ISSN 1833-4474

Fiscal Decentralisation and Economic Growth:

A Bayesian Model Averaging Approach

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JEL Classification: E62, H1, H7, R5.

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This version: December, 2009

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[1] Corresponding author: p.bodman@uq.edu.au. The research is supported by Australian Research Council Discovery Grant DP0877522. The authors would like to thank Robin Boadway for comments and suggestions. Alas, all remaining errors and omissions are attributable to the authors alone.

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Abstract

This article re-examines the relationship between fiscal decentralisation and economic growth by employing Bayesian model averaging (BMA). BMA enables the consideration of a range of measures of fiscal decentralisation and allows the incorporation of model uncertainty into the empirical methodology. Posterior coefficient estimates suggest that not straightforward relationship exists between fiscal decentralisation and economic growth based on time-series data for Australia.

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1. Introduction

Theoretically, fiscal decentralisation – the devolution of fiscal responsibilities and power from the national government to subnational governments – can enhance or detract from economic growth. Similarly, no consensus has developed in the empirical literature over the direction and strength of these linkages between structure of government and growth.[1] While some authors have found a positive relationship between fiscal decentralisation and economic growth (Oates, 1993; Yilmaz 1999; Iimi, 2005), others find evidence of the contrary (Xie, Zou and Davoodi, 1999) while others establish no direct relationship (Martinez-Vazquez and McNab, 2005; Thornton, 2007). Some studies have found differing effects in developed versus developing countries, with no relationship found for developed countries but a negative relationship for developing countries (Davoodi and Zou 1998; Woller and Phillips, 1998). Alternatively, in studies of high-income OECD countries, a number of studies have found results that suggest that a medium degree of decentralisation may be optimal (Thiessen, 2003; Eller, 2004; Bodman and Ford, 2006; Campbell, 2008). Single country studies have also produced mixed results.

In an analysis of the United States of America, Xie *et al.* (1999) found that existing spending shares for state and local governments were consistent with growth maximization and any further fiscal decentralisation would be detrimental to USA growth. On the other hand, Akai and Sakata (2002) and Stansel (2005), based on disaggregated analyses of USA states and metropolitan areas, concluded that fiscal decentralisation contributes positively to economic growth. In an analysis of economic growth in Spain, Carrion-i-Silvestre *et al.* (2008) found that decentralisation has a negative effect at the aggregated, economy-wide level but a positive relationship for communities with a high degree of fiscal autonomy. Finally, Bodman *et al.* (2009) analysed the impact of fiscal decentralisation on Australian macroeconomic conditions and economic growth and found no straightforward impact. Such a range of results highlights the lack of consensus in the literature on the relationship between fiscal decentralisation and economic growth.

[1] See Bodman *et al.* (2009)

To date, the empirical literature is characterised by the exclusive use of classical regression methods to test for any potential impact of fiscal decentralisation on economic growth. In this article we extend this literature by employing Bayesian Model Averaging (BMA) as an alternative to traditional growth regression procedures. BMA has recently been applied in the growth regression literature to account for the model uncertainty inherent in models of economic growth (Fernandez *et al.*, 2001; Eicher *et al.*, 2007; Masanjala and Papageorgiou, 2008). However, such a technique has not previously been applied to determine the influence of fiscal decentralisation on economic growth. We conduct the analysis using data for Australia over the period 1972-2005. Australia is a particularly interesting case for testing the relationship between fiscal decentralization and economic growth because it is one of the most centralized of all recognized federations and growing public displeasure with the privatisation of Australian government enterprises as a method to deal with concerns over the power and inefficiency of the national government as seen greater importance given to the process of decentralisation.

After employing a number of measures of fiscal decentralisation, the results suggest that only a limited number of indicators of decentralisation – relating mainly to taxation autonomy and revenue decentralisation – are likely to have an important contribution to economic growth in Australia. Such results reinforce the weak relationship between fiscal decentralisation and Australian economic growth estimated by Bodman *et al.* (2009) using traditional classical regression methods and supports their conclusion that that there are many ways in which fiscal decentralisation can affect the economy, with the outcome depending on the type of decentralisation undertaken.

2. Empirical Methodology and Data

The robustness of "growth regression" methods has been a particularly contentious issue in recent times (Levine and Renelt, 1992; Sala-i-Martin *et al.*, 2004). There is no consensus on what method that should be employed to determine which variables have a significant effect on

economic growth.[2] Consequently, model uncertainty is arguably the most significant limitation of traditional estimation procedures. Typically individual researchers develop a single model (or small set of models) and undertake inference as if that model had generated the data. Such procedures ignore the uncertainty that surrounds the validity of the model when it is not known exactly which model is the correct one, and thus, sequential testing procedures can lead to considerably misleading inferences (Draper, 1995). This issue can be addressed by using Bayesian Model Averaging to test the robustness of the results. The rationale behind BMA is relatively straightforward. When there is more than one model that fits the data well, but models produce conflicting coefficient estimates and standard errors, taking a weighted average of the potential models is superior to choosing just one "best" model and discarding the remainder (Fernandez *et al.*, 2001). Distributions for the regression coefficients are calculated by averaging the posterior density of each of the models considered and using their posterior model probabilities as weights. These weights are closely related to the predictive ability of the models and, as such, provide a more formal approach to model uncertainty than the traditional approaches (Temple, 2000).

It should be noted, however, that BMA is not without its critics. Sala-i-Martin *et al.* (2004) maintain that the impact of the choice of prior on the results in BMA analyses has not been sufficiently investigated and this choice may have significant, unexplored consequences. In the present study this problem is addressed by employing a benchmark prior distribution proposed by Fernandez *et al.* (2001) that they show to have very little impact on posterior results.[3] BMA allows for the estimation of 2^K models which in this analysis equal over one billion regressions. The results reported are from 1 million recorded draws after 500,000 burn-in replications to account for the starting value of the chain.

There is no consensus in the literature on any one "true" measure of fiscal decentralisation.

[2] Growth econometrics suffers from a number of other well documented problems, including: endogeneity, parameter heterogeneity, data quality, the problems associated with pre-test estimators, and the inability to address the issue of model uncertainty. See Durlauf *et al.* (2004) for an extensive review of these issues.

[3] The full specification of the BMA employed in this study is detailed in Appendix B of Bodman *et al.* (2009).

Consequently, we employ a total of sixteen indicators in an attempt to capture as many of the different element of fiscal decentralisation as possible.[4] The data set covers the 33 year period of 1972 to 2005. A majority of the time-series data was taken from the World Bank's *World Development Indicators* and IMF's *Government Finance Statistics* the *Australian Bureau of Statistics* databases. Standard measures of fiscal decentralisation are calculated from data on government expenditure share, government revenue share and tax revenue share. Corrected measures of fiscal decentralisation seek to capture the level of autonomy subnational governments have over their own actions. OECD (2005) developed an analytical framework for classifying subnational taxes in order of fiscal autonomy by considering three principal aspects: tax administration, the attribution of tax receipts, and legislative competencies to determine the tax rate and tax base. Following this framework, a number of measures of fiscal decentralisation have been developed. Moreover, a measure of expenditure centralisation is also included. We include a fairly standard set of other potential explanatory variables to estimate the growth equation, including population growth, a proxy for human capital (secondary school enrolment rate), inflation, unemployment, trade openness, government and private consumption, domestic savings and taxation revenue.

Davoodi and Zou (1998) asserted that the benefits and costs of fiscal decentralisation are not expected to affect year-to-year fluctuations in growth, and proposed estimating the regression on data averaged over five and ten year periods. Given the small sample size and consequent restricted degrees of freedom, we follow Meloche *et al.* (2004) suggestion of using a centred three-year moving average to smooth the fluctuations from the data.

3. Results

Table 1 presents the posterior means and standard deviations as well as the marginal posterior probabilities of inclusion for each of the sixteen measures of decentralisation and the other included explanatory variable using annual data.

[4] Given limitations on space full details of our dataset can be found in Bodman *et al.* (2009).

Fernandez *et al.* (2001) determine a variable to be an effective determinant of GDP growth per capita if its posterior probability of inclusion (provided in column (4)) is greater than 0.1. Conversely, Raftery (1995) suggests that 0.5 is an appropriate threshold. Raftery's threshold is approximately equivalent to requiring a ratio of posterior mean to standard deviation of 1. Masanjala and Papageorgiou (2008) instead contend that the absolute value of the ratio of the posterior mean to its standard deviation (provided in column (3)) provides a better measure than the posterior inclusion probability to determine whether an explanatory variable achieves economic and statistical significance in a model. Masanjala and Papageorgiou classified variables to be significant if the ratio of the posterior mean to its standard deviation passes a threshold of 1.3, which is roughly equivalent to a 90% confidence interval in frequentist hypothesis testing. Since there is no consensus in the BMA literature about the correct threshold we indicate which variables cross each threshold.

[Table 1 here]

The results suggest that all sixteen indicators of decentralisation satisfy the Fernandez *et al.* threshold, while two indicators (State expenditure share and Total Central tax autonomy) pass the Raftery threshold and one indicator (State expenditure share) passes the Masanjala and Papageorgiou threshold, suggesting the possibility that decentralisation has some important impacts on economic growth in Australia. Of the additional explanatory variables included, consumption, human capital, population growth, tax revenue and trade all have expected signs whilst domestic savings and unemployment have an estimated counter-intuitive relationship with growth in per capita GDP.

The estimated posterior means indicate that the impact of fiscal decentralisation is mixed. On balance the results suggest that, while total expenditure and revenue decentralisation tends to decrease Australia's rate of economic growth, the decentralisation of State and local governments' own source and non-tax revenue, and the decentralisation of government expenditure to the State and local level tend to increase the growth rate. The impact of

decentralised taxation is mixed. The estimate of the impact of the vertical fiscal imbalance on growth suggests that an increase in this imbalance (a greater divergence between the centralisation of taxation powers and the decentralisation of expenditure responsibilities) is in fact positive for per capita growth in Australia, despite the apparent political difficulties this can generate.

4. Conclusion

In this paper we set out to capture the varying influences of fiscal decentralisation on the growth performance of an advanced economy. We employ Bayesian model averaging methods to allow us to partially control for model uncertainty in our analysis and thus to more coherently test for any influence of different indicators of fiscal decentralisation on economic growth. Our main conclusion is that the impact of fiscal decentralisation in the Australian context is not straightforward, but that there is some support for positive effects of Australia's large vertical fiscal imbalance, centralisation of taxation powers and decentralised expenditure patterns..

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Table 1: Bayesian model averaging: Australia, 1972-2005

	(1) Posterior Mean	(2) Posterior Standard Deviation	(3) | Posterior Mean| / Posterior SD	(4) Posterior Probability of Inclusion
Decentralisation Measures				
Average share	-0.0063*	(0.0534)	0.1180	0.1353
Expenditure centralisation	0.0737*	(0.1693)	0.4353	0.3072
Expenditure share: Local	8.7249*	(143.5111)	0.0608	0.1585
Expenditure share: State	0.3358***	(0.2144)	1.5662	0.8034
Expenditure share: Total	-0.0527*	(0.1039)	0.5072	0.2986
Non-Tax share: Sub-central total	0.0656*	(2.1297)	0.0308	0.4313
Revenue decentralisation	-0.4713*	(2.1098)	0.2234	0.4959
Revenue share: Local	0.0948*	(53.2150)	0.0018	0.1293
Revenue share: State	8.5654*	(143.5654)	0.0597	0.2327
Revenue share: Total	-7.5782*	(130.2513)	0.0582	0.1622
Tax autonomy: Central total	0.1669**	(0.4016)	0.4156	0.6282
Tax autonomy: Sub-central total	-0.2998*	(53.1757)	0.0056	0.3088
Tax share: Central total	-0.0299*	(0.1176)	0.2543	0.1698
Tax share: Sub-central total	-0.0626*	(0.1629)	0.3843	0.2523
Transfer share	-2.5069*	(117.3347)	0.0214	0.1581
Vertical Imbalance	1.1124*	(62.7826)	0.0177	0.1363
Explanatory Variables				
Consumption	-1.8865***	(0.3854)	4.8949	0.9986
Government consumption	0.1196*	(0.4123)	0.2901	0.2045
Human capital	0.0384***	(0.0248)	1.5484	0.8118
Inflation	-0.0037	(0.0322)	0.1149	0.0858
Savings	-1.2786***	(0.5462)	2.3409	0.9029
Population growth	-2.3962***	(1.0010)	2.3938	0.9186
Tax revenue	-3.0750***	(1.2190)	2.5226	0.9157
Trade	1.6574***	(0.6638)	2.4968	0.9134
Unemployment	0.7750***	(0.1709)	4.5348	0.9916

Notes: (*) denote if variables is considered effective under Fernandez *et al.* (2001) [posterior probability of inclusion > 0.1] threshold only, (**) denotes if a variable is considered effective under both the Fernandez *et al.* (2001) and Raftery (1995) [posterior probability of inclusion > 0.5 ≈ |posterior mean|/ posterior SD > 1] thresholds and (***) denotes if a variable is considered effective under the Fernandez *et al.* (2001), Raftery (1995) and Masanjala and Papageorgiou (2008) [|posterior mean|/ posterior SD > 1.3] thresholds.