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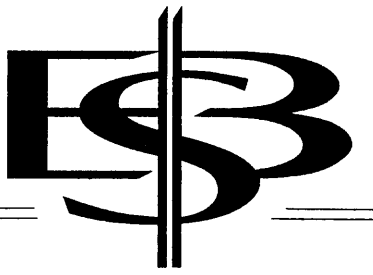

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No. 3 (1998)

Jaanus Raim

THE PRICE DIFFERENCES BETWEEN ESTONIA AND DEVELOPED COUNTRIES AND OPPORTUNITIES FOR ARBITRAGE 1991-1996

Tallinn

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Table of Contents

I Introduction 3

II Descriptions and Definitions 3

III Causes of price differences between transitional economies and developed countries 6

IV A description of the effect of Estonian export barriers on price differences 9

V Analysis of the Balassa-Samuelson effect on price differences between Estonia and Austria 11

VI Conclusions 22

References 23

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Lauteri 3, EE0001 Tallinn, Estonia
tel. (372) 6 466 336
fax. (372) 6 313 959

Reviewed by NataljaViilman, Ph.D., Macro-economics Department, Eesti Pank (Estonian Central Bank)

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I Introduction

The topic of this publication is price differences between Estonia and developed countries. The publication treats the period from autumn 1991 to the end of 1996. The publication describes price differences, price convergence and the respective theory. The publication describes the effect of Estonian export barriers on price differences and convergence (1991-1996), and analyses the Balassa-Samuelson effect on price differences (1993-1995).

Price differences have been handled as basic presumptions of international arbitrage.

The main aim is to create an adequate picture showing the significance and causes of price differences between Estonia and developed countries.

Austria has been held up as a typical example of developed countries in this publication because of the comparison of price levels in Estonia to that of Austria that has been done. The Estonian kroon nominal exchange rate against Austrian schilling has also been very stable over the last six years.

All goods are classified as tradables or nontradables.

In the context of price differences, price convergence as the gradually diminishing process of price differences is also handled. Causes of price convergence result directly from causes of price differences (their regression).

To find causes of price convergence between Estonia and Austria, the effect of Estonian export barriers is analysed. Problems have been seen from the standpoint of a company in a developed country.

II Descriptions and Definitions

After the fall of the socialist planned economy a situation, where in Estonia tradables and nontradables are much cheaper when compared to similar products in developed countries, has emerged and continued over several years. The fall of the "iron curtain" has created an opportunity to earn extra profit through the process of arbitrage for both domestic and foreign companies. Arbitrage is possible in three ways -

- Direct arbitrage. Companies buy Estonian tradables, their components and raw materials and sell them in developed countries at higher prices.
- Indirect arbitrage. Companies use Estonian nontradables, the work-force and materials as inputs to produce products and sell them in developed countries. These products can also be nontradable (for example: sea-transport services).
- Speculation. Companies buy Estonian tradables or nontradables, put them into storage, and later sell them in Estonia or in developed countries at higher prices. Companies can also speculate in nontradables (for example: real estate).

At the same time, a number of obstacles to the above arbitrage process exists.

Obstacles to arbitrage preserved at the same time the basic chance for arbitrage (the difference of prices between Estonia and developed countries).

It is therefore necessary to look for obstacles to arbitrage among the causes of price differences. Since the causes of price differences and the opportunities for arbitrage are different for tradables and nontradables, it is also reasonable to differentiate products to tradables and nontradables.

Tradables are products whose nature enables them to be traded internationally. Only tradables can be objects of direct international arbitrage.

Nontradables are the products whose nature does not enable them to be traded internationally. Nontradables can be objects of indirect arbitrage and speculation.

The majority of goods belong to the tradables group and the majority of services belong to the nontradables group, although exceptions do exist (for example: Estonian books, newspapers and real estate).

In general, activities that create tradables form the sector of tradables, where activities that create nontradables form the sector of nontradables.

Table 1

The Estonian average price level of tradables and nontradables compared with the Austrian price level at the beginning and end of the period under analysis[1]

	Dec 1991	1996
The Estonian price level of tradables divided by the Austrian price level of tradables	3%	5o%
The Estonian price level of nontradables divided by the Austrian price level of nontradables	below 1%	4o%

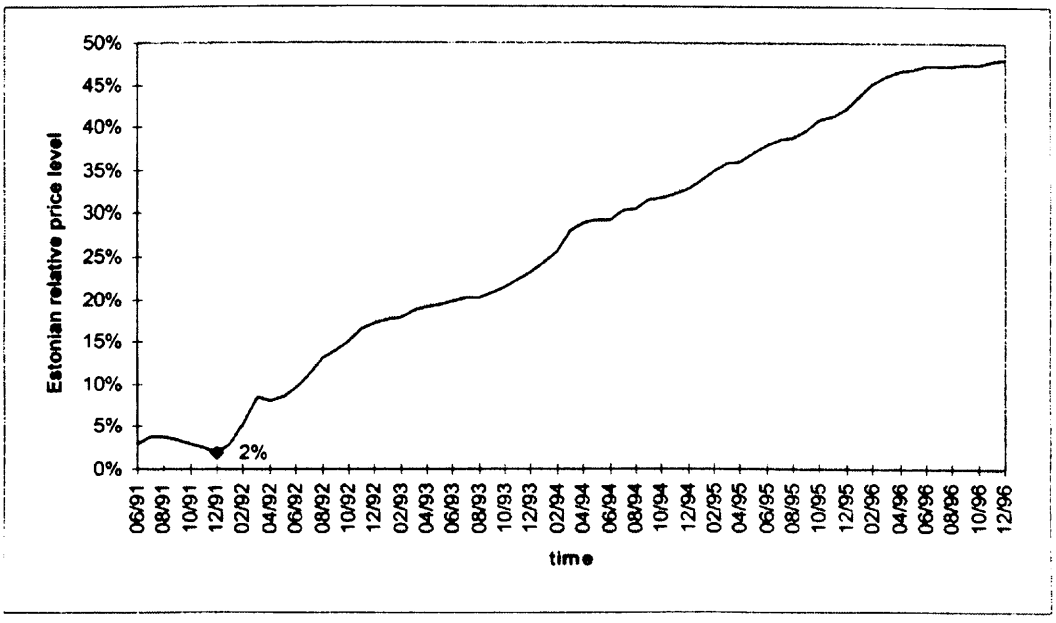
Sources:
Coorey, S., Mecagni, M., Offerdal, E.(1996). Disinflation in Transition Economies: The Role of Relative Price Adjustment. IMF, p.47.
Hinnainfo nr.3 (7)/1992. Eesti Konjunktuuriinstituut. Tallinn, p.27.
Ostujõu pariteedid ja tegelikud kulutused. Eesti Panga bülletään 1/1996. Tallinn, p.40.
Statistika aastaraamat 1996. Eesti Statistikaamet. Tallinn, p.149.

[1] The weights are the Estonian consumer bascet's ones.

The gap between the Estonian and Austrian price level, narrows due to the price convergence process. Price convergence expresses itself through the rise in Estonian prices in schillings, either through the nominal price rise or through the nominal exchange rate appreciation (or both). In Estonia, prices have converged only through the nominal price rise following monetary reform. The speed of the price convergence process has gradually slowed down during the period under analysis (see Figure 1).

Figure 1

The Estonian relative price level (compared with Austria)



$$\textbf{Estonian Relative Price Level} = \frac{\textbf{Estonian Average Consumer Price Level}}{\textbf{Austrian Average Consumer Price Level}}$$

Price convergence goes hand in hand with the real appreciation of domestic currency. In this publication, real appreciation means real appreciation Estonian domestic currency against developed countries´ currencies (in this publication, represented by the Austrian schilling).

The rouble was the unit of currency in Estonia until monetary reform (20. June 1992), when it was replaced by the kroon (EEK).

If other conditions remain unchanged, appreciation of the Estonian domestic currency reduces the chances of arbitrage.

To appraise the Estonian and Austrian price levels the Consumer Price Index (CPI) and its components have been used.

Besides this specific price index, specialists' appraisals are applied since CPI does not show clearly enough the prices of concrete products and inputs that are the most important ones from the standpoint of arbitrage.

The nominal exchange rate of domestic currency is meant to be the rate one can safely, legally, and without limit exchange foreign currency for domestic currency according to the official exchange rate of the Estonian Central Bank.

III Causes of price differences between transitional economies and developed countries

Many long-term factors resulted in the sizeable differences between transitional economies and western European prices. However, many of these factors were also obstacles to international arbitrage. The following shall discuss the most important theoretical causes of price difference between transitional economies and developed countries.

Customs Barriers

The hypothesis of customs barriers offers one possible explanation for price differences between countries. Customs barriers are both a barrier to exports and imports. Customs barriers cause differences in prices of tradables between countries because they distort the international process of arbitrage in tradables. Customs barriers (both export and import barriers) are divided into licence barriers and tariff barriers.

Licence barriers restrict tradables' imports and/or exports because an import (or export) licence is needed - therefore restrictions are quantitative[2].

Tariff barriers restrict tradables' imports and/or exports because of customs duties put on tradables' imports (or exports). The effect of tariff barriers on price differences is similar to the effect of transportation costs[3].

Customs barriers are also the indirect cause of nontradables' price differences. In accordance with the Balassa-Samuelson model, the lower price level of tradables is caused by customs barriers, lowering the wage level in both tradable and nontradable sectors, thus causing a lower price in nontradables.

The Balassa-Samuelson model

One of the hypotheses that could explain differences in prices of nontradables is the function of the Balassa-Samuelson model[4,5]. This model asserts that, when the ratio of

[2] The long-term effect of licence barriers was huge in Russia (Koen and De Masi (1995))
[3] Krugman, P.R., Obstfeld, M. International Economics, pp. 394-395.
[4] The authors of Balassa-Samuelson hypothesis are Bela Balassa (1964) and Paul Samuelson (1964).

labour productivity of tradables and nontradables is smaller in the domestic country to the foreign country, the price level of nontradables in the domestic country will be lower to a corresponding extent from the price level of nontradables in the foreign country.

When $Qt/Qn < Qt^*/Qn^*$, then $E\ Pn^* > Pn$, where

- Qt - the productivity of tradables in the domestic country
- Qn - the productivity of nontradables in the domestic country
- Qt^* - the productivity of tradables in the foreign country
- Qn^* - the productivity of nontradables in the foreign country
- E - the nominal exchange rate of the domestic currency
- Pn^* - the price level of nontradables in the foreign country
- Pn - the price level of nontradables in the domestic country.

The above-mentioned model is based on the principle that, when the relative labour productivity of tradable goods in the domestic country is lower from the foreign country, the positive (that is to say corresponding to labour productivity) ratio of salaries will be lower in the sector of tradables and nontradables of the domestic country. The condition where the labour-force can move freely from sector to sector has an influence on equalizing salary levels in the different internal sectors. The salary level of the tradable sector in the domestic country where internationally determined prices and efficiency are going to have an influence on the internationally indetermined nontradable sector, starts equalizing the salary level of the nontradable sector or, "pulling it down". This lower level of productivity in comparison with a foreign country in the sector of nontradables also makes it possible to sell goods in this sector at a cheaper price.

The algebraical explanation of the model.

The preconditions of the model are:

$$wn = wt$$
$$wn^* = wt^*$$
$$Pn = wn/Qn$$
$$Pt = wt/Qt$$
$$Pn^* = wn^*/Qn^*$$
$$Pt^* = wt^*/Qt^*$$
$$Pt = E\ Pt^*.$$

Consequently in the domestic country: $Pn = Pt\ (Qt/Qn)$.
And in the foreign country: $E\ Pn^* = Pt\ (Qt^*/Qn^*)$.

When $Qt^*/Qn^* > Qt/Qn$, then $E\ Pn^* > Pn$.

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[5] Coorey, S., Mecagni, M., Offerdal, E. (1996). Disinflation in Transition Economies: The Role of Relative Price Adjustment. IMF, p.9.

The cost-recovery hypothesis

The cost-recovery hypothesis[6] argues that the convergence of certain capital-intensive service prices (housing, utilities, and transportation) can take place gradually. These services are distinguished by a capital stock that was not only inherited, with no associated debt, from the pre-transition era, but is also 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 maintenance costs and then to cover (future) capital costs, until they reach a level at which new investment can take place[7].

Incomes could rise because of general productivity growth. Productivity gains are caused by predominantly foreign investments. These investments come due to the openness of the economy and lower risks.

The hypothesis implies that the relative nontradables' price level would be lower because of the pricing of capital.

Relationship between income and price levels

There is extensive literature showing a cross-country relationship between PPP-adjusted per capita GDP and price levels[8]. Relative domestic income as a demand-side factor influences the relative price level because the supply-side (nontradables' supply) is not flexible enough to react adequately to changes in the level of demand. This occurs because the labour supply (the main input of nontradables sector) is almost constant in the short-run.

At the same time, that factor not influenced by domestic income (foreign demand) is unable to raise demand for domestically produced nontradables.

The hypothesis implies that the relative nontradables' price level would be lower because of the pricing of labour.

Undervaluation

It is argued that the initial undervaluation[9] of new currencies (relative to their equilibrium levels) is a significant cause of price differences. The initial undervaluation relative to fundamentals may have been due to a range of asset market considerations including risks, incomplete markets and legal arrangements, imperfect information, and

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[6] Basil Zavoico (1995).

[7] Coorey, S., Mecagni, M., Offerdal, E. (1996). Disinflation in Transition Economies: The Role of Relative Price Adjustment. IMF, p.11.

[8] Sepp, U. (1996). Eesti krooni reaalkurss. Eesti Pank, p.7.

[9] Undervaluation has been suggested for Russia (De Masi and Koen (1995)) and the Baltics (Richards and Tersman (1995)).

the irreversibility of investments. In transitional economies, undervaluation usually arises when the nominal exchange rate of new currencies (o.g. Estonia) is initially set at an excessively low level (often to minimize risks to competitiveness or international reserves) or when the nominal exchange rate is influenced by temporary distortions in asset markets (o.g. Russia).

Undervaluation may be manifested in different ways: firstly, the domestic price of tradable goods may be lower than comparable goods on the world market because the arbitrage process of tradable goods´ prices takes place gradually. Secondly, even after tradables´ prices have equalized, real product wages may be lower than indicated by labour productivity in the tradable sector; these low wages would also be reflected in the prices of services which are lower than in countries with comparable levels of per capita PPP-adjusted GDP[10].

IV A description of the effect of Estonian export barriers on price differences

At the beginning of the transitional period, the authorities used licence barriers as an export restriction. Following this, there were no export barriers at all due to the new political move towards an open economy and free export. The strongest effect the export tariff had, was on metal products introduced in June 1992. It was partly repealed in early 1993[11]. There were also tariffs on rapeseed oil and works of art from June 1992 to December 1993[12].

The Estonian licence barriers had a strong effect on Estonian exports. Until the end of 1991, the authorities of the Soviet Union used licence barriers in Estonia[13], and in early 1992, during the state of emergency, the Estonian authorities used licence barriers, too. Until February 1992, licence barriers restricted the prevalence of Estonian tradables.

Export licences were difficult to get during the first months of transition, evidence of which can be seen in the total sum of Estonian official exports in the fourth quarter of 1991 (82 million roubles)[14] [15].This sum was very small also if we consider the very low Estonian price level of tradables[16].

The total sum of Estonian actual exports was, of course, much higher during these months. The official figures do not take into consideration exports executed by private persons (so-called "suitcase export") and smuggling.

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[10] Coorey, S., Mecagni, M., Offerdal, E. (1996). Disinflation in Transition Economies: The Role of Relative Price Adjustment. IMF, pp. 8-9.

[11] The Estonian average relative (wholesale) price level of metal products was ca. 50% (copper 75%) at the end of 1992 (compared with the prices of London exchange).

[12]Coorey, S., Mecagni, M., Offerdal, E. (1996). Disinflation in Transition Economies: The Role of Relative Price Adjustment. IMF, p.55.

[13] Väliskaubandus. Foreign Trade 1993.(1994). Eesti Statistikaamet. Tallinn, p.7.

[14] Without the export to the countries of the former Soviet Union.

[15] 1 rouble = ca. 0.01 USD

[16] The Estonian relative price level of tradables was ca. 3%.

Since the above-mentioned export methods were dominant during the second half of 1991, the quantity and assortment of exported tradables were very limited. Therefore, it was natural that the first to converge to Western levels were the prices of miniature tradables (precious metals, ancient coins and stamps).

After the end of the Estonian state of emergency in early 1992, the Estonian authorities eliminated licensing requirements on most tradables (manufactured products). By June 1992, licences were only required for 38 products (food items, forest products, mineral products, and cement). These licence barriers were eliminated during the second half of 1992[17,18]. Therefore, the licence barriers have had no effect on the Estonian (lower) relative price of tradables since 1992.

Since Estonian licence barriers blocked almost all legal trade (the most important "engine" for equalizing prices), licence barriers were the very important cause of the lower Estonian tradables´ price level during the first year of transition.

At the same time, the elimination of Estonian licence barriers was an important factor in the rapid convergence of tradables´ prices in 1992[19].

Estonian tariff barriers were not an important factor in lower tradables´ price levels in Estonia since they had almost no effect on Estonian foreign trade during the period under analysis.

Customs barriers have had an indirect effect on the Estonian (lower) price level of nontradables, too.

In accordance with the Balassa-Samuelson model, the lower price level of tradables (caused by customs barriers) is the cause of lower wage levels in the tradable sector (and, due to the principle of equal wages, also the cause of a lower wage level in the nontradable sector). The lower wage level in the nontradable sector makes the price level in the nontradable sector lower than, when is augumented with the difference in relative labour productivity.

Customs barriers also reduce the demand for inputs, also causing the Estonian lower relative price level of nontradables.

The cause analysed for the lower Estonian price level of tradables (Estonian export barriers) is simultaneously a very important obstacle to international arbitrage (both direct and indirect arbitrage). At the same time, export barriers do not disturb speculation. Companies can buy goods in Estonia in order to sell them later at higher prices in Estonia or in developed countries (after the elimination of barriers). Companies can also use Estonian nontradables ("nonspeculables") as inputs to produce speculable

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[17] By January 1, 1993 licences required only for shale oil, clay, and quartz. These licences were abolished during 1994.

[18] Coorey, S., Mecagni, M., Offerdal, E. (1996). Disinflation in Transition Economies: The Role of Relative Price Adjustment. IMF, p.55.

[19] The relative importance of developed countries in the Estonian official export increased from 5.3% to 53% in 1992. The total sum of Estonian official export (without former Soviet Union) increased from 82 million roubles to 2.5 billion roubles during the first quarter of 1992.

products (for example: they can use the relatively cheap work-force, electricity and transport services in construction).

V Analysis of the Balassa-Samuelson effect on price differences between Estonia and Austria

Methodology

In the process of analyzing the model, one megavaluekroon (mvk) has been used, as a unit of labour productivity.

1 megavaluekroon is a quantity of goods or services (their surplus value) produced by one worker on average, whose equivalent value would have been 1million EEK (879461 ATS) in Austria in 1993.

The advantage of the chosen unit is the possibility for comparison of created values (goods or services).

The shortcoming of the chosen unit is difficulties in determining the value of Estonian goods and services in adequate megavaluekroons.

In this publication the value of the Estonian goods and services in mvk-s are determined by multiplying the price level of goods (services) in Estonia by the ratio (difference) between the given price of goods (services) in Austria in 1993 and the given price of goods (services) in Estonia.

The above determination of value assumes that the reasons for the lower price level of Estonian goods and services in comparison with Austrian goods and services were exogenous to the goods (for example: customs barriers) and the good or service itself was of the same value as its Austrian counterpart.

As there was no possibility of valuing the lower quality of Estonian goods and services in comparison with their Austrian counterparts in 1993 and their influence on the Estonian price level, it was clear that average labour productivity in Estonian tradable and nontradable sectors per worker were lower than calculated. This is due to the lower quality of Estonian tradables and nontradables, and this will be taken into consideration when drawing conclusions. To begin with, let us analyse the correspondence of Estonia to the condition wn = wt in 1993, 1994 and 1995.

The foreign country is Austria.

Fields of activities are divided into the activities of the tradable and nontradable sectors. Given the level of activities, it is possible to do with sufficient accuracy.

Difficulties arose regarding such activities as energy, gas, and water. Energy (including gas) is considered to belong to tradables in many countries, but the specific character of trading made it possible to divide it into nontradables for the given period in Estonia.

So, economic activities are divided into tradable and nontradable sectors in the following way:

Tradable sector	Nontradable sector
Agriculture and hunting, forestry, fishing, mining, processing industry	Energy, gas, and water, construction, wholesale business and retail trade, maintenance and repairs of motor vehicles, hotels and restaurants, transport, investments and communications

Next, the average gross salaries of both sectors per worker will be considered on the grounds of the number of workers in all the fields of activities and on the grounds of average salary in 1993, 1994 and 1995.

Table 2

Average monthly salaries of tradable and nontradable sectors in Estonia (in EEK)

	1993	1994	1995
wt	988.180	1679.720	2283.420
wn	1113.800	1757.700	2413.290
wn/wt	1.127	1.046	1.057

As can be seen, the salary level of the nontradable sector is higher than the average salary level of the tradable sector during the years in question. At the same time, the difference in the salary level between the mentioned sectors is noticeably smaller (more than twice) in 1994 and in 1995 than in 1993, due to the more rapid growth in salaries of the tradable sector.

The above mentioned difference between salary levels is trifling in comparison with the difference between relative labour productivity and price levels in sectors.

Now consider labour productivity of both sectors in the period in question (from 1993 to 1995) on the grounds of the field of activities GDP, differences in price levels between tradable and nontradable sectors, changes in constant prices of the field of activities GDP in 1994-1995, as well as the number of workers in the fields of activity (taking different prices of Estonian and Austrian tradables and nontradables into consideration) thus making labour productivity in both sectors directly (without additional calculations) comparable with Austrian labour productivity in both sectors.

Price differences in Estonian sectors in comparison with Austria (to be called: Austrian deflator) were the following in 1993.

In the tradable sector Estonian prices form 28 % of the Austrian prices and in the nontradable sector the Estonian prices form 17.5%[20]. The field of activity GDP in Austrian value amounts to a one hundred multiple quotient of the field of activity GDP and Austrian deflator.

The average labour productivity is the following:

Table 3

Average labour productivity per worker in Estonia and the ratios of productivity

	1993	1994	1995
Qn	0.24	0.24	0.24
Qt	0.12	0.13	0.13
Qn/Qt	2.00	1.85	1.85

As can be seen from Table 3, average labour productivity of the nontradable sector has been much higher than average labour productivity of the tradable sector throughout the period under analysis. This difference exceeds the difference between average salaries significantly. The difference between productivity has decreased due to increase in the tradable sector's productivity. Average labour productivity of Estonian nontradable sector was almost constant.

Table 4

Austrian average monthly salaries in the tradable and nontradable sector (in ATS)

	1993	1994	1995
wn*	24553.00	25281.60	26500.80
wt*	29212.60	30408.60	31091.00
wn*/wt*	0.84	0.83	0.85

Sources:
Facts & Figures. Annual edition.(1996). Austrian Central Statistikal Office. Vienna, p.15.
Jahrbuch 1995.(1995). Vienna, p.145.

[20] Rahapoliitikast ja inflatsioonist. (1996). Eesti Pank. Tallinn, p.16.

Table 5

Austrian average monthly salaries in the tradable and nontradable sectors (in EEK)

	1993	1994	1995
wn*	27918.20	28748.70	30134.60
wt*	33216.50	34578.80	35354.20
wn*/wt*	0.84	0.83	0.85

Sources:
Facts & Figures. Annual edition.(1996). Austrian Central Statistical Office. Vienna, pp.15 and 31.
Jahrbuch 1995.(1995). Vienna, p.145.

As can be seen, the salary level in the tradable sector were higher than the salary level in the nontradable sector throughout the period in question. This difference has continued because salaries have increased almost equally in both sectors. The deviation from the assumption of the Balassa-Samuelson model (wn* = wt*) is significant enough to take it into account.

To calculate Austrian average labour productivity in tradable and nontradable sector, fields of activities are divided into the activities of the nontradable and tradable sectors.

Tradable sector	Nontradable sector
Agriculture, forestry, mining, industry	Energy, gas, and water, construction, trade, hotels and restaurants, transport and communication, finance, real estate, government administration

In the calculations, the nominal exchange rate of the Austrian schilling (ATS/EEK) was used.

Table 6

The nominal exchange rate of Austrian schilling (ATS/EEK)

	1993	1994	1995
1 ATS=	1.13706 EEK	1.13714 EEK	1.13712 EEK

Source:
Facts & figures. Annual edition. (1996). Austrian Central Statistical Office. Vienna, p. 31.

As can be seen, the nominal exchange rate of the Austrian schilling (ATS/EEK) was constant throughout the period in question.

Average productivity levels of 1994 and 1995 have divided by the inflation coefficients (1.035 and 1.057), respectively[21].

Therefore, the comparable productivity levels of 1993, 1994 and 1995 are as follows.

Table 7

Austrian average labour productivity per worker

	1993	**1994**	**1995**
Qn*	0.70	0.71	0.71
Qt*	0.79	0.84	0.90
Qn*/Qt*	0.89	0.85	0.79

As can be seen, average labour productivity in the tradable sector was higher than average labour productivity in the nontradable sector throughout the period in question. The difference between productivity levels has gradually increased, due to the very high increase in the tradable sector's level of productivity. In Austria (contrary to experience in Estonia) the average salary is also almost proportionally higher in the tradable sector (regression from the assumption wn* = wt*).

Now, the relative labour productivity levels and relative salaries are compared.

Table 8

Relative labour productivity and relative salaries

	1993	**1994**	**1995**
Qn*/Qt*	0.89	0.85	0.79
wn*/wt*	0.84	0.83	0.85
Qn*/Qt* from wn*/wt*	1.06	1.02	0.93

As can be seen, relative labour productivity in the nontradable sector fell substantially during the period under analysis. At the same time, the relative salary level in the nontradable sector was almost constant, the result being the substantial fall of relative

[21] Jahrbuch 1995.(1995). Vienna, p.164.

labour productivity and the relative salary ratio in the nontradable sector. The difference between labour productivity (in favour of the tradable sector) was already larger than the difference between salaries in 1995. Therefore, if in 1993 and in 1994, the labour-force was relatively "undervalued" in the nontradable sector, then, in 1995, the labour-force was relatively "undervalued" in the tradable sector.

Results

Table 9

The Estonian and Austrian average labour productivity per worker in nontradable and tradable sector (mvk)

	1993	1994	1995
Qn	0.24	0.24	0.24
Qt	0.12	0.13	0.13
Qn*	0.70	0.71	0.71
Qt*	0.79	0.84	0.90

Under the assumption that all the assumptions of the Balassa-Samuelson model are satisfied and all labour productivity levels are adequately found, the Balassa-Samuelson model states the difference between Estonian nontradables' prices and Austrian nontradables' prices as follows:

in accordance with the Balassa-Samuelson model

$$\text{if } Qt^*/Qn^* > Qt/Qn, \text{ then } E\,Pn^* > Pn..$$

And on the bases of the data from Table 9:

$$\text{since } 0.79 / 0.70 = 2.26(0.12 / 0.24), \text{ then } E\,Pn^* = 2.26\,Pn.$$

Therefore, the Balassa-Samuelson model identifies the price difference at the rate 2.26 (times) in 1993.

Table 10

The Estonian relative price level caused by the Balassa-Samuelson effect

	1993	1994	1995
The Estonian nontradables' relative price level caused by the Balassa-Samuelson effect	0.44	0.46	0.43

These are not the final results because all assumptions of the Balassa-Samuelson model were not met.

Firstly, average salaries were not equal in both sectors (the deviation from the assumptions wn = wt and wn* = wt*).

This deviation is taken into account arithmetically:

If wn = wt and wn* = wt*, then Pn/Pt = wn/wt / Qn/Qt => Pn = Pt (Qt/Qn)
and E Pn*/E Pt* = wn*/wt* / Qn*/Qt* => E Pn* = Pt (Qt*/Qn*)
Qt*/Qn* > Qt/Qn => E Pn* > Pn.

If wn ≠ wt and(or) wn*≠ wt*, then Pn/Pt = wn/wt / Qn/Qt =>
Pn = Pt (wn/wt) (Qt/Qn)
and E Pn*/ E Pt* = wn*/wt* / Qn*/Qt* =>E Pn* = Pt (wn*/wt*) (Qt*/Qn*)

=> **(wn*/wt*) (Qt*/Qn*) > (wn/wt) (Qt/Qn)** => E Pn* > Pn.

And with numbers.
Since (27918.20/33216.50) (0.79/0.70) = 1.68 (1113.80/988.18) (0.12/0.24),
then E Pn* = 1.68 Pn (in 1993).

After the deviation from the assumptions wn = wt and wn* = wt* have been taken into account, the Balassa-Samuelson model finds the difference between Estonian nontradables´ prices and Austrian nontradables´ prices to be:

E Pn* = 1.68 Pn (in 1993)
E Pn* = 1.72 Pn (in 1994)
E Pn* = 1.89 Pn (in 1995).

Table 11

Estonian nontradables´ relative price level caused by the Balassa-Samuelson effect after the deviation from the assumptions wn = wt and wt* = wn* is taken into account

	1993	**1994**	**1995**
The Estonian nontradables´ relative price level caused by the Balassa-Samuelson effect after the deviation from the assumptions wn = wt and wn* = wt* is taken into account	0.59	0.58	0.53

Secondly, the price levels of Estonian and Austrian tradables were not equal (the deviation from the assumption E Pt* = Pt).

This deviation is taken into account arithmetically:

If E Pt* = Pt, then Pn = Pt (wn/wt) (Qt/Qn)

and E Pn* = Pt (wn*/wt*) (Qt*/Qn*) =>

(wn*/wt*) (Qt*/Qn*) > (wn/wt) (Qt/Qn) => E Pn* > Pn.

If E Pt*≠ Pt, then Pn =Pt (wn/wt) (Qt/Qn)

and E Pn* = E Pt* (wn*/wt*) (Qt*/Qn*) =>

(wn*/wt*) (Qt*/Qn*) > (Pt/E Pt*) (wn/wt) (Qt/Qn) => E Pn* > Pn.

And with numbers.

Since (27918.20/33216.50) (0.79/0.70) = 6.01 x 0.28 x (1113.80/988.18) (0.12/0.24), then E Pn* = 6.01 Pn (in 1993).

Table 12

The price level of Estonian tradables from the price level of Austrian tradables

	1993	**1994**	**1995**
Pt/ E Pt*	0.28	0.33	0.40

Source:
Rahapoliitikast ja inflatsioonist. (1996). Eesti Pank. Tallinn, p.16.

After the deviation from the assumption E Pt* = Pt is taken into account, the Balassa-Samuelson effect finds the difference between Estonian nontradables´ prices and Austrian nontradables´ prices at the next rate to be.

E Pn* = 6.01 Pn (in 1993)
E Pn* = 5.26 Pn (in 1994)
E Pn* = 4.76 Pn (in 1995).

Table 13

The Estonian nontradables´ relative price level caused by the Balassa-Samuelson effect after the deviation from the assumption E Pt* = Pt is taken into account

	1993	**1994**	**1995**
The Estonian nontradables´ relative price level caused by the Balassa-Samuelson effect after the deviation from the assumption E Pt* = Pt is taken into account	0.17	0.19	0.21

Thirdly, quality levels of Estonian and Austrian tradables and nontradables were not equal. Thus the majority of similar Estonian and Austrian goods (services) were not actually equal in value. The Estonian consumer basket was less valuable than the Austrian one.

Therefore, Estonian average labour productivity levels (in mvk) are actually lower than accounted for above (see Table 3).

The ratio Qt/Qn which has an effect on the final results, changes, if the quality difference between Estonian and Austrian tradables is larger or smaller than the quality difference between Estonian and Austrian nontradables.

The average quality (value) of Estonian tradables was, at most, twice as lower than the average quality (value) of Austrian tradables in 1993[22]. The average quality (value) of Estonian nontradables was, at most, three times lower than the average quality (value) of Austrian nontradables in 1993.

The quality of both Estonian tradables and Estonian nontradables improved a minimum of 10% annually.

The quality differentials are also taken into account arithmetically:

If the quality (value) of Estonian and Austrian tradables and nontradables is equal, then:

$Pn = Pt\ (wn/wt)\ (Qt/Qn)$ and $E\,Pn^* = E\,Pt^*\ (wn^*/wt^*)\ (Qt^*/Qn^*)$

⇨ $\mathbf{(wn^*/wt^*)\ (Qt^*/Qn^*) > (Pt/E\,Pt^*)\ (wn/wt)\ (Qt/Qn)}$ => $E\,Pn^* > Pn$.

If the average quality (value) of Estonian tradables and nontradables is lower respectively 2 and 3 times, then

$Pn = 2\,Pt\ (wn/wt)\ (3Qt/2Qn)$ and $E\,Pn^* = E\,Pt^*\ (wn^*/wt^*)\ (Qt^*/Qn^*)$

⇨ $\mathbf{(wn^*/wt^*)\ (Qt^*/Qn^*) > (2\,Pt/E\,Pt^*)\ (wn/wt)\ (3Qt/2Qn)}$

⇨ $E\,Pn^* > Pn$.

After the deviation from the assumptions wn = wt, wn* = wt*, E Pt* = Pt and the quality differentials are all taken into account, the Balassa-Samuelson model finds the difference between Estonian nontradables´ prices and Austrian nontradables´ prices at the next rate to be :

$E\,Pn^* = 2.02\,Pn$ (in 1993)

$E\,Pn^* = 1.94\,Pn$ (in 1994)

$E\,Pn^* = 1.92\,Pn$ (in 1995).

[22] In conditions of uncertainity or vagueness the data (from all possibilities) which minimize the effect of the analyzed hypothesis has been used.

Table 14

The Estonian nontradables' relative price level caused by the Balassa-Samuelson effect after the deviation from the assumptions wn = wt, wn* = wt*, E Pt* = Pt and quality differentials are all taken into account

	1993	1994	1995
The Estonian nontradables' relative price level caused by the Balassa-Samuelson effect after the deviation from the assumptions wn = wt, wn* = wt*, E Pt* = Pt and quality differentials are all taken into account	0.49	0.51	0.52

The Balassa-Samuelson effect finds the Estonian nontradables to be ca. two times lower in quality in comparison with the Austrian nontradables. Therefore, the model explains an important cause of nontradables' price difference in the advanced stage of transition (see Table 15).

Table 15

The relative price of Estonian nontradables and the relative price of Estonian nontradables caused by Balassa-Samuelson effect

	1993	1994	1995
The relative price of Estonian nontradables	0.175	0.25	0.33
The relative price of Estonian nontradables caused by Balassa-Samuelson effect	0.49	0.51	0.52

Source:
Rahapoliitikast ja inflatsioonist. (1996). Eesti Pank. Tallinn, p.16.

The relative importance of the Balassa-Samuelson effect increased during the period under analysis and was highest in 1995. Therefore, the relative importance of other causes of Estonian lower nontradables' prices fell during the same period.

The Balassa-Samuelson effect was not the cause of Estonian tradables' lower relative prices.

The effect of the Balassa-Samuelson model on Estonian higher inflation was also not very significant[23]. The Estonian average relative inflation rate of nontradables was ca. 90% from 1993 to 1995. The Balassa-Samuelson effect (relatively higher tradable sector's productivity growth in Estonia) causes only ca. 5% of that.

[23] If $\Delta (Qt/Qn) > \Delta (Qt^*/Qn^*)$, then $\Delta Pn > \Delta (E\ Pn^*)$.

The analyzed cause of Estonian lower nontradables´ prices is not simultaneously an obstacle of international arbitrage. Companies can use the relatively cheaper Estonian nontradables as inputs to produce products , which are internationally tradable or speculable.

VI Conclusions

The topic of this publication is price differences between Estonia and Austria, and opportunities for international arbitrage from the autumn 1991 to the end of 1996. Price differences were especially large in the early stage of transition (from the end of 1991 to the mid-1992), as were the Estonian relative tradables' and nontradables' prices 3 and 0.6% respectively, at the end of 1991.

During the transitional period, Estonian relative prices increased substantially due to price convergence. Price convergence expressed itself through nominal price rise or through nominal exchange rate appreciation (or through both of them). In Estonia, prices have converged only through nominal price rise following monetary reform. The speed of the price convergence process has gradually slowed during the period under analysis. If other conditions remain unchanged, Estonian price convergence reduces the chances of arbitrage.

The most important causes of price differentiation between transitional economies and developed countries as suggested by theory are:

1) undervaluation
2) customs (export and import) barriers
3) the relationship between income and price levels
4) the Balassa-Samuelson effect
5) the cost-recovery effect

Since the Estonian export barriers blocked almost all legal trade (the most important "engine" which equalizes the prices), export barriers were a very important cause of Estonian lower tradables' price level in the first year of transition. Customs barriers also had an indirect effect on the Estonian (lower) price levels of nontradables.

The elimination of Estonian export barriers was a very important cause of the rapid price convergence in 1992.

Estonian export barriers had no significant effect on price differences and convergence in the advanced stage of transition (1993-1996).

The Balassa-Samuelson effect found the Estonian nontradables' price level to be ca. two times lower compared with the Austrian nontradables' price level in the analised period (1993-1995). Therefore, the effect of the Balassa-Samuelson model is the most important explanation of nontradables' price differences in the advanced stage of transition.

However, the Balassa-Samuelson effect has only a marginal effect on Estonian nontradable's price convergence in the analysed period (1993-1995).

References

1. Coorey, S., Mecagni, M., Offerdal, E. (1996). Disinflation in Transition Economies: The Role of Relative Price Adjustment. IMF.
2. *Eesti Panga bülletään nr.1 (24)/1996. Tallinn.*
3. *Facts & Figures. Annual edition. (1996). Austrian Central Statistical Office. Vienna.*
4. *Hinnainfo nr.3 (7)/1992. Eesti Konjunktuuriinstituut. Tallinn.*
5. *Jahrbuch 1995. (1995). Vienna.*
6. Krugman, P.R., Obstfeld, M. International Economics.
7. *Ostujõu pariteedid ja tegelikud kulutused. Eesti Panga bülletään 1/1996. Tallinn.*
8. *Palk. Wages and Salaries 4/95. (1996). Eesti Statistikaamet. Tallinn.*
9. *Palk Eesti Vabariigis. Wages and Salaries in the Republic of Estonia 4/94. (1995). Eesti Statistikaamet. Tallinn.*
10. *"Päevaleht" nr.299/1991. Tallinn.*
11. *"Päevaleht" nr.300/1991. Tallinn.*
12. Rahapoliitikast ja inflatsioonist. (1996). Eesti Pank. Tallinn.
13. Richards, A., Tersman, G. (1995). Growth, Nontradables, and Price Convergence in the Baltics. IMF.
14. Russo, M., Odling-Smee, J. (1996). Equilibrium Exchange Rates in Transition Economies. IMF.
15. Sepp, U. (1996). Eesti krooni reaalkurss. Eesti Pank.
16. *Statistika aastaraamat 1996. Eesti Statistikaamet. Tallinn.*
17. *Statistika kuukiri nr.6(18)/1996. Eesti Statistikaamet. Tallinn.*
18. Toodangu, tooraine, materjalide, seadmete ja kütuse keskmised hulgihinnad ja hinnaindeksid 1992.aastal. Statistiline kogumik. (1993). Riigi Statistikaamet. Tallinn.
19. *Tööjõud ja palk Eesti Vabariigis 1993. (1994). Eesti Statistikaamet. Tallinn.*
20. *Väliskaubandus. Foreign Trade 1993. (1994). Eesti Statistikaamet. Tallinn.*

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President Jüri Engelbrecht

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Lauteri 3 EE 0001
Tallinn ESTONIA
Phone: (372) 6 466 336
Fax: (372) 6 313 959
E-mail: madis@ebs.ee
Internet homepage:
http://www.ebs.ee/