

The Irish Consumption Function and Ricardian Equivalence

MICHAEL J. MOORE*

Central Bank of Ireland, Dublin

Abstract: The paper examines whether the Ricardian Equivalence Proposition holds for Ireland. This proposition argues that it does not matter how the government finances a given level of public spending. Specifically, it claims that economic agents anticipate the future tax liability implicit in the issue of government paper. The empirical results indicate that the Irish data provide evidence of *complete* tax discounting. One of the implications of this is that the level of domestic interest rates is not affected by the extent of government borrowing.

I INTRODUCTION

Over the last decade, debate in Ireland has increasingly focused on the growth of public sector borrowing. It is often argued that increases in government domestic borrowing tend to put upward pressure on interest rates. In addition, foreign borrowing by the state is presented as undesirable because it allegedly threatens the solvency of the economy as a whole. Other forms of monetary financing of government spending are presumed to have a different set of undesirable real effects. Finally, it is presumed that the immediate closing of the government's budgetary gap through substantial tax rises would lead to a sharp reduction in domestic demand. All of these notions can be summarised in a single proposition, i.e., for a given level of government spending, the manner of its financing "matters".

The Ricardian Equivalence Theorem or Barro Debt Neutrality argues precisely the opposite of this. Given perfect capital markets, optimising agents

*The views expressed in this paper are not necessarily those held by the Bank and are the personal responsibility of the author. Thanks are due to Patrick Honohan, Rodney Thom, two anonymous referees and my colleagues at the Central Bank. All remaining errors are mine.

with rational expectations are completely indifferent to the manner in which government services are funded. The issue of domestic debt does not affect interest rates because households increase saving one for one in rational anticipation of future taxes. Foreign borrowing by the public sector also evokes one for one additions to saving by households specifically in the form of privately held external assets. This leaves the net external asset and thus the net worth of the state unchanged. Money creation gives rise to a rationally expected inflation tax which also generates additional savings. All of these financing modes are thus equivalent in their effect on the consumption/savings decision to a continuously balanced budget.

The Ricardian Equivalence proposition was restated by Barro (1974). It has been contested by Feldstein (1976), Buchanan (1976) and by Tobin (1980), who places particular emphasis on its dependence on perfect capital markets. The purpose of this study is to test the proposition using Irish data. Specifically, the paper will explore the effect of government financing decisions on the consumption function.

The plan of the paper is as follows. In Section II, the US empirical literature on Ricardian Equivalence, on which the present work is based, is reviewed. Section III begins by outlining the evolution of empirical studies on the Irish Consumption Function. The main part of the paper is Section IV where my results are reported. The final section summarises the findings, and suggests directions for future research.

II THE US EXPERIENCE

By now a considerable literature has grown up to test for Ricardian Equivalence with US data. Overall, the consensus points to a considerable degree of tax discounting (see Seater (1985)). However, a number of different approaches have been tried. The present study concentrates on two of these, both of which involve estimating extended versions of conventional consumption functions. Other approaches are discussed in the conclusion.¹

Kochin (1974) started by drawing a graph similar to that at the end of Section III and showing a similar "stylised fact". He was the first writer to add the government deficit as an additional exogenous variable in the consumption function and to find it significant. However, both his theoretical specification and econometric methodology were unsatisfactory. A series of

1. I chose to approach the problem through the estimation of the consumption function because there is a substantial existing literature in Ireland on that subject. (See Section III of this paper.) By setting the issue in this context, it was possible to concentrate on those features which were peculiar to Ricardian Equivalence.

papers then emerged which addressed the first of these inadequacies. Yawitz and Meyer (1976), Barro (1978), Tanner (1979a/b) and Seater (1982) were broadly based on an expanded Ando-Modigliani type consumption function specification. The following is taken from Tanner (1979b).

$$C_t = \beta_1 YD_t + \beta_2 YD_{t-1} + \beta_3 RE_t + \beta_4 (UY)_t - \beta_5 DUR_{t-1} + \beta_6 W_{t-1} + \beta_7 SUR_t + \beta_8 D_{t-1} \quad (2.1)$$

C is real consumption expenditures, YD is real disposable income, RE is real corporate retained earnings, UY is the product of the unemployment rate and real disposable income, DUR is the real stock of consumer durables, W is net wealth, SUR is the real government surplus and D is the real market value of federal government debt outstanding. The coefficients β_i ($i = 1 \dots 6$) are assumed positive. Under the null hypothesis of Ricardian Equivalence $\beta_7 > 0$ and $\beta_8 = 0$. Tanner's point estimate for β_7 was .291 with a t-ratio of 3.23. The estimated coefficient for β_8 was negative and had a t-ratio of 0.38.

An obvious criticism of (2.1) is that it does not discriminate between the different possible causes of changes in the government surplus. Thus, if the surplus rises because of a fall in government spending without any change in the financing mix, a non-Ricardian might still expect β_7 to be significant because of substitution effects. In addition, changes in the tax/transfer mix might have distribution effects which are quite consistent with debt neutrality. Feldstein (1982) was the first to address this question in a paper which is highly controversial. He examined the following specification:

$$C = \beta_0 (Y, YD) + \beta_1 (Y, YD_{-1}) + \beta_2 \tilde{W}_{-1} + \beta_3 SSW_{-1} + \beta_4 G + \beta_5 T + \beta_6 TR + \beta_7 D_{-1} \quad (2.2)$$

where C, YD and D are as before and Y is national income. Wealth is \tilde{W} (including public debt), G is government expenditure on current goods and services, T is total taxes and TR is total transfer payments. The SSW is social security wealth and is constructed by Feldstein as the actuarial present value of social security benefits for which members of the existing workforce and their dependants would become eligible when they reach age 65.

He argues that Ricardian Equivalence implies different restrictions on the coefficients depending on whether disposable income or national income is used. If national income (Y) is used, Ricardian Equivalence implies a Null Hypothesis of $\beta_3 = \beta_5 = \beta_6 = \beta_2 + \beta_7 = 0$. The coefficient β_3 is 0 because according to Debt Neutrality, expected social security benefits are completely

offset by expected social security taxes (in a fully funded system). Similarly, $\beta_5 = \beta_6 = 0$ because changes in taxes or transfers are purely financing methods. Finally, $\beta_7 = -\beta_2$ because government debt is already contained in the wealth variable. The effect of changes in G is ambiguous. By contrast, if disposable income (YD) is the specified income variable, Ricardian Equivalence has quite different implications. Since YD reflects tax increases, Ricardian Equivalence demands that $\beta_5 > 0$ if taxes are to have no overall effect on consumption. Similarly, $\beta_6 < 0$ and $\beta_4 < 0$. As before, $\beta_3 = 0$ and $\beta_2 + \beta_7 = 0$.

Feldstein posits an alternative theory which is completely nested within (2.2) and can be easily tested if YD is the income variable. He calls this the "fiscal expectations" view. This is the "conventional" view of consumer behaviour and implies that disposable income captures the full effects of taxes and transfers ($\beta_5 = \beta_6 = 0$), that G has no effect on consumer spending, that SSW increases consumer spending and that public debt is treated like all other forms of wealth. This view implies that when YD is used, $\beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$ and $\beta_3 > 0$.

Feldstein's econometric methodology is marginally more sophisticated than his predecessors in that he allows T and YD to be endogenous in some equations and estimates using T_{-1} and YD_{-1} as instruments. He claims that he finds strong evidence against Ricardian Equivalence and that the results are consistent with fiscal expectations. Unfortunately, this is not at all clear from his paper and subsequent work casts doubt on even those results which he claims to obtain. Leimer and Lesnoy (1982) show that the SSW variable was constructed by Feldstein on a most tenuous basis. Kormendi (1983) estimates equations with a specification similar to (2.2) using the national income variable and is unable to replicate Feldstein's work. In fact, his equations provide no evidence against the null hypothesis of Ricardian Equivalence.²

Seater and Mariano (1985) re-estimate both the Barro-Tanner specification and that of Feldstein-Kormendi on the same data set treating a credible range of explanatory variables as potentially endogenous. The estimates based on the Tanner specification are "slightly less" consistent with the null hypothesis. Overall Seater and Mariano conclude in favour of Ricardian Equivalence. In the present study, both specifications will be estimated on Irish data.

2. Kormendi's results have been questioned by Barth, Iden and Russek (1986) and strongly contested by Modigliani and Sterling (1986). The original results are defended by Kormendi and Maguire (1986).

III THE IRISH CONSUMPTION FUNCTION

The earliest Irish study of the consumption function was carried out by Kennedy and Dowling (1970) and was mainly exploratory. Kelleher (1977) estimated a consumption model which identified liquid assets as having an important explanatory role. Honohan (1979) tested the idea of Deaton (1977) that the rate of inflation was a significant exogenous variable and obtained encouraging results.

McCarthy (1979) found that the product of the rate of unemployment and current income had a major role to play in addition to current income. He found that as unemployment rises, consumption falls. He and subsequent writers have failed to point out that this result is in fact perverse rather than intuitive. It was Ando and Modigliani (1963) who first suggested that this variable be included in the consumption function. They demonstrated that unemployment is important as an indicator of the gap between current and permanent income. For a given level of current income, high levels of unemployment suggest that permanent income is in fact higher than current income. Thus consumption is expected to be *increasing* in unemployment.³

Bradley (1979) speculated that the marginal propensity to consume (MPC) out of transfer income is different from the MPC out of earned income. He obtained a surprisingly negative MPC and insignificant results which bear directly on the immediate focus of this paper. Like McCarthy, Bradley also found that unemployment is significantly negative in its effect on consumption.

Honohan (1982) brought the initial phase of Irish consumption estimation to a close by carrying out a specification search according to the method of Leamer (1983). He concluded that inflation, liquid assets, unemployment and the rate of income growth were all potentially significant, that intertemporal and intratemporal price effects were not, and that the short-run marginal propensity to consume is about one-half. Two subsequent papers and the present study pay close attention to this ground-clearing exercise.

Von Ungern-Sternberg (1981) argues that neither inflation nor liquid assets should be specified directly as exogenous variables in the consumption function. Instead measured income should be adjusted to take account of the erosion of financial assets through inflation. Boyle (1982) successfully applied von Ungern-Sternberg's study to Irish data.⁴ O'Reilly (1983) refines Boyle's work in a number of ways. The Irish national accounts are only

3. The Ando-Modigliani argument means that as unemployment rises the marginal propensity to consume rises. This is, of course, Keynes Second Psychological Law and has been restated formally in Neary and Roberts (1980).

4. A similar exercise is contained in Bradley and Fanning (1983).

published on an annual basis: O'Reilly used estimated quarterly national accounts. In addition, he applies the full set of techniques which are associated principally with the name of David Hendry.⁵ The difficulty with O'Reilly's work is one of interpretation. Neither income nor wealth appears as a separate exogenous variable. Instead O'Reilly constructs a variable which draws both on Boyle's "adjusted" income and the negative relationship between unemployment and consumption which had been reported by McCarthy, Bradley and Honohan.

None of the Irish studies contemplated the sort of consumption/savings behaviour which is suggested by Barro's Debt Neutrality. In Diagram 1 the ratio of personal savings to personal disposable income is graphed against the left hand vertical axis. The public authorities' savings ratio is computed with the same denominator and the numerator is the national accounts concept "public authorities' savings". This is graphed against the right hand vertical axis which is drawn to the same scale as that on the left. The inverse relationship, though imperfect, is still highly significant with a correlation coefficient of -0.72. This negative correlation thus emerges as a "stylised fact" which must be explained by any theory of savings even if Ricardian Equivalence is regarded as unpalatable.⁶

IV RESULTS

IV.1 *Data*

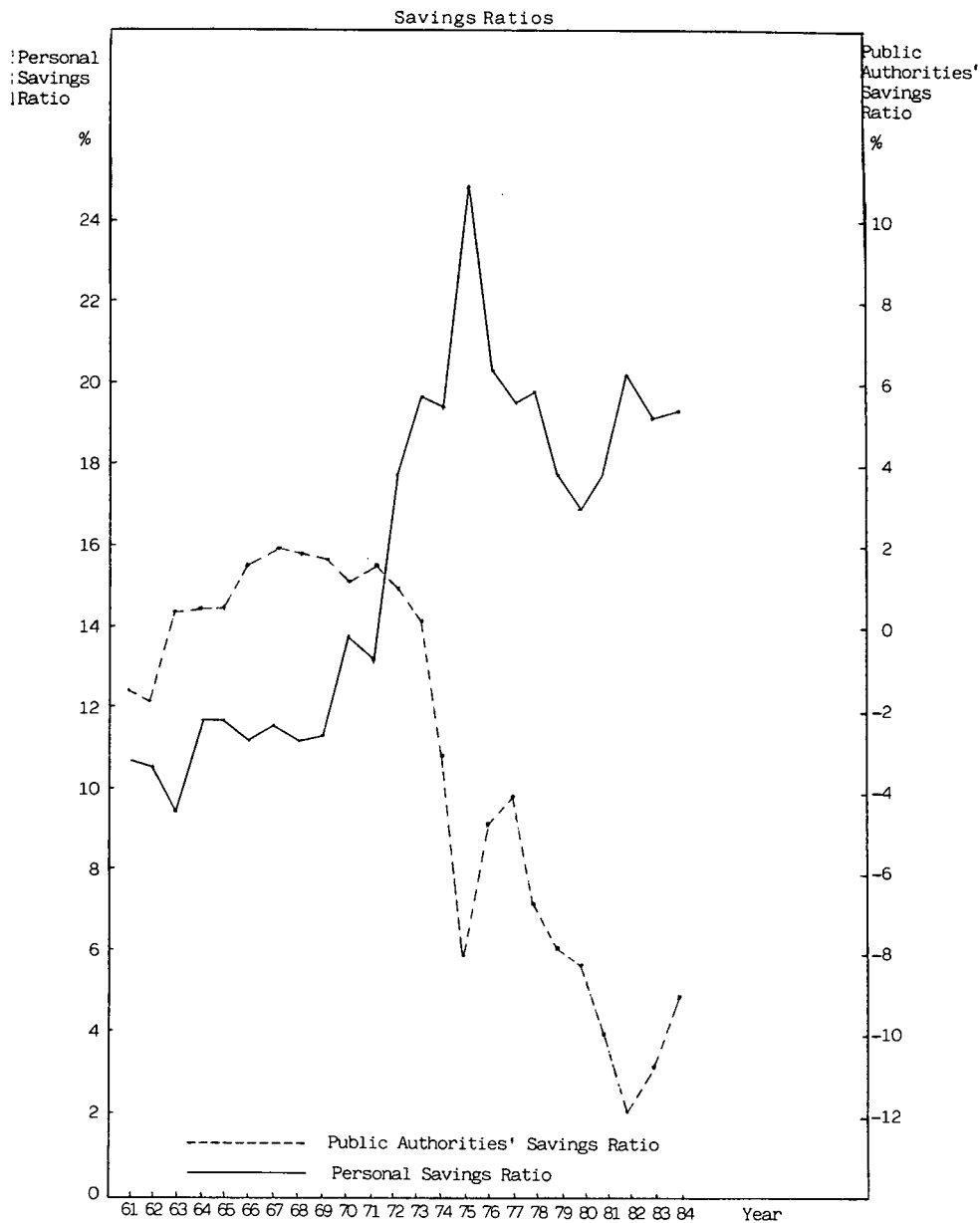
It is perhaps surprising that an Ando-Modigliani type consumption specification such as (2.1) has never been estimated for Ireland. The main reason has been data limitations: there are no published data on either the stock of consumer durables (DUR) or wealth (W). Thus both time series had to be constructed. (See Appendix 1).

IV.2 *Regressions using the Barro-Tanner Approach*

Equation (2.1) was estimated on annual data for the period (1961-1984). Retained Earnings (RE) was found to be completely insignificant in a preliminary specification search and was deleted. The following OLS regression was obtained with *t* statistics beneath the associated coefficients. The significance level was set at 5 per cent.

5. In a conversation with me, Hendry reaffirmed his well-known view that econometric "quality control" is prior to economic theory. He acknowledged that it is frequently difficult to interpret equations estimated according to his methodology.

6. Referees have pointed out that this correlation is most notable in the middle of the sample. This is why a full multiple regression study is required. It is also why tests for parameter stability are carried out in Section IV.



$$\begin{aligned}
 C = & -591 + .69 YD - .0042 UY - .53 DUR_{-1} + .13 W_{-1} \\
 & (-2.79) (10.84) (-3.71) \quad (-3.98) \quad (-4.43) \\
 & + .49 SUR + .13 D_{-1} \\
 & (3.40) \quad (1.64)
 \end{aligned} \tag{4.1}$$

$$\bar{R}^2 = .9960 \quad DW = 2.39 \quad SER = 54.767$$

$$\bar{C} = \text{£}4,610.1 \text{ million in 1980 prices.}$$

Two features are immediately striking about Equation (4.1). First, the stock of debt is insignificant. Secondly, disposable income and the government surplus have coefficients which are quite close in magnitude. The null hypothesis that the two coefficients are, in fact, the same yielded a *t* statistic of 1.55 and was not rejected. The *F*(2,24) statistic for the *joint* restriction that the coefficients on disposable income and the government surplus are identical *and* that the coefficient on government debt is 0 is 1.69, which again fails to reject the null hypothesis. I shall return to these points later. The obvious strategy is to eliminate *D* completely and to re-estimate the equation. The result is as follows:

$$\begin{aligned}
 C = & -672 + .67 YD - .0052 UY - 0.55 DUR_{-1} + .16 W_{-1} \\
 & (-3.09) (10.18) (-5.12) \quad (-3.95) \quad (8.75) \\
 & + .58 SUR \\
 & (4.11)
 \end{aligned} \tag{4.2}$$

$$\bar{R}^2 = .9958 \quad DW = 1.98 \quad SER = 57.74$$

This does not significantly affect the coefficients in Equation (4.1). The coefficients on *YD* and *SUR* are still insignificantly different from each other. Though the Standard Error of the Regression is higher in the second of the two equations, the latter is still superior. To see this, note that the value of Schwarz's Bayesian Criterion for (4.1) is 5.06 while the corresponding figure for (4.2) is 4.98.

An obvious criticism of both (4.1) and (4.2) is that some of the regressors may be endogenous. In particular, disposable income, the government surplus and *UY* could reasonably be suspected of being correlated with the error term. Equation (4.2) was re-estimated using *YD*₋₁, *UY*₋₁, *SUR*₋₁ and a time trend as instruments for these variables. Hausman's specification test yielded a χ^2_6 statistic of 3.29 which fails to reject the null hypothesis that the OLS estimates in (4.2) are consistent. An alternative set of instruments was also tried namely, *YD*₋₂, *UY*₋₂, *SUR*₋₂ and again the time trend. The test

statistic on this occasion was 1.70 which gives further support to the null hypothesis.

A number of detailed comments about (4.2) are in order: the short-run marginal propensity to consume differs from Honohan's (1982) posterior estimate of $\frac{1}{2}$ by 2.57 standard deviations. The coefficient on UY can be interpreted as follows: a rise of 1 per cent in the unemployment rate would cause a decrease of 0.52 per cent in the short-run MPC. This is 2.15 standard deviations from Honohan's estimate of 0.74 per cent and 9.61 standard deviations from McCarthy's original estimate of 1.5 per cent. Yet again, the Irish data throw up a result which confounds both the Ando-Modigliani specification and Keynes' Second Psychological Law with regard to the effect of unemployment on consumption.⁷

The inclusion of DUR_{-1} in an equation for consumer expenditures is due to Darby (1972), (1975) and (1977). He justifies it using a partial adjustment model where the faster the adjustment of desired to actual stocks, the higher the absolute value of the coefficient. The estimated coefficient of -0.55 suggests a fairly rapid adjustment of desired to actual stocks of consumer durables. The coefficient on wealth is surprisingly large suggesting a high real rate of return. This is almost certainly due to the high rates of return on house ownership which prevailed during the sample period because of inflation.

The key findings, however, relate to the coefficient on SUR in both Equations (4.1) and (4.2) and the insignificance of D in (4.1). Barro (1978) and Tanner (1979a) suggest that there is no reason to expect that the coefficients on disposable income and the government surplus should be the same. Tanner argues that the government surplus and disposable income may contain different information about permanent income and suggests that it is sufficient for the coefficient on SUR to be insignificant. Kormendi (1983, footnote 28) shows that finding the coefficient on SUR to be significant, but less than the MPC, is not evidence against the null hypothesis that future taxes are not perceived. It is easy to show from Kormendi's analysis that the null hypothesis that taxes are perfectly discounted implies that the coefficient on SUR should be the marginal propensity to consume. Hence the results that have been obtained provide strong evidence in favour of the Ricardian Equivalence Proposition.

A notable distinction between the estimated Equation (4.2) and that used by other students of the Irish consumption function is that neither liquid assets nor inflation appear as explanatory variables. The omission of liquid assets is easily justified as it was almost certainly acting as a proxy for wealth

7. It could be argued that the measure of unemployment being used in the consumption function in this way is quite important. It should either be demand-deficient unemployment only or perhaps white noise deviations from the natural rate of unemployment if demand-deficiency is unpalatable.

in previous estimates. Another possibility is that both real income (YD) and real public authorities savings (SUR) should be adjusted for the erosion of liquid assets through inflation or exchange rate changes along the lines of Boyle (1982) and O'Reilly (1983). The argument in favour of this is that the appropriate income definition is the Hickson accrual concept and the same argument applies to the government surplus. However, it is not at all clear that this argument applies to the specification (2.1). It has already been hinted that the relatively high implicit real return on wealth reflects the redistribution of wealth from net liquid asset holders to investors in residential housing during periods of high inflation. Thus the wealth variable is effectively "catching" the relevant effects. Similarly the inclusion of the stock of real domestic debt makes it unnecessary to adjust the government surplus variable.

The final question to ask about (4.2) is whether its parameters are stable over time. The equation was re-estimated for the two sub-sample periods 1961-1970 and 1974-1984. The sub-periods were selected by simply bisecting the sample and allowing for lags. The Chow test on the null hypothesis that the parameters were the same in both periods yielded the $F(7,7)$ statistic of 4.332. The null hypothesis is rejected at 5 per cent ($F = 3.79$) but comfortably accepted at 1 per cent ($F = 7.00$). This does not amount to strong evidence of parameter instability.

IV.3 *Regressions Using the Feldstein-Kormendi Specification*

The Felstein-Kormendi approach involves disaggregating the government surplus into spending, taxation and transfers. Equation (2.2) was estimated using both the national income and disposable income variables suggested by Feldstein (1982). The national accounts definition holds for G (real) public expenditure on current goods, and services, T is (real) total taxes and TR is (real) transfers by public authorities, excluding interest payments. There is no variable akin to social security wealth available for Ireland.⁸ It should also be recalled that unlike the variable which Feldstein (1982) and Kormendi (1983) used, government bonds are not included in our measure of wealth. Using national income as the income variable the null hypothesis of Ricardian Equivalence demands that the coefficients of taxes, transfers and domestic debt should all be equal to zero. The OLS equation estimates are:

$$C = 189.29 + .42 Y + .05 W_{-1} + 1.24 G - 0.09 T - 1.43 TR + 0.05 D_{-1} \quad (4.3)$$

(0.6) (5.15) (1.31) (2.56) (-0.32) (-1.93) (0.42)

$$\bar{R}^2 = .9917 \quad SER = 79.241 \quad DW = 216$$

8. I conclude from Leimer and Lesnoy (1982) that it is not possible to construct a definitive SSW series.

This is clearly an unsatisfactory equation: the low *t* statistics on so many variables including wealth are evidence of multicollinearity in view of the high \bar{R}^2 . At first sight it appears that Ricardian Equivalence obtains support since the coefficients on *T*, D_{-1} , and *TR* are insignificantly different from zero. However, the $F(3,24)$ statistic on the joint hypothesis that all three are insignificant is 12.55 which rejects full Ricardian Equivalence. (It is interesting that neither Feldstein nor Kormendi test coefficients jointly.)

Equation (4.3) was also estimated using G_{-1} , T_{-1} , TR_{-1} , YD_{-1} and time as instruments for *G*, *T*, *TR* and *YD*. The Hausman test yielded a χ^2_7 statistic of 3.91 which fails to reject the null hypothesis that the OLS estimates in (4.3) are consistent.

The second approach suggested by Feldstein involves using disposable income as the income concept in Equation (2.2). The "Fiscal Expectations" view (no tax discounting at all combined with no direct effect of government spending on private consumption) implies that the coefficients of *T*, *TR* and *G* should be 0 and that the coefficients of wealth and public debt should be the same.

The OLS estimates were:

$$C = -222.81 + .52 YD + .08 W_{-1} + .4 G + .27 T - 1.86 TR + .09 D_{-1} \quad (4.4)$$

$$(-0.74) \quad (6.58) \quad (2.42) \quad (0.81) \quad (1.4) \quad (-3.32) \quad (0.76)$$

$$\bar{R}^2 = .9938 \quad DW = 2.23 \quad SER = 68.613$$

Individually, the coefficients on taxes, government spending and debt are insignificantly different from 0 though transfers are highly significant. In addition, the coefficients of debt and wealth are quite close. However, when a rigorous joint test is applied, initial impressions are shown to be misleading. The $F(4,24)$ statistic on the joint hypothesis that the coefficients of *T*, *TR* and *G* are zero combined with there being no significant difference between the coefficients on D_{-1} and W_{-1} is 12.487. Thus "Fiscal Expectations" is decisively rejected by the data.

Thus the Feldstein-Kormendi approach of disaggregating the components of the government surplus gives rise to a fog of multicollinearity and fails to resolve the dispute between competing hypotheses with regard to the effect of fiscal financing on the consumption/savings decision. As a final test, Schwarz's Bayesian Criterion was computed as 5.43 and 5.28 for (4.3) and (4.4) respectively. These are both higher than the values of the criterion for (4.2).

V CONCLUSIONS

At the very least, the econometric evidence in the last section points to some degree of tax discounting. I find Equation (4.2) to be the most satisfactory estimate and this points to *complete* tax discounting. However, the question clearly requires further study. Aschauer (1985) tests Ricardian Equivalence using the Euler Equation framework of Hall (1978) and Flavin (1981) and finds support for tax discounting in the US. Evans (1985) tried to determine directly whether budget deficits have been historically associated with high interest rates in the US and finds that there is no evidence that they have. Plosser (1982) looks at the same issue using time series analysis techniques on US data and finds little evidence that government bonds represent net wealth to the private sector. It is suggested that these are the directions in which research should now proceed.

REFERENCES

- ANDO, A., and F. MODIGLIANI, 1963. "The Life Cycle Hypothesis of Saving: Aggregate Implications and Tests", *American Economic Review*, March, pp. 55-84.
- ASCHAUER, DAVID ALAN, 1985. "Fiscal Policy and Aggregate Demand", *American Economic Review*, Vol. 75, pp. 117-127.
- BARRO, R.J., 1974. "Are Government Bonds Net Wealth?", *Journal of Political Economy*, Vol. 82, pp. 1015-1117.
- BARRO, R.J., 1978. *The Impact of Social Security on Private Saving*, Washington: American Enterprise Institute, Washington D.C.
- BARTH, J.R., G. IDEN and FRANK S. RUSSEK, 1986. "Government Debt, Government Spending and Private Sector Behaviour: Comment", *American Economic Review*, December, Vol. 76, pp. 1158-1167.
- BOYLE, G.E., 1982. "Inflation and Consumption in Ireland Once Again", *Technical Paper 3/RT/82*, Central Bank of Ireland.
- BRADLEY, J., 1979. "A Note on the Estimation of Disaggregated Consumption Functions", *Technical Paper No. 8/RT/79*, Central Bank of Ireland.
- BRADLEY, J., and C. FANNING, 1983. *Aggregate Supply, Aggregate Demand and Income Distribution in Ireland, A Macro Sectoral Analysis of the Period 1960-1979*, Dublin: The Economic and Social Research Institute, Paper No. 115.
- BRADLEY, J., C. FANNING, C. PRENDERGAST, and M. WYNNE, 1985. *Medium-Term Analysis of Fiscal Policy in Ireland: A Macroeconometric Study of the Period 1967-1980*, Dublin: The Economic and Social Research Institute, Paper No. 122.
- BROWNE, F.X., 1987. "Mortgage Market Disequilibrium Holding Costs, Uncertainty and Real House Prices", Mimeo, Central Bank of Ireland.
- BUCHANAN, J.H., 1976. "Barro on the Ricardian Equivalence Theorem", *Journal of Political Economy*, Vol. 84, pp. 337-342.
- DARBY, MICHAEL R., 1972. "The Allocation of Transitory Income among Consumers' Assets", *American Economic Review*, December, pp. 928-941.
- DARBY, MICHAEL R., 1975. "Postwar U.S. Consumption, Consumer Expenditures and Savings", *American Economic Review, Papers and Proceedings*, May 1975, pp. 217-224.

- DARBY, MICHAEL R., 1977. "The Consumer Expenditure Function", *Explorations in Economic Research*, Vol. 4, Winter/Spring, pp. 645-674.
- DEATON, A., 1977. "Involuntary Saving through Unanticipated Inflation", *American Economic Review*, Vol. 67, pp. 889-910.
- EVANS, PAUL, 1985. "Do Large Deficits Produce High Interest Rates?", *American Economic Review*, Vol. 75, pp. 68-87.
- FELDSTEIN, M., 1976. "Perceived Wealth in Bonds and Social Security: A Comment", *Journal of Political Economy*, Vol. 84, pp. 331-336.
- FELDSTEIN, M., 1982. "Government Deficits and Aggregate Demand", *Journal of Monetary Economics*, Vol. 9, pp. 1-20.
- FLAVIN, MARJORIE A., 1981. "The Adjustment of Consumption to Changing Expectations about Future Income", *Journal of Political Economy*, Vol. 89, No. 5, October 1981, pp. 974-1009.
- HALL, ROBERT E., 1978. "Stochastic Implications of the Life Cycle – Permanent Income Hypothesis: Theory and Evidence", *Journal of Political Economy*, Vol. 86, No. 6, December 1978, pp. 971-987.
- HONOHAN, PATRICK, 1979. "Inflation and Consumption in Ireland", *The Economic and Social Review*, Vol. 10, No. 2, January, pp. 175-179.
- HONOHAN, PATRICK, 1982. "A Bayesian Look at Consumption", *The Economic and Social Review*, Vol. 13, No. 4, July, pp. 233-249.
- KELLEHER, R., 1977. "The Influence of Liquid Assets and the Sectoral Distribution of Income on Aggregate Consumers' Behaviour in Ireland", *The Economic and Social Review*, Vol. 8, No. 3, April, pp. 189-199.
- KENNEDY, K.A., and B.R. DOWLING, 1970. "The Determinants of Personal Savings in Ireland: An Econometric Inquiry", *The Economic and Social Review*, Vol. 2, No. 1, pp. 19-51.
- KOCHIN, LEVIS, 1974. "Are Future Taxes Discounted by Consumers? Comment", *Journal of Money, Credit and Banking*, August, Vol. 6, pp. 385-394.
- KORMENDI, ROGER, 1983. "Government Debt, Government Spending and Private Sector Behaviour", *American Economic Review*, December, Vol. 73, pp. 994-1010.
- KORMENDI, R., and PHILIP MAGUIRE, 1986. "Government Debt, Government Spending and Private Sector Behaviour: Reply", *American Economic Review*, December, Vol. 76, pp. 1168-1179.
- LEAMER, EDWARD E., 1983. "Let's Take the Con Out of Econometrics", *American Economic Review*, Vol. 73, No. 1, March.
- LEIMER, DEAN R., and SELIG D. LESNOY, 1982. "Social Security and Private Saving: Time Series Evidence", *Journal of Political Economy*, Vol. 90, pp. 606-629.
- MODIGLIANI, F., and ARLIE STERLING, 1986. "Government Debt, Government Spending and Private Sector Behaviour: Comment", *American Economic Review*, December, Vol. 76, pp. 1180-1187.
- MCCARTHY, COLM, 1979. "A Study of Aggregate Consumers' Behaviour in Ireland", Central Bank of Ireland, mimeo.
- NEARY, J.P., and K.W.S. ROBERTS, 1980. "The Theory of Household Behaviour under Rationing", *European Economic Review*, Vol. 13, pp. 25-42.
- O'REILLY, LIAM, 1983. "Quarterly Consumption Behaviour", *Central Bank Quarterly Bulletin*, Winter 1983.
- PLOSSER, CHARLES I., 1982. "Government Financing Decisions and Asset Returns", *Journal of Monetary Economics*, Vol. 9, pp. 325-352.

- SEATER, J., 1981. "The Market Value of Outstanding Government Debt, 1919-1975", *Journal of Monetary Economics*, Vol. 8, pp. 85-101.
- SEATER, J., 1982. "Are Future Taxes Discounted?", *Journal of Money, Credit and Banking*, Vol. 14, pp. 376-389.
- SEATER, J., 1985. "Does Government Debt Matter? a Review", *Journal of Monetary Economics*, Vol. 15, pp. 121-131.
- SEATER, J., and ROBERTO S. MARIANO, 1985. "New Tests of the Life Cycle and Tax Discounting Hypotheses", *Journal of Monetary Economics*, Vol. 15, pp. 195-215.
- TANNER, ERNEST J., 1979a. "Fiscal Policy and Consumer Behaviour", *Review of Economics and Statistics*, Vol. 61, No. 2, May, pp. 317-321.
- TANNER, ERNEST J., 1979b. "An Empirical Investigation of Tax Discounting", *Journal of Money, Credit and Banking*, Vol. 11, pp. 214-218.
- TOBIN, J., 1980. *Asset Accumulation and Economic Activity*, The University of Chicago Press.
- UNGERN-STERNBERG, T. VON, 1981. "Inflation and Savings: International Evidence of Inflation Induced Income Losses", *The Economic Journal*, Vol. 91, No. 364, December, pp. 961-976.
- VAUGHAN, R.N., 1980. *Measures of the Capital Stock in the Irish Manufacturing Sector, 1945-1973*, Dublin: The Economic and Social Research Institute, Paper No. 103.
- WHITAKER, T.K., 1949. "Ireland's External Assets", *Journal of the Statistical and Social Inquiry Society of Ireland*, Vol. 18, pp. 192-216.
- YAWITZ, J.B., and L.H. MEYER, 1976. "An Empirical Test of the Extent of Tax Discounting", *Journal of Money, Credit and Banking*, May.

APPENDIX 1

The Data

A number of attempts have been made to create a consumer durable stock series for Ireland using the perpetual inventory method (e.g., Bradley (1979)).

$$DUR_t = CD_t + (1 - \delta) DUR_{t-1} \quad (A.1)$$

where CD_t is (flow) real expenditure on consumer durables at time t and δ is the rate at which the stock of durables is depreciated.

There are a number of difficulties with these series. Typically, the definition of durable goods is too limited as it only includes the national accounts concepts "Durable Household Goods" and "Transport Equipment". Darby (1975) and (1977) argues that "Clothing and Footwear" should be properly included in the overall sub-aggregate "consumer durables" and I follow this here. Secondly, the proposed annual depreciation rates (in the region 0.20 to 0.33) are extremely high. Darby (1972) and (1977) suggests a depreciation rate (δ) of 5 per cent per quarter which amounts to a compound 18.55 per cent per annum which is used here. Finally, a sensible initial value has to be decided upon.

This was determined using the following formula:⁹

$$DUR_0 = \frac{CD_1}{g+\delta} \quad (A.2)$$

where g is the percentage growth rate in the stock between $t=0$ and $t=1$: g was estimated using the indicator "new private motor vehicle registrations" for 1957 and 1958. The estimated stock series, DUR is printed in Appendix 2 for the period 1960-1984.

A wealth series presented a far more daunting prospect. Barro (1978) suggests that the appropriate definition of wealth for the present purpose is the sum of residential housing and business capital. Recently, both of these concepts have become statistically accessible for the Irish case. Using a formula analogous to (A.1) Bradley *et al.* (1985) has constructed time series for the fixed capital stock in industry, agriculture and marketed services, building on Vaughan (1980). Browne (1987) has suggested that the value of the housing stock can be calculated using an analogue to (A.1). The gross annual addition to the stock is given by "new private house completions", he suggests a depreciation rate of 1 per cent per year and argues that the average value of housing units should be proxied by the average price of new houses. I constructed an annual series on this basis, which is printed in Appendix 2.

The openness of the Irish economy suggests that a third element should also be included in wealth: real net external assets (EXT). The null hypothesis of Ricardian Equivalence suggests the relevant external asset concept should include net public external assets (i.e., foreign reserves less public foreign debt less net external liabilities of state-sponsored bodies). The economy-wide aggregate budget constraint implies that the annual change in this concept of net external assets equals the surplus in the balance of payments on current account. Thus, a time series for net external assets can be constructed so long as we have a benchmark for the stock of net external assets for some year. This was estimated for 1951 as follows. In that year net income from (foreign) capital was £9 million of which £8.8 million was denominated in sterling. The UK consol rate was chosen as the typical rate of return. Since that rate averaged 3.78 per cent in 1951, the stock of net external assets was grossed up as £238.1 million.¹⁰ The series is printed in Appendix 2 along with the total wealth (W) series which is the sum of business capital, residential housing and net external assets.

The final point which is relevant to the application of (2.1) and (2.2) to an open economy is the appropriate definition of government debt. First,

9. I am indebted to Gabriel Fagan for suggesting this approach.

10. Whitaker (1949) estimated net external assets was £225 million in 1947.

there is no Irish time series on the market value of government debt along the lines of Seater (1981), or even the more primitive attempts of Yawitz and Meyer (1976) and Tanner (1979b). Thus, there is no alternative but to use the par value series. Secondly, not even the most ardent opponent of Ricardian Equivalence would suggest that publicly held *foreign* debt is part of net wealth. Thus the variable D in (2.1) and (2.2) will be the par value of real domestic debt.

APPENDIX 2

Constructed Data Series (see Appendix 1)

<i>£ million</i>				
	<i>DUR</i>	<i>H</i>	<i>EXT</i>	<i>W</i>
1960	1688.9	5081.7	1056.0	15727
1961	1808.2	5453.2	1030.4	16215
1962	1926.7	5761.3	910.82	16634
1963	2063.5	6126.7	758.66	17143
1964	2220.8	6135.9	530.55	17303
1965	2363.0	6354.6	293.67	17731
1966	2461.8	6722.2	202.36	18390
1967	2593.3	7101.9	265.42	19247
1968	2775.4	7429.7	181.31	19994
1969	2987.9	7764.4	-116.86	20731
1970	3174.4	8188.6	-353.69	21589
1971	3343.1	8438.6	-562.93	22392
1972	3543.3	8421.1	-646.22	23089
1973	3788.2	8266.9	-822.71	23801
1974	3938.7	9531.4	-1481.4	25248
1975	4006.6	9676.4	-1304.4	26278
1976	4163.4	9731.2	-1480.6	27000
1977	4376.5	10599.0	-1735.4	28480
1978	4675.1	12663.0	-2149.8	31294
1979	4936.4	13981.0	-3067.3	33161
1980	5156.1	14938.0	-3708.5	34739
1981	5399.6	15086.0	-4514.9	35446
1982	5348.8	14644.0	-4852.9	35800
1983	5247.6	13566.0	-4957.5	35439
1984	5130.6	13313.0	-5216.3	35656

Notes: DUR: Stock of Consumer Durables in 1980 prices

H : Real Value of Housing Stock in 1980 prices

EXT: Real Net External Assets in 1980 prices

W : Real Wealth in 1980 prices

H, EXT and W are deflated using the implicit GNP Expenditure Deflator. DUR is composed of three sub-categories of expenditure (Durable Household Goods, Clothing and Footwear and Transport Equipment), each of which is deflated using the own-implicit price index.

APPENDIX 3

Other Data Sources

Personal expenditure on consumers' goods and services (C), personal income (YD), GNP (expenditure) (Y), public authorities' savings (SUR) and total taxes (T) are all obtained from the national income accounts. Transfer income (TR) is the sum of the national accounts concepts, central government and local authorities' current transfer payments to residents and other transfer payments on capital account. The deflator used is the ratio of GNP (expenditure) in value and volume terms. Retained earnings (RE) is undistributed company profits less corporation profits tax and corporation tax. All national accounts data were taken from the Department of Finance databank.

UY is the product of YD and the percentage rate of unemployment. The latter concept is the average percentage rate of unemployment among the insured labour force. Since this series ended in the autumn of 1984, the 1984 observation is the mid-year figure. The source is OECD Main Economic Indicators. Data on the national debt is taken from "Finance Accounts". The average consol yield for the UK in 1951 was obtained for 2½ per cent consols from HMSO Annual Abstract of Statistics No. 90 (1952), p. 279.

The concept of the government surplus which is being used here is the national income accounts entry "public authorities' savings". It could be argued that other concepts such as the PSBR are more appropriate. There are a number of reasons why the former is preferable. First, "public authorities' savings" is a national accounts concept which is collected on the same basis as the other time series used. Secondly, it unambiguously gives rise to a future tax liability. In contrast, the public sector capital programme and borrowings by state-sponsored bodies *may* partially pay for themselves. The extent to which they do is highly debateable. To the extent that they do not, the burden on the state is expressed in future values of "public authorities' savings". Finally, the US literature has utilised this definition and it facilitates comparison for us to follow this here.