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Bootstrap panel granger-causality between government budget and external deficits for the EU

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Abstract

We investigate the existence of Granger-causality between current account and government budget balances over the period 1970-2007, for different EU and OECD country groupings. We use a panel-data approach based on SUR systems and Wald tests with country specific bootstrap critical values. Our results show a causal relation from budget deficits to current account deficits for several EU countries: Bulgaria, Czech Republic, Estonia, Finland, France, Italy, Hungary, Lithuania, Poland, and Slovakia, along the lines of the so-called twin-deficit relationship. Considering the effective real exchange rate in the SUR system does not substantially alter the results.

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1. Introduction

The argument that a budget deficit leads to a current account deficit results from the fact that budget deficit increases the domestic interest rate, and this attracts foreign capital and induces an appreciation of the domestic currency, which in turn leads to an increase in the current account deficit. Such an effect will be more relevant the higher the economy's degree of openness. In practice, the existence of a relationship between the budgetary position of a country and its current account balance naturally needs to be assessed empirically. While several studies have analysed the existence of convergence (or divergence) between the trade and budgetary imbalances on a country basis, only a few studies have taken advantage of the panel econometrics framework, particularly to assess the question of our paper, the existence of Granger causality between the two imbalances.

Empirical analysis does not necessarily provide a positive correlation between the budget balance and the current account balance. Indeed, the existing evidence is rather dissimilar, notably regarding single equation analysis, in the sense that budget balance deteriorations may hardly impinge on the current account position. Overall there is some mixed evidence in favour of a twin-deficits relationship, but this is neither robust nor stable over time, which may imply that fiscal tightening may not diminish the current account deficit. For related empirical analysis see, for instance, Bernheim (1988), Chinn and Prasad (2003), Corsetti and Müller (2006), and Piersanti (2000), while Afonso and Rault (2008) provide for a non-exhaustive overview of studies on this topic.

Moreover, scarcely any evidence relates the specific issue of causality, either unidirectional or bidirectional, between the two imbalances.

Therefore, this paper contributes to the literature with a bootstrap panel analysis of causality between budget balances and external balances for the European Union and OECD countries, during the period 1970-2007. In the approach we use, we allow for cross-country correlation, without the need of pre-testing for unit roots, and such methodology is explained in section two. Section three reports the empirical analysis and section four concludes.

2. Panel Granger causality test methodology

We use a panel data approach developed by Kónya (2006), based on the followings bivariate (here composed of current account balance, ca ; and budget balance, bud) or trivariate (here ca ; bud ; and real effective exchange rate, rex) finite-order vector autoregressive models:

$$\left\{ \begin{array}{l} ca_{it} = \mathbf{a}_{1,i} + \sum_{j=1}^{p_{1i}} \mathbf{b}_{1,i,j} ca_{i,t-j} + \sum_{j=1}^{p_{2i}} \mathbf{g}_{1,i,j} bud_{i,t-j} + \mathbf{e}_{1,i,t} \quad t=1,\dots,T \quad i=1,\dots,N \quad (1a) \\ bud_{it} = \mathbf{a}_{2,i} + \sum_{j=1}^{p_{1i}} \mathbf{b}_{2,i,j} ca_{i,t-j} + \sum_{j=1}^{p_{2i}} \mathbf{g}_{2,i,j} bud_{i,t-j} + \mathbf{e}_{2,j,t} \quad t=1,\dots,T \quad i=1,\dots,N \quad (1b) \end{array} \right. \quad (1)$$

and

$$\left\{ \begin{array}{l} ca_{it} = \mathbf{a}_{1,i} + \sum_{j=1}^{p_{1i}} \mathbf{b}_{1,i,j} ca_{i,t-j} + \sum_{j=1}^{p_{2i}} \mathbf{g}_{1,i,j} bud_{i,t-j} + \sum_{j=1}^{p_{3i}} \mathbf{h}_{1,i,j} rex_{i,t-j} + \mathbf{e}_{1,i,t} \quad t=1,\dots,T \quad i=1,\dots,N \quad (2a) \\ bud_{it} = \mathbf{a}_{2,i} + \sum_{j=1}^{p_{1i}} \mathbf{b}_{2,i,j} ca_{i,t-j} + \sum_{j=1}^{p_{2i}} \mathbf{g}_{2,i,j} bud_{i,t-j} + \sum_{j=1}^{p_{3i}} \mathbf{h}_{2,i,j} rex_{i,t-j} + \mathbf{e}_{2,i,t} \quad t=1,\dots,T \quad i=1,\dots,N \quad (2b) \end{array} \right. \quad (2)$$

where the index i ($i=1,\dots,N$) denotes the country, the index t ($t=1,\dots,T$) the period, j the lag, and p_{1i} , p_{2i} and p_{3i} , indicate the longest lags in the system. The error terms, $\mathbf{e}_{1,i,t}$ and $\mathbf{e}_{2,i,t}$, are supposed to be white-noises (i.e. they have zero means, constant variances and are individually serially uncorrelated) and may be correlated with each other for a given country, but not across countries.

Systems (1) and (2) are estimated by the Seemingly Unrelated Regressions (SUR) procedure (since possible links may exist among individual regressions via contemporaneous correlation¹ within equations (1a) and (1b) of system (1); and within equations (2a) and (2b) of system (2)). Then Wald tests for Granger causality are performed with country specific bootstrap critical values generated by simulations.

With respect to system (1) for instance, in country i there is one-way Granger-causality running from bud to ca if in the first equation not all $\mathbf{g}_{1,i}$ are zero but in the second all $\mathbf{b}_{2,i}$ are zero; there is one-way Granger-causality from ca to bud if in the first equation all $\mathbf{g}_{1,i}$ are zero but in the second not all $\mathbf{b}_{2,i}$ are zero; there is two-way Granger-causality between ca to bud if neither all $\mathbf{b}_{2,i}$ nor all $\mathbf{g}_{1,i}$ are zero; and there is no Granger-causality between ca to bud if all $\mathbf{b}_{2,i}$ and $\mathbf{g}_{1,i}$ are zero².

This procedure has several advantages. Firstly, it does not assume that the panel is homogeneous, so it is possible to test for Granger-causality on each individual panel member separately. However, since contemporaneous correlation is allowed across countries, it makes possible to exploit the extra information provided by the panel data setting. Secondly, this approach does not require pretesting for unit roots and cointegration (since country specific bootstrap critical values are generated), though it still requires the specification of the lag structure. This is an important feature since the unit-root and cointegration tests in general suffer from low power, and different tests often lead to contradictory outcomes. Thirdly, this panel Granger causality approach allows the researcher to detect for how many and for which members of the panel there exists one-way Granger-causality, two-way Granger-causality or no Granger-causality.

3. Econometric investigation

3.1 Data

All data for current account balances, general government budget balances and real effective exchange rates are taken from the European Commission AMECO (Annual Macro-

¹ This assumption is very likely to be relevant for many macroeconomic time series for EU or OECD countries for which strong economic links exist.

² As stressed by Kónya (2006) this definition implies causality for one period ahead. Note that in the trivariate system our focus will remain on the bivariate, one-period-ahead relationship between ca and bud , so we will not study the possibility of causality at longer horizons, nor the possibility of two variables jointly causing the third one. In other words, rex is treated here as an auxiliary variable, and will not be directly involved in the Granger causality analysis.

Economic Data) database, from the IMF and from the OECD databases.³ We consider four different country panels: EU15, EU25, Cgroup21, and Cgroup26. The data cover respectively the periods from 1970 to 2007 for the EU15 countries, from 1996 to 2007 for the EU25 countries (i.e. EU27 without Cyprus and Romania, due to short time span availability), from 1970 to 2007 for the Cgroup21 (i.e. EU15 and Australia, Canada, Iceland, Japan, Norway, USA), and from 1987 to 2007 for Cgroup26 (i.e. EU15 and Australia, Canada, Iceland, Japan, Korea, Mexico, New-Zealand, Norway, Switzerland, Turkey, USA). The unbalanced panels within the period 1970-2007 are used for the SUR analysis and Granger-causality testing.

3.2 Empirical results

We report in Table 1 the results for the Granger causality tests, using a bivariate model, from budget balances to current account balances. The table presents results for the country group EU25, as previously defined. Tables 2 presents a similar set of results for Granger causality tests regarding a trivariate model where the effective real exchange rate is also included, while the evidence on statistically significant causality is summarised in Table 3 for several country groups and for the reverse causality as well.⁴

Our results uncover the existence of one-way direct Granger causality from the government budget balance to the current account balance, in the bivariate model, for five EU countries: Bulgaria, Czech Republic, Finland, Lithuania, and Slovakia. Out of this set of countries only Finland is not a New Member State (NMS) of the EU. Interestingly, these results hold broadly when a trivariate specification is used, and the effective real exchange rate is considered. In this case, there is also evidence of one-way causality from the budget balances to the current account balances for some additional countries: Estonia, Hungary, Poland, France and Italy.

The fact that the majority of the countries, for which causality from the budget balance to the current account balance is found, are NMS, could be related to the existence of higher interest rates in those countries, high inflows of foreign investment and the appreciation of the respective domestic currencies. Notice that the time span used in the analysis for the NMS covers the period 1996-2007, when these economies followed a catching-up process, notably attracting foreign capital. Moreover, one can conjecture that government budgets also contributed to such process notably by raising internal demand. The evidence of causality from budget balances to the current balances for France and Italy can also be related to relevant budgetary imbalances and higher interest rates during the period used in the sample.

Regarding the existence of causality from the current account balances to the budget balances, there is statistical evidence for a different set of countries; seven from the EU (Austria, Belgium, Ireland, Spain, Czech Republic, Estonia, and Italy), and five other non-EU countries (Australia, Canada, Norway, Iceland, and Mexico). Such evidence is rather unchanged considering or not the effective real exchange rate in the SUR system.

4. Conclusion

³ The AMECO codes are the following ones: .1.0.319.0.ublge, Net lending (+) or net borrowing (-): general government, % of GDP at market prices - excessive deficit procedure). .1.0.310.0.UBCA, Balance on current transactions with the rest of the world (National accounts), % of gross domestic product at market prices.

⁴ Due to space constraints, all additional results for the alternative country groups are available from the authors on request.

We investigated the existence of Granger-causality between current account and government budget balances, with and without considering the effective real exchange rate, over the period 1970-2007, for several EU and OECD country groupings. We used the panel-data approach of Kónya (2006), which is based on SUR systems and Wald tests with country specific bootstrap critical values.

Our results support the hypothesis of a causal relation from budget deficits to current account deficits for several countries in the EU: Bulgaria, Czech Republic, Estonia, Finland, France, Italy, Hungary, Lithuania, Poland, and Slovakia, along the lines of the so-called twin-deficit relationship. On the other hand, the possibility of a reverse causality is found to be statistically significant for a somewhat different sub-set of OECD countries. Considering the effective real exchange rate in the SUR system does not substantially alter the causality results.

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Table 1 – Granger causality tests from budget balances to current account balances for the EU25 panel (1970-2007, 1996-2007 for NMS), bivariate (CA, BUD) models

Country	Estimated coefficient	Test Statistic	Bootstrap critical values		
			1%	5%	10%
Austria	-0.1125	2.14762	43.7973	26.2007	16.9958
Belgium	-0.1102	16.1655	56.5276	29.8958	21.162
Bulgaria	-0.3940	46.9707**	66.5806	31.3461	24.4404
Czech Republic	-0.2389	33.5267*	136.764	46.8060	27.8800
Denmark	0.0049	0.01253	42.398	26.3917	20.1636
Estonia	-0.2775	5.90757	86.9449	40.5836	26.5668
Finland	-0.1856	13.3247*	57.5861	29.4169	12.4979
France	-0.1529	10.0342	61.6752	38.4433	26.5120
Germany	-0.0009	0.00176	48.2582	29.6834	20.4028
Greece	-0.0330	0.58713	46.8234	30.1429	20.8347
Hungary	-0.2083	6.38740	82.4022	36.2005	26.1898
Ireland	-0.0338	0.26381	66.935	35.1428	25.4057
Italy	-0.0896	6.66486	38.7987	25.4962	19.6885
Lithuania	-0.5114	25.7777*	99.1208	30.9541	20.0091
Luxembourg	-0.2839	5.46588	113.034	44.2571	28.8312
Latvia	0.1188	0.26786	90.0605	39.9590	23.6354
Malta	0.0358	0.08439	48.6874	23.8899	15.8910
Netherlands	0.0693	0.79242	44.4382	26.0607	16.5963
Poland	-0.1027	2.24052	61.8482	26.5006	19.903
Portugal	-0.3014	8.28391	56.7452	32.3333	20.2260
Spain	-0.0845	1.85501	65.1751	37.3527	24.2919
Slovakia	0.3128	51.0487**	85.6138	31.5580	18.7401
Slovenia	0.0357	0.13581	81.2513	36.751	22.6962
Sweden	-0.0349	1.28510	53.7627	26.3205	18.8356
UK	-0.0082	0.03551	51.0868	23.9186	18.2811

Notes: a) ***, ** and * denotes significance at the 1%, 5% and 10% levels, respectively.

b) H_0 : BUD does not cause CA.

BUD – budget balance; CA – current account balance.

Table 2 – Granger causality tests from budget balances to current account balances for the EU25 panel (1970-2007, 1996-2007 for NMS), trivariate (CA, BUD, REX) models

Country	Estimated coefficient	Test Statistic	Bootstrap critical values		
			1%	5%	10%
Austria	-0.0886	0.5542	41.3010	28.9222	19.2597
Belgium	-0.1080	12.467	52.6592	27.4962	17.2239
Bulgaria	-0.3604	30.132*	97.1317	46.9680	29.8037
Czech Republic	-0.2999	48.945**	94.0543	42.4680	22.0298
Denmark	0.0077	0.0312	41.7944	23.9718	17.2537
Estonia	-0.5042	24.019*	87.5025	30.0444	20.2046
Finland	-0.2016	14.779*	60.0785	30.4698	14.3326
France	-0.1610	11.020	52.2093	26.1209	18.8321
Germany	-0.0325	0.2748	46.2398	27.5085	18.8700
Greece	0.0209	0.1388	38.2880	22.4442	16.1207
Hungary	-0.4590	25.318*	49.8247	30.8239	19.858
Ireland	-0.0525	0.6206	46.1688	25.7545	18.2065
Italy	-0.1011	6.9862	32.5002	20.6835	14.6002
Lithuania	-0.6572	58.804**	233.146	45.1415	23.5948
Luxembourg	-0.2871	3.7869	45.0295	26.2708	19.1888
Latvia	-0.0694	0.1149	67.0000	35.8248	27.0371
Malta	-0.2203	0.9705	50.9769	31.7786	21.2535
Netherlands	0.0697	0.7486	40.7907	23.8351	16.1974
Poland	-0.2310	25.698*	65.6607	27.4022	19.0187
Portugal	-0.2760	6.4198	34.2515	23.7551	17.9555
Spain	0.0334	0.1867	22.6425	12.9124	9.4359
Slovakia	0.2889	44.200**	95.2704	31.8745	15.8232
Slovenia	0.0376	0.0911	89.2911	35.7054	19.0756
Sweden	-0.0313	0.9367	54.5721	24.4355	16.4764
UK	-0.0011	0.0054	53.1380	21.5314	16.3642

Notes: a) ***, ** and * denotes significance at the 1%, 5% and 10% levels, respectively.

b) H_0 : BUD does not cause CA.

BUD – budget balance; CA – current account balance; REX – real effective exchange rate.

Table 3 – Summary of results

a) Bivariate models (CA, BUD)		
Panel	Budget balance \Rightarrow Current account balance	Current account balance \Rightarrow Budget balance
EU15, 1970-2007	Finland	Austria, Belgium, Spain
EU25, 1970-2007; NMS, 1996-2007	Bulgaria, Czech Republic, Finland, Lithuania, Slovakia	Austria, Belgium, Czech Republic, Spain
CGroup 21, 1970-2007	Finland	Australia, Austria, Canada, Ireland, Italy, Norway, Spain
CGroup 26, 1970-2007; 1987-2007 for KOR, MEX, NZ, SZ, TUR		Austria, Canada, Ireland, Iceland, Mexico, Norway, Spain
b) Trivariate models (CA, BUD, REX)		
Panel	Budget balance \Rightarrow Current account balance	Current account balance \Rightarrow Budget balance
EU15, 1970-2007	Finland	Austria, Belgium, Ireland, Spain
EU25, 1970-2007; NMS, 1996-2007	Bulgaria, Czech Republic, Estonia, Finland, Hungary, Lithuania, Poland, Slovakia	Austria, Belgium, Czech Republic, Estonia, Spain
CGroup 21, 1970-2007	Finland, France	Austria, Belgium, Ireland, Italy, Norway, Spain
CGroup 26, 1970-2007; 1987-2007 for KOR, MEX, NZ, SZ, TUR	Italy	Austria, Belgium, Iceland, Mexico, Norway, Spain

Notes: BUD – budget balance; CA – current account balance; REX – real effective exchange rate.