas Sepp (1996)). This was especially difficult during the first years of transition, when there were no international comparisons of aggregate price levels. Though, the infrequency of the International Comparison Program[3] (ICP) data gathering (need for extrapolation) and possible quality differences between the compared goods generate continuously significant ambiguity.

Second, the measuring of transitional countries' equilibrium price levels (Laszlo Halpern & Charles Wyplosz (1996)): the benchmarks for estimating the actual price levels´ undervaluation. In general, the country's price level is at its equilibrium level when its economy is simultaneously in internal (output, inflation, employment) and external (current and capital account) equilibrium. In practice the country's income level (GDP per capita PPP-adjusted) is often used as the only determinant of a country's equilibrium price level: a reasonable simplification is made by employing the income-predicted price level as a proxie for the equilibrium price level. Of course, these calculations became possible only after obtaining internationally comparable data on transitional countries' price and income levels.

When the Hungarian scientists Laszlo Halpern and Charles Wyplosz (1996) developed their general stylized fact about transitional countries' actual and equilibrium price levels (Figure 2) the available quantitative data on the transitional countries' price levels was limited to only a few. The Halpern-Wyplosz stylized fact states that: a) there is initially a sizable undervaluation in transitional countries; b) the initial undervaluation is gradually corrected; c) the equilibrium price level itself increases.

[3] The International Comparison Program is a global statistical program that produces internationally comparable price levels, expenditure values, and Purchasing Power Parity estimates.

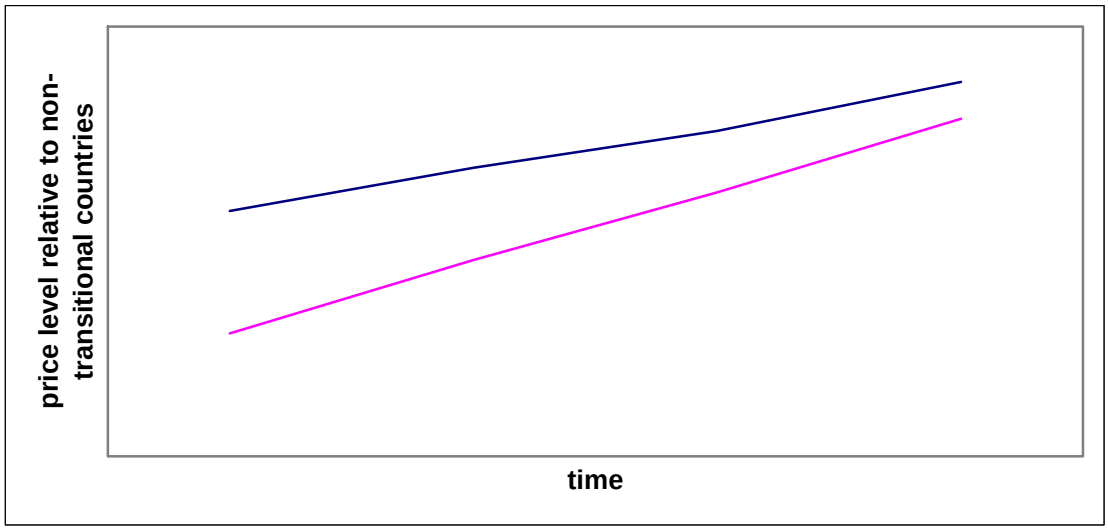


Figure 2. The Halpern-Wyplosz stylized fact about the levels and dynamics of equilibrium price levels and actual price levels in transitional countries
(the upper line denotes equilibrium price level and the lower line denotes actual price level, both in comparison with the non-transitional countries´ average price level)
Source: Halpern & Wyplosz (1996).

A decade later, we are able to estimate the empirical validity of the Halpern –Wyplosz stylized fact in the light of more recent data. The first statement of the stylized fact (the presence of initial undervaluation) is generally valid to all transitional countries, but there are huge differences in the size of undervaluation between the FSU and non-FSU transitional countries. The FSU republics' price levels were ca 10 times more undervalued than the non-FSU transitional countries' price levels.

The second statement of the Halpern-Wyplosz stylized fact (the initial undervaluation is corrected) is generally valid only in the long run − over the entire decade (1991-2000). The price convergence was a gradual and continuous process only in the FSU-Baltics and the non-FSU transitional countries: the FSU-CIS republics' price convergence was partly reversed during the second half of 1990s. There were also huge differences in the magnitude of price convergence: the non-FSU transitional countries' price developments were negligible compared to the FSU republics' price developments. The third statement of the stylized fact (the equilibrium price level increases) is not generally valid. It is valid only in the non-FSU transitional countries in the long run. The FSU-CIS republics' equilibrium price levels have remarkably fallen over the first transitional decade, and the FSU-Baltic republics' equilibrium price levels were at the end of the 1990s almost the same as they were at the beginning of the 1990s (slight decrease until 1996, slight increase after 1996).

Therefore, the data from the first transitional decade revealed the very important differences between transitional countries themselves. The three different modifications of the Halpern-Wyplosz transitional countries' stylized fact emerged: a)the non-FSU transitional countries' model; b)the FSU-CIS republics' model; and c)the FSU-Baltic republics' model. These models about the levels and dynamics of income-predicted price levels and actual price levels in non-FSU transitional countries, FSU-CIS republics and FSU-Baltics are based on the author's calculations using the Penn World Table (2002) data and presented as following (see Figures 3, 4 and 5).

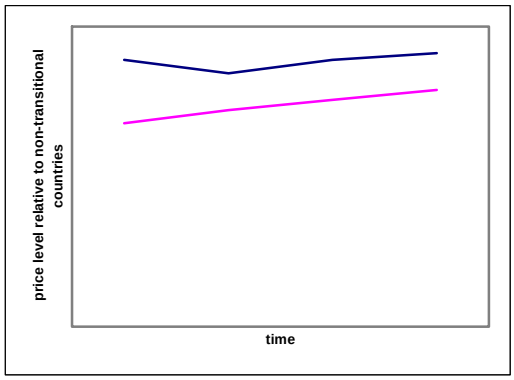


Figure 3. The model about the levels and dynamics of income-predicted price levels and actual price levels in non-FSU transitional countries
(the upper line denotes income-predicted price level and the lower line denotes actual price level, both in comparison with the non-transitional countries´ average price level)
Source: Author´s calculations.

The non-FSU transitional countries are characterized by much higher actual and relative (actual relative to equilibrium) price levels at the beginning of the 1990s, and the following modest and continuous price rise during the rest of the 1990s.

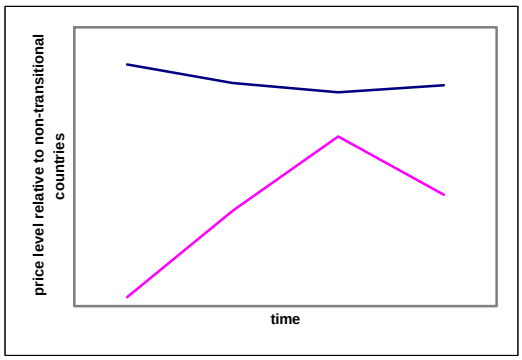


Figure 4. The model about the levels and dynamics of income-predicted price levels and actual price levels in FSU-CIS republics
(the upper line denotes income-predicted price level and the lower line denotes actual price level, both in comparison with the non-transitional countries´ average price level)
Source: Author´s calculations.

The FSU republics that belong to the CIS are characterized by much lower actual and relative price levels in comparison with the non-FSU transitional countries at the beginning of the 1990s, and followed by a very fast but not continuous price rise.

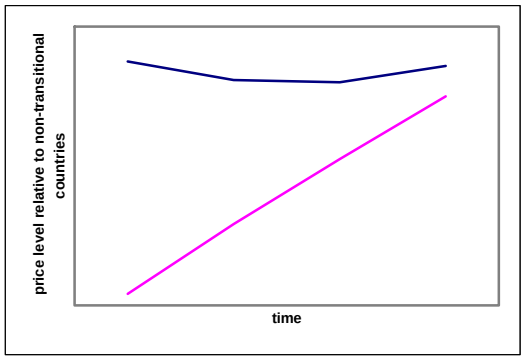


Figure 5. The model about the levels and dynamics of income-predicted price levels and actual price levels in FSU-Baltic republics
(the upper line denotes income-predicted price level and the lower line denotes actual price level, both in comparison with the non-transitional countries´ average price level)
Source: Author´s calculations.

The FSU-Baltic republics are characterized by the much lower actual and relative price levels in comparison with the non-FSU transitional countries at the beginning of the 1990s, and followed by a sharp and continuous price rise.

Therefore, the Baltic republics are similar to the rest of the FSU republics with the very low price levels at the beginning of the 1990s and the rapid development of the following price rise. At the same time, the Baltic republics are similar to the non-FSU transitional countries with the high price levels at the end of the 1990s and the irreversible nature of the price rise.

### 4.2. The methodology behind the modifications of the Halpern-Wyplosz transitional countries' stylized fact

The basic methodological idea behind the modifications of the Halpern-Wyplosz transitional countries' stylized fact is a cross-country analysis of the relationship between income and price levels. The aim of this analysis (in the first essay) is to determine the countries' income-predicted price levels as the proxies of their equilibrium price levels and to compare these income-predicted price levels with the actual price levels. This methodology was developed by Irving B. Kravis, Alan Heston & Robert Summers (1982) and Irving B. Kravis (1986).

A cross-country analysis of the relationship between income and price levels used in this study has already been employed in many previous studies on transitional countries' price levels (for example Cihak & Holub (2001) and De Broeck & Slok (2001)).

The first step of this analysis is the choice of estimated time points, sample countries and estimated countries. Unlike the previous studies, the author of this study estimates many (five) time points from the different stages of transition: this enables a clearer picture of the first transitional decade. All countries whose data were available in the Penn World Table are chosen to the sample; only the estimated (transitional) countries are excluded similar to De Broeck & Slok (2001). The estimated countries are all 15 FSU and 13 non-FSU transitional countries. Unlike the previous studies, this study treats the FSU republics as a group and compares it with other country-groups (non-transitional countries, non-FSU transitional countries). The FSU republics themselves are divided into two sub-groups: the FSU-Baltic republics and the FSU-CIS republics.

The second step is the comparison of the countries' actual price levels. All countries are arranged into the world-wide cheapness ranking in accordance with their actual price levels. Next, the price levels of country-groups are calculated and presented both as average price levels and as population-weighted average price levels. The average price levels of the country-groups are calculated as a simple arithmetic mean; the population-weighted average price levels of the country-groups are calculated as a weighted arithmetic mean.

The third step is the detection of the income-predicted price levels. For that, the cross-country regression analysis between income levels and price levels is carried out using the ordinary least square method. Unlike the previous studies, the author of this study excluded the countries with GDP per capita PPP-adjusted below 8-10% relative to the USA from the regression sample, because there was no clear relationship between income and price levels in the poorest countries. The regression equations for a sample of non-transitional countries show, that in the cross-country comparison a very strong positive relationship exists between income and price levels. Using these equations with the relationship between income and price levels in the non-transitional countries, the author of this study calculated the income-predicted price levels for all (both transitional and non-transitional) countries. For these countries, whose income levels were below 8% relative to USA, the income-predicted price levels are calculated just as if their income levels were equal to 8% relative to the USA − because analysis revealed no further decreases of price levels when income levels fell below 8-10% relative to the USA.

The fourth step is the comparison of the countries' relative (actual relative to income-predicted) price levels. All countries are arranged into the world-wide cheapness ranking in accordance with their relative price levels. Next, the income levels of country-groups are calculated and presented both as average income levels and as population-weighted average income levels. The average income levels of the country-groups are calculated as a simple arithmetic mean. The population-weighted average income levels of the country-groups are calculated as a weighted arithmetic mean. Next, using the equations of the relationship between income and price levels in non-transitional countries, the author of this study calculated the income-predicted price levels for all country-groups (FSU republics as a group, non-FSU transitional countries as a group) and country-subgroups (FSU-CIS republics as a group, FSU-Baltic republics as a group). The income-predicted price levels and the relative price levels of these groups are calculated both based on average price and income levels and also based on population-weighted average price and income levels. Lastly, the relative price levels of all country-groups (FSU republics, non-FSU transitional countries) and country-subgroups (FSU-CIS republics, FSU-Baltic republics) are presented.

Therefore, there are three methodological differences in this study in comparison with the previous studies analyzing a cross-country relationship between income and price levels in the transitional countries relative to non-transitional countries: a) multiple points from the different stages of transition are estimated in order to provide a wider picture of the FSU and non-FSU transitional countries' price developments throughout the first transitional decade; b) the countries with GDP per capita PPP-adjusted below 8-10% relative to USA are excluded from the regression sample to improve the explanatory power and residual distributions of the models; c) the non-FSU transitional countries, the FSU-CIS republics and the FSU-Baltic republics are also estimated as groups to reveal the important differences and similarities between the different transitional countries.

### 4.3. The purchasing power parity puzzle and the products' immobility view on price differences

There have traditionally been two complementary approaches to the explanation of PPP deviations: the monetary approach and the real approach. The products' immobility (the presence of arbitrage barriers) as a possible cause of PPP deviations was first articulated by the godfather of purchasing power parity Gustav Cassel (1921), but has since then been repelled from the canonical models of PPP deviations. Though, in spite of hundreds of researches the system of these two approaches has not been able to reconcile the extremely high short-term volatility of real exchange rates with the very slow rate at which PPP deviations die out − the purchasing power parity puzzle. Because this phenomenon was not interpretable in the traditional framework − with monetary and real (demand and supply) shocks − Maurice Obstfeld & Kenneth Rogoff (2000) incorporated cost of trading goods into the system of the causes of PPP deviations as a new different class of shocks, and showed that the purchasing power parity puzzle can be substantially resolved by this class of shocks.

Obstfeld and Rogoff showed that if arbitrage barriers keep the share of traded goods relatively small, then the exchange rate will play a relatively small role in the economy. Correspondingly, very large exchange-rate movements may be required before there is a significant effect on trade and economy. According to Obstfeld & Rogoff (2000), trade costs include not only tariffs and transport costs, but also other informal arbitrage barriers related to informational issues; such as differences in language, legal systems and currencies.

The author of this study concludes, based on the mutual relationship of the shocks/effects, that if arbitrage barriers form one basic class of shocks then all other possible causes of PPP deviations (both monetary, real demand-side and real supply-side shocks) must logically remain in the other basic class. Therefore, according to the products' immobility view on price differences, all causes of PPP deviations are classified to the following basic classes:

a) The arbitrage barriers (the shocks/effects that cause products' immobility). Both the formal arbitrage barriers (custom barriers) and the informal arbitrage barriers (transportation costs; differences in languages, legal systems and currencies; differences in the products' subjective quality; the costs connected with gathering information about prices, risks and trade conditions etc.) belong to this class.
b) The local differences in the products' supply and/or demand (the shocks/effects that are based on products' immobility). Both the monetary (the official undervaluation of nominal exchange rate), demand side (the incomes' growth, the demand shift from tradables to nontradables) and the supply side (Balassa-Samuelson effect, the cost recovery) shocks belong to this class.

The logical superiority of the products' immobility view consists of the interdependence of its basic classes of shocks: neither the arbitrage barriers nor the local differences in supply/demand are *alone* able to cause the PPP deviations. The differences in the countries' local supply and/or demand transform into the PPP deviations only due to products' international immobility and vice versa. If we really want to explain the PPP deviations, *both* classes of shocks must always be employed.

### 4.4. The purchasing power parity puzzle between Estonia and non-transitional countries

According to the products' immobility view on price differences, the ability of the one basic class shocks (both monetary and real shocks that are based on products' immobility) to explain the real exchange rate *movements* is limited, the more dynamic are the other basic class shocks (arbitrage barriers, the shocks that cause products' immobility). This is just the case of the former Soviet Union where both the arbitrage barriers (against the non-FSU countries) and the real exchange rates (against the non-FSU countries) changed wildly throughout the first transitional decade. Therefore, the former Soviet Union is a good example for revealing both the monetary and real approaches' inability to explain the real exchange rate movements.

From all of the FSU-republics the small and early liberalized Baltic republic of Estonia was chosen, because of the nominal exchange rate of the Estonian domestic currency (against the DEM) has been almost constant starting from the end of 1991[4] and the Estonian real exchange rate has appreciated most steadily during the first transitional decade. The Estonian domestic currency's nominal exchange rate has been stable throughout the first transitional decade due to the very early and radical monetary reform (Estonian kroon's nominal exchange rate was pegged with the German mark). This stability is especially important, because it reveals the monetary approach's inability to explain the Estonian vast real exchange rate appreciation during the 1990s. If the Estonian real exchange rate movements were caused by (pre-1992) monetary shock, one would expect convergence to PPP over one to two years, as wages and prices adjust to a shock. As we have seen, the evidence suggests this is not the case: the Estonian real exchange rate appreciation process also continued after 1993 and was not completed even in 2000 (Estonian actual real exchange rate in 2000 was still remarkably lower than its income-predicted real exchange rate).

At the same time, the Estonian real exchange rate appreciation is also not explainable by the real approach. It is not probable that real shocks to economic variables like productivities, preferences and incomes can be volatile enough to explain the intense volatility of the Estonian real exchange rate (for example the Estonian 128% real exchange rate appreciation between 1993 and 1996). The results of the present study confirm both the supply-side (productivities) and the demand-side (incomes) real shocks' inability to explain the Estonian real exchange rate appreciation.

### 4.5. The methodology of testing the productivities' and incomes' convergence as the possible cause of the price convergence between Estonia and non-transitional countries

In this study we tried to explain the price convergence between a small Baltic FSU republic Estonia and non-transitional countries by the traditional real approach. The author of this study employed the Balassa-Samuelson effect as the representative of real shocks for two reasons. First, the Balassa-Samuelson „productivity hypothesis" is the main traditional supply-side explanation of real exchange rate movements. Second, one of the proxies of the Balassa-Samuelson effect − GDP per capita PPP-

[4] The Estonian domestic currency's nominal exchange rate has been relatively stable already from December 1991 − six months before the Estonian monetary reform (June 1992).

adjusted relative to the reference country − is the main traditional demand-side explanation of real exchange rate movements.

The basic methodological idea behind the detection of the Balassa-Samuelson effect in Estonia is a time series analysis of relative productivities and prices. The methodology used in this study is similar to the previous studies analyzing the relationship between productivities and prices in the Baltic republics relative to non-transitional countries (Fabio Filipozzi (2000), Kirsten Lommatzsch & Silke Tober (2002), Martti Randveer & Mari Rell (2002)), but there are also some important differences.

The first step of the analysis is the choice of a reference country and estimated time period. Germany was selected as the reference country because of the very close relationships between Estonia and Germany (pegged currencies and intensive trade relations). The choice of an estimated time period was determined by the general aim of this study − to estimate the possible causes of price convergence throughout the first transitional decade. Therefore, unlike the previous studies, the entire decade 1991-2000 was estimated.

The second step is the choice of proxies for relative productivity. As often in the estimation of the Balassa-Samuelson effect, the author of this study employed: a) GDP per capita PPP-adjusted relative to the reference country (for example György Szapary (2000)), b) GDP per employee PPP-adjusted relative to the reference country (for example Rumen Dobrinsky (2001)) and c) GDP per employee in the tradable sector divided by GDP per employee in the nontradable sector relative to the reference country (for example Balazs Egert (2005)). Unlike the previous studies, all these alternative productivity proxies are employed simultaneously. This enabled the author to directly compare the results obtained using different productivity proxies.

The third step is choosing the form of analysis and the division of economic activities between tradable and nontradable sectors. Ensuing from the aim of this study, the simple data comparison as an alternative to the traditional sophisticated econometrics is employed. This enabled the author to study the whole decade (including the previously uninvestigated early 1990s) without incuring into insurmountable technical difficulties.

In the second essay the author has not employed traditional sophisticated econometrics in the following reasons. First, because the possibility of employing time series econometrics is limited by the unavailability of quarterly data of the Estonian productivities for the early 1990s (1991-1993). The same problem is with the Estonian 1991-1993 GDP deflators as well – these data that are necessary for calculating the Estonian 1991 and 1992 price levels are available only yearly. Using yearly data means that the number of estimated time points (10) is too small for tradtional econometric time series analyses for detecting the causal relationship between Estonian relative productivity level and relative price level. Second, because in the first essay the author has already employed the traditional panel econometric analysis for detecting the equation about the relationship between countries´ relative GDPs per capita levels PPP-adjusted and relative price levels. Since GDP per capita PPP-adjusted is also one of the most popular proxies for productivity (see for example György Szapary (2000)), the panel econometric analysis of productivities and prices was carried through in the first essay.

The aim of the second essay was to estimate the possible causes of the Estonian relative price level from the another angle: to assess the possibility of causal relationship between the Estonian relative productivities and relative prices using the Estonian time series. Here the author had only two choices: to let the first part of

1990s − the most interesting and crucial part of transitional period − unestimated, or to limit his study by the simple data analysis. It is also remarkable that there is no literature about these years because of the same problem. Therefore this analysis provides an important insight into what happened in the very early years.

We are not able to prove the existence of the causal relationship between the Estonian relative productivity rise and relative inflation using simple data analysis. Though, we are able to reject the existence of this relationship using simple data analysis and taking into account the information about the theoretical and empirical nature of the Balassa-Samuelson effect (the possible lag, the maximum possible effect of relative productivity increases on relative inflation). If the productivity rise emerges later than the price rise, then this can not be the cause of it.

Differently from most studies, with the only exception of Balazs Egert (2005), all possible (agriculture, industry, construction and services) sectors' divisions between tradable and nontradable sectors are employed. Like Egert (2005), the author of this study concludes, that the uncertainty surrounding agriculture and construction indicates that they might be borderline cases producing tradable goods with a higher non-tradable component. Therefore, agriculture and construction can belong to both tradable or nontradable sectors or can even be excluded.

The fourth step is the comparison of the productivities' time series with the prices' time series in order to research the possibility of the Balassa-Samuelson effect. The following productivities' time series are calculated: GDP per capita PPP-adjusted in Estonia relative to Germany, GDP per employee PPP-adjusted in Estonia relative to Germany and GDP per employee in the Estonian tradable sector devided by GDP per employee in the Estonian nontradable sector relative to GDP per employee in the German tradable sector devided by GDP per employee in the German nontradable sector. The productivities' time series and the prices' time series are arranged to the three parallel tables in the second essay. For interpreting the information in these tables, both the theoretical Balassa-Samuelson model (Patrick K. Asea & Max W. Gorden (1994)), the empirical studies about the effect of relative productivity on inflation (Menzie Chinn & Louis Johnston (1997), Annika Alexius & Jonny Nilsson (2000), Marco Cipriani (2001)) and the statistics of Estonian 1980s' relative productivity dynamics (National Accounts in Estonia 1992 (1994), Lucian Cernat & Radu Vranceanu (2002)) are employed.

## 5. DATA

The purpose of this chapter is to describe the choice criteria, sources and calculations of data. The data used in this study covers the period from 1991 to 2000. The output variable of this study is the GDP price level. The main input variable of this study is GDP per capita PPP-adjusted.

The main choice criteria of data are expediency from the standpoint of theoretical approach and availability. GDP per capita PPP-adjusted is chosen in all three essays because it is an important indicator of both demand-side (as an indicator of national income level) and supply-side (as an indicator of national productivity level) real shocks. In the second essay, the modifications of GDP per capita PPP-adjusted are used − GDP per employee PPP-adjusted and GDP per employee PPP-adjusted in tradable sector devided by GDP per employee PPP-adjusted in nontradable sector. The GDP price level is used in all three essays as an indicator of national price level. All national income, productivity and price level data are presented relative to the reference country.

The main data source of this study is the Penn World Table version 6.1 (2002) as an expanded set of international comparisons. The GDP price levels, GDP per capita PPP-adjusted levels and national population data are from the Penn World Table. In addition to the Penn World Table (2002), the other important data sources of this study are: ILO Yearbook of Labour Statistics 2001 (the Estonian numbers of employees by economic activity), ILO Yearbook of Labour Statistics 2004 (the German numbers of employees by economic activity), Quarterly National Accounts (2001) (Germany's Gross Domestic Product in constant prices by economic activity), Gross Domestic Product of Estonia (2002) (the Estonian 1993-2000 GDP at constant prices by economic activity), National Accounts in Estonia 1994 (the Estonian 1992-1993 GDP at constant prices by economic activity), National Accounts in Estonia 1992 (the Estonian 1991-1992 GDP at constant prices by economic activity), International Financial Statistics October 1997 (the Estonian and German GDP deflators for the years 1991-1993), EBRD (1998) & IMF (1998) (the FSU republics' GDP deflators and nominal exchange rate changes for the years 1991-1996), and Bank of Estonia (the ruble/DEM nominal exchange rates for the period January 1991 - June 1992).

Because there were no price and income data for the majority of FSU republics from 1991-1993 in the Penn World Table these missing price levels are calculated as follows (Equation 1):

$$P_{n-1} = \frac{P_n \cdot \Delta\varepsilon \cdot \pi^*}{\pi} \qquad (1)$$

where $P_n$ is the domestic country's GDP price level (relative to reference country), $P_{n-1}$ is the domestic country´s GDP price level (relative to reference country) of the previous year, $\Delta\varepsilon$ is the change in the nominal exchange rate of domestic country's currency vis-à-vis foreign (reference) country's currency, $\pi$ is the domestic country's GDP deflator relative to the previous year, and $\pi^*$ is the foreign (reference) country's GDP deflator relative to the previous year.

For detecting the FSU republics' nominal exchange rates vis-à-vis nontransitional countries two alternative market indicators, official Central Bank quotations and auction prices, existed until mid-1992 (Figure 6).

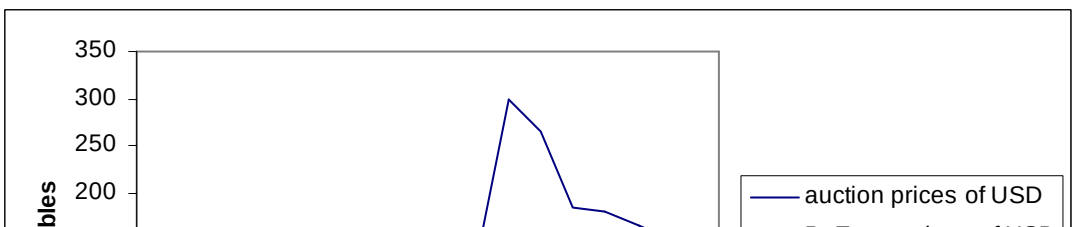

Figure 6. The Bank of Estonia quotations of USD, and the Bank of Estonia and Tallinn International Securities Exchange auction prices of USD during the period January 1991 – June 1992
Source: Hinnainfo (1992) and Bank of Estonia.

Ensuing from the goals of this study, the author conservatively uses the Central Bank quotations in his calculations to minimize the risk of underestimation of the FSU republics' possible nominal exchange rate appreciation 1991-1992 and therefore also their 1991 real exchange rates. The author minimizes the risk of showing the FSU republics price levels lower than they really were.

In the second essay, the missing Estonian income levels are calculated as follows (Equation 2):

$$I_{n-1} = \frac{I_n \cdot \Delta p \cdot G^*}{G \cdot \Delta p^*} \quad (2)$$

where $I_n$ is the Estonian GDP per capita PPP-adjusted (relative to reference country) of the year n, $I_{n-1}$ is the Estonian GDP per capita PPP-adjusted (relative to reference country) of the previous year (year n-1), $\Delta p$ is the change in the Estonian population, $\Delta p^*$ is the change in the reference country's population, G is the Estonian GDP growth at constant prices, and G* is the reference country's GDP growth at constant prices.

In the first essay the missing FSU republics' income levels are extrapolated from the existing income levels of the following years. From the standpoint of the goals of this study, this extrapolation is very conservative, because in the environment of income decreases in the FSU republics from 1991-1996, the income levels in the previous years tend to be higher relative to the following years. Therefore, the risk of overvaluation of the FSU republics' income levels at the beginning of the 1990s is minimized.

## 6. RESULTS

The present thesis has two goals, and in the beginning of this thesis were suggested five hypotheses for examining the deviations from purchasing power parity in Estonia. The last chapter of this thesis will present a short review of research results.

> 1.Goal: to measure the price differences between the former Soviet Union and remaining countries.

This goal was the first motivator for this thesis. The research conception accrues from the need to reveal the uniqueness of FSU republics' price levels and –dynamics during the 1990s. The present thesis was the first quantitative analysis of FSU republics' price scenarios that treats the whole first transitional decade (1991-2000).

Price level is one of the major economic indicators. It shows the (potential) investors' and consumers' interest to the country's products and production factors. Both foreign and domestic arbitragues, speculators and consumers have to consider the country's price level in their actions. The price increases is the sign of a resources' value, but is also the sign that others have already noticed this value. Therefore, price level is one important component of the monitoring of countries performance. The importance of price level as an indicator of a country's perceived business climate was considered in the third essay.

> **Hypothesis 1:** The price levels of FSU republics were remarkably lower vis-a-vis remaining countries.

This hypothesis found proof in the first essay. The FSU republics' price levels were the lowest at the beginning of the 1990s and have also remained remarkably modest during the second half of the 1990s (except the Baltic republics). Table 5 shows the FSU republics' cheapness relative to other countries.

Table 5
World-wide "cheapness rankings" in accordance with actual price levels (P) (USA price level = 100)*

| 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|
| **1)Rus 2,24** | **1)Ltu 5,78** | **1)Ukr 3,56** | **1)Tkm 11,29** | **1)Kgz 8,36** |
| **2)Ltu 2,26** | **2)Rus 6,98** | **2)Kgz 4,89** | **2)Kgz 15,38** | **2)Tjk 10,22** |
| **3)Lva 2,80** | **3)Lva 8,31** | **3)Geo 4,96** | 3)Npl 15,86 | **3)Geo 11,28** |
| **4)Est 3,84** | **4)Est 10,63** | **4)Arm 5,07** | **4)Tjk 15,89** | **4)Blr 11,64** |
| *5)Vnm 11,26* | *5)Vnm 13,26* | **5)Blr 5,42** | **5)Mda 17,29** | **5)Ukr 12,48** |
| *6)Bgr 12,96* | *6)Alb 14,03* | **6)Aze 6,56** | **6)Arm 17,68** | **6)Mda 13,57** |
| 7)Npl 16,32 | 7)Moz 14,73 | **7)Tjk 8,41** | 7)Eth 18,62 | 7)Eth 13,69 |
| 8)Sle 19,31 | *8)Bgr 16,84* | **8)Mda 8,86** | **8)Geo 18,67** | 8)Gin 13,73 |
| 9)Moz 19,66 | 9)Npl 16,88 | **9)Uzb 9,52** | *9)Vnm 19,11* | 9)Npl 14,79 |
| *10)Alb 20,04* | 10)Sle 18,11 | **10)Tkm 9,97** | **10)Ukr 19,80** | **10)Kaz 14,84** |
| *11)Chn 21,12* | 11)Ind 20,94 | **11)Ltu 11,02** | 11)Ind 19,86 | **11)Arm 16,22** |
| 12)Guy 21,13 | *12)Chn 21,54* | **12)Kaz 12,39** | *12)Bgr 19,91* | 12)Ind 17,07 |
| 13)Gin 21,16 | 13)Bgd 22,01 | **13)Rus 13,89** | **13)Aze 20,02** | **13)Rus 17,25** |
| 14)Egy 21,65 | 14)Guy 22,14 | **14)Lva 14,17** | **14)Blr 20,40** | 14)Sle 17,28 |
| 15)Ind 22,31 | 15)Gin 22,27 | *15)Vnm 15,15* | 15)Moz 20,56 | 15)Bdi 17,48 |
| 16)Lka 22,69 | *16)Rom 22,32* | 16)Moz 15,46 | **16)Uzb 20,92** | 16)Idn 18,06 |

| | | | | |
|---|---|---|---|---|
| 17)Bgd 22,95 | 17)Lka 22,59 | 17)Npl 15,91 | 17)Bgd 21,52 | **17)Aze 18,41** |
| *18)Svk 24,01* | 18)Uga 22,59 | **18)Est 16,58** | 18)Gin 21,67 | 18)Ner 18,73 |
| 19)Nic 24,23 | 19)Egy 23,64 | 19)Ken 16,92 | 19)Sle 22,08 | 19)Gha 18,77 |
| 20)Uga 24,48 | 20)Idn 25,63 | 20)Sle 18,59 | **20)Kaz 22,51** | 20)Tcd 19,07 |
| *21)Cze 24,53* | *23)Svk 26,52* | *22)Alb 18,94* | *28)Chn 24,33* | *31)Chn 23,14* |
| *34)Rom 30,29* | *26)Cze 26,79* | *26)Bgr 21,01* | *40)Alb 26,85* | *32)Bgr 23,29* |
| *52)Pol 36,87* | *35)Mkd 30,68* | *27)Mkd 21,13* | *48)Rom 31,19* | *46)Svk 28,28* |
| *74)Hun 42,79* | *58)Pol 38,17* | *31)Chn 23,80* | **52)Ltu 32,76** | *58)Alb 30,03* |
| *101)Svn 62,76* | *83)Hun 47,53* | *43)Svk 28,13* | **56)Lva 33,29** | *59)Mkd 31,84* |
| | *101)Svn 63,55* | *44)Rom 28,35* | *58)Mng 33,79* | **60)Est 31,97** |
| | | *50)Cze 30,36* | *69)Svk 36,82* | *61)Rom 32,52* |
| | | *72)Pol 36,33* | **79)Est 39,51** | *63)Cze 33,29* |
| | | *95)Hun 47,88* | **80)Rus 39,84** | **66)Lva 36,27** |
| | | *110)Svn 59,64* | *85)Cze 41,58* | **67)Ltu 36,47** |
| | | | *101)Pol 48,29* | *79)Hun 41,78* |
| | | | *102)Mkd48,69* | *80)Pol 42,25* |
| | | | *104)Hun 50,88* | *87)Hrv 45,51* |
| | | | *120)Hrv 59,53* | *93)Svn 53,75* |
| | | | *131)Svn 71,86* | |

*The 20 cheapest countries, and the remaining non-FSU and FSU transitional countries, are presented. Bold numbers denote former Soviet republics, italic underlined numbers denote non-FSU transitional countries, normal numbers denote non-transitional countries.
Sources: Author's calculations and the Penn World Table (version 6.1).

The FSU republics' actual price levels (P) were also much lower relative to their income-predicted equilibrium price levels (p). Table 6 shows the FSU republics' actual price levels relative to income-predicted price levels (P/p).
If P/p=1,00 (P=p), then P is neither overvalued nor undervalued and actual price level equals income-predicted price level (see Tables 6 and 7). If P/p>0, then P is overvalued. If P/p<0, then P is undervalued.

Table 6
World-wide "cheapness rankings" in accordance with actual price levels relative to income-predicted price levels (P/p)

| 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|
| **1)Rus 0,035** | **1)Rus 0,11** | **1)Ukr 0,07** | **1)Tkm 0,28** | **1)Blr 0,24** |
| **2)Lva 0,042** | **2)Ltu 0,11** | **2)Blr 0,11** | *2)Bgr 0,42* | **2)Kgz 0,31** |
| **3)Ltu 0,045** | **3)Lva 0,16** | **3)Geo 0,13** | **3)Blr 0,44** | **3)Geo 0,31** |
| **4)Est 0,074** | **4)Est 0,20** | **4)Kgz 0,15** | 4)Mus 0,45 | **4)Kaz 0,32** |
| *5)Bgr 0,24* | *5)Bgr 0,33* | **5)Arm 0,18** | **5)Geo 0,47** | **5)Rus 0,34** |
| *6)Cze 0,33* | *6)Cze 0,36* | **6)Ltu 0,22** | **6)Kaz 0,48** | **6)Ukr 0,35** |
| *7)Svk 0,36* | *7)Svk 0,41* | **7)Rus 0,23** | **7)Ukr 0,50** | **7)Tjk 0,40** |
| 8)Mus 0,46 | 8)Mus 0,45 | **8)Aze 0,25** | **8)Kgz 0,54** | 8)Mus 0,41 |
| *9)Vnm 0,47* | *9)Vnm 0,55* | **9)Tkm 0,26** | *9)Cze 0,54* | *9)Svk 0,49* |
| 10)Mac 0,54 | 10)Mac 0,56 | **10)Kaz 0,27** | *10)Svk 0,57* | *10)Cze 0,52* |
| 11)Cub 0,57 | *11)Alb 0,58* | **11)Lva 0,29** | 11)Swz 0,58 | 11)Gin 0,53 |
| 12)Tto 0,62 | 12)Brb 0,59 | **12)Est 0,32** | 12)Npl 0,59 | **12)Mda 0,53** |
| 13)Hkg 0,66 | *13)Rom 0,59* | **13)Tjk 0,33** | **13)Tjk 0,59** | 13)Eth 0,54 |
| 14)Egy 0,66 | 14)Moz 0,61 | **14)Mda 0,34** | 14)Omn 0,59 | 14)Gnq 0,55 |
| 15)Atg 0,67 | 15)Atg 0,62 | **15)Uzb 0,36** | 15)Brb 0,63 | 15)Npl 0,58 |
| 16)Npl 0,68 | 16)Cub 0,62 | *16)Cze 0,43* | **16)Mda 0,64** | 16)Idn 0,58 |

| | | | | |
|---|---|---|---|---|
| 17)Brb 0,69 | 17)Hkg 0,66 | *17)Bgr 0,43* | **17)Arm 0,65** | *17)Bgr 0,58* |
| 18)Col 0,71 | 18)Vct 0,69 | 18)Mus 0,45 | 18)Mac 0,65 | **18)Est 0,60** |
| *19)Hun 0,73* | 19)Npl 0,70 | *19)Svk 0,47* | **19)Ltu 0,66** | **19)Arm 0,61** |
| 20)Gin 0,76 | 20)Egy 0,70 | *20)Mkd 0,52* | **20)Lva 0,69** | **20)Aze 0,64** |
| *22)Rom 0,76* | *25)Pol 0,77* | *21)Vnm 0,60* | **22)Uzb 0,70** | *37)Chn 0,77* |
| *23)Pol 0,78* | *27)Hun 0,80* | *33)Pol 0,73* | *24)Vnm 0,71* | *38)Hun 0,77* |
| *32)Alb 0,84* | *32)Mkd 0,83* | *34)Rom 0,74* | **26)Est 0,72** | *42)Svn 0,78* |
| *40)Svn 0,88* | *38)Chn 0,87* | *39)Alb 0,75* | *29)Rom 0,73* | **43)Ltu 0,78** |
| *41)Chn 0,89* | *44)Svn 0,90* | *48)Hun 0,83* | **32)Aze 0,74** | **44)Lva 0,78** |
| | | *51)Svn 0,85* | **34)Rus 0,75** | *57)Pol 0,84* |
| | | *58)Chn 0,88* | *37)Chn 0,78* | *62)Mkd 0,87* |
| | | | *51)Alb 0,84* | *67)Hrv 0,91* |
| | | | *54)Hun 0,85* | *70)Rom 0,93* |
| | | | *59)Pol 0,87* | *85)Alb 1,02* |
| | | | *78)Svn 0,94* | |
| | | | *103)Hrv 1,10* | |
| | | | *122)Mkd 1,20* | |
| | | | *132)Mng 1,25* | |

*The 20 cheapest countries, and the remaining non-FSU and FSU transitional countries, are presented. Bold numbers denote former Soviet republics, italic underlined numbers denote non-FSU transitional countries, normal numbers denote non-transitional countries.
Source: Author's calculations.

Therefore, the FSU republics' price levels were remarkably lower vis-a-vis remaining countries both absolutely and relative to income-predicted price levels.

> **Hypothesis 2:** The non-FSU transitional countries, the FSU-Baltic republics and the FSU-CIS republics have remarkably different price scenarios.

This hypothesis also found proof in the first essay. The division of transitional countries between the different country-groups revealed significant differences between the non-FSU transitional countries, the FSU-Baltic republics and the FSU-CIS republics. The FSU republics' price levels were much lower at the beginning of the 1990s and their following price rise was much faster compared with the non-FSU transitional countries. At the same time, due to the irreversible nature of the FSU-Baltic republics' price rise, the FSU-Baltic republics' price levels were much higher at the end of the 1990s in comparison with the FSU-CIS republics. These three country-groups were very different concerning both actual and relative (actual relative to income-predicted) price levels. Table 7 shows the relative price levels of the non-FSU transitional countries, the FSU-Baltic republics and the FSU-CIS republics.

Table 7
The actual price levels relative to income-predicted price levels (P/p) of non-FSU transitional countries as a group, FSU-Baltic republics as a group and FSU-CIS republics as a group

| | 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|---|
| Non-FSU trans. countries average | 0,58 | 0,61 | 0,62 | 0,79 | 0,72 |
| **CIS average** | **0,04** | **0,11** | **0,21** | **0,56** | **0,38** |
| Baltics average | 0,05 | 0,16 | 0,28 | 0,69 | 0,71 |
| Non-FSU trans. countries population- | 0,84 | 0,82 | 0,83 | 0,77 | 0,76 |

| | | | | | |
|---|---|---|---|---|---|
| weighted average<br>Asian non-FSU trans. countries population-weighted average (China, Vietnam, Mongolia) | 0,86 | 0,87 | 0,88 | 0,78 | 0,77 |
| European non-FSU trans. countries population-weighted average (Pol, Cze, Svk, Hun, Rom, Bgr, Alb, Hrv, Mkd, Svn) | 0,62 | 0,62 | 0,65 | 0,76 | 0,76 |
| **CIS population-weighted average** | **0,04** | **0,11** | **0,20** | **0,66** | **0,34** |
| *Baltics population-weighted average* | *0,05* | *0,14* | *0,26* | *0,68* | *0,74* |

Bold numbers denote the FSU-CIS republics, italic underlined numbers denote the FSU-Baltic republics, normal numbers denote the non-FSU transitional countries.
Source: Author's calculations.

Therefore, the non-FSU transitional countries, the FSU-Baltic republics and the FSU-CIS republics had remarkably different price scenarios during the 1990s.

> 2.Goal: To research the causes of the price convergence between Estonia and non-transitional countries.

This goal was the second main motivator for this thesis and it was presented throughout the present study. The calculations of Mark De Broek and Vincent Koen (2000) as well as Naoro F. Campos and Fabrizio Coricelli (2002) had shown that the Estonian incomes and productivities decreased significantly during the period 1991-1997. They encouraged the author of this thesis to ask; is the Estonian real exchange rate appreciation can be caused by the Balassa-Samuelson effect?

Estonia has a number of desirable features for researching the PPP deviations between the former Soviet Union and non-transitional countries. Estonia is the smallest FSU republic and its foreign exchange market was early liberalized, which greatly improved the availability of data from the early 1990s. Estonia is also the only FSU republic whose currency's nominal exchange rate has been stable starting from 1992. This nominal exchange rate stability together with the huge real exchange rate appreciation provided a unique platform for testing the possible impact of traditional real shocks.

> **Hypothesis 3:** The price convergence between Estonia and non-transitional countries was caused by their income convergence.

This hypothesis was not supported in the present thesis. In essay two the Estonian incomes' and prices' (relative to Germany) time series were compared. The significant income growth did not emerged until 1997; when the majority of price increases was already over. In essay one, neither the initial low Estonian actual price level nor the following increases of Estonian actual price level were supported by the respective Estonian income-predicted price levels. Table 8 contains information in regards to the Estonian income and price levels relative to Germany.

Table 8
The Estonian GDP per capita PPP-adjusted relative to Germany (I; %) and the Estonian price level relative to Germany (P; %) 1991-2000

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 40.74 | 35.69 | 33.87 | 33.01 | 34.27 | 35.55 | 39.40 | 41.11 | 42.49 | 45.47 |
| P | 3.97 | 8.17 | 13.19 | 17.95 | 23.20 | 28.67 | 31.98 | 34.36 | 34.12 | 33.67 |

Sources: Author's calculations and the Penn World Table (Version 6.1).

Therefore, the price convergence between Estonia and non-transitional countries was not caused by their income convergence. This result is assured by the cross-country analysis in the first essay, according to which the income levels do not explain the price levels in Estonia as well as in the remaining FSU republics.

> **Hypothesis 4:** The price convergence between Estonia and non-transitional countries was caused by their productivity convergence.

This hypothesis was also not supported in the present thesis. In essay two the Estonian productivities' and prices' (relative to Germany) time series were compared. Table 9 shows that significant productivity growth did not emerged until 1997; when the majority of price increases was already over.

Table 9
The Estonian GDP per employee PPP-adjusted relative to Germany (Y; %) and the Estonian price level relative to Germany (P; %) 1991-2000

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Y | 36.97 | 32.99 | 32.52 | 31.65 | 34.22 | 35.45 | 38.10 | 39.71 | 42.83 | 45.87 |
| P | 3.97 | 8.17 | 13.19 | 17.95 | 23.20 | 28.67 | 31.98 | 34.36 | 34.12 | 33.67 |

Source: Author's calculations. Price levels are from Table 8.

This result is assured by the comparison of sectoral productivities: significant growth did not emerged until 1997. Table 10 contains information about the Estonian relative productivities and price levels relative to Germany. Different Q (Estonian relative productivity) values refer to the different divisions of Estonian economic sectors between open sector and closed sector.

Table 10
The Estonian relative productivities ($Q_n$; 2000=100) and the Estonian price level relative to Germany (P; 2000=100) 1991-2000[5]

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|
| Q1 | 125.9 | 87.0 | 84.8 | 86.9 | 96.3 | 96.2 | 97.5 | 98.1 | 99.0 |
| Q2 | 142.7 | 103.7 | 96.0 | 96.7 | 98.0 | 95.8 | 101.5 | 99.5 | 100.7 |
| Q3 | 154.2 | 102.2 | 95.7 | 95.9 | 97.0 | 97.7 | 98.6 | 100.1 | 99.2 |
| Q4 | 186.8 | 131.4 | 114.2 | 111.5 | 98.3 | 97.0 | 103.8 | 101.8 | 101.1 |
| Q5 | 148.2 | 114.7 | 102.1 | 101.5 | 97.4 | 94.8 | 103.1 | 100.2 | 101.2 |
| Q6 | 177.8 | 119.7 | 107.8 | 104.6 | 99.0 | 100.0 | 100.1 | 101.6 | 99.8 |
| Q7 | 215.4 | 153.9 | 128.6 | 121.6 | 100.3 | 99.2 | 105.3 | 103.4 | 101.7 |
| Q8 | 194.1 | 145.3 | 121.4 | 116.9 | 97.6 | 96.0 | 105.4 | 102.5 | 101.7 |
| Q9 | 218.7 | 165.1 | 134.2 | 126.0 | 99.7 | 98.1 | 106.7 | 103.8 | 102.2 |
| *Qav* | *173.8* | *124.8* | *109.4* | *106.8* | *98.2* | *97.2* | *102.5* | *101.2* | *100.7* |
| P | 11.8 | 24.3 | 39.2 | 53.3 | 68.9 | 85.2 | 95.0 | 102.1 | 101.3 |

Source: Author's calculations. Price levels are from Table 8.

Therefore, the price convergence between Estonia and non-transitional countries was not caused by their productivity convergence.

> **Hypothesis 5:** There is a purchasing power parity puzzle between Estonia and non-transitional countries.

This hypothesis found proof in the second and third essay. The author of the thesis revealed both the monetary and the real approach's inability to explain the Estonian real exchange rate appreciation during the 1990s. The Estonian real exchange rate appreciation is not explainable by monetary shocks, because the Estonian nominal exchange rate has been stable since 1992 and, according to the monetary approach, one would expect convergence to PPP over one to two years as wages and prices adjust to a monetary shock. At the same time, the Estonian real exchange rate appreciation is also not explainable by real shocks, because shocks to real economic variables like productivities, preferences and incomes can not be volatile enough to explain the tremense volatility of the Estonian real exchange rate; this is also confirmed by the results of the second essay.

Based on the results of the presented thesis, the author of this thesis can conclude that both goals of the thesis are obtained and all suggested hypothesis are inspected. The results, presented in this thesis will provide a useful basis for future research in the field of PPP deviations between transitional and non-transitional countries.

Further research is needed in the following areas: (a) effects of formal and informal arbitrage barriers on FSU republics' price levels; (b) effects of other domestic supply and/or demand side factors (for example, the Soviet people's cult for

[5] Q1 denotes the Estonian relative productivity in industry, agriculture and construction relative to services, Q2 denotes the Estonian relative productivity in industry and agriculture relative to services (construction is excluded), Q3 denotes the Estonian relative productivity in industry and construction relative to services (agriculture is excluded), Q4 denotes the Estonian relative productivity in industry relative to services (agriculture and construction are excluded), Q5 denotes the Estonian relative productivity in industry and agriculture relative to construction and services, Q6 denotes the Estonian relative productivity in industry and construction relative to agriculture and services, Q7 denotes the Estonian relative productivity in industry relative to agriculture and services (construction is excluded), Q8 denotes the Estonian relative productivity in industry relative to construction and services (agriculture is excluded), Q9 denotes the Estonian relative productivity in industry relative to agriculture, construction and services and Qav denotes the arithmetic average of Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8 and Q9.

foreign products and assets) on FSU republics' price levels; and (c) specifics of the Balassa-Samuelson effect's possibility in the other FSU republics.

The essays of the current doctoral thesis have been previously examined and discussed on various international conferences and published in respective conference proceedings and/or journals.

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**Former Soviet Union as the world champion in cheapness**

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**Abstract**

The paper assesses the relationship between income and price levels in the Former Soviet Union (FSU) republics relative to remaining countries during the period 1991-2000. The basic idea of the paper is that the price levels of FSU republics were in the 1990s remarkably lower not only *vis-à-vis* the non-transitional economies with income levels similar to those of the FSU republics but also vis-à-vis non-FSU transitional countries. The author finds out the cross-country relationship between income and price levels among non-transitional economies and derives from this equation the income-predicted price levels for the FSU republics both at the very beginning, in the middle and at the end of the 1990s. Based on his calculations, the author assesses the differences between the FSU republics´ income-predicted and actual price levels and compares the results with those of the non-FSU transitional countries.

## 1. Introduction

The phenomenon of very low price levels of the FSU economies in the 1990s vis-à-vis the non-transitional economies with similar GDP per capita levels is usually investigated only qualitatively (as transitional countries´ initial temporary undervaluation and proceeding price convergence) or with independent estimates from only one or two time points. There is much less debate about the quantity of the initial undervaluation and the path of its decrease in the FSU republics as well as about the important differences between the FSU and non-FSU transitional countries. The aim of this paper is to show quantitatively, that (and how much) the price levels of FSU republics were in the 1990s lower both vis-à-vis non-transitional economies with income levels similar to those of the FSU republics and vis-à-vis non-FSU transitional countries. This paper focuses on the quantitative assessment of the difference between actual and income-predicted ("equilibrium") price levels of the FSU republics in the 1990s and compares the results with those of the non-FSU transitional economies. Both the actual price levels and actual price levels relative to income-predicted price levels ("relative price levels") are arranged to the world-wide "cheapness rankings" and "country-group (FSU, non-FSU trans., non-trans.) results", which indicate clearly the FSU republics´ cheapness in comparison with other countries. Therefore, the price levels of the FSU republics are assessed both in the dimensions of space (in comparison with non-transitional and non-FSU transitional economies) and time (changes in the years 1991-2000). The results show, that the FSU republics were not only much cheaper vis-à-vis the remaining countries with income levels similar to those of the FSU republics in the 1990s, and that the price levels of non-FSU transitional countries were much more similar to the non-transitional countries´ price levels than the FSU republics´ price levels at the beginning of 1990s – but also that both the actual and relative price levels of FSU republics (excl. Baltics) were ca 3 times lower compared to non-transitional countries and ca 2 times lower compared to non-FSU transitional countries in 2000, nine years after the dissolution of the Soviet Union.

The paper is organized as follows. After this introduction, the second part gives the overview about the existing investigations about a cross-country relationship between income and price levels. The third part is devoted to the data, and the fourth part to the methodology. The analysis of results is presented in the fifth part. The sixth part concludes.

## 2. The literature overview

The cross-country relationship between income and price levels exists because of the barriers to the international arbitrage. Both the formal (custom barriers) and informal (transportation costs; differences in languages, legal systems and currencies; the costs of hunting information about prices, risks and trade conditions etc.) arbitrage barriers make products and production factors more or less immobile ("nontradable"). And due to this international immobility, the differences in the countries' local supply and/or demand transform into the price differences between these countries.

Most of the domestic supply and demand side factors are reflected in the country´s income level (GDP per capita PPP-adjusted). The most important supply-side factors, the productivity level and the productivity level in tradables´ sector relative to nontradables´ sector (Balassa-Samuelson effect), are clearly reflected in the

country´s income level. And in accordance with Bergstrand (1991) the higher income level causes the domestic demand shift to more nontradable products (services). Therefore, also the sectoral demands are correlated with the income level.

There is an extensive literature showing a cross-country relationship between income and price levels. Detailed price level surveys have been undertaken through the International Comparison Project (ICP) for several decades for a wide range of countries. As reported by Kravis, Heston and Summers (1982) and Summers and Heston (1991), the ICP data overwhelmingly reject the hypothesis that price levels are equal across countries and thus reject the absolute version of the purchasing power parity (PPP) hypothesis. Studies by Kravis and Lipsey (1987) and Clague (1988) supported the hypothesis that national price levels are strongly and positively correlated with PPP-adjusted per capita GDP. The cross-country relationship between income and price levels is also investigated for example by Kravis (1986) (in the 34 countries where GDP per capita PPP-adjusted was 30-60% relative to USA) and Hansson and Helliwell (1990) (in the Asian countries and Canada). Kravis (1986) found, that the rise of income level by 10 percentage points (USA=100) is accompanied by the rise of price level by 6-9 percentage points (USA=100). Hansson and Helliwell (1990) found, that the rise of income level by 10 percentage points is accompanied by the rise of price level by 4 percentage points.

There is also a growing literature, analyzing a cross-country relationship between income and price levels in the transitional countries relative to non-transitional countries ("normal market economies"). A number of studies focus on individual transitional countries, but there are also a couple of studies, that focus on the majority of transitional (both FSU and non-FSU) countries.

The most influential research in this field is De Broeck and Slok (2001) with the largest number of (FSU and non-FSU) transitional countries from two different time points (1993 and 1999) under investigation.

The general finding of the studies is, that the price levels of FSU republics were lower ("undervalued") vis-à-vis the non-transitional economies with similar GDP per capita levels at the beginning of the 1990s.

Though, the findings are controversial about the middle and end of 1990s. Some studies (Cihak and Holub (2001) study c and De Broeck and Slok (2001)) found, that the price levels of FSU republics were partly undervalued relative to their income levels at the end of the 1990s. But some studies report, that the price levels of FSU republics were not undervalued any more (Cihak and Holub (2001) study b), and some studies report even slight overvaluation at the end of 1990s (Randveer (2000) and Cihak and Holub (2001) study a). The last is, though, caused by the fact, that the regression samples (the baskets of benchmark countries) of these studies contain not only normal market economies, but also many FSU and non-FSU transitional economies. Therefore, their regressions estimate the relationship between income and price levels in FSU republics not in comparison with non-transitional economies, but partly in comparison with transitional (or even FSU) countries. This, of course, lessens the income-predicted price levels of FSU republics.

The second shortcoming of some studies is, that their regression samples contain only (Sepp (1996)) or mostly (Randveer (2000) and Cihak and Holub (2001) study a) these countries, whose income levels were much higher than the FSU republics´ ones. Therefore, the regression line is estimated at the basis of countries with much higher income levels (industrial countries), and then extrapolated to the lower income levels. This misspecifies the regression equation, because the relationship between income and price levels is in the richer countries somewhat

different (lower intercept and/or coefficient) from that in the poorer ones. This, in turn, lessens the income-predicted price levels of FSU republics.

## 3. Data

The main source of international data on relative income and price levels is the International Comparison Program (ICP), organized worldwide by the United Nations (Kravis, Heston and Summers (1982), Kurabayashi and Sakuma (1990) and Heston and Lipsey (1999)), and in Europe by OECD/Eurostat, in cooperation with the individual statistical offices. The data source of the present study is the Penn World Table (2002) (version 6.1) as an expanded set of international comparisons similar to Richards and Tersman (1996). National income and price levels data are presented relative to the United States (USA=100). The GDP per capita PPP-adjusted is used as an indicator of national income level. The GDP price level is used as an indicator of national price level.

Unfortunately, there were no income and price data for the majority of FSU republics 1991-1993 in the Penn World Table. Therefore, the price levels for 1991 (Est, Lva, Ltu, Rus), 1992 (Est, Ltu, Rus), 1993 (Blr, Ukr, Mda, Geo, Aze, Kaz, Kgz, Tjk, Tkm, Uzb), 1994 (Blr, Mda, Geo, Tjk, Tkm) and 1995 (Geo, Tjk, Tkm) are calculated by the author based on the existing price levels of the following years (from the Penn World Table), 1991-1996 GDP deflators and 1991-1996 changes in the nominal exchange rates (FSU republics´ currencies vis-à-vis USA dollars).
The missing price levels of FSU republics 1991-1995 are calculated as following (see Equation 1).

$$P_{n-1} = \frac{P_n \cdot \Delta\varepsilon \cdot \pi^*}{\pi} \qquad (1)$$

where:
$P_n$ – the domestic country´s price level (for example: the Russian price level in 1993);
$P_{n-1}$ – the domestic country´s price level of the previous year (for example: the Russian price level in 1992);
$\Delta\varepsilon$ – the change in the nominal exchange rate of domestic country´s currency vis-à-vis USA dollar (for example: the change in the nominal exchange rate between Russian ruble and USA dollar during the period 1992-1993);
$\pi$ – the domestic country´s GDP deflator relative to the previous year (for example: the price rise of the Russian GDP components in 1993 relative to 1992 in Russian rubles);
$\pi^*$ – the foreign (reference) country´s GDP deflator relative to the previous year (for example: the price rise of the USA´s GDP components in 1993 relative to 1992 in USA dollars).

The GDP deflators for the years 1991-1996 (see Appendix 1) and the changes in the nominal exchange rates during the years 1993-1996 (see Appendix 1) are from EBRD (1998) and IMF (1998). The changes in the nominal exchange rates during the years 1991-1993 (see Appendix 1) are from EBRD (1998), IMF (1998), Odling-Smee and Pastor (2002) and the author´s personal notes.

The income levels for 1991 (Est, Ltu), 1992 (Ltu), 1993 (Mda, Geo, Aze, Kaz, Kgz, Tjk, Tkm, Uzb), 1994 (Mda, Geo, Tjk, Tkm), 1995 (Geo, Tjk, Tkm) are extrapolated from the existing income levels of the following years. This method is

the very conservative one, because in the environment of income decreases in the FSU republics during 1991-1996, the income levels in the previous years can be rather higher than lower relative to the following years.

## 4. Methodology

The methodology used in this study is basically similar to the previous studies analyzing a cross-country relationship between income and price levels in the FSU republics relative to non-transitional economies (for example: Cihak and Holub (2001) and De Broeck and Slok (2001)). Though, there are also some important differences.

The first step is the choice of estimated time points (years), sample countries and estimated countries.

Unlike the existing studies, the author of this paper estimates not only one or two independent time points but five time points from the different stages of transition (both at the very beginning, in the middle and at the end of 1990s). This enables to get the picture about the FSU actual and relative price developments in the first transitional decade (1991-2000). The estimated years are 1991, 1992, 1993, 1996 and 2000. The first three estimated years (1991, 1992, 1993) represent the initial very low price levels and the following sharp price convergence closely after the liberalization of foreign exchange markets in the Baltics and Russia. The fourth estimated year (1996) represents the end of fast and consistent price convergence between FSU and the remaining world. The fifth estimated year (2000) represents the situation at the end of the first transitional decade.

The sample (benchmark) countries are all the countries, whose data were available in the Penn World Table. We excluded both FSU and non-FSU transitional countries from the sample similar to De Broeck and Slok (2001). There are 124 countries in the sample in 1991 and in 1992, 125 countries in 1993, 140 countries in 1996 and 112 countries in 2000, ranging from low to high income countries.

The estimated countries in the present study are all 15 FSU republics – Estonia (Est), Latvia (Lva), Lithuania (Ltu), Russia (Rus), Belarus (Blr), Ukraine (Ukr), Moldova (Mda), Georgia (Geo), Armenia (Arm), Azerbaijan (Aze), Kazakhstan (Kaz), Kyrgyzstan (Kgz), Tajikistan (Tjk), Turkmenistan (Tkm), Uzbekistan (Uzb); and 13 non-FSU transitional countries – Poland (Pol), Czech Republic (Cze), Slovak Republic (Svk), Hungary (Hun), Romania (Rom), Bulgaria (Bgr), Albania (Alb), Croatia (Hrv), Macedonia (Mkd), Slovenia (Svn), Mongolia (Mng), China (Chn), Vietnam (Vnm). Unlike the previous studies, the present study treats the FSU republics as a group and compares it with other country-groups (non-transitional economies, non-FSU transitional countries). The FSU republics themselves are devided, where necessary, into two sub-groups: the Baltic countries (Baltics) and the Commonwealth of Independent States (CIS).

The second step is the comparison of actual price levels (differences in income levels are not taken into account).

All countries (all non-transitional economies, non-FSU and FSU transitional countries) are arranged into the world-wide “cheapness rankings” in accordance with their actual price levels (see Table 1).

Table 1
World-wide "cheapness rankings" in accordance with actual price levels (P) (USA price level = 100)*

| 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|
| **1)Rus 2,24** | **1)Ltu 5,78** | **1)Ukr 3,56** | **1)Tkm 11,29** | **1)Kgz 8,36** |
| **2)Ltu 2,26** | **2)Rus 6,98** | **2)Kgz 4,89** | **2)Kgz 15,38** | **2)Tjk 10,22** |
| **3)Lva 2,80** | **3)Lva 8,31** | **3)Geo 4,96** | 3)Npl 15,86 | **3)Geo 11,28** |
| **4)Est 3,84** | **4)Est 10,63** | **4)Arm 5,07** | **4)Tjk 15,89** | **4)Blr 11,64** |
| *5)Vnm 11,26* | *5)Vnm 13,26* | **5)Blr 5,42** | **5)Mda 17,29** | **5)Ukr 12,48** |
| *6)Bgr 12,96* | *6)Alb 14,03* | **6)Aze 6,56** | **6)Arm 17,68** | **6)Mda 13,57** |
| 7)Npl 16,32 | 7)Moz 14,73 | **7)Tjk 8,41** | 7)Eth 18,62 | 7)Eth 13,69 |
| 8)Sle 19,31 | *8)Bgr 16,84* | **8)Mda 8,86** | **8)Geo 18,67** | 8)Gin 13,73 |
| 9)Moz 19,66 | 9)Npl 16,88 | **9)Uzb 9,52** | *9)Vnm 19,11* | 9)Npl 14,79 |
| *10)Alb 20,04* | 10)Sle 18,11 | **10)Tkm 9,97** | **10)Ukr 19,80** | **10)Kaz 14,84** |
| *11)Chn 21,12* | 11)Ind 20,94 | **11)Ltu 11,02** | 11)Ind 19,86 | **11)Arm 16,22** |
| 12)Guy 21,13 | *12)Chn 21,54* | **12)Kaz 12,39** | *12)Bgr 19,91* | 12)Ind 17,07 |
| 13)Gin 21,16 | 13)Bgd 22,01 | **13)Rus 13,89** | **13)Aze 20,02** | **13)Rus 17,25** |
| 14)Egy 21,65 | 14)Guy 22,14 | **14)Lva 14,17** | **14)Blr 20,40** | 14)Sle 17,28 |
| 15)Ind 22,31 | 15)Gin 22,27 | *15)Vnm 15,15* | 15)Moz 20,56 | 15)Bdi 17,48 |
| 16)Lka 22,69 | *16)Rom 22,32* | 16)Moz 15,46 | **16)Uzb 20,92** | 16)Idn 18,06 |
| 17)Bgd 22,95 | 17)Lka 22,59 | 17)Npl 15,91 | 17)Bgd 21,52 | **17)Aze 18,41** |
| *18)Svk 24,01* | 18)Uga 22,59 | **18)Est 16,58** | 18)Gin 21,67 | 18)Ner 18,73 |
| 19)Nic 24,23 | 19)Egy 23,64 | 19)Ken 16,92 | 19)Sle 22,08 | 19)Gha 18,77 |
| 20)Uga 24,48 | 20)Idn 25,63 | 20)Sle 18,59 | **20)Kaz 22,51** | 20)Tcd 19,07 |
| *21)Cze 24,53* | *23)Svk 26,52* | *22)Alb 18,94* | *28)Chn 24,33* | *31)Chn 23,14* |
| *34)Rom 30,29* | *26)Cze 26,79* | *26)Bgr 21,01* | *40)Alb 26,85* | *32)Bgr 23,29* |
| *52)Pol 36,87* | *35)Mkd 30,68* | *27)Mkd 21,13* | *48)Rom 31,19* | *46)Svk 28,28* |
| *74)Hun 42,79* | *58)Pol 38,17* | *31)Chn 23,80* | **52)Ltu 32,76** | *58)Alb 30,03* |
| *101)Svn 62,76* | *83)Hun 47,53* | *43)Svk 28,13* | **56)Lva 33,29** | *59)Mkd 31,84* |
| | *101)Svn 63,55* | *44)Rom 28,35* | *58)Mng 33,79* | **60)Est 31,97** |
| | | *50)Cze 30,36* | *69)Svk 36,82* | *61)Rom 32,52* |
| | | *72)Pol 36,33* | **79)Est 39,51** | *63)Cze 33,29* |
| | | *95)Hun 47,88* | **80)Rus 39,84** | **66)Lva 36,27** |
| | | *110)Svn 59,64* | *85)Cze 41,58* | **67)Ltu 36,47** |
| | | | *101)Pol 48,29* | *79)Hun 41,78* |
| | | | *102)Mkd48,69* | *80)Pol 42,25* |
| | | | *104)Hun 50,88* | *87)Hrv 45,51* |
| | | | *120)Hrv 59,53* | *93)Svn 53,75* |
| | | | *131)Svn 71,86* | |

The 20 cheapest countries, and the remaining non-FSU and FSU transitional countries, are presented. Bold values denote former Soviet republics, italic values denote non-FSU transitional countries.
Source: Penn World Table (version 6.1).

Next, all countries are arranged into three country-groups (non-transitional economies, non-FSU transitional countries, FSU republics). The price levels of these groups are calculated and presented both as average price levels (every country has the same weight) and as population-weighted average price levels. The population (1996 population) data are from Penn World Table (version 6.1).

The average price levels of the country-groups are calculated as simple arithmetic mean. The population-weighted average price levels of the country-groups are calculated as weighted arithmetic mean.

The price levels of the country-groups are presented in the Table 2.

Table 2
The actual price levels (P) of non-transitional economies as a group, non-FSU transitional countries as a group and FSU republics as a group (USA price level = 100)

| | 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|---|
| World (excl. non-FSU and FSU trans. countries) average | 59,12 | 61,03 | 55,66 | 58,10 | 50,04 |
| Non-FSU trans. countries average | 28,66 | 29,20 | 30,07 | 39,45 | 35,06 |
| FSU average | 2,78 | 7,93 | 9,02 | 23,02 | 18,38 |
| *CIS average* | *2,24* | *6,98* | *7,79* | *19,97* | *13,43* |
| *Baltics average* | *2,96* | *8,24* | *13,92* | *35,19* | *34,90* |
| World (excl. non-FSU and FSU trans. countries) population-weighted average | 55,39 | 57,39 | 50,70 | 54,26 | 45,16 |
| Non-FSU trans. countries population-weighted average | 21,39 | 21,85 | 24,02 | 25,41 | 24,25 |
| Asian non-FSU trans. countries population-weighted average (China, Vietnam, Mongolia) | 20,56 | 21,06 | 23,30 | 24,05 | 23,14 |
| European non-FSU trans. countries population-weighted average (Pol, Cze, Svk, Hun, Rom, Bgr, Alb, Hrv, Mkd, Svn) | 32,03 | 31,70 | 33,05 | 41,76 | 36,90 |
| FSU population-weighted average | 2,26 | 7,00 | 10,47 | 30,20 | 16,02 |
| CIS population-weighted average | 2,24 | 6,98 | 10,40 | 30,09 | 15,44 |
| Baltics population-weighted average | 2,74 | 7,53 | 13,11 | 34,23 | 35,54 |

Source: Author´s calculations based on Penn World Table (version 6.1) data.

The third step is the comparison of actual price levels relative to income-predicted price levels (differences in income levels are taken into account). For detecting income-predicted price levels, the cross-country regression analysis between income levels and price levels is carried out in Microsoft Excel 2000 using the ordinary least square method (OLSM).

The sample of the cross-country regression analysis includes 80 non-transitional countries in 1991, 82 in 1992, 83 in 1993, 92 in 1996 and 72 in 2000. Unlike the previous studies, we excluded the countries with GDP per capita PPP-adjusted below 8-10% (9% in 1991; 8% in 1992, 1993 and 1996; 10% in 2000) relative to USA from the sample, because there was no clear relationship between income and price levels in the poorest countries. The Syria (and Iran in 1991 and 1992) is also excluded from the sample, because its extraordinarily high price level relative to its income level. These exclusions improved remarkably the explanatory power and residual distributions of the models.

Equations 2a-2e show, for a sample of non-transitional economies in 1991-2000, that in the cross-country comparison, a very significant positive relationship exists between income and price levels. Unlike the previous studies, we estimate five different equations for each year under investigation (standard errors are in parentheses).

1991:

$$\mathbf{\ln p = 0{,}65 \ln I + 1{,}82} \qquad \textbf{(2a)}$$

(0,04) (0,14)

$R^2 = 0,78$; N = 80; F = 278,0

1992:

**ln p = 0,66 ln I + 1,82** **(2b)**

(0,04) (0,13)

$R^2 = 0,80$; N = 82; F = 322,6

1993:

**ln p = 0,61 ln I + 1,95** **(2c)**

(0,03) (0,12)

$R^2 = 0,80$; N = 83; F = 331,1

1996:

**ln p = 0,60 ln I + 2,04** **(2d)**

(0,04) (0,13)

$R^2 = 0,76$; N = 92; F = 282,3

2000:

**ln p = 0,55 ln I + 2,09** **(2e)**

(0,05) (0,16)

$R^2 = 0,67$; N = 72; F = 145,0

where p is income-predicted GDP price level and I is GDP per capita PPP-adjusted (in both cases USA=100).

Using these equations about the relationship between income and price levels in non-transitional economies, we calculated the income-predicted price levels for transitional (both non-FSU and FSU) countries. For these transitional countries, whose income levels were below 8% relative to USA, the income-predicted price level is calculated just as their income levels were equal to 8% relative to USA – because analysis revealed no further decreases of price levels when income levels fell below 8-10% relative to USA.

Next, we calculated the income-predicted price levels also for all non-transitional countries (using the same method as for transitional countries) and composed the world-wide "cheapness rankings" in accordance with countries´ actual price levels relative to their income-predicted price levels (differences in income levels are taken into account) (see Table 3).

Table 3

World-wide "cheapness rankings" in accordance with actual price levels relative to income-predicted price levels (P/p)

| 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|
| **1)Rus 0,035** | **1)Rus 0,11** | **1)Ukr 0,07** | **1)Tkm 0,28** | **1)Blr 0,24** |
| **2)Lva 0,042** | **2)Ltu 0,11** | **2)Blr 0,11** | *2)Bgr 0,42* | **2)Kgz 0,31** |
| **3)Ltu 0,045** | **3)Lva 0,16** | **3)Geo 0,13** | **3)Blr 0,44** | **3)Geo 0,31** |
| **4)Est 0,074** | **4)Est 0,20** | **4)Kgz 0,15** | 4)Mus 0,45 | **4)Kaz 0,32** |
| *5)Bgr 0,24* | *5)Bgr 0,33* | **5)Arm 0,18** | **5)Geo 0,47** | **5)Rus 0,34** |
| *6)Cze 0,33* | *6)Cze 0,36* | **6)Ltu 0,22** | **6)Kaz 0,48** | **6)Ukr 0,35** |
| *7)Svk 0,36* | *7)Svk 0,41* | **7)Rus 0,23** | **7)Ukr 0,50** | **7)Tjk 0,40** |
| 8)Mus 0,46 | 8)Mus 0,45 | **8)Aze 0,25** | **8)Kgz 0,54** | 8)Mus 0,41 |
| *9)Vnm 0,47* | *9)Vnm 0,55* | **9)Tkm 0,26** | *9)Cze 0,54* | *9)Svk 0,49* |
| 10)Mac 0,54 | 10)Mac 0,56 | **10)Kaz 0,27** | *10)Svk 0,57* | *10)Cze 0,52* |
| 11)Cub 0,57 | *11)Alb 0,58* | **11)Lva 0,29** | 11)Swz 0,58 | 11)Gin 0,53 |
| 12)Tto 0,62 | 12)Brb 0,59 | **12)Est 0,32** | 12)Npl 0,59 | **12)Mda 0,53** |
| 13)Hkg 0,66 | *13)Rom 0,59* | **13)Tjk 0,33** | **13)Tjk 0,59** | 13)Eth 0,54 |
| 14)Egy 0,66 | 14)Moz 0,61 | **14)Mda 0,34** | 14)Omn 0,59 | 14)Gnq 0,55 |

| | | | | |
|---|---|---|---|---|
| 15)Atg 0,67 | 15)Atg 0,62 | **15)Uzb 0,36** | 15)Brb 0,63 | 15)Npl 0,58 |
| 16)Npl 0,68 | 16)Cub 0,62 | *16)Cze 0,43* | **16)Mda 0,64** | 16)Idn 0,58 |
| 17)Brb 0,69 | 17)Hkg 0,66 | *17)Bgr 0,43* | **17)Arm 0,65** | *17)Bgr 0,58* |
| 18)Col 0,71 | 18)Vct 0,69 | 18)Mus 0,45 | 18)Mac 0,65 | **18)Est 0,60** |
| *19)Hun 0,73* | 19)Npl 0,70 | *19)Svk 0,47* | **19)Ltu 0,66** | **19)Arm 0,61** |
| 20)Gin 0,76 | 20)Egy 0,70 | *20)Mkd 0,52* | **20)Lva 0,69** | **20)Aze 0,64** |
| *22)Rom 0,76* | *25)Pol 0,77* | *21)Vnm 0,60* | **22)Uzb 0,70** | *37)Chn 0,77* |
| *23)Pol 0,78* | *27)Hun 0,80* | *33)Pol 0,73* | *24)Vnm 0,71* | *38)Hun 0,77* |
| *32)Alb 0,84* | *32)Mkd 0,83* | *34)Rom 0,74* | **26)Est 0,72** | *42)Svn 0,78* |
| *40)Svn 0,88* | *38)Chn 0,87* | *39)Alb 0,75* | *29)Rom 0,73* | **43)Ltu 0,78** |
| *41)Chn 0,89* | *44)Svn 0,90* | *48)Hun 0,83* | **32)Aze 0,74** | **44)Lva 0,78** |
| | | *51)Svn 0,85* | **34)Rus 0,75** | *57)Pol 0,84* |
| | | *58)Chn 0,88* | *37)Chn 0,78* | *62)Mkd 0,87* |
| | | | *51)Alb 0,84* | *67)Hrv 0,91* |
| | | | *54)Hun 0,85* | *70)Rom 0,93* |
| | | | *59)Pol 0,87* | *85)Alb 1,02* |
| | | | *78)Svn 0,94* | |
| | | | *103)Hrv 1,10* | |
| | | | *122)Mkd 1,20* | |
| | | | *132)Mng 1,25* | |

1,00 denotes the situation where actual price level equals income-predicted price level. The 20 cheapest countries, and the remaining non-FSU and FSU transitional countries, are presented. Bold values denote former Soviet republics, italic values denote non-FSU transitional countries.
Source: Author´s calculations based on Penn World Table (version 6.1) data.

Next, all non-sample (transitional) countries are arranged into two country-groups (non-FSU transitional countries, FSU republics). The price levels (see Table 2) and income levels (see Appendix 2) of these groups are presented both as average levels (every country has the same weight) and as population-weighted average levels. The population (1996 population) data are from Penn World Table (Version 6.1).

The average income levels of the country-groups are calculated as simple arithmetic mean. The population-weighted average income levels of the country-groups are calculated as weighted arithmetic mean. The results of these calculations (the average and population-weighted average income levels of the country-groups) are presented in the Appendix 2.

Next, using the equations about the relationship between income and price levels in non-transitional economies (Equations 2a-2e), we calculated the income-predicted price levels for FSU as a group and non-FSU transitional countries as a group. The income-predicted price levels (p) and the actual price levels relative to income-predicted price levels (P/p) of these groups are calculated both based on average price and income levels (every country has the same weight) (see Equations 3a-3e) and also based on population-weighted average price and income levels (see Equations 4a-4e).

The income-predicted price levels of the country-groups are calculated as following.

1991:

$$\ln p_{av} = 0{,}65 \ln I_{av} + 1{,}82 \quad \textbf{(3a)}$$

1992:

$$\ln p_{av} = 0{,}66 \ln I_{av} + 1{,}82 \quad \textbf{(3b)}$$

1993:

$$\ln p_{av} = 0{,}61 \ln I_{av} + 1{,}95 \quad \textbf{(3c)}$$

1996:

$$\ln p_{av} = 0{,}60 \ln I_{av} + 2{,}04 \quad \textbf{(3d)}$$

2000:

$$\ln p_{av} = 0{,}55 \ln I_{av} + 2{,}09 \quad \textbf{(3e)}$$

where:

$p_{av}$ – the income-predicted price level of the country-group (for example: the income-predicted price level of FSU);

$I_{av}$ – the average income level of the country-group (for example: the average income level of FSU).

1991:

$$\ln p_{w\text{-}av} = 0{,}65 \ln I_{w\text{-}av} + 1{,}82 \quad \textbf{(4a)}$$

1992:

$$\ln p_{w\text{-}av} = 0{,}66 \ln I_{w\text{-}av} + 1{,}82 \quad \textbf{(4b)}$$

1993:

$$\ln p_{w\text{-}av} = 0{,}61 \ln I_{w\text{-}av} + 1{,}95 \quad \textbf{(4c)}$$

1996:

$$\ln p_{w\text{-}av} = 0{,}60 \ln I_{w\text{-}av} + 2{,}04 \quad \textbf{(4d)}$$

2000:

$$\ln p_{w\text{-}av} = 0{,}55 \ln I_{w\text{-}av} + 2{,}09 \quad \textbf{(4e)}$$

where:

$p_{w\text{-}av}$ – the income-predicted (population-weighted) price level of the country-group (for example: the income-predicted price level of FSU);

$I_{w\text{-}av}$ – the average population-weighted income level of the country-group (for example: the average population-weighted income level of FSU).

Last but not least, the actual price levels relative to income-predicted price levels of FSU republics as a group and non-FSU transitional countries as a group are presented (see Table 4).

Table 4

The actual price levels relative to income-predicted price levels (P/p) of non-FSU transitional countries as a group and FSU republics as a group (actual price level equals income-predicted price level = 1)

| | 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|---|
| Non-FSU trans. countries average | 0,58 | 0,61 | 0,62 | 0,79 | 0,72 |
| FSU average | 0,05 | 0,14 | 0,22 | 0,59 | 0,47 |
| *CIS average* | *0,04* | *0,11* | *0,21* | *0,56* | *0,38* |
| *Baltics average* | *0,05* | *0,16* | *0,28* | *0,69* | *0,71* |
| Non-FSU trans. countries population-weighted average | 0,84 | 0,82 | 0,83 | 0,77 | 0,76 |
| Asian non-FSU trans. countries population-weighted average (China, Vietnam, Mongolia) | 0,86 | 0,87 | 0,88 | 0,78 | 0,77 |
| European non-FSU trans. countries population-weighted average (Pol, Cze, Svk, Hun, Rom, Bgr, Alb, Hrv, Mkd, Svn) | 0,62 | 0,62 | 0,65 | 0,76 | 0,76 |
| FSU population-weighted average | 0,04 | 0,11 | 0,20 | 0,66 | 0,35 |
| CIS population-weighted average | 0,04 | 0,11 | 0,20 | 0,66 | 0,34 |
| Baltics population-weighted average | 0,05 | 0,14 | 0,26 | 0,68 | 0,74 |

1,00 denotes the situation where actual price level equals income-predicted price level.

Source: Author´s calculations based on Penn World Table (version 6.1) data.

## 5. The analysis of results

The calculations show (see Tables 1 and 2), that the FSU republics´ actual price levels were ca 20 times lower compared to non-transitional countries and ca 10 times lower compared to non-FSU transitional countries at the beginning of 1990s (1991). The FSU republics´ relative price levels (actual price levels relative to income-predicted price levels) (see Tables 3 and 4) were also ca 20 times undervalued compared to non-transitional countries and 10-20 times undervalued compared to non-FSU transitional countries in 1991. Therefore, both the actual and relative price levels of non-FSU transitional countries were much more similar to non-transitional countries´ price levels than FSU republics´ price levels at the beginning of 1990s.

The very fast rise of the FSU actual and relative price levels occurred during the period 1991-1993. The FSU republics´ prices increased ca 5 times (see Tables 2 and 4) – 5 times in the Baltics, 6 times in Russia (see Tables 1 and 3). Though, the FSU republics´ actual price levels were still ca 5 times lower compared to non-transitional countries and 2-3 times lower compared to non-FSU transitional countries in 1993 (see Table 2). The FSU republics´ relative price levels were ca 5 times undervalued compared to non-transitional countries and 3-4 times undervalued compared to non-FSU transitional countries in 1993 (see Table 4). The actual price level of one FSU republic (Estonia) had increased to the level of the cheapest non-FSU countries (Vietnam, Mozambique, Nepal, Kenya) (see Table 1), but the relative price levels of all FSU republics were still much lower compared to all (both transitional and non-transitional) non-FSU countries in 1993 (see Table 3).

The fast rise of FSU republics´ actual and relative price levels continued 1993-1996. The FSU prices increased ca 3 times (see Tables 2 and 4) – 2,5 times in the Baltics, 3 times in Russia (see Tables 1 and 3). As a result, the FSU republics´ actual price levels were only ca 2 times lower compared to non-transitional countries and almost equal to the non-FSU transitional countries (slightly higher than Asian non-FSU trans. countries but significantly lower than European non-FSU trans. countries) in 1996 (see Table 2). Though, the FSU republics´ relative price levels were continuously undervalued in comparison with both non-transitional countries (1,5 times) and non-FSU transitional countries (1,2 times) in 1996 (see Table 4).

After 1996, the two FSU sub-groups (CIS, Baltics) experienced remarkably different price developments. The CIS republics´ actual and relative price levels decreased ca 1,6 times relative to non-FSU countries 1996-2000, but the Baltic countries´ prices continued to increase (ca 1,2 times) relative to non-FSU countries during the same period. As a result, the CIS actual and relative price levels were again ca 3 times lower compared to non-transitional countries and ca 2 times lower compared to non-FSU transitional countries in 2000 (see Tables 2 and 4). But the Baltic countries´ actual price levels were already 1,5 times higher compared to Asian non-FSU transitional countries and only slightly lower compared to European non-FSU transitional countries in 2000 (see Table 2). The Baltic countries´ relative price levels were only slightly lower compared to (both Asian and European) non-FSU transitional countries in the same time (see Table 4). Though, the Baltic republics´ actual and relative price levels were still significantly (1,3-1,4 times) lower relative to non-transitional countries in 2000.

These results refer to the very important differences between non-FSU transitional countries and FSU republics price levels (and price developments) all over the 1990s. The three different "pictures" emerged: a) non-FSU transitional countries; b) FSU republics, that belong to the CIS and c) FSU Baltic republics.

*Non-FSU transitional countries* are characterized by much higher actual and relative price levels at the beginning of 1990s, and the following modest and continuous price convergence during the rest of 1990s. The non-FSU transitional countries´ actual price levels have converged 1,4 times towards the non-transitional countries´ actual price levels during the period 1991-2000. Very slightly rose both actual price levels and income-predicted price levels. The actual price levels have come slightly nearer to the income-predicted price levels.

*FSU republics that belong to CIS* are characterized by the much lower actual and relative price levels at the beginning of 1990s, and the following very fast but not continuous price convergence. The FSU-CIS republics´ actual price levels have converged 7,1 times towards the non-transitional countries´ actual price levels during the period 1991-2000. Sharply rose (until 1996) and remarkably fell (after 1996) both actual and relative price levels. The FSU-CIS republics´ income-predicted price levels have significantly fallen during the same period. The actual price levels came sharply nearer to the income-predicted price levels until 1996, but have then remarkably diverged again.

*FSU republics that do not belong to CIS – the Baltic republics* are characterized by the much lower actual and relative price levels at the beginning of 1990s (similar to FSU-CIS), and the following sharp (similar to FSU-CIS) and continuous (similar to non-FSU trans. countries) price convergence. The Baltic countries´ actual price levels have converged 13,9 times towards the non-transitional countries´ actual price levels during the period 1991-2000. Sharply and continuously rose both actual and relative price levels of the Baltic republics. At the same time the Baltics´ income-predicted price levels have been rather stable over the decade (slight decrease until 1996, slight increase after 1996). The Baltics´ actual price levels have come sharply and continuously nearer to their income-predicted price levels 1991-2000.

Therefore, the Baltic countries are similar to the rest of the FSU with the very low price levels at the beginning of 1990s and the huge speed of the following price convergence. At the same time, the Baltic countries are similar to the non-FSU transitional countries with the high price levels at the end of 1990s and the continuous (irreversible) nature of the price convergence process. In fact, the Baltics´ (both actual and relative) price convergence have been even more continuous process than the non-FSU transitional countries´ one.

Then we compare these three pictures with the existing stilized fact (Halpern and Wyplosz (1996)) (see Figure 1).

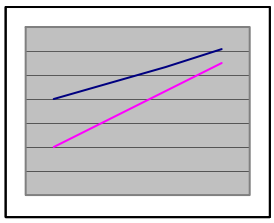
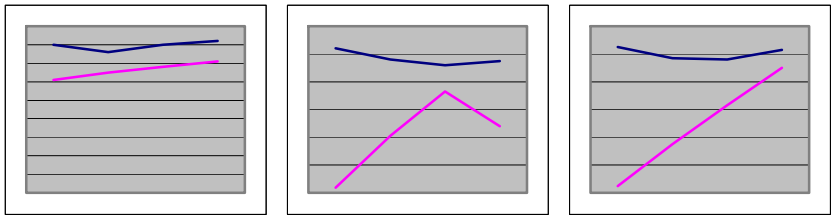


Figure 1. The Halpern-Wyplosz stylized fact about the levels and dynamics of equilibrium price levels and actual price levels in transitional countries
(the first line denotes equilibrium price level and the second line denotes actual price level, both in comparison with the non-transitional countries´ average price level)

We find that there are some important differences (in the actual price levels, in the income-predicted price levels and movements, in the price convergence speed and continuity) as well as one important similarity (in the general direction of actual price

movements over the decade) between our pictures and the existing stilized fact (see Figures 2a-2c).



a)non-FSU trans. b)FSU-CIS c)FSU-Baltics

Figures 2a, 2b and 2c. The stylized facts about the levels and dynamics of income-predicted price levels and actual price levels in non-FSU transitional countries, FSU-CIS republics and FSU-Baltics

(the first line denotes income-predicted price level and the second line denotes actual price level, both in comparison with the non-transitional countries´ average price level)

These findings are summarized in the following stilized fact about the (actual and relative) price levels and –dynamics in non-FSU transitional countries, FSU-CIS republics and FSU-Baltics (in comparison with the non-transitional countries´ average price level) during the period 1991-2000 (see Figure 3).

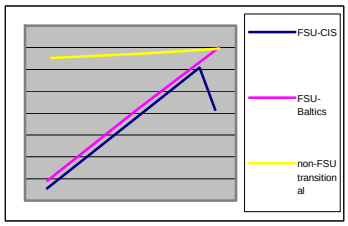



Figure 3. The stylized fact about the non-FSU transitional countries´, FSU-CIS republics´ and FSU-Baltic republics´ prices relative to the non-transitional countries´ prices 1991-2000

The results indicate that there is a very strong positive correlation (0,99) between actual and relative price levels time series (1991-2000) of FSU republics as a group. At the same time, there is strong negative correlation (-0,79 until -0,97) between actual and income-predicted price levels time series of FSU republics as a group – contrary to non-FSU transitional countries as a group whose actual and income-predicted price levels time series were strongly and positively (0,80 until 0,98) correlated.

These correlations and the FSU much higher income-predicted price level relative to its actual price level show, that the FSU income level (these domestic supply and demand side factors, that are reflected in the country´s income level – the productivity level, the productivity level in tradables´ sector relative to nontradables´ sector, sectoral demands) can not be the most important determinant of FSU actual price level during the period 1991-2000. Therefore, the main cause of FSU actual price level and -convergence have to be some combination of other domestic supply and/or demand side factor(s) (for example: the Soviet people´s cult for foreign products and assets) and arbitrage barrier(s) (for example: the costs of hunting information about FSU prices, risks and trade conditions). The more detailed determination of these causes is the main aim of further research in this field.

## 6. Conclusions

On the basis of this research the author made the following conclusions.

- The price levels of FSU republics were remarkably lower not only vis-à-vis the non-transitional economies with income levels similar to those of the FSU republics but also vis-à-vis non-FSU transitional countries in the 1990s.
- Both the actual price levels and the relative price levels (actual price levels relative to income-predicted price levels) of the non-FSU transitional countries were much more similar to the non-transitional countries´ price levels than the FSU republics´ price levels at the beginning of 1990s.
- There were three different scenarios about the levels and dynamics of actual and relative prices: a) the non-FSU transitional countries scenario; b) the scenario of the FSU republics, that belong to the CIS and c) the FSU Baltic republics scenario. The Baltic countries are similar to the rest of the FSU with the very low price levels at the beginning of 1990s and the huge speed of the following price convergence. At the same time, the Baltic countries are similar to the non-FSU transitional countries with the high price levels at the end of 1990s. The non-FSU transitional countries´ price developments were negligible compared to the FSU republics´ price developments.
- Both the actual and relative price levels of FSU republics (excl. Baltics) were ca 3 times lower compared to non-transitional countries and ca 2 times lower compared to non-FSU transitional countries in 2000, nine years after the dissolution of the Soviet Union.

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## Appendixes

### Appendix 1

**The FSU republics´ GDP deflators (π) and the changes in the FSU republics´ nominal exchange rates against US$ (Δε) for the years 1991-1996**

| | 1991/1992 | 1992/1993 | 1993/1994 | 1994/1995 | 1995/1996 |
|---|---|---|---|---|---|
| Estonia(π) | 8,370996 | 1,812855 | OK | OK | OK |
| Estonia(Δε) | 2,948428 | 1,135404 | OK | OK | OK |
| Latvia(π) | 10,76196 | OK | OK | OK | OK |
| Latvia(Δε) | 3,543267 | OK | OK | OK | OK |
| Lithuania(π) | 13,17372 | 4,104727 | OK | OK | OK |
| Lithuania(Δε) | 5,016946 | 2,103886 | OK | OK | OK |
| Russia(π) | 16,0401 | 9,783452 | OK | OK | OK |
| Russia(Δε) | 5,016897 | 4,798971 | OK | OK | OK |
| Belarus(π) | n.a. | n.a. | 20,67275 | 7,506034 | OK |
| Belarus(Δε) | n.a. | n.a. | 13,62825 | 3,144845 | OK |
| Ukraine(π) | n.a. | n.a. | 10,54199 | OK | OK |
| Ukraine(Δε) | n.a. | n.a. | 2,909091 | OK | OK |
| Moldova(π) | n.a. | n.a. | 3,801431 | 1,361966 | OK |
| Moldova(Δε) | n.a. | n.a. | 2,733333 | 1,121951 | OK |
| Georgia(π) | n.a. | n.a. | 94,49155 | 2,627401 | 1,402298 |
| Georgia(Δε) | n.a. | n.a. | 75,90341 | 1,172727 | 0,976744 |
| Armenia(π) | n.a. | n.a. | OK | OK | OK |

| | | | | | |
|---|---|---|---|---|---|
| Armenia(Δε) | n.a. | n.a. | OK | OK | OK |
| Azerbaijan(π) | n.a. | n.a. | 17,16434 | OK | OK |
| Azerbaijan(Δε) | n.a. | n.a. | 15,70544 | OK | OK |
| Kazakhstan(π) | n.a. | n.a. | 19,52302 | OK | OK |
| Kazakhstan(Δε) | n.a. | n.a. | 18,94737 | OK | OK |
| Kyrgyzstan(π) | n.a. | n.a. | 2,805759 | OK | OK |
| Kyrgyzstan(Δε) | n.a. | n.a. | 1,786885 | OK | OK |
| Tajikistan(π) | n.a. | n.a. | 3,115469 | 0,041481 | 4,976197 |
| Tajikistan(Δε) | n.a. | n.a. | 2,369892 | 0,061252 | 2,207407 |
| Turkmenistan(π) | n.a. | n.a. | 18,47291 | 8,281957 | 7,714147 |
| Turkmenistan(Δε) | n.a. | n.a. | 15,75 | 6,761905 | 9,211268 |
| Uzbekistan(π) | n.a. | n.a. | 13,29192 | OK | OK |
| Uzbekistan(Δε) | n.a. | n.a. | 11,4 | OK | OK |
| USA(π*) | 1,02434 | 1,024002 | 1,020592 | 1,0218 | 1,01908 |

Sources: EBRD (1998), IMF (1998), Odling-Smee and Pastor (2002) and the author´s notes.
n.a. − not available.

**Appendix 2**
**The average ($I_{av}$) and population-weighted average ($I_{w\text{-}av}$) income levels of the country-groups (USA = 100)**

| | 1991 | 1992 | 1993 | 1996 | 2000 |
|---|---|---|---|---|---|
| FSU ($I_{av}$) | 32,08 | 28,00 | 17,20 | 14,93 | 16,96 |
| FSU-CIS ($I_{av}$) | 36,47 | 34,56 | 15,32 | 12,89 | 14,30 |
| FSU-Baltics ($I_{av}$) | 30,62 | 25,81 | 24,72 | 23,06 | 25,81 |
| non-FSU transitional countries ($I_{av}$) | 24,84 | 22,61 | 23,09 | 22,36 | 25,29 |
| Non-transitional countries ($I_{av}$) | 28,09 | 27,83 | 27,44 | 28,28 | 28,01 |
| FSU ($I_{w\text{-}av}$) | 36,17 | 34,12 | 25,46 | 19,22 | 22,61 |
| FSU-CIS ($I_{w\text{-}av}$) | 36,47 | 34,56 | 25,48 | 19,13 | 22,55 |
| FSU-Baltics ($I_{w\text{-}av}$) | 30,34 | 25,66 | 24,74 | 22,58 | 24,82 |
| non-FSU transitional countries ($I_{w\text{-}av}$) | 8,795 | 9,305 | 10,00 | 11,16 | 11,98 |
| Asian non-FSU trans. count. ($I_{w\text{-}av}$) | 7,429 | 8,062 | 8,793 | 9,911 | 10,79 |
| European non-FSU trans. count. ($I_{w\text{-}av}$) | 26,29 | 24,92 | 25,18 | 26,19 | 25,48 |
| Non-transitional countries ($I_{w\text{-}av}$) | 27,72 | 27,49 | 27,24 | 27,14 | 26,55 |

Source: Author´s calculations based on Penn World Table Version 6.1.

**Essay No: 2**

**The possibility of the Balassa-Samuelson effect between Estonia and Germany**

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**Abstract**

The paper discusses the possibility of the Balassa-Samuelson effect between a small Baltic republic of Estonia and industrial Germany during the 1990s. The basic idea of the paper is that the Balassa-Samuelson effect can not be an important determinant of Estonian relative inflation before 1997. The findings of this paper suggest that the Balassa-Samuelson effect was not the dominant cause of Estonian relative inflation in 1995-1996 and that it was entirely impossible in 1991-1994. The author finds out the series of Estonian relative productivities and prices (including the less investigated years 1991-1992), compares these series and derives from this comparison the amounts of Estonian relative inflation that can have been caused by Estonian relative productivity growth.

## 1. Introduction

The price levels in the former Soviet Union (FSU, including the three Baltic States) vis-à-vis the remaining world were very low in the early 1990s. The phenomenon of the following very high relative inflation (real exchange rate appreciation) in the Baltic states (including Estonia) vis-à-vis the remaining (non-FSU) world during the 1990s is explained by the relative productivity growth in these countries. There is very little debate about the problem that the large productivity growth did not emerge in Estonia before 1997 when the fast price convergence was already over.

The aim of this paper is to show quantitatively year by year how much of Estonian inflation (relative to Germany) can have been caused by the Estonian productivity growth (relative to Germany). This paper focuses on the quantitative assessment of the difference between the Estonian relative inflation and productivity growth, and compares the results with the theoretical predictions of the Balassa-Samuelson model. Unlike the previous studies, we estimate also the years 1991-1992 taking into account the nominal exchange rate and GDP calculation difficulties. The results indicate that the Estonian relative productivities and the Estonian relative price level moved in opposite directions until 1994, which is clearly inconsistent with the Balassa-Samuelson predictions. Furthermore, the Estonian relative productivity growth was

many times smaller than the Estonian relative inflation even during the years 1995-1996.

This paper is organized as follows. After this introduction, the second part gives the motivation and the third part an overview about the existing investigations on the Balassa-Samuelson effect in the Baltic States. The fourth part presents the data, the fifth part is devoted to the 1991-1992 data calculation and the sixth part to the methodology and results. The seventh part is the concluding one.

## 2. Motivation

The period 1991-2000 was an extremely interesting era in the former Soviet Union (including the Baltic States). During the first part of the 1990s − just after liberalization and opening of the former socialist planned economy − there were ridiculously low price levels in the Baltic States and other FSU countries. The purchasing power of foreign currencies was unprecedentedly high both in the FSU consumer goods and services (CPI components) and in the FSU assets, resources and materials (GDP components). Though, some resources were relatively cheaper than others: for example, the prices of real estate and labour force wages, which formed less than 1% in comparison with their Western analogs. The FSU countries´ price levels were many times lower also in comparison with the other (non-FSU) transitional countries. The following huge price rise in the former Soviet countries during the 1990s, especially fast in the Baltic States, was unprecedented as well.

This whole period has not been previosly quantitatively studied (the early 1990s were always excluded from the investigated period) due to the lack of official data and the difficulties in connecting the (very dynamic) first part of the 1990s with the (much steadier) second part of the 1990s. As a result, we use a very simple arithmetic analysis as an alternative to the traditional sophisticated panel and time series econometrics. The main contribution of the present paper is that it proves for the first time numerically the previously hinted hypothesis that the Balassa-Samuelson effect could not drive Estonian real exchange rate appreciation during the first half of the 1990s (1991-1996). The second contribution is that we calculated the relative GDP price levels of the small Baltic State of Estonia for 1991 and 1992.

## 3. The literature overview

There is an urgent necessity to distinguish the Baltic States from the other FSU and non-FSU transition economies due to their different scenarios about the price levels and dynamics. The Baltic States are similar to the rest of the FSU in the very low price levels at the beginning of the 1990s and the huge speed of the following price convergence. At the same time, the Baltic countries are similar to the non-FSU transitional countries in the high price levels at the end of the 1990s (Raim (2005)).

There is a growing amount of literature that analyzes the Balassa-Samuelson effect in the Baltic States (including Estonia) during the 1990s. The results are contradictory. Some (De Broeck-Slok (2001), Rother (2000)) report no clear evidence of a Balassa-Samuelson effect in Estonia during the 1990s, while some (Egert-Drine-Lommatzsch-Rault (2003)) argue that the contribution of the Balassa-Samuelson effect to inflation differential against Germany ranges from 0.3 to 0.5% between 1995 and 2000. Sinn-Reutter (2001) reports even that the inflation resulting from the

Balassa-Samuelson effect was on average 4.06% between 1994 and 1998. Though, generally the Balassa-Samuelson effect on the inflation differential is the stronger, the later is the estimated period. All existing studies ignore the early 1990s (years before 1993 are excluded from the estimated period).

There is no systematic difference in accordance with the employed estimation method. Begg-Halpern-Wyplosz (1999), Rother (2000), De Broeck-Slok (2001), Dobrinsky (2001), Coricelli-Jazbec (2001), Halpern-Wyplosz (2001), Sinn-Reutter (2001), Egert-Drine-Lommatzsch-Rault (2003) and Egert (2005) employed panel econometric estimations, while Filipozzi (2000), Lommatzsch-Tober (2002) and Randveer-Rell (2002) employed time series econometrics. The classification of economic activities (sectors) as open and closed is indifferent also: most studies include only industry to the open sector (Rother (2000), Filipozzi (2000), Halpern-Wyplosz (2001), Fischer (2002) and Lommatzsch-Tober (2002)) but some include industry+agriculture (Egert-Drine-Lommatzsch-Rault (2003), Randveer-Rell (2002) and Sinn-Reutter (2001)) and some even industry+construction (Coricelli-Jazbec (2001) and De Broeck-Slok (2001)). Therefore, the investigated period (the middle 1990s or the end of the 1990s) matters much more than the choice of the research method or sector classification.

## 4. Data

The main data source of the present study is the Penn World Table (2002) (Version 6.1) as an expanded set of international comparisons. The Estonian numbers of employees by economic activity are from ILO Yearbook of Labour Statistics 2001 and the German numbers of employees by economic activity are from ILO Yearbook of Labour Statistics 2004. Germanys 1991-2000 Gross Domestic Product (in constant prices) by economic activity is from Quarterly National Accounts (2001). The Estonian 1993-2000 GDP at constant prices by economic activity is from Gross Domestic Product of Estonia (2002). The Estonian 1992-1993 and 1991-1992 GDPs at constant prices by economic activity are from National Accounts in Estonia 1994 and National Accounts in Estonia 1992, respectively. The Estonian and German GDP and price changes for the years 1991-1993 are from International Financial Statistics October 1997. The ruble/DEM nominal exchange rates for the period January 1991 – June 1992 are from Bank of Estonia. The GDP price level is used as an indicator of national price level.

## 5. The calculation of the GDP and price data for the years 1991 and 1992

Unlike the existing studies the author of this paper estimates the whole first transitional decade (1990s), that is including the years 1991-1992. This raises a question of data reliability. Unfortunately, no official data on the Estonian GDP per capita PPP-adjusted and price level relative to Germany were available for the years 1991 and 1992. Furthermore, there were no official data even on yearly average Estonia/Germany nominal exchange rates for the years 1991 and 1992. These, however, are indispensable for calculating the Estonian 1991-1992 price levels relative to Germany. Therefore, the yearly average Estonia/Germany nominal exchange rates for 1991 and 1992 were calculated by the author as simple arithmetic means of the single ruble/DEM (1 ruble in DEMs) exchange rates at the end of all 12

months. This method is more conservative than using the DEM/ruble (1 DEM in rubles) exchange rates, because it gives higher weight to the stronger ruble at the beginning of the years and therefore increases the Estonian nominal exchange rate depreciation in 1992/1993 and 1991/1992 (see Table 1).

Table 1
The Estonian currency nominal exchange rate against DEM 1991-1993

| | 1 DEM in Estonian currency units | 1 Estonian currency unit in DEMs |
|---|---|---|
| 31.01.91 | 15.00 (1 DEM in rubles) | 0.06667 (1 ruble in DEMs) |
| 28.02.91 | 15.00 | 0.06667 |
| 20.03.91 | 15.54 | 0.06435 |
| 24.04.91 | 17.05 | 0.05865 |
| 29.05.91 | 17.99 | 0.05559 |
| 26.06.91 | 17.08 | 0.05855 |
| 31.07.91 | 16.39 | 0.06101 |
| 28.08.91 | 16.89 | 0.05921 |
| 02.10.91 | 20.35 | 0.04914 |
| 30.10.91 | 25.89 | 0.03862 |
| 27.11.91 | 41.01 | 0.02438 |
| 18.12.91 | 60.60 | 0.01650 |
| 1991 average | 23.23 (1 ruble = 0.04304 DEM) | 0.05161 (1 DEM = 19.38 rubles) |
| 29.01.92 | 75.71 | 0.01321 |
| 26.02.92 | 57.31 | 0.01745 |
| 25.03.92 | 66.76 | 0.01498 |
| 29.04.92 | 69.15 | 0.01446 |
| 27.05.92 | 65.49 | 0.01527 |
| 17.06.92 | 73.01 | 0.01370 |
| 31.07.92 | 8.000 (1 DEM in EEKs, 1 EEK = 10 rubles) | 0.12500 (1 EEK in DEMs, 1 ruble = 0.1 EEK) |
| 31.08.92 | 8.000 | 0.12500 |
| 30.09.92 | 8.000 | 0.12500 |
| 31.10.92 | 8.000 | 0.12500 |
| 30.11.92 | 8.000 | 0.12500 |
| 31.12.92 | 8.000 | 0.12500 |
| 1992 average | 73.95 (1 ruble = 0.01352 DEM) | 0.01367 (1 DEM = 73.14 rubles) |
| Throughout 1993 | 8.000 (1 EEK = 0.12500 DEM) | 0.12500 (1 DEM = 8 EEK) |

Source: Bank of Estonia.
Bank of Estonia started to quote foreign currencies from March 12, 1991. For January and February 1991 the black market exchange rate (obtained from buying and selling advertisements in the Estonian weekly newspaper *Eesti Ekspress*) is presented.

During the Estonian monetary reform (June 20, 1992) the ruble was replaced by the Estonian kroon. With the Estonian monetary reform, the nominal exchange rate of the Estonian kroon was pegged to the DEM in a currency board system so that there was continuity with the nominal exchange rate of the ruble (1 EEK = 10 rubles, 1 DEM = 8 EEK). The exchange rate 1 DEM = 8 EEK has stayed unchanged from June 20, 1992 until today.

After calculating the 1991-1993 nominal exchange rates the missing 1991 and 1992 price levels of Estonia were calculated as follows (Equation 1).

$$P_{n-1} = \frac{P_n \cdot \Delta\varepsilon \cdot \pi^*}{\pi} \quad (1)$$

where $P_n$ is the Estonian price level (relative to Germany), $P_{n-1}$ is the Estonian price level of the previous year, $\Delta\varepsilon$ denotes the change in the nominal exchange rate of Estonian currency vis-à-vis DEM, $\pi$ is the Estonian GDP deflator relative to the previous year and $\pi^*$ is the German GDP deflator relative to the previous year.

The Estonian 1991 and 1992 GDPs per capita PPP-adjusted relative to Germany are calculated as follows (Equation 2).

$$I_{n-1} = \frac{I_n \cdot \Delta p \cdot G^*}{G \cdot \Delta p^*} \quad (2)$$

where $I_n$ is the Estonian GDP per capita PPP-adjusted (relative to Germany), $I_{n-1}$ is the Estonian GDP per capita PPP-adjusted of the previous year, $\Delta p$ denotes the change in the Estonian population, $\Delta p^*$ denotes the change in the German population, G is the Estonian GDP growth at constant prices and G* is the German GDP growth at constant prices.

## 6. Methodology and results

The methodology used in this study is partly similar to the previous studies analyzing a Balassa-Samuelson relationship between productivity and price levels. As often in the estimation of the Balassa-Samuelson effect, we employ: a) GDP per capita PPP-adjusted relative to the reference country (trading partner(s)) (for example Szapary (2000)); b) GDP per employee PPP-adjusted relative to the reference country (trading partner(s)) (for example Dobrinsky (2001)) and c) GDP per employee in the open (tradable) sector devided by GDP per employee in the closed (nontradable) sector relative to the trading partner(s) (for example Egert (2005) and many others) as proxies for productivity. As many other studies (for example Filipozzi (2000), Lommatzsch-Tober (2002) and Randveer-Rell (2002)) we calculate the time series and classify the sectors as open and closed.

However, there are also some important differences. Unlike the previous studies, we estimate the whole decade 1991-2000, for which we focus on very simple arithmetic comparison instead of the traditional sophisticated econometrics. Unlike the previous studies, we employ all the alternative productivity proxies (GDP per capita, GDP per employee and GDP in tradables divided by GDP in nontradables) simultaneously. Differently from most studies (with the only exception of Egert (2005)), we employ all possible (agriculture, industry, construction and services) sectors´ divisions between open and closed sectors. Like Egert (2005) we conclude that the uncertainty surrounding agriculture and construction indicates that they might be borderline cases producing tradable goods with higher non-tradable component and therefore they can belong to both open or closed sectors or can even be excluded. Last but not least, the aim of the present study is also different: we want to assess the general possibility of the Balassa-Samuelson effect between Estonia and Germany at the very beginning, in the middle and at the end of the 1990s instead of the exact quantification of its actual impact. Germany was selected as the reference country

because of the close relationships between the two countries (pegged currencies and intensive trade relations).

**a) GDP per capita PPP-adjusted and price level**

The Estonian GDPs per capita PPP-adjusted and price levels are presented in Table 2.

Table 2

The Estonian GDP per capita PPP-adjusted relative to Germany (I; %) and the Estonian price level relative to Germany (P; %) 1991-2000

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| I | 40.74 | 35.69 | 33.87 | 33.01 | 34.27 | 35.55 | 39.40 | 41.11 | 42.49 | 45.47 |
| P | 3.97 | 8.17 | 13.19 | 17.95 | 23.20 | 28.67 | 31.98 | 34.36 | 34.12 | 33.67 |

Sources: Penn World Table (2002) (Version 6.1). 1991-1992 data are from author´s calculations based on International Financial Statistics October 1997 (real GDP and price changes), Penn World Table (2002) (Version 6.1) (German 1991-1993 and Estonian 1992-1993 populations), National Accounts in Estonia 1992 (Estonian 1991 population) and Bank of Estonia (Estonian currency´ s 1991-1993 nominal exchange rates against DEM).

As we can see from Table 2, the most intense 352% price increases in 1991-1994 occurred during the 19.0% productivity *decreases*. The following less intense 60% price increases in 1994-1996 were accompanied by only 7.7% productivity increases. Only the least intense 20% price increases in 1996-1998 took place during the productivity increases of comparable size (15.6%). The large part of the productivity growth (10.6%) emerged during the years 1998-2000 when the price convergence had already stopped.

**b) GDP per employee PPP-adjusted and price level**

The Estonian GDPs per employee PPP-adjusted relative to Germany were calculated as follows (Equation 3).

$$Y = \frac{I \cdot w^* \cdot p}{w \cdot p^*} \tag{3}$$

where Y is the Estonian GDP per employee PPP-adjusted relative to Germany, I the Estonian GDP per capita PPP-adjusted relative to Germany, p the Estonian population, p* the German population, w the number of employees in Estonia and w* the number of employees in Germany.

The Estonian GDPs per employee PPP-adjusted obtained as a result of the above calculations and the Estonian price levels are presented in Table 3.

Table 3

The Estonian GDP per employee PPP-adjusted relative to Germany (Y; %) and the Estonian price level relative to Germany (P; %) 1991-2000

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Y | 36.97 | 32.99 | 32.52 | 31.65 | 34.22 | 35.45 | 38.10 | 39.71 | 42.83 | 45.87 |
| P | 3.97 | 8.17 | 13.19 | 17.95 | 23.20 | 28.67 | 31.98 | 34.36 | 34.12 | 33.67 |

Sources: GDPs per employee are from author´s calculations based on Penn World Table (2002) (GDPs per capita, German 1991-2000 and Estonian 1992-2000 populations), National Accounts in Estonia 1992 (Estonian 1991 population), ILO Yearbook of Labour Statistics 2001 (Estonian numbers of employees) and ILO Yearbook of Labour Statistics 2004 (German numbers of employees). Price levels are from Table 2.

As we can see from Table 3, the most intense 352% price increases in 1991-1994 also occurred during the 14.4% productivity *decreases*. The following less intense 60% price increases in 1994-1996 were accompanied by only 12.0% productivity increases. Only the least intense 20% price increases in 1996-1998 took place during the productivity increases of comparable size (12.0%). The most intense GDP per employee growth (15.5%) emerged during the years 1998-2000 when the price convergence had already stopped.

**c) GDP per employee in the open sector divided by the GDP per employee in the closed sector and price level**

We use nine different classifications of basic economic sectors (agriculture, industry, construction and services) as open and closed (see Table 4).

Table 4
Classification of sectors as open and closed

| No. | Open sector | Closed sector |
|---|---|---|
| 1 | Agriculture+industry+construction | Services |
| 2 | Agriculture+industry | Services; excl. construction |
| 3 | Industry+construction | Services; excl. agriculture |
| 4 | Industry | Services; excl. agriculture and construction |
| 5 | Agriculture+industry | Construction+services |
| 6 | Industry+construction | Agriculture+services |
| 7 | Industry | Agriculture+services; excl. construction |
| 8 | Industry | Construction+services; excl. agriculture |
| 9 | Industry | Agriculture+construction+services |

Using these classifications we can calculate the Estonian 1991-2000 productivities as follows (Equation 4).

$$Q = \frac{y_t \cdot w_n \cdot w_t{}^* \cdot y_n{}^* \cdot w_{t\,2000} \cdot y_{n2000} \cdot y_{t\,2000}{}^* \cdot w_{n\,2000}{}^*}{w_t \cdot y_n \cdot y_t{}^* \cdot w_n{}^* \cdot y_{t2000} \cdot w_{n2000} \cdot w_{t2000}{}^* \cdot y_{n2000}{}^*} \cdot 100 \qquad (4)$$

where Q is the Estonian relative productivity (2000 = 100), $y_t$ the Estonian real GDP (at constant prices) in the open sector, $w_t$ the Estonian number of employees in the open sector, $y_n$ the Estonian real GDP in the closed sector, $w_n$ the Estonian number of employees in the closed sector, $y_t$* the German real GDP (at constant prices) in the open sector, $w_t$* the German number of employees in the open sector, $y_n$* the German real GDP in the closed sector, $w_n$* the German number of employees in the closed sector, $y_{t2000}$ the Estonian real GDP in the open sector in 2000, $w_{t2000}$ the Estonian number of employees in the open sector in 2000, $y_{n2000}$ the Estonian real GDP in the closed sector in 2000, $w_{n2000}$ the Estonian number of employees in the closed sector in 2000, $y_{t2000}$* the German real GDP in the open sector in 2000, $w_{t2000}$* the German number of employees in the open sector in 2000, $y_{n2000}$* the German real GDP in the closed sector in 2000 and $w_{n2000}$* the German number of employees in the closed sector in 2000.

Table 5 presents the Estonian relative productivities (2000 = 100) obtained as a result of these calculations and the Estonian price levels (2000 = 100).

Table 5

The Estonian relative productivities ($Q_n$; 2000=100) and the Estonian price level relative to Germany (P; 2000=100) 1991-2000

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Q1 | 125.9 | 87.0 | 84.8 | 86.9 | 96.3 | 96.2 | 97.5 | 98.1 | 99.0 | 100 |
| Q2 | 142.7 | 103.7 | 96.0 | 96.7 | 98.0 | 95.8 | 101.5 | 99.5 | 100.7 | 100 |
| Q3 | 154.2 | 102.2 | 95.7 | 95.9 | 97.0 | 97.7 | 98.6 | 100.1 | 99.2 | 100 |
| Q4 | 186.8 | 131.4 | 114.2 | 111.5 | 98.3 | 97.0 | 103.8 | 101.8 | 101.1 | 100 |
| Q5 | 148.2 | 114.7 | 102.1 | 101.5 | 97.4 | 94.8 | 103.1 | 100.2 | 101.2 | 100 |
| Q6 | 177.8 | 119.7 | 107.8 | 104.6 | 99.0 | 100.0 | 100.1 | 101.6 | 99.8 | 100 |
| Q7 | 215.4 | 153.9 | 128.6 | 121.6 | 100.3 | 99.2 | 105.3 | 103.4 | 101.7 | 100 |
| Q8 | 194.1 | 145.3 | 121.4 | 116.9 | 97.6 | 96.0 | 105.4 | 102.5 | 101.7 | 100 |
| Q9 | 218.7 | 165.1 | 134.2 | 126.0 | 99.7 | 98.1 | 106.7 | 103.8 | 102.2 | 100 |
| *Qav* | *173.8* | *124.8* | *109.4* | *106.8* | *98.2* | *97.2* | *102.5* | *101.2* | *100.7* | *100* |
| P | 11.8 | 24.3 | 39.2 | 53.3 | 68.9 | 85.2 | 95.0 | 102.1 | 101.3 | 100 |

Sources: Relative productivities are from author´s calculations based on Quarterly National Accounts (2001) (German 1991-2000 real GDPs by economic sector), Gross Domestic Product of Estonia (2002) (Estonian real 1993-2000 GDPs by economic sector), National Accounts in Estonia 1994 (Estonian real 1992-1993 GDPs by economic sector), National Accounts in Estonia 1992 (Estonian real 1991-1992 GDPs by economic sector), ILO Yearbook of Labour Statistics 2001 (Estonian numbers of employees by economic sector) and ILO Yearbook of Labour Statistics 2004 (German numbers of employees by economic sector). Price levels are from Table 2.

As we can see from Table 5 the Estonian average relative productivity decreased continuously until 1996, increased significantly during the period 1996-1997 and decreased slightly again during the period 1997-2000. Only the productivities Q1, Q2 and Q3 showed insignificant increases in 1993-1994 (respectively 2.5%, 0.8% and 0.2%), and only Q1 and Q3 in 1994-1996 (respectively 10.8% and 1.9%).

According to the Balassa-Samuelson model (see for example Asea-Gorden (1994)), the decreasing productivity (proxied either by GDP per capita, GDP per employee or GDP per employee in the open sector) can theoretically not produce a positive inflation differential. Furthermore, even the slightly increasing relative productivity cannot produce an inflation differential that is much larger than the relative productivity increases themselves (in percentages). The effect of relative productivity on inflation differential is empirically found to be smaller than one (for example Alexius-Nilsson (1997), Chinn-Johnston (1997) and Cipriani (2000)). The huge price increases in 1991-1996 could not be caused even by the lagged productivity increases, because the Estonian GDP growth was smaller relative to the industrial countries´ GDP growth during the 1980s as well (see for example Cernat-Vranceanu (2002) and National Accounts in Estonia 1992, p.127).

The results confirm Egert´s (2005) hypothesis that whereas during high inflation periods the Balassa-Samuelson effect cannot drive real exchange rate appreciation, it can be a strong candidate when inflation is brought down to low one-digit territories coupled with fixed nominal exchange rates.

## 7. Conclusions

On the basis of this reseach the author made the following conclusions:

- The Balassa-Samuelson effect cannot explain the Estonian real appreciation during the years of quick price increases (1991-1994).
- The Balassa-Samuelson effect cannot be the important determinant of the Estonian real appreciation during the years of average price increases (1994-1996).

- The Estonia price level was only 4% relative to Germany at the beginning of the 1990s.

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**Essay No: 3**

**The improvements of the existing system of the concepts about PPP deviations − derived from the Estonian experience**

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**Abstract**

The huge price differences between the former Soviet Union (FSU) and remaining world emerged at the beginning of 1990s. This phenomenon of hundredfold relative purchasing power of foreign currencies in the republics of FSU is not systematically explained by the traditional system of the Purchasing Power Parity (PPP) deviations´ causes – by monetary, real demand side and real supply side shocks. In this context, the paper examines the traditional causes of price differences and derives the improved system of the PPP deviations´ causes. We show that both the basic causes of PPP deviations are determined by potential investors´ imagination about the usefulness of the countries´ assets.

## 1. Introduction

One of the central issues facing all former Soviet Union (FSU) republics at the beginning of 1990s was the huge deviation from the PPP. The consumer prices, wages and real estate prices in the FSU formed only ca 1 % in comparison with the developed countries (1 UScent purchasing power in FSU = 1US$ purchasing power abroad). During the period 1992-2001 the fast price convergence emerged between the FSU and remaining world. The concrete amount of this convergence was different in different republics of FSU – but the rise of consumer prices, wages and real estate prices was at least tenfold almost everywhere. The phenomenon of so high purchasing power of foreign currencies and the following collapse is unprecedented (also in the remaining transitional countries) and hard to explain.

The phenomenon of foreign currencies' huge purchasing power in the FSU is not explainable with the traditional system of the PPP deviations' causes – with monetary, real demand side and real supply side shocks. The especially hard problem for the traditional approaches of PPP deviations emerged in a small former Soviet republic Estonia, where the prices, foreign trade and investments were liberalized very early – and the nominal exchange rate of domestic currency has been almost constant already from the end of 1991. An important issue is what was the cause of hundredfold price differences between this small republic and developed countries.

In this context, the purpose of this article is to improve the existing system of the PPP deviations´ causes. The article examines the traditional causes of price differences and derives the improved system of the concepts about PPP deviations. We show that both the basic causes of PPP deviations are determined by potential investors´ imagination about the usefulness of the countries' assets (perceived business climate).

The organization of the paper is as follows. In the following Section 2, we describe the PPP and the existing system of the causes of PPP deviations. Section 3 shows that the phenomenon of price differences between Estonia (as one fastly liberalized small republic of the former Soviet Union) and developed countries is not explainable in the traditional theoretical framework. Section 4 presents the new classification of the causes of PPP deviations. In the Section 5, the conception of perceived business climate (the shift from productivity to image as the main explanatory factor of PPP deviations between countries) is developed and explained. The paper concludes in Section 6.

## 2. The PPP and the causes of PPP deviations

The PPP concept argues, that once converted to a common currency, national price levels should be equal.

$$E_{ij} = \frac{P_i}{P_j} \tag{1}$$

where
Eij – the exchange rate between the currency of country i and the currency of country j (or the price of j country`s currency unit in the i country`s currency;
Pi – the price level of country i (in local currency);
Pj – the price level of country j (in local currency).

PPP was first articulated by scholars of the Salamanca school in sixteenth century Spain (Officer, 1982). Though purchasing power parity had been discussed previously by classical economists such as J.S.Mill, V.Goschen, A.Marshall and L.v.Mises (Rogoff, 1996) – Swedish economist Gustav Cassel was really the first to treat PPP as a practical empirical theory. In a series of influential articles published in 1921-1922 Cassel promoted the use of PPP as a best means for setting relative gold parities (MacDonald et al., 2001).

Nowadays, there are several variants of PPP, used in accordance with the concrete aim.

PPP variants:

- The Law of One Price (LOP). LOP states, that the same good should sell for the same price in different countries (once prices are converted to a common currency).
- Absolute PPP. Absolute PPP is the LOP for the broader basket of goods. Frequently there is a need for broader measure of prices, when you want to investigate the price differences between different countries.
- Relative PPP. Relative PPP is the reduced form of absolute PPP. It states, that the price changes of the same basket of goods must be the same in different countries. Consequently: the nominal exchange rate between two countries will adjust exactly by the amount of the inflation differential between two countries (Rogoff, 1996).

Though the empirical investigations confirm the relationship between the prices and the nominal exchange rate in a very long run (Rogoff, 1996), the prices of most goods are not equal in different countries. During the 20th century the economists have postulated the main causes of PPP deviations (the causes of price differences).

Nowadays, there are two major approaches in this field – the sticky-price view and the equilibrium view. The first stresses on the importance of the nominal exchange rate fluctuations in the conditions of (especially in the short run) sticky prices, consequently monetary shocks. The second stresses the real economical shocks.

The real shocks themselves are devided as demand side and supply side shocks. The demand side shocks are (for example) the demand shift from tradables to nontradables, the country`s incomes growth and the growth of government expenditures. The supply side shocks are changes in technologies, changes in relative productivities and changes in material production factors. Some shocks (for example formal and informal trade barriers) are classified in accordance with their predicted impact both under demand shocks and under supply shocks.

Such classification of the causes of price differences – monetary shocks, demand shocks and supply shocks – is the basis of existing empirical research also.

The majority of researches (De Gregorio et al., 1994; Clarida et al., 1995; Rogers, 1995; Weber, 1997; Carstensen et al., 1997; Bjornland, 1998; Cheung, 2000; Akram, 2002) treats the concrete causes of price differences just as the representative of the entire class of shocks – for example the Balassa-Samuelson effect as the representative of supply side shocks, the growth of country`s income as the representative of demand side shocks and so on.

Though, some researches (Faruqee, 1995; Coorey et al., 1996; Rose et al., 2001) concentrate on the sole cause of price differences also, without the wish the generalize the results to the entire class of shocks.

There are literally houndreds of hypotheses and the hypotheses´ components derived on the purpose to explain the price differences between countries. As

following, the author of the present article is exhibited the most influential ones – the ones, that are found most notation and empirical improvement (among them in transitional countries).

**The traditional causes of PPP deviations:**

1. Real causes

*Transportation costs and custom barriers*

There are plenty of researches about their impact on price differences (Frenkel, 1981; Backus et al., 1993; Engel et al., 1994; Froot et al., 1995; Goldberg et al., 1997; Obstfeld et al., 1997; Rogoff et al., 2000), among them on the basis of transitional countries (Kaminski et al., 1995; Landesmann, 1995; Kaminski, 1996).

The transportation costs and custom barriers can be classified both under supply side factors and demand side factors – depended on the exact aim on the concrete research.

1.1 Supply side causes

*Balassa-Samuelson effect*

The Balassa-Samuelson effect[6] (says that the productivity growth in tradables sector increases the country`s price level) has found most interest and research – more than any other possible cause of price differences (Hsieh, 1982; De Gregorio et al., 1993; De Gregorio et al., 1994; Alexius et al., 1997; Chinn et al., 1997; Pfadt, et al., 1997; Alexius, 1999; Inflation..., 1999; Begum, 2000; MacDonald et al., 2001).

The Balassa-Samuelson effect is intensively investigated in the transitional countries also (Richards et al., 1995; Halpern et al., 1996; Coorey et al., 1996; Halpern et al., 1997; Krajnyak et al., 1998; Maliszewska, 1998; Jakab et al., 1999; Capriani, 2000; Fidrmuc et al., 2000; Rother, 2000; De Broeck et al., 2001; Halpern et al., 2001; Jazbec, 2001; Randveer, 2001).

1.2 Demand side causes

*The income differences*

The differences in countries incomes as the possible cause of the differences in countries prices is heavily investigated (Kravis et al., 1983; Bhagwati, 1984; Hansson et al., 1990; Heliwell, 1990; Bergstrand, 1991; De Gregorio et al., 1994; Rogoff, 1996; Chinn et al., 1997; Alexius, 1999; European..., 2000; De Broeck et al., 2001), among them on the basis of transitional countries` experience (Richards et al., 1995; Sepp, 1996; IMF, 2000; Randveer, 2000; De Broeck et al., 2001).

[6] From the standpoint of the Balassa-Samuelson effect there is urgent need to distinguish not only the spatially tradable and nontradable goods – but also temporally tradable and nontradable goods. The increasing productivity in the spatially traded goods´ sector must influence the price of temporally tradables much more quickly (with much smaller lag) than the price of temporally nontradables (the prices of spatially traded goods are anyway paritetic). It is so, because the price of temporally traded goods must better react to its predicted (by the Balassa-Samuelson mechanism) future price rise.

2. Monetary causes

*The changes in the nominal exchange rates*
The effect of the changes in the nominal exchange rates on price differences is researched deeply (Dornbush, 1976; Manzur, 1991; Lastrapes, 1992; Clarida et al., 1995; Rogers, 1995; Rogoff, 1996; Papell, 1998; Asplund et al., 2001; Rogoff et al., 2001), among them on the basis of transitional experience (Coorey et al., 1996; Halpern et al., 1997; Grubacic, 2000).

During the recent years, the economists have shown special interest in the causes of price differences between transitional countries (among them former Soviet republics) and developed economies. The following mechanisms, that can explain the very low price level of transitional countries, have worked out. These mechanisms do not always belong to one concrete class of shocks – they are rather the combination of different (supply side, demand side, monetary) shocks, which all amplify each other.

**The causes of PPP deviations specific to the transitional countries:**

*The cost-recovery hypothesis*
The cost-recovery hypothesis (Zavoico, 1995) argues that the convergence of certain capital-intensive service prices (housing, utilities, transportation) can take place gradually. These services are distinguished by a capital stock that not only was inherited, with no associated debt, from the pre-transition era, but also is large relative to the PPP-adjusted per capita income of these countries. Initially, when consumer wage levels are low, such service prices would be set to cover only current costs. Maintenance costs may not be covered because it is optimal initially to consume the excessively large stock. As incomes rise and the capital stock that can be supported by these incomes also rises, the prices of these services would be raised, at first to cover the maintenance costs and then to cover (future) capital costs, until they reach a level at which new investments can take place (Coorey et al., 1996).

The cost-recovery belongs to the class of real causes of price differences – it is the combination of demand side and supply side shocks.

The cost-recovery hypothesis has found also empirical verification (Coorey at al., 1996).

*The hypothesis of temporary distortions in asset markets*
The hypothesis of temporary distortions in asset markets argues that the nominal exchange rate of transitional countries´ currencies can be affected by the temporary distortions in asset markets (Coorey et al., 1996). The distortions in asset markets will occur (in transitional countries) if the long-repressed pent-up demand for foreign assets (previously reflected in the black market premium) faces a negligible supply or if the freeing of prices in the presence of a monetary overhang (met by a sudden burst of inflation) creates the flight from domestic currency (Halpern at al., 1996). For instance, with negative real interest rates on bank deposits and no other liquid inflation hedges, foreign exchange can become the most important form of liquid wealth holding and can drive the exchange rate far from its PPP level (Coorey et al., 1996). The distortions in asset markets are amplified by the fact, that the demand for foreign assets was extremely unsatisfied in the Soviet Union – import goods were not only the substitutes of domestic goods but also cult objects (Raim, 2001a).

The temporary distortions in asset markets are the combination of monetary, demand side and supply side shocks.

There are no empirical investigations of the hypothesis of temporary distortions in asset markets.

In addition to the two mentioned mechanisms of price differences, the author of present article exhibits also the third possible mechanism.

**The capital-information mismatch hypothesis**

The capital-information mismatch hypothesis argues that there was systematic mismatch between capital and information owners in the transitional countries – especially in the republics of the (former) Soviet Union. Due to the long-term isolation of transitional countries, the (potential) foreign investors lacked information about transitional countries´ products, prices, trade conditions and risks – and domestic entrepreneurs lacked capital. As a result, there was no demand for products and production factors in transitional countries in spite of their very low prices (Raim, 1999).

This situation was amplified by the problem of asymmetrical information (Akerlof, 1970). It was extremely hard for local entrepreneurs to deliver their business information backage to the potential foreign investors, because this information was so multidimensional and complex. Due to this complexity the potential investors were not convinced in the local information´s rightness without the real experience in local business (Raim, 2001a).

The capital-information mismatch belongs to the class of real demand side causes of price differences.

There are no empirical investigations of the capital-information mismatch hypothesis.

## 3. How to explain the price differences and price convergence between Estonia and the European Union during the 1990-s?

If there has ever been in the world the persuasive example of both monetary, demand side and supply side shocks´ powerless in explaining the PPP deviations, then it is just the case of (former) Soviet Union republics during the 1990s. Even the most superficial studies reveal, that the above-mentioned shocks were too weak to explain the huge price differences[7] (and the following price convergence) between the former Soviet Union republics and the developed economies.

The especially hard problem for the traditional approaches of PPP deviations emerged in Estonia, where the prices, foreign trade and investments were liberalized

[7] The Estonian consumer price level and average wage level were at the end of 1991 respectively 1.5% and 0.5% in comparison with the European Union´s corresponding indicators – and the price of apartments in Tallinn (the capital city of Estonia) was 1.5% in comparison with the Helsinki´s (the capital city of Finland) corresponding indicator (Raim et al., 2001). The situation was quite similar in the remaining territory of former Soviet Union: the relative price levels were there (e.g. in Latvia and Lithuania) even a bit lower (Raim, 2001b).

During the years from 1992 to 2001 both the Estonian relative consumer price level and relative wage level increased more than 30 times – the relative price level of Tallinn´s apartments increased 15 times (Raim et al., 2001). The concrete amount of this relative price rise was different in different republics of FSU, but the price rise was at least tenfold almost everywhere (Raim, 2001b).

very early – and the nominal exchange rate of domestic currency has been almost the same already from the end of 1991[8] (see Table 1).

Table 1. Estonian consumer prices, average monthly wages and real estate prices relative to European Union (at the end of the year)

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Consumer price level (%) | 1,5 | 15 | 20 | 28 | 35 | 39 | 43 | 45 | 47 | 48 | 49 |
| Wage level (%) | 0,5 | 3 | 4 | 8 | 10 | 12 | 14 | 15 | 16 | 17 | 18 |
| Real estate price level (%) | 1,5 | 3 | 7 | 10 | 13 | 14 | 15 | 16 | 15 | 17 | 22 |

Sources: Author´s own calculations based on Eurostat data; Statistical Office of Estonia data; Bank of Estonia data; Bank of Finland data; Egert, 2003; Raim et al., 2001; Eesti Statika, 2003; Hinnainfo, 1992.

Note: The price of real estate refers to apartments in Tallinn (the capital city of Estonia) relative to Helsinki (the capital city of Finland); in satisfactory condition: inhabitable, partly in disrepair, no changes to the subdivision, no improvements to the building made, area ca 50m².

During the first half of 1990s, Estonia was surely one of the most economically liberal countries in the world – nevertheless there was ca 5 times convergence of consumer prices between Estonia and the European Union (during the period from June 1992 to December 1995) in conditions with the Estonian relative labour productivities´ (as the traditional representative of supply side shocks) and incomes´ (as the traditional representative of demand side shocks) *decrease* in comparison with the European Union (Raim, 2001a) (see Figure 1). Therefore, the actual price convergence was just opposite to the predictions of both the Balassa-Samuelson effect and the conception about the positive relationship between the countries´ incomes and price levels.

[8] The selling price and the buying price of 1DEM were respectively 67 roubles and 65 roubles (in Tallinn) at the end of 1991. This rate fluctuates during the first half of 1992 only until 20% both upside and downside, and was 1DEM=73roubles in the end of June 1992 (in the time of the Estonian monetary reform). With the Estonian monetary reform, the nominal exchange rate of the Estonian new domestic currency (Estonian krown) was fixed (in DEMs) so, that there was continuity with the nominal exchange rate of the rouble (1DEM=8EEK, 1EEK=10roubles, 1DEM=73roubles). Consequently, there was no undervaluation or overvalution during the Estonian monetary reform (Raim, 2001b).

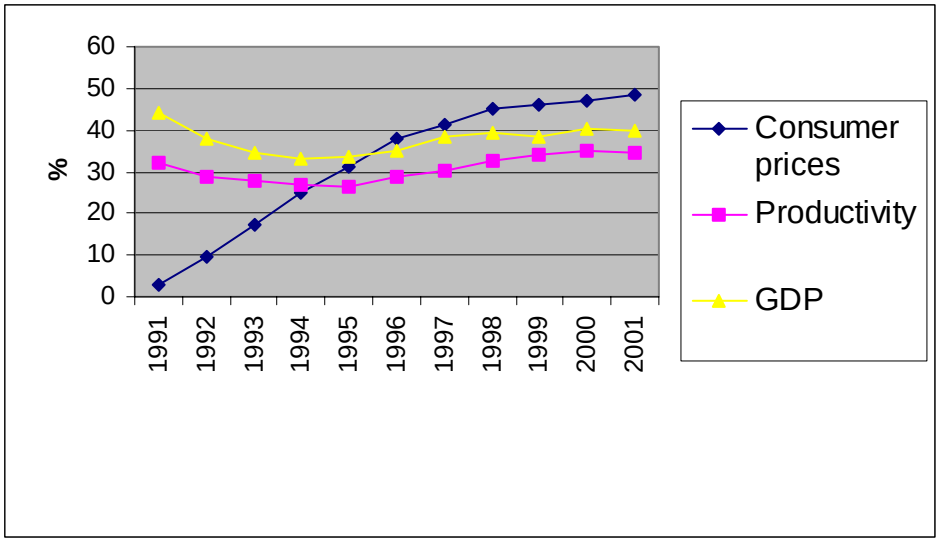


Figure 1. Estonian consumer prices, labour productivity and GDP per capita PPP-adjusted relative to European Union average

Sources: Author´s own calculations based on Eurostat data; Statistical Office of Estonia data; Bank of Estonia data; Barrell et al., 2002; Eesti Statika, 2003; Hinnainfo, 1992.

During the more recent period (1996-2001) the Estonian relative labour productivity and relative GDP (both in comparison with the EU countries´ average) rose respectively 20% and 13% – but the relative price level rose 40% (Raim, 2002). Since one percent increase in relative labour productivity generates, on average, a 0.7 percent increase in the relative price of nontradables (De Broeck et al., 2001), and since the proportion of nontradables is ca 50% in the Estonian average consumer basket – then, taking into account the lag, the Balassa-Samuelson effect to the EU candidate countries´ (among them Estonia) inflation remains in the range of one percentage point (De Broeck et al., 2001). However actually, the Estonian annual inflation (in comparison with the European Union) was 2-12% during these years.

Although the empirical investigations, that are carried through during the second half of 1990s on the purpose of explaining the price differences (and price convergence) between the former Soviet Union republics and remaining world, already confirmed sporadically both the Balassa-Samuelson effect (Capriani, 2000; De Broeck et al., 2001; Halpern et al., 2001; Jazbec, 2001; Randveer, 2001) and the conception about the positive relationship between the countries´ incomes and price levels (Randveer, 2000; De Broeck et al., 2001) – the above-mentioned shocks are though not powerful enough to explain the phenomenon. Furthermore, the cause of productivities´ and incomes´ rise remains unclear.

The irrelevance of the Balassa-Samuelson effect on the Estonian (as one former Soviet Union republic) relative inflation is due to the fact, that in the beginning of transitional period there were no internationally traded goods in Estonia – in spite of successful liberalisation. The huge relative inflation was caused by the rapid emergence of tradable goods (and the tradable goods´ sector) – that itself was caused by the rapid elimination of formal and especially just informal (lack of business information) arbitrage barriers. In addition to the lack of information (about Estonian products, prices, trade conditions and risks), the other arbitrage barriers had also important effect on price differences and price convergence (for example the Estonian staying out of trade unions (MFN, GSP, FTA) caused the developed countries´ import

barriers (Kaminski, 1996); and local export barriers (Coorey et al., 1996; Kaminski, 1996)).

Of course, the arbitrage barriers can not affect the price differences without the local specific influences on local demand and/or supply (for example cost recovery or temporary distortions in asset markets).

Therefore, the phenomenon of price differences (and price convergence) between Estonia (as one part of the former Soviet Union) and developed countries is not interpretable in the traditional theoretical framework – with monetary, demand side and/or supply side shocks. The lack of business information has too decisive role here, to treat it only as one shock in the classes of demand side or supply side shocks. We need to bring the (formal and informal) arbitrage barriers into the system as new different class of shocks.

## 4. The new classification of the causes of PPP deviations derived from transitional experience

The author of the current article classifies the causes of PPP deviations (the causes of international price differences) to the two following basic classes:

1) The causes of products´ immobility (the effects that explain immobility = the arbitrage barriers). Both the formal arbitrage barriers (custom barriers) and the informal arbitrage barriers (transportation costs; differences in languages, legal systems and currencies; differences in the products´ subjective quality; the costs connected with hunting information about prices, risks and trade conditions etc.) belong to this class.
2) The causes of local differences in the products´ supply and/or demand (the effects that are based on immobility = the local differences). Both the monetary (the official undervaluation of nominal exchange rate), the demand side (the incomes´ growth, the demand shift from tradables to nontradables) and the supply side (Balassa-Samuelson effect, the cost recovery) shocks belong to this class.

It is worth mentioning, that neither the effects that explain immobility nor the effects that are based on immobility are alone able to explain the price differences. The mutual relationship of the effects is revealed as following: due to international immobility of the products, the differences in the countries' local supply and/or demand transform into the price differences between these countries.

Therefore, it is not possible to research the basic classes (nor the sole hypotheses of these classes) confusedly[9]. The effects, that belong to one basic class, are independently totally meaningless – just as the fraction´s numerator (without the denominator). At the basis of one basic class´ effects it could be possible to make conclusions about the price differences only on the assumption, that the second basic class´ effects are known and constant both in time and space (in the all countries, that are under research) – this assumption was especially strikingly wrong just in the context of the former Soviet Union republics in the 1990s.

But the combined research of both basic classes is very difficult. The author of the present article has to admit, that both from the standpoint of the empirical analysis and

[9] For example the statement, that 60% of the price differences between Estonia and the European Union is explained by the income differences, is entirely without substance.

the resulting real economical policy, the concentration to one certain effect is much easier.

## 5. The conception of perceived business climate (the shift from productivity to image)

Due to the lack of business information, transportation costs, custom barriers and cultural-institutional heterogenity (as the main effects that explain products´ immobility) the Estonian low labour productivity (as the main effect that is based on products´ immobility) got the power to produce the price differences between Estonia and developed countries. But the low productivity of Estonian labour (and land) itself was not caused so much by its inner quality but rather by the lack of important complementary good – capital (and the knowhow that moves with capital). The low labour productivity was directly caused by the lack of capital, the low capital-intensity of the economy. Which itself was caused by the immobility of business information.

The driving force behind the price convergence between Estonia and developed countries is the decrease of Estonain products´ and production ressources´ immobility – the vanishing of material and especially informational barriers from the way of capital. The capital inflow to the products and assets causes the local prices´ increase both directly and through raising the local labour productivity (see Figure 2).

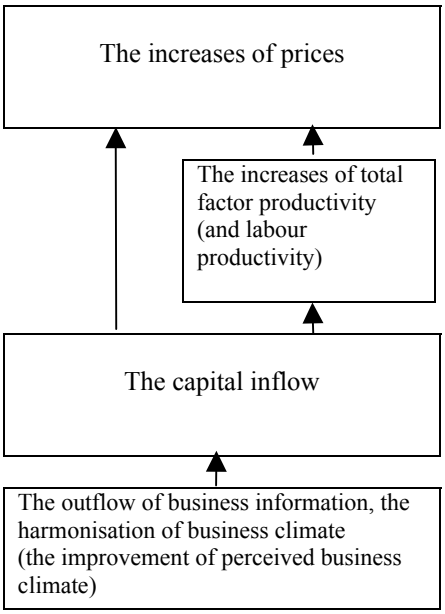


Figure 2. The causes of price convergence between Estonia and developed countries

The capital inflow to the Estonian products and production resources is affected by many factors connected with Estonian products international mobility. Though the terms 'lack of information' or 'information immobility' are too narrow to specify these factors entirely – because in addition to direct lack of business information the heterogenity in laws, manners and languages as well as custom barriers and transportation costs affected potential foreign investors. Much better seems to be the term 'perceived business climate', that reflects all world potential investors´ imagination about the concrete country´s and its assets´ usefulness.

Since the perceived business climate is not only the trigger mechanism of the effects that are based on products´ immobility (differences in productivities, differences in incomes) but it determines also these effects´ absolut value – then, as a simplification, it is worth trying to explain price differences (between countries) only with the perceived business climates differences (between these countries)[10].

It is clear, that potential investors´ better imagination about the assets´ usefulness increases directly their demand and price. Just as every economically thinking family acts consistently with the view of increasing its assets´ (force, knowledge, enterprise, real estate etc.) market price – so the price level of the country´s resources´ reflects the country´s success.

But the consumer prices´ level is not the best measure for assessing country´s success, because many consumer goods (for example quickly spoiling food products and services) can be investment objects only indirectly – as the complementary goods for real investment objects (working force, real estate, products). The direct measure of country´s (or smaller area´s) perceived business climate is nevertheless the level of real estate prices and wages. This ”two-horse team” of image indicators reflects also shocks (connected with information immobility and environment heterogenity – the factors, that discourage potential foreign investors), that are not reflected in the traditional success indicator – 'the real income per person'.

[10] For example the statement, that 60% of the price differences between Estonia and the European Union is explained by the differences in perceived business climates, is logical.

Since the difference between 'the (relative) level of real estate prices and wages' and 'the (relative) real income per person' was much bigger in the former Soviet Union republics than anywhere in the world (see Table 1 and Figure 1) – then the economical importance of subjective business climate became known in the basis of just these countries. But the (potential) foreign investors´ subjective imagination, that is reflected in the level of real estate prices and wages, is important for remaining world as well.

Therefore: though the traditional causes of PPP deviations are much stronger in the developed countries (because both the basic groups´ effects are more known and constant there both in time and space) in comparison with the former Soviet Union republics, the use of the concept of perceived business climate can create better results in the world scale also – and give the logical solution to the well-known PPP puzzle[11]. The big disadvantage of the concept of perceived business climate is the fact, that it is very hard to quantify it (unlike the factors, that are traditionally used as explanatory factors of price differences – labour productivities and incomes) directly – probably there is a need for some indirect indicator (for example capital inflow).

## 6. Conclusions

The huge price differences between FSU and remaining world were one of the central issues facing all former Soviet Union republics (among them Estonia) at the beginning of 1990s.

In this context, the article examined the traditional causes of price differences and derived the improved system of the concepts about PPP deviations from Estonian experience during the 1990s. We showed that both the basic causes of PPP deviations are determined by potential investors´ imagination about the usefulness of the countries' assets – the perceived business climate.

The main conclusions of the study are as follows:

1) The phenomenon of price differences (and price convergence) between Estonia (as one fastly liberalized small republic of the former Soviet Union) and developed countries is not explainable in the traditional theoretical framework – with monetary, demand side and/or supply side shocks.
2) Neither the effects that explain immobility nor the effects that are based on immobility are alone able to explain the price differences. PPP would hold in the world if there were no arbitrage obstacles (all products and information are internationally mobile) or if the regional supply and demand levels of all products were exactly equal.
3) It is not possible to research the basic classes (nor the sole hypotheses of these classes) of the causes of PPP deviations confusedly. The effects, that belong to one basic class, are independently totally meaningless.
4) The 'perceived business climate', that reflects all world potential investors´ imagination about the concrete country´s and its assets´ usefulness, determines the country´s relative price level.

[11] The purchasing power parity puzzle means, that the economists are in trouble reconciling the enormous short-term volatility of PPP deviations with the extremely slow rate at which shocks appear to damp out. Consequently the causes of PPP deviations can be neither real (because real economical factors do not change abruptly) nor monetary (because prices´ nominal stickiness is not so long-lasting) in nature (Rogoff, 1996).

Contrary to the real and monetary factors the country´s perceived business climate (or image) can change very quickly but relapse very slowly – especially if we take into account its effect on the real economy through capital flows and productivity.

The results of this article refer to the continuing necessity to include alternative explanatory variables (derived from the transitional experience) in the relative inflation explaining and forecasting process. We just cannot any more ignore the huge correctives "the bright transitional moment" (the unprecedented transition from a planned to a market economy) has brought into the economic theory.

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**Abstract**

**The PPP Deviations Between Estonia and Non-Transitional Countries**

The present thesis consists of six chapters and three essays. The thesis investigates the magnitude and causes of the PPP deviations between Estonia, a small Baltic FSU republic, and non-transitional countries during the years 1991-2000. This study was motivated from the need to illuminate the huge PPP deviations that emerged between the former Soviet Union republics (including Estonia) and the remaining countries after the liberalization and opening of the former socialist's planned economies. The main contribution of this thesis is to provide important information in regards to the PPP deviations between transitional and non-transitional countries. The first two essays of the thesis are empirical researches and the third essay is oriented more towards economic theory. The first essay studies the magnitude of the PPP deviations, and the second essay studies the possible causes of the PPP deviations. The third essay interprets the meaning of the PPP deviations in the context of existing theories. The analyses in the current thesis is the first quantitative analyses of the FSU republics' price levels examining the first transitional decade (1991-2000) in its entirety.

The present thesis has two main goals contributing towards the analysis of the PPP deviations between transitional and non-transitional countries:

- The first goal is to measure the price differences between the former Soviet Union and remaining countries.
- The second goal is to research the causes of the price convergence between Estonia and non-transitional countries.

In the first essay, the author focuses on the economic systems' aspect of price levels and the relationship between income and price levels. Economic systems' treatment comprises the following topic: country's belonging to the group of FSU-Baltics, FSU-CIS or non-FSU transitional countries as the most important determinant of its price level and income-price relationship. This is based on the empirical study of transitional countries' income and price levels during the period of 1991-2000. In the first essay, the author has touched upon the international economics' aspect as well. The international economics' treatment involves the insignificance of income levels as the determinants of the PPP deviations between FSU republics and the remaining world.

The first result of the first essay of the work was the crucial difference between the FSU republics' price levels from the non-FSU transitional countries' price levels. In fact, both the actual price levels and actual price levels relative to income-predicted price levels of the non-FSU transitional countries were much more similar to the non-transitional countries' price levels than the FSU republics' price levels. The non-FSU transitional countries' price developments were negligible compared to the FSU republics' price developments as well. The second result of the first essay is that there were three different price scenarios: (a) the non-FSU transitional countries' scenario; (b) the scenario of the FSU republics that belong to the CIS; and (c) the FSU Baltic republics' scenario.

The second essay of the work is oriented more towards international economics, and fully addresses the possible effect of the Estonian income and productivity growth on the Estonian real appreciation. The author examines the main

theoretical explanation for the PPP deviations − the Balassa-Samuelson effect − during the first transitional decade. For that purpose three different proxies of the Balassa-Samuelson effect is studied: GDP per capita PPP-adjusted, GDP per employee PPP-adjusted and the GDP per employee in the open sector divided by the GDP per employee in the closed sector. Simple data analysis of productivities' (incomes') and prices' time series reveals that the price convergence between Estonia and non-transitional countries was not caused by the productivity or income convergence between them.

The third essay of the work has a theoretical approach based on empirical results from the first two essays and emphasising the Estonian experiences as important to the remaining world. The author simultaneously examines the traditional system of the causes of PPP deviations used in international economics and the development of actual macro-economic variables in Estonia as a Baltic FSU republic. Therefore, the research object is the controversy between the Estonian empirics and the traditional (monetary versus real) explanations to PPP deviations. The logical analysis reveals the existence of the purchasing power parity puzzle between a small Baltic FSU republic-Estonia, and non-transitional countries.

## Kokkuvõte

### Kõrvalekalded ostujõu pariteedist Eesti ja mitte-üleminekuriikide vahel

Käesolev doktoriväitekiri koosneb kuuest peatükist ja kolmest esseest. Töös uuritakse väikese Balti vabariigi Eesti ja mitte-üleminekuriikide vaheliste ostujõu pariteedi kõrvalekallete (edaspidi: *hinnaerinevused*) ulatust ning põhjusi aastatel 1991 kuni 2000. Uurimisteema valiku peamiseks ajendiks oli vajadus valgustada ülisuuri hinnaerinevusi, mis ilmnesid endise Nõukogude Liidu vabariikide (sh Eesti) ning ülejäänud riikide vahel pärast endiste sotsialistlike plaanimajanduste avanemist ja liberaliseerumist. Doktoritöö peamine eesmärk on anda olulist informatsiooni üleminekuriikide ja mitte-üleminekuriikide vaheliste hinnaerinevuste kohta. Doktoritöö esimesed kaks esseed on empiirilise ning kolmas essee teoreetilise suunitlusega. Esimeses essees vaadeldakse hinnaerinevuste ulatust, teises essees hinnaerinevuste võimalikke põhjusi ning kolmandas essees tegeldakse hinnaerinevuste tähenduse teoreetilise interpreteerimisega. Käesolevas töös esitatud endise Nõukogude Liidu vabariikide hinnatasemete analüüsid on esimesed kvantitatiivsed uurimused, kus analüüsitakse kogu esimest üleminekukümnendit (1991-2000).

Doktoritöö panus üleminekuriikide ja mitte-üleminekuriikide vaheliste hinnaerinevuste uurimisse on esitatud alljärgnevalt kahe eesmärgina:

- Esimeseks eesmärgiks on määrata kindlaks endise Nõukogude Liidu vabariikide ja ülejäänud riikide vaheliste hinnaerinevuste ulatus.
- Teiseks eesmärgiks on uurida Eesti ja mitte-üleminekuriikide vahelise hinnaühildumise põhjuseid.

Esimeses essees on käsitletud peamiselt hinnatasemete ning sissetulekute- ja hinnatasemete vahelise seose majandussüsteemidega seonduvat aspekti. Majandussüsteemi-keskne käsitlus hõlmab järgnevat teemat: riigi kuulumine Balti riikide, Sõltumatute Riikide Ühenduse (SRÜ) riikide või Nõukogude Liitu mittekuulunud üleminekuriikide gruppi kui tema hinnataseme ning sissetulekute- ja hinnataseme vahelise seose kõige olulisem mõjur. See käsitlus põhineb üleminekuriikide 1991-2000 sissetulekute- ja hinnatasemete empiirilisel uuringul. Autor on esimeses essees puudutanud ka rahvusvahelise majanduse aspekti. Rahvusvahelise majanduse keskne käsitlus hõlmab sissetulekute taseme ebaolulisust endise Nõukogude Liidu liiduvabariikide ja ülejäänud maailma vaheliste hinnaerinevuste mõjurina.

Esimese essee esimeseks tulemuseks on endise Nõukogude Liidu vabariikide hinnatasemete oluline erinevus Nõukogude Liitu mitte kuulunud üleminekuriikide hinnatasemetest. Nõukogude Liitu mitte kuulunud üleminekuriikide hinnatasemed osutusid palju sarnasemaks mitte-üleminekuriikide kui endise Nõukogude Liidu vabariikide hinnatasemetele. Samuti olid Nõukogude Liitu mitte kuulunud üleminekuriikide hinnatasemete muutused tühised võrreldes endise Nõukogude Liidu vabariikide hinnatasemete muutustega. Esimese essee teiseks tulemuseks on kolme erineva hinnastsenaariumi olemasolu: a) Nõukogude Liitu mitte kuulunud üleminekuriikide stsenaarium; b) SRÜ-sse kuuluvate endise Nõukogude Liidu vabariikide stsenaarium; ja c) Balti vabariikide stsenaarium.

Teine essee on rohkem rahvusvahelisele majandusele orienteeritud ning käsitleb Eesti sissetulekute ja produktiivsuste kasvu kui Eesti hinnatõusu võimalikke

mõjureid. Vaatluse alla on võetud hinnaerinevuste peamise teoreetilise seletuse − Balassa-Samuelsoni efekti − toimimine esimesel üleminekukümnendil (1991-2000). Selle käigus uuritakse kolme erinevat Balassa-Samuelsoni efekti lähendit: hinnaerinevustega läbikaalutud SKP-d elaniku kohta, hinnaerinevustega läbikaalutud SKP-d töötaja kohta ning hinnaerinevustega läbikaalutud SKP-d töötaja kohta avatud sektoris jagatuna hinnaerinevustega läbikaalutud SKP-ga töötaja kohta suletud sektoris. Lihtne produktiivsuste (sissetulekute) ja hindade aegridade analüüs näitab, et Eesti ja mitte-üleminekuriikide vaheline hinnakonvergents ei olnud põhjustatud nende produktiivsuste või sissetulekute konvergentsi poolt.

Kolmas essee sisaldab teoreetilist lähenemist, mis toetub esimeses kahes essees saadud empiirilistele tulemustele ning rõhutab Eesti kui endise Nõukogude Liidu Balti liiduvabariigi kogemuste tähtsust ülejäänud maailma jaoks. Üheaegselt on vaatluse alla võetud nii rahvusvahelises majanduses kasutatav traditsiooniline hinnaerinevuste põhjuste süsteem kui ka Eesti tegelike makromajanduslike näitajate areng. Seega on uurimisobjektiks vastuolu Eesti empiirika ja traditsiooniliste hinnaerinevuste seletuste (monetaarsed versus reaalsed šokid) vahel. Loogilise analüüsi tulemuseks on kinnitus ´ostujõu pariteedi mõistatuse´ eksisteerimisest Eesti kui endise Nõukogude Liidu Balti liiduvabariigi ja mitte-üleminekuriikide vahel.

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