

Fiscal Federalism, Jurisdictional Competition, and the Size of Government: Appendix

Nonspherical Errors and Data Heterogeneity Issues

Government spending models typically feature contemporaneously correlated error structures (Beck and Katz, 1995; Kittel and Winner, 2005; Plümper, Troeger and Manow, 2005). Therefore, most models report panel-corrected standard errors (PCSEs), which also correct for cross-section heteroskedasticity.

Another possibility is a unit root in the dependent variable (nonstationarity). I conducted Dickey-Fuller tests on all dependent variables and error terms and, with appropriate specification of lags and time trends, was able to reject nonstationarity for at least one panel in all models at $p < 0.1$.

Finally, unit heterogeneity has been a concern in TSCS research. Country fixed effects (CFEs) will purge any unobserved country-level heterogeneity. However, since fiscal federalism does not change over time in most countries, the CFE model will be a highly inefficient estimator. There is no choice but to trade off risk of bias for efficiency gains by excluding CFEs. Nevertheless, concerns about endogeneity due to omitted variable bias may remain and must be addressed. If fiscal federalism is correlated with unobserved factors not included in the models, it may pick up some of the effects of those variables, leading to biased coefficient estimates. To purge endogeneity, there are several options. The first is simply to include more control variables that may be correlated with both the key independent and dependent variables, which is the approach taken here. The “fixed-effects vector decomposition” approach assumes that time-varying variables are endogenous and should be de-meanned, but that time-invariant variables are exogenous (Beck, 2011; Breusch, Ward, Nguyen and Kompas, 2011; Plümper and Troeger, 2011). The Hausman and Taylor (1981) approach divides time-invariant variables into those assumed exogenous and endogenous and instruments for the latter with the time-varying variables in the model. While fiscal federalism correlates strongly with country area and population and ethnic and linguistic diversity, these instruments are insufficiently powerful to meet the stringent requirements for reduction of bias in instrumental-variables regression (so-called “Stock-Yogo tests” (Stock, Wright and Yogo, 2002)). Note that the inclusion of lagged dependent variables will control for each country’s starting position, picking up considerable cross-country heterogeneity. Including CFEs would make sense only if it were thought that each country had its own time trend.

Additional Statistical Tables

Table 1 shows the countries included in the analysis, along with country-averaged scores (for 1991-1999) on fiscal federalism excluding tax decentralization, regional concentration (“Herf.Ind.”), tax decentralization, expenditure decentralization from the IMF, government consumption, and social spending.

Table 1: Country Averages

Country	Fisc.Fed.	Herf.Ind.	Tax Dec.	Exp.Dec.	Gov.Cons.	Soc.Spdg.
Australia	0.49	0.23	0.225	0.426	18.5%	17.3%
Austria	0.50	0.15	0.036	0.316	19.3%	27.2%
Belgium	0.56	0.44	0.227	0.168	21.4%	26.2%
Bulgaria	0	1.00	..	0.183	16.3%	..
Canada	1.00	0.22	0.536	0.590	21.8%	19.0%
Cyprus	0	1.00	..	0.029	17.7%	..
Czech Rep**	0	1.00	..	0.196	21.1%	18.6%
Denmark	0.19	0.08	0.313	0.468	25.5%	27.9%
Estonia*	0	1.00	..	0.232	23.1%	..
Finland	0.004	1.00	0.277	0.350	23.2%	30.1%
France	0.06	0.02	0.193	0.175	23.4%	28.3%
Germany	0.50	0.11	0.071	0.407	19.4%	27.3%
Greece	0	1.00	0.002	0.039	14.4%	17.4%
Hungary	0.08	0.08	..	0.232	11.1%	..
Iceland	0	1.00	0.230	0.243	21.7%	16.2%
Ireland	0	1.00	0.027	0.256	16.0%	15.1%
Italy	0.13	0.29	0.046	0.225	18.9%	24.4%
Japan	0.04	0.04	0.349	0.448	15.0%	14.4%
Latvia†	0	1.00	..	0.241	22.2%	..
Lithuania**	0	1.00	..	0.256	21.2%	..
Luxembourg	0	1.00	0.085	0.150	15.9%	20.4%
Netherlands	0.05	0.13	0.045	0.263	22.8%	24.2%
New Zealand	0.08	0.14	0.056	0.101	18.2%	20.1%
Norway	0.19	0.07	0.256	0.333	21.7%	24.5%
Poland†	0	1.00	..	0.208	18.7%	22.3%
Portugal	0.01	0.52	0.029	0.112	18.0%	16.8%
Slovenia*	0	1.00	..	0.106	0.195	..
Spain	0.61	0.10	0.152	0.324	17.9%	21.3%
Sweden	0.14	0.05	0.452	0.339	27.9%	32.7%
Switzerland	1.00	0.08	0.558	0.489	11.6%	23.4%
UK	0.09	0.01	0.049	0.232	19.5%	20.3%
USA	1.00	0.04	0.379	0.474	15.5%	15.4%

Notes: *averages are for 1992-1999, **averages are for 1993-1999, †averages are for 1994-1999.

Table 2 presents results of sensitivity analyses of the government consumption models with additional social and economic controls, including a variable for traditional-secular values from the World Values Survey (Inglehart and Welzel, 2005). Tables 3, 4, and 5 report results from other robustness checks of models of different government spending categories: log-linear models, estimates with dummies created at different threshold values of fiscal federalism, and estimates on countries with positive values of fiscal federalism only, respectively. These models also use the alternative measure of fiscal federalism excluding tax decentralization. In general, the results are even

stronger on fiscal federalism and regional concentration in the government consumption equations when the variable used in the paper, which includes tax decentralization, is used. The critical values of fiscal federalism used for testing the effect of regional concentration in these tables are equivalent to those used in the paper: one standard deviation above the mean. Note that these are one-tailed tests; a two-tailed test on the marginal effect of regional concentration at high fiscal federalism in the government investment equations would consistently show a statistically significant, negative effect (i.e., that regional (de-)concentration at high fiscal federalism is associated with *less* (respectively, more) government investment).

Table 2: Government Consumption Sensitivity Analyses

Variable	Coef.(SE)	Coef.(SE)	Coef.(SE)	Coef.(SE)	Coef.(SE)	Coef.(SE)	Coef.(SE)
	no	no	no	yes	no	no	no
Fiscal federalism _{t-1}	-0.50(0.11)***	-0.55(0.12)***	-0.54(0.13)***	-0.46(0.14)**	-0.56(0.13)***	-0.44(0.20)*	-0.56(0.13)***
Herf. index _{t-1}	-0.13(0.09)	-0.08(0.08)	-0.08(0.08)	-0.09(0.07)	-0.09(0.08)	-0.06(0.13)	-0.10(0.08)
FF _{t-1} · HI _{t-1}	1.27(0.36)***	1.28(0.42)**	1.30(0.39)***	1.21(0.35)**	1.47(0.39)***	1.06(0.45)*	1.3(0.3)***
Real GDP per capita _t	-0.70(0.06)***	-0.61(0.05)***	-0.65(0.05)***	-0.50(0.08)***	-0.65(0.05)***	-0.68(0.08)***	-0.65(0.05)***
RGDPPC _{t-1}	0.90(0.12)***	0.84(0.10)***	0.88(0.10)***	0.64(0.12)***	0.88(0.10)***	0.90(0.16)***	0.89(0.10)***
RGDPPC _{t-2}	-0.02(0.16)	-0.13(0.12)	-0.10(0.13)	-0.08(0.13)	-0.10(0.13)	-0.09(0.21)	-0.10(0.13)
RGDPPC _{t-3}	-0.17(0.09)†	-0.09(0.07)	-0.13(0.07)†	-0.04(0.09)	-0.12(0.07)†	-0.11(0.12)	-0.12(0.07)†
Age dependency ratio _{t-1}	0.88(0.62)	1.06(0.54)*	0.92(0.53)†	0.22(0.54)	1.11(0.59)†	-0.54(0.89)	1.1(0.6)†
Expenditure decentr. _{t-1}	0.52(0.19)**	0.60(0.24)*	0.55(0.20)**	0.22(0.21)	0.56(0.21)**	-0.004(0.29)	0.56(0.21)**
Religious frac.	-0.29(0.13)*	-0.24(0.13)†	-0.25(0.12)*	-0.27(0.08)**	-0.28(0.12)*	-0.36(0.23)	-0.31(0.15)*
Gini ratio _t	-0.0064(0.0047)						
Trade/GDP _t		-0.026(0.009)**					
Trade/GDP _{t-1}		0.026(0.010)**					
Ln(Population) _{t-1}		0.012(0.021)					
Postsocialist			-0.10(0.17)				
Wars _{t-1}					0.059(0.044)		
Trad/secular						-0.03(0.08)	
New World							0.05(0.07)
Y _{t-1}	1.14(0.1)***	1.12(0.1)***	1.12(0.1)***	1.10(0.1)***	1.1(0.1)***	1.1(0.1)***	1.1(0.1)***
Y _{t-2}	-0.22(0.12)†	-0.22(0.11)*	-0.22(0.11)*	-0.19(0.07)*	-0.21(0.11)*	-0.23(0.16)	-0.21(0.11)*
Y _{t-3}	0.04(0.06)	0.06(0.06)	0.05(0.06)	0.053(0.045)	0.05(0.06)	0.07(0.08)	0.05(0.06)
Constant	0.64(0.51)	0.2(0.5)	0.41(0.40)	0.57(0.38)	0.29(0.44)	1.1(0.7)†	0.3(0.4)
Adjusted R ²	97.5%	97.3%	97.3%	97.5%	97.2%	97.1%	97.2%
N (countries)	698 (37)	808 (37)	808 (37)	808 (37)	808 (37)	500 (33)	808 (37)
P(βF + 0.036βF · H ≥ 0)	< 0.0001	< 0.0001	< 0.0001	0.0011	< 0.0001	0.0151	< 0.0001
P(βH + 0.564βF · H ≤ 0)	0.0013	0.0055	0.0009	0.0015	0.0003	0.0104	0.0004

Notes: See paper for confidence thresholds. Panel-corrected standard errors.

Table 3: Log-Linear Models of Government Spending

<i>Dependent variable:</i>	Govt. cons.	Soc. spdg.	Soc. trnsf.	Subsidies	Govt. inv.
Variable	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)
Fiscal federalism _{t-1}	-0.043 (0.011)***	-0.007 (0.007)	-0.0003 (0.01)	-0.017 (0.025)	0.003 (0.02)
Herf. index _{t-1}	-0.009 (0.008)	-0.006 (0.007)	-0.0001 (0.01)	-0.002 (0.020)	0.0002 (0.02)
FF _{t-1} ·HI _{t-1}	0.14 (0.04)***	-0.01 (0.03)	-0.029 (0.038)	0.13 (0.11)	-0.21 (0.10)*
Expenditure decentr. _{t-1}	3.0 (1.2)*	0.5 (1.2)	-2.2 (1.4)	7.6 (3.6)*	1.4 (3.0)
Y _{t-1}	1.11 (0.1)***	1.06 (0.1)***	1.20 (0.05)***	0.94 (0.01)***	0.91 (0.02)***
Y _{t-2}	-0.23 (0.14)†	-0.11 (0.06)†	-0.24 (0.05)***		
Y _{t-3}	0.07 (0.08)				
Constant	0.11 (0.07)	0.22 (0.05)***	0.27 (0.04)***	0.07 (0.08)	0.19 (0.09)*
Adjusted R ²	96.9%	98.4%	99.2%	93.9%	87.4%
N (countries)	808 (37)	545 (28)	506 (29)	825 (36)	821 (37)
P($\beta \ln F + 0.05\beta \ln F \cdot \ln H \geq 0$)	< 0.0001	0.086	0.421	0.696	0.344
P($\beta \ln H + 0.41\beta \ln F \cdot \ln H \leq 0$)	0.0001	0.767	0.800	0.106	0.992
Notes: All variables are in logs. Control variables suppressed for space. Panel-corrected standard errors.					

Table 4: Estimates with “Dummied” Fiscal Federalism

<i>Dependent variable:</i>	Govt. cons.	Soc. spdg.	Soc. trnsf.	Subsidies	Govt. inv.
Variable	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)
Fiscal federalism dummy _{<i>t</i>-1}	-0.32 (0.08)***	-0.03 (0.07)	0.05 (0.07)	0.001 (0.03)	0.0003 (0.04)
Herf. index _{<i>t</i>-1}	-0.07 (0.08)	-0.04 (0.10)	0.06 (0.08)	0.01 (0.03)	0.03 (0.1)
FFd _{<i>t</i>-1} ·HI _{<i>t</i>-1}	1.0 (0.3)**	-0.3 (0.3)	-0.02 (0.3)	0.16 (0.15)	-0.44 (0.20)*
Expenditure decentr. _{<i>t</i>-1}	0.36 (0.19)†	-0.05 (0.3)	-0.62 (0.30)*	0.18 (0.09)*	0.10 (0.13)
<i>Y</i> _{<i>t</i>-1}	1.13 (0.1)***	1.12 (0.1)***	1.24 (0.1)***	0.93 (0.01)***	0.92 (0.02)***
<i>Y</i> _{<i>t</i>-2}	-0.21 (0.11)†	-0.16 (0.06)**	-0.27 (0.06)***		
<i>Y</i> _{<i>t</i>-3}	0.05 (0.06)				
Constant	0.3 (0.4)	2.0 (0.7)**	1.9 (0.6)**	0.25 (0.09)**	0.08 (0.19)
Adjusted <i>R</i> ²	97.3%	98.3%	99.1%	93.6%	89.7%
N (countries)	808 (37)	545 (28)	506 (29)	825 (36)	821 (37)
P($\beta F + 0.036\beta F \cdot H \geq 0$)	< 0.0001	0.257	0.790	0.612	0.338
P($\beta H + \beta F \cdot H \leq 0$)	0.0014	0.816	0.438	0.137	0.979
Notes: See paper for confidence thresholds. Control variables suppressed for space. Panel-corrected standard errors.					

Table 5: Estimates on Observations with Nonzero Fiscal Federalism

<i>Dependent variable:</i>	Govt. cons.	Soc. spdg.	Soc. trnsf.	Subsidies	Govt. inv.
Variable	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)
Fiscal federalism _{t-1}	-0.53 (0.11)***	-0.02 (0.12)	0.01 (0.10)	0.001 (0.04)	-0.03 (0.06)
Herf. index _{t-1}	0.07 (0.10)	0.02 (0.15)	0.01 (0.08)	-0.07 (0.04)	-0.09 (0.07)
FF _{t-1} · HI _{t-1}	1.19 (0.37)**	-0.4 (0.5)	-0.24 (0.31)	0.13 (0.15)	-0.26 (0.25)
Expenditure decentr. _{t-1}	0.86 (0.20)***	0.2 (0.3)	-0.11 (0.27)	0.27 (0.11)*	0.04 (0.18)
Y _{t-1}	1.15 (0.1)***	1.12 (0.1)***	1.27 (0.1)***	0.96 (0.02)***	0.93 (0.02)***
Y _{t-2}	-0.36 (0.08)***	-0.16 (0.06)*	-0.29 (0.06)***		
Y _{t-3}	0.18 (0.05)***				
Constant	-0.97 (0.44)*	1.5 (0.8)*	1.13 (0.43)**	0.10 (0.10)	0.03 (0.2)
Adjusted R ²	97.5%	98.7%	99.3%	95.0%	94.2%
N (countries)	565 (23)	420 (21)	398 (20)	587 (22)	583 (22)
P($\beta F + 0.036\beta F \cdot H \geq 0$)	< 0.0001	0.373	0.527	0.564	0.214
P($\beta H + 0.564\beta F \cdot H \leq 0$)	0.0002	0.830	0.750	0.478	0.941

Notes: See paper for confidence thresholds. Control variables suppressed for space. Panel-corrected standard errors.

Here are results with multiple imputation (paper’s measure of fiscal federalism) (Table 6). Control variables suppressed for space. The following table (7) presents results on imputed data for random-effects models with year dummies instead of a single time trend.

Table 6: Multiple Imputation Estimates, 1960-2006

<i>Dependent variable:</i>	Govt. cons.	Soc. spdg.	Soc. trnsf.	Subsidies	Govt. inv.
Variable	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)
Fiscal federalism _{t-1}	-2.0 (0.6)***	-0.90 (0.60)	-1.2 (0.5)*	0.35 (0.17)*	0.08 (0.20)
Herf. index _{t-1}	-0.07 (0.08)	-0.28 (0.17)†	-0.23 (0.15)	-0.07 (0.04)†	0.01 (0.06)
FF _{t-1} ·HI _{t-1}	6.4 (2.2)**	0.3 (3.1)	1.2 (2.5)	-1.3 (0.8)†	-1.3 (0.8)
Expenditure decentr. _{t-1}	0.41 (0.42)	0.29 (0.44)	-0.07 (0.38)	0.26 (0.13)*	0.005 (0.2)
Y _{t-1}	0.95 (0.1)***	0.91 (0.02)***	0.93 (0.01)***	0.84 (0.02)***	0.71 (0.06)***
Y _{t-2}	0.001 (0.11)				0.21 (0.16)***
Y _{t-3}	-0.05 (0.2)				
Constant	1.3 (0.5)*	2.8 (0.7)***	2.2 (0.7)***	0.37 (0.08)***	0.40 (0.19)*
N (countries)	1182 (39)	1264 (39)	1264 (39)	1264 (39)	1223 (39)
P($\beta F + 0.036\beta F \cdot H \geq 0$)	< 0.001	0.047	0.007	0.975	0.568
P($\beta H + 0.260\beta F \cdot H \leq 0$)	0.003	0.600	0.445	0.981	0.930

Notes: See paper for confidence thresholds. Control variables suppressed for space. Panel-corrected standard errors.

Table 7: Multiple Imputation Estimates, Random-Effects Models with Year Dummies, 1960-2006

<i>Dependent variable:</i>	Govt. cons.	Soc. spdg.	Soc. trnsf.	Subsidies	Govt. inv.
Variable	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)
Fiscal federalism _{t-1}	-1.4 (0.4)***	-0.8 (0.8)	-1.1 (0.5)*	0.3 (0.6)	0.02 (0.16)
Herf. index _{t-1}	-0.08 (0.07)	-0.31 (0.24)	-0.22 (0.15)	-0.03 (0.05)	0.05 (0.04)
FF _{t-1} ·HI _{t-1}	4.8 (1.4)***	0.3 (3.5)	1.3 (2.1)	-1.3 (2.6)	-1.1 (0.7)†
Expenditure decentr. _{t-1}	0.2 (0.3)	0.3 (0.5)	-0.07 (0.3)	0.23 (0.14)†	-0.12 (0.17)
Y _{t-1}	0.97 (0.1)***	0.91 (0.02)***	0.93 (0.02)***	0.80 (0.1)***	0.70 (0.1)***
Y _{t-2}	0.04 (0.1)				0.21 (0.06)***
Y _{t-3}	-0.06 (0.05)				
N (countries)	1182 (39)	1264 (39)	1264 (39)	1264 (39)	1223 (39)
P($\beta F + 0.036\beta F \cdot H \geq 0$)	< 0.001	0.137	0.007	0.700	0.454
P($\beta H + 0.260\beta F \cdot H \leq 0$)	0.001	0.595	0.401	0.703	0.927

Notes: See paper for confidence thresholds. Control variables suppressed for space. Robust standard errors clustered on countries.

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