

Flotho, D. Teja

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Fondazione Eni Enrico Mattei

**A Note on Consumption
Correlations and European
Financial Integration**

D. Teja Flotho

NOTA DI LAVORO 115.2002

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PRIV – Privatisation, Regulation, Antitrust

D. Teja Flotho, *University of Freiburg*

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A Note on Consumption Correlations and European Financial Integration

Summary

In this paper we use empirical cross-country correlation coefficients of GDP- and private consumption data as a measure of financial integration between the current EU-member states and the central and eastern European accession states. We find, that the so-called consumption correlation puzzle with high output correlations and considerably small(er) consumption correlations (just opposite to the theory of complete financial markets) does also and still exist among European countries, even using data-sets covering most recent time periods. Thus, there seems to be less financial market integration than often expected.

Keywords: Consumption correlations, European financial integration, financial markets, international risk sharing

JEL: E32, F41

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Address for correspondence:

D. Teja Flotho
Institut zur Erforschung der wirtschaftlichen Entwicklung
Universität Freiburg
79085 Freiburg
Germany
Phone: +49-761-203-2129
Fax: +49-761-203-2375
E-mail: teja.flotho@vwl.uni-freiburg.de

1. Introduction

The so-called “consumption correlation puzzle” is certainly one of the well-known anomalies to be found by comparing theoretical and empirical properties of international financial markets. The welfare gains exploitable by the use of these international capital markets include growth effects and smoothing of time-paths of consumption. International markets typically provide national agents with a much wider range of investment opportunities and thus allow better pooling of national consumption risk.

The availability to diversify away country specific risks allows to shift portfolio weights from low-risk and low-yield assets to high(er) risk and thus high(er) yield assets which should lead to increasing output growth. Secondly, under certain (restrictive) assumptions², even perfect risk-insurance is possible – with the striking result, that a country’s consumption can be shown to be a constant fraction of world output and totally independent of domestic output (and domestic output fluctuations, of course). This can be summarized in the cross-country correlation coefficients of consumption and output, where the consumption correlation should, at least, be larger than the respective correlation of outputs.

However, confronting these theoretic aspects to actual data, leads to a picture dramatically different, showing that there seems to exist a major discrepancy between models and data. Especially the international co-movements are somewhat opposite to the theoretic prediction: cross-country correlation coefficients of consumption are typically smaller than the output correlations.³ Combined with the also well-known equity home bias puzzle, it seems somewhat unclear, whether the benefits from international financial markets proposed by economic theory are too low to be realized profitably or that international markets offer a too incomplete set of assets.⁴

Concerning empirical studies on consumption correlations, it has to be mentioned that these studies usually cover the 1950s to the 1980s, only few have data-sets ending in the early 1990s. By taking into account that most of the liberalization and inte-

² It is assumed, that the market structure is complete, that there exist perfect capital mobility and tradability of all commodities. In addition, the absence of all transaction costs is necessary.

³ See for example: Backus Kehoe and Kydland (1992, 1993), Baxter and Crucini (1995), Devereux, Gregory and Smith (1992), Kollman (1996), Obstfeld (1994a, c, 1995), Stockmann and Tesar (1995) and Tesar (1993, 1995).

gration of world capital markets took place after the break-down of the Bretton-Woods system, more precisely, many countries only recently removed barriers to capital mobility etc. This leads to the assumption, that by using more timely data-sets, we should arrive at a different empirical picture. Olivei (2000) followed the same idea in his study for the G-7 Countries but failed to find a change in the structure of cross-country correlation coefficients.

Although four of the G-7 countries are members of the European Union, and one thus might expect to find for most other countries results similar to those of Olivei, it is still of interest to perform the calculations of international co-movements for all current EU members, since through the ongoing and ever increasing harmonization and integration across EU-members, there is at least some room for the expectation of a somewhat closer connection of theory and data for these countries. Next, including in the analysis the central and eastern European countries (CEEC), which will join the EU in the near future should add some more insight for at least two reasons, regardless the fact, that no such study has been undertaken with respect to these countries by now. Firstly, these countries are special insofar as they only joined the “global financial community” after the fall of the iron curtain in 1989,⁵ and secondly almost all of the tradable assets in these countries were formerly government-owned and have recently been privatized. These enormous privatization efforts lead to a broader range of investment opportunities which, as stated above, means an improvement of international risk-sharing opportunities, as for example, shown by Girmens (2002).

The effects of privatization should also be ascertainable among the EU members who also experienced notable privatization efforts of their governments.⁶

Applying an approach used by Obstfeld (1994a) we will use consumption correlations as a measure of financial market integration in a second way by concentrating on the evolution of these coefficients over time. In the recent times of more intensive market liberalization we should be able to observe higher numerical values of consumption correlations than before.

⁴ This question is widely debated and lead to a large body of literature. But, however, until know, no commonly accepted explanation has been found.

⁵ With the exceptions of Malta and Cyprus, of course.

⁶ Especially in Spain and Italy, but also in France and Germany, the recent privatizations of formerly public monopolies in the telecommunications and other utilities sectors are widely associated with the advancement of capital markets in the respective countries.

Our findings, however, do not show severe discrepancies to the results presented in earlier studies. What we observe is on the one hand, that the so-called consumption correlation puzzle does still exist among European countries, both EU members and accession states. The computations using shifting time intervals, show that the numerical values of consumption and output correlations are extremely sensitive to the specific time interval chosen. It seems not to be possible to use the numerical values of the coefficients and their change over time as a measure of market integration.

The structure of the paper is straightforward: the following section 2 highlights some basic properties of international consumption risk-sharing, section 3 gives a detailed data description whereas the computational results are presented in section 4. The last section thus concludes. All tables and figures are to be found in the appendix.

2. Consumption risk-sharing

A simple endowment model of a two-country world economy shall be used to emphasize the connection between risk-sharing through complete asset markets and consumption correlations.⁷

The representative agents in the domestic and the foreign country receive stochastic endowments of the consumption good, Y_t and Y_t^* respectively, and maximize the sum of the present and discounted future utility of consumption. Except for the endowment processes, both agents are assumed to be equal (for simplicity), especially with respect to the utility function and the discount factor. The social planner's maximization problem than is described by

$$\max E_0 \left[\mu \sum_{t=0}^T \beta^t u(C_t) + \mu^* \sum_{t=0}^T \beta^t u(C_t^*) \right] \quad (1)$$

with μ and μ^* representing country-weights. The resource constraints for all periods t are given by

$$C_t + C_t^* = Y_t + Y_t^*. \quad (2)$$

From the first order conditions, we derive the following relationship, which requires the ratio of marginal utilities to remain constant:

$$\frac{u'(C_t)}{u'(C_t^*)} = \frac{\mu}{\mu^*}. \quad (3)$$

From that property, one can easily derive that domestic and foreign consumption expenditures are perfectly correlated:

$$\text{corr}(C, C^*) = 1.^8 \quad (4)$$

In a more realistic multi-country framework, one country's consumption can be shown to be perfectly correlated with not only world consumption but also with any other country's consumption expenditure, i.e.

$$\text{corr}(C^i, C^W) = 1 \quad \text{and} \quad \text{corr}(C^i, C^j) = 1 \quad (5)$$

hold for all countries i and j . We also see, that country i 's consumption is a constant fraction of world output, implying a perfect correlation among these variables:

$$\text{corr}(C^i, Y^W) = 1.^9 \quad (6)$$

Finally, two other predictions of cross-country correlations within the complete markets environment shall be noted. Since the countries differ in their output streams, for all countries i and j the cross-country correlation of outputs should be smaller than the corresponding consumption correlation:

$$\text{corr}(Y^i, Y^j) < \text{corr}(C^i, C^j). \quad (7)$$

Close to that, we also see that there must be a smaller correlation of domestic consumption with domestic than with world output, i.e.

$$\text{corr}(C^i, Y^i) < \text{corr}(C^i, Y^W). \quad (8)$$

Weakening one or all of the underlying assumptions of market completeness, perfect capital mobility and perfect tradability of outputs lead to weaker relations of the variables. But nonetheless, the implications drawn from the very stylized version of the model can be found again in somewhat more sophisticated models. For example, Backus, Kehoe and Kydland (1992) construct a two-country real business cycle

⁷ The following is in part based on discussions by Pakko (1998) and Olivei (2000). For a more detailed and precise presentation of this model see for example Ch. 5 in Obstfeld and Rogoff (1996).

⁸ The correlation coefficient of two variables X and Y is defined as: $\text{corr}(X, Y) = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y}$, where

$\text{cov}(X, Y)$ is the covariance between the two variables. σ_X and σ_Y refer to the standard deviation of X and Y respectively. The inequality $-1 \leq \text{corr}(X, Y) \leq 1$ always holds. A linear relationship $Y = a + bX$ between X and Y leads to a positive ($b > 0$) or a negative ($b < 0$) perfect correlation.

⁹ $C^W = \sum_{i=1}^I C^i$ and $Y^W = \sum_{i=1}^I Y^i$.

model and calibrate it to the US economy. Simulations of their model lead to a cross-country consumption correlation of 0.88 and an output correlation of -0.18 – both very close to the “basic” forecast. Those predictions proved to be robust against several model modifications.¹⁰

As it already has been mentioned, from the co-movement behavior derived above, it is intuitive to expect there to be a closer correlation of consumption in the most recent times of increasing integration of world markets, especially the 1990s. Moreover, the ongoing efforts to develop ever more sophisticated financial instruments certainly lead to a more complete market structure and provides better opportunities to insure against country-specific consumption risks. For this reason, Obstfeld in his study of risk-sharing among the G-7 splits his sample into two subperiods, with the end of the Bretton-Woods era as the separator.¹¹ He indeed finds that the majority of country-pairs show larger values of the consumption and output correlations in the second subsample. Olivei (2000) also considers two subsamples,¹² the later covering the 1990s, but is unable to confirm Obstfeld’s earlier results. On the contrary, there are generally smaller values of consumption and output correlations found in the 1990s than before. Olivei suggests that one reason for this might be that in the earlier period the presence of severe global shocks might have overstated the amount of international risk-sharing.

3. Data

All data are from the IMF’s „International Financial Statistics (IFS)“. We use quarterly and annual data for gross domestic product (GDP) and private consumption expenditure for the 15 EU-members and the 10 current accession states plus Bulgaria, Romania, and Turkey. Data availability varies by country and is summarized in the Appendix (Table 1).

¹⁰ This paper is especially noteworthy, since the authors were the first to introduce the anomaly status of consumption correlations when they found that 1) confronting their model with empirical data for several industrial countries lead to the opposite than the prediction of the model and 2) that applying several modifications onto their model, such as introducing transportation costs, limiting international trade and variations of several model parameters did not really alter the general prediction of high consumption and low output correlations. Because of this robustness, they labelled it an anomaly.

¹¹ 1951-72 and 1973-88.

¹² 1973-87 and 1988-98.

Although quarterly data are the preferred choice, we also use annual data for two reasons. Firstly, there is very limited quarterly data available for the CEEC. However, even for three EU members, Greece, Ireland, and Luxembourg, we only have annual data. Secondly, the calculations using annual data may be used to verify and strengthen the quarterly results.

Since all time series in the IFS are nominal, we use the GDP-deflator to compute real time series of GDP and consumption. Annual population data is used to obtain comparable per-capita series.

Additionally, we compute aggregate time series for EU15 and „Europe“ (including all countries in sample) as population-weighted average of national time series.¹³ Therefore the 1995 average exchange rate of the US Dollar versus the national currencies is used to obtain plausible values for the aggregates.. Finally, we take the first difference of the natural logarithms of the time series to eliminate the time trend.¹⁴

4. Computational Results

As described above, our data input consists of growth rates of consumption and GDP for the countries in question. We now computed cross-country correlations of both, consumption and output growth rates, by applying several time intervals, ranging from twenty-years (annual data) to 4 years (quarterly data).

Since correlating 21 (quarterly data) or 30 (annual data) leads to matrices containing 210 and 435 relevant, i.e. different, country pairs, most of the following discussion will necessarily focus on the correlations between individual countries and the European averages. Due to the very limited data availability for the CEEC, most calculations could solely be performed for the current EU members.

¹³ European per capita consumption is $C^E = \sum_{i=1}^I \omega^i C^i$, with ω^i representing country i 's share in European population which is simply the sum of all sample countries populations. Population data are mid-year estimates from the IFS-Yearbook.

European per capita output is computed analogously.

¹⁴ Many empirical studies use instead of first differencing the Hodrick-Prescott (HP) Filter (Hodrick and Prescott (1997)). Although employing this method induces generally higher values of both consumption and output correlation coefficients, the general picture is not influenced by the method of detrending, so that it seems feasible to concentrate this presentation on the results derived with differenced data.

See King and Rebelo (1993) for a discussion of the properties of both detrending methods.

The first two tables show the values of the consumption and output correlation coefficients for those twelve EU members providing quarterly data to the IFS. The complete time sample from 1971 to 2000 has been subdivided into three equal-length (40 quarters) intervals. Thus, each cell reports for the specific country pair the coefficient for 1971:1-1980:4 in the first row, for 1981:1-1990:4 in the second row, and for 1991:1-2000:4 in the last row.

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 Tables 2 and 3
 =====

Not surprisingly, we observe that all consumption correlations are far from unity as would be in a complete markets framework. Condition (5) is thus never fulfilled.

For this reason, we will check the somewhat weaker condition (7) which requests that for all country pairs the consumption correlation shows a larger value than the corresponding correlation of outputs. To simplify this analysis, table 4 presents the differences of the entries in tables 2 and 3, i.e. Thus, positive entries mean that for the relevant country pair the consumption correlation is larger than the output correlation, negative entries are opposite.

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 Table 4
 =====

Of the 78 country pairs for which all three intervals are computable, only 23 during 1971-80, 18 for 1981-90, and 19 for 1991-2000 meet the requirement imposed by condition (7) of consumption correlations exceeding the relevant output correlation. And, however, none of these country pairs have a consumption correlation larger than the corresponding output correlation in all of three time intervals presented. Considering the two “intermediate” intervals from 1976-85 and 1986-95 give the same picture. Thus, using this approach, one cannot identify any order of countries being less or more integrated than others. Especially, there are very few correlations of national with European consumption that are larger than their GDP-counterparts. This, in fact, is quite embarrassing for the initial expectation of increasing European integration to be found herein.

More surprisingly, there is no general trend towards higher numerical values in later time periods certifiable from the results presented in tables 2 through 4. It does not seem that there exists any common trend of the evolvement of the coefficients over time. We observe several country pairs, where the numerical value tend to increase

from 1971-80 to 1991-2000 on the one hand, but there are both numerous pairs that behave just the other way round, and, however, for the majority of country-pairs we find a somewhat cyclical behaviour around a steady mean. This last observation will become even more evident, when we consider shorter intervals, in particular in the case of the 16-quarters rolling interval used for the CEEC presented later.

Including the six accession states providing quarterly data in our analysis leads to similar results for these countries, condition (5) is never and condition (7) only in 12 out of 36 country-pairs met. Table 5 summarizes all results for the ten-year quarterly data computations, tables 9 to 11 are the 1991-2000 equivalents to tables 2 to 4. In table 5, and the following tables 6 and 7, the first column always provides the data for intra-EU correlations, the second the corresponding intra-CEEC correlations, and in the last column, we report the data for correlation matrices containing all countries in our sample. The sub-columns give the absolute number of country pairs with larger consumption than output correlation, the total number of country pairs,¹⁵ and the percentage of pairs meeting condition (7), respectively.

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Tables 5 and 6

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When applying a rolling sixteen-quarter interval to the data-set we arrive at the figures summarized in table 6. Although the rather short interval-length seems not really appropriate for the “old” European Union members, this is a chance to enclose the CEEC into our analysis and to evaluate the evolution of their international co-movements.

First of all, we state the existence of the consumption correlation puzzle among the CEEC. Omitting the first observation¹⁶, there is an increase in the number of country pairs fulfilling the criterion of larger consumption correlations until the mid-1990s with a peak of 54%. Afterwards, the number decreases which leads to the conjecture that decreasing financial integration took place in the last years. This clearly contradicts the expectation of convergence in anticipation of the EU-accession.

Finally, we turn to the larger sample of countries with annual data available. Like before, table 7 summarizes the number of pairwise correlations meeting requirement

¹⁵ The variation in these numbers stems from the different lengths of the original time series employed.

¹⁶ which is not concining because of the very limited country sample.

(7). We observe instantaneously, that the consumption correlation puzzle is to be found in all time intervals used in this computation, regardless of data frequency, interval-length and time-period. This fact is not surprising as it comes to the “early” periods, since we here just replicate what has been done before. However, even when more recent periods are examined, the puzzle does not vanish, as assumed. Moreover, one might even identify a slight downward trend, meaning increasing persistence of the puzzle.

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Table 7
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Increasing financial integration among countries should be observable in increasing cross-country correlations. While Obstfeld (1994a) succeeded to show this circumstance for his data-set, regarding the present sample of European countries more or less shows a stable situation. Consider for example in table 8 the correlation coefficients of national with European average consumption and GDP in seven ten-year intervals (annual data) from 1961-70 until 1991-2000.

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Table 8
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Although there is some variation in the “time-series” of coefficients, to deduce a common trend for the EU members therefrom seems rather difficult. A slight upward trend in the numerical values of the consumption correlations may exist, whereas the output correlations remain even more stable. Figure 1 visualizes table 8 for choice of six countries. The results presented in table 8 are of interest insofar, as the chosen ten-year intervals and the 5-year distance between single observation suppresses most of the cyclical behavior that can be found in the data when using shorter intervals and considering shorter distances between specific intervals.¹⁷ This cyclical behavior is best demonstrated by Figure 2, which presents the consumption and output correlation coefficients and the difference between them, for France and Germany when a rolling sixteen-quarter interval is used (i.e. 1977:1-1980:4, 1978:1-1981:4, etc.). The cyclic behavior of the numerical values impedes the direct interpretation of several subsequent coefficients for a given country-pair. Although the consumption correla-

tion puzzle in itself is not affected by selecting specific time intervals, the numerical values of the coefficients are rather sensitive to that decision.

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 Fig. 1 and 2
 =====

5. Conclusion

The very basic macro approach presented in this paper resulted in two main findings. First, there is a remarkably high persistence of the consumption correlation puzzle to be found in the data-set of up to 28 European countries, regardless of the specific time intervals applied. The assumed increase of cross-country correlations as a result of the recent steps towards more integrated markets and the ongoing sophistication in financial assets could not be validated herein. Second, numerical values of cross-country coefficients vary widely depending on the specific time interval chosen. Trends towards higher consumption correlations in the most recent time periods as proposed by Obstfeld (1994a) cannot be identified in this European data-set.

At least three points are certainly worth further attention: Since the data availability for the CEEC improves with every quarter passed, it should be interesting to replicate the calculations for these countries in the near future. The co-movements of outputs with consumption should be reported in the next version of this paper as well as it seems appropriate to follow Pakko's (1998) suggestion of testing the statistical significance of the underlying hypotheses to enrich the interpretation of the results.

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¹⁷ As the average business cycle in industrial countries takes about four to five years, the chosen interval-length and distance between observations seems to serve well in showing long-term stability of the coefficients, not counting for short-term events.

¹⁸ Downloaded version w/o page-numbering. See <http://woodrow.mpls.frb.fed.us/research/qr>

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7. Appendix

Table 1: List of countries, country codes and data availability with data source.

ISO-Code	Country	data availability – quarterly (start dates only, all series end 2000, otherwise indicated)	data availability – annual
AT	Austria	1964	1964
BE	Belgium	1985	1953
BG	Bulgaria	NA	1991-1999
CY	Cyprus	NA	1960-1999
CZ	Czech Republik	1994	1993
DK	Denmark	1988	1966
EE	Estonia	1993	1993
FI	Finland	1970	1960
FR	France	1970	1952
DE	Germany	1960	1960
GR	Greece	NA	1950
HU	Hungary	NA	1970
IE	Ireland	NA	1948
IT	Italy	1970	1960
LV	Latvia	1992	1992
LT	Lithuania	1993	1992
LU	Luxembourg	NA	1950-1992
MT	Malta	NA	1954
NL	Netherlands	1977	1956
PL	Poland	NA	1980
PT	Portugal	1977	1969
RO	Romania	NA	1980
SK	Slovak Republik	1993	1993
SI	Slovenia	NA	1993
ES	Spain	1970	1954
SE	Sweden	1980	1950
TR	Turkey	1987	1987
GB	United Kingdom	1957	1948
XX	Average of all countries	1991-2000**	1981-2000**
EU	Average of EU-countries	1981-2000**	1961-2000**

Data source: IMF (2001)

IFS-line numbers: GDP: 99B ZF/ZW/CZF/CZW), consumption: 96F ZF/ZW/CZF/CZW, GDP-deflator: 99B VPZF/VRZF, population: 99Z ZF, exchange rates: AH_ZF

**：“relevant” interval due to different data availability across countries.

Table 2: Consumption correlations for EU countries. Quarterly data, comparison of intervals 1971-1980, 1981-1990, and 1991-2000.

		BE	DK	FI	FR	DE	IT	NL	PT	ES	SE	GB	EU
1971-1980	AT	NA	NA	-0.20	0.17	0.18	0.13	0.39	0.60	0.36	0.61	0.10	0.21
1981-1990		0.48	-0.52	-0.10	-0.08	0.11	-0.19	-0.29	-0.07	0.09	-0.14	-0.11	-0.03
1991-2000		0.27	0.07	0.13	-0.17	0.07	0.14	0.06	0.07	0.17	0.12	0.07	0.08
1971-1980	BE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1981-1990			0.29	-0.21	-0.25	0.27	-0.04	-0.18	-0.02	-0.13	0.12	-0.26	0.00
1991-2000			0.18	0.24	-0.06	-0.16	0.54	0.16	-0.04	0.37	0.00	-0.08	0.02
1971-1980	DK			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1981-1990				0.22	-0.55	-0.05	-0.21	0.16	-0.18	-0.12	0.42	-0.28	0.17
1991-2000				0.28	-0.08	0.07	0.21	0.17	0.10	-0.12	0.10	0.08	0.13
1971-1980	FI				0.06	0.17	-0.31	0.03	0.00	-0.09	0.21	0.14	0.10
1981-1990					0.14	-0.15	0.14	-0.06	-0.10	-0.12	0.52	0.27	0.22
1991-2000					0.24	0.25	0.31	0.35	0.27	0.08	0.06	0.37	0.51
1971-1980	FR					0.13	0.25	-0.17	0.00	0.43	0.03	0.12	-0.19
1981-1990						-0.05	0.01	0.22	0.35	0.09	0.24	0.17	0.32
1991-2000						0.05	-0.13	0.41	0.04	0.05	-0.07	0.30	0.56
1971-1980	DE						-0.09	0.01	-0.02	-0.02	0.66	0.55	0.61
1981-1990							0.23	0.25	-0.19	0.23	-0.03	-0.10	0.37
1991-2000							-0.10	0.04	-0.09	0.14	0.02	0.49	0.74
1971-1980	IT							0.17	0.45	0.36	0.21	-0.01	0.10
1981-1990								0.07	-0.10	-0.07	0.17	0.13	0.32
1991-2000								-0.02	-0.06	0.11	-0.15	-0.24	0.04
1971-1980	NL								0.46	0.09	-0.02	-0.02	0.02
1981-1990									0.04	0.39	0.03	-0.05	0.27
1991-2000									0.09	0.19	0.01	0.32	0.37
1971-1980	PT									0.44	0.43	-0.04	0.29
1981-1990										0.00	-0.11	0.05	0.26
1991-2000										-0.66	0.01	0.23	-0.20
1971-1980	ES										-0.20	0.10	0.04
1981-1990											0.04	-0.05	0.32
1991-2000											-0.07	-0.04	0.37
1971-1980	SE											0.83	0.58
1981-1990												0.36	0.39
1991-2000												-0.08	0.03
1971-1980	GB												0.39
1981-1990													0.28
1991-2000													0.55

Since the time series available for Belgium and Denmark commence in 1985 and 1988, respectively, the coefficients of these countries in the second time interval (1981-1990) should be read with caution.

Table 3: Output correlations for EU countries. Quarterly data, comparison of intervals 1971-1980, 1981-1990, and 1991-2000.

		BE	DK	FI	FR	DE	IT	NL	PT	ES	SE	GB	EU
1971-1980	AT	NA	NA	0.11	0.36	0.31	0.32	0.06	0.41	0.37	0.03	0.00	0.29
1981-1990		0.50	0.17	-0.14	0.10	0.44	0.25	0.26	-0.02	0.33	0.22	0.10	0.27
1991-2000		0.19	-0.06	0.20	0.41	-0.07	0.31	0.21	0.25	0.26	0.22	0.21	0.13
1971-1980	BE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1981-1990			-0.12	0.33	0.35	0.18	0.30	0.07	0.40	0.18	0.12	0.11	0.54
1991-2000			0.42	0.37	0.51	0.29	0.30	0.45	0.36	0.22	0.52	0.24	0.46
1971-1980	DK			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1981-1990				0.31	-0.18	-0.06	0.33	0.17	-0.02	0.17	0.25	-0.21	0.36
1991-2000				0.29	0.23	0.26	0.04	0.19	0.12	0.19	0.20	0.17	0.34
1971-1980	FI				0.08	0.08	-0.04	-0.18	-0.26	0.05	0.51	0.19	-0.05
1981-1990					0.32	-0.10	0.49	0.04	0.04	0.22	0.25	0.21	0.21
1991-2000					0.45	0.30	0.28	0.30	0.19	0.21	0.72	0.46	0.48
1971-1980	FR					0.47	0.53	0.28	-0.31	0.49	0.24	0.31	0.50
1981-1990						0.29	0.53	0.11	0.49	0.39	0.35	0.35	0.41
1991-2000						0.36	0.27	0.63	0.37	0.29	0.54	0.38	0.56
1971-1980	DE						0.30	0.57	0.41	0.25	0.02	0.55	0.46
1981-1990							0.32	0.26	-0.05	0.07	0.05	0.12	0.29
1991-2000							-0.51	0.41	0.44	0.12	0.21	0.35	0.88
1971-1980	IT							0.05	0.20	0.33	0.06	0.03	0.27
1981-1990								0.24	0.17	0.47	0.25	0.36	0.52
1991-2000								0.02	-0.21	0.12	0.44	-0.03	-0.24
1971-1980	NL								-0.15	0.56	-0.12	0.58	0.63
1981-1990									-0.07	0.33	-0.21	-0.02	0.27
1991-2000									0.32	0.34	0.41	0.53	0.55
1971-1980	PT									-0.14	-0.22	0.00	0.17
1981-1990										0.23	0.03	0.12	0.58
1991-2000										-0.08	0.30	0.06	0.37
1971-1980	ES										-0.09	0.25	0.18
1981-1990											0.18	0.26	0.34
1991-2000											0.11	0.12	0.44
1971-1980	SE											0.01	-0.13
1981-1990												0.26	0.21
1991-2000												0.37	0.39
1971-1980	GB												0.39
1981-1990													0.34
1991-2000													0.43

Table 4: Difference of consumption and output correlations for EU countries. Quarterly data, comparison of intervals 1971-1980, 1981-1990, and 1991-2000.

		BE	DK	FI	FR	DE	IT	NL	PT	ES	SE	GB	EU
1971-1980	AT	NA	NA	-0.31	-0.19	-0.12	-0.19	0.32	0.19	-0.01	0.59	0.09	-0.08
1981-1990		-0.02	-0.70	0.03	-0.17	-0.33	-0.44	-0.55	-0.06	-0.24	-0.36	-0.22	-0.30
1991-2000		0.08	0.13	-0.07	-0.58	0.14	-0.18	-0.15	-0.18	-0.09	-0.09	-0.14	-0.05
1971-1980	BE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1981-1990			0.42	-0.53	-0.60	0.09	-0.34	-0.25	-0.41	-0.31	0.00	-0.37	-0.54
1991-2000			-0.24	-0.13	-0.57	-0.45	0.25	-0.29	-0.40	0.15	-0.52	-0.32	-0.44
1971-1980	DK			NA	NA	NA	NA	N	NA	NA	NA	NA	NA
1981-1990				-0.08	-0.36	0.01	-0.54	-0.01	-0.16	-0.29	0.17	-0.07	-0.18
1991-2000				-0.02	-0.31	-0.19	0.17	-0.02	-0.02	-0.31	-0.10	-0.10	-0.21
1971-1980	FI				-0.02	0.09	-0.28	0.20	0.26	-0.14	-0.29	-0.05	0.15
1981-1990					-0.17	-0.05	-0.35	-0.11	-0.15	-0.35	0.27	0.06	0.02
1991-2000					-0.21	-0.05	0.03	0.06	0.08	-0.13	-0.67	-0.09	0.02
1971-1980	FR					-0.34	-0.28	-0.46	0.31	-0.07	-0.20	-0.19	-0.69
1981-1990						-0.34	-0.52	0.10	-0.15	-0.30	-0.11	-0.17	-0.09
1991-2000						-0.32	-0.40	-0.22	-0.33	-0.24	-0.60	-0.08	0.01
1971-1980	DE						-0.39	-0.55	-0.43	-0.27	0.64	0.00	0.14
1981-1990							-0.09	0.00	-0.14	0.17	-0.08	-0.22	0.08
1991-2000							0.41	-0.37	-0.52	0.01	-0.19	0.13	-0.14
1971-1980	IT							0.13	0.25	0.04	0.15	-0.04	-0.17
1981-1990								-0.17	-0.27	-0.54	-0.08	-0.22	-0.20
1991-2000								-0.03	0.15	0.00	-0.59	-0.21	0.28
1971-1980	NL								0.61	-0.47	0.10	-0.60	-0.61
1981-1990									0.11	0.06	0.24	-0.03	0.00
1991-2000									-0.23	-0.15	-0.41	-0.21	-0.19
1971-1980	PT									0.59	0.65	-0.04	0.12
1981-1990										-0.23	-0.15	-0.07	-0.32
1991-2000										-0.57	-0.29	0.17	-0.57
1971-1980	ES										-0.11	-0.15	-0.13
1981-1990											-0.14	-0.31	-0.02
1991-2000											-0.18	-0.15	-0.06
1971-1980	SE											0.82	0.72
1981-1990												0.10	0.18
1991-2000												-0.45	-0.36
1971-1980	GB												0.01
1981-1990													-0.06
1991-2000													0.12

Table 5: Number of country pairs, whose consumption correlation is larger than the corresponding output correlation, ten-year intervals of quarterly data.

Quarterly data	EU			CEEC			ALL		
	abs.	total	rel.	abs.	total	rel.	abs.	total	rel.
1971-1980	23	78	30%	---	---	---	---	---	---
1976-1985	32	91	35%	---	---	---	---	---	---
1981-1990	22**	91	24%	---	---	---	---	---	---
1986-1995	19**	91	21%	---	---	---	---	---	---
1991-2000	22	91	24%	12	36	33%	69	210	33%

** These numbers differ from those reported in the text, where we referred only to those 78 country-pairs covering all periods.

Table 6: Number of country pairs, whose consumption correlation is larger than the corresponding output correlation, four-year intervals of quarterly data.

Quarterly data	EU			CEEC			ALL		
	abs.	total	rel.	abs.	total	rel.	abs.	total	rel.
1977-1980	30	55	56%	---	---	---	---	---	---
1978-1981	22	55	40%	---	---	---	---	---	---
1979-1982	19	55	35%	---	---	---	---	---	---
1980-1983	15	55	27%	---	---	---	---	---	---
1981-1984	15	55	27%	---	---	---	---	---	---
1982-1985	33	66	50%	---	---	---	---	---	---
1983-1986	27	66	41%	---	---	---	---	---	---
1984-1987	22	66	33%	---	---	---	---	---	---
1985-1988	28	78	36%	---	---	---	---	---	---
1986-1989	23	78	29%	---	---	---	---	---	---
1987-1990	31	91	34%	---	---	---	---	---	---
1988-1991	29	91	32%	---	---	---	---	---	---
1989-1992	31	91	34%	3	6	50%	---	---	---
1990-1993	43	91	47%	11	28	39%	---	---	---
1991-1994	34	91	37%	11	28	39%	---	---	---
1992-1995	22	91	24%	15	28	54%	---	---	---
1993-1996	39	91	43%	16	36	44%	---	---	---
1994-1997	38	91	42%	17	36	47%	---	---	---
1995-1998	45	91	49%	7	36	19%	---	---	---
1996-1999	35	91	38%	9	36	25%	---	---	---
1997-2000	35	91	38%	8	36	22%	---	---	---

Table 7: Number of country pairs, whose consumption correlation is larger than the corresponding output correlation, ten, fifteen, and twenty-year intervals of annual data.

annual data	EU			CEEC			ALL		
ten years	abs.	total	rel.	abs.	total	rel.	abs.	total	rel.
1961-1970	37	120	31%	1	1	xxx	56	171	33%
1966-1975	14	136	10%	3	10	30%	32	190	17%
1971-1980	32	136	24%	4	10	40%	52	190	27%
1976-1985	40	136	29%	6	21	29%	66	231	29%
1981-1990	15	136	11%	9	28	32%	47	253	19%
1986-1995	24	136	18%	7	36	19%	57	276	21%
1990-2000	17	120	14%	41	104	39%	135	406	33%

annual data	EU			CEEC			ALL		
fifteen years	abs.	total	rel.	abs.	total	rel.	abs.	total	rel.
1961-1975	16	136	12%	4	10	40%	35	190	18%
1966-1980	19	136	14%	3	10	30%	39	190	21%
1971-1985	22	136	16%	8	21	38%	54	231	23%
1976-1990	33	136	24%	8	28	29%	74	253	29%
1981-1995	19	136	14%	9	28	32%	54	276	20%
1986-2000	20	120	17%	41	104	39%	129	406	32%

annual data	EU			CEEC			ALL		
twenty years	abs.	total	Rel.	abs.	total	rel.	abs.	total	rel.
1961-1980	19	136	14%	4	10	40%	Xxx	xxx	xxx
1981-2000	18	136	13%	43	104	41%	127	435	29%

Table 8: Correlation coefficients of EU countries with EU-average for consumption (left) and output (right), ten-year intervals of annual data.

Consumption Correlations								Output Correlations							
	1961	1966	1971	1976	1981	1986	1991		1961	1966	1971	1976	1981	1986	1991
	-70	-75	-80	-85	-90	-95	-00		-70	-75	-80	-85	-90	-95	-00
AT	-0.07	0.00	0.63	0.51	0.02	0.75	0.75	AT	0.87	0.81	0.74	0.61	0.68	0.56	0.41
BE	-0.19	0.30	0.74	0.13	0.06	0.44	0.51	BE	0.46	0.72	0.74	0.60	0.85	0.69	0.60
DK	0.53	0.47	0.56	0.70	-0.22	-0.26	0.09	DK	0.44	0.82	0.83	0.78	0.11	0.19	0.64
FI	0.01	0.13	0.40	-0.26	0.03	0.76	0.68	FI	0.41	0.61	0.35	-0.14	0.53	0.87	0.90
FR	0.58	0.77	0.72	0.43	0.00	0.53	0.66	FR	0.66	0.90	0.95	0.75	0.56	0.69	0.73
DE	0.10	0.16	0.31	0.92	0.58	0.74	0.85	DE	0.64	0.80	0.91	0.95	0.71	0.85	0.91
GR	-0.16	-0.19	-0.29	0.06	0.60	0.60	0.46	GR	0.25	0.50	0.41	0.88	0.70	0.32	0.40
IE	-0.06	0.20	0.08	0.52	0.70	0.66	0.75	IE	-0.07	0.42	0.31	0.06	0.63	0.66	0.84
IT	0.73	0.85	0.63	0.79	0.80	0.44	0.36	IT	0.06	0.76	0.78	0.85	0.83	0.45	0.25
LU	0.11	-0.42	-0.49	0.05	-0.11	-0.77	-1.00	LU	0.74	0.75	0.87	0.51	0.73	0.85	1.00
NL	-0.77	-0.48	-0.29	0.53	0.53	0.04	0.02	NL	-0.07	0.14	0.49	0.61	0.82	0.65	0.58
PT	NA	0.57	0.60	0.16	0.44	0.47	-0.17	PT	NA	0.96	0.88	0.45	0.62	0.69	0.45
ES	0.48	0.45	0.73	0.58	0.86	0.80	0.61	ES	-0.03	0.79	0.58	0.43	0.82	0.70	0.64
SE	-0.29	0.17	0.55	0.14	-0.09	0.15	0.28	SE	0.27	0.32	0.09	0.19	0.44	0.80	0.89
GB	-0.07	0.32	0.70	0.01	0.26	0.38	0.53	GB	0.31	0.55	0.82	0.66	0.48	0.63	0.77

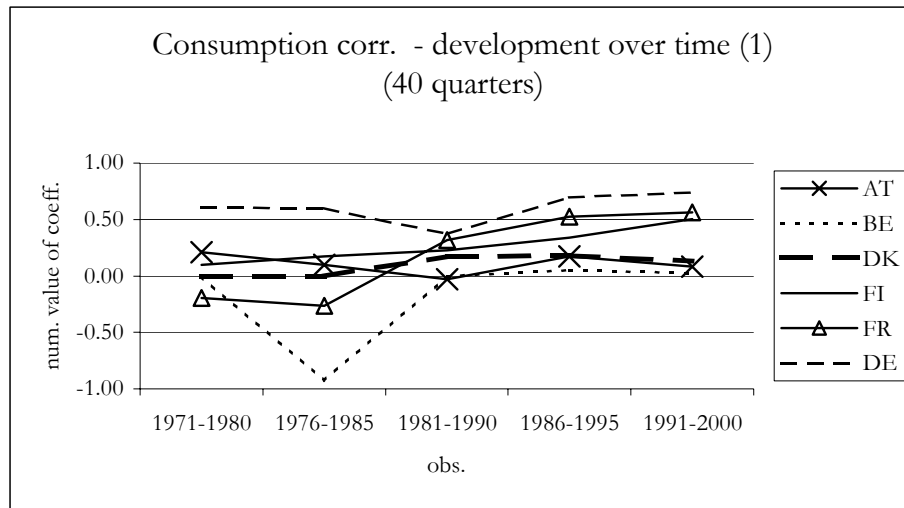


Figure 1: Numerical values of consumption correlations for 6 EU-countries with EU-average. 40 quarter time bands.

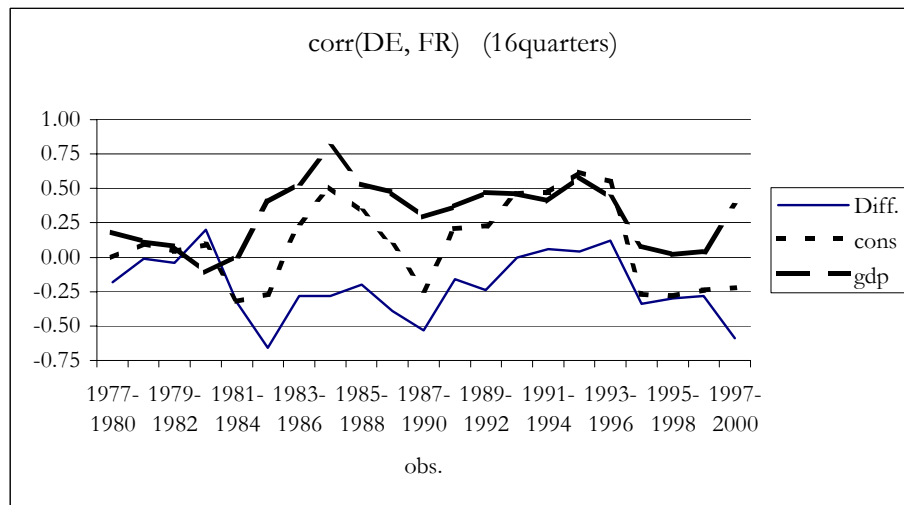


Figure 2: Time series of numerical values of correlation coefficients for Germany and France, 16-quarters time band, from 1977:1 – 1980:4 to 1997:1 – 2000:4.

Table 9: Consumption correlations for EU and CEEC countries. Quarterly data from 1991:1-2000:4.

ALL	BE	CZ	DK	EE	FI	FR	DE	IT	LV	LT	MT	NL	PT	SK	ES	SE	TR	GB	XX	ZZ
AT	0.27	0.04	0.07	0.14	0.13	-0.17	0.07	0.14	0.16	0.06	-0.16	0.06	0.07	0.33	0.17	0.12	0.25	0.07	0.14	0.08
BE		-0.07	0.18	0.26	0.24	-0.06	-0.16	0.54	-0.02	0.01	-0.10	0.16	-0.04	-0.10	0.37	0.00	0.03	-0.08	0.02	0.02
CZ			0.40	0.00	0.13	-0.05	0.00	-0.24	0.23	-0.27	0.50	0.19	0.02	-0.07	-0.03	0.11	0.09	-0.13	0.05	0.01
DK				-0.05	0.28	-0.08	0.07	0.21	0.16	-0.13	0.08	0.17	0.10	-0.03	-0.12	0.10	0.18	0.08	0.25	0.13
EE					-0.29	-0.02	-0.03	-0.27	0.11	0.39	-0.08	0.33	-0.18	0.07	0.18	-0.09	0.11	0.17	0.06	-0.09
FI						0.24	0.25	0.31	-0.07	-0.24	0.57	0.35	0.27	0.08	0.08	0.06	0.06	0.37	0.38	0.51
FR							0.05	-0.13	-0.21	-0.02	0.17	0.41	0.04	-0.03	0.05	-0.07	-0.32	0.30	0.35	0.56
DE								-0.10	-0.34	-0.47	0.03	0.04	-0.09	0.14	0.14	0.02	0.29	0.49	0.84	0.74
IT									-0.35	-0.35	-0.05	-0.02	-0.06	-0.07	0.11	-0.15	0.11	-0.24	0.04	0.04
LV										0.27	0.04	0.10	-0.07	0.08	-0.04	0.12	0.09	-0.27	-0.32	-0.32
LT											0.28	0.38	-0.02	0.17	-0.07	-0.50	0.20	0.18	-0.02	-0.24
MT												0.43	0.06	-0.02	0.00	-0.06	-0.06	-0.03	0.20	0.24
NL													0.09	-0.05	0.19	0.01	-0.17	0.32	0.34	0.37
PT														0.14	-0.66	0.01	-0.02	0.23	-0.11	-0.20
SK															-0.02	0.04	0.43	0.20	0.11	0.04
ES																-0.07	-0.07	-0.04	0.25	0.37
SE																	-0.15	-0.08	-0.13	0.03
TR																		-0.08	0.29	-0.01
GB																			0.53	0.55
XX																				0.89

Table 10: Output correlations for EU and CEEC countries. Quarterly data from 1991:1-2000:4.

ALL	BE	CZ	DK	EE	FI	FR	DE	IT	LV	LT	MT	NL	PT	SK	ES	SE	TR	GB	XX	ZZ
AT	0.19	-0.04	-0.06	0.06	0.20	0.41	-0.07	0.31	0.39	-0.04	0.00	0.21	0.25	-0.07	0.26	0.22	0.00	0.21	0.10	0.13
BE		0.21	0.42	0.46	0.37	0.51	0.29	0.30	0.67	0.00	0.52	0.45	0.36	-0.10	0.22	0.52	0.05	0.24	0.38	0.46
CZ			-0.03	0.16	0.21	0.16	0.02	0.38	-0.07	0.09	0.56	-0.03	-0.21	0.01	0.00	0.27	0.14	-0.16	0.11	0.11
DK				0.18	0.29	0.23	0.26	0.04	0.27	-0.01	-0.35	0.19	0.12	-0.07	0.19	0.20	0.05	0.17	0.32	0.34
EE					0.13	0.22	0.02	0.35	0.35	0.27	0.46	0.09	-0.10	0.03	0.08	0.08	0.18	-0.10	0.15	0.17
FI						0.45	0.30	0.28	0.56	0.13	0.51	0.30	0.19	0.01	0.21	0.72	0.10	0.46	0.43	0.48
FR							0.36	0.27	0.43	0.02	0.57	0.63	0.37	-0.20	0.29	0.54	-0.17	0.38	0.54	0.56
DE								-0.51	0.26	0.27	0.11	0.41	0.44	0.18	0.12	0.21	0.28	0.35	0.93	0.88
IT									0.47	0.02	0.63	0.02	-0.21	0.06	0.12	0.44	-0.20	-0.03	-0.32	-0.24
LV										-0.10	0.51	0.59	0.38	0.05	0.26	0.57	0.03	0.47	0.32	0.43
LT											0.59	-0.10	-0.02	0.34	0.02	-0.15	0.04	-0.24	0.14	0.07
MT												0.25	0.22	0.27	-0.19	0.39	-0.11	-0.06	0.07	0.13
NL													0.32	-0.35	0.34	0.41	-0.06	0.53	0.54	0.55
PT														0.08	-0.08	0.30	-0.15	0.06	0.40	0.37
SK															0.05	-0.21	0.11	0.01	0.13	0.14
ES																0.11	0.07	0.12	0.33	0.44
SE																	-0.20	0.37	0.33	0.39
TR																		-0.13	0.24	0.22
GB																			0.41	0.43
XX																				0.97

Table 11: Differences of consumption and output correlations for EU and CEEC countries. Quarterly data from 1991:1-2000:4.

	ALL	BE	CZ	DK	EE	FI	FR	DE	IT	LV	LT	MT	NL	PT	SK	ES	SE	TR	GB	XX	ZZ
AT	0.08	0.08	0.13	0.08	-0.07	-0.58	0.14	-0.18	-0.23	0.10	-0.16	-0.15	-0.18	0.40	-0.09	-0.09	0.24	-0.14	0.04	-0.05	
BE		-0.28	-0.24	-0.19	-0.13	-0.57	-0.45	0.25	-0.69	0.01	-0.63	-0.29	-0.40	0.00	0.15	-0.52	-0.02	-0.32	-0.36	-0.44	
CZ			0.43	-0.17	-0.08	-0.21	-0.02	-0.62	0.31	-0.36	-0.06	0.22	0.22	-0.08	-0.03	-0.17	-0.05	0.03	-0.07	-0.10	
DK				-0.23	-0.02	-0.31	-0.19	0.17	-0.10	-0.12	0.43	-0.02	-0.02	0.04	-0.31	-0.10	0.13	-0.10	-0.07	-0.21	
EE					-0.41	-0.24	-0.05	-0.62	-0.24	0.11	-0.55	0.24	-0.09	0.04	0.09	-0.16	-0.07	0.27	-0.09	-0.26	
FI						-0.21	-0.05	0.03	-0.63	-0.37	0.06	0.06	0.08	0.07	-0.13	-0.67	-0.04	-0.09	-0.04	0.02	
FR							-0.32	-0.40	-0.64	-0.04	-0.40	-0.22	-0.33	0.17	-0.24	-0.60	-0.16	-0.08	-0.18	0.01	
DE								0.41	-0.60	-0.74	-0.08	-0.37	-0.52	-0.04	0.01	-0.19	0.01	0.13	-0.08	-0.14	
IT									-0.82	-0.37	-0.68	-0.03	0.15	-0.14	0.00	-0.59	0.31	-0.21	0.36	0.28	
LV										0.37	-0.47	-0.49	-0.45	0.03	-0.30	-0.45	0.06	-0.74	-0.63	-0.75	
LT											-0.31	0.47	0.00	-0.17	-0.08	-0.35	0.16	0.42	-0.16	-0.31	
MT												0.17	-0.16	-0.29	0.20	-0.46	0.05	0.03	0.13	0.12	
NL													-0.23	0.30	-0.15	-0.41	-0.11	-0.21	-0.20	-0.19	
PT														0.05	-0.57	-0.29	0.13	0.17	-0.51	-0.57	
SK															-0.06	0.25	0.33	0.19	-0.02	-0.10	
ES																-0.18	-0.13	-0.15	-0.08	-0.06	
SE																	0.04	-0.45	-0.46	-0.36	
TR																		0.05	0.06	-0.23	
GB																			0.12	0.12	
XX																				-0.07	

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