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Sub Title	
Author	BAIRAM, Erkin I.
Publisher	Keio Economic Society, Keio University
Publication year	1988
Jtitle	Keio economic studies Vol.25, No.1 (1988.) ,p.59- 66
JaLC DOI	
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Notes	
Genre	Journal Article
URL	https://koara.lib.keio.ac.jp/xoonips/modules/xoonips/detail.php?koara_id=AA00260492-19880001-0059

GOVERNMENT EXPENDITURE AND ECONOMIC GROWTH: REFLECTIONS ON PROFESSOR RAM'S APPROACH, A NEW FRAMEWORK AND SOME EVIDENCE FROM NEW ZEALAND TIME-SERIES DATA

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Abstract. In this paper the approach taken by Ram (1986) to study the impact of government size on economic growth is examined. It is shown that the models used by Ram cannot measure the impact of increase in government expenditure on economic growth. An alternative framework, based on the conventional demand theory, is also proposed and tested using annual time-series data on New Zealand.

I. INTRODUCTION

In the 1980's in many Western countries the pro-market approach to economic growth has become government policy. The supporters of this approach to economic growth have successfully argued that a large government size generates inefficiency and reduces the size of the more efficient private sector through its adverse effects on private consumption and investment. The advocates of the pro-market approach rarely admit that government size can be a powerful engine of growth. In particular they totally ignore the fact that government can increase productive investment and generate additional demand and, consequently, can accelerate economic growth. Recently Professor Ram (1986) has attempted to test the impact of government expenditure on economic growth using, for the first time, a framework based on production theory. Unfortunately, his approach has important limitations and it cannot be used to make reliable predictions about the impact of government size on economic growth.

This study has two major objectives. The first is to show the limitations of Ram's approach, while the second is to specify and test a new model based on demand theory. The model is tested using annual time-series data for New Zealand covering the period 1960–80.

The outline of the paper is as follows. In Section II Ram's framework and its limitations are discussed and the new framework is introduced. In Section III the new framework is tested on New Zealand economy and the policy implications of

* This study is one in a series of analysis by the author based on New Zealand data. The research is supported by a University of Otago research grant. The author would like to thank Ms Christina Cregan for preparing the data and to Assoc. Prof. J. M. Howells and Dr. Paul Dalziel for their helpful comments.

these results are analysed. Finally, in Section IV the conclusions of the study are summarised.

II. RAM'S APPROACH, ITS LIMITATIONS AND A NEW FRAMEWORK

Rati Ram has recently examined the role of government size in economic growth in seventy developed and underdeveloped countries. For this purpose he used Summers and Heston's (1984) cross-section and annual time-series data covering the period 1960–80 and the following models:

$$gY = \lambda + \alpha(I/Y) + \beta gL + \theta gG \tag{1}$$

and

$$gY = \lambda + \alpha(I/Y) + \beta gL + \upsilon gG(G/Y) \tag{2}$$

where Y, I, L and G are total output (GDP), private investment, population and government expenditure, respectively; gX denotes the growth rate of the relevant variable, $X = Y$, G or L—i.e. $gX = \Delta X/X$.

Ram derived equations (1) and (2) using a two sector [government (G) and non-government (NG), where $Y \equiv G + NG$] production function framework "... adapted from the reasoning developed by Gershon Feder (1983, pp. 61–67)" Ram (1986, p. 192). λ is the rate of technical change (therefore $\lambda = 0$ if cross-section data is used) and α and β are the elasticities of non-government output with respect to labour and capital, respectively. Ram showed that in his framework υ can be interpreted as total elasticity of non-government output with respect to G, and θ can be interpreted as the externality effect of government size (i.e. $\upsilon > \theta$).[1]

Ram's derivations and interpretations of θ and υ would be most persuasive were it not for the fact that gY is *definitionally* related to gG.

To show this, total output, Y, may be defined as:

$$Y \equiv G + NG \tag{3}$$

where G and NG denote government and non-government output, respectively.

Hence, the growth of total output, gY, is given by:

$$gY \equiv wgG + (1 - w)gNG \tag{4}$$

where w is the share of government in total output.

If equation (4) to be estimated the coefficient w could be unambiguously interpreted as the share of G in Y. This suggests that, if (I/Y) and gL do not vary significantly between countries or in a given country over time [or if $\alpha + \beta = (1 - w)$], θ in equation (1) is a biased estimate of w for the group of countries studied using cross-country data or for the individual country studied

[1] Derivations and more detailed interpretations of the models and the parameters can be found in Feder (1983), Ram (1986) and Bairam (1987, 1988).

using annual time series data.[2]

The present investigator explicitly tested the hypothesis: $\theta = w$ using annual time-series data on the New Zealand economy and equation (1).[3] For the period 1960–80 equation (1) takes the form:

$$gY = -.04 - 2.92^{-5}(I/Y) + 3.80gL + .12gG \qquad (5)$$
$$\qquad (.02) \qquad\qquad (3.07) \quad (1.46)$$
$$\bar{R}^2 = .394; \quad F = 5.34; \quad DW = 2.14$$

(t statistics in parentheses).

It can be seen from equation (5) that α is not significantly different from zero. But this is not surprising because, as it is emphasised earlier, (I/Y) is constant over time for many countries and New Zealand is no exception. Indeed the insignificance of α gives some support to the supposition that θ can be a biased estimate of w. The hypothesis that $\theta = w$ can further be tested by comparing the estimated θ with the average share of government in total output $(\bar{w})$ for the period 1960–80.[4] The average value of $\bar{w}$ calculated from the data is .12 (with a standard deviation of .03). This is exactly equal to the value of θ obtained, implying that $t = 0$, hence confirming that θ estimated only measures the share of G in Y. This suggests that θ implies nothing about the externality role of government size in economic growth.

Turning next to equation (2), it is easy to show that the υ values obtained from this model are also misinterpreted by Ram. Since $w = G/Y$, equation (2) can be written as:

$$gY = \lambda + \alpha(I/Y) + \beta gL + \upsilon wgG. \qquad (6)$$

This specification suggests that if it can be shown that $\upsilon = 1$, wgG still only represents the share of the government sector in economic growth and does not imply anything about total or externality contributions of government size to economic growth. In order to test the hypothesis $\upsilon = 1$ [i.e. gG is just the part of a misspecified identity—equation (4)], equation (2) is estimated using annual time-series data for New Zealand for the period 1960–80:

$$gY = -.04 - 3.21^{-5}(I/Y) + 3.90gL + .90gG(G/Y) \qquad (7)$$
$$\qquad (.02) \qquad\qquad (3.16) \quad (1.42)$$
$$\bar{R}^2 = .390; \quad F = 5.27; \quad DW = 2.14.$$

[2] There exists significant empirical evidence that suggests I/Y and gL are very stable over time and I/Y does not greatly vary between countries [see, for example, Gomulka and Sylwestrowicz (1976, p. 567, Table 7)].

[3] The New Zealand data used throughout this study are from Summers and Heston (1984). All the variables are in 1975 constant prices. Annual rates of growth are approximated by first differences of the logarithms of the variable values for successive years.

[4] The appropriate test statistic is; $t = (\theta - \bar{w})/SE(\theta)$.

It is clear from the equation that the null hypothesis $\upsilon = 1$ cannot be rejected at the 5 percent test level. This implies that the model in equation (2), like the model in equation (1), is just a misspecified identity. It measures the share of G in Y and, unfortunately, suggests nothing more about the role of gG in gY.

The present investigator believes that the following specifications which use the demand-oriented approach to economic growth as their underlying theoretical structure are more appropriate to test the role of government sector in economic growth:

$$gI = f[gL \text{ or } gY,\ g(Pc/Pi),\ gG] \tag{8}$$
$$\quad (+)\quad (+)\quad (+)\quad (?)$$

and

$$gC = f[gL \text{ or } gY,\ g(Pc/Pi),\ gG] \tag{9}$$
$$\quad (+)\quad (+)\quad (-)\quad (?)$$

where gI, gC, $g(Pc/Pi)$ are changes in private investment, consumption and the relative price ratio of consumption to investment over time, respectively. All the other variables are defined as before.

Equations (8) and (9) together are more appropriate to test the externality effect of government on the private sector (investment and consumption) than Ram's specifications because gI and gC are *not* definitionally related to gG. The signs suggested by the conventional demand theory are given below each variable. Theory suggests that gY is the best proxy for estimating the income elasticity of demand, unfortunately using this variable is problematic because, as shown earlier, gY is definitionally related to gG which is one of the other explanatory variables. If gY and gG were used together it may cause severe multicollinearity and may also bias the estimates coefficients of gG which are the most important parameters in specifications (8) and (9). To overcome this problem models will also be used which replace gY with growth in population, gL, as an explanatory variable. The latter variable can be interpreted as the measure of growth in market size. Like, gY, it is expected to have a positive sign as it is reasonable to assume that an increase in market size and, hence in demand, will have a positive effect on gI and gC.

III. ROLE OF GOVERNMENT IN ECONOMIC GROWTH: THE NEW ZEALAND EXPERIENCE, 1960–80

For the New Zealand economy using Summers and Heston (1984) annual time-series data the following specifications were estimated:

$$gI = \pi + \eta gL + \psi g(Pc/Pi) + \phi gG \tag{10a}$$

$$gI = \pi + \varepsilon gY + \psi g(Pc/Pi) + \phi gG \tag{10b}$$

TABLE 1. THE EXTERNALITY EFFECT OF GOVERNMENT SECTOR ON PRIVATE INVESTMENT: ESTIMATED EQUATIONS FOR THE NEW ZEALAND ECONOMY, 1960–80

	π	η	ε	ψ	ϕ	$\bar{R}^2$	σ	DW	Estimator
(1a)	−.03				1.18	.227	.121	1.75	*OLS*
	(−.95)				(2.57)*				
(1b)	−.03				1.17		.121	1.73	*IV*
	(−.89)				(2.48)*				
(1c)	−.03				1.05		.131	1.95	*ML*
	(−.70)				(2.32)*				
(2a)	−.28	15.93		0.30	0.93	.513	.096	2.38	*OLS*
	(−3.05)*	(2.81)*		(1.55)	(2.45)*				
(2b)	−.23	14.65		0.34	0.90		.094	2.43	*IV*
	(−2.79)*	(2.61)*		(1.76)†	(2.57)*				
(2c)	−.29	16.23		0.32	1.06		.083	2.03	*ML*
	(−4.32)*	(3.91)*		(1.73)†	(3.33)*				
(3a)	−.10		3.12	0.42	0.65	.660	.080	2.40	*OLS*
	(−3.81)*		(4.27)*	(2.83)*	(1.96)†				
(3b)	−.13		3.01	0.46	0.67		.081	2.43	*IV*
	(−3.44)*		(4.23)*	(2.81)*	(1.98)†				
(3c)	−.10		3.27	0.54	0.52		.070	2.18	*ML*
	(−5.28)*		(5.64)*	(3.56)*	(2.76)*				

Data source: Summers and Heston (1984).

Notes: *OLS*, *IV*, and *ML* denote Ordinary Least Squares, Instrumental Variable and Maximum Likelihood estimators, respectively. The t-statistics (and for the *ML* results asymptotic t-statistics) are shown in the parentheses. * and † denote the estimated coefficient is statistically significant and least 5 percent and 10 percent, respectively. σ and DW are the standard error of the equation and Durbin-Watson statistic, respectively.

and

$$gC = \tau + vgL + \mu g(Pc/Pi) + \rho gG \tag{11a}$$

$$gC = \tau + \gamma gY + \mu g(Pc/Pi) + \rho gG \tag{11b}$$

All the variables are defined as before. The annual growth rates are approximated by first differences of the logarithms of the variable values of successive years.

The *OLS* and instrumental variable (*IV*) estimates of the above specifications are reported in Tables 1 and 2. The latter method is used to allow for measurement errors and simultaneity biases. However it can be seen from the results presented that the *IV* method used provides parameter estimates very similar, if not identical, to those obtained using *OLS*.[5] This suggests the biases induced by measurement errors and/or simultaneity are not large-which is reassuring because it implies that

[5] The instrumental variable estimates reported in Tables 1 and 2 are those obtained using Durbin's (1954) ranking method. But initially the same specifications were also estimated using Wald's and Bartlett's grouping methods. The results obtained using these latter methods (not reported) are remarkably close to those given by Durbin's ranking method.

TABLE 2. THE EXTERNALITY EFFECT OF GOVERNMENT SECTOR ON PRIVATE CONSUMPTION: ESTIMATED EQUATIONS FOR THE NEW ZEALAND ECONOMY, 1960–80

	τ	ν	γ	μ	ρ	$\bar{R}^2$	σ	DW	Estimator
(1)	.02				0.23	.021	.051	2.02	*OLS*
	(1.28)				(1.19)				
(1b)	.02				0.24		.052	2.04	*IV*
	(1.27)				(1.17)				
(2a)	−.02	0.58		−.23	0.15	.235	.045	2.07	*OLS*
	(−.52)	(.98)		(−2.61)*	(0.88)				
(2b)	−.03	0.57		−.25	0.14		.046	2.08	IV
	(−.47)	(1.01)		(−2.59)*	(0.87)				
(3a)	−.01		1.17	−.20	−.01	.588	.033	1.90	*OLS*
	(−.84)		(3.98)*	(−3.12)*	(−.02)				
(3b)	−.02		1.18	−.21	−.02		.034	1.92	*IV*
	(−.81)		(3.97)*	(3.13)*	(−.03)				

Data source and notes: See Table 1.

the *OLS* estimates are not inefficient.

It can be seen from Table 1 that all the estimated coefficients but one [ψ in equation (2a)] are statistically significant at least 10 percent level. Furthermore, the signs of the estimates η, ε and ψ coefficients are consistent with the conventional demand theory. However, it is important to note that some of the equations reported in Table 1 *may* suffer from serial correlation. Durbin-Watson test results for the *OLS* estimates are inconclusive. Consequently, the specifications are also estimated using the Maximum Likelihood (*ML*) technique based on Cochrane-Orcutt procedure developed by Beach and MacKinnon (1978). Equations (1c), (2c) and (3c) reported in Table 1 are corrected for autoregressive error terms using this *ML* procedure. It is easy to check from the Durbin-Watson statistics reported the removal attempt was successful. At the 0.95 confidence level the null hypothesis (no serial correlation) is accepted for all the specifications estimated. It can also be seen that the *ML* estimates of the parameters, as expected, have smaller standard errors and, hence, larger t-statistics. However, the *ML* estimates reported do not change the conclusions to be drawn from the results.

Turning to the interpretation of the estimated ϕ coefficients, it is clear from the results reported in Table 1 that —regardless of the specification and estimation techniques used— they suggest increases in government expenditure accelerates private investment. That is to say increase in government size has a positive externality effect on investment and, hence, eventually, on economic growth. This conclusion drawn from the results is clearly inconsistent with the pro-free market approach taken by the present New Zealand government. The results presented in Table 1 refute the view that suggests a growth in government expenditure hurts economic growth.

Turning next to the results reported in Table 2, it can be seen that the estimated income/market size as well as price elasticities all have correct signs and, what is more, with the exception of the v estimates reported, they are all statistically significant at 5 percent level. Finally, the Durbin-Watson statistics reported yield test results that suggest serial-correlation is not a problem. The estimated government externality coefficients, ρ, reported are not significantly different from zero. These results, therefore, imply that growth in consumption is only determined by growth in income and changes in relative prices; and changes in government expenditure have no significant effect on consumption. Nevertheless, the estimates reported in Table 2 are still interesting because they clearly refute the 'crowding out' hypothesis and, hence, the pro-market approach to economic growth.

IV. CONCLUSION

In this paper the author discussed the approach taken by Professor Ram to study the impact of government size on economic growth. It is shown that the models used by Ram cannot measure the impact of increase in government expenditure on economic growth. The present investigator proposed an alternative framework based on the conventional demand theory and tested it using annual time-series data on New Zealand.

The estimated equations for the New Zealand economy suggest that an increase in government expenditure has *no* adverse effect on consumption and, what is more, it *accelerates* private investment. Therefore, the results obtained refute the pro-market approach to economic growth which suggests that an increase in government size hurts economic growth.

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