Professor Ioan TALPOS, PhD
Associate Professor Bogdan DIMA, PhD
Senior Lecturer Mihai MUTASCU, PhD
Senior Lecturer Cosmin ENACHE, PhD
Faculty of Economics and Business Administration
West University of Timisoara

EMPIRICAL EVIDENCES FOR THE BUDGET DEFICITS CO-INTEGRATION IN THE OLD EUROPEAN UNION MEMBERS: ARE THERE ANY INTERLINKAGES IN FISCAL POLICIES? (PART TWO)

Abstract. *In the last years, the fiscal harmonization among the European Union members has become a pillar of economic integration and of fiscal and financial stability in the European area. The institutional changes, the semi-failure of the "old" Stability and Growth Pact as well as the recent waves of enlargements all these were put a greater emphasis on this issue inducing a higher pressure for fiscal discipline.*

In this context, the objective of the paper is to examines recent empirical evidences for bilateral and multilateral integration between fiscal policies, as this are synthesised by budget deficits, of old European Union members in the framework of the Johansen co-integration procedure with a preliminary appliance of the principal component analysis. The study finds that the dynamic of European fiscal policies takes place under the impact of some common driving forces which leads to a differentiate behaviour of two sub regional-groups individualized by the budget deficit series evolutionary patterns. Overall, it concludes that there could be find empirical evidences to support the thesis that a process of fiscal integration is currently running at least at the level of old European Union countries.

Key words : *Fiscal policies in E.U., budget deficits, co-integration, Johansen Test.*

JEL Classification: F15, H00, H61

3. Data and empirical results

Data consists on quarterly budget deficit values for 14 European Union old members' countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Spain, Sweden and United Kingdom (in order to ensure the data homogeneity and completeness the case of Portugal was excluded) from *Quarterly Summary Government Finance Statistics template tables*, *Eurostat 2008*.

The choice of data frequency was based on Blanchard and Perotti (1999,2) argument:" with enough institutional information about the tax and transfer systems and the timing of tax collections, one can construct estimates of the

automatic effects of unexpected movements in activity on fiscal variables, and, by implication, obtain estimates of fiscal policy shocks".

Of course, we are aware of the counter-arguments which make a case for the usage of year frequency data (see, for instance, Mélitz (2000, 24) position according to which "the move to the quarterly frequency may do little. If government expenditures (especially those on goods and services) really respond automatically to the cycle, no amount of institutional detail about taxes and transfers will account adequately for the automatic responses, any more at the quarterly than the annual frequency"). Still, we consider that since there is an unclear empirical support for the "automatic" response of fiscal policies in European Union it could be with an acceptable analytical price take into consideration such a data frequency. All the values are expressed as percentage of GDP ensuring the scale comparability. The time span of the analysis is almost 7 years (2000:04-2007:03).

Table 1 provides the descriptive statistics of the data. The budget deficit series are positively *skewed* (with the exception of Austria, Belgium, Netherlands, Spain and United Kingdom) and "flat" (*platykurtic*) relative to the normal (with the exception of Austria, Belgium and Greece data).

Table 2 reports the correlation coefficients between the analyzed budget deficit series. There could be identified three groups of correlation coefficients: one with high values between 0.63 and 0.73 for Austria, Belgium, Finland, France and Luxemburg, one with medium values of 0.49 and 0.71 for United Kingdom, Ireland and Sweden and one with low/negative values for Spain, Greece and Italy and Denmark.

3.1. The principal Components Results

The results from the appliance of *principal components* analysis are reported in Table 3. The "header" describes the sample of observations, the method used to compute the dispersion matrix, and information about the number of components retained (in this case, all nine).

The next section summarizes the eigenvalues, showing the values, the forward difference in the eigenvalues, the proportion of total variance explained, etc. Since there is performed a *principal components* analysis on a correlation matrix, the sum of the scaled variances for the fourteen variables is equal to 14. The first *principal component* accounts for 50% of the total variance, while the second contributes with 25% and the third with 11% of the total. Together the first three components generated 86% of the global variance.

The second section describes the linear combination coefficients. We see that the first principal component (labelled "PC1") is a roughly-equal linear combination of all 14 indices and could be interpreted as an "overall deficit". The second *principal component* (labelled "PC2") has negative loadings for the Austria, Belgium, Finland, France, Italy and Luxemburg and positive loading for the rest of the countries suggesting the existence of at least two sub-regional groups of fiscal families.

The third section of the output displays the calculated correlation matrix with significant high levels of ordinary correlations.

3.2. The Johansen Co-integration Test

The first task in performing a co-integration analysis is to check if the used series are integrated of order "1". For this purpose, several unit root tests are employed (The Augmented Dickey-Fuller, the Phillips-Perron, and Kwiatkowski, Phillips, Schmidt, and Shin tests are implemented and provide the same results) (Table 4). These tests significantly confirm at all levels (1%, 5% and 10%) that the budget deficit series are not stationary in levels. Complementary, the same tests (not reported here) had been done on first order differences confirming that the indices' evolution could be described as an *I(1)* process.

Based on these results we proceed with the co-integration, applying the methodologies described previously. The analysis strategy consists in applying the Johansen procedure for each pair of countries selecting the lag length by using both *Akaike's information criterion* and *Schwarz Bayesian Information Criterion*. The involved length was established by taking into account the common results of these measures of the goodness of fit. All the five deterministic trends cases were tested. In order to count for the effects of the "new" Stability Pact an exogenous dummy variable with "0" before and "1" after the second quarter of 2005 was included in the tests. Table 5 reports the results considering that the co-integration hypothesis is supported by both ***trace statistic*** and ***maximum eigenvalue statistics*** that confirms the existence of 1 co-integration relation at a 5% level. Supplementary, the residuals for the co-integration equations had been tested in terms of stationarity and only the cases for which this stationarity was confirmed according to all the three mentioned stationarity tests had been retained. The statistic significance of the adjustment coefficients for the pairs of countries we detected co-integration relations was used to accept / reject the hypothesis that one of the index dominates the existing common trend with the other one. For most of the pairs, there was not found a clear evidence for such domination.

After a co-integration status was detected on individual pairs, for each of the deficits there was a re-run of the procedure on a multi-dimensional system with all the connections that was founded significant. The co-integration relations are reported in Table 6. It could be noticed the fact that all the co-integration coefficients are significant and overall the considered co-integration relations seems to be stable for the analysis period.

The main findings are resumed by Figure 1. This depicted the sub-groups of countries and the interlinkages between them (the groups are constructed based on the principle "all are co-integrated with all"). A first group is composed by continental countries (Germany, Austria, Finland, Netherlands, Denmark, Greece, and Spain). A second group is formed by Ireland and United Kingdom. Interesting, France and Sweden are also integrated in this group. There also three countries (Italy, Luxemburg and Belgium) which are also co-integrated with the majority of the first group members (with the notable exceptions of no co-integration relationships with Austria, Belgium, Denmark and Greece).

4. Conclusions and Further Research

In this paper, we examine the long-run relations between 14 European budget deficits data. Our results suggest that in terms of co-integration status there could

be highlighted the existence of two sub-groups of countries with non-uniform degree of co-integration.

Two main points emerge from the analysis performed. First, we find evidences that there are long-run connections between fiscal unbalanced evolutions at the level of old European Union members. These evidences are consistent with the alternative empirical studies. Second, according to these results there could be distinguishing between two main cases of association in the evolutions of the fiscal disequilibrium: the "continental" and respectively the "Anglo-Saxon / Nordic plus France" ones.

Of course, these results could be ample criticised since the underline analytical framework have a large number of weakness. Between these:

(1) What kind of transmission mechanism?

One of the major weaknesses of the proposed analysis consists in the fact that there is no associated formal explanation of the fiscal imbalances propagation among the considered countries. So that, there is no clear how the mentioned results could be fitted in a conceptual approach of the fiscal interlinkages issue.

(2) What are the determinants?

In the absence of a theoretical background there is no possible to count for the influence of a possible explanatory variables such as Maastricht Treaty and the Stability and Growth Pact.

(3) What about other analytical methods?

The *principal component* method is used as complementary analysis to the Johansen procedure and it tends to support its conclusions but nothing is mentioned about the approached used in other studies such as *Dynamic Conditional Correlation* (DCC) and *Markov Switching ARCH-L* more proper designed to deal in an adequate manner with co-integration. Also, as for instance is mentioned in Alfonso (2005) the panel co-integration methodology has several advantages in comparison to the univariate analysis applied in the empirical literature and used also in this study.

Also it could be noticed that the described situation could change due to the advance in deepening the CEE / Baltic fiscal systems and in their harmonization with old European Union ones, the consequences of the European constitution project failure and also as a result of the global financial instability. Thus, a further development of the proposed analysis should as a minimal requirement:

1) Apply alternative methodologies for a proper study of co-integration status of budget deficits in an environment of financial and fiscal instability;

2) Propose a sound conceptual model able to capture the determinants of the fiscal co-integration and to explain the discriminant factors for the existence of the mentioned sub-groups;

3) To estimate the consequences of the current financial volatility for the public revenues.

Despite these *caveats* (and many others not specified) we consider that such type of analysis could highlight the long-run process of fiscal harmonization between the old European Union member countries as a part of the economic integration deepening process.

ANNEXES

Table 1. The main characteristics of the budget deficits data

State	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxemburg	Netherlands	Spain	Sweden	U.K.
Mean	-1.52	-0.5	2.39	3.97	-2.81	-2.48	-5.03	1.27	-3.07	1.98	-0.76	-0.51	0.37	1.22
Median	-1.42	-0.12	2.05	3.65	-2.68	-3.31	-4.81	1.17	-3.37	1.37	-0.5	0.26	-0.3	1.74
Maximum	0.1	0.65	5.34	6.93	-1.23	1.31	-3.09	4.71	-0.86	6.17	2	6.46	2.85	3.75
Minimum	-3.91	-3.34	-0.23	2.18	-4.19	-4.22	-8.84	-0.95	-4.4	-1.27	-3.32	-9.44	-1.02	-1.62
Std. Dev.	1.1	1.08	2.02	1.49	0.9	1.74	1.52	1.45	0.87	2.53	1.57	4.24	1.23	1.73
Skewness	-1.04	-1.6	0.2	0.49	0.13	0.98	-0.91	0.44	0.76	0.42	-0.06	-0.71	0.71	-0.23
Kurtosis	3.37	4.27	1.49	2	1.88	2.54	3.15	2.85	2.88	1.8	1.95	2.65	1.95	1.7
Jarque-Bera	5.38	14.4	2.94	2.35	1.59	4.87	4.07	0.98	2.85	2.6	1.35	2.56	3.77	2.3
Probability	0.07	0	0.23	0.31	0.45	0.09	0.13	0.61	0.24	0.27	0.51	0.28	0.15	0.32
Sum	-44	-14.5	69.45	115.2	-81.6	-71.9	-145.9	36.9	-89.1	57.5	-22.1	-14.67	10.7	35.41
Sum Sq. Dev.	33.99	32.7	114.6	62.14	22.86	84.88	64.34	58.5	21.23	178.6	68.73	503.6	42.3	84.08
Obs.	29	29	29	29	29	29	29	29	29	29	29	29	29	29

Table 2: Correlation coefficients of quarterly budget deficit series

State	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxemburg	Netherlands	Spain	Sweden	U.K.
Austria	1	0.69	-0.16	0.63	0.52	0.31	0.51	-0.1	0.43	0.73	0.24	-0.35	-0.02	0.09
Belgium	0.69	1	-0.22	0.45	0.35	0.27	0.24	0.08	0.36	0.53	0.12	-0.28	-0.06	-0.01
Denmark	-0.16	-0.22	1	0.09	0.32	0.48	0.45	0.5	-0.03	-0.13	0.65	0.49	0.86	0.76
Finland	0.63	0.45	0.09	1	0.9	0.79	0.63	0.39	0.76	0.92	0.74	-0.62	-0.06	0.62
France	0.52	0.35	0.32	0.9	1	0.72	0.63	0.54	0.52	0.86	0.87	-0.54	0.05	0.73
Germany	0.31	0.27	0.48	0.79	0.72	1	0.61	0.68	0.74	0.55	0.85	-0.25	0.32	0.84
Greece	0.51	0.24	0.45	0.63	0.63	0.61	1	0.21	0.47	0.56	0.62	-0.01	0.46	0.51
Ireland	-0.1	0.08	0.5	0.39	0.54	0.68	0.21	1	0.35	0.2	0.77	-0.25	0.17	0.71
Italy	0.43	0.36	-0.03	0.76	0.52	0.74	0.47	0.35	1	0.6	0.5	-0.5	-0.09	0.44
Luxemburg	0.73	0.53	-0.13	0.92	0.86	0.55	0.56	0.2	0.6	1	0.56	-0.72	-0.25	0.38
Netherlands	0.24	0.12	0.65	0.74	0.87	0.85	0.62	0.77	0.5	0.56	1	-0.28	0.35	0.93
Spain	-0.35	-0.28	0.49	-0.62	-0.54	-0.25	-0.01	-0.25	-0.5	-0.72	-0.28	1	0.76	-0.09
Sweden	-0.02	-0.06	0.86	-0.06	0.05	0.32	0.46	0.17	-0.09	-0.25	0.35	0.76	1	0.49
U.K.	0.09	-0.01	0.76	0.62	0.73	0.84	0.51	0.71	0.44	0.38	0.93	-0.09	0.49	1

Table 3. Principal components analysis of the budget deficits

Computed using: Ordinary correlations
Extracting 14 of 14 possible components

Eigenvalues: (Sum = 14, Average = 1)

Number	Val.	Diff.	Prop.	Cum. Value	Cum. Prop.
1	6.922	3.423	0.494	6.922	0.494
2	3.498	1.917	0.25	10.42	0.744
3	1.581	0.869	0.113	12	0.857
4	0.712	0.061	0.051	12.71	0.908
5	0.651	0.396	0.047	13.36	0.955
6	0.255	0.086	0.018	13.62	0.973
7	0.169	0.075	0.012	13.79	0.985
8	0.094	0.052	0.007	13.88	0.992
9	0.042	0.018	0.003	13.92	0.995
10	0.024	0.001	0.002	13.95	0.996
11	0.022	0.005	0.002	13.97	0.998
12	0.017	0.008	0.001	13.99	0.999
13	0.009	0.004	0.001	14	1
14	0.005	---	0	14	1

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10	PC 11	PC 12	PC 13	PC 14
Austria	0.206	-0.26	0.472	0.004	0.142	0.156	0.768	0.107	0.005	-0.066	0.125	0.037	-0.008	0.037
Belgium	0.155	-0.25	0.362	0.663	0.319	-0.05	-0.4	-0.19	-0.15	-0.117	0.096	0.014	-0.029	0.015
Denmark	0.146	0.481	0.057	-0.055	0.15	0.068	0.086	-0.34	-0.2	-0.348	-0.194	0.093	0.568	0.247
Finland	0.354	-0.15	0.008	-0.11	-0.09	0.197	-0.2	0.256	0.237	-0.249	-0.004	-0.714	0.195	0.143
France	0.354	-0.05	-0.05	-0.24	0.318	0.022	-0.14	-0.09	0.461	-0.093	0.06	0.303	0.143	-0.589
Germany	0.341	0.113	-0.07	0.224	-0.3	0.14	-0.06	0.621	-0.29	-0.175	-0.217	0.361	0.012	-0.158
Greece	0.273	0.096	0.365	-0.328	-0.21	-0.71	-0.12	0.035	-0.22	0.002	0.24	-0.041	-0.014	-0.033
Ireland	0.233	0.186	-0.41	0.424	0.229	-0.46	0.302	0.171	0.205	0.292	0.018	-0.146	0.162	0.079
Italy	0.275	-0.14	-0.05	0.248	-0.71	0.028	0.1	-0.48	0.258	0.059	-0.004	0.104	0.068	0.007
Luxemburg	0.306	-0.28	0.074	-0.25	0.139	0.082	-0.19	0.021	-0.01	0.566	-0.331	0.241	0.118	0.443
Nether lands	0.345	0.176	-0.15	-0.078	0.151	-0.04	0.043	-0.17	0.097	-0.322	-0.181	0.045	-0.731	0.288
U.K.	-0.174	0.392	0.366	0.103	-0.09	0.058	-0.15	0.267	0.584	0.015	0.234	0.235	-0.006	0.34
Spain	0.072	0.452	0.379	0.09	-0.02	0.144	0.019	-0.09	-0	0.397	-0.413	-0.328	-0.179	-0.377
Sweden	0.305	0.271	-0.16	-0.035	0.036	0.402	-0.05	-0.08	-0.28	0.298	0.679	-0.029	-0.083	0.02

Ordinary correlations:

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxemburg	Netherlands	U.K.	Spain	Sweden
Austria	1													
Belgium	0.691	1												
Denmark	-0.158	-0.22	1											

Finland	0.626	0.454	0.088	1										
France	0.52	0.35	0.316	0.896	1									
Germany	0.312	0.267	0.477	0.791	0.716	1								
Greece	0.513	0.24	0.448	0.627	0.632	0.612	1							
Ireland	-0.096	0.082	0.505	0.393	0.54	0.676	0.212	1						
Italy	0.429	0.359	-0.03	0.757	0.516	0.745	0.472	0.346	1					
Luxemburg	0.73	0.53	-0.13	0.917	0.861	0.545	0.555	0.195	0.603	1				
Nether lands	0.236	0.125	0.653	0.74	0.874	0.847	0.624	0.77	0.504	0.564	1			
U.K.	-0.35	-0.29	0.489	-0.619	-0.54	-0.25	-0.01	-0.25	-0.51	-0.724	-0.281	1		
Spain	-0.018	-0.06	0.863	-0.063	0.055	0.325	0.46	0.174	-0.09	-0.25	0.35	0.755	1	
Sweden	0.086	-0.01	0.76	0.616	0.729	0.84	0.514	0.714	0.437	0.384	0.93	-0.09	0.495	1

Table 4. Unit root tests for budget deficits

State	ADF	PP	KPSS
Austria	-0.635693	-1.778833	0.869672
Belgium	-2.312359	-2.313734	0.366086
Denmark	-1.933882	-2.546872	0.785872
Finland	0.191058	-0.867101	4.372407
France	-1.526999	-1.574816	2.187663
Germany	-2.041683	-2.271259	1.492133
Greece	-1.319081	-2.100976	0.946071
Ireland	-2.604207	-2.565583	1.949515
Italy	-0.220636	-1.753521	0.948248
Luxemburg	-0.490754	-1.927535	0.978770
Netherlands	-2.939341	-2.095233	1.794515
Spain	-1.573853	-1.675745	3.157598
Sweden	-2.653885	-2.186183	1.475573
United Kingdom	-1.018890	-1.235180	0.640207

Notes:
ADF, PP and KPSS are the *Augmented Dickey-Fuller*, the *Phillips-Perron* and the *Kwiatkowski-Phillips-Schmidt-Shin* unit root tests, respectively. The lag length is chosen using the *Modified Hannan-Quinn* information criterion.
The spectral estimation method is *AR spectral-GLS detrended* for the PP and KPSS tests. For the ADF and PP tests, the null hypothesis is the *presence of a unit root*, whereas for the KPSS tests, the null hypothesis is *stationarity*.
For all the tests there is a constant and a linear trend as exogenous variables. The ADF critical values for 1%,5% and 10% significance levels are -4.323979, -3.580623 and -3.225334, the PP critical values are -4.323979, -3.580623and -3.225334, the KPSS critical values are 0.216, 0146 and respectively 0.119.

***Table 5*. The pairs Johansen co-integration test**

State	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxemburg	Netherlands	Spain	Sweden	U.K.
Austria		No	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes/ No	No
Belgium			No	Yes	No	Yes	Yes	Yes	No	No	No	Yes	No	No
Denmark				Yes	Yes/ No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No
Finland					No/ Yes	Yes	Yes	Yes	Yes	Yes/ No	Yes	Yes	Yes	Yes
France						Yes	No	Yes	No	Yes/ No	Yes	No	Yes	Yes
Germany							Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Greece								No	No	No	Yes	Yes	Yes/ No	No
Ireland									No	Yes/ No	No	Yes	Yes	Yes
Italy										No	No	Yes	No	No
Luxemburg											Yes	No	No	Yes
Nether lands												Yes	Yes	Yes/ No
Spain													Yes	No
Sweden														Yes
U.K.														

Table 6. The co-integration equations

GREDEF(-1)	1	SWEDEF(-1)	1
SPADEF(-1)	-3.459386	FRADEF(-1)	-2.986802
	-0.14274		-0.25529
	[-24.2355]		[-11.6997]
DANDEF(-1)	-1.057636	UKDEF(-1)	-0.526759
	-0.08869		-0.18183
	[-11.9254]		[-2.89696]
FINDEF(-1)	-1.433974	IRLDEF(-1)	0.397196
	-0.06241		-0.13916
	[-22.9759]		[2.85426]
AUSDEF(-1)	1.15352	@TREND(00Q4)	0.212532
	-0.07168		-0.08804
	[16.0928]		[2.41414]
NETHEF(-1)	2.448402	C	-13.37523
	-0.10096		
	[24.2523]		
GERDEF(-1)	-0.064492		

	-0.04194
	[-1.53776]
@TREND(00Q4)	0.550511
C	9.810692

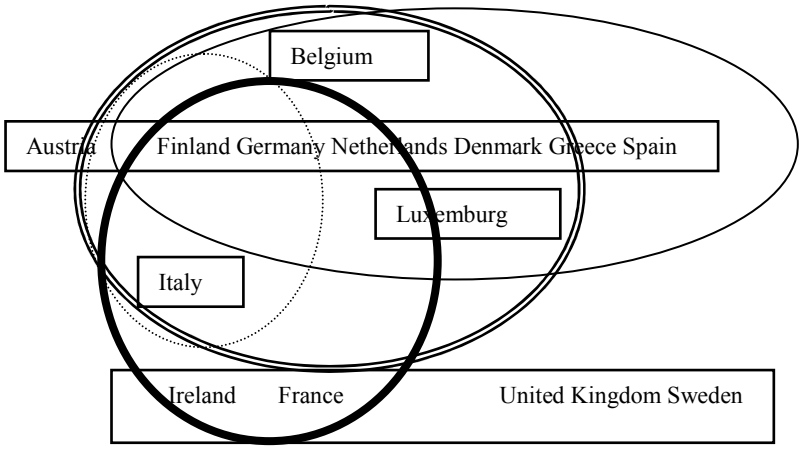

Figure 1. The sub-groups of "fiscal families"

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