DOCUMENTOS DE TRABALHO

Nº 11

PUBLIC DEBT NEUTRALITY AND PRIVATE CONSUMPTION SOME EVIDENCE FROM THE EURO AREA(*)

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June, 1999

(*) This paper is part of the current research project for the author's PhD thesis. The paper benefited from the comments of Jorge Santos and João Santos Silva. I am also grateful for comments received by the participants of the Economics Department Seminar held at ISEG- UTL, May 1999. The usual disclaimer applies.
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Sumário

A neutralidade da dívida pública e a questão da Equivalência Ricardiana têm sido um dos assuntos mais frequentemente abordados e investigados pela moderna macroeconomia. Segundo a análise macroeconómica convencional, a dívida pública tem efeitos sobre a economia pois os consumidores encaram a dívida pública como riqueza líquida. Então, quanto maior for a dívida pública mais ricos se sentem os consumidores e mais tendem a consumir. Este texto resulta de uma leitura da literatura sobre a neutralidade da dívida pública e respectivas implicações para o consumo privado. O texto apresenta ainda os resultados de cálculos efectuados para a área do Euro os quais parecem lançar algumas dúvidas sobre a validade da hipótese Ricardiana para este conjunto de países.

Abstract

Debt neutrality and the Ricardian Equivalence issue has been subject to extensive discussion and empirical research in modern macroeconomics. According to conventional macroeconomics, public debt has a significant effect on the economy since consumers see public debt as net wealth. The bigger the stock of public debt the wealthier consumers consider themselves leading them to increase consumption. This text emerges from an exercise of reading the literature concerning public debt neutrality and its implications on private consumption. Some calculations for the Euro area are presented and they seem to cast some doubts upon the validity of the Ricardian hypothesis for this set of countries.

JEL: C23, E21, H62, H63.
Keywords: Ricardian equivalence, deficit finance, private consumption, Euro area, panel data.

1 - Introduction

Public debt neutrality and the Ricardian Equivalence question have been one of the most debated issues of modern macroeconomics and the subject of a large number of theoretical and empirical research papers.[1] Under conventional macroeconomic analysis, public debt has an effect on the economy since consumers consider public debt as net wealth.[2] Therefore, the bigger the stock of public debt the wealthier the consumers feel and the more inclined they are to consume.

The terms "Ricardian Equivalence Theorem" or "Ricardian Equivalence Proposition" are nowadays included in the vocabulary of macroeconomics being the expression Ricardian Equivalence apparently coined by Buchanan (1976).[3] While the first formal exposition is credited to Barro (1974), in a seminal paper, the theoretical rational behind the Ricardian Equivalence hypothesis was originally stated by Ricardo (1817, 1820). Even if Barro does not initially refer Ricardo, he ends up acknowledging Ricardo's merit in his reply to Buchanan's (1976) comment.[4]

In a very simplified way the main idea of the Ricardian Equivalence proposition dwells on the supposition that public debt and lump sum taxes are equivalent methods of financing a given amount of public expenses. Deficits merely postpone the future imposition of taxes. If consumers are rational it becomes indifferent to pay 100 Euros of taxes today or tomorrow. In that sense, being irrelevant to the consumers the moment when taxes are paid, the consumers do not change their consumption decisions after variations in the

[1] Seater (1993) when writing about this issue cited 207 references.
[2] See for instance Blinder and Solow (1973) and Christ (1978).
[3] Feldstein (1982) prefers the term pre-Ricardian Equivalence hypothesis or proposition. Buiter and Tobin (1979) use the expression neo-Ricardian Equivalence.

budget deficit. For instance Phelps (1982, p. 379) considers that increases in the supply of public debt ends up creating its own demand, and it would not influence the demand for other assets. In other words, there would be a sort of "Say's Law" for the deficits and its financing by public debt, idea also mentioned namely by Bernheim (1987).

Nevertheless, Ricardo was convinced that in practice it was quite relevant the method the government chooses to finance its expenses, this conviction of Ricardo led O' Driscoll (1977) to suggest that the Ricardian Equivalence Theorem should be called "Ricardian Nonequivalence Theorem."[5]

One of the several implications of the theorem's validity is the conclusion of the deficit neutrality when it is financed by public debt, that is, deficits do not influence real variables, and have no effects on aggregate demand should be visible.[6] Some authors envisage this public expense financing indifference as an extension, applied to the public sector, of the Modigliani-Miller theorem (Modigliani and Miller[1958] and Stiglitz [1969]) formerly postulated for the financing of enterprises.

The paper is organised as follows: Barro's result for debt neutrality is presented in a very simple and intuitive way in section two, with also a few words for the conditions necessary for that result to hold; theoretical formalisation and some international empirical results concerning private consumption are the subject of section three; section four gives some preliminary test results of the Ricardian Equivalence hypothesis for Euro area; section five concludes the paper.

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[4] "Buchanan begins his comment by pointing my failure to acknowledge an intellectual debt to David Ricardo. I readily accept his criticism (...)", Barro (1976, p. 346).

[5] Barro (1979, p. 940) labels O' Driscoll (1977) comments as "an amusing discussion of whether Ricardo actually held to the Ricardian view."

[6] For Barro (1978, p. 570) "the rise in the government deficit would have no (first order) effect on the price level, rate of return, or the capital/labor ratio."

2 – Public debt wealth effects

Barro's (1974) paper definitely set a landmark and represented a turning point of the literature concerning the public debt issue. The necessary conditions for the Ricardian Equivalence to hold are clearly presented on that paper namely the intergenerational solidarity model.[7]

The Ricardian Equivalence result, or the debt neutrality hypothesis, is presented formally by Barro (1974) with a theoretical set up inspired in the overlapping generations model of Samuelson (1958) and Diamond (1965). The existence of intergenerational altruism, a major hypothesis for Barro, implies that the utility function of consumers in generation t may be written as

$$U_t = U(C_t^t, C_t^{t+1}, U_{t+1}^*) , \tag{1}$$

where

C_t^t - consumption of generations born in t, when they are young;

C_t^{t+1} - consumption of generations born in t, when they are old;

U_{t+1}^* - utility level of generation t descendants.

This link between generations is paramount to guarantee the debt neutrality result, which can be grasped in a quite simple way. Assume that the government gives an identical number of public debt bonds to each consumer. In the future it will be necessary for the government to use taxes in order to meet the interest payments and the redemption of the bonds. The actual value of consumer's wealth can be written as

[7] As Elmendorf and Mankiw (1998) put it, "Barro can be viewed as the Christopher Columbus of Ricardian Equivalence (…) Barro was not the first economist to discover Ricardian Equivalence, but he was surely the last (…) and no one will be able to discover it again."

$$W_1 = W_0 + B - AVT \tag{2}$$

where

W_0 - consumers wealth before receiving the bonds;

W_1 - consumers wealth after receiving the bonds;

B - bond value;

AVT - actual value of taxes necessary to meet interest payments and bond redemption.

Suppose as a first situation that the bonds are reimbursed, plus interest, in the next year and also that the consumers still belong to the same generation. In that case, the actual value of the taxes is given by

$$AVT = \frac{(1+r)B}{1+r} = B \tag{3}$$

where r is the interest rate. Substituting (3) in (2) obviously gives,

$$W_1 = W_0 + B - B\,, \tag{4}$$

$$W_1 = W_0\,, \tag{5}$$

allowing us to conclude that the issuing of public debt had no effect on the consumer’s wealth level. Public debt was not considered by consumers as wealth, the main idea proposed by Ricardo and recovered by Barro.

Let’s see yet another situation where public bonds are perpetuities and consumers behave as if they had infinite lives. Now, the actual value of the sum of the future tax flows is equal to the actual value of the sum of the future interest payments flows. One should then write

$$AVT = \sum_{t=1}^{n} \frac{rB}{(1+r)^t} \qquad (6)$$

when $n \to \infty$ we have

$$AVT = \sum_{t=1}^{n} \frac{rB}{(1+r)^t} = rB\frac{1}{r} = B \qquad (7)$$

and, once more, public debt would have no effect on the consumer's net wealth.

One must however bear in mind that the Ricardian Equivalence theoretical assumptions are quite demanding, ranging from consumer behaviour suppositions to hypothesis concerning the financial and economic environment. In other words, the models that produce the Ricardian Equivalence results have always a set of specific and well-defined characteristics to produce the Ricardian result.

The following conditions are labelled necessary in order to corroborate the Ricardian Equivalence theorem:

i) Successive generations are linked by principles of altruism reflected on financial intergenerational transfers, in such a way that consumption decisions may be thought as being taken by a hypothetical representative consumer with infinite horizons.

ii) Capital markets are perfect and efficient, the consumers and the government are able to lend and borrow at the same interest rates and the households face no liquidity constraints.

iii) Consumers have perfect knowledge about their actual and future income.

iv) Public debt issued at the first period must be reimbursed and remunerated with the receipts from taxes of the next periods.

v) Consumers fully anticipate the responsibilities related with future taxes, underlying the issuing of new public debt.

vi) Taxes are lump sum, non-distortionary. If taxes depend on income the government may use them to affect national income and, since future income is uncertain, then there will be doubts about the actual value of future taxes.[8]

Obviously in real world these restrictive conditions do not hold. For instance Sims (1998) states in a vigorous way that the Ricardian Equivalence theorem is irrelevant for the reality economists try to understand and formalise. It should therefore be considered as an extreme situation since taxes are not lump-sum, some prices are not perfectly flexible, people do not live forever and many people do not have ascendants or descendants willing to help them financially.[9] Generally the critics to the Ricardian Equivalence focus on conditions i), ii), v) and vi).

The altruistic behaviour is open to much criticism and discussion. The absence of intergenerational transfers may for instance be the result of divergent preferences among household members.[10] Also the commonly accepted supposition in the literature is that intergenerational transfers span through two

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[8] Discussions of the necessary conditions for Ricardian Equivalence to hold may be found namely in Brennan and Buchanan (1986), Bernheim (1987, 1989), Aschauer (1988) and Seater (1993).

[9] Silva (1986) writes that "debt neutrality doesn't seem to be useful macroeconomics for the real world, and that it has received little empirical confirmation," while Buiter (1985) states that "neutrality of public debt and deficits is little more than a theoretical curiosum."

[10] On this topic see namely Carmichael (1982) and Becker (1974). Laitner and Ohlsson (1998) present several versions of possible altruistic models.

consecutive generations. However, altruism may be extended to three consecutive generations and one may also consider gifts, transfers from the young generations to the older generations. According to Boskin and Kotlikoff (1985) this is more or less what happens on pay-as-you-go social security systems. Finally, the opposition between finite horizons and infinite horizons may not be that important when one considers budget deficits short run effects. Notice for instance that if public debt has an average maturity of 10 or 15 years then there is a great probability that present generations will be called upon to finance debt redemption, through the imposition of future taxes, even if there is a certain amount of Ponzi games.[11]

It is quite unlikely that capital markets are efficient or that households do not face liquidity constraints namely credit constraints.[12] One of the causes for capital markets imperfections is the existence of credit rationing eventually due to adverse selection or asymmetric information problems.[13] Adverse selection in the capital markets, specifically in the credit market, is usually the main obstacle against the possibility of accepting Ricardian Equivalence. As a final comment one may say that when a considerable part of consumers is liquidity constrained, favourable evidence for supporting Ricardian Equivalence should be quite feeble. As a matter of fact, in such a setting, many consumers will be led to eventually consume their entire income.[14]

Another crucial assumption for Ricardian equivalence to hold is the hypothesis that taxes are lump sum. In the presence of distortionary taxation, a

[11] The results forwarded by Poterba e Summers (1987) somehow confirm these assumptions.

[12] Afonso and Teixeira (1999) present results of inefficiency on the formation of price quotes in the public debt market for the Euro area.

[13] See for instance the work of Jaffee and Russell (1976) and Stiglitz and Weiss (1981). Hillier and Ibrahimo (1993) present a survey of capital markets asymmetric information literature. Afonso and St. Aubyn (1998) present some empirical results for credit rationing in Portugal.

[14] Cushing (1992) and Rockerbie (1997) present results for the USA, which seem to indicate that about 40 per cent of the consumers are liquidity constrained. Leiderman and Razin (1988) develop and test a model where part of the consumers also face liquidity constraints in the capital markets.

reduction of income taxes and an increase of public debt will allow for an increase of consumption in the short run. Indeed, with a non-distortionary tax system, with taxes independent from the period when consumers have to pay them, public debt and taxes could then actually be equivalent.

3 - Ricardian Equivalence and private consumption

As already mentioned, the key idea behind Ricardian Equivalence is that consumers are linked by intergenerational altruism, and also that they have a fairly good perception about the future taxes needed to repay the present increase in public debt. Consumer's net wealth would be invariant between more debt today and more taxes tomorrow. By this reasoning budget deficits would have no real effects and fiscal policy would be unable to change consumption, quite a different notion from the one sustained by Keynes. In a limit situation, as Gramlich (1989) noted, when the government reduces taxes consumers just save more, for instance placing money in time deposit accounts, in order to help pay the higher future taxes, and consumption remains unchanged.

According to conventional macroeconomic theory deficits affect negatively private investment. In a closed economy a deficit increase, financed in the market, would raise interest rates since the government is competing with the private sector for the available savings in the economy and that might also cause more inflation.[15] Increasing interest rates would then have a negative stimulus on private investment.[16] In an open economy with capital mobility, the interest rate increase would appreciate the national currency and increase foreign demand by assets denominated in national currency. On the other hand, currency appreciation is bound to deteriorate the current account.

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[15] Santos (1992) and Afonso (1993, 1995) present some results concerning the inflationary effects of budget deficits namely for Portugal and European Community countries.

[16] Possible references for the effects of deficits on interest rates are Eisner (1989) and Rose and Hakes (1995).

Still another comment is in order concerning now private saving. Assuming the goodness of the Ricardian theory, the actual value of public expenses must be equal to the actual value of the future tax sequence. This simply means that there is a budget constraint that the government must face and, at last, the government will have to pay its debts.

Concerning the empirical validation of Ricardian Equivalence one may define two broad categories: direct tests, which evaluate the effect of deficits on economic quantities and indirect tests, which try to determine the influence of deficits on prices. In the first category Ricardian Equivalence is validated if for instance one can accept the existence of a one to one relationship between deficits and private saving or if there is no relation between deficits and private consumption. For the indirect tests one may think for instance, as a validation of Ricardian Equivalence, that there is no effect of deficits on real interest rates or on the inflation rate.

Empirical validation through the consumption function may also generically be divided into two categories: first, tests using reaction functions inspired in the Permanent Income/Life Cycle hypothesis and secondly Euler equation tests resulting from the consumer's inter-temporal optimisation problem.

3.1 - Consumption reaction functions

A usual approach to assess the validity of Ricardian Equivalence is the estimation of aggregate consumption functions with consumption as dependent variable and wealth, deficit, income and other control variables as independent variables.[17] Ricardian Equivalence is rejected if for instance the coefficients of

[17] Among the first authors to consider the existence of wealth effects on consumption is Pigou (1943), and the effect of variations of wealth on consumption became known as "Pigou effect". In Pigou's words "(…) the extent to which the representative man desires to make savings otherwise than for the sake of their future income yield depends in part on the size, in items of

public debt or the coefficients of taxes are statistically different from zero on consumption regressions. Examples of this procedure are, among others, the earlier texts of Kochin (1974), Yawitz and Meyer (1976), Tanner (1979), Buiter and Tobin (1979), Feldstein (1982), Kormendi (1983), Seater and Mariano (1985) and Modigliani and Sterling (1986).

Most of the specifications used by several authors may be broadly synthesised through the following model

$$C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 (T_t - G_t - r_t D_t) + \alpha_3 G_t + \alpha_4 D_t + \alpha_5 W_t + \alpha X_t + \varepsilon_t \quad (8)$$

where we have

C_t – consumption;
Y_t – output;
T_t – taxes;
G_t – public expenditures;
D_t – public debt;
W_t – private wealth;
r_t – interest rate;
X_t – vector of other exogenous variables.

The Ricardian Equivalence hypothesis implies that $\alpha_2 = 0$ that is, the budget deficit does not influence consumption. Concerning the wealth measure there are two common ways of using it as an explanatory variable: wealth either includes public debt or it doesn't. The appropriate conclusions under these two alternative constructions of wealth, sometimes not clearly perceived in the literature, are resumed in Table 1.

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real income, of his existing possessions. As this [wealth] increases, the amount that he so desires to save out of any assigned real income diminishes (…)," Pigou (1943, p. 349).

Table 1 – Wealth in the consumption function

$$C_t = \cdots \beta_1 W_t + \beta_2 D_t \cdots$$

Wealth (W) includes public debt (D).	$\beta_2 = -\beta_1$	We cannot reject the Ricardian Equivalence hypothesis, debt is not seen as wealth.
	$\beta_2 \neq -\beta_1$	We reject the Ricardian Equivalence hypothesis
Wealth (W) does not include public debt (D).	$\beta_2 \neq \beta_1$	We cannot reject the Ricardian Equivalence hypothesis, debt is not seen as wealth.
	$\beta_2 = \beta_1$	We reject the Ricardian Equivalence hypothesis

3.2 - Inter-temporal consumption optimisation: Euler equations

Another possible approach to validate Ricardian Equivalence, more recently presented in the literature, is the direct use of Euler equations derived from the intertemporal consumer's maximisation problem, following the initial work of Hall (1978).[18] By using the first order condition for the representative consumer it is possible to skip the problems surrounding the specification of consumer functions based on the Permanent Income/Life Cycle hypothesis. Bernheim (1987) and Seater (1993) give a critical discussion of the tests based on Euler equations.

Different strategies are followed in the literature to obtain the aggregate consumption function. For instance Hayashi (1982), Evans (1988, 1993), Himarios (1995) and Graham and Himarios (1996) use for their empirical tests, Euler equations based on a discrete time version of Blanchard' s (1985) finite

[18] See for instance Aschauer (1985), Dalamagas (1992) and Gupta (1992).

horizons model. A brief formulation of how to obtain a testable Euler consumption equation, under that theoretical framework, is presented below.

Suppose the following expression for the aggregate consumption function, as the sum of non-human wealth and human wealth

$$C_t = \alpha \left[(1+\rho) A_{t-1} + \sum_{i=0}^{\infty} (1+\mu)^{-i} E_t Y_{t+i} \right], 0 < \alpha < 1; \qquad (9)$$

with

C_t - aggregate consumption in period t;
A_{t-1} - *stock* of assets at the end of t-1, non-human wealth, including public debt held by the public;
ρ - real rate of return (assumed constant);
Y_t - after tax labour income (human wealth);
α - marginal propensity to consume out of total wealth;
E_t - expectation operator, conditional to the information known by consumers at period t;
μ - discount rate used by consumers to discount future labour income.

If $\mu = \rho$ then consumers act as if they lived forever that is they consider the consumption decisions of future generations. In a nutshell, if $\mu = \rho$ consumers are Ricardian.[19] The bigger the μ the bigger the myopia effect in present generations when considering future taxes, and if that were the case we would be in a situation of almost complete absence of Ricardian Equivalence.

With finite horizons consumers may discount future income at a discount rate higher than the interest rate they receive from their holdings of non-human wealth. When $\mu > \rho$, consumers are expecting to receive the total actual value of interests on public debt (included in the *stock* of assets) but they think they are

[19] In Blanchard' s (1985) words "agents have infinite horizons."

going to pay only a fraction of future taxes. This simply means that consumers are assuming a discount rate for human wealth higher than the real interest rate.[20]

In order to reach a testable model from expression (9) this equation is going to be lagged one period, multiplied by (1+μ) and the result subtracted from (9). The final result is given by

$$C_t = (1+\mu)C_{t-1} + \alpha(1+\rho)\left[A_{t-1} - (1+\mu)A_{t-2}\right] - \alpha(1+\mu)Y_{t-1} + u_t \tag{10}$$

where

$$u_t = \alpha\sum_{i=0}^{\infty}(1+\mu)^{-i}\left[E_t - E_{t-1}\right]Y_{t+i}\ . \tag{11}$$

Assuming that available aggregate income may be either consumed or accumulated in assets,

$$Y_t + \rho_t A_{t-1} = C_t + A_t - A_{t-1} \tag{12}$$

the economy's budget constraint is then given by

$$A_t = (1+\rho)A_{t-1} + Y_t - C_t\ . \tag{13}$$

Using equation (10) and (13) to eliminate human wealth from (10), the aggregate consumption function may be written as[21]

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[20] Notice that for instance Evans (1988, p. 985-986), one of the first authors to use this approach, uses a slightly different notation from the one used in this paper. The term (1+μ) in this paper is equivalent to the term (1−μ)/(1+ρ) on Evans paper. In Evans notation μ is the fraction of population that dies each period and, when μ = 0 consumers are Ricardian, they have infinite horizons, when μ > 0 consumers have finite horizons. Evans (1993) interprets this fraction (probability) as a measure of the intensity of the existing links between actual consumers and futures generations.

[21] This procedure is similar to the one followed by Evans (1988). Hayashi (1982) chooses to eliminate neither non-human wealth nor human wealth (cfr Himarios (1995)).

$$C_t = (1+\mu)(1-\alpha)C_{t-1} + \alpha(\rho-\mu)A_{t-1} + u_t \tag{14}$$

and the testable model is then

$$C_t = \beta + \delta C_{t-1} + \theta A_{t-1} + u_t \ , \tag{15}$$

where β is a constant, $\delta = (1+\mu)(1-\alpha)$ and $\theta = \alpha(\rho-\mu)$. Through equation (15) it is then possible to test if consumers are Ricardian, specifically the null hypothesis of Ricardian Equivalence is $\theta = 0$ ($\rho=\mu$). Under the alternative hypothesis where consumers do not have a Ricardian behaviour ($\mu \neq \rho$) and the coefficient θ might be significantly different from zero. This might imply that consumers have finite horizons and government bonds are seen as net wealth.

For the empirical implementation of equation (15) several measures of wealth are possible. Public debt held by the public is sometimes included along with for instance monetary base, time deposits or demand deposits.

Table 2 offers a summary of the results presented by several authors concerning Ricardian Equivalence validation through aggregate consumption functions. It is easy to conclude by the last column of this table that the results are quite divergent.[22]

[22] The divergence of results on this topic had already led Barro (1989, p. 49) to consider that "basically, the results are all over the map, with some favoring Ricardian equivalence, and others not."

Table 2 - Ricardian Equivalence: empirical evidence using aggregate consumption functions

Author and date	Data frequency	Period and country	Evidence in favour of Ricardian Equivalence?
Kochin (1974)	Annual	1952-1971 (EUA)	Yes
Tanner (1979)	Annual	1947-1974 (EUA)	Yes
Seater and Mariano (1985)	Annual	1931-1974 (EUA)	Yes
Kormendi (1983)	Annual	1930-1976 (EUA)	Yes
Aschauer (1985)	Quarterly	1948:I –1981:IV (EUA)	Yes
Evans (1988)	Quarterly	1947:II – 1985:IV (EUA)	Yes
Leiderman and Razin (1988)	Monthly	1980:9-1985:12 (Israel)	Yes
Kormendi and Meguire (1990)	Annual	1931-1985 (EUA)	Yes
Evans (1993)	Annual	1960-1988 (19 OECD countries) (a)	Yes
Yawitz and Meyer (1976)	Annual	1953-1969 (EUA)	No
Buiter and Tobin (1979)	Annual	1949-1976 (EUA)	No
Feldstein (1982)	Annual	1930-1977 (EUA) (b)	No
Reed (1985)	Annual	1890-1981 (EUA)	No
Modigliani and Sterling (1986)	Annual	1952-1984 (EUA)	No
Bernheim (1987)	Annual	1972-1983 (26 countries) (c)	No
Feldstein and Elmendorf (1990)	Annual	1934-1985 (EUA)	No
Graham and Himarios (1996)	Annual	1949-1991 (EUA)	No
Blinder and Deaton (1985)	Quarterly	1951:I - 1984:IV	Inconclusive
Himarios (1995)	Annual	1953-1986 (EUA)	Inconclusive
Gupta (1992)	Annual	1960-1985 (10 Asian countries) (d)	Yes for some countries and no for others

(a) Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Sweden, Switzerland, United Kingdom and United States.
(b) Excluding the years 1941-46.
(c) Cross-section analysis for: Argentina, Belgium, Canada, Costa Rica, El Salvador, Finland, France, Germany, Guatemala, Iceland, India, Italy, Korea, Luxembourg, Morocco, New Zealand, Norway, Philippines, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, United Sates and Venezuela.
(d) Countries included are India, Indonesia, South Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan and Thailand.

4 – Preliminary empirical tests for the Euro area

After the 1st of January 1999 several European currencies gave way to the Euro. Eleven countries successfully met the convergence criteria underlined in the Maastricht Treaty and, according to the decisions of the European Council of May 1998, those countries were the founders of Economic and Monetary Union.[23]

The purpose of this section is to assess the validity of the Ricardian result in the Euro area, using namely the Euler equation derived in the previous section. Annual data is used for ten of the eleven Euro countries. Luxembourg was not considered because it was not possible to get information for the monetary aggregate M1, or even for an acceptable substitute compatible with other countries aggregates, being M1 one of the parts of the wealth measure. M1 was chosen because it turned out to be quite difficult to find data for the monetary base for the entire time sample.

Data for private consumption and private wealth was used in order to estimate equation (15). The wealth measure includes both public debt and the monetary aggregate M1. All variables are expressed in real per capita terms, measured in constant 1990 prices and are denominated in ECU.[24]

The strategy followed started by dividing the countries into two separate groups taking into account their indebtedness degree. A possible indicator to perform this selection is the 60 per cent limit imposed by the Maastricht Treaty on the debt-to-GDP ratio. There is obviously no economic reason to choose this

[23] The eleven countries were Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. Four other countries of the European Union remained outside the Euro either because they wanted, United Kingdom and Denmark, or because they did not fulfil the convergence criteria, Greece and Sweden.

[24] A description of the data and its sources is given in the Appendix.

limit but lets just see what the data tells us. The countries are then classified either as "less indebted" if the debt-to-GDP ratio is bellow 60 per cent or as "indebted" if the debt-to-GDP ratio is above 60 per cent.[25] This partition of countries favours the construction of a dummy variable D1, which assumes a value of one for the so called "less indebted" countries and a value of zero for the less "less indebted" countries, that is

$$D1 = \begin{cases} 1, \text{ if } \ \text{ratio} \ \leq 0{,}6 \\ 0, \text{ if } \ \text{ratio} \ > 0{,}6 \end{cases} .$$

The idea is to see if consumers from "less indebted" countries have some sort of debt illusion, in other words to see if they are not aware of the future tax responsibilities associated with the substitution of taxes for debt. If this was true, then a tax cut would imply an increase in consumption denying therefore the Ricardian hypothesis. On the other hand, consumers from the "indebted" countries may be more aware of the future implications of debt financing. If that is the case then the substitution of taxes for debt in the present may actually leave consumption unchanged.

As a working hypothesis the average debt-to-GDP ratio for the sample period was computed for each country. The results of these calculations, the accurate sample period for each country and the corresponding values attributed to the dummy variable are presented in Table 3.

The complete panel data sample has 176 observations divided between the two groups of countries: "less indebted" countries, 106 observations and "indebted" countries, 70 observations.

[25] Calculations for the 50 and 80 per cent debt-to-GDP ratio were also performed in this paper.

Table 3 - "Less indebted" and "indebted" Euro countries on the basis of the 60 per cent limit for the debt-to-GDP ratio

Country	Average debt-to-GDP ratio (%)	D1	Period	Number of observations
Austria	55,8	1	1980-1996	17
Belgium	119,7	0	1980-1996	17
Finland	30,3	1	1981-1997	17
France	37,8	1	1980-1997	18
Germany	45,6	1	1980-1997	18
Ireland	90,7	0	1980-1996	17
Italy	95,7	0	1980-1997	18
Netherlands	71,5	0	1980-1997	18
Portugal	58,8	1	1980-1997	18
Spain	46,7	1	1980-1997	18
"Less indebted" countries	45,8			106
"Indebted" countries	94,4			70
All countries	65,3			176

For the entire sample the following equation, inspired in equation (15), was estimated,

$$C_{it} = \beta + \delta C_{it-1} + \theta A_{it-1} + \gamma D1_{it} + u_{it}\,, \qquad (16)$$

where the subscript i identifies the country and the subscript t identifies the period to which the observation relates. Table 4 presents the results of the estimation of this linear model and also those of a model where the logarithms of private consumption and wealth were used.

Table 4 - Estimates of consumption function coefficients, Euro area
(*pooled regression*)

Model	Model description	β	δ	θ	γ	$\bar{R}^2$	*DW*
M1	linear, with dummy variable	-0,079 (-0,583)	0,987 (43,536)	0,019 (1,629)	0,086 (0,871)	0,9628	1,045
M2	linear, no dummy variable	-0,025 (-0,208)	0,998 (52,942)	0,011 (1,494)		0,9629	1,043
M3	with logarithms, with dummy variable	-0,040 (-1,198)	0,969 (40,434)	0,043 (2,130)	0,017 (1,198)	0,9664	0,998
M4	with logarithms, no dummy variable	-0,020 (-0,698)	0,986 (51,024)	0,024 (1,902)		0,9663	0,994

Notes: t statistics in parenthesis. The DW statistics of this table and those of the following tables are computed according to Bhargava, Franzini and Narendanathan (1982), using the TSP program, version 4.4, 1997.

The results of the estimations indicate that the dummy variable D1 does not seem to be statistically different from zero. Probably there isn’t much difference in consumer behaviour between "less indebted" countries and "indebted" countries after changes in wealth, mainly composed of public debt. Another interesting result is the fact that for the entire pooled panel data sample, an increase in wealth seems to have a positive effect on consumption. This conclusion is clearer in models M3 and M4 and casts some doubts upon the validity of the Ricardian hypothesis for this set of countries [26]

[26] Calculations were also made dividing the countries, between the two categories in each year, on the basis of the level of the debt-to-GDP ratio in each year, for every country. This allowed D1 to assume different values for the same country. However, the results are very similar to the ones reported on Table 4 since the values attributed to D1 didn’t change that much.

Since the 60 per cent limit chosen to the debt-to-GDP ratio has no strong economic rational, it was decided to perform the estimation of equation (16) with two alternative threshold values, 50 per cent and 80 per cent. The two groups of data under these new limits are given in Table 5.

Table 5 – Observations on the basis of the 50 and 80 per cent limits for the debt-to-GDP ratio

	Number of observations	
	50 per cent ratio	**80 per cent ratio**
"Less indebted" countries	71	124
"Indebted" countries	105	52
Total	176	176

With the 50 per cent limit the results are worse than those in Table 4 in the sense that the dummy variable becomes even more statistically insignificant, and these results are not reported in the text. Therefore this limit seems inadequate to segregate different consumption patterns among the Euro area countries, on the basis of the specific country indebtedness.

On the other hand, the results obtained from the estimation with the 80 per cent limit (see Table 6) are in line with those of the 60 per cent limit and allow us to conclude that now the dummy variable becomes more statistically significant. This may imply that the relevant threshold on the debt-to-GDP ratio, at which consumers become more aware of the importance of the debt burden in the economy, might well be somewhere around the 80 per cent level. Also, the wealth effect is now more statistically significant than in the model where countries were divided on the basis of a 60 per cent boundary. In fact, with this 80 per cent threshold for the debt-to-GDP ratio one cannot reject the hypothesis that wealth is relevant to explain private consumption.

Table 6 - Estimates of consumption function coefficients, Euro area, 80 limit percent for the debt-to-GDP ratio
(*pooled regression*)

Model	Model description	β	δ	θ	γ	$\bar{R}^2$	*DW*
M11	linear, with dummy variable	-0,150 (-1,093)	0,973 (42,642)	0,028 (2,398)	0,192 (1,870)	0,9634	1,057
M31	with logarithms, with dummy variable	-0,051 (-1,558)	0,958 (40,300)	0,054 (2,798)	0,029 (2,037)	0,9670	1,009

Notes: t statistics in parenthesis.

If one assumes that there are fundamental differences between the several Euro countries these differences may be captured by distinct autonomous terms in the consumption function. Under this rational each country could be assigned a specific autonomous term and the consumption function would be given by the following fixed effects or within model, in the panel data context

$$C_{it} = \beta_i + \delta C_{it-1} + \theta A_{it-1} + u_{it} \; . \tag{17}$$

Table 7 gives the estimation results for equation (17) under the limits of 60 and 80 per cent for the debt-to-GDP ratio. One should immediately observe that now wealth is much more significant in explaining positively private consumption, either for the linear model or for the logarithmic specification. This is also true for both limits on the debt-to-GDP ratio, even though the differences between the results from these two models are not very substantial.

Table 7 - Estimates of consumption function coefficients, Euro area, country specific autonomous term (*within model*)

Model	**Model description**	**Constant**	δ	θ	$\bar{R}^2$	*DW*
		60 per cent debt-to-GDP ratio				
M21	linear	-	0,837 (22,321)	0,052 (3,560)	0,9682	1,152
M41	with logarithms	-	0,818 (22,790)	0,077 (3,507)	0,9719	1,111
		80 per cent debt-to-GDP ratio				
M211	linear	-	0,837 (22,253)	0,052 (3,548)	0,9680	1,152
M411	with logarithms	-	0,818 (22,721)	0,077 (3,496)	0,9717	1,111

Note: t statistics in parenthesis.

Even if the pertinence of dividing the Euro countries in two groups, according to the degree of solvency may be somehow doubtful, equation (15) was estimated separately for the two groups of countries. Table 8 presents the results of these estimations.

The coefficients for the wealth variable are not unequivocally significant with the 60 per cent limit. Nevertheless those coefficients are all positive and more statistically different from zero for the "less indebted" countries. However, with the 80 per cent limit the coefficients on wealth are statistically different from zero (see for instance regressions M10 and M12).

Table 8 - Estimates of consumption function coefficients, Euro area, "less indebted" countries and "indebted" countries (*pooled regressions*)

Model	Model description	β	δ	θ	$\bar{R}^2$	DW
60 per cent debt-to-GDP ratio						
M5	"less indebted" countries, linear model	-0,057 (-0,370)	0,975 (32,373)	0,037 (1,678)	0,9641	0,972
M6	"less indebted" countries, model with logarithms	-0,043 (0,112)	0,967 (31,589)	0,055 (1,880)	0,9678	0,894
M7	"indebted" countries, linear model	0,077 (0,350)	0,972 (19,946)	0,017 (1,045)	0,9592	1,270
M8	"indebted" countries, model with logarithms	0,017 (0,329)	0,947 (20,947)	0,039 (1,362)	0,9598	1,345
80 per cent debt-to-GDP ratio						
M9	"less indebted" countries, linear model	-0,031 (-0,223)	0,977 (38,636)	0,032 (2,058)	0,9650	0,989
M10	"less indebted" countries, model with logarithms	-0,036 (-1,052)	0,968 (36,882)	0,050 (2,268)	0,9686	0,914
M11	"indebted" countries, linear model	0,264 (0,989)	0,869 (11,861)	0,052 (2,127)	0,9587	1,300
M12	"indebted" countries, model with logarithms	0,020 (0,342)	0,834 (12,073)	0,120 (2,544)	0,9609	1,386

Note: t statistics in parenthesis.

Yet another test was performed in order to estimate the within model from equation (17) separately, for the two groups of countries, allowing therefore for the existence of differences between countries within each group. Table 9 presents those results.

Table 9 - Estimates of consumption function coefficients, Euro area, solvent" countries and "indebted" countries, country specific autonomous term (*within models*)

Model	**Model description**	**Constant**	δ	θ	$\bar{R}^2$	*DW*
60 per cent debt-to-GDP ratio						
M51	"less indebted" countries, linear model	-	0,838 (18,025)	0,042 (1,849)	0,9694	1,054
M61	"less indebted" countries, model with logarithms	-	0,818 (18,765)	0,057 (2,014)	0,9738	1,005
M71	"indebted" countries, linear model	-	0,854 (12,114)	0,056 (2,698)	0,9540	1,429
M81	"indebted" countries, model with logarithms	-	0,817 (11,708)	0,116 (3,180)	0,9648	1,489
80 per cent debt-to-GDP ratio						
M91	"less indebted" countries, linear model	-	0,834 (19,293)	0,050 (2,563)	0,9701	1,080
M101	"less indebted" countries, model with logarithms	-	0,816 (20,212)	0,067 (2,655)	0,9743	1,030
M111	"indebted" countries, linear model	-	0,871 (9,885)	0,052 (2,141)	0,9600	1,400
M121	"indebted" countries, model with logarithms	-	0,842 (10,073)	0,125 (2,645)	0,9616	1,487

Note: t statistics in parenthesis.

The results are similar to the ones from the estimation of the pooled regressions of equation (15) for the two groups of countries (compare Table 9 with Table 8), with the wealth coefficients still statistically more relevant with the 80 per cent limit. Observe also that wealth seems to be statistically more significant for explaining consumption in the "less indebted" countries than in the "indebted" countries, when the 80 per cent limit for the debt-to-GDP is used. One may therefore tentatively conclude that these results indicate somehow that consumption in "less indebted" countries is more responsive to wealth increases than in the "indebted" countries. The overall conclusion seems however to be the impossibility of accepting the existence of a Ricardian behaviour for the Euro area consumers.[27]

Noticing that the construction of a wealth measure is always a difficult task, an alternative empirical test was made without that variable. Still considering the panel data sample for the Euro area countries, a reaction function was formulated, inspired namely in Bernheim (1987) and in several other models from the literature,

$$c_{it} = \beta_1 + \beta_2 def_{it} + \beta_3 div_{it} + \beta_4 y_{it} + \beta_5 popg_{it} + u_{it}, \qquad (18)$$

where once more the subscript i identifies the country and the subscript t identifies the period to which the observation relates.

c - private consumption as a percentage of GDP;
def - budget deficit as a percentage of GDP;
div - public debt as a percentage of GDP;
y - GDP real growth rate;
popg - population growth rate.

[27] With a different formalisation Dalamagas (1992) concludes, for a panel data of 52 countries, that Ricardian behaviour is more evident for what the author calls “debt-ridden countries”. On his paper there is however no information about the threshold used for the indicators chosen to divide the countries according to their solvency degree.

If consumers were Ricardian then it would be possible to accept the null hypothesis $\beta_2 = 0$ for equation (18). In that case, budget deficit changes will not affect the individuals consumption decisions.

The solution of dividing consumption, deficit and debt by the GDP obviates the necessity of converting the data to per capita values and into a common currency, as done previously, in order to bypass some possible data heteroscedasticity. The inclusion of the last two dependent variables in equation (18) tries to capture some of the factors that might justify consumption pattern differences among the various countries.

Since now wealth was not explicitly included it was possible to increase the number of observations for each country. As a matter of fact, the availability of information for the monetary aggregate M1 set a restriction to the sample dimension. Table 10 specifies the sample periods for each country allowing us now to use a total of 262 observations. Once more Luxembourg was not included since data concerning the budget deficit was not available for some of the years in our sample.

Table 10 - Sample periods for the estimation of equation (18)

Country	Period	Number of observations
Austria	1970-1996	27
Belgium	1970-1996	27
Finland	1970-1997	28
France	1977-1997	21
Germany	1970-1997	28
Ireland	1970-1996	27
Italy	1970-1997	28
Netherlands	1975-1997	23
Portugal	1973-1997	25
Spain	1970-1997	28
All countries		262

The results for the estimation of several versions of equation (18) are presented in Table 11.

Table 11 - Estimates of consumption function (18) coefficients, Euro area
(*pooled regression*)

Model	Constant	def	div	y	popg	$\bar{R}^2$	*DW*
H1	57,610 (82,448)	0,411 (4,596)	0,007 (0,612)	-0,121 (-1,097)	2,035 (3,832)	0,1907	0,118
H2	58,561 (110,685)	0,488 (5,539)	-0,006 (-0,529)			0,1486	0,113
H3	58,861 (92,824)	0,471 (5,210)	-0,005 (-0,455)	-0,097 (-0,859)		0,1477	0,108
H4	57,258 (92,237)	0,433 (4,974)	0,006 (0,507)		2,002 (3,774)	0,1900	0,119
H5	57,865 (103,182)	0,448 (6,739)		-0,114 (-1,044)	1,945 (3,816)	0,1926	0,119
H6	57,486 (134,292)	0,463 (7,142)			1,928 (3,784)	0,1923	0,120

Note: t statistics in parenthesis.

A first conclusion is that the budget deficit coefficient is positive and statistically different from zero. This obviously contradicts the Ricardian Equivalence hypothesis. Furthermore, this coefficient is significant either if public debt is included or omitted as an explanatory variable in the consumption function.

Also, the public debt coefficient is not significantly different from zero questioning therefore the effect of public debt on private consumption, for the Euro area countries as a whole, when the budget deficit is accounted for. Population growth is also important in explaining private consumption, in any of the several versions of equation (18), a result that can be easily accepted on theoretical grounds. One must notice however that these results are clearly suspect since the values of the adjusted R-squared and of the DW statistics are very small.

The hypothesis of allowing for a different autonomous intercept for each country was also empirically tested. The regression equation in this case is given by

$$c_{it} = \beta_{i1} + \beta_2 def_{it} + \beta_3 div_{it} + \beta_4 y_{it} + \beta_5 popg_{it} + u_{it} , \qquad (19)$$

and the results are presented in Table 12.

Table 12 - Estimates of consumption function (19) coefficients, country specific autonomous term (*within model*)

Model	**Constant**	**def**	**div**	**y**	**popg**	$\bar{R}^2$	*DW*
H11	-	0,039 (0,772)	0,011 (1,652)	-0,271 (-4,964)	1,379 (5,827)	0,8391	0,556
H31	-	0,054 (1,015)	0,001 (0,194)	-0,293 (-5,128)		0,8217	0,504
H41	-	0,128 (2,610)	0,013 (1,932)		1,481 (5,446)	0,8238	0,498
H51	-	0,067 (1,410)		-0,114 (-1,044)	1,945 (3,816)	0,8380	0,548
H61	-	0,166 (3,641)			1,300 (5,064)	0,8219	0,487

Note: t statistics in parenthesis.

From Table 12 it is possible to observe that the adjusted R-squared of the regressions is much higher than the one from the pooled regressions. Again the public debt coefficient is not statistically different from zero, even if it becomes more significant. The deficit is relevant in explaining consumption in those models where real GDP growth rate is absent as an exogenous variable. We still have nevertheless the problem of the small values for the DW statistics. An alternative specification was tested using the one year lagged consumption variable also on the right-hand side of equation (18) and (19). Accordingly we have for the pooled regressions

$$c_{it} = \beta_1 + \rho c_{it-1} + \beta_2 def_{it} + \beta_3 div_{it} + \beta_4 y_{it} + \beta_5 popg_{it} + u_{it}\,, \quad (20)$$

and for the fixed effects model

$$c_{it} = \beta_{i1} + \rho c_{it-1} + \beta_2 def_{it} + \beta_3 div_{it} + \beta_4 y_{it} + \beta_5 popg_{it} + u_{it}\,. \quad (21)$$

Table 13 and Table 14 present respectively the results from the estimations of equations (20) and (21).

Table 13 - Estimates of consumption function (20) coefficients, Euro area
(*pooled regression*)

Model	**Const.**	**Cons(-1)**	**def**	**div**	**y**	**popg**	$\bar{R}^2$	*DW*
W1	4,605 (3,894)	0,930 (45,617)	0,021 (0,690)	0,003 (0,070)	-0,210 (-5,731)	0,226 (1,729)	0,9170	1,753
W2	3,886 (3,144)	0,934 (44,572)	0,056 (1,821)	-0,003 (-0,794)			0,9065	1,761
W3	4,026 (3,216)	0,930 (42,961)	0,055 (1,765)	-0,002 (-0,800)		0,137 (0,733)	0,9064	1,749
W4	4,610 (3,912)	0,930 (45,789)	0,022 (0,934)		-0,210 (-5,773)	0,223 (1,314)	0,9174	1,754
W5	3,979 (3,190)	0,930 (43,059)	0,044 (1,796)			0,166 (0,923)	0,9066	1,744

Note: t statistics in parenthesis.

Table 14 - Estimates of consumption function (21) coefficients, country specific autonomous term (*within model*)

Model	Const.	Cons(-1)	def	div	y	popg	$\bar{R}^2$	*DW*
W11	-	0,667 (16,124)	-0,007 (-0,204)	0,001 (0,121)	-0,250 (-6,767)	0,542 (2,956)	0,9307	1,662
W21	-	0,735 (17,176)	0,067 (1,907)	-0,004 (-0,800)			0,9153	1,655
W31	-	0,692 (15,406)	0,065 (1,890)	0,002 (0,344)		0,565 (2,826)	0,9284	1,687
W41	-	0,668 (16,424)	-0,006 (-0,178)		-0,250 (-6,786)	0,534 (3,161)	0,9310	1,663
W51	-	0,694 (15,742)	0,069 (2,103)			0,538 (2,924)	0,9180	1,614

Note: t statistics in parenthesis.

With lagged consumption on the right-hand side of the consumption function the adjusted R-squared of the regressions is very high, even for the pooled regressions. Also the values for the DW statistics are now much higher. Once more the public debt coefficient is not statistically different from zero.

As in the previous regressions, the deficit is still relevant in explaining consumption in those models where real GDP growth rate is not an exogenous variable. For those models, for instance regressions W3, W5, W31 and W51, independently of considering public debt or not, a deficit increase of 1000 Euros might stimulate consumption by an amount between 44 and 69 Euros. One must however bear in mind that these are very preliminary results and therefore probably subject to further adjustments.

7 - Conclusion

The empirical research on debt neutrality concerning the effects on private consumption is broadly divided into two approaches. On the one hand we have the literature where the aggregate consumption function is inspired on the Permanent Income/Life Cycle hypothesis, on the other hand we have a set of papers that estimate Euler equations resulting from the consumer's inter-temporal optimisation problem.

For the consumption reaction functions of the first group of tests, Ricardian Equivalence rejection depends crucially on the coefficient of the exogenous budget deficit variable. Nevertheless, some authors criticise this approach on the basis that it is not consistent with a rational expectations formulation.[28] These criticisms are however dismissed by other authors who argue that when these aggregate consumption functions are properly specified, they are perfectly consistent with the rational expectations framework. For the second group of tests it is also assumed that the representative consumer forms its expectations in a rational way.

The general picture emerging from the results presented by several authors ends up being largely inconclusive. This is a rather "disturbing" conclusion since in the end the decision to reject or accept a possible Ricardian behaviour from consumers is basically an empirical question.

Preliminary test results presented in the previous section, with namely Euler equations, seem to indicate that it would be wise to reject the Ricardian Equivalence hypothesis for the Euro area. Alternative limits of 60 and 80 per

[28] For instance Flavin (1987) labels this approach as "the nonrational expectations aggregate consumption function approach."

cent for the debt-to-GDP ratio were used in order to obtain two groups of countries, the so called "less indebted" countries and the "indebted" countries.

Tentatively, and only in a very moderate way, one could perhaps notice that private consumption in "less indebted" countries is more responsive to wealth increases than in the "indebted" countries, but clearly further work is needed on this subject. Also the 80 per cent limit for the debt-to-GDP ratio seems to proportionate a clearer consumer behaviour distinction according to the country indebtedness level. The relevance of the neutrality result for the Euro area is quite important because as Detken (1999) points out "If, for example, Ricardian equivalence holds, the Stability and Growth Pact will be superfluous in any possible sense."

Appendix - Data used and statistical sources

Public Debt - in national currency, at current prices, annual data, source: *European Economy*, nº 65, European Commission, 1998.

Gross Domestic Product - in national currency, at current prices, annual data, source: *European Economy*, nº 65, European Commission, 1998; *National Accounts*, 1984-1996, vol. II, OECD, 1998.

Private Consumption - in national currency, at current prices, annual data, source: *National Accounts*, 1979-1991, vol. II, OECD, 1992; *National Accounts*, 1984-1996, vol. II, OECD, 1998.

M1 - in national currency, at current prices, annual data, source: *Main Economic Indicators*, *Historical Statistics*, 1960-1996, OCDE, 1997; *Main Economic Indicators*, September, OECD, 1998.

Exchange Rates - ECU *versus* national currency, source: *European Economy*, nº 65, European Economy, 1998; *Main Economic Indicators*, *Historical Statistics*, 1960-1996, OECD, 1997.

Consumer Price Index - 1990 = 100, source: *Main Economic Indicators*, *Historical Statistics*, 1960-1996, OECD, 1997; *Main Economic Indicators*, July, OECD, 1998.

Population - source: *European Economy*, nº 65, European Commission, 1998.

Budget Deficit - source: *European Economy*, nº 65, European Commission, 1998.

GDP Real Growth Rate - source: *European Economy*, nº 65, European Commission, 1998.

References

Afonso, A. (1993). "Causality between Public Deficits and Inflation: Some Tests for the Portuguese Case," *Estudos de Economia*, XIII (4), July-September, 349-362.

Afonso, A. (1995). "Public Deficits and Inflation, some more Results for Portugal," *Estudos de Economia*, XV (3), April-June, 273-286.

Afonso, A. and **Teixeira**, J. (1998). "Non-linear Tests of Weakly Efficient Markets: Evidence from Government Bond Markets in the Euro Area," *Cadernos do Mercado de Valores Mobiliários*, 3, 2nd Semester.

Afonso, A. and **St. Aubyn**, M. (1999). "Credit Rationing and Monetary Transmission: Evidence for Portugal," *Estudos de Economia*, XIX (1), 5-19.

Aschauer, D. (1985). "Fiscal Policy and Aggregate Demand," *The American Economic Review*, 75 (1), March, 117-127.

Aschauer, D. (1988). "The Equilibrium Approach to Fiscal Policy," *Journal of Money, Credit and Banking*, 20 (1), February, 41-62.

Barro, R. (1974). "Are Government Bonds Net Wealth?" *Journal of Political Economy*, 82 (6), November/December, 1095-117.

Barro, R. (1976). "Reply to Feldstein and Buchanan," *Journal of Political Economy*, 84 (2), April, 343-349.

Barro, R. (1978). "Comments from an Unreconstructed Ricardian," *Journal of Monetary Economics*, (2), August, 569-581.

Barro, R. (1979). "On the Determination of Public Debt," *Journal of Political Economy*, 87 (5), 940-971.

Barro, R. (1989). "The Ricardian Approach to Budget Deficits,"*Journal of Economic Perspectives*, 3 (2), Spring, 37-54.

Bhargava, A.; **Franzini**, L. and **Narendanathan**, W. (1982). "Serial Correlation and the Fixed Effects Model,"*Review of Economic Studies*, XLIX (4), October, 533-549.

Becker, G. (1974). "A theory of social interactions," *Journal of Political Economy*, 82 (6), December, 1063-1093.

Bernheim, D. (1987). “Ricardian Equivalence: An Evaluation of Theory and Evidence,” in Fischer, S. (ed.), *NBER Macroeconomics Annual 1987*, Cambridge, Mass., MIT Press, 263-315.

Bernheim, D. (1989). “A Neoclassical Perspective on Budget Deficits,” *Journal of Economic Perspectives*, 3 (2), Spring, 55-72.

Blanchard, O. (1985). “Debt, dficits, and finite horizons,” *Journal of Political Economy*, 93, 223-247.

Blinder, A. and **Solow**, R. (1973). “Does Fiscal Policy Matter*?” Journal of Public Economics*, 2, 319-337.

Blinder, A. and **Deaton**, A. (1985). “The Time Series Consumption Function Revisited,*” Brookings Papers on Economic Activity*, 2, 465-521.

Boskin, M. and **Kotlikoff**, L. (1985). “Public debt and United States saving: a new test of the neutrality hypothesis,” *Carnegie-Rochester Conferences Series on Public Policy*, 23, Autumn, 55-86.

Brennan, H. and **Buchanan**, J. (1986). “The Logic of the Ricardian Equivalence Theorem,” in Buchanan, J; Rowley, C and Tollison, R. (eds), *Deficits*, Oxford, Basil Blackwell, 79-92.

Buchanan, J. (1976). “Barro on the Ricardian Equivalence Theorem,” *Journal of Political Economy*, 84 (2), April, 337-342.

Buiter, W. (1985). “A Guide to Public Sector and Deficits,” *Economic Policy*, 1, November, 13-79.

Buiter, W. and **Tobin**, J. (1979). “Debt Neutrality: A Brief Review of Doctrine and Evidence” in von Furstenberg, G. (ed.), *Social Security versus Private Saving*, Cambridge, Mass., Ballinger, 39-63.

Carmichael, (1982). “On Barro's theorem of debt neutrality: the irrelevance of net wealth,” *American Economic Review*, 72 (1), 202-213.

Christ, C. (1978). “Some Dynamic Theory of Macroeconomic Policy Effects on Income and Prices under the Government Budget Restraint,*” Journal of Monetary Economics*, 4, January, 45-70.

Cushing, M. (1992). “Liquidity constraints and aggregate consumption behaviour,” *Economic Inquiry*, 30 (1), 134-53.

Dalamagas, B. (1992). "How Rival are the Ricardian Equivalence Proposition and the Fiscal Policy Potency View," *Scottish Journal of Political Economy*, 39 (4), November, 457-476.

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

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

Eisner, R. (1989). "Budget Deficits: Rethoric and Reality," *Journal of Economic Perspectives*, 3 (2), Spring, 73-93.

Elmendorf, D. and **Mankiw**, N. (1998). "Government Debt," January. NBER Working Paper nº 6470, March (text written for the *Handbook of Macroeconomics*).

Evans, P. (1988). "Are Consumers Ricardian? Evidence for the United States," *Journal of Political Economy*, 96 (5), 983-1004.

Evans, P. (1993). "Consumers are not Ricardian: evidence from nineteen countries," *Economic Inquiry*, XXXI, October, 534-548.

Feldstein, M. (1982). "Government Deficits and Aggregate Demand," *Journal of Monetary Economics*, 9 (1), January, 1-20.

Feldstein, M. and **Elmendorf**, D. (1990). "Government Debt, Government Spending, and Private Sector Behavior Revisited: Comment," *American Economic Review*, LXXX (3), June, 600-603.

Flavin, M. (1987). "Comment" on "Ricardian Equivalence: An Evaluation of Theory and Evidence," in Fischer, S. (ed.), *NBER Macroeconomics Annual 1987*, Cambridge, Mass., MIT Press, 304-309.

Graham, F. and **Himarios**, D. (1996). "Consumption, Wealth, and Finite Horizons: Tests of Ricardian Equivalence," Economic Inquiry, XXXIV, July, 527-544.

Gramlich, E. (1989). "Budget Deficits and National Saving: Are Politicians Exogenous?" *Journal of Economic Perspectives*, 3 (2), Spring, 23-35.

Gupta, K. (1992). "Ricardian Equivalence and Crowding out in Asia," *Applied Economics*, 24, 19-25.

Hall, R. (1978). "Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence," *Journal of Political Economy,* 86 (6), 971-987.

Hayashi, F. (1982). "The Permanent Income Hypothesis: Estimation and Testing by Instrument Variables," *Journal of Political Economy*, 90 (5), 895-916.

Hillier, B. and **Ibrahimo**, M. (1993). "Asymmetric information and models of credit rationing," *Bulletin of Economic Research*, 45, 271-304.

Himarios, D. (1995). "Euler Rquation Tests of Ricardian Equivalence," *Economics Letters*, 48, 165-171.

Jaffee, D. and **Russell**, T. (1976). "Imperfect information, uncertainty, and credit rationing," *Quarterly Journal of Economics*, 4, 651-666.

Kochin, L. (1974). "Are Future Taxes Anticipated by Consumers?" *Journal of Money, Credit and Banking*, 6, August, 385-394.

Kormendi, R. (1983). "Government Debt, Government Spending, and Private Sector Behavior," *American Economic Review,* LXXIII (5), December, 994-1010.

Kormendi, R. and **Meguire**, P. (1990). "Government Debt, Government Spending, and Private Sector Behavior: Reply and Update," *American Economic Review*, 80 (3), June, 604-617.

Laitner, J. and **Ohlsson**, H. (1998). "Bequest Motives: A Comparison of Sweden and the United States," July, *mimeo*.

Leiderman, L. and **Razin**, A. (1988). "Testing Ricardian Neutrality with na Intertemporal Stochastic Model," *Journal of Money, Credit and Banking*, 20 (1), February, 1-21.

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

Modigliani, F and **Sterling**, F. (1986). "Government Debt, Government Spending, and Private Sector Behavior: Comment," *American Economic Review*, LIX (5), December, 1168-1174.

O'Driscoll, G. P. (1977). "The Ricardian Nonequivalence Theorem," *Journal of Political Economy*, 85 (1), February, 207-210.

Phelps, E. (1982). "Cracks on the Demand Side: A Year of Crisis in theoretical Macroeconomics," *American Economic Review*, LXXII (2), May, 378-381.

Pigou, A. (1943). “The classical Stationary State,” *Economic Journal*, LIII, 343-351.

Poterba, J. and **Summers**, L. (1987). “Finite lifetimes and the effects of budget deficits on national savings,” *Journal of Monetary Economics*, 20 (2), September, 369-410.

Reed, B. (1985). “Aggregate Consumption and Deficit Financing: an Attempt to Separate Permanent from Transitory Effects,” *Economic Inquiry*, XXIII (3), July, 475-486.

Ricardo, D. (1817). *On the Principles of Political Economy and Taxation*, in P. Sraffa (ed.), *The works and correspondence of David Ricardo, Volume I*, 1951, Cambridge University Press, Cambridge.

Ricardo, D. (1820). *Funding System*, in P. Sraffa (ed.), *The works and correspondence of David Ricardo, Volume IV*, 1951, Cambridge University Press, Cambridge.

Rockerbie, D. (1997). “Are consumers Ricardian when some are liquidity constrained? Evidence for the United States,” *Applied Economics*, 29 (6), 821-827.

Rose, D. and **Hakes**, D. (1995). “Deficits and Interest Rates as Evidence of Ricardian Equivalence,” *Eastern Economic Journal*, 21 (1), Winter, 57-66.

Samuelson, P. (1958). “An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money,” *Journal of Political Economy*, 66 (6), December, 467-482.

Santos, J. (1992). “Budget deficits and inflation: Portugal and the other EC high debt countries,” *Estudos de Economia*, XII (3), April-June, 245-253.

Seater, J. (1993). “Ricardian Equivalence,” *Journal of Economic Literature*, XXXI, March, 142-190.

Seater, J. and **Mariano**, R. (1985). “New tests of the life cycle and tax discounting hypothesis,” *Journal of Monetary Economics*, 15, 195-215.

Silva, A. (1986). *Os Efeitos Macroeconómicos dos Défices Orçamentais Financiados por Dívida Pública*, Working Paper nº 14, Banco de Portugal.

Sims, C. (1998). “Econometric implications of the government budget constraint,” *Journal of Econometrics*, 83 (1-2), 9-19.

Stiglitz, J. (1969). "A Re-Examination of the Modigliani-Miller Theorem," *The American Economic Review*, LIX (5), 784-793.

Stiglitz, J. and **Weiss**, A (1991). "Credit rationing in markets with imperfect information," *The American Economic Review*, LXXI, 393-411.

Tanner, J. (1979). "An Empirical Investigation of the Tax Discounting – A Comment," *Journal of Monetary Economics*, 31, 207-227.

Yawitz, J. and **Meyer**, L . (1976). "An Empirical Test of the Extent of tax Discounting," *Journal of Money, Credit and Banking*, 8, May, 247-254.