SUPPLEMENT

for

Pairwise Tests of Purchasing Power Parity Using Aggregate and Disaggregate Price Measures

by

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1 Real Effective Exchange Rates: Procedures and Results

Define M_{ijt} and X_{ijt} to be import of i from j and export from i to j at time t, respectively. The total trade between i and j is defined as

$$D_{ijt} = M_{ijt} + X_{ijt}.$$

We compute fixed trade weights by averaging trade flows over a three year time interval 1987–1989, using the data on imports and exports from the IMF Direction of Trade Statistics (DOTS) as

$$w_{i,j} = \frac{\bar{D}_{i,j}}{\sum_{j=0}^{N} \bar{D}_{i,j}}$$

where $\bar{D}_{i,j} = \sum_{t=1987}^{1989} D_{i,j}/3$. Observe that $w_{ii} = 0$ and $\Sigma\ {}_{j=0}^{N} w_{ij} = 1$. The weights are shown as below:

Table S1.1: Trade Weights

(i,j)	**BE**	**DK**	**FI**	**FR**	**DE**	**GR**	**IT**	**NL**	**PT**	**ES**	**UK**	**US**
BE	0	0.0100	0.0067	0.2287	0.2788	0.0049	0.0680	0.2046	0.0061	0.0231	0.1083	0.0608
DK	0.0456	0	0.0473	0.0926	0.3431	0.0094	0.0740	0.0838	0.0133	0.0239	0.1636	0.1034
FI	0.0463	0.0662	0	0.0971	0.2853	0.0087	0.0740	0.0704	0.0131	0.0272	0.1924	0.1193
FR	0.1343	0.0123	0.0093	0	0.2650	0.0085	0.1743	0.0794	0.0163	0.0723	0.1210	0.1072
DE	0.1175	0.0317	0.0179	0.2009	0	0.0142	0.1491	0.1544	0.0125	0.0439	0.1335	0.1243
GR	0.0483	0.0175	0.0120	0.1156	0.3163	0	0.2222	0.0870	0.0042	0.0246	0.0894	0.0630
IT	0.0651	0.0139	0.0090	0.2423	0.3066	0.0205	0	0.0685	0.0116	0.0515	0.0994	0.1116
NL	0.1920	0.0187	0.0114	0.1214	0.3478	0.0079	0.0672	0	0.0080	0.0231	0.1225	0.0800
PT	0.0472	0.0192	0.0126	0.1766	0.1989	0.0035	0.0958	0.0712	0	0.1702	0.1355	0.0692
ES	0.0470	0.0104	0.0081	0.2283	0.2125	0.0064	0.1385	0.0579	0.0503	0	0.1174	0.1231
UK	0.0804	0.0280	0.0224	0.1555	0.2397	0.0074	0.0878	0.1237	0.0151	0.0457	0	0.1944
US	0.0751	0.0162	0.0127	0.1398	0.2582	0.0071	0.1169	0.0914	0.0095	0.0465	0.2267	0

Notes: The source of the data is http://www.esds.ac.uk/international/support/user_guides/imf/dots.asp

Table S1.2: ADF Test Results of Real Effective Exchange Rate, $\bar{q}_{it} = \sum_{j=0}^{N} w_{ij} q_{ijt}$, With an Intercept

	Test	DF	ADF(1)	ADF(2)	ADF(3)	ADF(4)	ADF(5)	ADF(6)	ADF(7)	ADF(8)	ADF(9)	ADF(10)	ADF(11)	ADF(12)
BE	**Statistic**	-1.013	**-1.602**	-1.548	-1.825	-1.705	-1.679	-1.323	-1.489	-1.479	-1.616	-1.497	-1.649	-1.399
	AIC	570.013	**575.964**	574.977	575.672	574.781	573.784	574.205	573.732	572.740	572.152	571.350	570.971	571.254
DE	**Statistic**	-0.419	**-0.777**	-0.863	-0.840	-0.676	-0.697	-0.904	-1.040	-0.966	-1.097	-1.390	-1.519	-1.728
	AIC	555.388	**555.388**	554.539	553.540	553.092	552.110	551.790	551.105	550.118	549.351	549.717	549.077	548.856
DK	**Statistic**	-0.823	-1.232	-1.100	**-1.325**	-1.229	-1.218	-1.086	-0.953	-1.093	-1.066	-0.994	-0.916	-0.940
	AIC	568.716	574.972	574.496	**575.657**	574.857	573.857	573.340	572.936	572.762	571.781	571.050	570.492	569.556
ES	**Statistic**	-0.910	**-1.257**	-1.254	-1.290	-1.153	-1.183	-1.358	-1.489	-1.392	-1.485	-1.403	-1.289	-1.241
	AIC	490.756	**499.201**	498.204	497.318	497.225	496.313	497.108	496.976	496.259	495.735	494.934	494.468	493.546
IT	**Statistic**	-1.072	-1.524	-1.208	-1.566	**-1.266**	-1.416	-1.397	-1.293	-1.298	-1.386	-1.468	-1.459	-1.588
	AIC	464.282	471.204	473.074	477.193	**478.203**	477.875	476.875	476.001	475.020	474.248	473.557	472.559	472.175
FR	**Statistic**	-1.780	-2.528	-2.221	-2.487	-2.127	-1.988	-1.681	-1.990	**-2.270**	-2.317	-2.329	-2.187	-1.960
	AIC	552.808	558.853	558.590	558.835	559.262	558.361	558.790	559.774	**559.911**	559.043	558.095	557.246	557.133
GR	**Statistic**	-1.626	-1.910	**-1.600**	-1.444	-1.287	-1.242	-1.100	-1.320	-1.313	-1.074	-0.877	-0.807	-0.925
	AIC	435.685	436.879	**437.622**	437.081	436.625	435.647	435.105	435.565	434.568	434.899	435.037	434.181	433.773
NL	**Statistic**	-1.112	**-1.520**	-1.598	-1.392	-1.487	-1.564	-1.933	-1.877	-1.808	-2.257	-2.187	-2.152	-2.784
	AIC	602.563	**604.781**	603.953	603.530	602.792	601.965	603.001	602.001	601.003	602.179	601.179	600.185	604.073
PT	**Statistic**	-0.358	-0.774	**-0.549**	-0.676	-0.580	-0.418	-0.298	-0.260	-0.314	-0.444	-0.456	-0.454	-0.612
	AIC	480.016	484.189	**484.593**	484.149	483.373	483.105	482.526	481.560	480.743	480.324	479.335	478.335	478.324
FI	**Statistic**	-0.981	**-1.320**	-1.295	-1.278	-1.365	-1.584	-1.718	-1.494	-1.524	-1.667	-1.937	-1.804	-2.120
	AIC	455.064	**460.633**	459.640	458.641	458.051	458.837	458.461	458.606	457.678	457.417	458.266	457.461	458.689
UK	**Statistic**	-1.759	**-2.641**	-2.515	-2.667	-2.657	-2.151	-2.151	-2.220	-2.162	-2.172	-2.005	-2.074	-2.039
	AIC	429.512	**441.896**	440.939	440.448	439.490	441.741	440.764	440.014	439.040	438.078	437.824	437.303	436.319
US	**Statistic**	-0.809	**-1.245**	-1.139	-1.308	-1.247	-1.215	-1.164	-1.201	-1.317	-1.424	-1.498	-1.435	-1.554
	AIC	368.561	**375.657**	374.962	375.153	374.227	373.239	372.287	371.371	370.888	370.334	369.585	368.645	368.243
CV	**10%**	-2.586	-2.584	-2.574	-2.572	-2.579	-2.562	-2.549	-2.541	-2.535	-2.537	-2.525	-2.547	-2.533
CV	**5%**	-2.882	-2.880	-2.872	-2.884	-2.872	-2.872	-2.864	-2.884	-2.864	-2.872	-2.840	-2.867	-2.854

Notes: The real effective exchange rate, $\bar{q}_{it} = \sum_{j=0}^{N} w_{ij} q_{ijt}$, is based on the CPI of the countries. The lag augmentation is chosen by AIC from $\ell = 1, 2, ..., 12$. In bold is the maximum AIC value and the corresponding test statistic. The last two rows represent critical values which depend upon T and are obtained by simulation with 10000 replications.

Table S1.3: ADF Test Results of Real Effective Exchange Rate, $\bar{q}_{it} = \sum_{j=0}^{N} w_{ij} q_{ijt}$, With an Intercept and a Trend

	Test	DF	ADF(1)	ADF(2)	ADF(3)	ADF(4)	ADF(5)	ADF(6)	ADF(7)	ADF(8)	ADF(9)	ADF(10)	ADF(11)	ADF(12)
BE	**Statistic**	-4.579	-5.090	-5.046	**-5.382**	-5.279	-5.306	-4.969	-5.137	-5.127	-5.238	-5.139	-5.245	-5.101
	AIC	579.588	586.541	585.559	**587.255**	586.255	585.539	585.321	585.338	584.436	584.136	583.280	583.106	583.532
DE	**Statistic**	-1.378	**-1.716**	-1.794	-1.773	-1.594	-1.621	-1.838	-1.989	-1.925	-2.060	-2.390	-2.574	-2.858
	AIC	554.003	**555.826**	555.027	554.028	553.440	552.493	552.345	551.803	550.803	550.160	550.865	550.506	550.723
DK	**Statistic**	-1.707	-2.275	-2.106	**-2.465**	-2.353	-2.361	-2.193	-2.018	-2.229	-2.203	-2.090	-1.950	-2.006
	AIC	568.860	575.814	575.140	**576.852**	575.921	574.966	574.235	573.609	573.754	572.758	571.863	571.094	570.263
ES	**Statistic**	-1.114	**-1.602**	-1.606	-1.668	-1.494	-1.536	-1.778	-1.971	-1.843	-2.018	-1.905	-1.718	-1.655
	AIC	489.971	**498.706**	497.721	496.894	496.695	495.817	496.800	496.852	496.033	495.728	494.826	494.170	493.204
IT	**Statistic**	-1.161	-1.557	-1.209	-1.535	**-1.193**	-1.297	-1.214	-1.016	-0.836	-0.837	-0.897	-0.837	-0.963
	AIC	465.902	471.609	474.283	477.531	**479.089**	478.407	477.462	476.899	476.022	475.029	474.128	473.161	472.481
FR	**Statistic**	-2.600	-3.267	-2.972	-3.195	-2.880	-2.739	-2.473	-2.718	**-2.936**	-2.952	-2.943	-2.798	-2.594
	AIC	554.331	560.373	560.083	560.289	560.891	560.016	560.683	561.508	**561.518**	560.598	559.627	558.829	558.949
GR	**Statistic**	-2.189	-2.402	**-2.125**	-1.979	-1.834	-1.774	-1.636	-1.785	-1.753	-1.525	-1.335	-1.247	-1.309
	AIC	436.746	437.686	**438.662**	438.298	438.076	437.156	436.882	436.988	435.993	436.693	437.253	436.633	435.921
NL	**Statistic**	-1.253	**-1.628**	-1.692	-1.486	-1.578	-1.652	-2.013	-1.953	-1.877	-2.307	-2.232	-2.193	-2.811
	AIC	602.203	**604.275**	603.417	603.028	602.290	601.462	602.473	601.474	600.476	601.570	600.570	599.575	603.380
PT	**Statistic**	-2.600	-2.843	**-2.657**	-2.742	-2.663	-2.558	-2.475	-2.440	-2.483	-2.592	-2.607	-2.602	-2.818
	AIC	483.214	487.432	**487.684**	487.313	486.492	486.235	485.662	484.696	483.948	483.677	482.741	481.759	482.223
FI	**Statistic**	-1.188	**-1.501**	-1.476	-1.458	-1.541	-1.750	-1.878	-1.661	-1.687	-1.816	-2.063	-1.936	-2.227
	AIC	454.438	**459.982**	458.990	457.991	457.402	458.193	457.820	457.962	457.032	456.753	457.567	456.774	457.966
UK	**Statistic**	-1.943	**-2.914**	-2.789	-2.966	-2.970	-2.404	-2.414	-2.510	-2.448	-2.472	-2.264	-2.380	-2.340
	AIC	428.860	**441.659**	440.675	440.302	439.389	441.342	440.393	439.733	438.738	437.819	437.423	437.038	436.038
US	**Statistic**	-1.988	**-2.414**	-2.306	-2.518	-2.453	-2.425	-2.374	-2.420	-2.536	-2.636	-2.720	-2.658	-2.765
	AIC	369.442	**376.910**	376.125	376.606	375.620	374.622	373.631	372.789	372.438	371.992	371.365	370.381	370.085
CV	**10%**	-3.138	-3.124	-3.124	-3.131	-3.127	-3.126	-3.110	-3.100	-3.101	-3.080	-3.066	-3.080	-3.058
CV	**5%**	-3.447	-3.445	-3.427	-3.424	-3.414	-3.419	-3.404	-3.413	-3.412	-3.429	-3.393	-3.388	-3.370

Notes: The real effective exchange rate, $\bar{q}_{it} = \sum_{j=0}^{N} w_{ij} q_{ijt}$, is based on the CPI of the countries. The lag augmentation is chosen by AIC from $\ell = 1, 2, ..., 12$. In bold is the maximum AIC value and the corresponding test statistic. The last two rows represent critical values which depend upon T and are obtained by simulation with 10000 replications.

2 Unit Root Tests With Just Intercept

Table S2.1: Fractions of Pairs q_{ijct} for Which the Unit Root Hypothesis is Rejected at 10% Significance Level in the Case With an Intercept, for All 12 Countries

	Lag Order Chosen by AIC			Lag Order Chosen by SBC			KPSS		
	ADF	**ADF-GLS**	**ADF-WS**	**ADF**	**ADF-GLS**	**ADF-WS**	$0.75T^{1/3}$	$2T^{1/2}$	av
CPI	7.58	6.06	7.58	9.09	10.61	10.61	96.97	31.82	53.03
Subcategories									
Bread	6.06	4.55	6.06	9.09	7.58	10.61	96.97	50.00	72.73
Meat	12.12	19.70	19.70	10.61	18.18	19.70	95.45	25.76	50.00
Dairy	22.73	13.64	21.21	24.24	12.12	19.70	89.39	28.79	51.52
Fruits	28.79	18.18	30.30	53.03	46.97	65.15	77.27	37.88	50.00
Tobacco	21.21	19.70	21.21	21.21	16.67	22.73	81.82	28.79	46.97
Alcohol	9.09	18.18	19.70	6.06	18.18	16.67	93.94	33.33	59.09
Clothing	6.06	10.61	10.61	6.06	9.09	9.09	92.42	60.61	77.27
Footwear	18.18	6.06	13.64	15.15	6.06	7.58	86.36	37.88	46.97
Rents	18.18	9.09	12.73	14.55	5.45	7.27	94.55	30.91	49.09
Fuel	21.82	18.18	27.27	38.18	23.64	34.55	90.91	23.64	49.09
Furnit.	12.73	5.45	5.45	10.91	3.64	3.64	90.91	50.91	67.27
Dom. Appl.	9.09	9.09	5.45	5.45	5.45	5.45	94.55	56.36	67.27
Vehicles	7.58	3.03	6.06	10.61	3.03	4.55	95.45	45.45	63.64
Pub. Transp	13.64	9.09	12.12	19.70	7.58	12.12	90.91	24.24	46.97
Comm.	6.06	15.15	15.15	6.06	16.67	18.18	90.91	33.33	51.52
Sound	9.09	12.73	14.55	18.18	14.55	20.00	87.27	36.36	47.27
Leisure	16.67	9.09	13.64	15.15	7.58	9.09	98.48	22.73	57.58
Books	10.61	10.61	7.58	9.09	9.09	9.09	93.94	39.39	69.70
Hotels	7.58	10.61	16.67	4.55	7.58	13.64	96.97	33.33	60.61
Average	13.54	11.72	14.69	15.68	12.58	16.25	91.50	36.83	57.08

Notes: ADF is a standard Dicky-Fuller unit root test, ADF-GLS is Elliot et al. (1996) test, ADF-WS is Park and Fuller's (1995) weighted symmetric test. Unit root tests are conducted at 10% significance level for $N_c(N_c+1)/2$ distinct pairs of q_{ijct}, $i \neq j$, for each commodity c, and augmentation orders are chosen by AIC and SBC of ADF regression from augmentation orders $p = 0, 1, ..., 12$, then the fraction of the rejected pairs over $N_c(N_c+1)/2$ are computed. Critical values are tabulated in Section 4, which are different for T_{ijc} and augmentation orders. Lag window to compute KPSS statistics is shown in the second row. The category 'Average' located at the bottom raw of the table is a simple average of fractions of all the commodities except for CPI.

3 Seasonal Adjustment: Procedures and Results

Price data series can be written as (suppressing i, c)

$$P_{ym},\ y = 1, 2, ..., Y_m; m = 1, 2, ..., 12,$$

where y indicates year, $y = 1, 2, ..., Y_m$, and m stands for month, $m = 1, 2, ..., 12$. We use, as usually, lower case to indicate logarithm:

$$p_{ym} = \ln(P_{ym}).$$

Next, we take the first difference:

$$\Delta p_{ym} = p_{ym} - p_{y,m-1.}$$

Note that for p_{ym} with $m = 1$, $p_{y,m-1} \equiv p_{y-1,12}$. As the initial observation is lost, it is replaced with $\Delta p_{y+1,1}$, which is the lagged price of the initial month of the second year. Then, take the monthly average of Δp_{ym}:

$$\Delta \bar{p}_m = \frac{1}{Y_m} \sum_{y=1}^{Y_m} \Delta p_{ym}.$$

Note that the number of years, Y_m, depends on the month. Also, as $\sum_{m=1}^{M} \Delta \bar{p}_m \neq 0$ we compute demeaned monthly average, $\Delta \bar{p}_m^+ = \Delta \bar{p}_m - a$, $a = M^{-1} \sum_{m=1}^{M} \Delta \bar{p}_m$, and define monthly demeaned lagged price as

$$\Delta \mathring{p}_{ym} = \Delta p_{ym} - \Delta \bar{p}_m^+.$$

This ensures that

$$\sum_{m=1}^{M} \Delta \mathring{p}_{ym} = \sum_{m=1}^{M} \Delta p_{ym} \text{ for all } y,$$

which we wanted. Next, we recover level price by taking a cumulative sum. Here, the initial observation is replaced with the original initial observations of p_{ym}, and we find seasonally adjusted log of price, p^*_{ym}. Transform double index to the single index, i.e. $\{p^*_{11}, p^*_{12}, ..., p^*_{1m};\ p^*_{21}, p^*_{22}, ..., p^*_{2m};\ ...;\ p^*_{y1}, p^*_{y2}, ..., p^*_{ym}\}$ to p^*_t, $t = 1, 2, ..., T$, $T = 12Y_m$. We define the log of seasonally adjusted price index of country i for commodity c at time t as

$$q^*_{ict} = e_{it} - p^*_{ct} + p^*_{ict},$$

where e_{it} is the log of the bilateral exchange rate between country i and the US, p^*_{ct} is the log of seasonally adjusted US price index, and $p^*_{ict}$is the log of the seasonally adjusted price index of country i's commodity c at time t. The log of seasonally adjusted real exchange rate for commodity c between any other pair of countries $i, j \neq 0$ is computed as

$$q^*_{ijct} = q^*_{ict} - q^*_{jct}.$$

Criterion for Seasonal Adjustment Application

We apply seasonal adjustment described above if the following criteria are satisfied. First, we run a joint significance test of the regression of Δp_{ict} on seasonal dummies for all commodity categories across countries at 1% level. Next, if the joint tests are significant for a half of the countries or more, we examine whether the time series plot of p_{ict} exhibits seasonality pattern. Otherwise, no seasonal adjustment is applied. We also do not apply seasonal adjustment if the level price exhibits a step function. The summary of seasonal adjustment is reported below.

Table S3.1: Summary on Seasonal Adjustment Application

Commodity	**# rej at 1%**	**Description**	**Adjust?**
Bread	5/12	Step function	No
Meat	8/12	Not step function except DK	Yes except BE,
			DE,DK,FE,US
Dairy	4/12	Only DE, ES, NL, US's dummies are jointly significant. For DE and ES seasonal adjustment seems effective	No
Fruits	12/12	It may be reasonable to seasonally adjust all	Yes
Tobacco	6/12	Clear step function	No
Alcohol	5/12	DK and FI are step functions, but others are smooth.	No
Clothing	11/12	Except US, seasonality exists (For us, p-value is 0.88)	Yes, except US
Footwear	9/12	Except US, seasonality exists (For us, p-value is 0.999)	Yes, except US
Rents	10/12	Most series are step functions	No
Fuel	4/12	No seasonality	No
Furnit.	10/12	It may be reasonable to seasonally adjust all	Yes
Dom. Appl.	7/12	It may be reasonable to seasonally adjust all	Yes
Vehicles	6/12	It is not very clear. DK is step function.	Yes except DK
Pub. Transp	11/12	Clear step function is only GR, others are kind of mixture.	No
Comm.	5/12	Most series are step functions	No
Sound	8/11	Sudden jump for US after 1995M10. DK is a sort of step function	Yes except DK
Leisure	11/12	Mixture of step type movement and seasonality.	No
Books	4/12	Step function	No
Hotels	11/12	DK and FI are step functions. Higher seasonality for BE after 1992M1, for NL after 1991M1.	Yes, except DK, FI,BE,NL
CPI	11/12	All to be adjusted	Yes

Table S3.2: Fractions of Pairs q^*_{ijct} (Seasonally Adjusted) for Which the Unit Root Hypothesis is Rejected at 10% Significance Level in the Case with an Intercept and a Trend, for All 12 Countries

	Lag Order Chosen by AIC			Lag Order Chosen by SBC			KPSS	
	ADF	**ADF-GLS**	**ADF-WS**	**ADF**	**ADF-GLS**	**ADF-WS**	$0.75T^{1/3}$	$2T^{1/2}$
CPI	13.64	4.55	9.09	12.12	10.61	12.12	96.97	31.82
Subcategories								
Bread	13.64	13.64	12.12	13.64	7.58	10.61	98.48	22.73
Meat	21.21	10.61	15.15	13.64	10.61	15.15	98.48	28.79
Dairy	13.64	13.64	12.12	13.64	7.58	10.61	98.48	22.73
Fruits	42.42	39.39	39.39	57.58	54.55	59.09	93.94	24.24
Tobacco	40.91	15.15	22.73	42.42	19.70	25.76	93.94	16.67
Alcohol	19.70	16.67	18.18	15.15	12.12	13.64	96.97	28.79
Clothing	12.12	7.58	7.58	18.18	3.03	4.55	98.48	18.18
Footwear	22.73	1.52	6.06	21.21	3.03	6.06	96.97	28.79
Rents	16.36	7.27	10.91	12.73	1.82	3.64	98.18	34.55
Fuel	27.27	23.64	27.27	32.73	30.91	34.55	96.36	30.91
Furnit.	27.27	9.09	16.67	24.24	6.06	12.12	98.48	21.21
Dom. Appl.	27.27	15.15	21.21	15.15	7.58	12.12	93.94	12.12
Vehicles	18.18	15.15	19.70	15.15	13.64	21.21	95.45	30.30
Pub. Transp	13.64	7.58	9.09	18.18	9.09	9.09	95.45	33.33
Comm.	7.58	12.12	7.58	7.58	9.09	4.55	100.00	22.73
Sound	25.45	16.36	21.82	25.45	20.00	21.82	98.18	27.27
Leisure	13.64	7.58	10.61	12.12	7.58	10.61	98.48	33.33
Books	22.73	15.15	19.70	18.18	16.67	16.67	95.45	18.18
Hotels	10.61	12.12	9.09	12.12	7.58	7.58	100.00	40.91
Average	20.86	13.65	16.16	20.48	13.06	15.76	97.14	26.09

Notes: ADF is a standard Dicky-Fuller unit root test, ADF-GLS is Elliot et al. (1996) test, ADF-WS is Park and Fuller's (1995) weighted symmetric test. Unit root tests are conducted at 10% significance level for $N_c(N_c+1)/2$ distinct pairs of q^*_{ijct}, $i \neq j$, where q^*_{ict} is based on seasonally adjusted prices, for each commodity c, and augmentation orders are chosen by AIC and SBC of ADF regression from augmentation orders $p = 0, 1, ..., 12$, then the fraction of the rejected pairs over $N_c(N_c+1)/2$ are computed. Critical values are tabulated in Section 4, which are different for T_{ijc} and augmentation orders. Lag window to compute KPSS statistics is shown at the second row. The category 'Average' located at the bottom raw of the table is a simple average of fractions of all the commodities except CPI.

Table S3.3: Fractions of Pairs q^*_{ijct} (Seasonally Adjusted) for Which the Unit Root Hypothesis is Rejected at 10% Significance Level in the Case With an Intercept, for All 12 Countries

	Lag Order Chosen by AIC			Lag Order Chosen by SBC			KPSS		
	ADF	**ADF-GLS**	**ADF-WS**	**ADF**	**ADF-GLS**	**ADF-WS**	$0.75T^{1/3}$	$2T^{1/2}$	av
CPI	7.58	9.09	10.61	7.58	10.61	7.58	96.97	31.82	53.03
Subcategories									
Bread	6.06	4.55	6.06	9.09	7.58	10.61	96.97	50.00	72.73
Meat	13.64	10.61	16.67	10.61	12.12	15.15	95.45	25.76	50.00
Dairy	6.06	4.55	6.06	9.09	7.58	10.61	96.97	50.00	72.73
Fruits	36.36	30.30	39.39	57.58	45.45	62.12	84.85	36.36	51.52
Tobacco	21.21	19.70	21.21	21.21	16.67	22.73	81.82	28.79	46.97
Alcohol	9.09	18.18	19.70	6.06	18.18	16.67	93.94	33.33	59.09
Clothing	6.06	6.06	3.03	4.55	1.52	0.00	92.42	60.61	77.27
Footwear	13.64	4.55	6.06	12.12	4.55	3.03	87.88	37.88	46.97
Rents	18.18	9.09	12.73	14.55	5.45	7.27	94.55	30.91	49.09
Fuel	21.82	18.18	27.27	38.18	23.64	34.55	90.91	23.64	49.09
Furnit.	18.18	6.06	10.61	16.67	7.58	10.61	92.42	57.58	71.21
Dom. Appl.	9.09	12.12	10.61	7.58	13.64	12.12	95.45	62.12	71.21
Vehicles	6.06	3.03	4.55	10.61	3.03	4.55	95.45	45.45	63.64
Pub. Transp	13.64	9.09	12.12	19.70	7.58	12.12	90.91	24.24	46.97
Comm.	6.06	15.15	15.15	6.06	16.67	18.18	90.91	33.33	51.52
Sound	12.73	10.91	14.55	12.73	10.91	14.55	87.27	36.36	47.27
Leisure	16.67	9.09	13.64	15.15	7.58	9.09	98.48	22.73	57.58
Books	10.61	10.61	7.58	9.09	9.09	9.09	93.94	39.39	69.70
Hotels	4.55	10.61	10.61	1.52	4.55	4.55	96.97	33.33	60.61
Average	13.14	11.18	13.56	14.85	11.76	14.61	92.50	38.52	58.69

Notes: ADF is a standard Dicky-Fuller unit root test, ADF-GLS is Elliot et al. (1996) test, ADF-WS is Park and Fuller's (1995) weighted symmetric test. Unit root tests are conducted at 10% significance level for $N_c(N_c+1)/2$ distinct pairs of q^*_{ijct}, $i \neq j$, where q^*_{ict} is based on seasonally adjusted prices, for each commodity c, and augmentation orders are chosen by AIC and SBC of ADF regression from augmentation orders $p = 0, 1, ..., 12$, then the fraction of the rejected pairs over $N_c(N_c+1)/2$ are computed. Critical values are tabulated in Section 4, which are different for T_{ijc} and augmentation orders. Lag window to compute KPSS statistics is shown at the second row. The category 'Average' located at the bottom raw of the table is a simple average of fractions of all the commodities except CPI.

4 Critical Values

	With Intercept, 10%					With Intercept and Trend, 10%				
p,T	**84**	**125**	**132**	**165-166**	**175-180**	**84**	**125**	**132**	**165-166**	**175-180**
	ADF					**ADF**				
0	-2.594	-2.549	-2.590	-2.586	-2.601	-3.148	-3.151	-3.141	-3.138	-3.130
1	-2.604	-2.571	-2.600	-2.584	-2.603	-3.143	-3.141	-3.148	-3.124	-3.144
2	-2.563	-2.548	-2.564	-2.570	-2.578	-3.122	-3.116	-3.132	-3.124	-3.125
3	-2.592	-2.557	-2.584	-2.572	-2.583	-3.127	-3.124	-3.128	-3.131	-3.126
4	-2.557	-2.547	-2.572	-2.579	-2.572	-3.129	-3.117	-3.120	-3.127	-3.122
5	-2.587	-2.560	-2.576	-2.562	-2.576	-3.116	-3.121	-3.115	-3.126	-3.124
6	-2.534	-2.536	-2.569	-2.549	-2.570	-3.083	-3.098	-3.116	-3.110	-3.118
7	-2.531	-2.533	-2.551	-2.541	-2.576	-3.087	-3.089	-3.117	-3.100	-3.109
8	-2.519	-2.523	-2.539	-2.535	-2.569	-3.062	-3.071	-3.111	-3.101	-3.094
9	-2.529	-2.530	-2.540	-2.537	-2.583	-3.068	-3.075	-3.111	-3.080	-3.111
10	-2.504	-2.522	-2.531	-2.525	-2.574	-3.036	-3.053	-3.090	-3.066	-3.077
11	-2.495	-2.529	-2.526	-2.547	-2.561	-3.030	-3.070	-3.090	-3.080	-3.079
12	-2.491	-2.516	-2.522	-2.533	-2.559	-3.007	-3.042	-3.071	-3.058	-3.082
	ADF-GLS					**ADF-GLS**				
0	-1.876	-1.793	-1.797	-1.783	-1.754	-2.764	-2.691	-2.684	-2.656	-2.650
1	-1.866	-1.786	-1.789	-1.793	-1.744	-2.759	-2.695	-2.681	-2.663	-2.664
2	-1.843	-1.772	-1.772	-1.777	-1.740	-2.715	-2.667	-2.664	-2.642	-2.638
3	-1.843	-1.778	-1.787	-1.763	-1.728	-2.714	-2.675	-2.677	-2.651	-2.636
4	-1.830	-1.767	-1.773	-1.745	-1.736	-2.691	-2.651	-2.659	-2.638	-2.625
5	-1.833	-1.772	-1.781	-1.738	-1.733	-2.698	-2.666	-2.643	-2.643	-2.630
6	-1.799	-1.748	-1.760	-1.727	-1.722	-2.655	-2.635	-2.640	-2.635	-2.620
7	-1.799	-1.749	-1.751	-1.729	-1.727	-2.642	-2.637	-2.630	-2.625	-2.618
8	-1.789	-1.731	-1.743	-1.717	-1.707	-2.594	-2.619	-2.606	-2.606	-2.600
9	-1.785	-1.720	-1.748	-1.713	-1.711	-2.610	-2.622	-2.599	-2.605	-2.615
10	-1.768	-1.708	-1.725	-1.707	-1.697	-2.562	-2.600	-2.585	-2.576	-2.581
11	-1.750	-1.712	-1.728	-1.707	-1.693	-2.541	-2.594	-2.581	-2.582	-2.584
12	-1.728	-1.696	-1.710	-1.696	-1.674	-2.501	-2.555	-2.555	-2.558	-2.581
	ADF-WS					**ADF-WS**				
0	-2.279	-2.254	-2.272	-2.275	-2.256	-2.963	-2.932	-2.933	-2.928	-2.928
1	-2.285	-2.268	-2.279	-2.279	-2.274	-2.983	-2.954	-2.958	-2.965	-2.937
2	-2.279	-2.257	-2.267	-2.269	-2.260	-2.969	-2.951	-2.937	-2.939	-2.939
3	-2.297	-2.269	-2.282	-2.288	-2.269	-2.993	-2.976	-2.976	-2.952	-2.946
4	-2.278	-2.262	-2.286	-2.258	-2.261	-2.991	-2.964	-2.983	-2.966	-2.947
5	-2.313	-2.288	-2.287	-2.274	-2.277	-3.034	-2.990	-2.998	-2.982	-2.985
6	-2.306	-2.289	-2.276	-2.268	-2.281	-3.021	-2.980	-2.983	-2.968	-2.964
7	-2.327	-2.277	-2.271	-2.283	-2.285	-3.034	-3.006	-3.003	-2.981	-2.985
8	-2.318	-2.271	-2.278	-2.276	-2.268	-3.017	-2.999	-2.999	-2.980	-2.969
9	-2.329	-2.284	-2.286	-2.291	-2.278	-3.055	-3.017	-3.002	-2.998	-2.980
10	-2.315	-2.284	-2.289	-2.270	-2.264	-3.016	-3.006	-2.993	-2.964	-2.973
11	-2.331	-2.298	-2.302	-2.286	-2.279	-3.032	-3.016	-3.008	-2.983	-2.988
12	-2.313	-2.300	-2.280	-2.269	-2.270	-3.005	-3.003	-3.000	-2.981	-2.988

Note: Critical values are obtained based on 10000 simulations.

5 Average Lags

Table S5: Average Lag Order $\overline{p}$ Chosen by AIC and SBC of the ADF Regressions for q_{ijct} With a Maximum lag of 12, When the Null Hypothesis is Rejected at 10% Significance Level in the Case with an Intercept and a Trend, for all 12 Countries

	$\overline{p}$(**AIC**)	$\overline{p}$(**SBC**)
CPI	4.33	1.17
Subcategories		
Bread	3.38	0.92
Meat	2.56	0.77
Dairy	2.23	0.74
Fruits	8.85	2.24
Tobacco	1.98	0.38
Alcohol	2.86	1.02
Clothing	8.77	6.73
Footwear	7.21	4.94
Rents	5.18	2.38
Fuel	2.73	0.65
Furnit.	5.15	2.67
Dom. Appl.	5.55	2.87
Vehicles	3.03	0.52
Pub. Transp	4.08	0.68
Comm.	2.15	0.62
Sound	4.42	0.64
Leisure	3.79	0.59
Books	2.11	0.48
Hotels	6.59	0.97
Average	4.35	1.62

Notes: This table is a supplement for Table 3 of the paper. The 'Average' located at the bottom raw of the table is a simple average of the average lag orders chosen by AICs and SBCs for all the commodities except CPI.

6 Estimates of the Commodity Factor Models

Country	$\hat{\alpha}_{ic}$	$\hat{\gamma}_{ic1}$	$\hat{\gamma}_{ic2}$	$\hat{\alpha}_{ic}$	$\hat{\gamma}_{ic1}$	$\hat{\gamma}_{ic2}$	$\hat{\alpha}_{ic}$	$\hat{\gamma}_{ic1}$	$\hat{\gamma}_{ic2}$	$\hat{\alpha}_{ic}$	$\hat{\gamma}_{ic1}$	$\hat{\gamma}_{ic2}$
	Bread			**Alcohol**			**Furnit.**			**Sound**		
BE	1.43	−0.39	1.28	1.04	0.54	0.47	0.38	0.36	0.87	1.01	0.66	0.41
DE	−1.45	−0.26	1.10	−2.00	−0.17	1.18	−2.27	0.50	0.61	−2.02	0.61	0.46
DK	−0.79	−0.28	1.34	−0.21	0.50	0.35	−1.42	0.42	0.84	−0.87	0.56	0.56
ES	0.96	−0.34	1.76	1.69	2.23	−1.09	1.04	0.75	0.61	2.35	0.70	0.28
IT	5.02	1.73	−0.89	4.91	1.22	−0.34	3.91	1.21	0.00	4.79	1.03	−0.04
FR	−0.22	−0.13	0.94	−0.59	0.29	0.64	−1.37	0.45	0.74	−0.70	0.47	0.52
GR	2.85	−1.50	2.20	2.34	1.25	−0.42	1.79	0.46	0.58	1.95	0.68	0.35
NL	−0.89	−0.22	0.90	−1.55	0.19	0.71	−1.97	0.32	0.72	−1.15	0.58	0.23
PT	1.49	−1.16	2.42	1.47	1.77	−0.56	0.90	1.34	0.05	.	.	.
FI	−1.15	3.77	−2.77	−0.84	1.40	−0.49	.	.	.	−1.80	1.14	0.17
UK	−1.76	0.49	0.00	−2.53	0.50	0.27	−2.43	0.11	0.60	−1.79	0.71	−0.15
	Meat			**Clothing**			**Dom. Appl.**			**Leisure**		
BE	1.37	−0.20	1.09	0.57	1.22	−0.06	0.23	0.17	1.12	1.08	0.85	0.15
DE	−1.41	−0.23	1.04	−1.98	0.23	0.79	−2.42	0.28	0.87	−1.69	1.27	−0.35
DK	−0.26	0.20	0.67	−0.58	1.52	−0.54	−1.23	0.12	1.07	−0.80	0.31	0.73
ES	1.55	1.14	0.07	1.51	1.14	0.07	1.14	−0.16	1.49	1.75	3.12	−1.96
IT	4.87	0.74	0.14	4.89	1.39	−0.51	4.04	1.44	−0.28	3.77	−0.27	1.52
FR	−0.41	−0.25	1.10	−0.62	1.13	−0.19	−1.09	0.02	1.07	−0.38	2.22	−1.35
GR	3.60	−1.14	1.54	2.43	1.79	−0.97	2.29	0.12	0.73	2.78	5.90	−5.11
NL	−1.12	−0.46	1.20	−0.58	0.32	0.26	−2.11	0.12	0.96	−1.18	1.80	−1.00
PT	2.98	0.57	0.15	0.68	1.18	0.30	1.07	0.25	1.13	2.99	5.18	−4.39
FI	−2.47	3.41	−1.90	0.47	2.66	−2.17	.	.	.	−0.90	1.09	−0.17
UK	−1.41	−0.26	0.62	−2.67	−1.66	2.46	−2.30	−0.26	0.92	−2.06	5.46	−4.78
	Dairy			**Footwear**			**Vehicles**			**Books**		
BE	1.21	0.57	0.38	0.93	1.17	−0.13	1.33	0.92	−0.01	0.45	−0.49	1.68
DE	−1.58	−0.02	0.89	−2.02	0.91	0.12	−2.13	1.46	−0.39	−1.94	−0.15	1.13
DK	−0.64	1.43	−0.43	−0.63	1.17	−0.18	−0.80	0.70	0.36	−1.16	0.27	0.89
ES	1.51	1.09	0.13	1.70	1.35	−0.20	1.86	2.24	−1.15	1.75	0.32	0.79
IT	4.45	1.62	−0.58	4.76	1.54	−0.61	5.02	0.73	0.11	5.19	2.31	−1.50
FR	−0.42	0.34	0.52	−0.60	1.31	−0.38	−0.65	1.04	−0.09	−0.47	−0.33	1.19
GR	2.83	−2.37	3.03	2.96	2.08	−1.43	3.77	−2.39	2.77	0.96	0.72	0.61
NL	−1.44	0.01	0.84	−0.97	0.11	0.59	−1.84	1.20	−0.20	−1.36	−0.29	1.11
PT	2.37	1.67	−0.74	1.30	0.54	0.73	1.98	3.59	−2.58	0.51	−1.08	2.64
FI	−1.55	5.27	−4.07	−0.47	1.41	−0.62	−1.22	0.72	0.32	−0.30	4.06	−3.27
UK	−2.49	−0.55	1.28	−3.16	−1.45	2.41	−2.23	0.70	−0.05	−2.49	−0.21	0.94
	Fruits			**Rents**			**Pub. Transp**			**Hotels**		
BE	1.91	1.01	−0.29	1.92	2.02	−1.19	1.38	0.09	0.81	0.99	1.03	0.00
DE	−2.01	1.15	−0.13	−1.49	1.31	−0.37	−1.52	0.10	0.76	−1.38	1.44	−0.64
DK	−0.08	0.82	−0.02	−0.21	2.16	−1.16	−0.81	0.38	0.69	−0.14	1.56	−0.74
ES	1.35	0.79	0.49	3.23	1.76	−1.03	1.50	0.56	0.66	1.40	0.59	0.67
IT	4.55	1.03	−0.02	4.63	0.58	0.45	4.49	2.18	−1.18	4.51	1.35	−0.33
FR	−0.25	0.75	0.08	−0.29	1.86	−0.92	−0.29	0.06	0.77	−0.64	1.13	−0.20
GR	2.94	1.04	−0.40	3.94	4.69	−4.11	2.90	−0.56	1.23	2.59	0.24	0.54
NL	−1.12	0.97	−0.21	−0.95	2.16	−1.32	−1.29	0.05	0.78	−1.11	1.44	−0.70
PT	2.02	1.00	0.01	.	.	.	2.34	0.58	0.40	1.91	0.02	1.06
FI	−1.55	2.30	−1.20	−0.95	−0.55	1.50	−1.29	2.36	−1.31	−1.42	2.72	−1.64
UK	−2.52	1.40	−0.66	−2.67	1.54	−0.62	−2.22	0.96	−0.32	−2.20	1.56	−0.92

The table is continued on the next page.

Estimates of the Commodity Factor Models, Continued

Country	$\hat{\alpha}_{ic}$	$\hat{\gamma}_{ic1}$	$\hat{\gamma}_{ic2}$	$\hat{\alpha}_{ic}$	$\hat{\gamma}_{ic1}$	$\hat{\gamma}_{ic2}$	$\hat{\alpha}_{ic}$	$\hat{\gamma}_{ic1}$	$\hat{\gamma}_{ic2}$
	Tobacco			**Fuel**			**Comm.**		
BE	1.88	0.42	0.32	1.36	1.38	−0.49	0.90	1.24	−0.19
DE	0.25	0.03	0.24	−2.19	1.22	−0.15	−2.43	1.33	−0.17
DK	1.43	0.00	0.32	−1.57	0.52	0.77	−1.13	0.72	0.46
ES	3.47	0.28	0.27	1.69	1.36	−0.23	1.44	1.46	−0.24
IT	4.88	0.68	0.22	4.33	0.34	0.73	4.96	0.88	−0.01
FR	0.97	0.62	−0.24	−1.03	0.96	0.11	−0.34	1.36	−0.51
GR	2.90	0.58	0.08	1.26	2.31	−1.15	1.18	1.58	−0.41
NL	−0.01	0.34	0.07	−1.42	0.98	−0.12	−2.25	1.29	−0.15
PT	2.82	0.59	0.19	1.56	0.61	0.60	2.42	1.81	−0.90
FI	−0.51	−0.40	1.24	.	.	.	1.30	0.00	0.24
UK	−0.66	0.16	−0.02	−3.33	1.15	−0.14	−3.19	1.76	−0.78

Notes: This table reports the OLS estimates for the regressions $q_{ict} = \hat{\alpha}_{ic} + \hat{\gamma}_{ic1}\bar{q}_{ct} + \hat{\gamma}_{ic2}\bar{q}_t + \hat{\varepsilon}_{ict}$, $i = 0, 1, ..., N_c$; $c = 1, 2, ..., C$, $t = 1, 2, ..., T_{ic}$, where $\bar{q}_{ct} = (N_c + 1)^{-1} \sum_{i=0}^{N_c} q_{ict}$ and $\bar{q}_t = C^{-1} \sum_{c=1}^{C} \bar{q}_{ct}$, for each combination of (i, c).

7 Countries With Similar Factor Loadings

Table S7: Countries Whose Differences of Factor Loadings are ±0.1 From Those of a Base Country

Category	Base country	Countries with ±0.1 Difference
Bread	FR	NL
	NL	FR
Meat	BE	DE FR
	DE	BE FR
	FR	BE DE
Dairy	DE	NL
	NL	DE
Fruits	BE	NL
	IT	PT
	NL	BE
	PT	IT
Tobacco	DE	DK
	DK	DE
	IT	PT
	PT	IT
Alcohol	DK	UK
	IT	GR
	FR	NL
	GR	IT
	NL	FR
	UK	DK
Footwear	BE	DK
	DK	BE
Fuel	DE	UK
	UK	DE
Furnit.	BE	DK
	DE	GR
	DK	BE
	GR	DE
Dom. Appl.	BE	DK PT
	DK	BE
	PT	BE
Vehicles	DK	FI
	FI	DK
Pub. Transp	BE	DE FR NL
	DE	BE FR NL
	FR	BE DE NL
	NL	BE DE FR
Comm.	BE	DE NL
	DE	BE NL
	NL	BE DE
Sound	BE	DE GR
	DE	BE
	DK	FR
	ES	GR
	FR	DK
	GR	BE ES
Books	FR	NL
	NL	FR
Hotels	DE	NL
	NL	DE

Notes: The third column of the table reports the countries such that $|\hat{\gamma}_{ic1} - \hat{\gamma}_{jc1}|$ and $|\hat{\gamma}_{ic2} - \hat{\gamma}_{jc2}|$ are less than 0.1, where i is the base country and $j \neq i$ for each commodity c, $\hat{\gamma}_{ic1}$ and $\hat{\gamma}_{ic2}$ are factor loadings estimated from the regression $q_{ict} = \hat{\alpha}_{ic} + \hat{\gamma}_{ic1}\bar{q}_{ct} + \hat{\gamma}_{ic2}\bar{q}_t + \hat{\varepsilon}_{ict}$, $\bar{q}_{ct} = (N_c + 1)^{-1} \sum_{i=0}^{N_c} q_{ict}$ and $\bar{q}_t = C^{-1} \sum_{c=1}^{C} \bar{q}_{ct}$, for each combination of (i, c).