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Government expenditure on public order and safety, economic growth and private investment: Empirical evidence from the United States☆

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ABSTRACT

The analysis begins by using annual data for the US from 1959 to 2003 to examine the macroeconomic relationship between government expenditure on public order and safety, output and investment. In practice, total spending on public order and safety is divided up into four categories (police force, fire service, law courts and prison service) so in the second part of the analysis we test for Granger causality between output, investment and each category of spending. But the division of aggregate spending may give rise to trade-offs/complementarities so in the final part of the analysis Granger causality tests are used to investigate this issue. Among other things, the results suggest that changes in output Granger cause changes in total spending on public order and safety. In particular, when total spending is disaggregated the findings suggest that changes in output Granger cause changes in spending on the police force and the law courts.

1. Background

According to the Solow (1956) neoclassical theory of economic growth the long-run growth rate is exogenous. Specifically, the long-run growth rate depends solely on autonomous technological progress. Therefore, in the above theory a change in government expenditure will only have an impact on the transition towards the long-run growth rate. But a number of economists were not comfortable with the idea of an exogenous growth rate. This motivated, among others, Romer (1986) and Lucas (1988) to develop theories where the long-run growth rate is determined endogenously.

Barro (1990) was the first to explicitly model government expenditure in a theory of endogenous growth. In this theory the long run rate of growth depends on, among other things, the structure of government expenditure. The structure of government spending refers to the proportion of spending that is productive/non-productive. Barro, however, does not formally classify expenditure on for example, defence, education, etc. as productive or non-productive in the theoretical modelling. Having said this, he does make some conjectures about the productivity of some categories of government spending. These conjectures are now discussed in more detail.

Drawing on the results reported in Aschauer (1989), Barro predicts that investment in infrastructure will be one category of spending that is productive. Specifically, the coefficient on the aggregate infrastructure variable in the Aschauer study ranges from 0.34 to 0.49. The implication is that a 1% increase in public spending on aggregate infrastructure will lead to at least a 0.34% increase in private sector productivity. But such a large elasticity seems implausible and is almost certainly because Aschauer uses level data on productivity and infrastructure expenditure which is non-stationary. Using non-stationary data can lead to spurious relationships (Granger & Newbold, 1974). When Tatom (1991) and Holtz-Eakin (1994) carry out unit root tests on similar data they find that the level series are non-stationary. Moreover, when Tatom and Holtz-Eakin use stationary first differenced data they both find that the coefficient on the aggregate infrastructure variable is not significant. In light of the above, unit root tests are carried out in this paper to establish if a series is stationary.[1] Barro also predicts that expenditure on law and order will be productive because it reinforces property rights. This assertion is formally tested here. It may be the case of course that expenditure on public order and safety does not cause growth and causality actually runs in the opposite direction, i.e. reverse causality.

One way of financing an increase in expenditure on public order and safety is by cutting spending in another area such as defence, education, etc. This paper will therefore complement studies of the

☆ The views expressed in this paper, however, are entirely my own and I take full responsibility for any errors and omissions.

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[1] It is beyond the scope of this paper to review the literature on infrastructure productivity in detail because it is so vast. For an extensive recent survey of this literature see Romp and de Haan (2005).

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relationship between output and other areas of government expenditure, e.g. defence (Dunne & Vougas, 1999; Karagol & Palaz, 2004; Kollias, Naxakis, & Zarangas, 2004), health (Gerdtham & Löthgren, 2000) and transport (Glass, 2008). A brief look at the government expenditure data for the US also highlights why an analysis of the relationship between spending on public order and safety and the macroeconomy is worthwhile. Over the period 1993–2003 there was a 90% increase in government spending on public order and safety in the US. This compares to an increase in government expenditure on defence, education, health and transport of 37%, 75%, 31% and 74%, respectively. Further in this paper, the salient features of the data on government spending on public order and safety are discussed in more detail.

All the above studies of the relationship between output and government spending on defence, health and transport test for cointegration, i.e. test for a long-run relationship between two or more variables. This approach is also used here. For the US, Cullison (1993) examines the relationship between economic growth and 21 categories of government spending, one of which is civilian safety.[2] He finds that only two categories of government spending have a statistically significant effect on economic growth—education and labour training. But although Cullison fits a vector autoregression (VAR) he does not test for cointegration or reverse causality. In this paper we follow the above study by Glass as opposed to the aforementioned defence and health expenditure papers. This is because the above defence and health papers only analyse the relationship between output and total spending on defence and health. Glass on the other hand analyses the productivity of aggregate transport spending and the productivity of its four constituent parts (waterways, highways, public transit and railways, and aviation).[3]

The direction of any causality between output/investment and total expenditure on public order and safety is investigated in the first part of the empirical analysis. In practice, however, total spending on public order and safety is divided up into four categories: the police force, the fire service, the law courts and the prison service. The direction of any causality between output/investment and each of the above four categories is examined in the second part of the empirical modelling. But there may be trade-offs/complementarities between the four categories which could have implications for output and investment. Typically, studies test for trade-offs/complementarities between defence, health and education expenditures at the aggregate level (Apostolakis, 1992; Davis & Chan, 1990; Deger, 1985; Hess & Mullan, 1988; Yildirim & Sezgin, 2002). In light of this, in the final part of the empirical analysis Granger causality tests are used to establish if there are trade-offs/complementarities at a more disaggregate level.

The full layout of the remainder of this paper is as follows. In Section 2 the methodology is briefly described and in Section 3 the salient features of the data set are analysed. The results for the aggregate, disaggregate and trade-off analyses are then presented and discussed in Sections 4–6, respectively. Finally, in Section 7 the empirical findings are used to make some recommendations about the allocation of the US government budget.

[2] In the Cullison study defence expenditure is a separate category of spending and is not part of the civilian safety category.

[3] Moreover, unlike the above defence and health papers Glass also examines the relationship between spending and investment. It should be noted though that some studies in the defence economics literature focus solely on the relationship between defence expenditure and private investment (e.g. Gold, 1997).

2. Methodology

There are four stages to each part of the empirical analysis: (i) testing for a unit root; (ii) testing for cointegration; (iii) testing for Granger causality; and (iv) an impulse response function.[4] All four stages are now briefly described because a lot of the material is covered in detail in various textbooks (e.g. Enders, 2004).

2.1. Unit root test

If variables are all integrated of the same degree we can go on and test for cointegration. In short, the degree of integration is the number of times a variable must be differenced in order for it to be stationary. According to Nelson and Plosser (1982) most macroeconomic variables are integrated of degree one, $I(1)$. For each variable which features in this paper this must be verified so the Augmented Dickey–Fuller (ADF) test (Dickey & Fuller, 1979) is used to test for a unit root. This will involve estimating one or more equations of the following form. Under the null hypothesis the level series X has a unit root (H_0: $\psi = 0$) but if the null is rejected in favour of the alternative hypothesis (H_1: $\psi < 0$) X is stationary:

$$\Delta X_t = \gamma + \psi X_{t-1} + \sum_{i=1}^{k} \lambda_i \, \Delta X_{t-i} + \varepsilon_t \quad (1)$$

where Δ is the first difference operator; γ is a constant; k is the order of the autoregression; λ_i is a vector of coefficients on the lagged values of ΔX; and ε_t is a random disturbance.

2.2. Cointegration test

If variables are cointegrated they will move together in the long run. Even if variables drift away from one another in the short run, if they are cointegrated some equilibrating force will ensure that in the long run the distance between them does not grow as they drift. To establish if variables are cointegrated the max-eigenvalue test (Johansen, 1991, 1995) is used. This involves estimating the following Vector Error Correction (VEC) model to determine the rank (r) of the Ω matrix:

$$\Delta X_t = \gamma + \psi_1 \, \Delta X_{t-1} + \psi_2 \, \Delta X_{t-2} + \ldots + \psi_{k-1} \, \Delta X_{t-k+1} + \Omega X_{t-1} + \varepsilon_t \quad (2)$$

where ΔX_t is an $n \times 1$ vector of variables; γ is an $n \times 1$ vector of constants; ψ_j is an $n \times n$ matrix of parameters that must be estimated for $j = 1, 2, \ldots, k-1$; and Ω is the long-run parameter matrix. The rank corresponds to the number of cointegrating equations so n is the maximum rank but if the n variables are genuinely non-stationary in levels $0 \le r < n$ will be the case. To maintain consistency with the ADF tests the max-eigenvalue tests are performed with an intercept in the cointegrating equations but no time trend.

2.3. Granger causality test

A Wald test can be performed on the fitted equations to establish if one variable is Granger caused by another variable (Granger, 1969). Assume there are two series ΔX and ΔY, if ΔX Granger causes ΔY this means that better predictions of ΔY can be made by using past values of both ΔX and ΔY as opposed to just using past values of ΔY.

[4] Each stage is carried out using EViews version 5.1 (Quantitative Micro Software, 2004).