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A Proposal of Exploratory Analysis of Price Disparity in EU28

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Abstract

This document presents several alternatives for an exploratory analysis of price convergence (and disparity) within the EU28. Both cross-sectional (across countries) and dynamic (over time) analyses of the evolution of price levels have been undertaken. The results show that prices are still very different across Member States, particularly in services where prices are closely linked to rates of income. Over time, price levels have increased in the majority of EU28 countries; however the differences between prices across countries appear to have decreased. The observed price convergence has however been relatively small, and prices seem to have converged towards a higher average. Faster convergence in price levels is observed within EU13 and Eurozone countries. Overall, the analysis shows that conclusions regarding convergence/divergence of prices in EU28 are to a great extent dependent on and sensitive to the empirical data and methodological framework chosen, in particular when analysing data from a dynamic perspective.

1 CROSS COUNTRY (EU28) COMPARISONS: PRICE DISPARITY IN 2013

This exploratory analysis of cross-sectional dispersion of prices (across countries) in this section is based on 2013 data on Price Level Indices (PLIs) provided by Eurostat. PLIs are calculated as the ratio between the corresponding Purchasing Power Parity (PPP) index and the current nominal exchange ratio of the national currency vs. euro. PLIs are calculated for different national accounts and consumption aggregates, from basic headings (i.e. groups of products) to Gross Domestic Product (GDP).

As shown in Figure 1, the highest PLIs in terms of GDP aggregate for 2013 correspond to Denmark, Sweden, Finland and Luxembourg, whilst the lowest have been found in Eastern countries (Hungary, Poland, Romania and Bulgaria). In absolute terms, one might calculate an absolute price dispersion measure as the result of the comparison between the lowest (cheapest) price level value registered in Bulgaria (PLI = 47.6) and the highest (most expensive) values from Denmark (PLI = 136.3). This means that, on average, prices were 186% higher in Denmark than in Bulgaria.

Figure 1: Price level indices (GDP) for EU28

Source: Own elaboration from 2013 PLIs (EU28=100) by Eurostat

According to their GDP PLIs, EU 28 countries can be divided into three groups (relatively cheap, around EU28 average and relatively expensive) by using the intuitive criterion proposed by Wolszczak (2006): EU average (100) +/- one standard deviation (26.13 in our dataset). As reported in Table 1 only two Scandinavian countries populate the relatively expensive countries group, whilst 10 of the most of the recent (EU13) member states are included in the relatively cheap group.

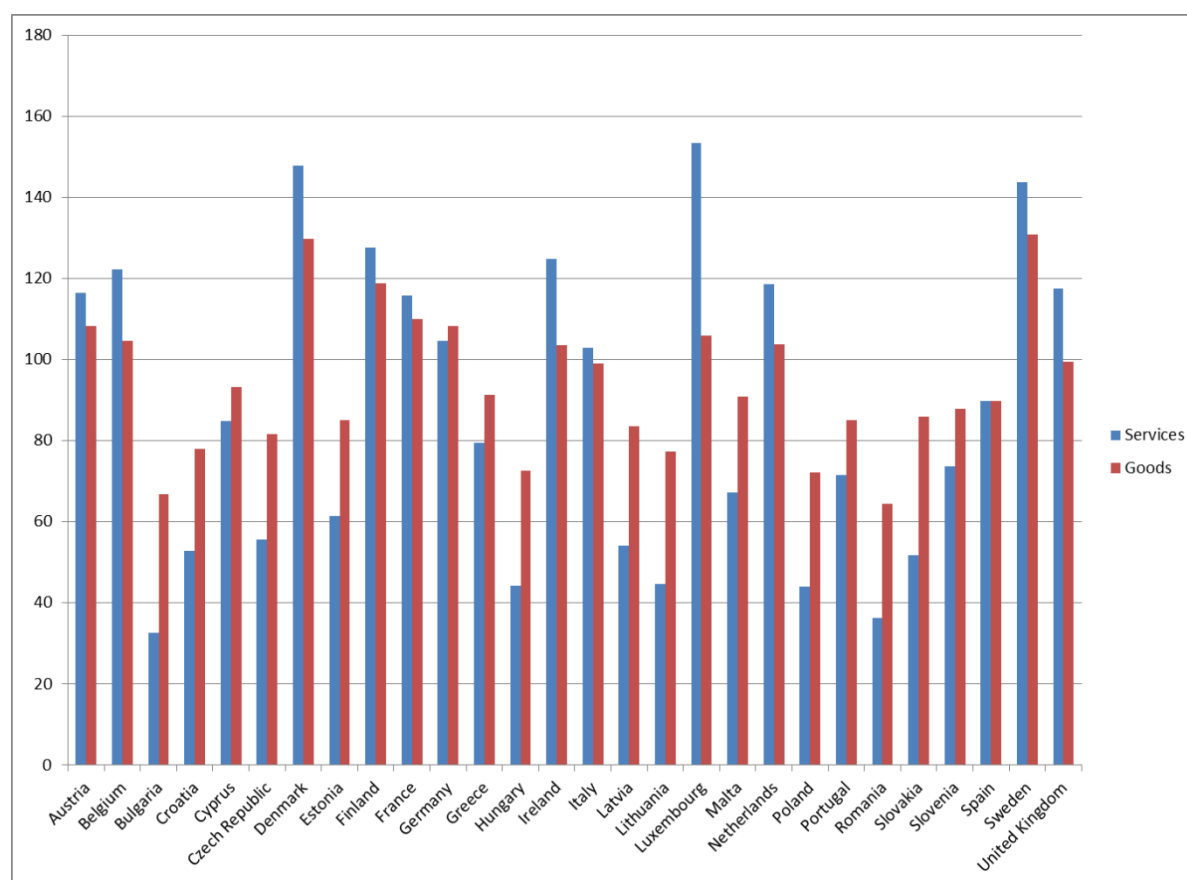**Table 1: Division of countries according to GDP PLIs**

Relatively expensive	
Denmark	136.3
Sweden	134.8
Around the average	

Finland	123.4
Luxembourg	121.2
France	113.1
Belgium	112.6
Austria	111.8
Ireland	110.2
Netherlands	109.7
United Kingdom	108.9
Germany	105.1
Italy	100.9
Spain	90.1
Cyprus	89.2
Greece	85.4
Slovenia	80.5
Portugal	78.0
Malta	78.0
Relatively cheap	
Estonia	72.9
Czech Republic	68.3
Latvia	68.1
Slovakia	67.9
Croatia	63.5
Lithuania	60.9
Hungary	57.7
Poland	57.5
Romania	49.9
Bulgaria	47.6

Source: Own elaboration from 2013 PLIs (EU28=100) by Eurostat

By making a distinction in terms of price levels for goods vs. services across countries (Figure 2) it is evident that in those countries where price levels for goods are above average, prices are higher than average for services. Moreover, in those countries with prices for goods and services above average, in relative terms price levels for services are comparatively higher than price levels for goods (with the exception of Germany). In the United Kingdom and in Italy, prices for services are above average, whilst prices for goods remain slightly below average. For the rest of the countries, price levels for goods and services are below the EU28 average, with prices for goods within each country relatively higher than those for services (with the exception of Spain, even though in that case the difference can be considered too small to be significant). In addition, price dispersion (measured in terms of the standard deviation of PLIs) remains greater for services than for goods across the EU – this is explained in more detail in the dynamic analysis of prices in Section 2.

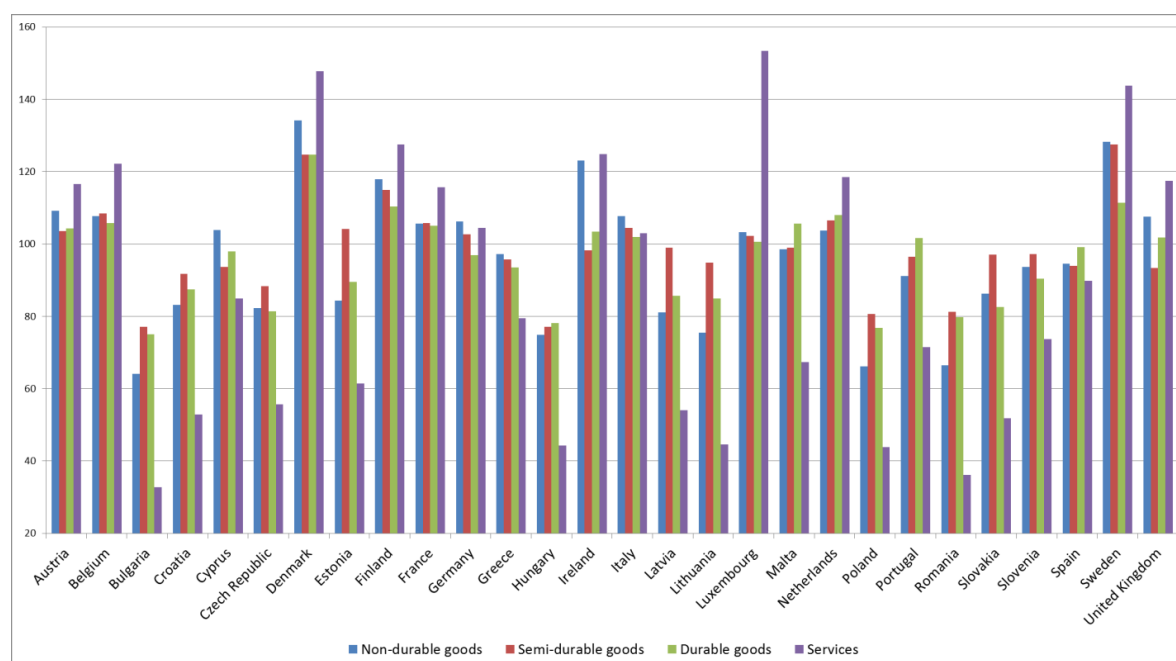Figure 2: Price level indices for goods and services

Source: Own elaboration from 2013 PLIs (EU28=100) by Eurostat

Looking more in depth into the differences in price levels for goods and services, it is interesting to make a distinction between, on the one hand, prices for consumer goods that are considered durable (e.g. furniture, major appliances, vehicles, etc.), semi-durable (e.g. clothing and footwear, household utensils and small appliances, toys and equipment for sports) and non-durable (the remaining categories of consumer goods, such as food, fuels and lubricants, medical products, etc.) and, on the other hand, prices for services. Figure 3 provides a comprehensive picture of the situation in the EU28 for 2013.

In addition to Figure 3, results summarised in Table 2 indicate that EU13 countries and southern countries within the euro area have price levels for services comparatively lower than those for the aggregate consumer goods. The same result is obtained when comparing price levels for services directly with price levels for durable goods (with the exception of Italy). Moreover, price levels for goods in those countries are much closer to the EU28 average than price levels for services. These findings are broadly in line with the Balassa-Samuelson assumptions: lower income (catching-up) countries should have lower prices for less tradable and more labour intensive products (e.g. services). Moreover, as described in detail in Section 2, the overall pattern of least price dispersion for more durable (i.e. presumably most tradable) goods across the EU has remained unchanged over the last years.

Figure 3: Price level indices for types of goods (according to durability) and services

Source: Own elaboration from 2013 PLIs (EU28=100) by Eurostat

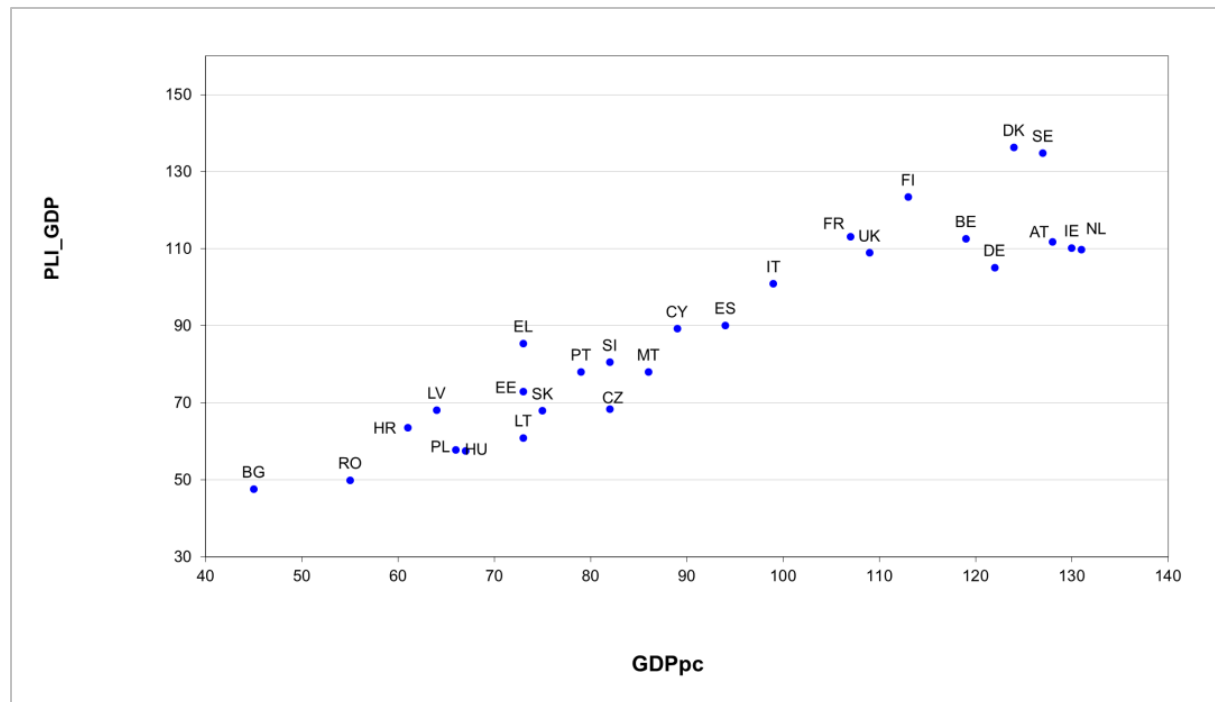**Table 2: Price disparity between services and consumer goods**

	Non-durable goods	Semi-durable goods	Durable goods	Services	Consumer goods	Diff. Services vs. Consumer goods	Diff. Services. vs. Durable goods
Luxembourg	103.2	102.3	100.6	153.4	102.4	51.0	52.8
Sweden	128.2	127.5	111.4	143.7	125	18.7	32.3
Denmark	134.2	124.7	124.7	147.7	130.5	17.2	23.0
Belgium	107.7	108.4	105.7	122.2	107.1	15.1	16.5
United Kingdom	107.5	93.3	101.8	117.5	103.1	14.4	15.7
Netherlands	103.7	106.5	108	118.5	104.6	13.9	10.5
Finland	117.9	114.9	110.3	127.5	115.9	11.6	17.2
France	105.6	105.7	105.1	115.7	105.3	10.4	10.6
Austria	109.1	103.6	104.3	116.5	107	9.5	12.2
Ireland	123	98.2	103.4	124.8	115.7	9.1	21.4
Germany	106.2	102.7	96.9	104.5	103.6	0.9	7.6
Italy	107.7	104.5	101.9	102.9	105.9	-3.0	1.0
Spain	94.6	93.9	99.1	89.8	94.6	-4.8	-9.3
Cyprus	103.8	93.6	97.9	84.9	100.9	-16.0	-13.0
Greece	97.2	95.7	93.5	79.4	96	-16.6	-14.1
Slovenia	93.6	97.2	90.4	73.7	93.3	-19.6	-16.7
Portugal	91.2	96.4	101.7	71.5	92.9	-21.4	-30.2
Poland	66.1	80.7	76.8	43.9	68.8	-24.9	-32.9
Estonia	84.4	104.2	89.5	61.4	87.4	-26.0	-28.1
Czech Republic	82.2	88.4	81.4	55.7	82.5	-26.8	-25.7
Latvia	81.1	99	85.7	54.1	83.7	-29.6	-31.6
Hungary	74.9	77.1	78.2	44.3	75.2	-30.9	-33.9
Croatia	83.1	91.8	87.5	52.8	84.4	-31.6	-34.7
Malta	98.6	99	105.6	67.3	99.4	-32.1	-38.3
Romania	66.4	81.2	79.8	36.2	68.8	-32.6	-43.6
Bulgaria	64.1	77.1	75	32.7	66.8	-34.1	-42.3
Lithuania	75.5	94.9	84.9	44.6	79	-34.4	-40.3
Slovakia	86.2	97.1	82.6	51.8	86.7	-34.9	-30.8

Source: Own elaboration from 2013 PLIs (EU28=100) by Eurostat

Finally, analysing the correlation between price level indices and the indices of real GDP per capita (in Purchase Parity Standards, PPS) across countries, a positive relationship between income and price levels can be observed. The value calculated for the correlation coefficient between GDP per capita and the PLI corresponding to the GDP aggregate is 0.78 (0.67 for goods PLIs and 0.83 for services PLIs). However, as shown in Figure 4, Figure 5 and Figure 6, the relationship between price and income per capita is far from perfectly linear, and income alone is not able to explain cross-country differences in price levels. Figure 6 shows that, even in the case of services (where, as

expected from the Balassa-Samuelson hypothesis, correlation between prices and income is higher), there are substantial differences in price levels between countries with relatively similar real GDPpc, for example in the cases of Denmark and Germany, or Greece and Lithuania. It is also worth noting that the differences in price levels for services between the aforementioned countries more than double (43.2 for DK-DE and 34.8 for EL-LT) those observed for goods (21.5 and 13.9, respectively).

Figure 4: Comparison of price level indices (GDP) and real income per capita across EU 28 countries

Note: Luxembourg (GDPpc = 257) excluded due to outlier problems

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Figure 5: Comparison of price level indices (goods) and real income per capita across EU 28 countries

Note: Luxembourg (GDPpc = 257) excluded due to outlier problems

Figure 6: Comparison of price level indices (services) and real income per capita across EU 28 countries
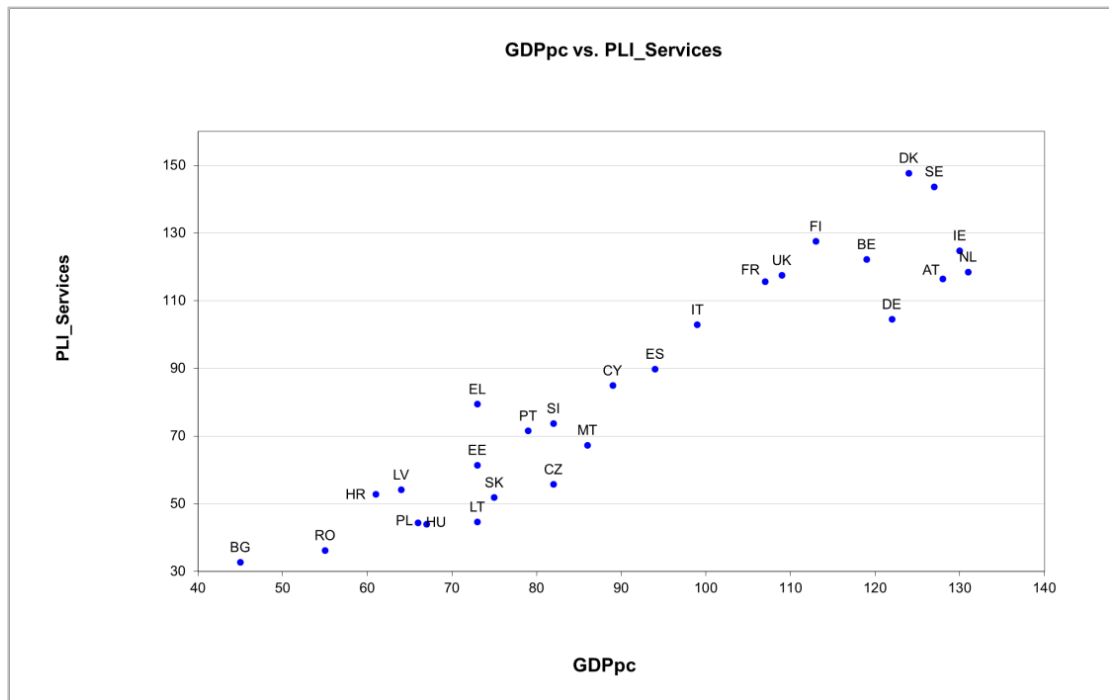

Note: Luxembourg (GDPpc = 257) excluded due to outlier problems

1.1 Price disparity analysis at a more disaggregate level: individual product prices and PLIs for basic headings
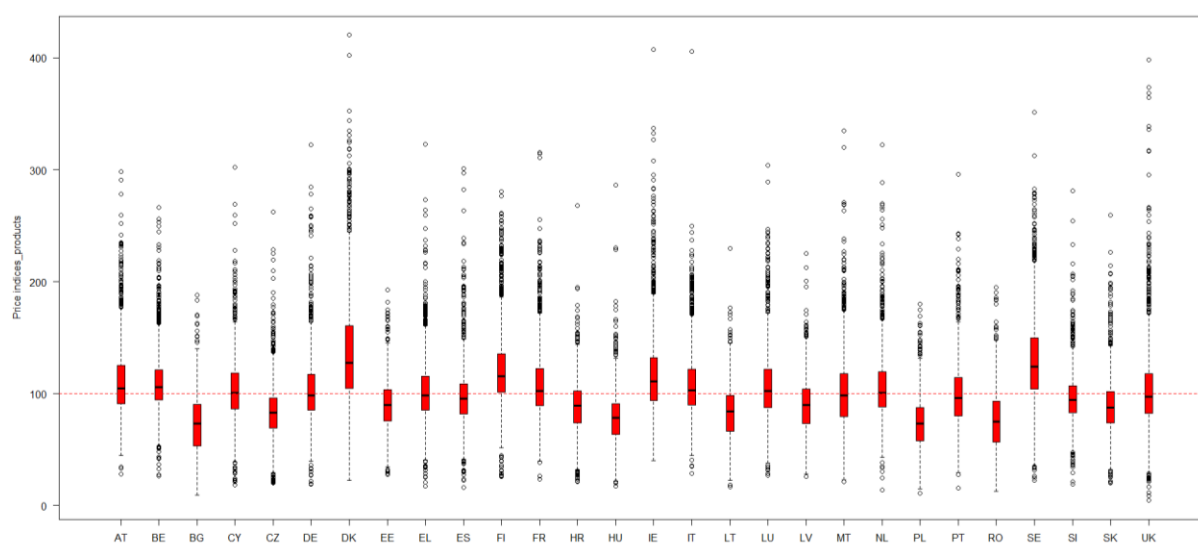
For the analyses undertaken in this section, confidential Eurostat data (i.e. not available to the public) is used on annual average prices for individual products, and price level indices calculated for basic expenditure aggregates (i.e. "basic headings") provided by Eurostat for research purposes. Data on individual products (collected over a period of three years, from 2011 to 2013) covers the whole set of consumer products except housing, hospital services and education, ranging from categories 01.01.11.1 "Rice" to 11.12.32.1 "Other personal effects". More precisely, the list of products to be priced is divided in six parts (surveys): i) food, drinks and tobacco; ii) personal appearance; iii) house and garden; iv) transport, restaurants and hotels; v) services; vi) furniture and health. However, the fact that the data collection procedure is performed over a period of three years is one of the main caveats of this particular data source, in particular when it comes to looking at price convergence at the level of individual products. This disadvantage should be acknowledged when comparing this dataset to other data sources such as the prices of individual products collected within the framework of the Detailed Average Prices (DAP) project. With regards to the data available at the level of basic headings, it covers a broader set of items, ranging from categories 01.01.11.1 to 17.01.11.1 "Balance of exports and imports". In particular, price level indices are available not only for consumer goods and services, but also for capital goods (collected once every two years), collective services and government-produced hospital services (provided each year), housing (every year) and education (each year). For the sake of comparison, throughout this section the whole dataset on individual prices will be confronted with the range of price levels for basic headings corresponding to categories from 01.01.11.1 to 11.12.32.1.

Price indices for individual products have been calculated by dividing the nominal price in euros registered for product i in country j by the average price for product i across EU28 countries. Price levels for individual products compared to the EU28 average within each country are shown in Figure 7.[1] One may note that price levels in Denmark, Finland and Sweden are above average for ¾ of the whole set of products considered. In contrast, in countries like Bulgaria, Czech Republic, Hungary, Lithuania, Poland and Romania, prices levels are below EU28 average for ¾ of the products considered.

Looking now at the price level indices for basic headings (rather than individual product price levels) within every country (Figure 8), the results are slightly different. In particular, the number of countries for which the level of prices is above average for at least 75% of the categories (basic headings) considered increases significantly. In addition to Denmark, Finland and Sweden, the group of countries with a higher than average level of prices for the majority of products now includes Austria, Italy, Belgium, Ireland, Netherlands and France. The group of countries with below-average price levels for ¾ of the basic headings comprises Bulgaria, Czech Republic, Croatia, Hungary, Lithuania, Latvia, Poland, Romania, and Slovak Republic.

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[1] Caution is needed when interpreting Figure 7 in the sense that the underlying data matrix for individual products is not necessarily complete (i.e. the number of countries pricing a given product varies).

Figure 7: Price levels across individual products in EU28 countries

Source: Own elaboration from price data 2011-2013 by Eurostat

Figure 8: Price levels across basic headings in EU28 countries

Source: Own elaboration from 2013 PLIs by Eurostat

In addition, looking at Figure 9 one can see that the results obtained from PPPs-PLIs data are largely in line with those corresponding to the Detailed Average Prices (DAP) collection from 2012, presented in the 10th edition of the Consumer Markets Scoreboard (European Commission, 2014).[2] With the exception of Luxembourg, the remaining countries (Austria, Belgium, Ireland and Italy) showing price levels higher than average for more than 75% of the products considered in the DAP survey have been also singled

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[2] Note that as explained in European Commission (2014), not all the EU28 countries are included in the data collection, and coverage for the different products is not necessarily the same in all countries.

out in the analyses based on either one or both of the previous data sets. An equivalent result is also observed for those countries (Bulgaria, Czech Republic, Hungary, Poland and Romania) with 75% of the individual prices below average levels.

Figure 9: Price levels from DAP collection in selected EU countries

Another comparison can be made by measuring and plotting price dispersion across countries as the standard deviation of the price indices calculated for either the individual products, the basic headings or the DAP categories, obtaining the graphical representation of price dispersion shown in Figure 10. Focusing first on the differences between PPP based data (basic headings and individual prices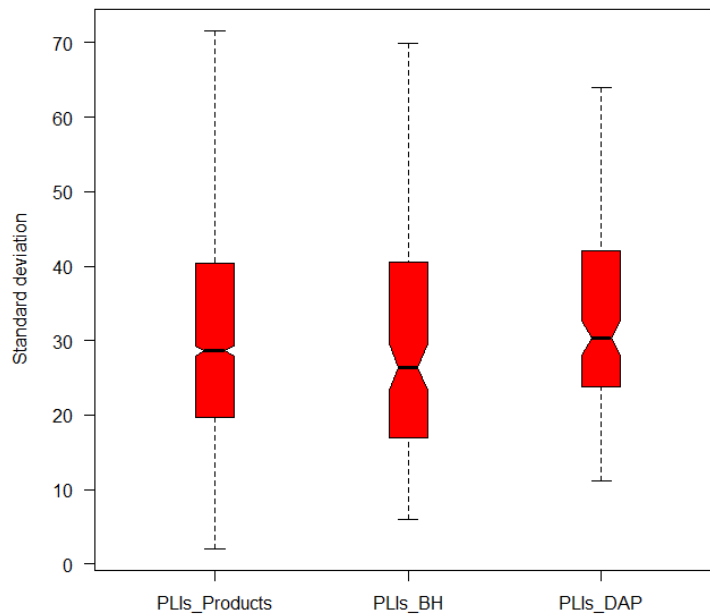), as expected (see e.g. Wolszczak 2006) the magnitude of the price dispersion seems to be larger when the analysis is based on a more disaggregate (i.e. individual price level) data. This result is confirmed by the corresponding F-test for the ratio of variances (p-value = 0.003). However, in terms of average price dispersion, the differences between both approaches do not seem to be statistically significant. More precisely, overlapping notches in the boxplots indicate that it is not possible to reject the null hypothesis of equal medians in both distributions (Chambers et al. 1983). When looking at PLIs based on the DAP collection of prices, we observe significant differences in dispersion when compared to data on basic headings (p-value = 0.006), but not when compared to data on individual prices (p-value = 0.403). Moreover, overlapping notches in the boxplots also indicate the absence of significant differences in average price dispersion between the DAP and both PPP data sets.

Finally, it is also worth noting that, according to Table 3, there is a high positive and significant linear correlation between the average PLIs calculated for each country based on the three different data collections that have been used in this section (DAP, PPP for individual products and PPP for basic headings). This means that these data sets present a roughly similar behaviour when it comes to illustrating the different (average) price levels occurring across EU countries.

Source: Own elaboration, from Eurostat (2011-2013) and DAP project (2012) surveyed data

Table 3: Correlations across countries between average PLIs from DAP vs. PPP data (individual products and basic headings)

	PLIs_DAP_avg	PLIs_Products_avg	PLIs_BH_avg
PLIs_DAP_avg	1	0.911926	0.908335
PLIs_Products_avg		1	0.978092
PLIs_BH_avg			1

Note: All correlations significant at the α = 0.001 significance level

1.2 Price dispersion and market assessment: matching PLIs with Consumer Market Scoreboard indicators

This section aims to establish a correspondence between the markets included in the Consumer Markets Scoreboard (CMS) and the data on price levels for analytical categories/basic headings available from Eurostat. The original CMS markets, the equivalent Eurostat-COICOP categories, and the final recoded markets used for the analysis throughout this section are displayed in Table 4. As explained in European Commission (2013, pp. 99-101), it is not possible in every case to establish a direct link between CMS and Eurostat-COICOP categories. In particular, the following rules have been followed to make the data comparable:

- If more than one Eurostat-COICOP category exists for a market covered in the CMS survey, the average PLI score for the different Eurostat categories will be calculated.

- If more than one market in the CMS survey is linked to one specific category in the Eurostat-COICOP classification, the average CMS score is assigned to a newly recoded market.
- If no Eurostat-COICOP data is available for the market in the CMS survey, that market is excluded from the analysis.

Table 4: Equivalence between CMS markets and Eurostat-COICOP categories

	CMS market		Eurostat-COICOP category		Recoded market
1	Fruit and vegetables	a01010106	Fruits, vegetables, potatoes		Fruit and vegetables
2	Meat and meat products	a01010102	Meat		Meat and meat products
3	Bread, cereals, rice and pasta	a01010101	Bread and cereals		Bread, cereals, rice and pasta
5	Non-alcoholic drinks	a010102	Non-alcoholic beverages		Non-alcoholic drinks
6	Alcoholic drinks	a010201	Alcoholic beverages		Alcoholic drinks
7	Clothing and footwear	a0103	Clothing and footwear		Clothing and footwear
8	Maintenance products	11.04.31.1	Materials for the maintenance and repair of the dwelling		Maintenance products
		11.05.61.1	Non-durable household goods		
9	Furniture and furnishings	11.05.11.1	Kitchen furniture		Furniture and furnishings
		11.05.11.2	Bedroom furniture		
		11.05.11.3	Living-room and dining-room furniture		
		11.05.11.4	Other furniture and furnishings		
		11.05.12.1	Carpets and other floor coverings		
		11.05.21.1	Household textiles		
		11.05.41.1	Glassware, tableware and household utensils		
		11.05.51.1	Major tools and equipment		
		11.05.52.1	Small tools and miscellaneous accessories		
10	Electronic products	11.09.11.1	Equipment for the reception, recording and reproduction of sound and pictures		Electronic products
		11.09.12.1	Photographic and cinematographic equipment and optical instruments		
		11.09.14.1	Pre-recorded recording media		
		11.09.14.2	Unrecorded recording media		
11	Large household appliances	11.05.31.1	Major household appliances whether electric or not		Large household appliances
12	Small household appliances	11.05.32.1	Small electric household appliances		Small household appliances
13	ICT products	11.08.21.1	Telephone and telefax equipment		ICT products
		11.09.13.1	Information processing equipment		
14	Entertainment goods	11.09.21.1	Major durables for outdoor recreation		Entertainment goods
		11.09.22.1	Musical instruments and major durables		

			for indoor recreation	
		11.09.31.1	Games, toys and hobbies	
		11.09.32.1	Equipment for sport, camping and open-air recreation	
15	New cars	11.07.11.1	Motor cars with diesel engine	Motor cars
		11.07.11.2	Motor cars with petrol engine of cubic capacity of less than 1200cc	
		11.07.11.3	Motor cars with petrol engine of cubic capacity of 1200cc to 1699cc	
		11.07.11.4	Motor cars with petrol engine of cubic capacity of 1700cc to 2999cc	
		11.07.11.5	Motor cars with petrol engine of cubic capacity of 3000cc and over	
16	Second hand cars	11.07.11.1	Motor cars with diesel engine	
		11.07.11.2	Motor cars with petrol engine of cubic capacity of less than 1200cc	
		11.07.11.3	Motor cars with petrol engine of cubic capacity of 1200cc to 1699cc	
		11.07.11.4	Motor cars with petrol engine of cubic capacity of 1700cc to 2999cc	
		11.07.11.5	Motor cars with petrol engine of cubic capacity of 3000cc and over	
17	Fuel for vehicles	11.07.22.1	Fuels and lubricants for personal transport equipment	Fuel for vehicles
18	Books, magazines and newspapers	11.09.51.1	Books	Books, magazines and newspapers
		11.09.52.1	Newspapers and periodicals	
		11.09.53.1	Miscellaneous printed matter, stationery and drawing materials	
19	Personal care products	11.12.12.1	Electric appliances for personal care	Personal care products
19	Personal care products	11.12.13.1	Other appliances, articles and products for personal care	Personal care products
20	Real estate services	NA		-
21	Maintenance services	11.04.32.1	Services for the maintenance and repair of the dwelling	Maintenance services
22	Personal care services	11.12.11.1	Hairdressing salons and personal grooming establishments	Personal care services
23	Vehicle maintenance and repair	11.07.23.1	Maintenance and repair of personal transport equipment	Vehicle maintenance and repair
26	Bank accounts	11.12.62.1	Other financial services n.e.c.	Other financial services
28	Investment products			
58	Loans, credit and credit cards			
51	Mortgages			
29	Home insurance	11.12.51.1	Insurance	Insurance
30	Vehicle insurance			
31	Postal services	11.08.11.1	Postal services	Postal services

32	Fixed telephone services	11.08.31.1	Telephone and telefax services	Telephone and telefax services
33	Mobile telephone services			
34	Internet provision			
35	Tram, local bus, metro	NA		-
36	Train services	11.07.31.1	Passenger transport by railway	Train services
37	Airline services	11.07.33.1	Passenger transport by air	Airline services
38	Vehicle rental services	11.07.24.1	Other services in respect of personal transport equipment	Vehicle rental services
39	Holiday accommodation	11.11.21.1	Accommodation services	Holiday accommodation
40	Packaged holidays and tours	11.09.61.1	Package holidays	Packaged holidays and tours
41	Cafés, bars and restaurants	11.11.11.1	Restaurant services whatever the type of establishment	Cafés, bars and restaurants
42	Commercial sport services	11.09.41.1	Recreational and sporting services	Commercial sport services
43	Culture and entertainment	11.09.42.2	Other cultural services	Culture and entertainment
45	Water supply	11.04.41.1	Water supply	Water supply
46	Electricity services	11.04.51.1	Electricity	Electricity services
47	Gas services	11.04.52.1	Gas	Gas services
48	Non-prescription medicines	11.06.11.1	Pharmaceutical products	Non-prescription medicines
52	Private life insurance	NA		-
53	Spectacles and lenses	NA		-
54	TV-subscriptions	NA		-
55	Dairy products	a01010104	Milk, cheese and eggs	Dairy products
57	Legal and accountancy services	NA		-
59	Off-line gambling services	NA		-
60	On-line gambling services	NA		-

- Source: Own elaboration, based on European Commission (2013)
- Note: 'NA' refers to data not available from Eurostat-COICOP

After having set the equivalence between Eurostat categories and CMS markets, Table 5 presents the main descriptive statistics (standard deviation, median, first and third quartile) of price level indices calculated for each of the recoded markets. Recoded markets in the table have been sorted according to the magnitude of the price dispersion figures.

Recoded market	Std. Dev.	Q1	Median	Q3
Maintenance services	78.07	60.96	98.68	162.86
Personal care services	61.08	71.86	91.85	133.76
Non-prescription medicines	54.65	62.71	108.78	159.06
Train services	53.74	63.47	94.90	159.92
Culture and entertainment	50.62	71.37	103.84	148.70
Water supply	48.94	68.60	101.65	131.84
Vehicle rental services	41.85	72.82	106.90	131.11
Postal services	39.72	79.67	102.96	131.81
Vehicle maintenance and repair	38.70	79.86	100.16	129.46
Commercial sport services	33.63	73.57	108.90	127.95
Gas services	32.88	80.16	99.72	121.28
Books, magazines and newspapers	32.01	78.42	107.99	121.10
Holiday accommodation	31.86	76.96	105.80	120.26
Packaged holidays and tours	31.33	80.25	103.80	126.50
Maintenance products	29.99	84.82	99.05	120.90
Cafés, bars and restaurants	29.89	77.64	108.15	128.08
Telephone and telefax services	29.24	81.13	104.66	120.57
Electricity services	29.07	82.01	98.10	121.19
Alcoholic drinks	27.39	91.15	99.90	115.00
Meat and meat products	26.21	73.65	89.50	121.58
Insurance	26.11	80.86	102.32	123.42
Other financial services	26.11	80.86	102.32	123.42
Bread, cereals, rice and pasta	24.73	83.20	100.50	112.73
Fruit and vegetables	22.10	85.83	97.10	113.65
Non-alcoholic drinks	20.50	92.98	103.20	111.05
Airline services	20.07	89.92	99.26	114.83
Furniture and furnishings	17.82	89.14	103.19	118.77
Motor cars	16.75	89.50	98.27	106.09
Dairy products	16.74	93.45	101.40	115.95
Large household appliances	14.67	93.06	98.59	110.25
Clothing and footwear	12.43	91.05	97.25	104.90
Electronic products	12.02	92.84	99.74	108.02
Small household appliances	11.63	95.06	100.21	106.63
Personal care products	10.75	95.02	98.19	103.32
Fuel for vehicles	8.92	92.13	100.08	107.82
Entertainment goods	8.19	96.81	100.53	102.41
ICT products	5.93	95.24	100.82	104.12
Services markets	36.92	53.78	82.15	117.75
Goods markets	17.26	83.13	91.05	104.85

As a second step, the potential correlations between CMS and PLIs indicators for each recoded market may be established. Table 6 shows the Pearson linear correlation coefficient values between the CMS scores and the PLIs, as well as the associated p-values. If $p<0.05$ is taken to indicate statistical significance, only a few of the product groups have statistically significant correlation values for any of the market assessment components. The Market Performance Indicator (MPI) is a composite index which indicates how well a given market performs according to consumers. As reflected in Table 6, some of the underlying dimensions considered in the index are the assessment of how easy or difficult it is for consumer to compare goods or services in a market (comparability), how easy or difficult it is to switch provider (switching), and the extent to which consumers are satisfied with the number of providers available to choose from in the market (choice).

Table 6: linear correlation between CMS scores and PLIs

Market group	MPI		Comparability		Switching		Choice	
	corr	p-value	corr	p-value	corr	p-value	corr	p-value
Fruit and vegetables	0.344	0.073	-0.036	0.854			0.247	0.204
Meat and meat products	0.452	0.016	0.178	0.364			0.180	0.358
Bread, cereals, rice and pasta	0.375	0.050	-0.130	0.508			0.036	0.856
Non-alcoholic drinks	0.338	0.079	-0.173	0.380			0.129	0.512
Alcoholic drinks	0.593	0.001	0.223	0.255			0.040	0.846
Clothing and footwear	0.131	0.505	-0.121	0.539			0.199	0.311
Maintenance products	0.354	0.065	-0.002	0.993			0.097	0.624
Furniture and furnishings	0.519	0.005	0.190	0.333			-0.070	0.722
Electronic products	0.070	0.725	-0.227	0.246			-0.031	0.876
Large household appliances	0.267	0.170	-0.005	0.979			-0.163	0.406
Small household appliances	0.251	0.197	-0.126	0.524			0.046	0.815
ICT products	0.048	0.809	-0.177	0.368			0.059	0.765
Entertainment goods	0.237	0.225	-0.126	0.523			0.050	0.801
Motor cars	0.204	0.297	0.226	0.248			0.219	0.264
Fuel for vehicles	0.278	0.153	0.043	0.830			-0.296	0.127
Books, magazines and newspapers	-0.237	0.225	-0.468	0.012			-0.190	0.333
Personal care products	0.113	0.567	-0.351	0.067			-0.047	0.813
Maintenance services	0.113	0.566	-0.193	0.326			0.395	0.037
Personal care services	-0.232	0.234	-0.551	0.002			0.164	0.405
Vehicle maintenance and repair	0.194	0.324	-0.325	0.092			0.245	0.210
Other financial services	0.283	0.145	-0.051	0.798	0.005	0.980	-0.147	0.454
Insurance	-0.003	0.987	-0.644	0.000	-0.179	0.363	-0.231	0.237
Postal services	-0.386	0.043	-0.543	0.003			-0.245	0.209
Telephone and telefax services	-0.344	0.073	-0.340	0.077	-0.064	0.748	-0.320	0.097
Train services	-0.065	0.754	-0.329	0.101				

Airline services	0.319	0.098	0.229	0.240			0.214	0.275
Vehicle rental services	0.047	0.813	-0.293	0.130			0.339	0.078
Holiday accommodation	0.331	0.086	0.050	0.802			0.103	0.603
Packaged holidays and tours	0.414	0.028	0.036	0.855			-0.097	0.623
Cafés, bars and restaurants	0.254	0.191	-0.401	0.035			-0.136	0.489
Commercial sport services	-0.011	0.956	-0.113	0.569	-0.369	0.054	0.358	0.061
Culture and entertainment	0.243	0.212	0.039	0.845			0.450	0.016
Water supply	0.624	0.000	0.129	0.512				
Electricity services	0.292	0.131	0.087	0.661	0.627	0.001	0.502	0.010
Gas services	0.062	0.775	-0.252	0.236	0.529	0.010	0.526	0.010
Non-prescription medicines	0.209	0.287	-0.220	0.261			-0.271	0.163
Dairy products	0.402	0.034	0.210	0.283			-0.106	0.591
Services markets	0.184	0.349	-0.304	0.116	0.037	0.852	0.241	0.217
Goods markets	0.494	0.008	0.027	0.893			0.029	0.884

Note: Values of p<0.05 have been highlighted

The market performance indices only show 8 out of 39 markets with significant correlations to the PLIs. Of these, almost all are positive correlations, suggesting that in those markets higher performance scores are associated with higher prices. Comparability was found to be correlated with a statistical significance in 5 recoded markets, all of which have negative correlations. This implies that, for those markets, increased comparability is associated with lower price indices. The highest correlation is in the insurance market, with a correlation value of -0.644.

Of the different recoded market categories for which switching and PLI data are available, only two have a statistically significant correlation. Both of these (electricity services and gas services) show a positive correlation with price indices. This implies that countries with a higher ease of switching actually experience higher prices in gas and electricity. Examining Figure 11 gives a little more insight into this – the countries with the lowest PLIs in electricity are generally those from Eastern Europe. These countries have poor switching scores, but have low electricity prices, presumably due to lower rates of income. The highest PLIs are found in Northern Europe, where the opposite is true. This suggests that switching is perhaps strongly correlated with a third factor such as GDP per capita, presumably much more influential than switching on the prices of electricity. A further brief investigation confirms this to be the case: GDP per capita is found to have a correlation value of 0.76 with switching scores in the electricity market, and 0.69 with the PLIs.

The same effect described in the case of switching appears to be true for choice – the highest significant correlations are to be found in the electricity and gas markets, and a scatterplot similar to Figure 11 would reveal a cluster of Eastern European countries with low choice scores and low PLIs, with North-Western European countries having high choice and high PLIs.
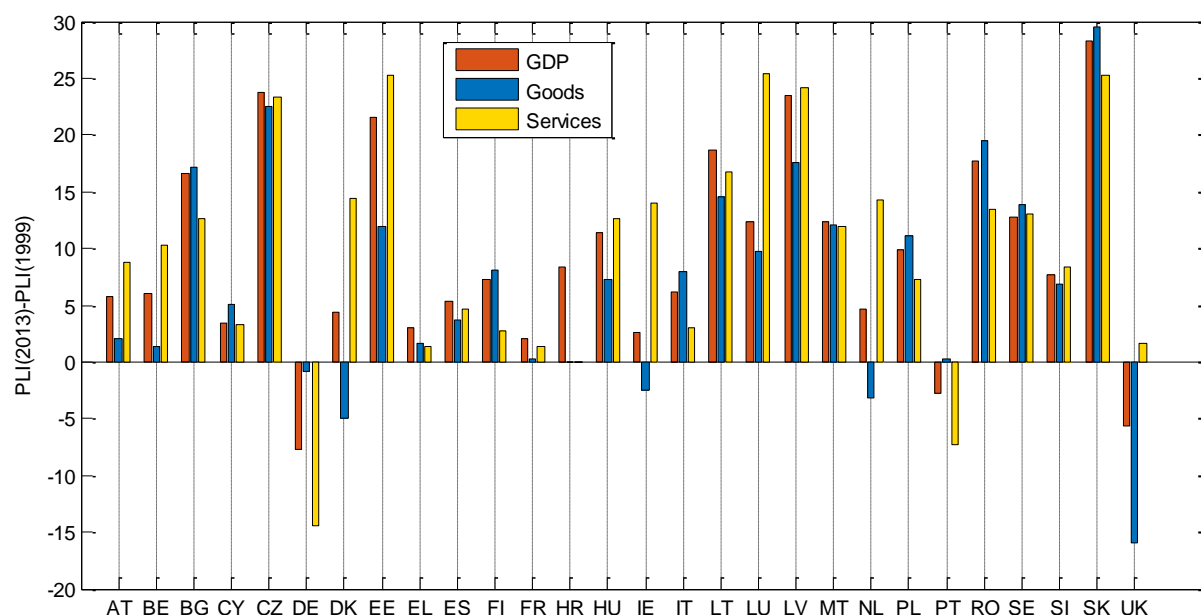
An additional brief investigation was performed to ascertain whether price dispersion, as measured by the variance over countries of the PLIs by market, has any correlation to MPI dispersion. It was found that the correlation is extremely low, with a value of 0.03.

2 DYNAMIC ANALYSIS: CHANGES IN PRICE DISPERSION IN EU28 OVER THE PERIOD 1999-2013

This section explores how the distributions of prices across member states have changed over time. PLIs of a wide range of products, goods and services are available from Eurostat, as well as aggregate measures such as gross domestic product (GDP) and actual individual consumption (AIC). The available data spans the period 1999-2013.

A first impression of changes in price dispersion can be seen from Figure 12, which shows the difference in PLIs over the period 1999-2013 for GDP, goods and services, by member state. The difference is taken simply by subtracting the 2013 PLI value from that of 1999 – it does not therefore describe what happened in the intervening years.
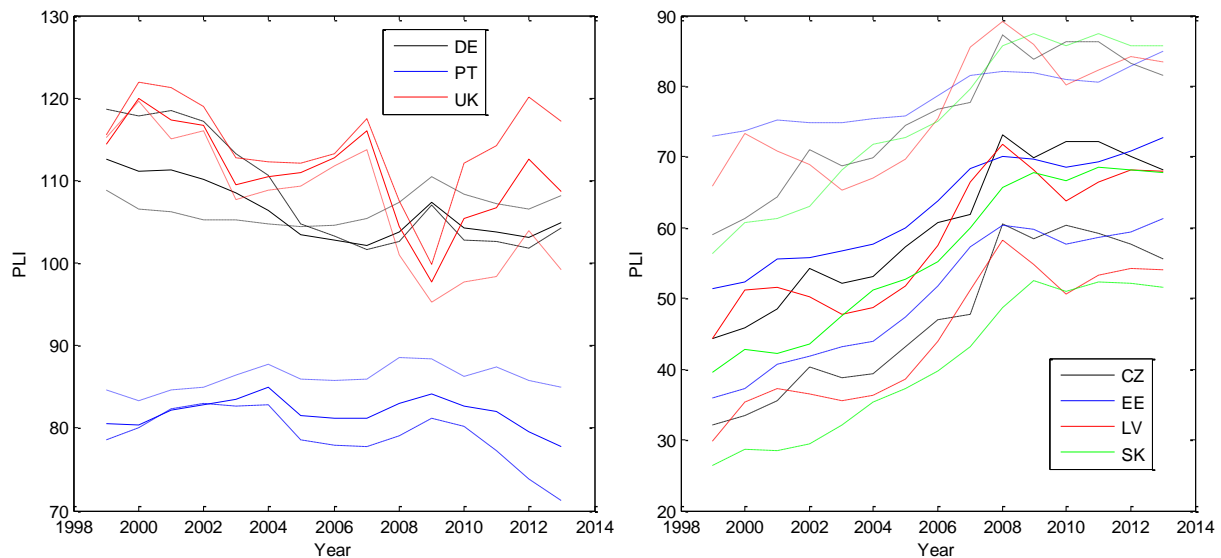
Overall the trend is that relative[3] price levels have increased substantially. The majority of countries show increases in GDP relative price levels (price level indices over all categories of goods and services measured), with corresponding increases in PLIs of goods and services. In general the increase in the PLIs of services is greater than that of goods.

Some countries like Germany, Portugal and the UK have experienced a fall in GDP price levels. Figure 13 (left) shows the PLIs of GDP, goods and services, over the period of 1999-2013 for the aforementioned countries. Portugal has seen a modest decrease in overall PLIs, driven by a fall in the price of services. Similarly, Germany has experienced a large decrease in service prices. The UK saw a significant reduction in the price of goods and services around 2008, caused by large swings in the exchange rate, but subsequently prices have begun to return to pre-2008 levels.

Particularly high increases in GDP and service PLIs appear in Eastern European countries such as the Czech Republic, Estonia, Latvia and Slovakia. Figure 13 (right) shows that these countries have seen steady increases in GDP PLIs, with slight decreases in prices around 2008.
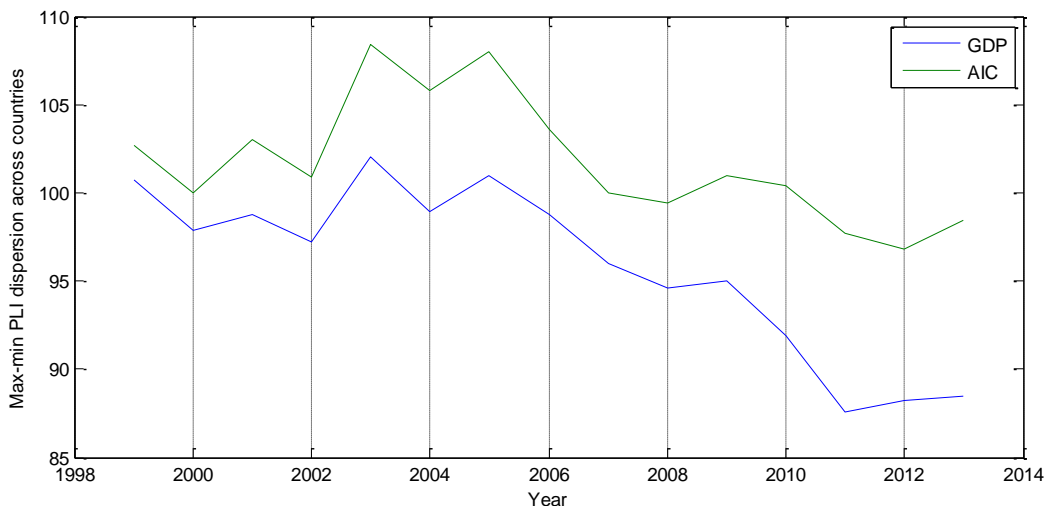
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[3] Note that comparisons are made with a weighted EU average. That means that big countries (UK, DE as in Figure 12) outweigh the rest.

Figure 13: PLIs of GDP (unbroken line), goods (short-dashed line), and services (long-dashed line) for selected countries with net GDP PLI decrease (left) and net GDP PLI increase (right).

To begin to examine how the dispersion of prices has changed across the EU, Figure 14 shows, for each year, the difference between the maximum and minimum price levels of all 28 countries, for the GDP and AIC aggregates. The trend in both cases is that the spread of prices has decreased, although there was a notable increase around 2002, and price spread has begun to increase again since around 2011.

Figure 14: Difference between maximum and minimum PLIs over countries for GDP and AIC.

A more detailed picture of price dispersion can be seen in Figure 15, which shows the standard deviation across countries for the various components of the AIC. All categories have seen an overall fall in price dispersion over the period 1999-2013, with the exception of education and health,[4] which are also the categories that have the highest price dispersion. It is notable that the highest dispersions tend to occur in non-tradable services, as well as energy, whereas the lowest variation is observed in typically more

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[4] According to Eurostat, both education and health have been subject to methodological changes in data collection that result in a break in the time series (education in 2005 and health in 2010).

tradable goods, such as clothing and footwear, and household furnishing, equipment and maintenance.

Figure 15: Standard deviation, across countries, of PLIs of AIC expenditure categories. Legend lists categories in order of 2013 standard deviation.
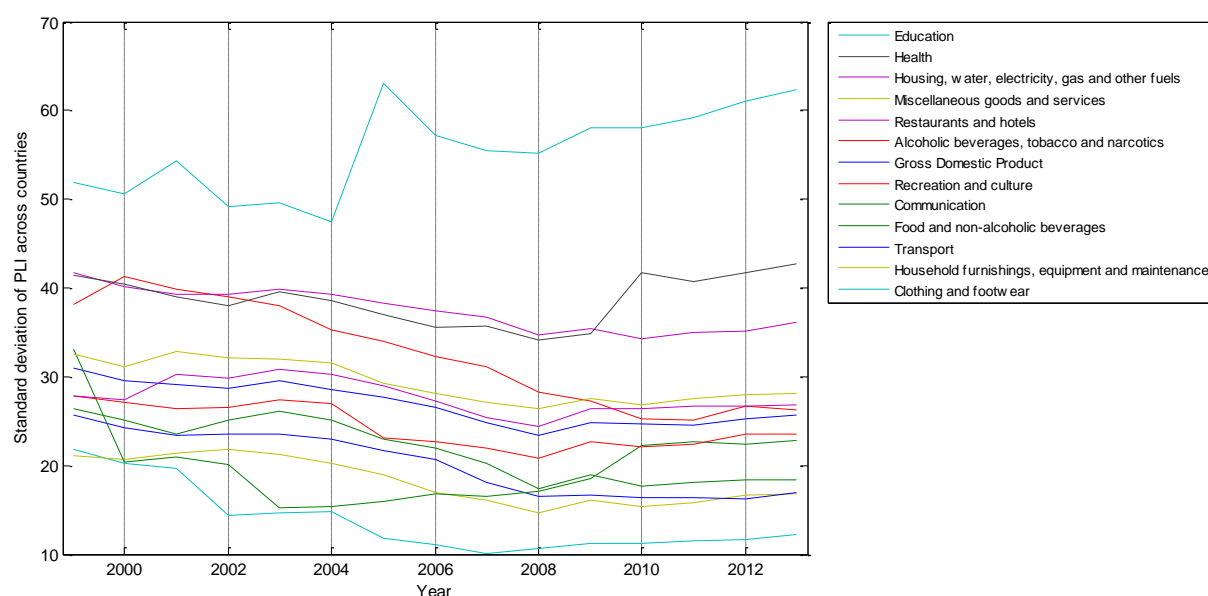

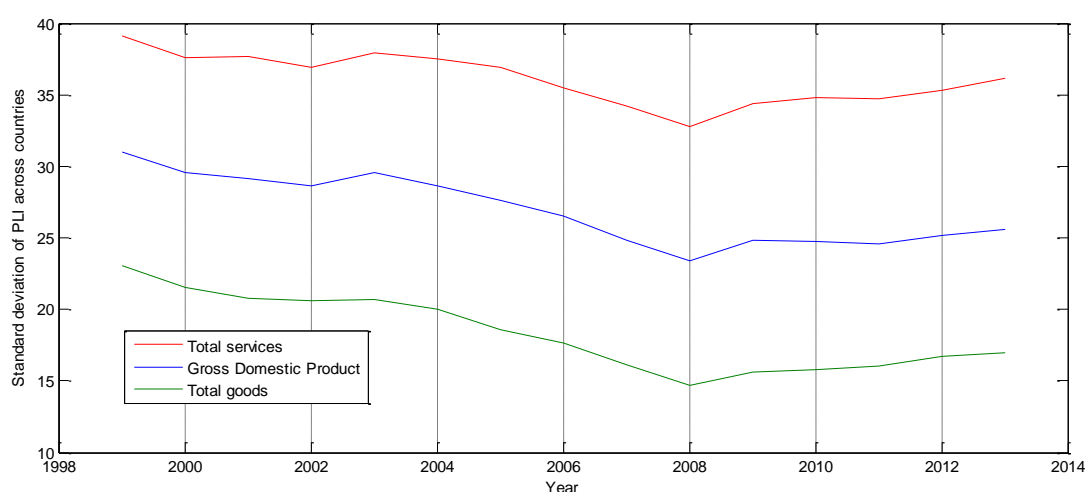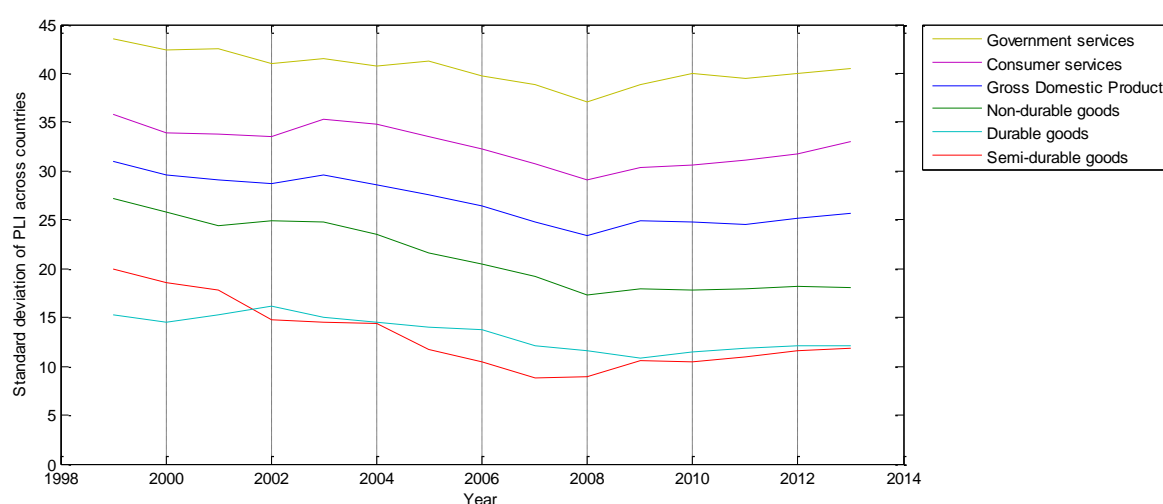**Figure 16: Standard deviation of PLIs of total services, GDP, and total goods.**

Figure 16 shows the dispersion of PLIs (as measured by standard deviation) for GDP and higher level aggregates such as total goods and total services. Over 1999-2013 the dispersion of PLIs has in all three cases fallen overall, however dispersion reached a minimum point in 2008, since when there has been a steady increase. One possible explanation for this turning point might be related to the economic crisis in the EU and to the fact that some countries have suffered more from the crisis (i.e. asymmetric shocks). Dispersion in services is consistently higher than dispersion in goods, presumably due to the fact that many goods are more open to competitive pressures

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from international markets, whereas service prices are highly dependent on local wages and domestic factors.[5]

To explore in a little more detail the drivers of the changes in dispersion, Figure 17 shows the dispersion of the various components of the goods and services aggregates. The highest dispersion is found in government services, followed by consumer services. Goods have lower levels of dispersion, with durable and semi-durable goods exhibiting the lowest levels of spread, given that these can be readily stored and traded, as opposed to non-durable goods which are more typically produced locally and therefore affected by local labour markets.
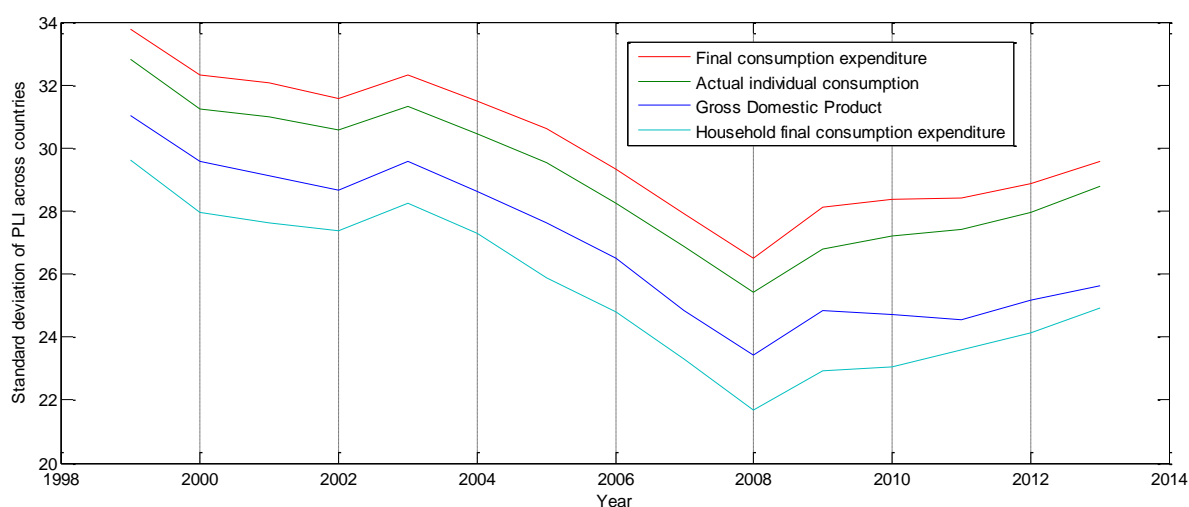
Figure 17: Standard deviation of PLIs of components of goods and services

Finally, it is useful to compare the results obtained for AIC and GDP with those from two additional alternative expenditure aggregates: household final consumption expenditure (HFC) and final consumption expenditure (FC) (see Figure 18). HFC comprises all the AIC expenditure categories except those related to non-profit institutions serving households and general government, and FC adds collective consumption expenditure items to those already included in the AIC aggregate. The trends are very similar for all four aggregates –there has been a downward trend in dispersion of prices across the EU, interrupted briefly in 2002, until 2008, after which point the dispersion has begun to increase in all aggregates.

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[5] However, note that changes in PLIs might also reflect changes in exchange rates, and not only in prices.

2.1 Convergence towards the higher or lower end of the distribution: a comparison between EU15 and New Member States

Figure 19 and Figure 20 compare on aggregate (GDP) the evolution of price level indices over time (1999-2013) in EU15 countries and New Member States (EU13). Points below the 45 degrees line in the graphs indicate countries for which prices have decreased over the period relative to the EU average. Within the EU15, this has occurred in three countries, two of which can be characterised as countries with higher price levels (Germany and United Kingdom), with the third belonging to the group of countries where price levels are comparatively lower (Portugal). Regarding New Member States, price levels have increased over the period when compared to EU average in all the countries, irrespective of the higher or lower level of prices registered in each country in the base period.

If we take into account the evolution of PLIs for different COICOP categories across groups of countries, Table 7 presents in the first place evidence of overall price convergence in EU28 for the highest level of aggregation considered ("Actual individual consumption"). For that aggregate, a decrease in the dispersion of price levels has been observed in the EU28 during the period 1999-2013. However, differences appear when considering EU15 and EU13 countries separately, as price convergence for the "Actual individual consumption" aggregate has only occurred in EU13 countries. The "Services" category shows a similar trend in terms of price convergence, with a reduction of price dispersion in EU28 and EU13 countries, but with an increase in EU15 countries. On the other hand, "Goods" prices have converged not only in the EU28 as a whole but also in both groups of countries. As usual, convergence in price aggregates can mask disparities occurring at a more disaggregate level (see Dreger et al. 2007, p. 46). For instance, at the EU28 level there is no observable price convergence in the COICOP categories of 'Health' and 'Education'. For both categories, small reductions in dispersion in EU13 have been more than counterbalanced by a huge increase in dispersion in EU15 countries. By contrast, there are also categories such as "Alcoholic beverages, tobacco and narcotics", "Furnishings, household equipment and routine household maintenance", "Transport" and "Communications", for which there has been a simultaneous reduction of price dispersion in the EU28, EU15 and EU13.

A complementary analysis of the average annual inflation rates over the period can help to shed more light on the dynamics of the price convergence process. According to the data presented in Table 7, consumer price inflation measured in terms of weighted average HICP annual rates has been higher in New Member States for all the expenditure categories considered. Deflation across the narrower COICOP categories has only been observed in "Clothing and footwear" and "Communications", both in the EU28 and EU15, but in any case in the New Member States. These results suggest that the observed convergence in price levels is happening mainly towards the higher end of the distribution.

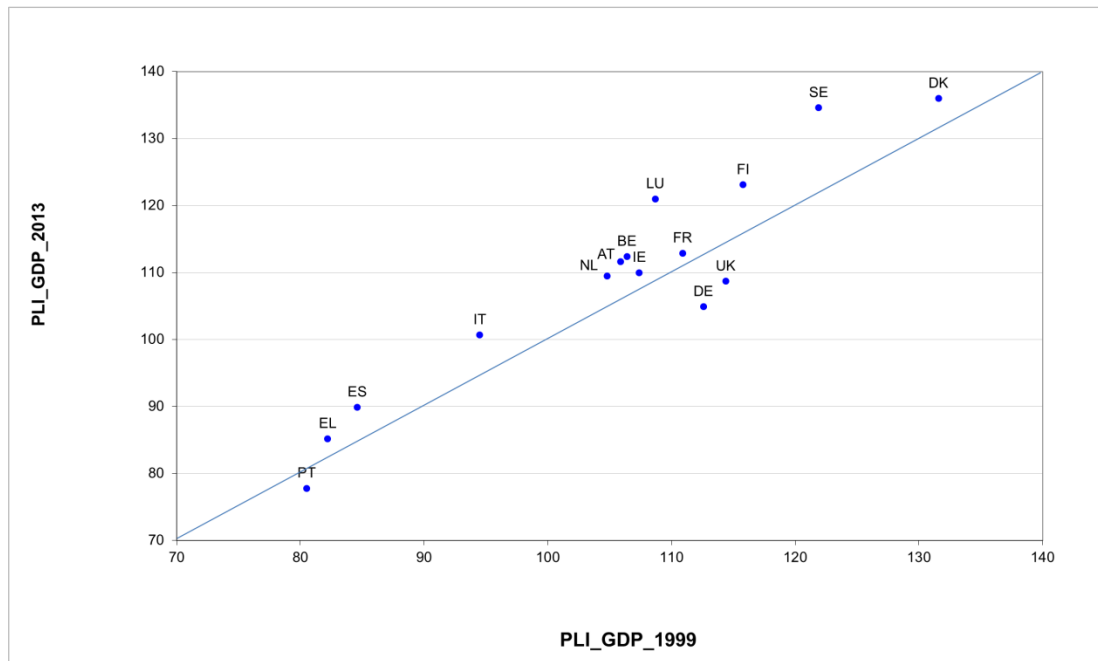Figure 19: PLIs for GDP aggregate in EU15 (1999 vs. 2013)

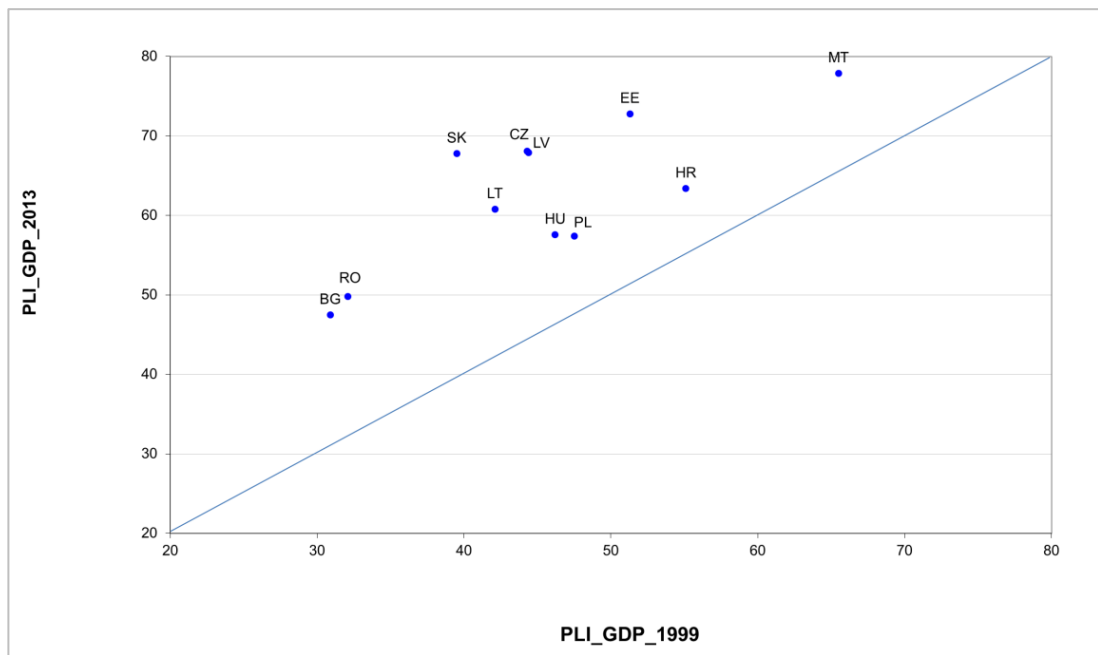Figure 20: PLIs for GDP aggregate in EU13 (1999 vs. 2013)

	Year	Weighted[1] annual avg. HICP rate (%)			Std. dev. PLIs		
		EU28	EU15	EU13	EU28	EU15	EU13
Actual individual consumption	1999				33.45	14.68	17.44
	2013				29.31	18.66	13.82
	1999-2013	2.19	2.03	4.86	-4.15	3.98	-3.62
Services (overall index excluding goods)	1999				39.85	17.66	18.72
	2013				36.81	23.44	14.79
	1999-2013	2.51	2.39	4.41	-3.04	5.78	-3.94
Goods (overall index excluding services)	1999				23.51	13.30	12.81
	2013				17.24	13.06	9.00
	1999-2013	1.85	1.74	3.50	-6.27	-0.24	-3.81
Food and non-alcoholic beverages	1999				26.83	12.93	17.39
	2013				18.70	13.60	13.30
	1999-2013	2.31	2.17	4.36	-8.14	0.66	-4.09
Alcoholic beverages, tobacco and narcotics	1999				38.88	35.38	20.60
	2013				26.70	27.31	10.80
	1999-2013	4.11	3.90	7.23	-12.19	-8.07	-9.80
Clothing and footwear	1999				22.21	10.29	16.89
	2013				12.41	12.19	9.07
	1999-2013	-0.20	-0.19	0.18	-9.79	1.90	-7.81
Housing, water, electricity, gas and other fuels	1999				42.55	21.70	13.92
	2013				36.86	23.90	14.54
	1999-2013	3.59	3.30	8.23	-5.69	2.20	0.62
Furnishings, household equipment and routine household maintenance	1999				21.45	10.60	13.74
	2013				17.09	9.60	11.29
	1999-2013	1.18	1.13	2.22	-4.36	-1.00	-2.45
Health	1999				42.29	20.03	23.41
	2013				43.48	30.27	19.85
	1999-2013	2.45	2.22	6.17	1.20	10.25	-3.55
Transport	1999				26.16	17.24	12.33
	2013				17.19	12.78	7.06
	1999-2013	2.95	2.81	5.54	-8.97	-4.45	-5.27
Communications	1999				33.77	35.01	22.17
	2013				23.25	17.46	15.86

	1999-2013	-1.85	-2.08	2.29	-10.52	-17.56	-6.31
Recreation and culture	1999				28.39	10.48	19.70
	2013				23.90	13.42	13.61
	1999-2013	0.50	0.35	3.13	-4.49	2.94	-6.09
Education	1999				52.93	31.03	26.15
	2013				63.42	59.97	25.78
	1999-2013	3.86	3.72	6.73	10.49	28.94	-0.37
Restaurants and hotels	1999				28.37	12.63	19.50
	2013				27.34	19.89	15.17
	1999-2013	2.84	2.67	5.67	-1.03	7.26	-4.32
Miscellaneous goods and services	1999				33.11	14.71	16.38
	2013				28.69	19.80	11.84
	1999-2013	2.49	2.35	4.80	-4.42	5.09	-4.54

[1] Weighted annual average inflation over the period 1999-2013 is calculated using the country shares in total nominal GDP in euro as weights

2.2 Price convergence in terms of *beta* and *sigma* convergence models

In order to perform a more rigorous assessment of price convergence, two standard convergence models have also been proposed and estimated: *sigma* and *beta* convergence.[6] The results obtained from the calculation of those convergence measures are presented below.

Sigma convergence

Sigma convergence occurs if there is a significant decline in price dispersion over time. There are different ways to check whether a decline in the standard deviation is statistically significant. As a straightforward strategy (see e.g. Wolszczak 2006), a classical *F*-test can be performed for the variance of the GDP PLI values (EU27=100) across countries observed in 1999 and 2013. The resulting *p*-value ($p = 0.3249$) obtained for the data suggests that it is not possible to reject the null hypothesis of equal variances, and as a result there is not sufficient evidence to conclude that *sigma* convergence has occurred.

A second and more formal attempt to test whether there is a negative time trend in price dispersion across the EU28 would imply regressing the yearly variance of price levels (S_t) against a time trend t and an intercept a, together with the corresponding slope coefficient β and error term ε_t:

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[6] Beta convergence is indicative of catching up processes from where countries with low relative prices converge to higher price countries by means of higher rates of change in price levels. Intuitively, beta convergence assumes that cheaper countries experience more dynamic growth in prices than more expensive countries. On the other hand, the concept of sigma convergence is applied to the reduction of disparities among economies in time. Intuitively, beta convergence is a necessary but not sufficient condition for sigma convergence, because for instance economies can converge to one another but random shocks might push them apart (see e.g. Monfort 2008).
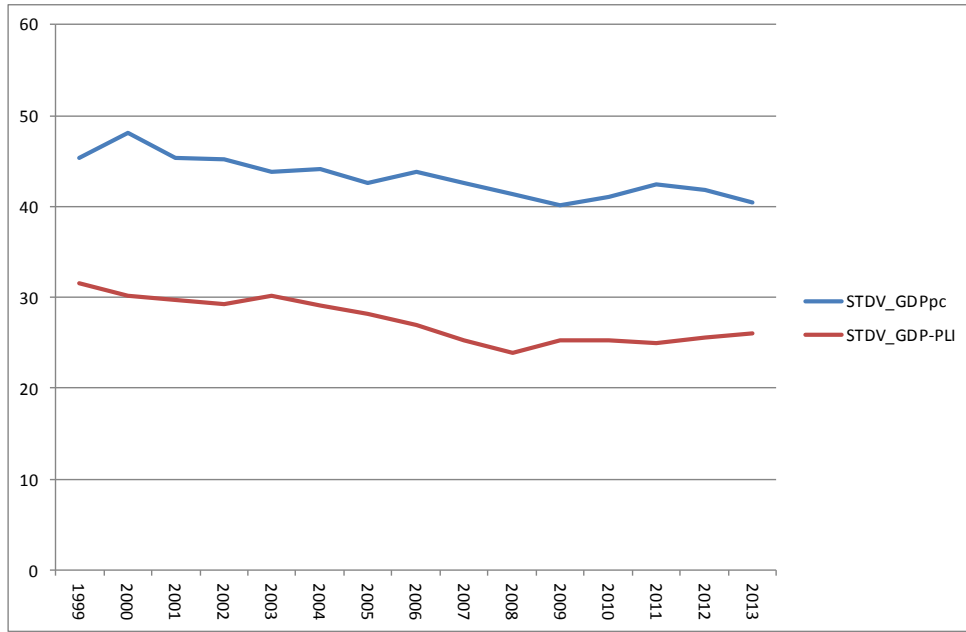
$$S_t = \alpha + \beta t + \varepsilon_t$$

To perform the regression analysis, the annual data on variance of GDP PLIs is used as a first option. However, as suggested by Dreger et al. (2007), the analysis can also be performed using an expanded dataset on price level variance, comprising 60 broad categories of PLIs for different groups of products published by Eurostat. The negative and highly significant slope coefficients resulting from both Ordinary Least Squares (OLS) regressions (see Table 8) indicate that there has been a significant reduction in price dispersion over time. Notwithstanding, when comparing the R^2 values for the simple and expanded dataset model specifications, the goodness of fit of the latter is extremely low. Furthermore, comparing the results from the *sigma* convergence analysis with those of the *F*-test shows that they do not coincide. However, as explained by Wolszczak (2008) this result is somewhat as expected, given that the traditional test of the ratio between variances usually leads to a low probability of accepting the hypothesis of convergence.

The reduction of dispersion in price levels (measured in terms of GDP PLIs) has paralleled that of income levels (measured in terms of volume indices of GDP per capita in PPS). As depicted in Figure 21, there has been a similar downward trend in the evolution of income per capita and price levels across EU countries over the period considered. More precisely, the slopes of the regression lines estimated from both data sets seem to be of a very similar magnitude (-0.47 for PLIs, and -0.43 for GDPpc). Given the small difference between both values, there only appears to be a slightly more intense convergence of prices than income towards the upper level and, as a result, a very limited negative effect on the living standards for people in poorer Member States.

Table 8: Sigma convergence OLS regression models

	Coefficient	Std. Error	t-value	Pr(>|t|)
GDPs - PLIs				
(intercept)	31.203	0.650	48.038	<0.001
time	-0.473	0.071	-6.625	<0.001
R^2	0.772			
Expanded dataset (60 aggregates) - PLIs				
(intercept)	29.541	0.7660	38.560	<0.001
time	-0.481	0.0843	-5.710	<0.001
R^2	0.035			

Beta convergence

Beta convergence measures the persistence of deviation from the Law of One Price, i.e., the speed of the price convergence process. More precisely, *beta* convergence models estimate the relationship between the initial price differences between countries and those price differences in subsequent periods.

The basic model proposed here to estimate *beta* convergence is in line with the models specified in Wolszczak (2006) and ECME Consortium (2010). It follows a simple autoregressive specification with the addition of time dummies:

$$\Delta P_{ij,t} = \alpha - \beta P_{ij,t-1} + i.\,year + \varepsilon_{ij,t}$$

which can be written equivalently as:

$$P_{ij,t} = \alpha + (1 - \beta)P_{ij,t-1} + i.\,year + \varepsilon_{ij,t}$$

where $P_{ij,t}$ is the absolute log-difference in GDP PLIs between countries *i* and *j* in period *t*, $i.\,year$ are the time dummies, $\varepsilon_{ij,t}$ is the error term, α the constant term and $(1 - \beta)$ the parameter on the lagged gap, which should have an estimated value <1 for the convergence hypothesis to hold. In this model specification, all possible combinations (pairs) of differences between EU28 countries have been taken into account when constructing the panel data set for estimation. In panel data situations characterised by few time periods and many individuals, the Linear Generalized Method of Moments (GMM) estimators are used to perform the estimation, both in the first-differences (DIFF-) and in the system (SYS-) GMM form (see e.g. Roodman, 2006).

Even though estimation results for both DIFF- and SYS-GMM are shown in Table 9, the SYS-GMM results will be the focus for interpretation and analysis, since DIF-GMM appears to give downward-biased estimates (Wolszczak 2006, p. 22). Moreover, results for SYS-GMM are presented not only for the model that includes yearly dummies as standard instruments, but also for the expanded model that includes multiplicative dummy variables corresponding to price differences calculated between EU13 (EU_13_d), EU15 (EU_15_d), Eurozone (EZ_d) or no-eurozone (No_EZ_d) countries. The results obtained from the SYS-GMM models indicate that, on average, the half-life of

the convergence process (i.e. the number of years expected to half the difference in prices between the countries) is around 15 years. Moreover, price convergence is expected to happen significantly faster within EU13 and Eurozone countries, as indicated by the negative and highly significant dummy coefficients estimated in the expanded SYS-GMM model. According to the *p*-values from the Hansen/Sargan and autocorrelation (AR) tests, there is mixed evidence of the misspecification of the models. On the one hand, the null of joint validity of the instruments is rejected, while on the other hand the AR tests are indicative of first-order correlation and the lack of second-order correlation in the differenced residuals.

Table 9: *Beta* convergence GMM regression models (GDP PLIs)

	DIFF-GMM	SYS-GMM	SYS-GMM expanded
$(1 - \beta)$	0.788	0.955 (<0.001)	0.953 (<0.001)
Speed of convergence	0.239	0.046	0.048
Half-life (years)	2.904	15.080	14.461
EU_15_d * $P_{ij,t-1}$	-	-	0.013 (0.024)
EU_13_d * $P_{ij,t-1}$	-	-	-0.030 (<0.001)
EZ_d * $P_{ij,t-1}$	-	-	-0.026 (<0.001)
NoEZ_d * $P_{ij,t-1}$	-	-	0.003 (0.269)
Sargan/Hansen test	(<0.001)	(<0.001)	(<0.001)
Arellano-Bond AR(1) test	(<0.001)	(<0.001)	(<0.001)
Arellano-Bond AR(2) test	(0.392)	(0.413)	(0.452)

Note: *p*-values included between brackets

In addition, to illustrate to what extent the results for the *beta* convergence analysis are dependent on the aggregate considered, the analysis above has been repeated using absolute log-differences in price level indices for the AIC, Goods and Services aggregates in the period 1999-2013 (see Table 10). According to the results shown in Table 10, the half-life estimated by the models varies for the different aggregates considered, with AIC values being situated in between faster converging Goods and slower converging Services. On the other hand, all the models give significant evidence of faster convergence happening within EU13 and Eurozone countries.

Table 10: *Beta* convergence GMM regression models for AIC, Goods and Services PLIs

	SYS-GMM AIC	SYS-GMM Goods	SYS-GMM Services
$(1 - \beta)$	0.953 (<0.001)	0.913 (<0.001)	0.961
Speed of convergence	0.049	0.091	0.039
Half-life (years)	14.274	7.615	17.608
EU_15_d * $P_{ij,t-1}$	0.010 (0.010)	0.013 (0.080)	0.018 (0.005)
EU_13_d * $P_{ij,t-1}$	-0.029 (<0.001)	-0.066 (<0.001)	-0.023 (<0.001)
EZ_d * $P_{ij,t-1}$	-0.027 (<0.001)	-0.051 (<0.001)	-0.020 (<0.001)
NoEZ_d * $P_{ij,t-1}$	0.003 (0.284)	0.017 (0.003)	0.003 (0.313)
Sargan/Hansen test	(<0.001)	(<0.001)	(<0.001)
Arellano-Bond AR(1) test	(<0.001)	(<0.001)	(<0.001)
Arellano-Bond AR(2) test	(0.051)	(0.450)	(0.039)

Note: *p*-values included between brackets

3 COMMENTS AND DISCUSSION ON PRICE DATA AVAILABILITY

Apart from the obvious interest in undertaking an exploratory analysis of price disparity across EU countries, the main motivation for this document has been the need to understand whether the DAP project can be discontinued without significant consequences for the consumer scoreboard. Consequently, this final section is devoted to a discussion on the issues of price data availability and their implications for the CMS.

When considering to what extent data available from the DAP project have added value with respect to regular data on PPP and HICP, recall first that presently some countries do not supply data for the DAP project, and the differences between the samples of goods and services for which prices are collected might be considered too large to allow for a proper comparability of prices (Eurostat 2014). Also, HICP data collection, based on a mix of semi-tight or loose product specifications, puts special emphasis on the representativity of monitored items for local markets, but not on international comparability. Consequently, the evolution of price levels over time will refer to a basket of goods which differs from one country to the next, reflecting locally representative items (see e.g. Dreger et al. 2007).

On the other hand, PLIs calculated using PPPs allow comparison of countries' price levels, but always relative to the EU average. To overcome this limitation, information on PLIs can be combined with information on inflation rates, which can shed light on whether convergence is the result of a price rise of different magnitude in two groups of countries, or the result of combining inflation in one group with deflation in the other. However, comparability of prices across countries based on PPPs-PLIs data will always be

limited by the fact that the underlying survey is conducted only once every three years, only in capital cities, and based on tight specifications of products included in the survey framework, which in any case are also subject to changes over time. In addition, flexibility or inaccuracy in the definition and selection of the goods or services to monitor can affect the comparability of prices. More precisely, flexibility in the selection of products might lead to an underestimation of price levels in poorer countries, as the prices gathered there might refer to goods and services of an inferior quality. Conversely, when income per capita increases in those countries, households are likely to shift consumption towards higher quality and more expensive goods and services (Dreger et al. 2007).

On the problem of analyses based on aggregated price data (rather than individual goods), Dreger et al. (2007) and Wolszczak (2006) provide some additional interesting insights. When using PLIs, data at the basic heading level is calculated as unweighted (geometric) averages, so cross country differences in expenditure have no consequence for the basic headings (i.e. basic headings are robust against changes to the weighting structure). Accordingly, PLIs above basic heading level can change not only because of changes in underlying relative prices, but also due to changes in the weighting structure. But on the other hand, higher levels of aggregation will reduce the volatility caused by potential changes in the list of products selected to be monitored. Further, the use of any aggregate will usually mask situations where convergence and divergence occur at the same time for individual product prices.

As a bottom line conclusion, throughout this document several analyses have been presented on prices across countries that can be performed using essentially PPPs-PLIs data at different aggregation levels. In that sense, some alternatives seem to be available for the analysis of price dispersion/price convergence in the EU, even in the case that the DAP data collection ceased to be continued. However, some specifics of the PPPs-PLIs data collection procedure have also been highlighted, in particular the fact that the PPP survey is conducted only once per three years. That circumstance should be taken into account, for example, when considering with which periodicity an updated analysis on EU prices should be presented together with the CMS report. Last but not least, more disaggregate data on PPPs-PLIs are presently available for research purposes only on the base of confidentiality, thus precluding the possibility of disseminating the results obtained from those data in publications such as the CMS.

4 References

Chambers, J. M., Cleveland, W. S., Kleiner, B., Tukey, P. A. (1983). Graphical methods for data analysis. Wadsworth & Brooks/Cole Publishing Co, Pacific Grove, CA.

Dreger, C., Kholodin, K., Lommatzsch, J., Slacalek, J., Wozniak, P. (2007). Price convergence in the enlgarged internal market. European Economy Economic Papers, Number 292 – November 2007.

ECME Consortium (2010). The functioning of retail electricity markets for consumers in the European Union – Final Report. EAHC/FWC/2009 86 01.

European Commission (2013). Monitoring Consumer Markets in the European Union 2013 – Part I.

European Commission (2014). Consumer Markets Scoreboard: Making markets work for consumers. 10th ed. -June 2014. Publications Office of the European Union, Luxembourg.

Eurostat (2014). Detailed average prices report. October 2014.

Monfort, P. (2008). Convergence of EU regions: Measures and evolution. European Commission, Regional Policy, Working papers 01/2008.

Roodman, D. (2006) How to do xtabond2: An introduction to "Difference" and "System" GMM in Stata. Center for Global Development, Working Paper 103, December 2006.

Wolszczak, J. (2006) One Europe, one product, two prices: the price disparity in the EU. Katholieke Universiteit Leuven, Center for Economic Studies.

Wolszczak, J. (2008) Does one currency mean one price? European University Institute Working Papers, MWP 2008/21.

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