TESTING PURCHASING POWER PARITY FOR THE NEW EU MEMBERS AND TURKEY: PANEL COINTEGRATION ANALYSIS WITH DISAGGREGATED CPI

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ABSTRACT This study applies multivariate panel cointegration technique to evaluate PPP hypothesis by using consumer price sub-indices of new EU member transition economies and Turkey. We aim not only to compare parameter estimates across the sectors of an economy but also across the economies at different EU transition stages. We find that failure to get evidence for cointegration to support PPP can be attributed to the inclusion of non-tradable goods in the aggregated data, as well as to the extent of trade relationship.
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Keywords PPP, Panel cointegration, EU, transition economies, Turkey

ÖZ Bu çalışma, yeni AB üyesi geçiş ekonomileri ve Türkiye'nin tüketici fiyatları alt endekslerini kullanarak, satın alma gücü paritesi (SGP) hipotezini test etmek amacıyla çok değişkenli panel eş-bütünleşme tekniğini uygulamaktadır. Amacımız, tahmin edilen parametrelerin sadece bir ekonominin sektörleri arası değil, fakat aynı zamanda farklı geçiş sürecindeki ekonomiler arası kıyaslamasını yapmaktır. Bulgumuz, SGP hipotezini destekleyecek eş-bütünleşme kanıtlarının elde edilememesindeki başarısızlığın hem toplulaştırılmış verilere ticarete konu olmayan malların dâhil ediliyor olmasına, hem de ticaret ilişkilerinin derinliğine atfedilebilir olmasıdır.
YENİ AB ÜYELERİ VE TÜRKİYE İÇİN SATIN ALMA GÜCÜ PARİTESİ TESTİ: TÜFE ALT ENDEKSLERİYLE BİR PANEL EŞ-BÜTÜNLEŞME ANALİZİ
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1. Introduction

Purchasing power parity (PPP) is built on the law of one price, which implies equalization of price of a commodity across countries when it is expressed in a common currency. However, the early literature does not provide an overwhelming empirical support for the hypothesis. Failure to verify the validity of the hypothesis is not only attributed to the inclusion of both tradable and non-tradable goods together into the analysis, but also to the use of low power econometric techniques.

The recent globalization trends have retaken the attention of researchers and governments on the empirical performance of the PPP hypothesis. Recent studies, by using disaggregated and cross-country data, aim to improve power of their analysis. In line of this trend, we want to analyze the validity of the hypothesis by using sub-indices of the consumer prices of the European economies with special emphasis on transition economies and Turkey by employing recently developed panel cointegration techniques. By doing this, we not only can compare how the parameter estimates may vary across the sectors of an economy with different trade openness rates, but also across the economies at different EU transition stages.

Empirical research on this field has been developing in two directions. While some of these studies improve the power of hypothesis testing by using pooled data from many countries, others use sub-indices of CPI in order to control for the effect of inclusion of tradable and non-tradable sectors on the test results. Among those studies, which use multivariate panel cointegration techniques, Chakrabarti (2006) failed to find a cointegrating relationship between exchange rates and relative price index thus rejected even the weak form PPP hypothesis for the overall price index by using pooled data from 7 developed economies for the 1977-1994 period. This result contradicted with Narayan (2006), who showed that when the structural breaks in data are taken into account, the weak form of the hypothesis might not be rejected even for the overall price index of 16 OECD countries. In addition, Cerrato and Sarantis (2007) found empirical support for the long-run PPP when they relaxed the assumption of symmetry and proportionality of the impact of domestic and foreign prices on the exchange rates for 20 OECD countries. Similarly, Koedijik *et al.* (2004) and Lopez *et al.* (2007) found evidence for the weak form PPP hypothesis for

the euro area countries and argued that the process of economic integration in Europe accelerated convergence toward PPP within the area. Meanwhile, Offermanns (2005) showed that the deviation from the long run relationship is also due to the inclusion of non-traded sectors into the analysis and the strength of this relationship depends on the degree of trade integration instead of EU membership. In line with Offermanns (2005), Jenkins and Snaith (2005) also concluded that failure to support the validity of the PPP hypothesis is due to the existence of non-tradable goods' prices in the overall index.

There is also an increase in research on European and Asian economies in transition to test the PPP hypothesis. These transition economies are providing natural experiment for economists to study effects of transition from a highly regulated and planned economy to a market economy. In general, results of these studies support the weak form PPP hypothesis. Sideris (2006) found that weak form of the hypothesis holds for 17 Eastern European transition economies for the 1990-2004 period, when symmetry and proportionality assumptions are relaxed. Similarly, Solakoğlu (2006) provided evidences for the weak form PPP for 21 transition economies in Europe and Asia by using unbalanced panel data from the second half of 1990s till 2003. She argued that real exchange rates in more open economies converge to its theoretical value faster than the less open economies.

In this paper, we use both the overall consumer prices and its sub-indices in order to analyze whether the rejection of the hypothesis is due to the inclusion of non-tradable goods in the overall index. We use monthly panel data from 17 European countries from January 1996 to December 2006 (Table 1). Data includes both developed European countries outside the euro area, new member states that joined the EU in 2004, Romania[1] and Turkey. Our sample is quite heterogeneous as we are interested in testing whether our empirical results differ among the subgroups of these economies as parallel to their degree of integration to the euro area economies. New EU member countries are in the process of integration to the euro area countries. In fact, Slovenia entered the euro area at the beginning of 2007, while S.Cyprus and Malta have started using Euro as a national currency at the beginning of 2008. Yet, Turkey has long history of economic relation with the euro area countries.

Accordingly, contributions of this study to the literature are twofold. Firstly, this is the first paper, which uses pooled cointegration analysis on sub-indices of the consumer prices for the countries in transition. Secondly,

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[1] Romania joined the EU in January 2007. Since our data period ends in 2006, the study treats Romania as a non-EU member country.

this study estimates coefficients of the cointegration vectors and tests the validity of the strong form PPP for the pooled data. In this respect, this paper strengthened the test of PPP hypothesis by both controlling for tradable and non-tradable sectors, and increasing the power of the test by pooling data from many countries.

As a first step, we conduct multivariate panel cointegration analyses to examine the validity of PPP by using pooled data for the whole sample of 17 countries. Even though, PPP hypothesis is rejected for the overall price index, the weak form of the hypothesis is supported for mostly the tradable sub-indices of the CPI. Secondly, it is interesting to find that prices and exchange rates in the new members of EU, especially countries in transition, do not converge to their fundamental values suggested by the law of one price, with the exception of food and nonalcoholic beverages. This could be either due to the transition of these economies from highly regulated prices to market prices or due to still weak trade and financial links between eastern and western parts of the Europe or both. Inclusion of Turkey among the new member of EU countries straightens the results, increases the number of cointegrated vectors. On the other hand, exclusion of either Slovenia, S. Cyprus, or Malta, countries which are the member of the euro area as of 2007 and 2008, from the sample of transition countries does not affect the estimation results, which may indicate that there is still a room for improving trade links between these economies and euro area countries.

Rest of the paper is organized as follows: The second section summarizes the test procedure, the third section presents the empirical results, and the final section concludes.

2. Panel Cointegration Tests

Multivariate panel cointegration technique developed by Pedroni (1999) and Pedroni (2004) is employed to test the PPP hypothesis. Panel cointegration technique is a powerful method to investigate inferences on existence of cointegration, since it combines both time series and cross sectional information. Panel cointegration techniques in Pedroni (2004), also, allow for heterogeneity in the long-run co-integrating vectors among individual members of the panel and make time series cointegration technique applicable for multiple regressions.

Pedroni uses the following standard panel regression to develop test statistics for panel cointegration:

$$y_{it} = \alpha_i + \delta_i t + \beta_i x_{it} + u_{it} \qquad i=1,...,N;\ t=1,...,T. \tag{1}$$

where y_{it} and x_{it} are panels of observations over the members of the panel and assumed to be integrated of order one (I(1)) for each panel member i. Under the null of no cointegration, residual u_{it} is assumed to be I(1). Parameters α_i and δ_i capture any fixed effects and deterministic trends that are specific to each member of the panel, respectively and β_i is a vector of parameters that are allowed to vary across members of the panel.

Based on equation (1), Pedroni suggests two sets of statistics that use fully modified OLS (FMOLS) for testing the null hypothesis H_0: "All of the individuals of the panel are not cointegrated, $u_{it} \sim$ I(1)" against the alternative H_1: "A significant portion of the individuals are cointegrated, $u_{it} \sim$ I(0)". Thus, under the alternative hypothesis Pedroni permits individual members of the panel to differ whether they are cointegrated or not. Use of FMOLS principles not only accommodates considerable heterogeneity across individual members of the panel, but also produces asymptotically unbiased estimators.

The first set of statistics consists of three panel statistics; 'panel variance ratio statistics', 'panel rho statistics' and 'panel t-statistics' that are based on pooling the residual of the regression along the within-dimension of the panel. The second set consists of two group statistics; 'group rho statistics' and 'group t-statistics', which are based on pooling the data along the between-dimensions of the panel. The main idea of these two statistics is to compute the group mean of the individual conventional time series statistics. As noted in Pedroni (2004), the first set of statistics is constructed by summing the numerator and denominator terms separately for the analogous time series statistics. The second set of statistics, as opposed to the first set, is constructed by first calculating the ratio corresponding to the time series statistics and then computing the standardized sum of the ratio over the cross section of the panel. In fact, the second set of statistics is the group mean of the individual time series statistics.[2] As Pedroni (1999, 2001) notes, the FMOLS between-dimension estimator overcomes the endogeneity problem and accounts for dynamic heterogeneity among the regressors. In other words, while the within-dimension estimators allow to test $H_0 : \beta_i = \beta_0$ for all i versus $H_0 : \beta_i = \beta \neq \beta_0$ for all i, the test statistics constructed from the

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[2] Pedroni (2004) points out that the asymptotic distribution of residual-based tests for the null of no cointegration in heterogeneous panels is affected by the averaging measure in calculating the tests. Therefore, some adjustments must be made to allow statistics to be N(0,1) as (T, N) → ∞ under the null. Under the alternative hypothesis the variance ratio statistics converges to positive infinity while the other statistics converges to negative infinity. Therefore, the right tail of the normal distribution is used to reject the null hypothesis for the variance ratio test; where as the left tail of the normal distribution is used for the other statistics.

between-dimension estimators are designed to test $H_0 : \beta_i = \beta_0$ for all i, against the alternative $H_0 : \beta_i \neq \beta_0$, so that value of β_i varies across individuals under the alternative hypothesis.

3. The PPP Hypothesis, Data and the Empirical Results

Formally, the following cointegrating system is set for a panel of $i= 1…N$ members to test the PPP hypothesis:

$$e_{it} = \alpha_i + \beta_i p_{it}^s + \varepsilon_{it} \qquad i=1,...,N; \ t=1,...,T. \qquad (2)$$

Here, e_{it} is the logarithm of bilateral nominal exchange rates at time t for country i and p_{it}^s is the logarithm of relative consumer price index of country i over the consumer price index of euro area at time t and sector s. Existence of a cointegration relationship implies a weak form PPP relationship. In this case, the strong form PPP holds if the null hypothesis of $\beta_i = 1$ is not rejected.

Data includes monthly observations for 17 developed, developing and transition economies of Europe for the January 1996 - December 2006 period. We use both the overall harmonized consumer price index (HICP) and its sub-indices in our analysis to test the PPP hypothesis (Table 1). All data have been taken from the Eurostat website. One difficulty of using this data set, however, is its deficiency in clearly distinguishing tradable goods from non-tradable ones. Sub-indices for food and non-alcoholic beverages, alcoholic beverages, clothing and footwear include highly tradable goods while education, and restaurant and hotels, on the other hand, include mostly non-tradable goods. Yet, the rest of the categories have both types of commodities. For example, furnishing and housing equipment category includes both tradable goods e.g. household appliances and non-tradable goods e.g. household maintenance. Similarly, health includes both pharmaceutical products (tradable) and hospital services (non-tradable). However, we will proceed with the current official classification of the commodities by keeping in mind that this classification does not clearly distinguish tradable nature of the commodities.

Table 1. Commodity Groups

P0	**All-items HICP**	61	Medical products, appliances and equipment
P1	**Food and non-alcoholic beverages**	62	Out-patient services
11	Food	63	Hospital services
12	Non-alcoholic beverages	**P7**	**Transport**
P2	**Alcoholic beverages, tobacco and narcotics**	71	Purchase of vehicles
21	Alcoholic beverages	72	Operation of personal transport equipment
22	Tobacco	73	Transport services
P3	**Clothing and footwear**	**P8**	**Communications**
31	Clothing	81	Postal services
32	Footwear including repair	82	Telephone and telefax equipment
P4	**Housing, water, electricity, gas and other fuels**	83	Telephone and telefax services
41	Actual rentals for housing	**P9**	**Recreation and culture**
43	Maintenance and repair of the dwelling	91	Audio-visual, photographic and inf. processing equip.
44	Water supply and misc. services relating to the dwelling	92	Other major durables for recreation and culture
45	Electricity, gas and other fuels	93	Other recreational items and equip., gardens and pets
P5	**Furnishings, household equip. and routine maint. of the house**	94	Recreational and cultural services
51	Furniture and furnishings, carpets and other floor coverings	95	Newspapers, books and stationery
52	Household textiles	96	Package holidays
53	Household appliances	**P10**	**Education**
54	Glassware, tableware and household utensils	**P11**	**Restaurants and hotels**
55	Tools and equipment for house and garden	111	Catering services
56	Goods and services for routine household maintenance	112	Accommodation services
P6	**Health**		

Source: Eurostat.

We also categorize 17 countries into several subgroups. The first subgroup includes 5 developed EU member economies: Denmark, Iceland, Norway, Sweden and U.K. The second subgroup consists of 12 countries that are new members and candidate economies of the EU: S. Cyprus, Malta, Romania, Czech Rep., Estonia, Latvia, Slovenia, Slovakia, Hungary, Poland, Lithuania and Turkey.[3] The third subgroup consists of 11 countries, which is formed by taking out Turkey, S. Cyprus, Malta and Slovenia one by one from the group of 12 countries. The primary purpose of forming such an additional group is to investigate how the exclusion of these countries from our original 12-country list would affect validity of PPP hypothesis among the transition countries. Finally, the fourth group consists of 8 new members

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[3] We exclude Bulgaria from our dataset since Bulgaria has been implementing currency board since 1997.

of EU, which are also considered as transition countries: Czech Rep., Estonia, Latvia, Slovenia, Slovakia, Hungary, Poland, and Lithuania.

Note that in some cases, such as exchange rate policies that are targeted relative to each other and aggregate price ratios that are driven by a common external disturbance, series may become correlated across the countries. Pedroni (2001) and Levin, Lin, and Chu (2002) suggest that demeaning procedure, subtracting out individual time mean, can be used to mitigate the impact any form of cross-sectional dependency. Accordingly, before we proceed with the empirical analysis we demeaned each variable used in the analysis.

Table 2. Test Results for Panel Unit Root

	IPS	Fisher-ADF	IPS	Fisher-ADF
	Level		First Difference	
Exchange Rates	3.03*	13.49*	-10.67	244.34
Overall HICP	3.32*	26.61*	-3.44	92.19
Food & Non-alco. Beverages	0.96*	26.63*	-10.25	262.66
Alcoholic Beverages	0.18*	36.75*	-13.09	308.91
Clothing and Footwear[a]	1.43*	32.03*	-26.58	729.57
Housing, Water & Electricity	3.47*	16.41*	-9.27	259.39
Furnishings & Household Equip.	2.36*	35.02*	-2.31	52.05
Health	3.58*	15.84*	-4.47	115.18
Transportation	2.67*	16.00*	-7.00	162.06
Communications	0.53*	50.84*	-24.03	671.94
Recreation and Culture	1.71*	34.72*	-5.51	166.18
Education	1.49*	25.29*	-8.32	235.17
Restaurants and Hotels	-0.50*	69.58*	-5.71	201.31

Notes: All estimations include a constant and a trend. '*' and '**' indicate the non-rejection of the null of nonstationarity at 5% and 10% significance levels, respectively. Modified Akaike Information criteria is used for appropriate lag selection for each panel member.
a: If Schwarz Information Criteria is used for lag selection clothing and footwear prices are also demonstrates unit root process.

Then, the first step in applying cointegration technique is to test whether variables are stationary to avoid spurious regressions in the panel. Specifically, we check for the presence of unit root in data by using both IPS test developed by Im, Peseran and Shin (2003) and ADF-Fisher test developed by Wu and Maddala (1999).[4] Table 2 presents panel unit root test

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[4] IPS proposes a unit root tests for a dynamic heterogeneous panel, based on the mean of the individual Dickey-Fuller *t*-statistics of each unit in the panel. The test allows for individual effects, time trend, and common time effect in testing panel unit root. We may also add lags of the dependent variable to account serial correlation in the errors. The *t*-bar statistic of IPS is distributed standard normal under the null hypothesis of non-stationarity, after it is transformed by the factors provided in Im *et al*. (2003). On the other hand, Fisher test combines *p*-values from N independent unit root tests. Both IPS and Fisher tests assume that

results, where Modified Akaike Information Criteria (MAIC) is used for lag selection, for both level and first difference of the series. According to IPS and ADF-Fisher tests all series are I(1) at 5% significance level, except the food and non-alcoholic beverages, which is I(1) at 10% significance level according to the ADF-Fisher test. Also, there is a poor evidence for the non-rejection of unit root for clothing and footwear prices.[5]

Since the variables contain unit root, cointegration properties must be analyzed in the next step. The results of all seven different panel cointegration tests for different country groups are presented in Tables 3-7. The first four columns of these tables report the panel statistics and the next three columns display the group statistics. The parametric ADF version of these types of statistics is added next to each set of statistics for comparison purpose. The last two columns report the number of rejection of the null hypothesis at the 5% and 10% significance levels, respectively.

Table 3 reports the cointegration test results for the group of 17 countries. Majority of the cointegration tests fail to reject no cointegration hypothesis for the panel constructed with overall price index (HICP). This result is consistent with the previous empirical literature, which also fails to find overwhelming support for the PPP hypothesis. Next, the cointegration tests are run for the sub-indices of the HICP index. Majority of these tests suggest strong evidence in favor of weak form PPP for 4 out of 11 sub-indices of consumer prices, panels constructed with food and non-alcoholic beverages, clothing and footwear, furnishing, etc., and transportation sub-indices of consumer prices at 10% or better significance level. Note that, these sectors are generally considered as the tradable sectors of the economy. Those indices that fail to verify the existence of long run relationship are usually considered as the non-tradable sectors.

Results of the panel cointegration tests state that the weak form PPP holds for the significant number of those 17 countries. However, this does not imply that such a long run relationship exists for each individual member. In order to analyze the validity of PPP hypothesis for the new members of the EU, we need to run the same tests for the subgroup of these countries. We want to find out whether results are driven by the new members of the EU, which are mostly considered as the transition economies, or the other developed economies in Europe, or both.

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all series are non-stationary under the null hypothesis against the alternative that at least one series in the panel is stationary.
[5]However, if Schwarz Information Criteria (SIC) is used for the lag selection both IPS and ADF-Fisher tests suggest unit root process for clothing and footwear prices as well.

Table 3. Full Sample Panel Cointegration Tests (H0: No co-integration)

Commodity group	Panel				Group			#. of Rej.	
	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	1.700	-0.665	-0.851	-1.316	-1.219	-1.443	-2.383	1	2
Food & Non-alco. Beverages	3.255	-2.773	-2.129	-2.702	-1.683	-1.693	-3.048	5	7
Alcoholic Beverages	-0.191	0.769	0.662	0.306	0.687	0.599	-0.145	0	0
Clothing and Footwear	-0.311	-7.214	-5.752	-0.081	-8.116	-5.356	-0.842	4	4
Housing, Water & Electricity	0.585	-0.841	-1.434	-2.401	0.062	-0.711	-2.330	2	2
Furnishings & Household Equip.	4.794	-2.935	-2.614	-3.314	-1.949	-2.323	-3.231	6	7
Health	0.455	0.475	0.303	-0.004	-0.600	-0.678	-1.842	0	1
Transportation	2.866	-2.514	-2.459	-3.036	-1.037	-1.703	-2.699	5	6
Communications	-1.186	-0.741	-1.564	-1.919	-0.283	-1.082	-2.230	1	2
Recreation and Culture	1.741	-0.705	-0.497	-1.327	-0.374	-0.444	-1.767	0	2
Education	0.769	-0.643	-0.965	-1.191	-1.300	-1.428	-1.805	0	1
Restaurants and Hotels	1.317	-2.443	-1.896	-0.744	-0.387	-0.385	-0.750	1	2

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.

Table 4 shows that weak form PPP exists for 7 out of 10 sub-indices of consumer prices, including the general index at 10% significance level, when the panel includes 5 developed countries. The commodity groups that are semi tradable in nature also favor weak form of PPP for the group of developing countries, but the results should be interpreted cautiously. Although fewer numbers of cross sections reduce distortions, it may diminish the power of the test as well.

Table 4. Panel Cointegration Tests (5 developed countries, H0: No co-integration)

Commodity group	Panel				Group			#. of Rej.	
	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	2.337	-1.712	-1.739	-2.158	-0.746	-1.394	-2.060	3	5
Food & Non-alco. Beverages	3.462	-3.156	-2.330	-2.756	-2.311	-2.212	-3.156	7	7
Alcoholic Beverages	1.644	-1.374	-1.599	-2.032	-0.419	-1.215	-1.784	0	2
Clothing and Footwear	1.902	-1.630	-1.761	-2.029	-0.777	-1.520	-1.949	0	4
Housing, Water & Electricity	2.181	-2.034	-1.945	-2.672	-1.221	-1.796	-2.761	3	6
Furnishings & Household Equip.	1.547	-1.192	-1.537	-2.111	-0.320	-1.195	-2.048	2	2
Health	1.906	-2.043	-1.906	-2.365	-0.885	-1.484	-2.239	3	5
Transportation	1.661	-1.713	-1.915	-2.193	-0.974	-1.762	-2.221	2	5
Communications	1.445	-1.336	-1.742	-2.283	-0.320	-1.361	-2.091	2	3
Recreation and Culture	2.030	-1.557	-1.766	-2.001	-0.679	-1.443	-1.872	0	4
Education	2.040	-1.686	-1.773	-2.381	-0.834	-1.533	-2.448	3	5
Restaurants and Hotels	2.264	-1.632	-1.458	-1.553	-0.821	-1.175	-1.573	1	1

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.

The number of sub-indices of the consumer prices where there is an evidence for the existence of weak form PPP in the case of 12 transition economies is less than that of the panel composed of 5 developed economies (Table 5). In this new group, only 4 tradable sectors, namely food & non-alcoholic beverages, clothing and footwear, furnishing & household equipments and transportation, support the weak form PPP at 10% significance level.

Table 5. Panel Cointegration Tests (12 transition countries, H0: No co-integration)

Commodity group	Panel				Group			#. of Rej.	
	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	1.893	-0.194	-0.009	-0.424	-0.797	-0.596	-1.344	0	1
Food & Non-alco. Beverages	4.012	-3.319	-2.469	-2.939	-2.105	-1.924	-2.997	6	7
Alcoholic Beverages	0.413	0.400	0.505	0.564	1.084	1.029	0.850	0	0
Clothing and Footwear	1.632	-7.522	-5.074	0.424	-8.028	-4.775	-0.270	4	4
Housing, Water & Electricity	0.910	-1.283	-1.961	-3.091	-0.412	-1.150	-2.898	2	3
Furnishings & Household Equip.	3.732	-2.225	-1.900	-2.233	-2.072	-1.984	-2.427	5	7
Health	2.225	0.192	0.136	-1.393	0.094	-0.094	-1.658	1	1
Transportation	3.737	-1.947	-1.679	-1.999	-0.932	-1.321	-1.842	1	5
Communications	-1.467	0.339	-0.576	-0.944	-0.554	-1.094	-1.946	0	1
Recreation and Culture	1.952	-0.231	0.045	-0.571	0.134	0.248	-0.796	0	1
Education	1.208	-0.140	-0.076	-0.055	-1.187	-0.926	-0.994	0	0
Restaurants and Hotels	0.801	-0.916	-0.630	0.295	0.058	0.423	0.546	0	0

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.

The panel cointegration techniques test whether significant portion of the individual cross sections are cointegrated or not. These tests do not tell us whether weak form PPP holds for any particular country or not. One simple but indirect way to assess relative contribution of each member countries to these test results is to delete a country from the group and repeat the same tests for the rest of the group members. If excluding a country weakens the test results, then we may argue that, that particular country contributes in favor of the acceptance of the null hypothesis (weak form PPP). If not, then its inclusion to the group does not strengthen our test results in favor of weak form PPP. The problem with this exercise is, since the power of the test changes as the number of cross sections varies; some questions may arise regarding the test results. In other words, we cannot tell for sure whether different test results are due to excluding a country from the group or because of having different number of cross sections. One way to deal with this problem is deleting countries from the group one by one and then comparing the results across the tests of the same number of cross sections.

This section summarizes the findings regarding the individual contributions of each country to the group results.

Table 1a in Appendix together with 5 implies that exclusion of Turkey from the sample of 12 transition economies decreases the number of cointegrated sub-indices of consumer prices from 4 to 2. Particularly, exclusion of Turkey from this group of countries weakens the evidence for the weak form PPP for food and non-alcoholic beverages, and transportation (Table 1a). On the other hand, excluding Slovenia, S. Cyprus, or Malta (new euro area countries), though weakens few test results, does not decrease the number of cointegrated vectors (Tables 1b, c and d respectively in appendix). These test results cast doubt on validity of the law of one price for our sample of countries when Turkey is dropped from the group.

Table 6. Summary Statistics of the Panel Cointegration Tests

	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
17 countries		x		x		x		x				
5 developed countries	x	x		x	x		x	x		x	x	
8 transition countries						x						
12 countries		x		x		x		x				
11 countries excluding:												
S. Cyprus		x		x		x		x				
Czech Republic		x		x		x		x				
Estonia		x		x		x						x
Hungary		x		x		x		x				
Latvia		x		x		x						
Lithuania		x		x		x						
Malta		x		x		x		x				
Poland		x		x		x						
Romania		x		x		x		x			x	
Slovakia	x	x		x	x	x		x			x	
Slovenia		x		x		x		x				
Turkey				x		x						

Notes: x stands for the existence of the panel cointegration for the respective HICP sub-indices. Significance at 10% level.
p0: Overall HICP; P1: Food & Non-alcoholic. Beverages; p2: Alcoholic Beverages; p3: Clothing and Footwear; p4: Housing, Water & Electricity; p5: Furnishings & Household Equip.; p6: Health; p7: Transportation; p8: Communications; p9: Recreation and Culture; p10: Education; p11: Restaurants and Hotels.

We performed the same exercise on the rest of the countries as well. In order to save space, we provide only a summary statistics of the panel cointegration tests in Table 6. In this table, "x" marks the commodity prices that we found an evidence for the weak form PPP. For the full sample of 12 countries, 4 commodity groups satisfy weak PPP hypothesis. Excluding S. Cyprus, Czech Rep., Hungary, Malta and Slovenia does not change the

results at all. In case of Estonia, Romania and Slovakia their deletion seems to change the number of commodity groups that fulfill the hypothesis, but still 4 or more sectors' commodity prices satisfy the hypothesis. In case of Latvia, Lithuania and Poland the number of commodity groups that support the weak form PPP hypothesis drops from 4 to 3. Among all group members only exclusion of Turkey from the group decreases the number of cointegration relationships to 2.

Table 7. Panel Cointegration Tests (8 transition countries)

Commodity group	Panel				Group			#. of Rej.	
	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	0.239	0.109	-0.280	-0.575	0.707	0.127	-0.364	0	0
Food & Non-alco. Beverages	0.814	-0.282	-0.148	-0.340	0.030	-0.376	-0.907	0	0
Alcoholic Beverages	-0.667	0.248	-0.384	-0.745	0.865	0.002	-0.623	0	0
Clothing and Footwear	-0.627	-2.468	-2.836	-1.189	-0.249	-1.103	-1.366	2	2
Housing, Water & Electricity	-1.672	1.254	0.586	0.307	2.047	1.423	0.900	1	2
Furnishings & Household Equip.	0.599	-1.164	-2.427	-2.820	0.101	-1.844	-2.420	3	4
Health	-1.119	1.154	0.736	0.419	0.841	0.292	-0.608	0	0
Transportation	-0.016	-1.341	-2.151	-2.558	-0.134	-1.299	-1.614	2	2
Communications	-1.596	0.461	0.026	-0.562	0.520	0.351	-0.638	0	0
Recreation and Culture	-0.008	-0.556	-0.493	-1.028	0.695	0.624	-0.338	0	0
Education	-1.059	-1.001	-1.133	-0.954	0.327	-0.587	-0.718	0	0
Restaurants and Hotels	-0.898	0.321	-0.668	-1.085	1.283	0.370	-0.072	0	0

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.

We also set another group of countries that only includes eight Eastern European transition economies in order to analyze relevance of PPP hypothesis for this particular group of countries. Narrowing the data set allows us to draw clearer picture on how the economic development and economic integration level may affect the results of the PPP tests. Table 7 reports the panel cointegration tests results for this group of countries. We do not find any significant long run relationship for any sectors, except for furnishing & household equipment, even at 10% significance level. Use of different time periods in the analysis did not change our results as well.[6] These results are probably due to the fact that prices of those particular sectors are highly regulated in these transition economies. The share of administered prices in the CPI index was 26.9%, 16%, 19.8%, 10.9%, 17.9%, 1%, 19.9% and 16.1% for Estonia, Latvia, Lithuania, Czech Republic, Hungary, Poland, Slovakia, and Slovenia in 2004, respectively (Egret *et al*.,

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[6] Results are robust to the choice of different time periods. These results are available upon request.

2006).[7] These shares were even higher in the earlier years. It is also possible that price indices for the EU countries and the transition economies enter the PPP relationship asymmetrically (Sideris, 2006). Sideris (2006) argues that domestic and foreign price coefficients may enter into the PPP equation differently. Inclusion of either Turkey or S. Cyprus to this group of countries slightly strengthens the evidence for the weak form PPP for food and non-alcoholic beverages, and transportation. However, this is not the case for Malta or Romania.

   Comparison of our cointegration test results across the country groups reveals several implications. First of all, in most of the cases, we find that panels that are constructed with food and non-alcoholic beverages, clothing and footwear, furnishing, etc and transportation strongly reject the null of no cointegration possibly due to their relatively strong tradable nature. Secondly, we compare the number of sectors that supports the existence of PPP across different country groups and find that number of sectors that have cointegrating relationship decreases significantly for the transition economies. Thirdly, inclusion of Turkey in these different country groups improves the test results in favor of weak form PPP.

Table 8. Individual and Panel FMOLS Results ($H_1 : \beta = 1$)

	Food and Non-Alcoholic Beverg		Clothing & Footwear		Furnishings & Household Equip.		Transportation	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
S. Cyprus	1.34*	(2.52)	0.68*	(-10.49)	0.84*	(-5.10)	0.53*	(-24.48)
Czech Republic	1.03	(0.58)	1.00	(-0.01)	1.24*	(4.85)	1.15*	(2.85)
Denmark	0.73*	(-8.06)	0.54*	(-11.70)	0.84*	(-2.90)	0.59*	(-13.18)
Estonia	0.91*	(-2.15)	-1.76*	(-5.52)	0.88*	(-4.04)	1.33*	(2.97)
Hungary	-0.51*	(-4.50)	-0.40*	(-9.72)	1.81	(1.91)	1.89*	(3.73)
Iceland	0.84	(-1.58)	0.56*	(-7.23)	1.01	(0.14)	0.76*	(-4.16)
Latvia	1.22*	(3.63)	3.33*	(5.01)	1.61*	(4.47)	1.25*	(2.55)
Lithuania	1.31*	(9.88)	1.59*	(10.40)	1.24*	(4.97)	1.84*	(9.48)
Malta	0.91*	(-2.09)	0.73*	(-6.33)	0.97	(-1.44)	0.74*	(-7.24)
Norway	0.79*	(-5.23)	0.45*	(-15.82)	0.75*	(-5.70)	0.69*	(-7.72)
Poland	0.68	(-1.86)	0.52*	(-2.88)	1.60	(1.38)	1.19	(0.52)
Romania	0.98	(-0.94)	0.93*	(-2.48)	0.97	(-1.12)	0.82*	(-10.24)
Slovakia	1.33*	(2.24)	0.82	(-0.32)	1.10	(1.61)	1.21	(1.25)
Slovenia	-0.43*	(-9.45)	0.37*	(-5.55)	0.33*	(-6.40)	0.11*	(-5.24)
Sweden	0.51*	(-12.09)	0.64*	(-7.51)	0.52*	(-12.32)	0.4*	(-23.35)
Turkey	1.00	(0.09)	0.97	(-1.31)	0.97*	(-2.45)	0.94*	(-3.79)
UK	0.96	(-0.61)	0.47*	(-12.08)	0.89	(-1.70)	0.84*	(-2.60)
Panel Group FMOLS Results								
Demeaned	0.8*	(-7.18)	0.67*	(-20.26)	1.03*	(-5.78)	0.96*	(-19.08)
Unadjusted	0.16*	(-72.87)	0.32*	(-84.10)	0.49*	(-41.80)	0.08*	(-124.34)

*: Different from one at 5% level. t-stats are in parentheses.

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[7] Egert *et al*. (2006) and Egert *et al*. (2003) explain why in the case of administered prices exchange rates in transition economies may not behave in a manner that conforms to the Balassa-Samuelson effect. Balassa-Samuelson effect assumes that prices are determined by the market forces.

Rejection of the null of no cointegration implies that weak form PPP hypothesis holds for significant portion of individuals in the panel. In the next step we test the existence of strong form PPP (H_0: $\beta = 1$) for both individuals and groups of countries. Individual FMOLS estimates and its t-statistics for $\beta = 1$ are presented in Table 8-11 for the group of 17, 5 developed, 11 new member plus Turkey and 11 new member countries. While individual FMOLS results are reported for only demeaned series, panel group FMOLS estimates are reported for unadjusted and demeaned series for those sectors that we found evidence for the weak form PPP.

Among the 17 countries strong form PPP hypothesis is not rejected for food and non-alcoholic beverages in Czech Rep., Iceland, Poland, Romania, Turkey and UK, for clothing and footwear in Czech Rep., Slovakia and Turkey; for furnishing and housing equipment in Hungary, Iceland, Malta, Poland, Romania, Slovakia, and UK; and for transportation in Poland and Slovakia (Table 8). However, it should be noted that our panel data has relatively short time span that requires caution in interpreting these individual results. Instead, we would rather emphasize more on the panel group FMOLS results. Panel group FMOLS results for the group of 17 countries are presented at the bottom panel of Table 8. Group panel FMOLS results reject the strong form PPP for all of the sub-indices, no matter the series are demeaned or not. Yet, using demeaned series, though still insignificant, increases the panel group slope coefficient closer to its theoretical value.

Individual FMOLS results for 5 developed countries reveal that there is a wide variation in the value of the estimated β across the countries (Table 9). Interestingly, estimated coefficients verify their theoretical values (PPP hypothesis) even for sectors that have low tradability e.g. transportation and recreation & culture. Albeit, panel group FMOLS results suggest that PPP hypothesis is not rejected for food & non-alcoholic beverages only.

Among 12 countries, strong form PPP hypothesis holds for food and non-alcoholic beverages in Czech Rep., Slovakia, and Turkey; for clothing and footwear in Hungary, Romania, Slovakia and Turkey; for furnishing and housing equipment in Hungary, Romania, and Slovakia; for transportation in Czech Rep., Estonia, Hungary, Latvia, Poland and Slovakia (Table 10). Panel group FMOLS results suggest that for the group of 12 countries strong form PPP holds for food and non-alcoholic beverages, when the data is demeaned. All coefficient values are closer to one in Table 11 compared to that of in Table 8, may be suggesting that group of 12 countries are more integrated within itself rather than with the developed countries.

Table 9. Individual and Panel FMOLS Results (H$_1$:β = 1) (5 developed countries)

		Individual					Panel Group	
		Denmark	Iceland	Norway	Sweden	UK	Demeaned	Unadjusted
Overall HICP	Coeff.	3.89*	0.65	2.33*	-1.59*	1.24	1.3*	0.03*
	t-stat	(2.84)	(-1.92)	(2.15)	(-8.85)	(0.55)	(-2.34)	(-43.11)
Food & Non-alco.	Coeff.	-0.27*	0.84	1.16	-1.38*	2.26*	0.52	0.17*
Beverages	t-stat	(-2.17)	(-0.90)	(1.06)	(-5.94)	(4.11)	(-1.72)	(-33.14)
Clothing and	Coeff.	-0.28*	0.45*	0.14*	0.26*	0.23*	0.16*	0.07*
Footwear	t-stat	(-14.69)	(-3.28)	(-9.19)	(-13.67)	(-8.63)	(-22.12)	(-53.86)
Housing, Water &	Coeff.	0.67*	0.39*	-0.7*	-0.91*	0.65	0.02*	0.02*
Electricity	t-stat	(-2.25)	(-2.83)	(-10.60)	(-10.78)	(-1.33)	(-12.42)	(-78.40)
Health	Coeff.	0.16*	0.35*	0.16*	1.72	-2.69*	-0.06*	0.04*
	t-stat	(-8.88)	(-3.57)	(-2.23)	(1.60)	(-6.62)	(-8.81)	(-47.24)
Transportation	Coeff.	-0.48*	0.83	0.96	-1.11*	0.6	0.16*	0.04*
	t-stat	(-1.99)	(-1.08)	(-0.08)	(-10.83)	(-0.84)	(-6.63)	(-61.80)
Recreation and	Coeff.	0.64	0.41*	1.8	-0.81*	0.58	0.52*	-0.41*
Culture	t-stat	(-0.65)	(-3.76)	(1.62)	(-11.72)	(-1.01)	(-6.94)	(-26.84)
Education	Coeff.	-0.24*	0.29*	-0.74*	-0.08*	-0.52*	-0.26*	-0.03*
	t-stat	(-17.50)	(-6.10)	(-10.09)	(-35.63)	(-7.87)	(-34.53)	(-122.27)

*: Different from one at 5% level. t-stats are in parentheses.

Table 10. Individual and Panel FMOLS Results (H$_1$:β = 1) (12 countries, Demeaned)

	Food and Non-Alcoholic Beverg		Clothing & Footwear		Furnishings & Household Equip.		Transportation	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
S. Cyprus	1.18*	(3.06)	0.63*	(-17.59)	0.82*	(-7.81)	0.55*	(-25.92)
Czech Republic	0.96	(-1.05)	0.85*	(-5.56)	1.10*	(2.57)	0.98	(-0.60)
Estonia	0.87*	(-5.54)	1.86*	(6.85)	0.85*	(-6.59)	1.06	(1.51)
Hungary	2.14*	(3.88)	0.94	(-0.08)	1.00	(-0.01)	0.92	(-0.81)
Latvia	1.14*	(2.89)	1.61*	(4.96)	1.36*	(4.17)	1.06	(0.98)
Lithuania	1.20*	(7.81)	1.24*	(6.58)	1.16*	(4.16)	1.46*	(10.5)
Malta	0.86*	(-3.40)	0.67*	(-10.62)	0.92*	(-4.78)	0.71*	(-9.88)
Poland	0.79*	(-2.29)	0.64*	(-4.16)	1.34*	(2.53)	1.11	(0.96)
Romania	0.99	(-0.25)	0.98	(-0.69)	0.99	(-0.40)	0.84*	(-8.88)
Slovakia	1.09	(1.32)	1.22	(1.57)	0.97	(-0.79)	0.96	(-0.42)
Slovenia	0.23*	(-10.49)	0.34*	(-14.27)	0.42*	(-13.45)	0.32*	(-11.28)
Turkey	1.02	(0.86)	1.02	(0.76)	0.98	(-1.48)	0.97*	(-1.98)
Panel Group FMOLS Results								
Demeaned	1.04	(-0.92)	1.00*	(-9.31)	0.99*	(-6.32)	0.91*	(-13.23)
Unadjusted	0.16*	(-65.35)	0.43*	(-65.33)	0.57*	(-23.68)	0.10*	(-108.10)

*: Different from one at 5% level. t-stats are in parentheses.

Table 11. Individual and Panel FMOLS Results

	Clothing & Footwear		Furnishings & Household Equip.	
	Coeff.	t-stat.	Coeff.	t-stat.
S. Cyprus	0.45*	(-18.85)	0.71*	(-7.57)
Czech Republic	0.78*	(-5.71)	1.22*	(3.58)
Estonia	-0.48*	(-4.14)	0.76*	(-6.02)
Hungary	-0.02*	(-7.79)	0.17	(-1.65)
Latvia	2.99*	(7.21)	1.84*	(4.98)
Lithuania	1.34*	(6.96)	1.22*	(3.88)
Malta	0.52*	(-12.19)	0.88*	(-3.90)
Poland	0.2*	(-6.04)	-2.24*	(-3.72)
Romania	0.98	(-0.61)	0.99	(-0.52)
Slovakia	0.2*	(-2.22)	1.03	(0.34)
Slovenia	0.41*	(-2.83)	0.61*	(-2.62)
Panel Group FMOLS Results				
Demeaned	0.67*	(-13.93)	0.65*	(-3.99)
Unadjusted	0.38*	(-67.26)	0.54*	(-22.83)

*: Different from one at 5% level. t-stats are in parentheses.

Individual and panel FMOLS results for 11 countries excluding Turkey are presented in Table 11. Comparison of Table 10 and Table 11 also allows us to analyze Turkey's contribution on the strong form PPP test results. Exclusion of Turkey from the sample results in disappearance of not only the weak but also strong form PPP for food and non-alcoholic beverages. Moreover, demeaned panel group FMOLS coefficient estimates drops from 1 to 0.67 for clothing and footwear and from 0.99 to 0.65 for furnishing and household equipment when Turkey is excluded from the group.

4. Conclusion

In this study a multivariate panel cointegration method is employed to evaluate the PPP hypothesis by using panels constructed with overall consumer price indices and its sub-indices. The empirical findings of this study can be summarized under two broad headings: tradable nature of the sectors and country groups. Our results indicate that failure to find evidence for cointegration results to support weak form PPP for consumer prices can be attributed to the inclusion of non-tradable goods in the aggregated data. We find that results for the panel that are constructed with highly tradable goods strongly reject the null of no cointegration in favor of weak form PPP. Robustness of these results for these sub-indices to different country groupings strengthen our belief that tradability is the key to the validity of weak form PPP, yet majority of panel group FMOLS and individual tests still significantly reject the null hypothesis of strong form PPP. Secondly,

we compare the number of sectors that verify the weak form PPP across the different country groupings and find that number of sectors that have cointegrating relationship increases when we include only developed countries, while it decreases significantly for the transition economies. Moreover, inclusion of Turkey into the group of transition economies seems to strengthen our test results in favor of weak form PPP. By using this evidence we may conclude that even if Turkey is still not a member of EU, its consumer prices follow the rule of one price quite closely relative to new members of the EU, implying its strong trade and financial links with the euro area countries.

References

Cerrato,M. and N.Sarantis, 2007, "Symmetry, Proportionality and the Purchasing Power Parity: Evidence from Panel Cointegration Tests", *International Review of Economics and Finance*, forthcoming.

Chakrabarti,A., 2006, "Real Exchange Rates and Real Interest Rates Once Again: A Multivariate Panel Cointegration Analysis", *Applied Economics*, 28, pp: 1217-1221.

Egert,B., I.Drine, K.Lommatzsch, and C.Rault, 2003, "The Balassa-Samuelson Effect in Central and Eastern Europe: Myth or Reality"?, *Journal of Comparative Economics*, 31, pp: 552-572.

Egert,B., L.Halpern and R.MacDonald, 2006, "Equilibrium Exchange Rates in Transition Economies: Taking Stock of the Issues", *Journal of Economic Surveys*, 20 (29), pp: 257-324.

Jenkins,M.A. and S.M.Snaith, 2005, "Tests of Purchasing Power Parity Via Cointegration Analysis of Heterogeneous Panels with Consumer Price Indices", *Journal of Macroeconomics*, 27, pp:345-362.

Im,K.S., M.H.Peseran and Y.Shin, 2003, "Testing for Unit Roots in Heterogenous Panels", *Journal of Econometrics*, 115, pp.53-74.

Kao,C. and Chiang,M., 2000, "On the Estimation and Inference of A Co-integrated Regression in Panel Data", *Advances in Econometrics*, 15, pp.179-222.

Koedijik, K.G., B.Tims, and M.A.van Dijk, 2004, "Purchasing Power Parity and the Euro Area", *Journal of International Money and Finance*, 23, pp. 1081-1107.

Levin, A., C.-F. Lin, and C.-S. J. Chu., 2002, "Unit Root Tests in Panel Data: Asymptotic and Finite-sample Properties", *Journal of Econometrics,* 108, pp. 1-24.

Lopez,C. and D.H.Papell, 2007, "Convergence to Purchasing Power Parity at the Commencement of the Euro", *Review of International Economics*, 15(1), pp. 1-16.

Narayan, P.K., 2006, "The Purchasing Power Parity Revisited: New Evidence for 16 OECD Countries from Panel Unit Root Tests with Structural Breaks", *International Financial Markets, Institutions, and Money*, 18:137-46.

Offermanns, C.J., 2005, "PPP in Panel Data and the Role of Long-run Homogeneity in Europe", unpublished.

Pedroni, P., 1999, "Critical Values for Cointegration Test in Heterogeneous Panels with Multiple Regressors", *Oxford Bulletin of Economics and Statistics*, 61, pp.653-70.

Pedroni, P., 2001, "Purchasing Power Parity Tests in Cointegrated Panels", *The Review of Economics and Statistics*, 83, pp.727-31.

Pedroni, P., 2004, "Panel Cointegration, Asymptotic and Finite Sample Properties of Pooled Time Series Test, with An Application to PPP Hypothesis", *Econometric Theory*, 20, pp. 576-625.

Sideris, D., 2006, "Purchasing Power Parity in Economies in Transition: Evidence from Central and East European Countries", *Applied Financial Economics*, 16, pp.135-143.

Solakoğlu, E.G., 2006, "Testing Purchasing Power Parity Hypothesis for Transition Economies", *Applied Financial Economics*, 16, pp: 561-568.

Wu, S. and G.S.Maddala, 1999, "A Comperative Study of Unit Root Tests", Oxford Bulettin of Economics and Statistics, 61:631-652.

Appendix

Table 1.a. Panel Cointegration Tests (11 transition countries, excl. Turkey, H_0: No co-integration)

	Panel				Group			#. of Rej.	
Commodity group	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	0.514	0.822	1.089	0.928	-0.160	0.200	-0.074	0	0
Food & Non-alco. Beverages	2.174	-2.080	-1.670	-1.643	-0.940	-1.009	-1.450	2	3
Alcoholic Beverages	-0.586	0.477	0.630	1.074	0.739	0.920	1.246	0	0
Clothing and Footwear	0.967	-6.288	-4.539	-0.619	-4.553	-2.559	-0.397	4	4
Housing, Water & Electricity	-0.055	-0.780	-1.303	-1.739	0.369	-0.370	-1.222	0	1
Furnishings & Household Equip.	4.192	-2.755	-2.280	-3.226	-1.330	-1.873	-3.204	5	7
Health	0.432	0.544	0.803	0.435	1.017	1.030	0.311	0	0
Transportation	0.836	-1.510	-1.513	-1.729	-0.778	-1.129	-1.546	0	1
Communications	-1.619	0.023	-0.764	-1.102	0.509	-0.514	-1.279	0	0
Recreation and Culture	1.088	0.410	0.657	-0.104	1.335	1.575	0.266	0	0
Education	0.065	-0.849	-1.034	-0.976	-0.967	-0.812	-0.548	0	0
Restaurants and Hotels	0.170	-1.766	-1.295	0.742	-0.519	-0.077	0.582	0	1

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.

Table 1.b. Panel Cointegration Tests (11 transition countries, excl. Slovenia, H_0: No co-integration)

	Panel				Group			#. of Rej.	
Commodity group	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	1.723	-0.071	0.070	-0.406	-0.629	-0.442	-1.324	0	1
Food & Non-alco. Beverages	4.358	-3.531	-2.661	-3.142	-2.321	-2.140	-3.235	7	7
Alcoholic Beverages	0.404	0.518	0.619	0.523	1.141	1.122	0.943	0	0
Clothing and Footwear	1.647	-6.567	-4.487	0.469	-7.589	-4.395	-0.191	4	4
Housing, Water & Electricity	0.524	-1.181	-1.931	-3.034	-0.661	-1.392	-3.162	2	3
Furnishings & Household Equip.	3.329	-1.798	-1.561	-2.079	-1.554	-1.559	-2.284	3	4
Health	1.285	0.523	0.911	-0.001	0.377	0.659	-0.545	0	0
Transportation	3.793	-1.811	-1.627	-1.978	-1.051	-1.376	-1.981	1	4
Communications	-1.467	0.495	-0.128	-0.534	-0.304	-0.674	-1.662	0	0
Recreation and Culture	1.486	0.021	0.268	-0.313	0.278	0.441	-0.642	0	0
Education	1.213	-0.109	-0.062	-0.123	-1.086	-0.856	-1.109	0	0
Restaurants and Hotels	0.659	-0.828	-0.504	0.272	-0.069	0.402	0.540	0	0

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.

Table 1.c. Panel Cointegration Tests (11 transition countries, excl. S. Cyprus, H_0: No co-integration)

Commodity group	Panel				Group			#. of Rej.	
	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	1.649	-0.121	0.004	-0.216	-0.310	-0.236	-0.611	0	0
Food & Non-alco. Beverages	4.292	-2.456	-1.864	-2.598	-1.629	-1.615	-2.850	4	5
Alcoholic Beverages	0.629	0.604	0.743	0.685	0.956	1.005	0.729	0	0
Clothing and Footwear	2.235	-3.211	-2.266	-0.309	-3.467	-2.275	-0.153	5	5
Housing, Water & Electricity	0.535	-0.997	-1.888	-2.829	-0.435	-1.184	-2.672	2	3
Furnishings & Household Equip.	2.978	-1.765	-1.528	-2.277	-1.223	-1.355	-2.522	3	4
Health	1.107	0.667	1.032	0.101	0.406	0.770	-0.278	0	0
Transportation	3.867	-1.753	-1.598	-1.986	-0.968	-1.344	-1.960	1	4
Communications	-0.942	0.315	0.179	-0.195	-0.737	-0.589	-1.309	0	0
Recreation and Culture	1.866	-0.148	0.101	-0.354	0.320	0.416	-0.374	0	1
Education	1.083	0.092	0.175	0.166	-0.828	-0.575	-0.686	0	0
Restaurants and Hotels	0.574	-0.689	-0.420	0.300	-0.061	0.350	0.488	0	0

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.

Table 1.d. Panel Cointegration Tests (11 transition countries, excl. Malta, H_0: No co-integration)

Commodity group	Panel				Group			#. of Rej.	
	v-stat	rho-stat	pp-stat	adf-stat	rho-stat	pp-stat	adf-stat	5%	10%
Overall HICP	1.768	-0.142	0.043	-0.571	-0.610	-0.359	-1.630	0	1
Food & Non-alco. Beverages	4.315	-3.570	-2.573	-3.331	-2.623	-2.315	-3.473	7	7
Alcoholic Beverages	0.442	0.382	0.496	0.499	1.145	1.148	0.959	0	0
Clothing and Footwear	2.849	-6.587	-4.620	-0.672	-6.582	-4.167	-1.090	5	5
Housing, Water & Electricity	0.313	-0.750	-1.638	-2.781	-0.429	-1.061	-2.952	2	3
Furnishings & Household Equip.	3.587	-2.222	-1.837	-2.281	-2.168	-1.999	-2.559	5	7
Health	0.963	0.713	1.152	0.047	0.897	1.295	-0.067	0	0
Transportation	3.934	-1.803	-1.529	-1.892	-0.939	-1.287	-1.865	1	4
Communications	-1.299	0.158	-0.264	-0.539	-1.027	-1.275	-1.967	0	1
Recreation and Culture	2.021	-0.314	-0.034	-0.696	-0.109	0.042	-1.113	0	1
Education	1.058	-0.156	-0.048	-0.033	-1.152	-0.808	-0.842	0	0
Restaurants and Hotels	0.379	0.892	1.202	0.410	1.557	1.792	0.619	0	1

Note: The last two columns list the total number of statistics that rejects the null hypothesis at 5% and 10% levels of significance respectively.