JOURNAL OF ECONOMIC DEVELOPMENT
Volume 26, Number 1, June 2001

Testing the Ricardian Equivalence Theorem: Time Series Evidence from Greece

Kostas Drakos*

The paper explores the long-run relationship between government domestic borrowing and private savings for a small EU country. It represents an attempt to assess the relevance of Ricardian Equivalence in Greece. The empirical findings are that in accordance to the Ricardian Equivalence theorem prediction, government borrowing in Greece leads to an increase in household savings. However, the increased private savings do not completely offset increased government debt. In other words, contrary to the Ricardian Equivalence theorem, households to some extent perceive government bonds as net wealth and consequently increased their consumption. This behaviour can be thought as being the result of liquidity constraints faced by households and also myopic behaviour due to uncertainty regarding the future path of taxes.

I. Introduction

The issue of how fiscal policy affects the macro-economy has for long divided the economics profession. In particular, of great importance is the impact, if any, of government debt on savings. The Public debt neutrality, usually called Ricardian Equivalence, has been one of the most debated issues of modern macroeconomics and the subject of a large number of theoretical and empirical studies (Kormendi and Meguire (1983, 1995), Blanchard (1985), Barth *et al*. (1986), Bernheim and Bagwell (1988), Evans (1988, 1993), Barro (1989), Feldstein and Elmendorf (1990), Bohn (1992), Graham (1995), Becker (1997)).

Three alternative ways (or a mix of those) can finance government spending: raising taxes, printing money or borrowing. Assume that the government chooses to finance its increased spending by borrowing and thus holds tax rates and money supply unaltered.[1] The crucial question is if there is any effect of such a policy on national saving, and if indeed there is one, what it is. This question is widely known as whether government bonds represent net wealth (Barro (1974)). In essence, the main idea of the Ricardian Equivalence proposition asserts that public debt and lump sum taxes are equivalent methods of financing a given amount of public expenses. In other words, it is government spending that matters

* Department of Economics, London Guildhall University, 31 Jewry Street, London, EC2N 3EY, UK. E-mail: drakos@lgu.ac.kr. The author is grateful to an anonymous referee for his/her valuable comments and insights that helped considerably improve the paper. The paper was completed when the author was at the University of Essex as a Ph.D. student. Any remaining errors and ambiguities remain his responsibility.

1. Raising taxes is a practice that often affects government popularity since the extra burden is felt directly by households and businesses. Similarly, printing money has adverse inflationary effects.

not the method of financing it. This public expense financing irrelevance is an extension, applied to the public sector, of the Modigliani-Miller theorem (Modigliani and Miller (1958)).

By virtue of the Ricardian Equivalence Theorem, Government bonds do not represent net wealth therefore household savings will increase to offset the government policy. The argument, well established in the literature, is that while government bonds represent an asset to those holding them, they represent a liability to taxpayers that must redeem them in a future date (Poterba and Summers (1987), Seater (1993)).

In fact, since the assets at the same time are liabilities as well, it must be the case that increased saving must exactly match government borrowing. Households, by recognising that the government must satisfy its intertemporal budget constraint anticipate that the current increase in wealth will be cancelled out by the future increase in taxes and therefore offset it in present value. As a result the households' consumption path is not modified and the current 'extra' wealth is saved in order to provide the funds for paying the higher future taxes. Thus, the issuing of government debt to finance a fiscal imbalance represents not a reduction in the tax burden but merely a postponement of it. Consumers discounting the future understand that their total tax burden is not affected, therefore there is no reason to respond to the tax cut by increasing consumption. Instead, they will save the entire tax cut to meet the future tax liability; as a result, the decrease in public saving (the budget deficit) will coincide with an increase in private saving of precisely the same size (Elmendorf and Mankiw (1998)).

If however it is the case that government bonds do represent net wealth then there should be an indirect adverse effect on savings through increased consumption of households.[2] How can one justify the idea that government bonds are net wealth? Bonds are net wealth to the extent that the asset of current generations is matched by a liability of future generations (Modigliani (1961), Diamond (1965), Detken (1999)). However, if households have infinite horizons, for instance through intergenerational linkages, then intergenerational transfers (bequests) offset burdens shifted to future generations.

The present paper will focus on the case of the Greek economy that is traditionally characterised by a high government debt[3] and also has a number of structural characteristics that are almost unique. The Greek case is interesting since, apart from being a member of the EU, it lies on the borderline between developed and emerging economies.

In particular, the paper will test the Ricardian Equivalence Theorem for the Greek economy by exploring the dynamic link between domestic government borrowing and private sector savings. Furthermore, an attempt will be made to quantify the long-run impact in the quest of producing a complete characterisation of the underlying mechanism. The research questions will be addressed in a dynamic context by the use of time series techniques.

Thus, the paper contributes to the existing empirical literature in the following ways. Firstly, it offers a case study on the relevance of Ricardian Equivalence for a small EU country, Greece. Secondly, by employing time series techniques (cointegration) it takes into

2. Assuming that wealth enters the consumption function.

3. In 1994 the general government gross debt, as a percentage of GDP was 129%.

account the dynamic properties of the variables and explores the issue in an intertemporal framework. Thirdly, by recognizing that fiscal policy is not simply an economic phenomenon but also has a political dimension, the testing procedure controls for changes in the political environment by introducing dummy variables identifying changes in regimes.[4] In this way the inference is not contaminated from government-specific policies. Furthermore, the significance of the coefficients related to the dummies will signal that indeed the underlying relationship between government borrowing and private savings is affected by the economic policies pursued by the political forces in power. The paper is organized as follows. Section II discusses the econometric methodology employed. Section III presents the data used. Section IV summarizes the empirical findings of the paper. Finally, Section V concludes.

II. Data Issues

The unavailability of comprehensive and complete data for savings led to using as a proxy private sector bank deposits. The same problem was encountered with public debt, which led to the use of government borrowing as a proxy. The choice of proxies is justified on the basis that domestic borrowing is part of the change in debt and therefore highly correlated with it. The same holds for household savings and bank deposits. For the period considered households held the bulk of their savings in the form of bank deposits, since the stock market was not developed enough and also savings in the form of foreign assets was virtually non-existent.

The data consist of quarterly observations on real government domestic borrowing (B) and real private sector bank deposits which will be used as a proxy for savings (S). Both series are seasonally adjusted using the U.S. Bureau of the Census X-11 (additive) method. The nominal series have been expressed in real terms by using the Consumer Price Index (in 1990 prices) in order to avoid inflation-dependent results and also correct for the business cycle. The data span the period from 1981:1 to 1996:3 and are taken from the IFS CD-ROM.

III. Econometric Methodology

The present study is an attempt to test the Ricardian Equivalence (RE hereafter) for the Greek economy. The variables under scrutiny are the real domestic government borrowing and real private savings. Domestic government borrowing (as opposed to total borrowing) is used in order to focus on the effect on the saving behaviour of households. That is, by ignoring external borrowing one can solely measure the effect on behaviour of domestic households.

One of the testable hypotheses of the RE is that increased private savings will match government borrowing (increase in debt). In other words, the extra wealth in the form of bonds held by households will be transformed into savings. The operational hypothesis tested here will be that there should be a positive relationship between government domestic

4. That is whether the socialist or the conservative party was in power.

borrowing and private savings. Finding a positive relationship will provide evidence in favour of the RE. If in contrast there is evidence for a negative relationship that will constitute a prima facie rejection of the RE.

The time series of the macroeconomic variables involved in the subsequent analysis are non-stationary[5] therefore the appropriate econometric framework should take into account this property. Thus, the dynamic link between government borrowing and savings will be explored within a possibly cointegrated system where effectively the joint endogeneity of the variables is allowed.

Cointegration[6] of a vector of variables implies that the number of unit roots in the system is less than the number of unit roots in the corresponding univariate series (Granger (1981), Granger and Weiss (1983), Granger (1986), Engle and Granger (1987)).

In order to test whether the government borrowing and savings are cointegrated the Johansen procedure will be employed (Johansen (1988), Johansen (1991), Johansen (1995)). The Johansen procedure starts with the definition of an n-dimensional vector of non-stationary variables *X*, which potentially form a cointegrating set. The Vector Autoregressive (VAR) representation of the unrestricted system with Gaussian error *u* (the intercept terms are omitted for simplicity) is:

$$\times_t = A_1 \times_{t-1} + A_2 \times_{t-2} + ... + A_k \times_{t-k} + u_t \qquad (1)$$

where $u_t \sim N(0, \Sigma)$ (2)

and X_t is (n x 1) and each of the A_i is an (n x n) matrix of parameters. Model (1) can be reformulated into a Vector Error Correction (VECM) form:

$$\Delta X_t = \tilde{A}_1 \Delta X_{t-1} + \tilde{A}_2 \Delta X_{t-2} + ... + \tilde{A}_{k-1} \Delta X_{t-k-1} - \Pi X_{t-k} + u_t \qquad (3)$$

where $\Gamma_i = -(I - A_1 - ... - A_i) \qquad i = 1,2,...,k-1$ (4)

and $\Pi = -(I - A_1 - ... - A_k)$ (5)

The rank of matrix Π determines whether there are any significant cointegrating vectors between the variables. Clearly if the rank of Π is zero the matrix is null and (3) is just a VAR model in first differences. The other extreme case is when Π has full column rank, which is equivalent to the stationarity of the vector process. The intermediate case of reduced column rank implies that there exist stationary linear combinations of the variables, corresponding to the cointegration vectors. Furthermore, Johansen has developed a sequence of Likelihood Ratio tests to test for the number of the cointegration vectors (or equivalently

5. The relevant stationarity tests will follow.

6. A brief discussion of the concept of multivariate cointegration and the Johansen procedure is given in this section since it is a well-known method in the discipline. For a more rigorous and extensive discussion see (Johansen (1988), Johansen (1991), Johansen (1995), Hatanaka (1996)).

the rank of P) the so-called trace test (denoted by l_{tr}) and the maximum eigenvalue test denoted by $l_{\max}$). In particular, to decide on the number of the cointegration vectors the maximum eigenvalue test will be used, since $l_{\max}$ has a sharper alternative and thus it is preferred to the trace test. Critical values obtained from Monte Carlo simulations of the limiting distribution are given in Johansen and Juselius (1990) and Osterwald-Lenum (1992).

IV. Empirical Results

To explore the dynamic link between government borrowing and domestic savings the order of integration of the series has to be established. For that reason, the Augmented Dickey-Fuller (ADF) unit root test was employed (Dickey and Fuller (1979, 1981)). The following table reports the results for the tests.

Table 1 Unit Root Tests *

Series	Pseudo t-statistic (lag order)
Real Domestic Government Borrowing (level)	1.18 (2)
Real Private Bank Deposits (level)	1.66 (3)
Real Domestic Government Borrowing (difference)	5.61 (2)
Real Private Bank Deposits (difference)	7.23 (2)

* Critical value at the 5% significance level is 2.89.

Both series seem to be I(1) in levels so the necessary condition for cointegration among them is satisfied. The next step was to employ the Johansen method in order to test whether the series constitute a cointegrated system. The following table summarises the cointegration statistics.

Table 2 Cointegration Results

Panel A. Cointegration Results (1981:1 - 1996:3)				
Rank under the Null	Alternative Hypothesis	$ë_{\max}$	5% (significance)	10% (significance)
r = 0	r = 1	15.9*	15.67	13.75
r = 1	r = 2	0.85	9.24	7.52
Panel B. Error Correction Mechanism				
ECM = S 0.068*B 1.88				
(2.47) (3.76)				
Panel C. Multivariate Diagnostics				
p-val				
LM(14)		0.17		
LM(1)		0.14		

a. The estimation was based on a VECM of lag order four (chosen by the Schwarz criterion), including a restricted constant and two dummies for the different political parties in power.

b. The asterisk denotes significance at the 5% level.

The model was estimated by using four lags, including a restricted drift term. The choice of the lag length was based on the Schwarz Bayesian Criterion (Schwarz (1978)). Alternative lag structures were considered but results were insensitive to the particular choice of lag length. However, at this lag order the residual vectors from the system satisfied the no-autocorrelation assumption, which is a critical assumption in the Johansen procedure. Furthermore, as discussed earlier, to avoid regime-specific results dummies will be included in order to capture differences in economic policy. In particular, dummy ND takes the value 1 when the conservative party (New Democracy) was in power between 1990:Q1 until 1993:Q3, and zero otherwise. Similarly, dummy PSK takes the value of 1 when the socialist party (PASOK) was in power between 1981:Q1 to 1989:Q4, 1993:Q4 to 1996:Q3, and zero otherwise.

The maximum eigenvalue test statistic suggests that the cointegration rank of the system is equal to one. The null of no cointegration is rejected at the 5% significance level, whereas the null that the rank of the cointegration space is equal to one is not rejected. This provides evidence that government borrowing and private savings are tied together by one long run relationship or equivalently that they share a common stochastic trend. To be more precise there is evidence for the presence of a unique statistical equilibrium, which works as an ‘attractor’ for the variables. The estimated long-run equilibrium relationship (EQ) had the following form (t-statistics in parentheses):

$$EQ = S - 0.068^{*}B - 1.878 \qquad (6)$$
$$(\ 2.47)\ (\ 3.76)$$

The long run relationship as it stands allows one to test for the Ricardian Equivalence. Recall that according to the RE the long-run impact of government borrowing on savings should be positive. Additionally, strictly speaking the long run impact should equal unity. In other words, rational forward-looking agents increase their savings on-to-one with any increased debt ‘passed on’ them by the public sector. That is the following should hold:

$$\frac{\partial S}{\partial B} = 1 \qquad (7)$$

The estimated long run impact took the following form (*d-hat* denotes the estimated long-run ‘derivative’):

$$\hat{d} = 0.068 \qquad (8)$$
$$(s.e = 0.0275)$$

Thus, according to the information in the sample used, government borrowing is indeed associated with a long-run increase in savings. However, the null that the long-run impact is unity (or equivalently that the elements of the cointegration vector are symmetric) can be rejected at all conventional levels of significance. This suggests that, to some extent, agents perceive government debt (government bonds) as net wealth and consequently do not

increase their savings in such a way as to counteract public borrowing. In fact, the coefficient of government borrowing in the long run relationship can be interpreted as the long-run marginal propensity to save out of increased wealth induced by holding government debt (bonds). The marginal propensity to save was found to be approximately *7%*, that is in the long run the effect of government borrowing is to increase household savings by this fraction, which ultimately is translated into increased household consumption (93% of the 'extra' wealth acquired is channelled to consumption).

Furthermore, another useful metric that would shed more light in the long-run relationship describing the time paths of the variables is the long-run elasticity of private savings with respect to government borrowing. This is (the ordering of variables in subscript denotes that we calculate the elasticity of savings with respect to borrowing):[7]

$$\boldsymbol{e}_{S,B} = \frac{\partial S}{\partial B}\frac{B}{S} \tag{9}$$

Since we are dealing with time series, although the long-run impact (the derivative) is a constant, the elasticity depends on the levels assumed by the variables and for that reason is time-dependent. Therefore, one cannot use a unique point estimate for the elasticity but only observe the value it attains at specific points in time. Alternatively one may want to see how the elasticity behaves across time. The following table summarises the point estimate of the elasticity for various points in the sample.

Table 3 Savings Long-Run Elasticity*

Mean	Median	Maximum	Minimum
0.17	0.149	0.74	0.004

* Elasticity calculated at the mean, median, max and min of the ratio B/S multiplied by the long-run marginal propensity to dissave as in equation 4 in main text.

One way to interpret this metric is that the elasticity denotes the percentage of government borrowing that is perceived by households as representing net wealth in particular points in time. For instance, across the time span considered in the analysis, households' behaviour indicates that on average *17%* (*t-stat. = 10.6*) of government borrowing has been thought as representing net wealth.

The following table reports the estimation results for the VECM and also a set of diagnostics.

Tests for Weak Exogeneity[8] (significance of speed of adjustment to deviations from equilibrium) also reveal that government borrowing is weakly exogenous whereas private

7. We acknowledge an anonymous referee for suggesting an alternative way of calculating the elasticity. Essentially, one can base the elasticity on the long run components extracted from the variables using the common trend representation from the estimated VECM.

8. We thank an anonymous referee for pointing this out. However, in accordance with the existing empirical literature we continue to use the term 'Weak Exogeneity' in a rather more flexible and somewhat informal way.

Table 4 VECM Estimation Results

Equation for Real Private Bank Deposits (S)[a]		
Variable	Coefficient	t-statistic[b]
Ä(S)(1)	0.03	0.15
Ä(S)(2)	0.03	0.27
Ä(S)(3)	0.32	2.17
Ä(S)(4)	0.07	0.66
Ä(B)(1)	0.02	1.04
Ä(B)(2)	6.32E 05	0.002
Ä(B)(3)	0.009	0.47
Ä(B)(4)	0.02	1.37
ECM(1)	0.5	3.16
ND[c]	0.33	3.31
PSK	0.25	2.71
Diagnostics		
R^2	0.54	
Adjusted R^2	0.44	
Serial Correlation LM(4)	(p-val) 0.19	
ARCH LM(4)Test:	(p-val) 0.022	
Equation for Real Government Domestic Borrowing (B)		
Variable	Coefficient	t-statistic
Ä(S)(1)	0.61	0.32
Ä(S)(2)	0.51	0.37
Ä(S)(3)	2.00	1.68
Ä(S)(4)	2.78	2.95
Ä(B)(1)	0.79	7.80
Ä(B)(2)	0.95	4.99
Ä(B)(3)	0.39	1.94
Ä(B)(4)	0.26	1.80
ECM(1)	1.56	1.23
ND	0.98	0.93
PSK	1.47	2.15
Diagnostics		
R^2	0.59	
Adjusted R^2	0.51	
Serial Correlation LM(4)	0.08	
ARCH LM(4)Test:	0.97	

a. Ästands for the difference operator.

b. Heteroskedasticity-adjusted (White) t-statistics.

c. ND and PSK dummies for New Democracy and PASOK governments respectively.

savings are not. However, some caution is needed when using the term Weak Exogeneity since the two VECM equations do not constitute the 'mean' equations of the conditional and the marginal distributions (because among other issues, the covariance of the error terms is not necessarily zero). Based on the coefficients of the error correction terms it is not strictly valid to refer to Weak Exogeneity in the Engle *et al.* (1983) sense. Thus bearing this in mind, private savings seem to respond to systemic shocks and change in order to 'drive' the system back to equilibrium. So, private savings act as receptor of the shock and in a sense absorb it so as to eliminate the realised equilibrium error.

Given the evidence against the Ricardian Equivalence, one has to identify the assumptions that are likely to be violated. For that reason, recall that the debt neutrality is achieved under the following conditions:

Intergenerational altruism (bequests),
No capital market imperfections (households do not face liquidity constraints),
Households can accurately forecast their future income,
Public debt must be ultimately repaid with the receipts from taxes of the next periods (the government satisfies its intertemporal budget constraint),
Taxes are lump sum and non-distortionary.

The negative long-run impact of the budgetary policy (government borrowing) on private savings signals that one or more of the above assumptions is violated. First, it could be the case that some households are liquidity constrained. As a result, changes in government debt policies that effectively allow consumers to borrow by deferring taxes may affect their consumption. In particular, when liquidity constraints arise due to adverse selection then Ricardian Equivalence may be invalidated (Yotsuzuka (1987), Rockerbie (1997)). Furthermore, if the liquidity constraints arise from limitations on the set of debt contracts that the government will enforce, then the RE is likely to fail.

A second possible explanation is that households may exhibit 'myopic' behaviour. That is they may fail to project the path of their future income and also may fail to take into account future tax liabilities. Essentially, instead of solving their 'dynamic optimisation problem' by using all available information and discount future properly, they resort to 'rules of thumb' that lead them to consume a higher fraction of their disposable income than the solution of the dynamic optimisation would suggest.

A third possibility is that the non-lump-sum character of taxes could cause departures from RE (Barsky *et al.* (1986)).

The fourth possibility is that the configuration of growth and interest rates is such that the government need never raise future taxes to pay for increases in its indebtedness. Basically, this would be the case when the steady state growth rate is in excess of the steady state rate of interest. In such a case, households will treat part of the government debt as net wealth and consequently will reduce their savings.

As far as the Greek economy is concerned, the empirical finding is most likely to be the result of the combined presence of the first two possibilities. The third possibility is not theoretically robust (Chan (1983), Poterba and Summers (1987)). The fourth possibility is irrelevant for the Greek case since the observed growth has consistently fallen short of the

rate of interest in the economy. On the other hand, the first two possibilities are highly consistent with stylised facts in the Greek economy. For the period under scrutiny the Greek financial markets did not exhibit sufficient 'depth' and also the liberalisation process was slow. Furthermore, uncertainty regarding the future path of income and especially taxes was high. In particular, it is an anecdotal fact that frequent legislative changes in taxation have increased uncertainty.

V. Conclusion

An implication of Ricardian Equivalence was tested for the Greek economy. In particular, the hypothesis tested was that fiscal imbalances financed by debt are matched by an increase in household savings. By employing the Johansen procedure to accommodate for the time series properties of the series, the paper explored the qualitative and quantitative impact of government borrowing on private sector bank deposits. The empirical findings were that increases in government debt are associated with household increased saving, albeit far from being a one-to-one effect, providing evidence against the Ricardian Equivalence theorem. In other words, households perceive government debt as net wealth and therefore consume part of it. The estimation indicated that households' long-run marginal propensity to save as a result of increased debt is approximately *7%*.

Furthermore, the mean elasticity of private bank deposits with respect to government borrowing was found to be approximately *17%*. That is, for the period considered, government borrowing has increased private savings by an average of *17%*.

A number of possible explanations have been offered that could account for a negative impact of government borrowing on savings. As far as the Greek case is concerned, reasonable explanations seem to be that the private sector is liquidity constrained and/or also exhibiting 'myopic' behaviour.

The policy implication is the following. To the extent that private sector bank deposits are used to finance private sector investment, the negative impact of government borrowing on it will result, at least partially, in a 'crowding-out' effect. Private investment will be adversely affected either by facing a higher cost of borrowing (shortage of available funds in the capital market 'pushing' up the rate of interest) or by some kind of credit rationing (where a smaller fraction of private projects will be financed). In either case, the reduced private investment is likely to lead to lower income growth in the future.

References

Barro, R. (1974), "Are Government Bonds Net Wealth?" *Journal of Political Economy,* Vol. 82, 1095-1117.

_____ (1989), "The Ricardian Approach to Budget Deficits," *Journal of Economic Perspectives*, Vol. 3, No. 2, 37-54.

Barsky, R., G. Mankiw, and P. Zeldes (1986), "Ricardian Consumers with Keynesian Propensities," *American Economic Review*, Vol. 76, 676-691.

Barth, J., G. Iden, and F. Russek (1986), "Government Debt, Government Spending, and Private Sector Behaviour: Comment," *American Economic Review*, Vol. 76, 1158-1167.

Becker, T. (1997), "An Investigation of Ricardian Equivalence in a Common Trends Model," *Journal of Monetary Economics*, Vol. 39, 405-431.

Bernheim, D., and K. Bagwell (1988), "Is Everything Neutral?" *Journal of Political Economy*, Vol. 96, 308-338.

Blanchard, O. (1985), "Debt, Deficits and Finite Horizons," *Journal of Political Economy*, Vol. 93, 223-247.

Bohn, H. (1992), "Budget Deficits and Government Accounting," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 37, 1-84.

Chan, L. (1983), "Uncertainty and the Neutrality of Government Financing Policy," *Journal of Monetary Economics*, Vol. 11, 351-373.

Detken, C. (1999), "Fiscal Policy Effectiveness and Neutrality Results in a non Ricardian World," Working Paper No 3, European Central Bank.

Diamond, P. (1965), "National Debt in a Neoclassical Growth Model," *The American Economic Review*, Vol. 60, 1126-1150.

Dickey, D., and W. Fuller (1979), "Distribution of Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association*, Vol. 84, 427-431.

_____ (1981), "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica*, Vol. 49, 1057-1072.

Elmendorf, D., and N. Mankiw (1998), "Government Debt," NBER Working Paper No 6470.

Engle, R., and C. Granger (1987), "Cointegration and Error-Correction: Representation, Estimation, and Testing," *Econometrica*, Vol. 55, 251-276.

Evans, P. (1988), "Are Consumers Ricardian? Evidence for the United States," *Journal of Political Economy*, Vol. 96, 983-1004.

_____ (1993), "Consumers are not Ricardian: Evidence from Nineteen Countries," *Economic Inquiry*, Vol. 31, 534-548.

Feldstein, M., and D. Elmendorf (1990), "Government Debt, Government Spending, and Private Sector Behaviour Revisited: Comment," *American Economic Review*, Vol. 80, 589-599.

Graham, F. (1995), "Government Debt, Government Spending, and Private-Sector Behaviour: Comment," *American Economic Review*, Vol. 85, 1348-1356.

Granger, C. (1981), "Some Properties of Time Series Data and Their Use in Econometric Model Specification," *Journal of Econometrics*, Vol.16, No 1, 121-130.

_____ (1986), "Developments in the Study of Cointegrated Variables," *Oxford Bulletin of Economics and Statistics*, Vol. 48, 213-228.

Granger, C., and A. Weiss (1983), "Time Series Analysis of Error Correction Models," in *Studies in Econometrics, Time Series, and Multivariate Statistics: In Honour of Theodore W. Anderson*, eds. by T. Amemiya and L. Goodman, Academic Press, New York, 255-278.

Hatanaka, M. (1996), *Time-Series-Based Econometrics: Unit Roots and Cointegration*, Oxford University Press, Oxford.

Kormendi, R. (1983), "Government Debt, Government Spending, and Private Sector Behaviour," *American Economic Review*, Vol. 73, 994-1010.

Kormendi, R., and P. Meguire (1995), "Government Debt, Government Spending, and Private Sector Behaviour: Reply," *American Economic Review*, Vol. 85, 1357-1361.

Johansen, S. (1988), "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, Vol.12, No. 2, 231-254.

_____ (1991), "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models," *Econometrica*, Vol. 59, 1551-1580.

_____ (1992), "Testing Weak Exogeneity and the Order of Cointegration in UK Money Demand Data," *Journal of Policy Modelling*, Vol.14, 313-334.

_____ (1995) *Likelihood-Based Inference in Cointegrated Vector Autoregressive Models*, Oxford University Press, Oxford.

Johansen, S., and K. Juselius (1990), "Maximum Likelihood Estimation and Inference on Cointegration - With Application to the Demand for Money," *Oxford Bulletin of Economics and Statistics*, Vol. 52, 169-210.

Modigliani, F., and M. Miller (1958), "The Cost of Capital, Corporation Finance, and the Theory of Investment," *American Economic Review*, Vol. 48, 261-297.

Modigliani, F. (1961), "Long Run Implications of Alternative Fiscal Policies and the Burden of the National Debt, " *Economic Journal*, Vol. 71, 730-755.

Osterwald-Lenum, M. (1992), "A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics," *Oxford Bulletin of Economics and Statistics*, Vol. 54, 461-472.

Poterba, J., and L. Summers (1987), "Finite Lifetimes and the Effects of Budget Deficits on National Savings," *Journal of Monetary Economics*, Vol. 20, No. 2, 369-410.

Rockerbie, D. (1997), "Are Consumers Ricardian when Some are Liquidity Constrained? Evidence for the United States," *Applied Economics*, Vol. 29, No. 6, 821-827.

Schwarz, G. (1978), "Estimating the Dimension of a Model," *Annals of Statistics*, Vol. 2, 461-464.

Seater, J. (1993), "Ricardian Equivalence," *Journal of Economic Literature*, Vol. 31, 142-190.

Yotsuzuka, T. (1987), "Ricardian Equivalence in the Presence of Capital Market Imperfections," *Journal of Monetary Economics*, Vol. 20, 411-436.