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Spend-and-tax: a panel data investigation for the EU

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Abstract

Using bootstrap panel analysis, allowing for cross-country correlation, without the need of pre-testing for unit roots, we study the causality between government spending and revenue for the EU in the period 1960-2006. We find spend-and-tax causality for Italy, France, Spain, Greece, and Portugal, while tax-and-spend evidence is present for Germany, Belgium, Austria Finland and the UK, and for several EU New Member States. Moreover, in the run-up to EMU there was some shifting away from a spend-and-tax strategy, implying adjustments of fiscal behaviour.

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1. Introduction

Fiscal sustainability studies usually assess the existence of a long-term cointegration relationship between government revenue and spending.[1] Nevertheless, an important feature linked to the existence of such cointegration relation is the direction of causality between spending and revenue, which conveys how fiscal policy is set-up in practice. Indeed, one may have one-way Granger-causality from spending (revenue) to revenue (spending), i.e. "spend-and-tax" ("tax-and-spend") causality, two-way causality or no Granger-causality between revenue and spending.

The literature essentially assesses the existence of causality in a single country set-up.[2] However, there is economic rational for undertaking a panel approach, taking advantage of non-stationary panel data econometric techniques. In the European Union (EU), and even if there is no single fiscal policy in place, panel analysis is relevant in the context of countries seeking to pursue sound fiscal policies within the framework of the Stability and Growth Pact. Cross-country dependence can be envisaged in the run-up to Economic and Monetary Union (EMU), via peer pressure or via integrated financial markets. Moreover, cross-country spillovers in government bond markets are to be expected, and interest rates comovements inside the EU have also gradually become more noticeable.

This paper contributes to the literature with a bootstrap panel analysis of causality between government revenue and spending in the EU country set, to assess which countries are characterised by a tax-and-spend or by a spend-and-tax behaviour during the period 1960-2006. Section two explains the methodology, section three reports the empirical analysis and section four concludes.

2. Methodology

We employ the panel data approach of Kónya (2006), based on a bivariate finite-order vector autoregressive model, and we apply it in our context to general government revenue, *R*, and spending, *G*:[3]

$$\begin{cases} R_{it} = \alpha_{1,i} + \sum_{j=1}^{p_{1i}} \beta_{1,i,j} R_{i,t-j} + \sum_{j=1}^{p_{2i}} \gamma_{1,i,j} G_{i,t-j} + \varepsilon_{1,i,t} \quad t = 1,...,T \quad i = 1,...,N \\ G_{it} = \alpha_{2,i} + \sum_{j=1}^{p_{1i}} \beta_{2,i,j} R_{i,t-j} + \sum_{j=1}^{p_{2i}} \gamma_{2,i,j} G_{i,t-j} + \varepsilon_{2,j,t} \quad t = 1,...,T \quad i = 1,...,N \end{cases} \tag{1}$$

where the index i $(i = 1,...,N)$ denotes the country, the index t $(t = 1,...,T)$ the period, j the lag, and p_{1i}, p_{2i} and p_{3i}, indicate the longest lags in the system. The error terms, $\varepsilon_{1,i,t}$ and $\varepsilon_{2,i,t}$, 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.

System (1) is estimated by the Seemingly Unrelated Regressions (SUR) procedure, since possible links may exist among individual regressions via contemporaneous correlation[4]

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[1] Afonso (2005) explains the relevant linkages and reviews the empirical evidence. Afonso and Rault (2007) test the cointegration relationship with panel unit root and cointegration tests, allowing for correlation within and between units.

[2] See, for instance, von Fursternberg et al. (1986), Chang et al. (2002), Payne (2004), and Kollias and Paleologou (2006).

[3] We are grateful to L. Kónya for providing his TSP codes, which we have adapted for our analysis.

within the two equations. Wald tests for Granger causality are performed with country specific bootstrap critical values generated by simulations.

With respect to system (1), in country *i* there is one-way Granger-causality from *G* to *R* if in the first equation not all $\gamma_{1,i}$ are zero but in the second all $\beta_{2,i}$ are zero; there is one-way Granger-causality from *R* to *G* if in the first equation all $\gamma_{1,i}$ are zero but in the second not all $\beta_{2,i}$ are zero; there is two-way Granger-causality between *R* to *G* if neither all $\beta_{2,i}$ nor all $\gamma_{1,i}$ are zero; and there is no Granger-causality between *R* to *G* if all $\beta_{2,i}$ and $\gamma_{1,i}$ are zero.[5]

This procedure has several advantages. Firstly, it does not assume that the panel is homogeneous, being 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, it does not require pre-testing 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 approach allows detecting for how many and for which members of the panel there exists one-way, two-way, or no Granger-causality.

3. Empirical analysis

Data for general government expenditure and revenue are taken from the European Commission AMECO database.[6] The data cover the periods 1960-2006 for the EU15 countries, and 1998-2006 for the EU25 countries and the unbalanced panels are used for the SUR analysis and Granger-causality testing.[7] The following panels are used: EU15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Luxembourg, the Netherlands, Portugal, Spain, United Kingdom, and Sweden); and EU25 (EU15 countries, Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Slovakia and Slovenia).

We use government spending and revenue data as a ratio of GDP. Apart form the fact that ratios of nominal magnitudes are commonly used in the international debate, it is also important to scale the variables for the panel approach. In addition, the bootstrap causality test that we use does not require unit root testing.

Table 1 shows the results of the causality tests for the EU15 panel for the period 1960-2006. It is possible to observe that while government revenue positively causes government spending for Germany and negatively for Ireland, there are more cases pointing to the spend-and-tax hypothesis: Austria, France, Greece, Italy, Spain, and Sweden.

[Table1]

We also compared the results (not shown) for two sub-periods, 1960-1985 and 1986-2006. In the first sub-period, causality from revenue to spending occurs in six countries,

[4] Contemporaneous correlation is a reasonable assumption for macroeconomic time series for EU countries, with strong economic links.

[5] This implies one period ahead causality.

[6] The AMECO codes are as follows: total expenditure (% of GDP), .1.0.319.0.UUTGE, .1.0.319.0.UUTGF; total revenue (% of GDP), .1.0.319.0.URTG, .1.0.319.0.URTGF.

[7] For the SUR approach to work properly, the time series dimension should be substantially larger than *N*, a condition that is only fulfilled for the EU25 over the 1998-2006 period. Therefore, for the EU25 panels the SUR estimation is performed on the (unbalanced) 1970-2006 period.

while causality from spending to revenue is detected for Greece, Italy and Portugal. In addition, the tax-and-spend result is obtained for Portugal in the second sub-period while a negative causality from revenue to spending is found for Italy and Belgium, which may signal increased concerns regarding fiscal behaviour in the run-up to EMU. On the other hand, the spend-and-tax result occurs in the second sub-period for France and Ireland.

Table 2 reports the results for the EU25 country sample, considering most of the EU New Member States (NMS). The spend-and-tax result is still found for Austria, France, Greece, Italy, and Spain, and causality still runs from revenue to spending in the case of Germany and Luxembourg. On the other hand, the evidence shows causality from revenue to spending in several EU New Members States: Czech Republic, Estonia, Lithuania, and Poland. Finally, two countries exhibit two-way, bi-directional causality between government revenue and spending: Ireland and Slovakia. Table 3 summarises the causality results.

[Table2]

[Table3]

4. Conclusion

We used a bootstrap panel analysis of causality between government revenue and spending for the EU, which allows for contemporaneous correlation across countries and dispenses the need of pre-testing for unit roots. The results support the so-called spend-and-tax causality for such countries as Italy, France, Spain, Greece, and Portugal. Tax-and-spend evidence is present notably for Germany, Belgium, Austria Finland and the UK, and also for several EU New Member States. Some changes regarding the direction of the causality patterns can also be detected, after the 2nd half of the 1980s, notably with countries like Greece, Italy, and Portugal, shifting away from a spend-and-tax strategy, which may imply welcome adjustments of fiscal behaviour in the run-up to EMU.

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Table 1a – Causality from government revenue to spending, EU15 (1960-2006)

	Estimated coefficient	Test Statistic	Bootstrap critical values		
			1%	5%	10%
Austria	0.1351	1.2361	26.5043	15.5115	11.5606
Belgium	0.0183	0.0600	21.6994	12.7869	8.60072
Denmark	-0.0238	0.1362	24.1007	13.7943	9.80305
Finland	0.1050	1.6209	21.8583	13.4235	10.4536
France	-0.0119	0.0153	33.3617	23.3719	16.5679
Germany	0.4409	28.130***	23.0660	14.5004	9.82668
Greece	-0.0986	1.5955	27.2009	16.9224	12.2377
Ireland	-0.2049	11.572*	22.1834	12.5130	9.63277
Italy	0.0003	0.0004	21.0231	16.4763	12.2038
Luxembourg	0.2337	6.8957	21.7075	12.2952	9.19950
Netherlands	0.1453	1.9476	21.0882	13.4699	9.83869
Portugal	0.1810	7.7905	29.4152	20.8129	16.4777
Spain	-0.0867	2.4448	32.6605	23.7844	17.7405
Sweden	0.0281	0.1175	25.0536	15.5121	10.4427
UK	0.1628	3.6575	17.4399	9.79579	7.52149

***, **, *: significance at the 1%, 5% and 10% levels, respectively.

H_0: *R* does not cause *G*.

Table 1b – Causality from government spending to revenue, EU15 (1960-2006)

	Estimated coefficient	Test Statistic	Bootstrap critical values		
			1%	5%	10%
Austria	0.2290	8.2731*	22.2499	11.1867	7.9895
Belgium	0.0052	0.0266	18.3643	10.5409	7.73236
Denmark	0.1307	3.9247	23.6322	12.5703	9.37391
Finland	0.0632	1.1145	18.9469	13.1284	9.68753
France	0.3230	25.450***	19.3738	14.0002	10.7197
Germany	0.1468	5.0713	18.5037	11.7241	8.79791
Greece	0.1043	12.325*	28.6306	16.7483	11.6541
Ireland	0.0988	6.3321	29.5567	12.8465	8.51660
Italy	0.1363	17.783**	27.4934	16.1808	11.8194
Luxembourg	0.0806	0.7435	20.2061	11.3574	8.39400
Netherlands	0.0871	0.9737	19.4031	11.6964	8.71781
Portugal	0.1075	4.9057	26.1445	15.9634	13.1014
Spain	0.1340	10.590*	17.4415	11.5850	8.50721
Sweden	0.1285	8.1168*	15.9548	10.9160	7.76927
UK	-0.0434	0.3727	20.3780	10.9510	6.97039

***, **, *: significance at the 1%, 5% and 10% levels, respectively.

H_0: *G* does not cause *R*.

Table 2a – Causality from government revenue to spending, EU25
(1960-2006, 1998-2006 for NMS)

	Estimated coefficient	Test Statistic	Bootstrap critical values		
			1%	5%	10%
Austria	0.2009	3.6305	41.2461	23.1395	16.6998
Belgium	-0.0010	0.0020	32.2159	17.9067	13.2455
Bulgaria	2.1296	1.9209	72.7410	18.1467	10.6635
Czech Republic	1.1902	117.58***	60.7540	22.8137	16.6407
Denmark	-0.0645	1.3795	41.9757	22.3520	16.6643
Estonia	0.5861	116.77***	72.8279	24.2003	16.6886
Finland	0.1707	6.4720	46.0596	26.9281	20.8231
France	0.0676	0.7831	43.3779	24.2287	19.8115
Germany	0.4764	47.753***	34.4426	23.1298	15.8835
Greece	-0.1240	3.3001	29.8829	19.4335	14.3818
Hungary	1.3929	13.215	133.850	33.8927	22.9206
Ireland	-0.1863	10.846*	32.9529	16.8088	9.91600
Italy	-0.0093	0.0406	40.0782	24.0417	18.1905
Lithuania	0.7834	71.052***	45.0261	25.1628	17.2383
Luxembourg	0.2527	11.364*	36.1252	17.8449	10.5813
Latvia	-0.2954	0.8001	72.6016	26.0319	18.1718
Malta	0.1944	0.0612	66.7247	27.0500	18.7337
Netherlands	0.0917	1.1335	40.9455	20.3194	14.3195
Poland	0.7741	16.350*	75.7026	29.3214	16.1523
Portugal	0.1771	9.9942	66.3728	34.3644	24.1508
Spain	-0.0987	3.6759	50.0771	32.0511	26.2648
Slovakia	0.8231	91.575***	47.1513	18.5281	12.4573
Slovenia	1.3726	0.9320	66.6083	25.8891	17.3368
Sweden	0.0286	0.1586	34.9508	18.8386	13.6560
UK	0.2061	6.7309	27.4755	14.3481	10.2508

***, **, *: significance at the 1%, 5% and 10% levels, respectively.
H_0: *R* does not cause *G*.

Table 2b – Causality from government spending to revenue, EU25
(1960-2006, 1998-2006, for NMS)

	Estimated coefficient	Test Statistic	Bootstrap critical values		
			1%	5%	10%
Austria	0.2529	12.044*	19.5303	13.4184	10.2562
Belgium	0.0224	0.54781	19.5653	13.9294	10.8562
Bulgaria	1.6730	1.04981	42.6198	25.0232	10.3543
Czech Republic	-0.0349	0.41078	71.0631	41.1924	28.0181
Denmark	0.1089	3.27944	26.2961	19.5282	14.9182
Estonia	-0.0841	2.03649	72.0515	39.0268	28.0185
Finland	0.0329	0.42829	21.5672	13.2089	10.1670
France	0.2434	18.0268**	21.3095	13.3523	10.4775
Germany	0.0991	3.13249	20.9963	14.3719	10.3984
Greece	0.1141	19.9956*	28.9023	21.6341	17.0258
Hungary	-0.3327	0.57414	51.9562	29.3867	18.4169
Ireland	0.1169	9.55691*	19.7658	12.5920	9.21358
Italy	0.1159	16.4259**	22.1347	15.3167	11.6779
Lithuania	-0.0018	0.00152	69.7456	45.8297	29.9929
Luxembourg	0.0927	1.18539	21.8078	13.8562	10.6759
Latvia	0.3720	0.78022	32.1787	21.9743	16.1741
Malta	0.1615	0.09375	28.1466	17.6842	10.9345
Netherlands	0.0557	0.48933	20.5256	14.6298	12.2631
Poland	-0.4814	6.97142	75.3512	40.3326	28.0697
Portugal	0.1048	7.61307	30.8244	20.4392	15.4292
Spain	0.1273	12.0118*	25.0689	17.7928	11.3755
Slovakia	0.1732	40.8910**	67.3608	36.4847	29.9371
Slovenia	0.0828	0.00149	41.5854	23.4056	14.1824
Sweden	0.1010	6.42458	18.9381	12.8071	9.37407
UK	-0.0523	0.63520	18.1513	11.5070	8.34389

***, **, *: significance at the 1%, 5% and 10% levels, respectively.
H_0: *G* does not cause *R*.

Table 3 – Summary of results

Panel	Revenue $\Rightarrow$ Spending		Spending $\Rightarrow$ Revenue (spend-and-tax)
	$\Delta R \Rightarrow \Delta G$ (tax-and-spend)	$\Delta R \Rightarrow \nabla G$	
EU15, 1960-2006	Germany	Ireland	Austria, Italy, France, Spain, Greece, Sweden
EU15, 1960-1985	Belgium, Germany, Spain, Sweden, Luxembourg, UK		Greece, Italy, Portugal
EU15, 1986-2006	Austria, Finland, Portugal	Belgium, Denmark, Italy, Sweden	France, Ireland
EU25, 1960-2006; NMS, 1998-2006	Czech Republic, Estonia, Lithuania, Poland, Slovakia Germany, Luxembourg	Ireland	Slovakia, Austria, France, Greece, Ireland, Italy, Spain