ORIGINAL SCIENTIFIC PAPER

Differences Between Harmonized Indices of Consumer Prices and Consumer Price Indices in Selected Countries

Milecová Zuzana[*], Technical University of Košice, Faculty of Economics, Slovakia

UDC: 338.51 **JEL:** C12, E31, E58

ABSTRACT *– The aim of the paper is to analyse the differences between the harmonized indices of consumer prices and the national consumer price indices on the theoretical as well as on the practical levels. We are dealing with defining the differences between the indices not only in the euro area and in V4-countries, but also in Serbia. The main differences are geographic and population coverage and owner-occupied housing. For statistical testing we have used a paired two sample t-test, which allows us to test the null hypothesis that the difference between the indices has a mean value of zero. Out of all 21 realised tests we reject null-hypothesis in 14 cases.*

KEY WORDS: *harmonized index of consumer prices, consumer price index*

Introduction

The Consumer Price Indices (CPIs) constitute one of the key macroeconomic indicators, play an important role in monetary policy and economic analysis, are typically referred to in wage negotiations and often used for indexing prices in contracts. However, the underlying concepts and methods differ across countries. That is the reason why the Harmonized Indices of Consumer Prices (HICPs) were constructed, they facilitate the carrying out of international comparisons. In addition, the HICP serves as one of the convergence criteria to assess whether a member state is ready to join the euro area. By means of HICP the European Central Bank (ECB) defines price stability as a year-on-year increase in the HICP for the euro area of below but close to 2% over the medium term. The HICP has found an important place in the economy and has replaced the CPIs in several areas.

On the other hand, the measurement of inflation in two different ways is after all confusing for consumers. That is one of the reasons why the significant differences between indices were not desirable. An example is the price progress in the Slovak Republic in August 2008. Inflation measurement by the CPI rises from 2.2 to 2.4 per cent and the HICP showed the decrease from 1.1 to 0.7 per cent year on year. We can not clearly say which index is correct. Simplest would be to have only one price index, but both have their justification in the economy. That is the reason why it is important to discuss the differences between the HICPs and CPIs.

In each country the differences between these two indices were analysed. According to the results we can say that the most important differences are consumption expenditure coverage and treatment of owner-occupied housing (OOH).

[*] E-mail: Zuzana.Milecova@tuke.sk

This paper deals with the differences between the HICPs and CPIs on both theoretical and practical levels. The aim is to analyse the differences between the used indices in the euro area and in V4-countries and also in Serbia. For statistical testing a paired two sample t-test was used. We tested the null hypothesis that the difference between the indices has a mean value of zero.

Differences between indices in euro area

Both HICPs and CPIs measure the changes in the prices over time of buying goods and services. The used calculation method is the same, Laspeyres chain index. The HICPs and CPIs are based on the same data sources, but they measure inflation with different concepts or methods. [9]

In each member state analyses were realised to identify the differences between the national indices and the HICPs. For example in Netherlands the indices were compared by Leendert (2001), in Belgium by Druant (2001). The differences between the indices in Austria were analysed by Fluch and Rumler (2005). Ray Barrell, Simon Kirby and Rebecca Riley analysed the differences in UK and the results were published in the National Institute Economic Review in 2003. In the Slovak Republic Kosseyova and Doliak (2005) published the analysis of the differences. Ahnert and Branchi (2005) analysed the main differences in all European Union countries. Some information about the differences is available on the web-sides of individual statistical offices.

With respect to these studies, the most important difference is the geographic and population coverage. The CPIs applying the residence concept reflect price changes in all goods and services purchased by consumers living in the country concerned, including their purchases abroad. By contrast, the domestic concept covers all consumption expenditure in the country concerned, regardless of who (residents or non-residents) purchased the goods and services. The HICPs apply the domestic concept. [7], [9] Decision about including the domestic concept is not random. ECB needs an index to monitor price changes in the territory of an individual member state, not in individual households. [8] On the other hand the choice of concept may have important impact on the differences between the indices in small countries like Luxemburg. We could find the differences between the indices in coverage of institutional household's spending too. Most national indices follow only spending of private households. As an example we can mention Estonia, Latvia, Slovenia, Sweden, Belgium, Luxemburg and Portugal. [1]

The differences are also in the number and coverage of items in goods and services basket, especially in subsidized areas, such as in health, social protection, education and insurance services. [8], [9] For example in France are healthy services excluded from the CPI. The Netherlands's national price index follows some costs paid within healthy care and includes membership fees in sport and social clubs. The national index in Sweden includes some items of social protection. Games of chance are excluded from the CPI index for example in Italy and in Germany. The national index in Germany includes lottery tax and motor vehicle tax. [1]

But the most important factor affecting the international comparability between the CPIs is the treatment of OOH. Sixteen of twenty seven European Union countries exclude OOH

by calculating the CPIs. [7] OOH is included in the CPI for example in Denmark, Sweden, Germany, Ireland, Netherlands, Austria and Finland, but this countries use different approaches to cover OOH. In the HICP is OOH still excluded, because it has not yet been decided how owner-occupied housing should be covered. [1]

The differences are formed by rounding the indices on individual aggregation levels too. [9] Some national statistical institutes use different aggregation formulas in their national CPI and HICP for aggregation at the lowest levels of the index. [7] The consumption basket and the expenditure shares of the items covered in the national CPIs and the HICPs may be updated at different intervals. [7] France, Italy, Luxemburg, Portugal, Estonia, Latvia, Lithuania, Slovenia, Sweden and UK update weights in consumer basket for calculating the national CPIs annually. The other member states review basket weights mostly every five years. Updates interval in Greece is as late as six years. [1] Different update interval leads to the fact that there are many new goods and services which are in basket of the HICP, but the CPI does not cover them yet. For example organic food, air tickets, mobile phones and computers, were covered in the HICP sooner than in the CPI in Belgium. [6] The methods used to estimate prices for goods when their quality is changing over time are differ across countries. The differences are in coverage of price reductions during winter and summer sales periods. There may be also differences between the national classifications used for the CPI and the harmonized classification of the HICP. [8]

The progress of the HICPs and the CPIs is shown in Picture 1 in the annex.

Table 1 Differences Between Indices in Euro Area

		mean	**variance**	**p-value**
Belgium	HICP	1.97	1.53	1.000000
	CPI	1.97	1.52	
Germany	HICP	1.49	0.70	0.168871
	CPI	1.46	0.57	
Ireland	HICP	2.91	2.80	0.069507
	CPI	3.10	6.35	
Greece	HICP	3.26	0.95	0.844333
	CPI	3.25	0.94	
Spain	HICP	2.84	1.51	0.041505
	CPI	2.89	1.52	
France	HICP	1.68	0.83	7.38E-23
	CPI	1.55	0.70	
Italy	HICP	2.26	0.47	0.022933
	CPI	2.21	0.46	
Luxembourg	HICP	2.48	2.19	1.83E-11
	CPI	2.09	1.08	
Malta	HICP	2.64	1.56	0.003881
	CPI	2.44	1.67	
Netherlands	HICP	2.24	1.40	0.00124
	CPI	2.14	0.83	
Austria	HICP	1.70	0.77	9.75E-06
	CPI	1.80	0.85	

Portugal	HICP	2.58	1.69	0.001239
	CPI	2.64	1.55	
Slovenia	HICP	5.34	7.20	0.008323
	CPI	5.31	7.15	
Slovakia	HICP	5.90	13.76	9.46E-10
	CPI	6.11	12.51	
Cyprus	HICP	2.51	2.42	0.000706
	CPI	2.65	2.01	
Finland	HICP	1.75	1.12	0.513191
	CPI	1.72	1.62	

Sources: Eurostat, national data, own calculations

For statistical testing of the differences between the indices we used a paired two sample t-test. We have assumed normal distribution, which was verified by visual methods. We tested the null hypothesis that the difference between the indices has a mean value of zero on significance level 5%. If the p-value is less than 0.05, we reject the null hypothesis and if the p-value is more than 0.05, we cannot reject the null hypothesis. The results of this analysis are in Table 1.

We tested data from January 1998 to October 2009 for all sixteen countries, which gradually accessed the euro area (142 observations). In just five cases we could not reject the null hypothesis (Belgium, Germany, Ireland, Greece and Finland). According to this analysis, we could not clearly say that there are no significant differences between the national CPIs and the HICPs in the euro area.

Ahnert and Branchi (2005) analysed the differences between the HICPs and the individual CPIs. The aim of their research was to prove that the differences are not significant and there is a decreasing trend. To confirm this hypothesis, authors draw up an index as simple weighted average of the CPIs of the euro area member states. The country weights are equal to the countries share of Household Final Monetary Consumption Expenditure (HFMCE) in total. This index was compared with the official Monetary Union Index of Consumer Prices (MUICP), which is configured by Eurostat of the HICPs of the member states participating in the EMU. [1] This analysis inspired us to repeat calculations of current information and review present situation.

Von der Lippe (2001) states the compiation method of the MUICP index as follows [17]:

$$M_{0t} = \left(\sum_{m=1}^{k} c_{m1} H_{m1}\right) \cdot \left(\sum_{m=1}^{k} c_{m2} H_{m2}\right) \cdot \ldots \cdot \left(\sum_{m=1}^{k} c_{mt} H_{mt}\right). \qquad (1),$$

where M stands for the MUICP, H for the individual HICPs, c_m represents the country weights, k the individual member states (m = 1, ..., k) and t is for the time. H_{mt} is then the link (from t-1 to t) for country m. Formula (1) represents time series of the MUICP, which could by written as follows:

$$M_{0t} = M_1 \cdot M_2 \cdot \ldots \cdot M_t. \qquad (2),$$

Greece accessed the euro area in the year 2001 and the MUICP index has been extended, as shown in Formula (3):

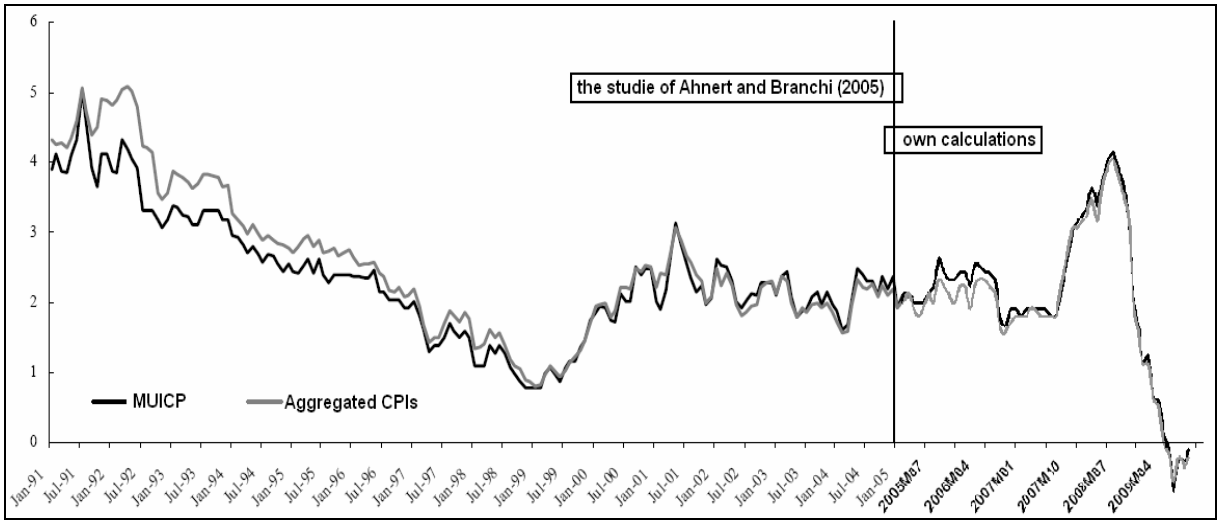
$$M_{0,t+1} = M_{0t} \cdot \left(\sum_{m=1}^{k} c^{*}_{m,t+1} H_{m,t+1} + c_{k+1,t+1} H_{k+1,t+1} \right). \quad (3),$$

$$M_{0,t+1} = M_1 \cdot M_2 \cdot \ldots \cdot M_{t+1}. \quad (4),$$

where *t+1* states for the year 2001. Star marks out the new country weights system after access of a new member state. The MUICP has been extended progressively with access of individual member states to the euro area. The index includes sixteen countries till today.

Necessary data are published by individual national statistical offices, OECD and Eurostat. We found the differences of up to 1.3 percentage points between data published by OECD and individual statistical offices. The same data are published only for Germany, France and Italy. For our model we used data published by statistical offices of member states, because they are revised. The country weights used in individual years are published on the web-side of Eurostat.

Figure 2. MUICP versus Aggregated CPIs



Sources: Eurostat, national data, own calculations

The result of calculations is shown in Figure 2. We can confirm that the differences between the MUICP and the index composed from the CPIs have been diminishing over time. On the other hand, we tried to use the statistical test, to identify if the difference between the indices is significant or not.

Table 2. Differences between MUICP and Aggregated CPIs

		mean	variance	p-value
Euro Area	MUICP	1.96	0.67	0.000184
	Aggregated CPIs	1.92	0.63	

Sources: [1], Eurostat, national data, own calculations

For statistical testing we used a paired sample t-test as in the previous case. We analysed data from January 1998 to October 2009. Considering the fact that the p-value of analysed data is less than 0.05, we decided to reject null-hypothesis that the difference between the indices has a mean value of zero.

Differences between Indices in V4-Countries

The differences between the HICPs and the national CPIs in V4-countries are collected by Eurostat and the statistical offices of the individual countries.

The Hungarian national CPI includes approximately 900 items, which are observed in 35-150 outlets depending on their character. Altogether more than seventy-five thousand prices are collected monthly. [11] The main differences between the indices in Hungary concern the coverage of owner-occupied housing and games of chance which are excluded from the HICP and the expenditure of foreign visitors which are excluded from the national CPI. The national CPI does not monitor development of expenditure of institutional households. The weights are updated in Hungary every year, but weights for the HICP are updated every 5 years, only if required, review is made annually. [10], [11]

The number of price representatives in consumer basket for the CPI calculation in the Czech Republic (CR) is 729. Consumer prices are surveyed in 35 selected districts in the CR and in the Capital of Prague. Consumer basket represents approximately 55,000 prices to be surveyed monthly. [4], [13] Regarding the differences between the HICP and the national CPI in the Czech Republic, consumption expenditure of non-residents in the economic territory of the country is included in the HICP, but excluded from the national CPI. Institutional households are excluded from the CPI, unlike from the HICP. Expenditure of investments in the owner-occupied houses (major repairs) is included in the national CPI, but excluded from the HICP. The purchase of the house itself is excluded from both indices. [10]

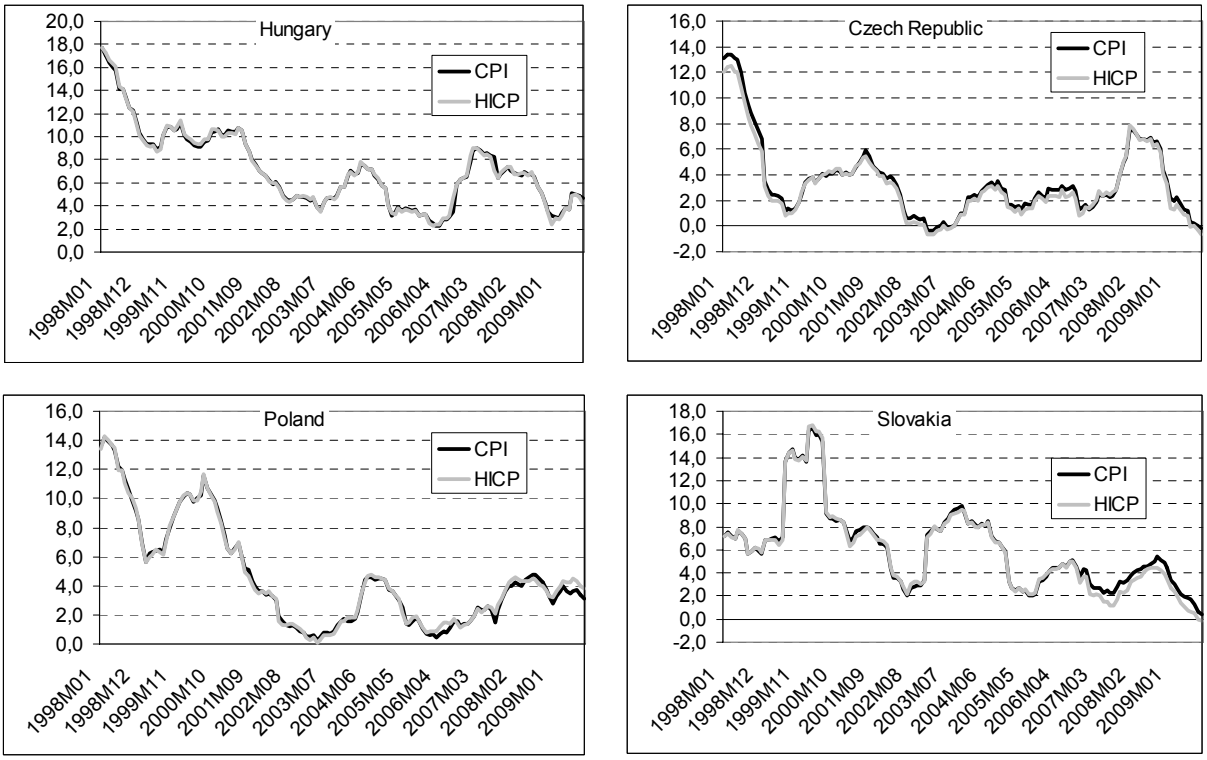
In Poland there were about 1,800 representative consumer goods and services chosen for completing the CPI in 2009. On average, there are about 292 thousand prices collected each month in 209 price survey regions. [3] Regarding the differences between the HICP and the national consumer price index in Poland, institutional households and consumption expenditure of non-residents in the economic territory of the country are included in the HICP, but excluded from the national CPI. Games of chance are included in the national CPI, but excluded from the HICP. Another contributory factor to the differences between the HICP and the national consumer price index concerns the use of different weights. The CPI is calculated with the use of weights from the Household Budget Survey for the previous year, while the HICP utilizes weights from the National Accounts. Owner-occupied housing is excluded from the HICP and from the CPI, too. Weights for the CPI are reviewed annually. [10]

The Slovak CPI covers approximately 90 % of all households and the calculation is based on consumer basket with 709 representative items. Prices of goods and services are collected in about 13,400 outlets and business premises. Number of price quotations is about 90,000. [16] The main difference between the HICP and the national CPI in the Slovak Republic concerns the coverage of owner-occupied housing, in particular imputed rents and

expenditure on major maintenance and repair which are excluded from the HICP. The weights for the CPI are reviewed annually. [10]

The progress of the HICPs and the national CPIs in V4-countries is shown in Figure 3.

Figure 3. Progress of CPIs and HICPs in V4 countries



Sources: Eurostat and individual statistical offices

The introduction of the HICP is an advantage in terms of convergence criteria and monetary policy, especially in the Slovak Republic. The inflation measured by method of the HICP is less than inflation measured by method of the CPI. The reason for this progress is that the CPI includes the OOH, which significantly increased in last months. The OOH was recently monitored only as monthly payments for repairs and maintenance of owner occupied apartments calculated per an apartment's square meter floor (regular payments to so-called repairs fund). The government decided to support insulating homes by interest-free loans within anti-crisis measures. Residents began to use them massively. This has led to the increase of payments to repair fund. Significant increase of the CPI and its deviation in the HICP is not due to inflation, but due to numerous projects of insulating homes. This progress forced statistical office to change the method to calculate the OOH. The repair fund is only 60% of the OOH today, the other 40% are other items related to housing. Data of the CPI were revised retroactively from January 2009. [12]

For statistical testing we used also a paired two sample t-test, as in the previous cases.

Table 3. Differences Between Indices in V4-Countries

		mean	variance	p-value
Hungary	HICP	7.16	11.13	0.844968
	CPI	7.17	10.89	
Poland	HICP	4.59	12.49	0.030217
	CPI	4.54	12.74	
Czech Republic	HICP	3.16	7.97	8.38E-21
	CPI	3.44	8.61	

Sources: Eurostat, national data, own calculations

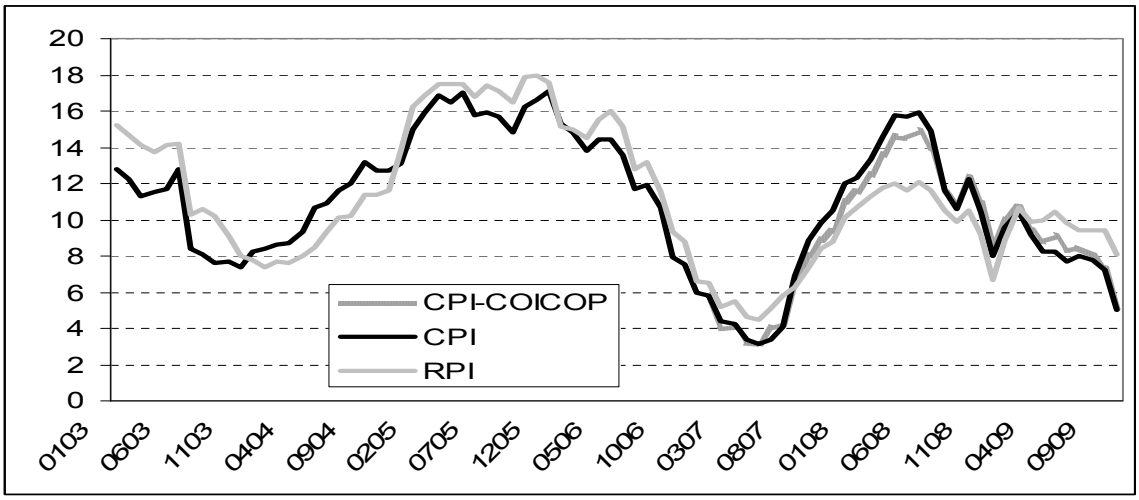
We tested data from January 1998 to October 2009 for V4-countries (the analysis of Slovakia is in Table 1). In just one case we could not reject the null hypothesis (Hungary). In the other three cases we reject the null hypothesis, that the difference between the indices has a mean value of zero. According to this analysis, we could not clearly say that there are no significant differences between the national CPIs and the HICPs in V4-countries.

Consumer price indices in the Republic of Serbia

In the Republic of Serbia two retail price indices were used on national level until January 2003. The first, the Retail Price Index (RPI) is used as national inflation measure and deflator of output and assets. Retail prices are the prices that retail outlets, individual agricultural producers and service providers apply in selling their products and services to end users, including the turnover tax. The second, the Consumer Price Index, is a type of cost of living index and is used for wages, pensions and other social benefits revaluation. The weights for the RPI are based on structure of retail turnover of goods and services. The weights for the CPI were calculated from structure of household consumption. [5] The national CPI in Serbia has different classification from COICOP and follows seven sub-categories of goods and services. Food; Tobacco and beverages; Clothes and footwear; Housing and household operations; Hygiene and health care; Education, culture and entertainment; Vehicles and services. [7] Serbian national statistical office started to calculate the CPI by COICOP in January 2007. [5] This index presents a special retail prices index that is being calculated according to the methodology that is harmonized with recommendations for retail prices index calculation in the European Union. CPI-COICOP is comparable with the HICP of the European Union. [15]

Statistical office of the Republic of Serbia has published monthly series of indices on the web-side from January 2000 till now. For better demonstrations of the differences between the mentioned indices, we decided to construct Figure 4 from shorter time series (from January 2003 to October 2009).

Figure 4. Progresses of CPI, CPI-COICOP and RPI in the Republic of Serbia (y-o-y)



Sources: Statistical office of the Republic of Serbia

The main difference between the CPI-COICOP and the Index of Retail Prices is coverage, because the list of products and services also includes rent, financial services, educational services as well as catering trade services. The indices use different weight systems and classification by calculating. Also the formula for the index calculation at the lowest level of aggregating is different for the CPI-COICOP and for the RPI too. [15]

Table 4. Differences Between RPI and CPI-COICOP

		mean	variance	p-value
The Republic of Serbia	RPI	8.89	5.19	0.894883
	CPI-COICOP	8.93	11.97	

Sources: Statistical office of the Republic of Serbia, own calculations

For statistical testing we have used a paired sample t-test as in the previous cases. We tested data from January 2007, when the CPI-COICOP was introduced in to the practice to the present (October 2009). Considering that the p-value of analysed data is more than 0.05, we cannot reject null-hypothesis that the difference between the indices has a mean value of zero. We could test only the 35 observations this time.

The RPI was the official measure of inflation in Serbia for a long time, but from the start of 2009 the CPI became the main inflation indicator, which is targeted by the National Bank of Serbia. Their aim is to have measurements for inflation comparable with EU. [14]

Time series of the HICP for Serbia are not available so far.

Conclusion

The harmonized index of consumer prices replaced the national consumer price index in several areas. The harmonized index is used as one of the convergence criteria, which

assesses the readiness of a member state to join the euro area. European central bank defines price stability through the harmonized index of consumer prices. But in economy there are differences between the indices. The main differences are geographic and population coverage and owner-occupied housing.

For statistical testing we used a paired sample t-test, which allows testing if the difference between the indices has a mean value of zero. We tested data from January 1998 to October 2009 from all euro area member states and V4-countries. From 19 realised tests in the countries of the European Union, we cannot reject the null-hypothesis in only six cases (Belgium, Germany, Greece, Ireland, Finland and Hungary). In the other cases we had null-hypothesis rejected on a significance level of 5 per cent. Considering the realised analysis we could not clearly say that the differences between the indices are not significant.

In the next step we have drawn up an aggregated CPI index. This analysis confirmed that the differences between the indices have been diminishing over time. On the other hand, the statistical test did not confirm the null-hypothesis.

In the Republic of Serbia three retail price indices are followed; the Retail Price Index, the Consumer Price Index by national structure and the Consumer Price Index by COICOP. While the National Bank of Serbia used the Retail price index as the main indicator until December 2008, from the start of 2009 it is targeting the CPI-COICOP. Considering the statistical analysis we cannot reject the null-hypothesis that the difference between the indices has a mean value of zero.

References

[1] **AHNERT, H., BRANCHI, M.** The HICP as an anchor for European consumer price statistics [online]. 2005 [cit. 2009-12-21] available on the Internet: <http://www.oecd.org/dataoecd/14/45/34996095.pdf>.

[2] **ASTIN, J.** The European Union Harmonized indices of consumer prices (HICP) [online]. 1999 [cit. 2010-01-16] available on the Internet: <http://www.ottawagroup.org/Ottawa/ottawagroup.nsf/home/Meeting+5/$file/1999%205th%20Meeting%20-%20Astin%20John%20-%20The%20European%20Union%20harmonized%20indices%20of%20consumer%20prices%20%28HICP%29.pdf>.

[3] **Central statistical office of Poland** Consumer Price Index [online] 2009 [cit. 2010-01-15] available on the Internet: <http://stats.oecd.org/mei/default.asp?lang=e&subject=8&country=POL>.

[4] **Czech Statistical office** Consumer Price Indices - User's methodological manual [online]. 2010 [cit. 2010-01-06] available on the Internet: <http://www.czso.cz/csu/2009edicniplan.nsf/p/7101-09>.

[5] **JANKOVIC, M.** Price collection in unstable market conditions [online]. 2006 [cit. 2010-01-17] available on the Internet: <http://www.unece.org/stats/documents/ece/ces/ge.22/2006/mtg2/11.e.ppt>.

[6] **DRUANT, M.** Belgian HICP: A Major Step Forward in the accurate measurement of inflation [online]. 2002 [cit. 2010-01-16] available on the Internet: <http://www.pedz.uni-mannheim.de/daten/edz-ma/eus/02/KS-PB-02-003-EN.PDF>. ISSN 1725-1338.

[7] **ECB** Understanding price developments and consumer price indices in South-Eastern Europe [online]. 2007 [cit. 2010-01-16] available on the Internet: <http://www.ecb.int/pub/pdf/scpops/ecbocp57.pdf>. ISSN 1725-6534.

[8] **Eurostat** HICP-CPI Differences [online]. [cit. 2009-12-21] available on the Internet: <http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/documents/Tab/Tab/HICP-CPI%20DIFFERENCES>.

[9] **Eurostat** Harmonized indices of consumer prices (HICPs): A short Guide for Users [online]. 2004 [cit. 2009-12-21] available on the Internet: <http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-BE-04-001/EN/KS-BE-04-001-EN.PDF>.

[10] **Eurostat** Information Note on the Harmonized Indices of Consumer Prices, Compliance Monitoring [online]. 2008, 2009 [cit. 2010-01-12] available on the Internet: <http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/methodology/compliance_monitoring

[11] **Hungarian central statistical office** Consumer Price Index Booklets October – December 2006 [online]. 2002 [cit. 2010-01-14] available on the Internet: <http://www.eszt.hu/images/inflacio.pdf>. ISSN 0864-8409.

[12] **KOVALČÍK, J.** Inflácia je po oprave výrazne nižšia [online]. 2009 [cit. 2009-10-01] available on the Internet: <http://ekonomika.etrend.sk/ekonomika-slovensko/inflacia-po-oprave-vyrazne-nizsia.html>.

[13] **KUDLÁK, K.** K výpočtu indexů spotřebitelských cen v ČSÚ [online]. 2002 [cit. 2010-01-09] available on the Internet: <http://www.cepin.cz/cze/prednaska.php?ID=187>.

[14] **Raiffeisen banka a.d.** Serbia Economic report No. 18 [online]. 2009 [cit. 2010-01-17] available on the Internet: <http://www.raiffeisen.at/eBusiness/services/resources/media/1023296711504-1025308884300_1025311539513_1025311893931-496114812233705012-1-NA-DE.pdf>.

[15] **Statistical office of the Republic of Serbia** Communication Nr. 345 Price statistics [online]. 2009 [cit. 2010-01-17] available on the Internet: <http://webrzs.statserb.sr.gov.yu/axd/en/dokumenti/saopstenja/CN11/cn11112009.pdf>. ISSN 0353-9555.

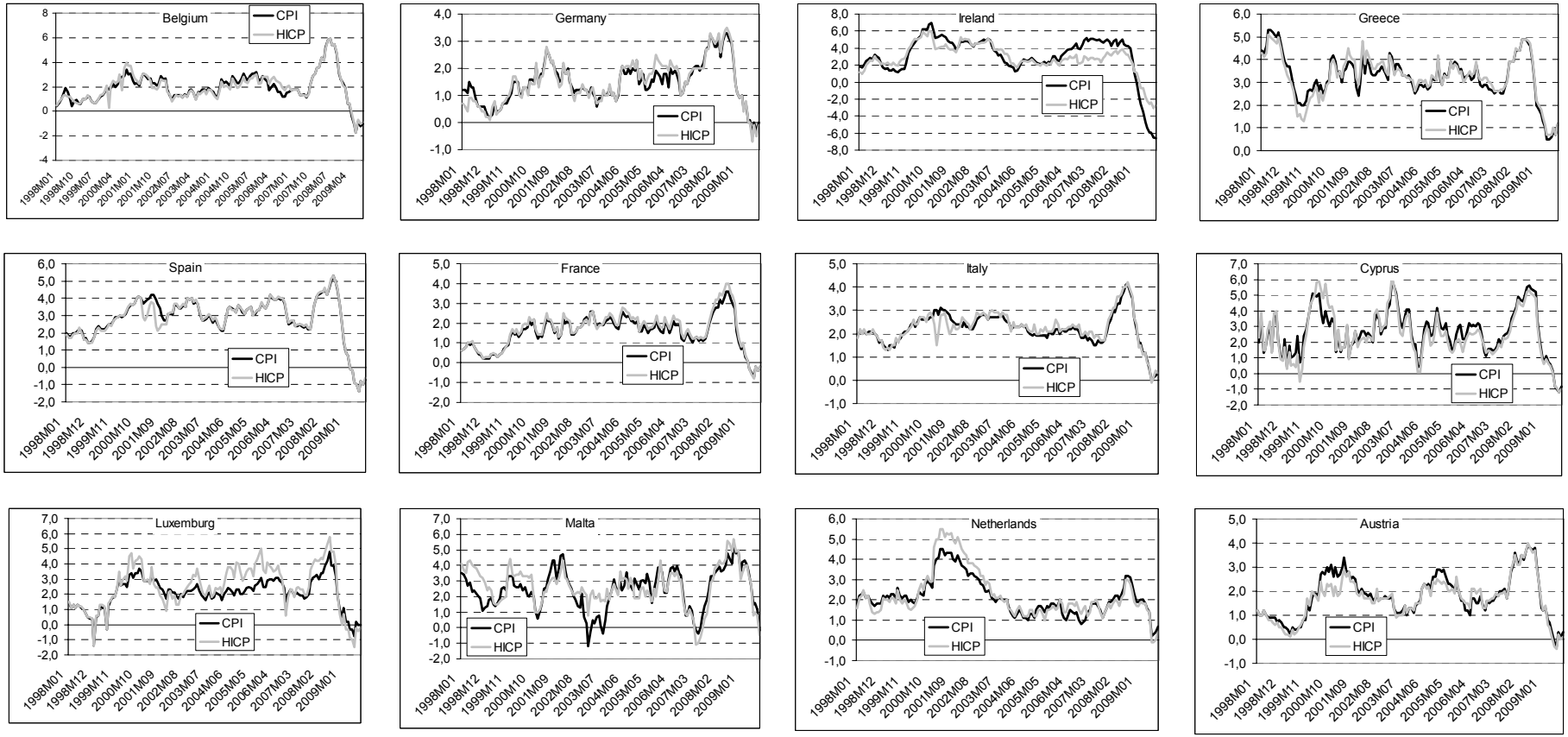
[16] **Statistical office of the Slovak Republic** Metodika Spotrebiteľské ceny (inflácia) [online]. 2010 [cit. 2010-01-14] available on the Internet: <http://portal.statistics.sk/showdoc.do?docid=1670>.

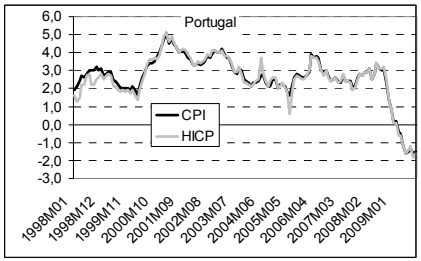
[17] **VON DER LIPPE, P.:** Inflation in Europe – Different Measures and their users [online]. 2001 [cit. 2010-01-09] available on the Internet: <http://von-der-lippe.org/dokumente/ceies_english.pdf>.

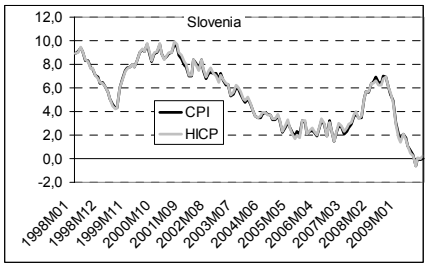
Article history: Received: 6 January 2010
Accepted: 22 March 2010

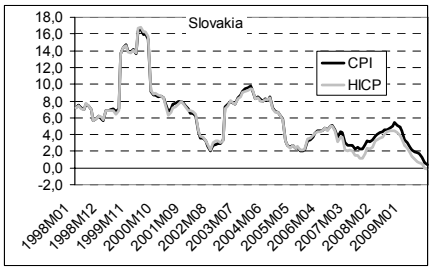
Anex 1

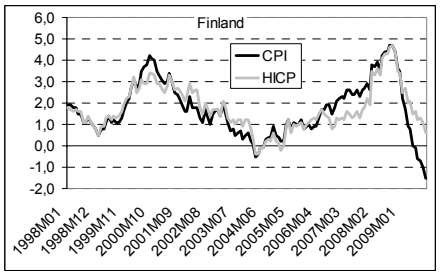
Picture 1. Progress of Harmonized Indices of Consumer Prices and National Consumer Price Indices in Euro Zone Member States











Source: Eurostat and individual statistical offices