The Economic and Social Review, Vol. 22, No. 3, April, 1991, pp. 229-238

NOTES and COMMENTS

Ricardian Equivalence and the Irish Consumption Function: The Evidence Re-examined

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I INTRODUCTION

The Ricardian Equivalence hypothesis states that economic agents perceive the future tax liabilities implicit in government debt issue and thus that increasing government expenditure partially crowds out private sector consumption through its effects on perceived permanent income. Thus, Ricardian equivalence implies that not only does a contraction of government expenditure provoke offsetting effects on aggregate demand but that it also leads to an increase in indirect tax revenues, thus setting in train a relatively painless cycle of debt reduction. Moore (1987) has presented results, based on tests from US literature, which he concluded provided strong evidence in favour of the hypothesis. Walsh (1988) confirmed that Moore's favoured econometric result was robust to data revisions and changes in data definition. Furthermore, Giavazzi and Pagano (1990) have discussed the notion of government spending reductions increasing private consumption to suggest a demand-side explanation of Ireland's post-1987 experience of fiscal retrenchment combined with economic recovery while McAleese (1990) has referred to Moore's results in a similar context.

*I am grateful to John Bradley for his encouragement and comments during the preparation of this paper. Thanks are due also to Frank Barry, Denis Conniffe, John Fitz Gerald and Dermot McAleese. The usual disclaimer applies.

In this note, we first take issue with Moore's conclusion in favour of Ricardian equivalence on the grounds that:

(i) Moore's application of tests taken from Feldstein (1982) and Kormendi (1983) in fact produced *no* consistent pro-Ricardian evidence.
(ii) Moore's evidence in favour of the hypothesis was based on testing restrictions different to those tested in his other equations and these restrictions were rejected in the Feldstein-Kormendi equations.
(iii) Definitions of key variables were inappropriate.

Having outlined these points, re-estimations of Moore's equations with the latest data are presented in both OLS "levels" and differences form. A test of the Ricardian hypothesis' implications for the effect of foreign debt is also presented.

II TESTING RICARDIAN EQUIVALENCE: MOORE, 1987

The Feldstein-Kormendi Tests

The modern version of the Ricardian equivalence hypothesis derives from Robert Barro's 1974 paper "Are Government Bonds Net Wealth?". Barro described a theoretical model in which a fiscal deficit of $x today is perceived by economic agents to lead to a tax increase of $x at some stage in the future, with the bequest motive ensuring that people take into account tax increases expected beyond their life-horizon. This analysis has important implications for the effects of fiscal policy on private sector aggregate demand.

(a) If all fiscal debt is perceived as being paid off in the future through tax increases, the real burden of current fiscal policy is measured not by the size of current tax revenues but by the size of total tax revenues plus fiscal deficits, i.e., by the size of government expenditure. The larger the size of government expenditure the larger is the perceived tax-induced reduction in permanent income and thus consumption.

(b) If the real net tax burden of current fiscal policy is measured solely by the size of government expenditures then the size of current tax revenues has no effect on private sector wealth and consumption once these expenditures have been taken into account.

(c) If all personal transfer payments must be paid for through tax revenues at some stage in the future then increasing transfer payments does not increase permanent aggregate disposable income.

(d) If deficits are financed by a domestic bond issue then perceived net wealth and permanent income remain the same since the future taxes implied by the debt interest payments and repayment of the principal are exactly offset by the fact that these payments are going to domestic bond-holders.

Thus a domestic bond issue should have no effect on long-run aggregate income and so, according to the permanent income hypothesis, should not stimulate consumption.

Moore (1987) uses the following specifications adapted from Kormendi (1983) and Felstein (1982) to test all the above implications of Ricardian equivalence:

$$C = \beta_0 + \beta_1(Y,YD) + \beta_2 W_{-1} + \beta_3 G + \beta_4 T + \beta_5 TR + \beta_6 D_{-1} \qquad (2.1)$$

where C is real personal consumption expenditures, Y and YD are, respectively, real GNP and real disposable income, W is private sector net wealth, G and TR are real government expenditure on goods and services and personal transfers, T is real total tax revenues and D is real value of domestically held government debt. When Y is the income variable the test thus consists of testing the restrictions:

$$H_0: \beta_3 < 0 = \beta_4 = \beta_5 = \beta_6.$$

When YD is the income variable the restrictions to be tested are

$$H_0: \beta_3 < 0 = \beta_6 \ \beta_1 = \beta_4 = -\beta_5.$$

Moore's application of these tests produced *no consistent pro-Ricardian evidence*. He concluded, though, that these results were unsatisfactory due to the effect of a "fog of multicollinearity" on parameter estimates. He did not, however, attempt any transformation of the data set which would have alleviated this problem: differencing would be one such transformation.[1] Furthermore, Kormendi (1983) has argued that, due to variables in Equation (2.1) being nonstationary and the consequent danger of spurious regressions, differencing is the correct procedure. Thus in Section III, we will present the results from updating the Feldstein-Kormendi equations in both levels and differenced form.

Government Surplus Tests

Another test used by Moore was based on a specification taken from Tanner (1979):

$$C = \alpha_0 + \alpha_1 YD + \alpha_2 UY + \alpha_3 DUR_{-1} + \alpha_4 W_{-1} + \alpha_5 SUR + \alpha_6 D_{-1} \qquad (2.2)$$

1. One possible approach would be to employ an Error Correction Mechanism (ECM) formulation (as used in Davidson *et al.* (1978)). We will not present such a formulation in this paper, however, both because the short-run dynamics postulated in the ECM are more suited to quarterly data and the fact that it would make comparison with Moore (1987) more difficult.

where YD, W and D are as before, UY is the product of the unemployment rate and real disposable income, DUR is the stock of consumer durables and SUR is the real government surplus. Tanner's test was for a positive effect for the government surplus on consumption. Moore found a significantly positive coefficient for the government surplus. However, unlike Tanner, he did not offer this as evidence in favour of Ricardian equivalence, citing Kormendi and stating that the correct test consists of testing for equal coefficients on SUR and YD. But the cited section of Kormendi's paper (Kormendi (1983) pp. 1002-1003, footnote 28) was concerned with deriving a test based on a specification which can be nested within (2.2), but which is consistent with the hypothesis being tested in specification (2.1).[2] The derived specification was:

$$C = \alpha_0 + \alpha_1 YD + \alpha_2 G + \alpha_3 TR + \alpha_4 SUR + \alpha_5 D_{-1} + \ldots \qquad (2.3)$$

where the null hypothesis embodied in Kormendi's restrictions implies

$$H_0: \alpha_3 = \alpha_5 = 0 < \alpha_1 = \alpha_4 > \alpha_2.$$

2. Simplified, Kormendi's derivation of the test was as follows:
Given the specification

$$C = \beta_0 + \beta_1 Y + \beta_2 G + \beta_3 T + \beta_4 TR + \beta_5 D_{-1} + \ldots$$

Ricardian equivalence implies:

$$H_0: \beta_2 < 0 = \beta_3 = \beta_4 = \beta_5.$$

Using the identities

$$T \equiv G + TR + SUR \quad Y \equiv YD - TR + T$$
$$\Rightarrow Y = YD - TR + G + TR + SUR$$
$$\Rightarrow Y = YD + G + SUR.$$

Thus

$$C = \beta_0 + \beta_1 (YD + G + SUR) + \beta_2 G + \beta_3 (G + TR + SUR) + \beta_4 TR + \beta_5 D_{-1} + \ldots.$$
$$\Rightarrow C = \beta_0 + \beta_1 YD + (\beta_1 + \beta_2 + \beta_3) G + (\beta_3 + \beta_4) TR + (\beta_1 + \beta_3) SUR + \beta_5 D_{-1} + \ldots$$

and so given the specification

$$C = \alpha_0 + \alpha_1 YD + \alpha_2 G + \alpha_3 TR + \alpha_4 SUR + \alpha_5 D_{-1} + \ldots$$

we see that Kormendi's restrictions $H_0: \beta_2 < 0 = \beta_3 = \beta_4 = \beta_5$ imply

$$H_0: \alpha_3 = \alpha_5 = 0 < \alpha_1 = \alpha_4 > \alpha_2.$$

Moore did not employ specification (2.3) and hence Kormendi's analysis cannot explain his result of acceptance of the hypothesis of identical coefficients on YD and SUR. In any case, this hypothesis is simply equivalent to the restrictions $H_0: \beta_1 = -\beta_3\ \beta_5 = \beta_4 = 0$ on Equation (2.1) when Y is the income variable and $H_0: \beta_1 = \beta_4 = -\beta_3 = -\beta_5$ when YD is the income variable. Though Moore did not test these restrictions in his reported Feldstein-Kormendi equations, they would seem to be strongly rejected by them given that no significant negative effect for G was reported. Thus, Moore's "strong evidence in favour of the Ricardian Equivalence proposition" derives from a test which is superfluous in the sense that the restrictions being tested could just as easily be tested within the standard approach and is also roundly contradicted by his other equations. Whether this constitutes strong evidence can certainly be questioned.

Foreign Debt Tests

Another implication of Ricardian equivalence, not tested by Moore, which is very important in the Irish case and easily testable using Irish data, is that if deficits are financed by foreign borrowing, the effects on perceived net wealth and permanent income are negative. This is because the future taxes implied by the debt interest payments and repayment of principal are perceived to decrease domestic permanent disposable income while these payments, unlike those on domestically-held bonds, merely boost foreign wealth.

Data[3]

All data used in the regression analyses in Section III were drawn from the National Accounts. The differences in data construction from the methods used by Moore and Walsh are as follows.

(a) A flaw in Moore's analysis, pointed out by Walsh, 1988, was the use of current government expenditure and budget surplus variables to represent G and SUR. Since most public capital expenditure does not pay for itself in terms of directly recouped tax revenues, it must also be included in the G and SUR variables if they are to represent variables used by consumers to form tax expectations. We use the broader variable "Public Authorities Surplus" to represent SUR, rather than using the "Net Borrowing" variable employed by Walsh or "Public Authorities Current Surplus" variable used by Moore. We define G to be total current expenditure on goods and services plus total capital expenditure minus total capital revenue. Defined in this manner G

3. Full details of the data construction, together with a copy of the data in Lotus-123 format, are available from the author on request.

and TR represent the full debt and tax burden of present government expenditure policies. Also this definition of G is consistent with our definition of SUR in that SUR ≡ T - G - TR.

(b) Moore defines his private sector wealth variable, W, by W = FC + H + EXT where FC is the value of the fixed capital stocks for industry, services and agriculture, H is the value of the private housing stock and EXT is external assets. For FC, Moore uses the data for fixed capital stocks used by Bradley *et al.* (1985). These were obtained by using capital investment data from the National Accounts as the flow figures and choosing an appropriate depreciation rate to construct the stock. However, despite the availability of similar data for private housing investment in the National Accounts, Moore constructs H from data on new private house completions and the average price of a new house. Given the desirability of keeping all data being used from the same source, thus minimising the importance of differences in accounting practise, we propose to define H by using the same depreciation rate (.01) as Moore and data on "Private Housing Investment" from the National Accounts as the flow figures.

III RESULTS

This section presents the results from a set of regression equations estimated over the sample 1961-87. We first present our estimation of the three specifications presented by Moore (1987). We then present the results obtained from applying differenced specifications and finally we test the Ricardian equivalence hypothesis' implications for the effects of public foreign debt on consumption. In what follows t-statistics for regression coefficients are in parentheses with * denoting significance at the 5 per cent level and ** denoting significance at the 1 per cent level.

Updating the Tanner and Feldstein/Kormendi Regressions

$$\begin{array}{l} C = \underset{(-2.84)^{**}}{-3613.39} + \underset{(3.91)^{**}}{0.4YD} - \underset{(-0.39)}{0.008UY} - \underset{(-0.98)}{0.17DUR_{-1}} \\ \quad + \underset{(3.4)^{**}}{0.41W_{-1}} + \underset{(1.11)}{0.23SURC} + \underset{(2.03)}{0.11D_{-1}} \end{array} \qquad (3.1)$$

$$\bar{R}^2 = .9943 \quad DW = 1.61 \quad SER = 142.752 \quad \rho = \underset{(5.69)^{**}}{.74}$$

$$C = \underset{(-3.13)^{**}}{-3947.33} + \underset{(3.56)^{**}}{0.36YD} - \underset{(-0.36)}{0.008UY} - \underset{(-1.56)}{0.27DUR_{-1}}$$

$$+ \underset{(4.37)^{**}}{0.47W_{-1}} + \underset{(0.19)}{0.03SUR} + \underset{(1.98)}{0.11D_{-1}} \qquad (3.2)$$

$$\bar{R}^2 = .994 \quad DW = 1.55 \quad SER = 147.13 \quad \rho = \underset{(5.24)^{**}}{.72}$$

Equations (3.1) and (3.2) show the results obtained from estimating the Tanner specification, corrected for autocorrelation. Equation (3.1) reproduces Moore's equation by including the current surplus, SURC while Equation (3.2) employs the broader definition of the surplus. We can observe that the result obtained by Moore and Walsh, that the government surplus is a statistically significant explanatory variable, does not prove robust to extending the data sample and using our data. We may note, however, that Moore's result of a significant positive coefficient does hold for our data when estimated over his data sample, 1961-84.

$$C = \underset{(-2.31)^{*}}{-2584.39} + \underset{(2.26)^{*}}{0.39Y} + \underset{(1.71)}{0.25W_{-1}} - \underset{(-0.12)}{0.01G}$$

$$- \underset{(-0.5)}{0.1T} - \underset{(-0.51)}{0.16TR} + \underset{(4.91)^{**}}{0.2D_{-1}} \qquad (3.3)$$

$$\bar{R}^2 = .9947 \quad DW = 1.7 \quad SER = 143.47$$

$$C = \underset{(-1.04)}{-1175.38} + \underset{(3.52)^{**}}{0.38YD} + \underset{(1.54)}{0.18W_{-1}} + \underset{(1.38)}{0.14G}$$

$$+ \underset{(2.11)}{0.34T} - \underset{(-3.95)^{**}}{0.94TR} + \underset{(4.58)^{**}}{0.17D_{-1}} \qquad (3.4)$$

$$\bar{R}^2 = .996 \quad DW = 1.86 \quad SER = 126.297$$

Equations (3.3) and (3.4) present the two Feldstein-Kormendi specifications used by Moore, with our definition of G. Like the equations reported by Moore, they fail to accept the restrictions implied by Ricardian equivalence. Both regressions show a significant positive coefficient for D, neither show a significant negative effect for G while testing the linear restrictions of $H_0: \beta_4 = \beta_5 = \beta_6$ for (3.3) and $H_0: \beta_1 = \beta_4 = -\beta_5$ for (3.4) yields F(3.20) statistics of

9.125 and 3.59 which reject the restrictions at, respectively, the 1 per cent and 5 per cent level.

Differenced Regressions

$$\Delta C = \underset{(4.35)^{**}}{0.39\Delta YD} - \underset{(-0.94)}{0.002\Delta UY} - \underset{(-1.45)}{0.18\Delta DUR}$$

$$+ \underset{(5.26)^{**}}{0.49\Delta W_{-1}} + \underset{(0.8)}{0.1\Delta SUR} + \underset{(1.72)^{*}}{0.09\Delta D_{-1}} \qquad (3.5)$$

$$\bar{R}^2 = .8391 \quad DW = 1.86 \quad SER = 147.262$$

$$\Delta C = \underset{(2.95)^{**}}{0.42\Delta Y} + \underset{(3.75)^{**}}{0.47\Delta W_{-1}} - \underset{(-0.37)}{0.06\Delta G} - \underset{(-2.18)^{*}}{0.45\Delta T}$$

$$+ \underset{(0.16)}{0.06\Delta TR} + \underset{(2.27)^{*}}{0.12\Delta D_{-1}} \qquad (3.6)$$

$$\bar{R}^2 = .8343 \quad DW = 1.94 \quad SER = 149.433$$

$$\Delta C = \underset{(4.18)^{**}}{0.37\Delta YD} + \underset{(3.59)^{**}}{0.43\Delta W_{-1}} + \underset{(0.64)}{0.08\Delta G} + \underset{(0.32)}{0.06\Delta T}$$

$$- \underset{(-2.6)^{*}}{0.9\Delta TR} + \underset{(1.75)}{0.08\Delta D_{-1}} \qquad (3.7)$$

$$\bar{R}^2 = .873 \quad DW = 1.92 \quad SER = 130.851$$

Equation (3.5) is the differenced version of the Tanner equation. Again the government surplus is not a significant explanatory variable. Equations (3.6) and (3.7) present the results of estimating the Feldstein-Kormendi specifications in terms of first differences. The results shown in (3.6) and (3.7) again fail to support the Ricardian hypothesis. Neither equation shows a significant negative effect for G and while again some of the coefficients may appear to accept the Ricardian restrictions the F(3.20) test statistics for the hypotheses $\beta_4 = \beta_5 = \beta_6 = 0$ for (3.6) and $H_0: \beta_1 = \beta_4 = -\beta_5$ for (3.7) are 3.89 and 3.83, both rejecting the hypotheses at 5 per cent. Furthermore, for Equation (3.6) the anti-Ricardian hypothesis of the coefficient for T being minus that for Y is strongly accepted. We can note, then, that our

rejection of the Ricardian restrictions proves robust to estimating the equations in differenced form, a specification in which the explanatory variables do not exhibit an unduly high level of collinearity.

Foreign Debt

$$\begin{aligned} C = {} & -2925.08 + 0.51Y + 0.25W_{-1} + 0.06G - 0.3T \\ & (-2.78)^{*} \quad (2.96)^{**} \quad (1.82) \qquad (0.52) \quad (-1.42) \\ & - 0.58TR + 0.17D_{-1} + 0.1DF_{-1} \\ & (-1.57) \qquad (4.28)^{**} \quad (2.02) \end{aligned} \tag{3.8}$$

$$\bar{R}^2 = .9966 \quad DW = 1.97 \quad SER = 133.47$$

$$\begin{aligned} \Delta C = {} & 0.42\Delta Y + 0.48\Delta W_{-1} - 0.03\Delta G - 0.49\Delta T \\ & (2.85)^{*} \quad (3.17)^{**} \quad (-0.13) \quad (-1.95) \\ & - 0.13\Delta TR + 0.12\Delta D_{-1} + 0.02\Delta DF \\ & (-0.28) \qquad (2.21)^{*} \qquad (0.26) \end{aligned} \tag{3.9}$$

$$\bar{R}^2 = .8262 \quad DW = 2.03 \quad SER = 153.044$$

Equations (3.8) and (3.9) show the results obtained from adding foreign debt, DF, to both levels and differences versions of the Feldstein/Kormendi specification. Neither equation reports a significant negative effect for foreign debt, a result which, given the size of foreign deficit financing in Ireland, must be taken as a strong and important rejection of Ricardian equivalence.

We can point out that estimating regressions (3.2) to (3.9) with current government expenditures for G and the current budget surplus for SUR, as Moore did, gives results which reject the Ricardian hypothesis at similar levels of significance to those reported above. Instrumental variables estimation of our equations (with lags and time trends as instruments) also failed to accept the Ricardian restrictions. Thus, our rejection of the Ricardian equivalence hypothesis cannot be attributed solely to using different definitions of G and SUR or ignoring endogeneity of explanatory variables.

IV CONCLUSION

This paper has examined the results of Moore (1987) and has concluded that they do not in fact provide strong evidence in favour of the Ricardian equivalence hypothesis. Updated tests presented here also fail to accept the

hypothesis. It would seem, then, that those who advocate that fiscal contractions can have expansionary effects may need to look to other theories which, perhaps, do not require economic agents to have the ultra-rationality and foresight required of them by the Ricardian equivalence hypothesis.

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