*Josip Tica**
*Ljubo Jurčić***

UDK 330.354:331.2
JEL Classification D24, J38
Prethodno priopćenje

A RELATIVE UNIT LABOR COST: CASE OF ACCESSION COUNTRIES

In this paper, framework of the relative unit labor cost has been used in order to analyze relative competitiveness of the economic agents in Croatia and five new member countries. Unit labor costs have been calculated for Croatia, Czech Republic, Hungary, Poland, Slovakia and Slovenia. The cointegration tests and VAR methodology was used in order to estimate importance of relative unit labor costs vis-à-vis accession countries on industrial production in Croatia. Our findings suggest that relative unit labor costs (RULC-competitiveness) increased quite modestly (within the margin of error) during the observed period and that movements of RULC can explain short run movements in industrial production of Croatia.

Key words: competitiveness, relative unit labor costs, productivity, wages, employment

Introduction

Throughout the twentieth century, the mainstream measure of competitiveness in the international economics has been the real exchange rate. The hypothesis of purchasing power parity simply implies that the real exchange rate will be stationary in the long run. According to the PPP theory, under assumption of

* J. Tica, Ph.D., Assistant Professor, University of Zagreb, Faculty of Economics, e-mail: jtica@efzg.hr

** Lj. Jurčić, Ph.D., Associate Professor, University of Zagreb, Faculty of Economics, e-mail: ljurcic@efzg.hr. Prva verzija rada primljena u uredništvo 29. 5. 2007., a definitivna 5. 11. 2007.

perfect competition, international trade will have the effect of equalizing prices for the same good in different countries since profits can be made by transporting a good from a location where the price is low and selling it where the price is high. According to the basic theories of international economics, under perfect competition, price will be equal to marginal costs, marginal costs will be equalized in all countries and there will be no supernormal profits.

The PPP assumption that is founded in such a quite basic and unrealistic theoretical framework can not account for a whole range of empirical and theoretical problems such as the Marshall-Lerner condition, the Exchange rate pass through effect, full employment issues etc. Therefore, contemporary analyses should abandon perfect markets and concentrate on the concerns related to the market imperfections (monetary policy and exchange rate policy issues) such as price and wage rigidities, pricing to market, menu costs etc. The best theoretical framework for such an approach is the imperfect market analysis.

Under the assumption of an imperfect competition most tradable goods and services are differentiated products and producers pursue pricing strategies to maximize their long-run profits. In other words, prices are not equal to marginal costs, profits exist even in the long run, market participants are large enough to affect prices and quantities, etc. Therefore, when it comes to foreign markets, firms will use world pricing in order to set their prices at the international level. In other words, export companies will set their prices based on the prices of similar products produced abroad and their profit margins will squeeze or expand accordingly. In such an imperfect market environment, a rise in domestic costs will have no effect on the export prices, higher costs will be simply accommodated with smaller profits. In this case there is no change in the price competitiveness of exports (real exchange rate), but there is an effect on the exporter's ability to compete.

In such an imperfect market, squeezed profits result in relative disadvantage in company's access to internal finance to fund future investments, marketing, research and development, or after-sales service. In the imperfect competition, higher costs will have no effect on price competitiveness, but "non-price" competitiveness will be reduced. Therefore in this case, a definition of competitiveness and the real exchange rate based relative costs rather than relative prices are more appropriate. One commonly used measure of competitiveness is called relative unit labor costs or RULC and is defined as ratio of relative productivity and wages between trading partners.

In this paper, the framework of the relative labor cost has been used in order to analyze relative competitiveness of the economic agents in Croatia and five new member countries. The unit labor costs have been calculated for Croatia, Czech Republic, Hungary, Poland, Slovakia and Slovenia. All of the analyzed countries are transition countries, on the similar level of GDP per capita, and are or will be in the near future EU members. It is more than obvious that all of the analyzed

countries will be direct competitors in the common European markets. Furthermore, in order to highlight the significance of the RULC indices, the relative unit labor cost indices constructed in the paper are used in econometrical analysis in order to explain movements in industrial production, industrial and total employment and trade balance of Croatia.

Data

Two sources of data were used in order to compile the database required for the calculation of relative unit labor costs in Croatia, Czech Republic, Hungary, Poland, Slovakia and Slovenia. Analysis on yearly frequency was based on data for GDP (LCU), industrial value added (LCU), employment (industry and total), and official exchange rates of USD (LCU) acquired from World Development Indicators (2005) and data for average gross wages acquired from Vienna Institute for International Economic Studies (2006). Due to availability of data construction of RULC with yearly data is possible only for the period between 1994 and 2002.

Monthly data for the analysis, industrial production, average gross wages (€), employees in industry, as well as productivity in industry were acquired from Vienna Institute for International Economic Studies (2006) monthly database. Due to availability of data (data for average monthly employment in industry in Croatia starts in September 1999), construction of RULC indicator is possible only for the period between September 1999 and June 2006.

Methodology

The relative unit labor cost indicator for Croatia is constructed as a ratio of unit labor cost of country x and unit labor cost of Croatia (Carlin i Soskice 2006, p. 296-298):

$$RULC = \frac{ULC_X}{ULC_{HRV}} \tag{1}$$

A rise in relative labor cost index is interpreted as increase in competitiveness of Croatia and decrease of relative labor costs is interpreted as a decrease of competitiveness of Croatia compared to country x. It is important to notice here that the equation can also be reversed with unit labor costs of Croatia in the numerator and unit labor costs of country x in the denominator. In that case the

interpretation of increase and decrease of the index is opposite as well: increase of RULC is loss of competitiveness and *vice versa* (Griffiths and Wall 1995, p. 20). In both cases relative changes of index are exactly the same, and as it is the case with nominal and real exchange rates, the choice of denominator and nominator is the matter of personal preferences. In this research, Croatian ULC is in denominator in order to make this analysis compatible with analysis of real exchange rates. Therefore, as it is the case with exchange rates, increase of indicator is increase of competitiveness (Carlin i Soskice 2006, p. 296-298).

Unit labor costs of all five countries were calculated as ratio of average gross wages (W-wages, E-nominal exchange rate[1]) and average productivity (Y/L):

$$ULC = \frac{W * E}{Y / L} \qquad (2)$$

Total factor productivity is not used due to the problems with data on capital and controversies related to the explicit form of aggregate productivity function. Three different proxies for average productivity were used. Yearly data series use two measures of productivity: ratio of industrial value added and number of employees in industry and ratio of GDP and total number of employees. Monthly data series use ratio of industrial production and number of employees in industry.

Indices

In the analysis with yearly data, two different indices of productivity were constructed: relative unit labor cost for the industrial sector and relative labor cost for the total economy. Due to availability of data, the relative labor unit cost for the total economy covers a much longer time span. In the analysis with monthly data, only one index, the relative unit labor cost of industry is constructed.

RULC with yearly frequency

The analysis of the annual relative unit labor costs more or less confirmed results previously obtained by Zdunić (2004). Between 1996 and 2002 fastest

[1] The current nominal exchange rate is used as a measure of current costs of doing business in respective countries. The use of PPP adjusted real exchange rate is applicable for the comparisons of the living standards among countries, but it does not help a lot in terms of competitiveness analysis.

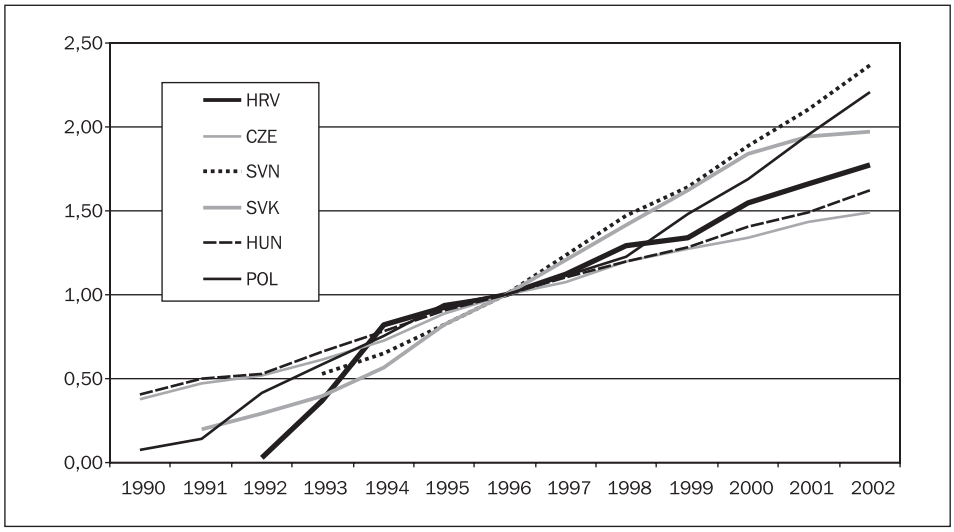
growth of productivity is recorded in Slovenia where productivity more than doubled. Slovakia is a country with slowest productivity growth of the total economy. Compared to the analyzed countries, Croatian increase of productivity of total economy is slightly below average. Compared to the 1996 level, productivity is 77% higher; during the same period productivity increased 137% in Slovenia, 121% in Poland, 97% in Slovakia, 62% in Hungary and 49% in Czech Rep (Figure 1).

Compared to 1996, in 2001 average productivity of industrial sectors increased the most in Slovenia 175% and slowest in Hungary 17%. As in the case of productivity of total economy, Croatian growth is in between amounting to 46%. Poland increased 100%, Slovakia 79%, Czech Rep. 36% (Figure 2).

Average gross wages in USD, between 1996 and 2005 increased fastest in Hungary 207% and Poland 153%. The smallest increase was recorded in Croatia 87% and Czech Rep. 90%. Slovenian average gross wages increased 128% and Slovakian 112%. Compared to the period between 1996 and 2002, increases are larger, but relative ranking of countries is exactly the same (Figure 3).

Figure 1:

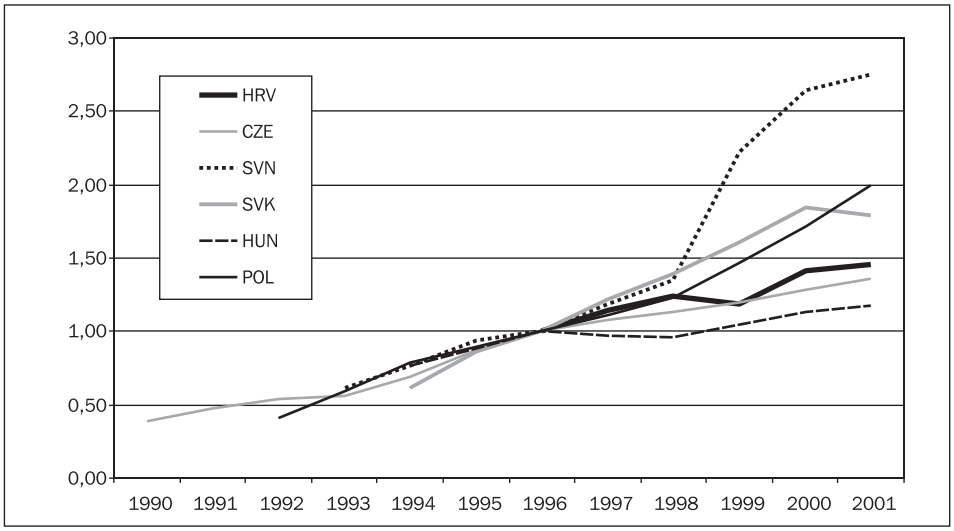
AVERAGE PRODUCTIVITY OF TOTAL ECONOMY 1996=1



Source: WDI (2005)

Figure 2:

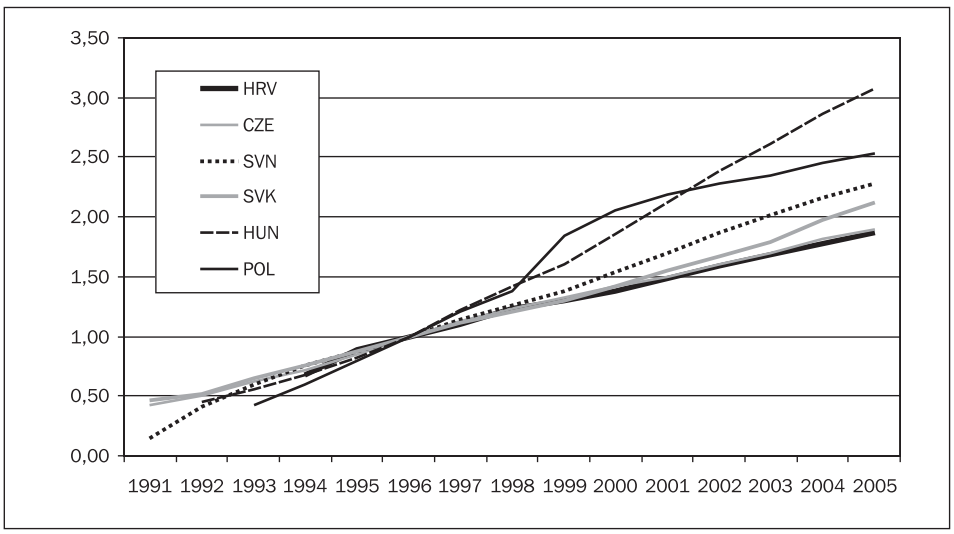
AVERAGE PRODUCTIVITY OF INDUSTRIAL SECTOR 1996=1



Source: WDI (2005)

Figure 3:

AVERAGE GROSS WAGES TOTAL ECONOMY 1996=1



Source: WIIW (2006)

Unit labor costs of the total economy in 2002, compared to 1996 increased the most, in Hungary 47% and the least in Slovenia -21%. Once again the performance of Croatian economy is quite average with a decrease of 10%. The Czech Rep. (8%) and Poland (3%) experienced relative loss of competitiveness (measured with unit labor costs), while Slovakia joined Slovenia and Croatia with a decrease in costs of 15% (Figure 4).

Unit labor costs of the industrial sector in 2001 compared to 1996 show quite similar dynamics as the total economy. Compared to 1996, an increase in unit labor costs is recorded in Hungary 81%, Poland 10%, Czech Rep. 10% and Croatia 2%, and decrease in unit labor costs is recorded in Slovakia 13% and Slovenia 38% (Figure 5).

Between 1996 and 2002, relative unit labor costs and/or competitiveness of Croatia increased relative to Hungary 64%, Czech Rep. 20% and Poland 15% and decreased relative to Slovakia 5% and Slovenia 12%. Analysis of relative unit labor cost is even more interesting if period prior to 1996 is analyzed. It is obvious that Croatia experienced a tremendous drop in competitiveness *vis-à-vis* all the analyzed countries, with the exception of Poland.

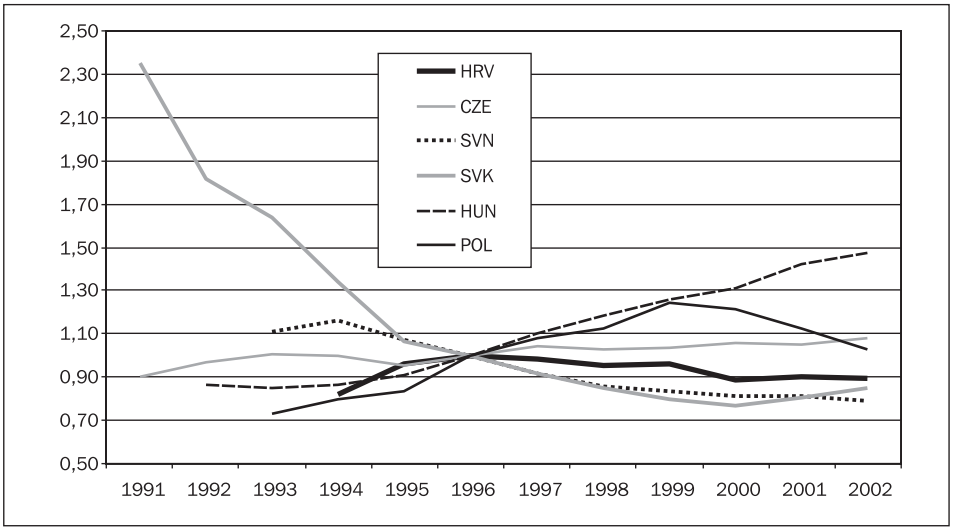
Between 1994 and 1996, competitiveness of Croatia decreased 63% relative to Slovakia, 42% relative to Slovenia, 21% relative to the Czech Rep. and 5% relative to Hungary. These results empirically confirm explanations offered in the quite thorough and extensive analysis by Zdunic and Grgic (2001).

Throughout the entire analyzed period (1996-2002), competitiveness constantly deteriorated relative to Slovakia and Slovenia. Relative to other countries competitiveness started improving after the initial shock in pre 1996 period (Figure 6).

Relative unit labor costs in industry moved similarly to relative unit labor costs of the total economy. Competitiveness of Croatia increased relative to Hungary 85%, the Czech Rep. 13% and Poland 12%. Relative unit labor costs decreased relative to Slovenia 47% and Slovakia 11%. Analysis of movements of five bilateral competitiveness indices shows that there is a strong trend toward a decrease relative to Slovenia and Slovakia and an increase relative to Hungary. Relative to Poland and Czech Rep., the index of competitiveness shows relatively stationary (small) movements (Figure 7).

Figure 4:

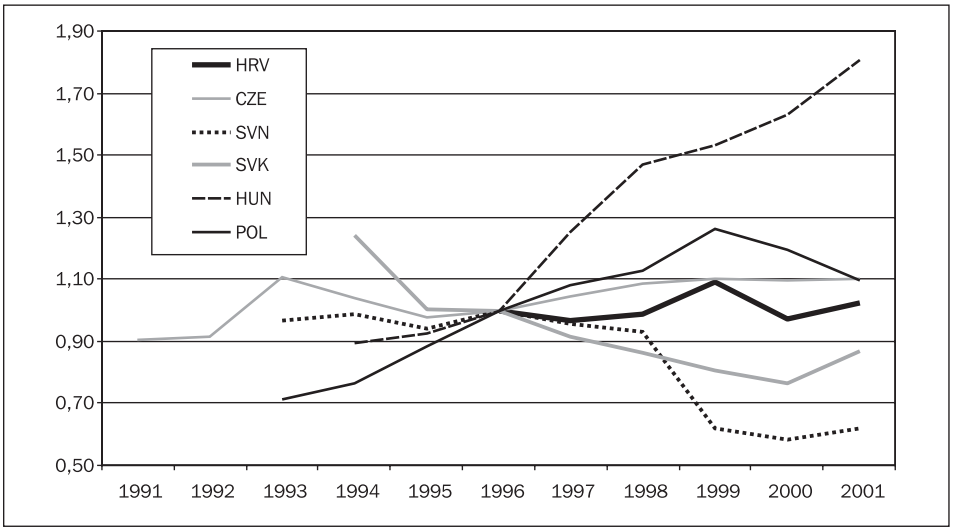
UNIT LABOR COSTS OF TOTAL ECONOMY 1996=1



Source: WDI (2005)

Figure 5:

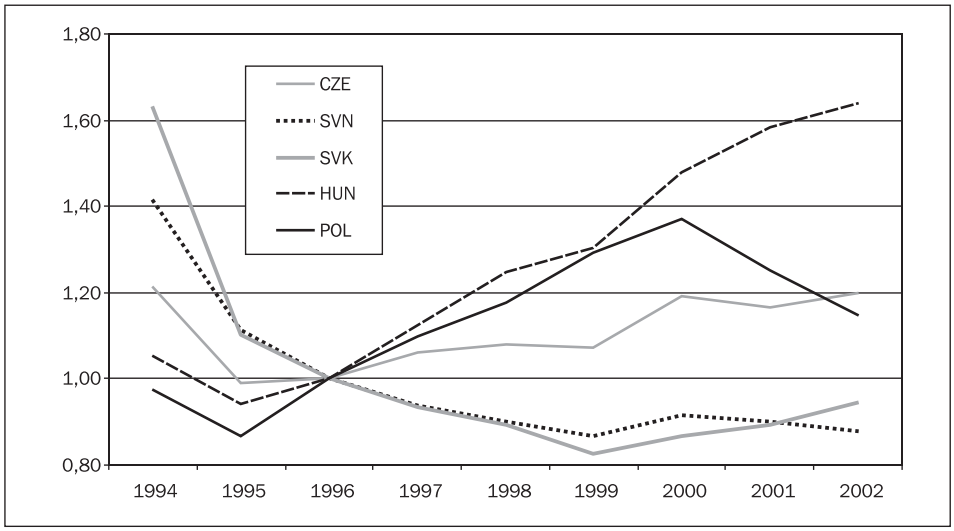
UNIT LABOR COSTS OF INDUSTRIAL SECTOR 1996=1



Source: WDI (2005)

Figure 6:

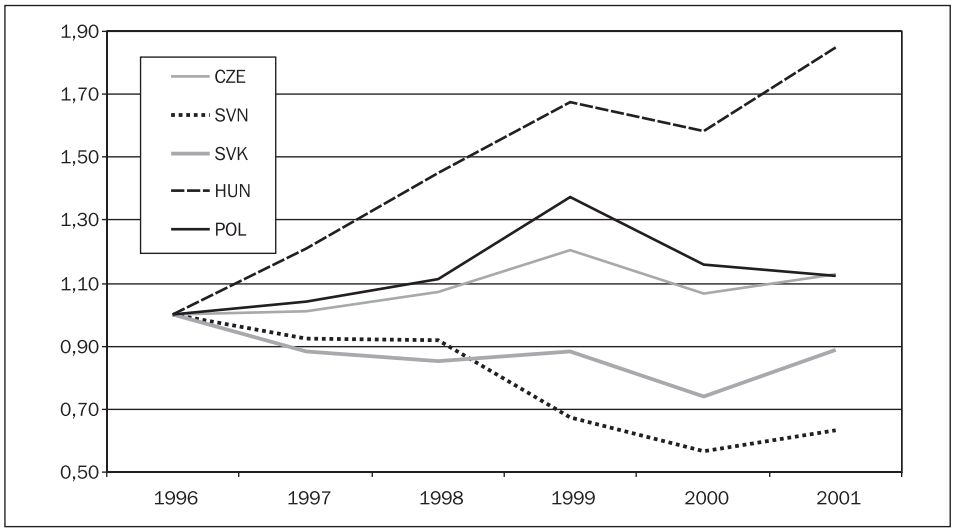
RELATIVE UNIT LABOR COSTS OF TOTAL ECONOMY 1996=1



Source: WDI (2005)

Figure 7:

RELATIVE UNIT LABOR COSTS OF INDUSTRIAL SECTOR 1996=1



Source: WDI (2005)

RULC with monthly frequency

The employment data in Croatia with monthly frequency are available after September 1999 only. Therefore, the relative unit labor cost series of all analyzed countries are constructed for the post 1999:9 period. The fact that analysis of data with monthly frequency starts in September 1999 is a technical issue and all series should be interpreted as relative change compared to September 1999. Authors do not claim that September 1999 is equilibrium level of relative unit labor cost, or any other variable, it is "randomly" selected period for the purpose of construction of the relative labor cost indices.

The average gross wages are expressed in Euros in the analysis on monthly data. Since September 1999, wages increased 109% in Hungary and Czech Rep., 101% in Slovakia, 67% in Croatia, 52% in Poland and 39% in Slovenia (Figure 8).

During the same period, the index of industrial production increased 70% in Czech Rep., 55% in Slovakia, 49% in Hungary, 38% in Croatia and 28% in Slovenia. The data on industrial production of Poland are not available (Figure 9).

Between September 1999 and June 2006, the number of employees in industry decreased in all analyzed countries, 14% in Poland, 13% in Croatia, 11% in Slovenia, 10% in Hungary, and 5% in Czech Rep. Data on the number of employees in Slovakia are not available (Figure 10).[2]

Data on industrial production in Poland and number of employees in industry in Slovakia are not available. Therefore, the data for productivity in industry are used in order to estimate relative unit labor costs (Table 1).

Table 1:

AVAILABILITY OF DATA

	HR	**CZ**	**HU**	**PL**	**SK**	**SL**
Industrial production	+	+	+	-	+	+
Employees industry	+	+	+	+	-	+
Wages industry	+	+	+	+	+	+
Industrial productivity	+	-	-	+	+	+

Source: WIIW (2006)

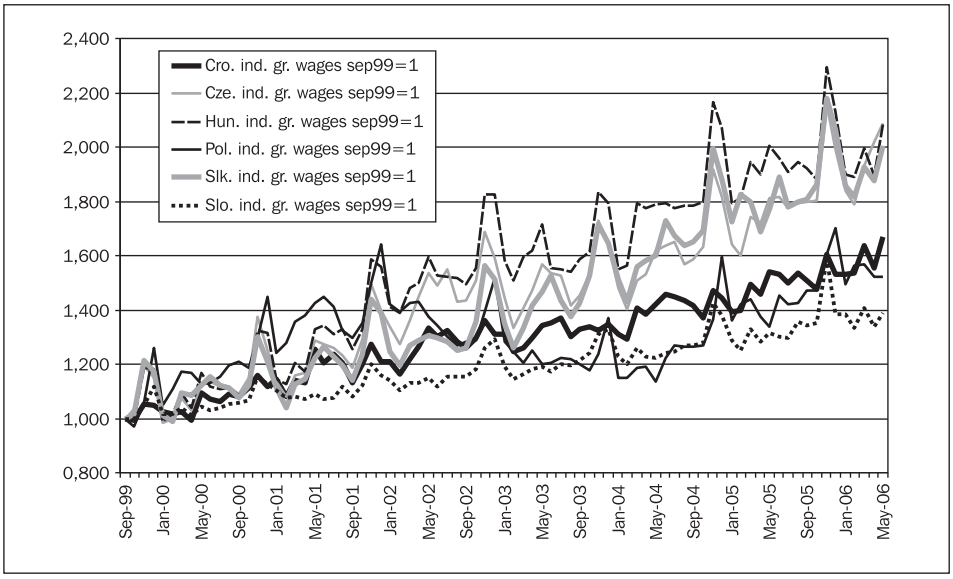
[2] It should be highlighted here that the goal of the analysis is to estimate movements in competitiveness and not to defend de-industrialisation of Croatia through the manipulation of data time spans. Any earlier time span of the industrial employment clearly indicates that something went wrong in Croatia compared to other transition countries.

In the analyzed period unit labor costs increased 30% in Slovakia, 26% in Hungary, 17% in Czech Rep. and 6% in Croatia. In Slovenia and Poland, unit labor costs decreased 4% and 9%. These results are quite similar to the analysis with yearly data. Croatia is in the middle of the countries in the sample. The only exception compared to previous analysis is the fact that Poland and Slovakia switched places. In the present decade Poland is improving its competitiveness while Slovakia is not doing as great as it used to in yearly data analysis (Figure 11).

Accordingly, relative unit labor costs of Croatia increased relative to Slovakia 23%, Hungary 19%, Czech Rep. 11% and decreased relative to Slovenia 8% and Poland 13% (Figure 12).

Figure 8:

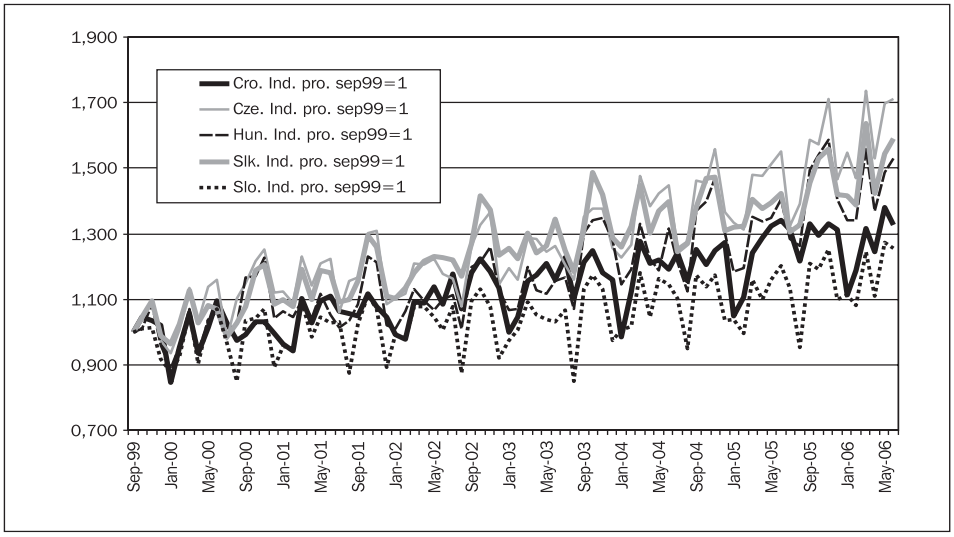
AVERAGE GROSS WAGES IN INDUSTRY (€) 1999:9=1



Source: WIIW (2006)

Figure 9:

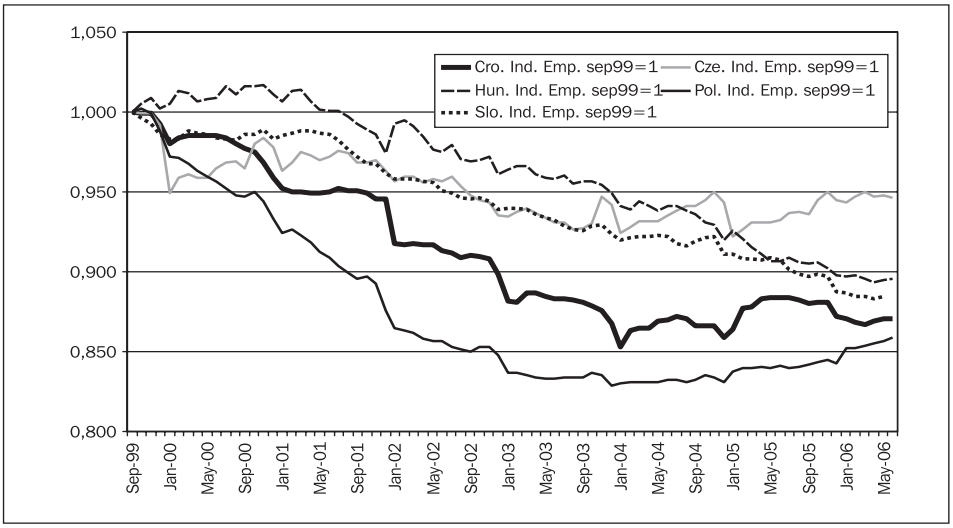
INDUSTRIAL PRODUCTION 1999:9=1



Source: WIIW (2006)

Figure 10:

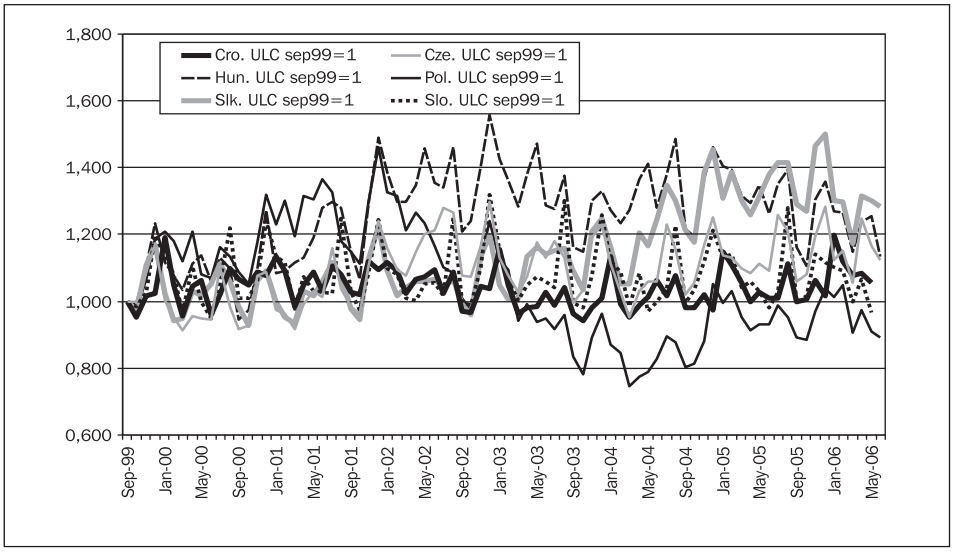
EMPLOYEES IN INDUSTRY 1999:9=1



Source: WIIW (2006)

Figure 11:

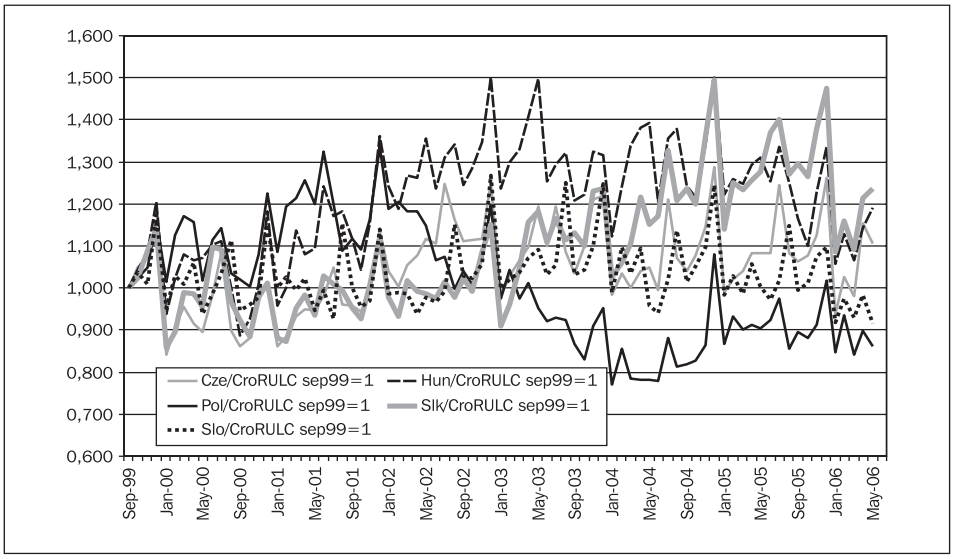
UNIT LABOR COSTS IN INDUSTRY 1999:9=1



Source: WIIW (2006)

Figure 12:

RELATIVE UNIT LABOR COSTS IN INDUSTRY 1999:9=1



Source: WIIW (2006)

Econometric test

After constructing relative unit root cost indices for Czech Rep., Poland, Hungary, Slovakia and Slovenia, we have tested for cointegration between upper mentioned indices and industrial production, industrial employment, total employment[3] and trade deficit in Croatia. Due to the fact that the series of yearly indices are too short, only the monthly data series were used in the econometrical tests. According to the theory, indices of relative unit root costs should have positive effects on (net) export (deficits), industrial production and/or employment (total and in industrial sector).

We have used general to specific methodology described by Enders (2004). At the beginning all variables have been tested for unit roots. Results suggest that relative unit labor cost indices of Czech Rep., Hungary, Slovakia and Slovenia, and index of industrial production are I(1) series integrated of order one. Trade deficit and total employment are I(0) stationary series and employment in industrial sector and relative unit labor cost of Poland are higher order series (I(2) probably).

Table 2:

UNIT ROOT TESTS

	Level			1st differencing		
	trend+intercept	intercept	none	trend+intercept	intercept	none
lcze	-1,43144	-1,86510	-0,93137	-2,88983	***-2,714157	**-2,56973
lhun	-0,61261	-2,42589	-0,42518	**-3,267046		
lpol	-2,96851	-1,32122	-1,34423	-1,56349	-1,56847	-1,49865
lslk	-2,41160	-0,82975	-0,29208	-1,93535	-2,19147	**-1,947382
lslo	-0,37156	-1,09510	-0,92386	-2,98420	***-2,749862	**-2,760319
ldef	*-7,063720					
ly	-2,11205	0,04265	2,90486	*-11,78392		
ln	-2,05658	-2,10814	-0,12080	-1,83389	-1,11644	-0,88793
ltn	*-4,567023					

Note: * denotes 1% significance, ** denotes 5% significance and *** denotes 10% significance. Lcze, lhun, lpol, lslk and lslo denotes log RULC *vis a vis* respective countries. Ldef is trade deficit, ly is industrial production, ln is industrial employment and ltn is total employment.

Source: WIIW (2006), DZS (2007)

[3] Total employment includes employed in legal entities, crafts and selfemployed persons, while agriculture, policy and army are excluded.

Five I(1) series, relative unit labor cost indices of Czech Rep., Hungary, Slovakia and Slovenia, and index of industrial production were used in cointegration test. Unfortunately, the number of observations was not sufficient for the combine test with 12 lags (it is common to use 12 lags on monthly data - industrial employment statistics for Croatia is not available prior to September 1999). Therefore, it was not possible to construct RULC series for the period before 1999:9 and cointegration tests with five variables and 68 observations resulted with noninvertible matrixes.

Next step was to test for cointegration between industrial production index and relative unit labor cost index for each country separately. Lag length test indicated 12 lags for all four countries.

Table 3:

LAG LENGTH TEST FOR INDUSTRIAL PRODUCTION

Lag length test	LR	FPE	AIC	SC	HQ
Czech Rep.	12	12	12	12	12
Hungary	12	12	12	12	12
Slovakia	12	12	12	4	12
Slovenia	12	12	12	12	12

Note: LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

Source: WIIW (2006), DZS (2007)

The cointegration test with 12 lags did not manage to reject null hypothesis of no cointegration for the Czech Republic. Models suggested by Akaike and Schwarz criterion indicated zero cointegration vectors according to both trace and max eigenvectors methodology (Table 4).

Table 4:

COINTEGRATION TEST FOR THE INDUSTRIAL PRODUCTION AND RULC VIS-À-VIS THE CZECH REP.

Date: 10/25/07 Time: 19:57					
Sample: 1999M09 2006M05					
Included observations: 68					
Series: LY LCZE					
Lags interval: 1 to 12					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	**Linear**	**Linear**	Quadratic
Test Type	No Intercept	Intercept	**Intercept**	**Intercept**	Intercept
	No Trend	No Trend	**No Trend**	**Trend**	Trend
Trace	1	1	**0**	**0**	0
Max-Eig	1	1	**0**	**0**	0
*Critical values based on Osterwald-Lenum (1992)					
Information Criteria by Rank and Model					
Data Trend:	None	None	**Linear**	**Linear**	Quadratic
Rank or	No Intercept	Intercept	**Intercept**	**Intercept**	Intercept
No. of CEs	No Trend	No Trend	**No Trend**	**Trend**	Trend
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-6.273727	-6.273727	**-6.705442***	**-6.705442***	-6.662161
1	-6.414322	-6.635083	**-6.667191**	**-6.703613**	-6.688476
2	-6.353088	-6.550601	**-6.550601**	**-6.630949**	-6.630949
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-4.707015	-4.707015	**-5.073451***	**-5.073451***	-4.964890
1	-4.717051	-4.905173	**-4.904641**	**-4.908423**	-4.860646
2	-4.525258	-4.657491	**-4.657491**	**-4.672560**	-4.672560

Source: WIIW (2006), DZS (2007)

In the case of Hungary AIC and SC statistics indicated models which were not able to reject null hypothesis of no cointegration according to both trace and max eigenvectors methodology (Table 5).

Table 5:

COINTEGRATION TEST FOR THE INDUSTRIAL PRODUCTION AND RULC VIS-À-VIS HUNGARY

Date: 10/25/07 Time: 20:00					
Sample: 1999M09 2006M05					
Included observations: 68					
Series: LY LHUN					
Lags interval: 1 to 12					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	**Quadratic**
Test Type	No Intercept	Intercept	Intercept	Intercept	**Intercept**
	No Trend	No Trend	No Trend	Trend	**Trend**
Trace	1	2	0	0	**0**
Max-Eig	1	2	1	0	**0**
*Critical values based on Osterwald-Lenum (1992)					
Information Criteria by Rank and Model					
Data Trend:	None	None	Linear	Linear	**Quadratic**
Rank or	No Intercept	Intercept	Intercept	Intercept	**Intercept**
No. of CEs	No Trend	No Trend	No Trend	Trend	**Trend**
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-6.178495	-6.178495	-6.451561	-6.451561	**-6.583969**
1	-6.390319	-6.381048	-6.542033	-6.531203	**-6.595801***
2	-6.316346	-6.425596	-6.425596	-6.486748	**-6.486748**
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-4.611783	-4.611783	-4.819570	-4.819570	**-4.886699***
1	-4.693048	-4.651137	-4.779483	-4.736013	**-4.767971**
2	-4.488516	-4.532486	-4.532486	-4.528359	**-4.528359**

Source: WIIW (2006), DZS (2007)

The cointegration test for Slovakia repeated results obtained for Hungary and Czech Rep. No cointegration vectors were found according to both trace and max eigenvectors methodology.

Table 6:

COINTEGRATION TEST FOR THE INDUSTRIAL PRODUCTION AND RULC VIS-À-VIS SLOVAKIA

Date: 10/25/07 Time: 20:01					
Sample: 1999M09 2006M05					
Included observations: 68					
Series: LY LSLK					
Lags interval: 1 to 12					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	**Linear**	**Linear**	Quadratic
Test Type	No Intercept	Intercept	**Intercept**	**Intercept**	Intercept
	No Trend	No Trend	**No Trend**	**Trend**	Trend
Trace	1	1	**0**	**0**	2
Max-Eig	1	1	**0**	**0**	0
*Critical values based on Osterwald-Lenum (1992)					
Information Criteria by Rank and Model					
Data Trend:	None	None	**Linear**	**Linear**	Quadratic
Rank or	No Intercept	Intercept	**Intercept**	**Intercept**	Intercept
No. Of CEs	No Trend	No Trend	**No Trend**	**Trend**	Trend
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-6.189596	-6.189596	**-6.416539**	**-6.416539**	-6.359451
1	-6.295659	-6.331593	**-6.394728**	**-6.467042***	-6.437926
2	-6.197889	-6.279138	**-6.279138**	**-6.392152**	-6.392152
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-4.622885	-4.622885	**-4.784549***	**-4.784549***	-4.662180
1	-4.598389	-4.601682	**-4.632178**	**-4.671852**	-4.610096
2	-4.370059	-4.386029	**-4.386029**	**-4.433763**	-4.433763

Source: WIIW (2006), DZS (2007)

The last test for Slovenia repeated the results obtained for other three countries. Obviously, series of relative industrial production in Croatia is not cointegrated with relative unit labor costs *vis-à-vis* Czech Rep., Hungary, Slovakia and Slovenia. Either series are to short for a long run equilibrium to be identified, or there is not long term equilibrium at all.

Table 7:

COINTEGRATION TEST FOR THE INDUSTRIAL PRODUCTION AND RULC VIS-À-VIS SLOVENIA

Date: 10/25/07 Time: 20:03					
Sample: 1999M09 2006M05					
Included observations: 68					
Series: LY LSLO					
Lags interval: 1 to 12					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	**Linear**	Linear	**Quadratic**
Test Type	No Intercept	Intercept	**Intercept**	Intercept	**Intercept**
	No Trend	No Trend	**No Trend**	Trend	**Trend**
Trace	1	1	**0**	0	**0**
Max-Eig	1	1	**0**	0	**0**
*Critical values based on Osterwald-Lenum (1992)					
Information Criteria by Rank and Model					
Data Trend:	None	None	**Linear**	Linear	**Quadratic**
Rank or	No Intercept	Intercept	**Intercept**	Intercept	**Intercept**
No. Of CEs	No Trend	No Trend	**No Trend**	Trend	**Trend**
Akaike Information Criteria by Rank (rows) and Model (columns)					
0	-6.454699	-6.454699	**-6.855270**	-6.855270	**-6.859391**
1	-6.590509	-6.862313	**-6.832911**	-6.960464	**-6.989439***
2	-6.475669	-6.768469	**-6.768469**	-6.873362	**-6.873362**
Schwarz Criteria by Rank (rows) and Model (columns)					
0	-4.887987	-4.887987	**-5.223279***	-5.223279*	**-5.162120**
1	-4.893239	-5.132402	**-5.070360**	-5.165273	**-5.161610**
2	-4.647840	-4.875360	**-4.875360**	-4.914972	**-4.914972**

Source: WIIW (2006), DZS (2007)

According to Enders (2004, p. 287) if I(1) series are not cointegrated in levels, an analysis should proceed with VAR estimation on differenced data series. Therefore, the VAR system is constructed for industrial production of Croatia and relative unit labor cost indices of Czech Rep., Hungary, Slovakia and Slovenia. Three lag length tests indicated lag length of 12 (Table 8).

Table 8:

LAG LENGTH TEST FOR VAR

VAR Lag Order Selection Criteria						
Endogenous variables: DLOGY DLOGCZE DLOGHUN DLOGSLK DLOGSLO						
Exogenous variables: C						
Date: 10/25/07 Time: 20:37						
Sample: 1999M09 2006M05						
Included observations: 68						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	461.2978	NA	1.02e-12	-13.42052	-13.25732	-13.35586
1	512.8866	94.07376	4.68e-13	-14.20255	-13.22335	-13.81456
2	574.0600	102.5554	1.64e-13	-15.26647	**-13.47128***	-14.55516
3	596.6701	34.58010	1.81e-13	-15.19618	-12.58499	-14.16155
4	637.9546	57.06976	1.19e-13	-15.67513	-12.24795	-14.31718
5	681.8924	54.27617	7.53e-14	-16.23213	-11.98895	-14.55085
6	712.6916	33.51678	7.44e-14	-16.40269	-11.34352	-14.39810
7	754.0581	**38.93316***	5.82e-14	-16.88406	-11.00889	-14.55614
8	791.7140	29.90324	5.69e-14	-17.25630	-10.56513	-14.60505
9	836.5787	29.03005	5.30e-14	-17.84055	-10.33339	-14.86598
10	876.4202	19.92076	7.38e-14	-18.27706	-9.953910	-14.97918
11	955.6871	27.97657	5.03e-14	-19.87315	-10.73400	-16.25194
12	1073.381	24.23111	**2.85e-14***	**-22.59944***	-12.64430	**-18.65491***

Note: LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion.

Source: WIIW (2006), DZS (2007)

Estimation of VAR system resulted with quite interesting variance decomposition results. According to the model, after 1 period, relative unit labor cost of Czech Rep. explained 8% of variance of industrial production in Croatia. The relative unit labor cost of Hungary, Slovakia and Slovenia explained 1.2%, 2.8% and 1.8% of movements respectively. After 12 months, the relative unit labor cost of Czech Rep., Hungary, Slovakia and Slovenia explained 14%, 5%, 8% and 28% movements respectively (Table 9). Persistence of the shocks in industrial production of Croatia is quite moderate and the variable can explain 43% of its own variance after 12 months.

Table 9:

VARIANCE DECOMPOSITION OF INDUSTRIAL PRODUCTION

Variance Decomposition of DLOGY:						
Period	S.E.	DLOGY	DLOGCZE	DLOGHUN	DLOGSLK	DLOGSLO
1	0.040451	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.053293	86.57336	8.076889	1.254606	2.812339	1.282810
3	0.057696	73.87139	14.70922	3.626777	2.577981	5.214625
4	0.059189	70.22666	14.00009	7.183092	2.774682	5.815480
5	0.067249	58.22100	16.24628	5.567172	6.225526	13.74002
6	0.075850	48.86444	18.91479	5.491540	5.292105	21.43713
7	0.078591	50.58149	18.85847	5.487440	5.089892	19.98270
8	0.081372	52.02172	17.67613	5.126113	5.232778	19.94326
9	0.082657	50.50151	17.24307	4.968131	5.224869	22.06242
10	0.086788	45.83202	15.73355	4.657996	6.563904	27.21252
11	0.090707	44.05239	14.50981	4.494950	8.256579	28.68628
12	0.091466	43.43044	14.27451	5.367956	8.122323	28.80477

Source: WIIW (2006), DZS (2007)

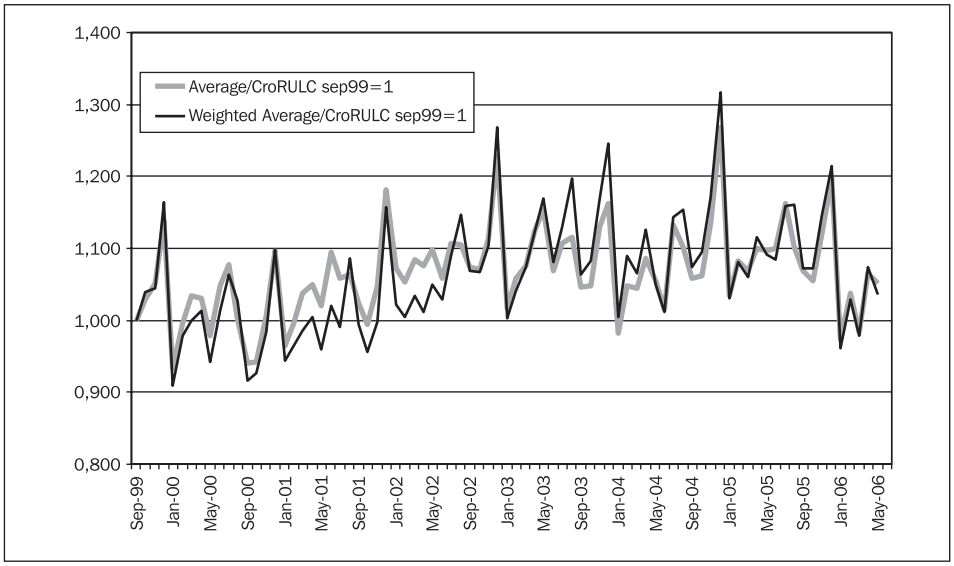
At the end three major conclusions can be highlighted. First, the data series are either too short for long term equilibrium to be estimated, or there is not a long term equilibrium between industrial production and competitiveness *vis-à-vis* analyzed countries. Second, almost half of the short term variance movements in industrial production of Croatia can be explained with relative unit labor costs *vis-à-vis* Czech Rep., Hungary, Slovakia and Slovenia. Third, impact of the relative unit labor cost *vis-à-vis* Slovenia is strongest (almost 15% of the variance movements).

The reason is probably the fact that besides being competitor for FDI, Slovenia is also a major trade partner of Croatia, and it is more than probable that relative unit labor costs affect trade together with FDI inflows.

Figure 13 shows average RULC of Croatia *vis-à-vis* five countries and weighted average RULC *vis a vis* four countries (Poland is excluded since the RULC *vis-à-vis* Poland is I(2) process). Obviously, since Slovenia has highest weight (28% of the variance) in the weighted average RULC, gains in Croatian competitiveness are even more modest compared to the plain arithmetic average.

Figure 13:

AVERAGE AND WEIGHTED UNIT LABOR COST 1999:9=1



Source: WIIW (2006) and authors' calculation

At the end, under assumption of multicointegration (Lee and Granger 1990), an attempt is made to test for the multicointegration between total employment as possible proxy for the effects of RULC changes on the nontradable sector, notably services. GDP is probably better proxy, but it is not available with monthly frequency. The logic behind this attempt is the fact that most of the FDIs in Croatia are in the service sector such as retailing, IT, construction related services, banking etc. Therefore it is more than probable that increases in RULC affects positively FDI inflows in nontradable sector, while tradable sector is not affected at all.[4]

Unfortunately, the number of observation is too small to invert matrix and it is not possible to perform the test. The cointegration test for each country is not feasible due to the fact that multicointegration assumes at least three variables and at least two variables with higher order of integration.

In terms of economic policy this purely econometric findings actually mean that the relationship between relative unit labor costs and industrial production

[4] The reason for small attractiveness of Croatia's tradable sector should be found in level of relative unit labor costs and real exchange rate.

exists only in the short run. Possible explanation for such movements might be the consequence of the nontradable (services and construction) sector boom in Croatia and the fact that almost all FDIs in Croatia are in nontradable sector. Sorsa et al. (2007, p. 14) offer quite interesting discussion on the tradable (Ireland) vs. nontradable (Portugal) sector capital inflows and its consequences on convergence and growth vulnerabilities.

Conclusion

The analysis of movements of the relative unit labor costs suggests the following conclusions. First, after the strong collapse in competitiveness of Croatia during 1994 and 1995, relative unit labor costs became less volatile. In general, trends in competitiveness changed in 1996 (war and institutional brake)[5], and improvements occurred. In the period between 1996 and 2002 Croatia improved competitiveness relative to Hungary, Poland and Czech Rep., and after 2000/01 improvements continued relative to Hungary, Czech Rep., and positive trend emerged relative to Slovakia. Throughout the entire analyzed period competitiveness of Croatia relative to Slovenia has been eroding constantly. Relative to Slovakia, competitiveness eroded until the end of nineties, and relative to Poland erosion stared recently.

Second, combined movements of employment, output and wages resulted in quite mediocre improvements in competitiveness of Croatia, which sums up to 3.6-5.1% on average during the last seven years.

Third, the quality of data slightly undermines the reliability of results. The fact that data series for working hour's adjusted productivity in industry are not available in all countries definitively raises strong doubts on such a small increase in competitiveness. Therefore, the most exact interpretation of the result is that competitiveness of Croatia most probably increased on average, but the size of the increase is relatively small compared to potential size of errors in data set.

Fourth, increase of RULC represents an improvement of the attractiveness of Croatia as destination for FDI and an increase of attractiveness of Croatian industrial production in international trade. The econometric analysis has indicated that RULC of the Czech Rep., Hungary, Slovakia and Slovenia affect industrial production of Croatia only in the short run.

Fifth, RULC approach to the competitiveness is suitable for high value added industrial sectors, banking, IT, real estate, construction, consulting, retailing

[5] The majority of occupied territory of the Republic of Croatia has been liberated in 1995.

and other high value added sectors. Agricultural, fisheries and mining sectors or any industry with low value added in production are generally much closer to perfectly competitive markets and relative real exchange rates can be a much better measure of competitiveness (and relative productivities within the framework of the Harrod-Balassa-Samuelson effect). The basic rule is, the higher value added, the more imperfect market, or in our case, the more value added, more RULC and less REER should matter in the econometrical analyses.

LITERATURE

1. Carlin, W., Soskice, D., (2006): *Macroeconomics, Institutions & Policies*, Oxford University Press , Oxford.
2. DZS (2007): Robna razmjena s inozemstvom u 2007. (razna godišta) http://www.dzs.hr/ ; zaposlenost (razna godišta) http://www.dzs.hr/
3. Enders, W., (2004): *Applied Time Series Econometrics*, John Wiley and Sons, Hoboken.
4. Granger, C. and Lee, T., (1990): *Multicointegration*, Advances in Econometrics 8, p. 77-84.
5. Griffiths, A., Wall, S. (1995): *Applied Economics, An Introductory Course*, 6th Edition, Longman, London i New York.
6. Sorsa, P., Bakker, B. B., Duenwald, C., Maechler, A. M. and Tiffin, A. (2007): "Vulnerabilities in Emerging Southeastern Europe – How much Cause for Concern", *IMF working paper* 236.
7. Zdunić, S., (2004.): "Relativne cijene i izvori rasta", *Ekonomski pregled*, 55 (11-12), p. 853-893.
8. Zdunić, S., and Grgić, M. (2001.): "Međupovezanost cijena, intervalutarnog tečaja, troškova proizvodnje, agregatne potražnje i korištenja raspoloživih kapaciteta privrede u Hrvatskoj - teoretska analiza", u: *Ekonomska politika Hrvatske u 2002*., (zbornik radova), Hrvatsko društvo ekonomista, Opatija, 2001.
9. WDI (2005): *World Development Indicators*, United Nations.
10. WIIW (2006): WIIW *Monthly database on Eastern Europe*, Vienna Institute for International Economic Studies.

RELATIVNI JEDINIČNI TROŠKOVI RADA: SLUČAJ NOVOPRIDRUŽENIH ZEMALJA

Sažetak

Konkurentnost Hrvatske i pet novopridruženih članica EU analizirana je u ovome radu u okviru teorije relativnih jediničnih troškova rada. Jedinični troškovi rada izračunani su za Češku, Hrvatsku, Mađarsku, Poljsku, Slovačku i Sloveniju. Testovi kointegracije i VAR metodologija je primijenjena u procjenjivanju utjecaja relativnih jediničnih troškova rada na industrijsku proizvodnju. Rezultati naših istraživanja su ukazali na činjenicu da su relativni jedinični troškovi rada (konkurentnost) neznatno porasli tijekom promatranog razdoblja i da njihovo kretanje može objasniti kratkoročna kretanja industrijske proizvodnje u Hrvatskoj.

Ključne riječi: konkurentnost, relativni jedinični troškovi rada, proizvodnost, plaće, zaposlenost