Is there a Laffer Curve between Private Output and Public Sector Employment?

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How does government spending affect total output or output growth? At the theoretical level the relationship is a priori ambiguous. On the one hand, one can argue for a positive relationship due to the direct and/or indirect productivity effects of government investments in infrastructure. On the other hand, the relationship may be negative due to distortionary taxation which is used to finance government expenditure or due to the crowding out of investment and/or output in the private sector. It is reasonable to argue that the relationship between output and government expenditures may be non-linear; when government size is "small enough", the positive productivity effects will quite likely dominate, while the distortionary and crowding out effects start to dominate when government size becomes "large enough".

Relationship between public sector employment and private output

In Koskela-Viren (2000) a simple theoretical and numerical analysis is carried out, where a non-linear relationship between public sector employment and total output is demonstrated. The model is "classical" with some additional features. Private output is produced by private labour. Public employment affects private output both directly and via the private labour demand by increasing the marginal product of labour. We assume that there is some inter-sectoral rigidity in real wages. Private labour demand and output supply depend negatively on the real wage and positively on public employment, while labour supply is a non-negative function of the net real wage. The tax rate is determined by the public sector resource costs. A rise in public employment increases public production and raises private supply of goods via increasing the marginal productivity of private labour. But also labour demand and the tax rate will increase and labour supply goes down. For both of these reasons the real wage tends to rise so that private demand for labour and private production will be crowded out via the real wage effect.

One can conjecture as follows: When the share of public employment in total employment is "small", the positive marginal productivity effects dominate the negative distortionary and crowding out effects due to the response of taxes and real wages to changes in public employment, and the other way round when the share is "large".[1]

Some empirical evidence

We use data on two observable variables, public sector employment L_g and private sector output D. The data cover the period 1960–1996 from 22 OECD countries with some minor exceptions.[2] We started the empirical analysis by estimating a simple linear VAR-type model

$$\Delta \log D_t = \alpha + \beta \Delta \log L_{g,t-1} + \gamma \Delta \log D_{t-1} + u_t,$$

where u refers to the error term. There seemed to be no clear pattern in the sign of the coefficient of public employment and it was never significant in the linear model.

An obvious way to try to account for the potential non-linearity between public sector employment and private sector output is to use the so-called threshold model, where the coefficients of the independent variables are allowed to vary depending on the value of the threshold variable. The simplest way to account for this kind of switching phenomenon is to fit the following type of non-linear specification to the data

$$\Delta \log D_t = \alpha + \beta_1 \Delta \log L_{g,t-1} + \gamma \Delta \log D_{t-1} + e_t, \quad \text{if } G/Y \leq (\hat{G}/\hat{Y}) \qquad (1a)$$

$$\Delta \log D_t = \alpha + \beta_2 \Delta \log L_{g,t-1} + \gamma \Delta \log D_{t-1} + e_t, \quad \text{if } G/Y > (\hat{G}/\hat{Y}) \qquad (1b)$$

where e refers to the error term and $(\hat{G}/\hat{Y})$ denotes the threshold value of the size of the public sector.

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[1] Barro (1990) has developed a similar type of argument in a constant-returns model of economic growth where is a trade-off between the productivity effect of public services as an input to private production and the negative distortionary effect of taxes which are used to finance those public services.

[2] Private sector output is measured either by "GDP-public consumption" or by "GDP-public sector production" and public sector employment by the number of employees in the "producers of government services" sector.

It is assumed in (1a–1b) that the coefficient of the lagged dependent term does not depend on the size of the public sector. A set of estimation results from the threshold specification (1a–1b) with the exception of the coefficient of the lagged dependent term are presented in Table 1, where G/Y has been used as the threshold variable.

Table 1

Threshold model estimation results. G/Y as the threshold variable

Country	$\hat{\beta}_1$	$\hat{\beta}_2$	SEE/DW	FHO	FHT	LM
Australia	.365	.049	.025	18.9	9.7	2.14
	(1.74)	(0.51)	(2.069)	(.051)	(.016)	(.154)
Austria	.580	–.568	.019	20.4	11.52	0.39
	(1.71)	(1.69)	(1.759)	(.046)	(.003)	(.538)
Belgium	.690	–.119	.023	36.7	7.5	0.120
	(2.34)	(0.48)	(2.159)	(.000)	(.119)	(.283)
Canada	.370	–.751	.027	4.9	4.3	2.86
	(1.57)	(1.26)	(1.714)	(.865)	(.663)	(.104)
Denmark	.113	–.700	.024	19.2	7.2	1.63
	(0.80)	(2.86)	(1.833)	(.046)	(.167)	(.212)
Finland	.458	–1.144	.032	10.6	3.6	1.25
	(1.68)	(2.25)	(1.648)	(.308)	(.876)	(.274)
France	1.417	.121	.017	12.9	8.7	.002
	(3.23)	(0.25)	(1.961)	(.270)	(.028)	(.966)
Germany	–.063	–1.537	.023	14.6	6.3	0.98
	(0.80)	(3.64)	(1.767)	(.138)	(.283)	(.331)
Greece	.933	–.354	.031	26.6	11.6	0.16
	(1.98)	(1.39)	(1.734)	(.007)	(.003)	(.696)
Iceland	.138	–1.021	.040	5.25	3.8	0.95
	(0.61)	(1.61)	(1.813)	(.862)	(.830)	(.338)
Ireland	–.109	–.941	.029	7.1	7.2	0.04
	(0.44)	(1.89)	(1.947)	(.697)	(.177)	(.845)
Italy	1.278	.293	.022	12.7	5.9	0.89
	(3.28)	(0.99)	(1.785)	(.221)	(.415)	(.354)
Japan	1.325	–.880	.024	24.3	6.8	2.74
	(2.16)	(2.55)	(2.366)	(.024)	(.237)	(.108)
Netherlands	.156	–1.617	.013	24.6	6.3	0.27
	(0.67)	(4.37)	(1.868)	(.040)	(.210)	(.605)
New Zealand	.418	–.697	.037	15.8	6.1	.04
	(1.06)	(1.69)	(2.047)	(.129)	(.360)	(.853)
Norway	.448	.159	.019	7.6	7.3	5.05
	(1.54)	(1.01)	(1.642)	(.663)	(.131)	(.033)
Portugal	.169	–.153	.032	7.7	3.5	0.28
	(1.37)	(1.23)	(2.076)	(.521)	(.935)	(.603)
Spain	.186	–.172	.020	17.6	5.8	0.31
	(1.14)	(1.57)	(2.272)	(.096)	(.359)	(.584)
Sweden	.330	–.123	.022	12.8	7.7	3.99
	(1.90)	(0.88)	(1.673)	(.222)	(.117)	(.055)
Switzerland	.325	–.904	.022	15.2	5.4	7.51
	(1.06)	(2.05)	(1.407)	(.106)	(.449)	(.010)
UK	.628	–.131	.024	7.9	4.6	12.41
	(1.74)	(1.04)	(1.488)	(.636)	(.681)	(.002)
USA	.551	–.008	.024	8.8	3.9	10.72
	(1.62)	(0.03)	(1.594)	(.491)	(.876)	(.003)

Numbers inside parentheses below the coefficient estimates are t-ratios. SEE is the standard error of estimate and DW the Durbin-Watson test statistic. FHO denotes the LM (F) test for no threshold and FHT the corresponding test for threshold allowing for heteroskedastic errors. Numbers inside parentheses below the F statistics are bootstrap probability values. Finally, LM denotes a LM test for first-order autocorrelation of residuals with corresponding marginal significance levels inside parentheses.

The following features of results merit attention. The threshold model fits the data much better than the linear model in terms of diagnostics, and the coefficient estimates of the public employment are now considerably more precise. Finally, the coefficient of β_1 is usually positive and in all cases larger than the coefficient β_2; i.e. as the public sector gets larger, the effect of public sector employment on private output gets smaller and even negative. All in all, estimation results from the linear and threshold specifications give at least weak support to the hypothesis according to which the relationship between public sector employment and private output is non-linear; positive for "small" public sector and negative for "large" public sector. See also the figure below, which describes the threshold estimation results.

In order to alleviate the problem of small sample size with single country models and increase the efficiency of estimation (by using the SUR estimator) we also estimated the model using pooled panel data from the same set of countries by using a multiplicative specification of the following form

$$\Delta \log D_t = \alpha + \beta \Delta \log L_{g,t-1} + \gamma \Delta \log D_{t-1} + \phi\, H_t \cdot \Delta L_{g,t-1} + e_t \qquad (2)$$

where H denotes the threshold variable (either G/Y, G/C or L_g/L). According to (2), the public employment effect depends on the interaction term $H_t \cdot \Delta L_{gt-1}$ and thus on the size of the government sector so that we might expect ϕ to be negative. Using this specification we can compute the critical value of this variable at which public sector employment growth has zero effect on private sector output growth. The estimation results in Table 2 lie in conformity with the results from individual country regressions reported in Table 1. When the size of the public sector increases, the employment effect diminishes and, after some critical value, becomes negative. The implied critical values are, in fact, quite close to the average threshold values obtained in the context of threshold model estimations.

EFFECT OF PUBLIC SECTOR EMPLOYMENT ON PRIVATE SECTOR OUTPUT

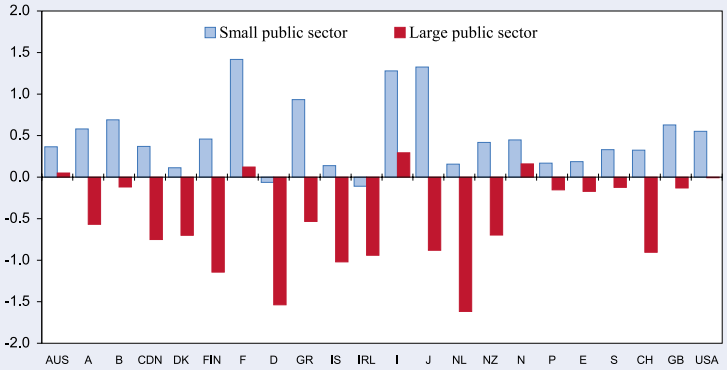

Table 2 **Estimation results with panel data**

	β/β_1	β_2	γ	ϕ	SEE/R^2	$\hat{H}$
Linear	–.020		.294		.028	–
	(0.12)		(8.59)		0.171	
G/Y	.131	–.058	.325		.027	0.157
Threshold	(2.64)	(1.35)	(9.35)		0.185	
G/C	.044	–.037	.293		.028	0.211
Threshold	(1.65)	(1.71)	(8.57)		0.175	
L_g/L	.072	–.060	.294		.028	0.152
Threshold	(2.86)	(2.82)	(8.68)		0.178	
Eq (2) with	.404		.281	–2.460	.028	0.164
H = G/Y	(5.55)		(8.35)	(5.85)	0.186	
Eq (2) with	.299		.292	–1.400	.028	0.213
H = G/C	(3.98)		(8.62)	(4.23)	0.178	
Eq (2) with	.197		.291	–1.324	.028	0.149
$H = L_g/L$	(4.13)		(8.65)	(4.55)	0.178	

Estimates are SUR estimates consisting of 736 data points. Equations include country intercepts, which are not reported. The threshold models (columns 2–4) are estimated using the average values of the threshold variable from the single country models. With the multiplicative model (the last three sets of estimates) the "threshold values" are derived from the estimates of β and ϕ.

Conclusion

Empirical evidence using data from 22 OECD countries over the period 1960(1996 concerning the relationship between public sector employment and private sector output seems to lie in conformity with the nonlinearity hypothesis. While the linear model cannot explain anything, the threshold model gives results according to which the public sector employment effect on private output depends on the size of the public sector and decreases or even turns negative when the public sector grows.

References

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