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Fiscal Effectiveness and Debt Illusion in a Rational Expectations Model

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ABSTRACT. – The question of how substitution of debt for taxes affects private sector wealth and consumption has long been an unresolved macroeconomic theory and policy dispute. The present study attempts to address this problem within a modified fiscal-illusion setting, by utilizing an explicit rational expectations optimizing model of consumer behaviour for a sample of six developed countries. The empirical evidence presented is strongly supportive of the assertion that consumers make their consumption decisions without regard to the future tax implications of a current expansion in government debt at low levels of public sector indebtedness. At high levels of debt-GNP ratios, however, consumers tend to fully discount the future tax obligations implicit in an expansionary debt-financed fiscal policy.

L'efficacité fiscale et l'illusion de l'endettement dans un modèle d'anticipations rationnelles.

RÉSUMÉ. – La question des effets de la substitution de l'endettement par l'imposition sur la consommation et la richesse du secteur privé a toujours été un grand débat au niveau de la théorie et de la politique macroéconomique.

La présente étude essaie d'aborder ce problème à l'aide d'une approche modifiée basée sur l'illusion fiscale en utilisant un modèle explicite d'optimisation des anticipations rationnelles du comportement du consommateur pour un échantillon de six pays développés.

Les consommateurs tendent à anticiper et à s'adapter aux obligations fiscales futures implicites à une politique budgétaire expansionniste aux niveaux élevés du ratio dette-PNB, tandis qu'ils tendent a les ignorer aux niveaux bas d'endettement.

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1 Introduction

The economic effects of government debt on real economic activity (output, demand, growth, interest rates etc.) have been a recurring topic in the literature on macroeconomic policy analysis. The central question usually addressed is whether the economy is sensitive to the financing mix between taxes and debt, given the level of government expenditures. The problem is normally addressed by examining the extent to which individuals perceive government bonds as net wealth.

The traditional (Keynesian) view holds that, given the level of government spending, an increase in government debt tends to stimulate private consumption, raise interest rates and crowd out private investment. The underlying reasoning is that the issue of government bonds raises private assets, while the corresponding tax liabilities for interest payments and retirement of the debt extend indefinitely into the future.

The proposition that the substitution of bond finance for tax finance will increase aggregate spending has been challenged by the Ricardian equivalence hypothesis popularized by BARRO [1974]. Ricardians stress that, under reasonable conditions (perfect capital markets, identical planning horizons, nondistortionary taxes, operative altruistic bequest motives etc.), taxpayers will fully capitalize the future tax obligations, that public debt issue embodies. As a result, government bonds will not add to the perceived net wealth of private agents and the substitution of debt for tax finance will exert no expansionary effect on total spending.

As dealing with the controversy over the true nature of government debt (hereafter debt) is rather a matter of empirical investigation, a well established procedure is to test the statistical significance of debt in an output equation or a consumption (saving) function [1]. In doing this, KORMENDI [1983], ASCHAUER [1985], SEATER and MARIANO [1985], KORAY and MCMILLIN (1987], EVANS [1985] and –for some of the countries studied– GUPTA [1992], among others, find evidence supporting the view that debt is not net wealth, while FELDSTEIN [1982], KOSKELA and VIREN [1983], REID [1985], JOHNSON [1987] and the author [1992a] find contrary evidence.

Recent developments in the subject by VAUGHN and WAGNER [1992] on theoretical grounds and the author [1992b] in an empirical setting concentrate on reconciling these competing views by bringing forth the concept of debt illusion.

1. KOSKELA and VIREN [1983] maintain that the test of examining the statistical significance of the coefficient on government debt combines debt neutrality with the subsidiary hypothesis that increases in government spending and decreases in taxes have the same effect on private sector consumption.

2 Formulation of the Debt-Illusion Hypothesis

The efforts to reconcile Keynesian and Ricardian positions as to the impact of debt on real economy are based on a newly emerging view that debt controversy is more a matter of analytical incompleteness than an expression of disagreement over the substance.

In particular, Keynesian economists, typified by LERNER [1948], contend that debt is a method of shifting real resources among uses in the current period solely, just as taxation, so that the present generation cannot shift the real burden of debt to future generations. This happens because it is the present generation which foregoes current consumption in exchange for a debt-financed expansionary fiscal policy. The servicing of debt in the future is simply an income transfer from taxpayers to bond holders and hence aggregate private wealth remains unchanged. This is the famous "we owe debt to ourselves" doctrine.

Similarly, Ricardian proponents, though arguing on different grounds, maintain that debt cannot be shifted forward to future generations: present bondholders-taxpayers will increase their saving to bequeath a stock of assets sufficient to service the debt in the future since they view their heirs as extentions of themselves.

From this point on, however, the two schools of thought follow different lines of reasoning as to the real consequences of debt. According to the conventional approach, debt has a strong positive impact on present taxpayers' net worth and hence on economic activity, whereas the Ricardian theorem tends to trace out a zero or negative link between debt and demand.

At first blush, the traditional approach seems to suffer from a sort of internal inconsistency. It sounds strange, indeed, to utilize debt as an expansionary fiscal measure in a "we owe debt to ourselves" environment, where the income gains related to the resource flows to government are admittedly offset by the income losses associated with the concomitant resource flows away from private agents. In an attempt to provide a firm theoretical backing to the conventional assertion of regarding debt as a net asset, VAUGHN and WAGNER [1992] argue that positive income effects from a policy of substituting debt for taxes can only result from debt illusion. The debt-illusion argument predicts that the income gains, arising from a tax cut financed by an increase in debt, are misperceived by consumers as exceeding their income losses. Such a presumption of debt illusion that makes debt finance seem less costly than tax finance is, in fact, essential for the Keynesian position: the larger is debt illusion, the more net wealth households perceive as embodied in government bonds; and the larger the stock of bonds, the wealthier households perceive themselves to be and thus the more they want to consume.

Debate on debt illusion is a conceptual exploration of one aspect of the theory of fiscal illusion. The idea of fiscal illusion is not at all new as it dates back to the classical economists. J. S. MILL in his "Principles of Political

Economy" and J. R. McCULLOCH took the attitude that governments have generally had recourse to those means of financing which cause taxpayers to underestimate the costs (e.g., indirect taxation in preference to direct). This behavioural tactic is thought to be necessary in order to counterbalance the tendency of most people to underestimate the benefits derived from government activity, as these benefits, though of high importance, are not readily felt or appreciated by the public [2].

The contemporaneous view of fiscal illusion has been adequately analyzed by POMMEREHNE and SCHNEIDER [1978], WAGNER [1976], MUNLEY and GREENE [1978], WEST and WINER [1980] and DILORENZO [1982], to name a few. Their argumentation, therefore, needs not be repeated here, but a short summary would be useful. According to the illusion proponents, fiscal illusion is attributable to the cost of obtaining accurate information on the individual's tax burden. The more complex the tax system, the higher the cost of obtaining budgetary information and, hence, the stronger the tendency of individuals to ignore or underestimate the tax price of government activities. Putting it differently, a debt-induced (or tax-induced) increase in the complexity of a government's revenue structure severs the link between public benefits received and taxes paid, creating a fiscal illusion that causes underestimation of the actual cost of government by consumer-taxpayers.

This string of thoughts leads directly to the debt-illusion hypothesis, implicit in the conventional view of contemplating debt as net addition to private wealth. In fact, underestimation of the cost of public activities would normally result in not only larger government-expenditure levels but also larger private consumption levels. This is so because perception per se of a lower tax-price for public goods releases purchasing power to be ejected in the market for private goods, probably at the cost of a lower savings level.

As becomes evident from the preceding review of the literature, no constraints are imposed by existing theory as to the manifestation of the "fiscal- illusion phenomenon". In a fiscal-illusion setting, government bonds behave like net wealth, regardless of the size of debt. Such a presumption may have far-reaching implications for the developed economies. Endorsing the idea that households view government bonds as net wealth in all cases means in essence that the higher is the ratio of debt to GNP, the more net wealth households perceive as embodied in government bonds, so that consumption will keep growing without limits. Such an unconditional impact of the "debt- illusion stimulus" on consumers'behaviour not only builds up unsustainable political pressures against any program of fiscal consolidation but also gives rise to serious doubts as to the degree of self-consiousness and socio-economic maturity of the citizens in industrialized countries.

It thus becomes of primary importance for economic theory to show that there are self-stabilizing mechanisms in a debt-piling up process. Such an assertion could be strongly supported should one prove that consumers' behaviour is not uniform at low and high levels of indebtedness. This, in

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2. For an English-language survey of fiscal illusion, see BUCHANAN ([1960], pp. 59-64).

turn, presupposes a modification of the fiscal–and debt–illusion notions and a reformulation of the relative hypothesis to be tested along the following lines:

At a low debt-GDP ratio, no one has serious reasons to draw individuals' attention to the long-run consequences of debt. Thereby, private agents are tempted into exhibiting a consumption pattern consistent with the debt-illusion hypothesis. In this case, private sector perceptions are viewed to be irrational as households are unable to perceive the future tax implications of a current expansion in debt and continue to regard the stock of debt in their hands as part of private wealth. The resulting stimulation in consumption demand lends ample support to the traditional (Keynesian) analysis concerning the favourable effects of an increasing debt on economic activity.

At a high debt-GDP ratio, the above reasoning tends to be reversed. Expansionary fiscal policy (defined as the substitution of debt for tax finance) comes increasingly under attack by the public opinion. It is in the self-interest of opposition parties and special interest groups (journalists, bureaucrats, economists etc.) to provide the median voter-consumer with valuable information concerning the adverse effects of the large debt on the long-term prospects of the economy (heavier tax burdens in the future, excess demand, inflation, balance-of-payments problems, low growth rates and so on), given that these effects are no more a "coming from a distance" threat to the individuals' standards of living. Public awareness of the major problems associated with an increasing level of indebtedness leaves no margins for "a debt-illusion prompted" consumption behaviour. The gloomy prospects and the future taxes implied by debt cancel its wealth effects, thus giving rise to repercussions opposite to those predicted by the traditional view. The increase in income uncertainty allows no errors in private sector perceptions of fiscal policy and the equivalence theorem displaces the traditional view, regardless of whether the basic assumptions of Ricardian equivalence are met in practice.

The objective of this study is thus obvious. The main issue to be taken up is to demonstrate that the direction and the strength of the relationship (if any) between debt and consumption depends upon the size of the debt. This relationship should be positive and significant for countries with low debt-GDP ratios, turning gradually to insignificant and negative as debt-GDP ratio rises. To elaborate on this point, an aggregate consumption function for six industrialized countries is derived and estimated in the context of a simulteneous equations model based on intertemporal consumption theory.

3 A Model of Fiscal Policy and Private Consumption

We draw on the well articulated work of TAYLOR [1979] and ASCHAUER [1985] to develop an alternative approach to modeling private sector

consumption behaviour. A simple variant of the agent's utility function may be given by

$$U_t = E_t \left[\sum_{j=0}^{\infty} (1/(1+\delta))^{j_u} u(C_{t+j}) \right] \tag{1}$$

where δ is a constant discount factor, C is private consumption, $u(\ )$ is a time invariant concave utility function and $E_t x_{t+j}$ is the mathematical expectation of x_{t+j} conditional on the information set at t.

The household maximizes equation (1) subject to the budget constraint

$$C_t = N_t - T_t + W_t - W_{t+1}/(1+r) \tag{2}$$

where W defines asset holdings, r is the real rate of return, N is labour earnings and T is tax revenue which conforms to the rules, usually ascribed to the government sector budget constraint:

$$T_t = G_t + B_t - B_{t+1}/(1+r) \tag{3}$$

where G is government expenditure on goods and services and B is debt.

Following the same procedure as Aschauer, we end up with a consumption function of the form

$$C_t = a_0 + a_i \, E_{t-1} \left[\sum_{j=0}^{\infty} (1/(1+r))^j (N_{t+j} + G_{t+j}) \right] + (W_t - B_t)$$

or

$$C_t = a_0 + a_1 \, E_{t-1} N_t + a_2 E_{t-1} G_t + a_3 B_t + a_4 W_t \tag{4}$$

where $E_{t-1} N_t$ and $E_{t-1} G_t$ stand for the expected levels of labour earnings and government purchases, respectively, at time t, conditional upon all information available to the agent at time t–1.

Equation (4) can be further simplified by accepting Aschauer's view that the permanent income measure, if chosen as GDP, includes both future labour income, N, and future nonlabour income accounted for in the wealth variable, W. Thus, equation (4) may be rewritten as

$$C_t = a_0 + a_1 E_{t-1} Y_t + a_2 E_{t-1} G_t + a_3 B_t \tag{5}$$

where Y is gross domestic product (hereafter income).

The auxiliary equations to be employed in the prediction of the current levels of income and government spending are given by a small model in which all wage and price decisions have been reduced to a single aggregate price determination equation. For the purpose of exploring the behaviour of debt, such an aggregate model (augmented of course by the consumption equation) is sufficient if its parameters are policy-invariant. This happens when the model is structural, in the sense that the parameters can be treated as fixed over the relevant range of potential changes in the policy of

substituting debt for taxes. Most of the parameters of the model are made structural through the use of rational expectations. Thus, the parameters in the expected government spending and expected income equations are structural because these equations are consistent with the overall model and, hence, with the behaviour of policy.

The model is assumed to take the following form:

$$(6) \quad Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 M_t + \beta_4 M_{t-1} + \beta_5 E_{t-1}\pi_t + \beta_6 \tau + u_t$$

$$(7) \quad \pi_t = \gamma_0 + \gamma_1 E_{t-1} Y_t + \gamma_2 \pi_{t-1} + v_t$$

$$(8) \quad G_t = \delta_0 + \delta_1 G_{t-1} + \delta_2 G_{t-2} + \delta_3 Y_{t-1} + \delta_4 Y_{t-2} + e_t$$

where M is money balances, π is the rate of inflation and τ is the time trend, with $E_{t-1} Y_t$ and $E_{t-1}\pi_t$ being the conditional expectations of Y_t and π_t respectively, given information through period t–1. The random vector (u_t, v_t, e_t) is assumed to be serially uncorrelated. Thus, the linear least squares predictors of Y_t, π_t and G_t are given by

$$(9) \quad E_{t-1} Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 M_t + \beta_4 M_{t-1} + \beta_5 E_{t-1}\pi_t + \beta_6 \tau$$

$$(10) \quad E_{t-1}\pi_t = \gamma_0 + \gamma_1 E_{t-1} Y_t + \gamma_2 \pi_{t-1}$$

$$(11) \quad E_{t-1} G_t = \delta_0 + \delta_1 G_{t-1} + \delta_2 G_{t-2} + \delta_3 Y_{t-1} + \delta_4 Y_{t-2}$$

Income equation (6) and inflation equation (7) are quite similar to those employed by Taylor. In equation (8), it is postulated that, apart from past values of government spending, past values of income help to predict current government expenditure. The results from testing the hypothesis that past values of government financial variables, such as past taxes or deficits, would also help to predict current government spending in the sample countries were not encouraging. The F-statistics for testing the null hypothesis that their coefficients were all zero ranged substantially below the 5 percent critical values in Germany, Italy, France, the United Kingdom and the United States (but below the 10 percent critical value in the Netherlands) for the corresponding degrees of freedom.

For estimation purposes, equation (6) must be written in a form which does not depend on the unobservable expectations variables $E_{t-1}\pi_t$ and $E_{t-1} Y_t$. Following Taylor, we assume that the money supply is predetermined so that the conditional expectation of M_t, given information through period t–1, is equal to M_t itself. Subsequently, we substitute equation (10) into (9) and solve for the expected income:

$$(12) \quad E_{t-1} Y_t = \theta_0 + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + \theta_3 M_t + \theta_4 M_{t-1} + \theta_5 \pi_{t-1} + \theta_6 \tau$$

where

$$\theta_0 = \kappa(\beta_0 + \beta_5\gamma_0), \qquad \kappa = [1/(1-\beta_5\gamma_1)], \qquad \theta_1 = \kappa\beta_1,$$

(13) $$\theta_2 = \kappa\beta_2, \quad \theta_3 = \kappa\beta_3, \quad \theta_4 = \kappa\beta_4, \quad \theta_5 = \kappa\beta_5\gamma_2, \quad \theta_6 = \kappa\beta_6$$

Therefore, the reduced form equation for income is given by

(14) $$Y_t = \theta_0 + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + \theta_3 M_t + \theta_4 M_{t-1} + \theta_5\pi_{t-1} + \theta_6\tau + u_{1t}$$

At the final stage, we substitute equations (11) and (12) into (5) to obtain the unconstrained form of the consumption function:

(15) $$C_t = \varepsilon_0 + \varepsilon_1 Y_{t-1} + \varepsilon_2 Y_{t-2} + \varepsilon_3 M_t + \varepsilon_4 M_{t-1} + \varepsilon_5\pi_{t-1} + \varepsilon_6\tau + \varepsilon_7 G_{t-1} + \varepsilon_8 G_{t-2} + \varepsilon_9 B_t + z_t$$

where

$$\varepsilon_0 = a_0 + a_1\theta_0 + a_2\delta_0, \qquad \varepsilon_1 = a_1\theta_1 + a_2\delta_3,$$

(16) $$\varepsilon_2 = a_1\theta_2 + a_2\delta_4, \qquad \varepsilon_3 = a_1\theta_3, \qquad \varepsilon_4 = a_1\theta_4, \qquad \varepsilon_5 = a_1\theta_5,$$

$$\varepsilon_6 = a_1\theta_6, \qquad \varepsilon_7 = a_2\delta_1, \qquad \varepsilon_8 = a_2\delta_2, \qquad \varepsilon_9 = a_3$$

The three-equation system, composed of the reduced form equations (14) and (15) and equation (8), is suitable for estimation [3]. The rational expectations assumption has placed the set of restrictions (16) on the coefficients of the above equations: the 22 coefficients of the predetermined variables depend on the 19 unknown parameters in the structural model. Hence, these coefficients are policy-invariant since the parameters of the structural model are.

4 Empirical Results

As discussed earlier, the empirical testing of the hypothesis that debt is viewed as net wealth has been designed for six industrial countries in the context of a three-equation rational expectations model, in which the consumption function has been derived from an optimizing approach. The six countries are those for which quarterly observations on the basic macroeconomic variables were available without breaks. Another criterion for selecting these countries was the desire to maintain a "level of

3. It should be noted that, apart from rational expectations, the model presented in this paper has some important similarities with the model proposed by MODIGLIANI and STERLING [1986].

indebtedness" balance ; that is, to obtain a sample representing developed countries with a variety of debt-income ratios. Thus, the sample contains five European countries (Germany, Italy, France, Netherlands, United Kingdom) and the United States. The data used [4] were obtained from the Quarterly National Accounts of OECD and the International Financial Statistics of IMF. All data were seasonally adjusted using the X-11 procedure of SAS. The statistical properties of the debt-income ratio and the exact length of the series used for each country are shown in Table 1. Figure 1 plots the values of the debt-income ratio calculated from the corresponding annual series.

TABLE 1

Statistical Properties of the Debt-Income Ratio in Six Industrialized Countries

	mean	stand. deviation	maximum	minimum	period covered
Germany	0.161	0.062	0.230	0.065	1971.I-1991.II
France	0.168	0.064	0.279	0.073	1971.I-1991.I
USA	0.333	0.075	0.470	0.242	1971.I-1991.II
Netherlands	0.379	0.165	0.625	0.200	1977.I-1991.II
U.K.	0.486	0.037	0.576	0.435	1971.I-1991.I
Italy	0.647	0.204	1.033	0.382	1971.I-1990.III

On the basis of the mean value and the time path of the debt-income ratio, the sample countries can be classified into three categories. The first group includes the countries with a relatively high debt-income ratio (Italy, U.K.), the second group contains the countries with a low debt-income ratio (Germany, France) and the third group covers the in-between cases (Netherlands, USA). The primary empirical postulate advanced in the present text is that the higher the level of indebtedness in a particular country the lower will be the degree of debt illusion. Therefore, the main hypothesis to be tested throughout the remainder of this paper may be recasted in the following form:

(i) Consumers in such countries as Italy and the U.K., with a relatively high debt-income ratio, will not be easily drifted into the illusion of perceiving

4. The list of the variables used and their definition, as well as the data sources, are given below:
C=Private final consumption,
Y=Gross domestic product,
G=Government expenditure on goods and services,
(the data for these variables were obtained from the Quarterly National Accounts, OECD).
M=Money supply (M2),
π=Rate of inflation estimated as the rate of change of the consumer price index,
B=General Government debt,
(the data for these variables were obtained from the International Financial Statistics, IMF).
All variables are expressed at constant 1980 prices and at the local currencies. Deflation of nominal aggregates is by the consumer price index.

the debt as net wealth, because they are well informed of the perverse consequences accompanying an expansionary fiscal regime. Such being the case, the issue of bonds will not be interpreted as raising private assets and the ultimate result on private consumption will be zero or negative, thus producing Ricardian-type effects.

(ii) On the contrary, consumers in countries like Germany and France, with low debt-income ratios, tend to be trapped in a "state of artificial euphoria", created by the lack of any serious discussion or public anxiety over the long-run implications of an expansion in debt. Accordingly, they do not capitalize the future obligations that debt issue embodies. Government bonds are viewed as adding to the perceived net wealth in the economy and the substitution of debt for tax finance will exert an expansionary impact on private spending, thus producing Keynesian-type effects.

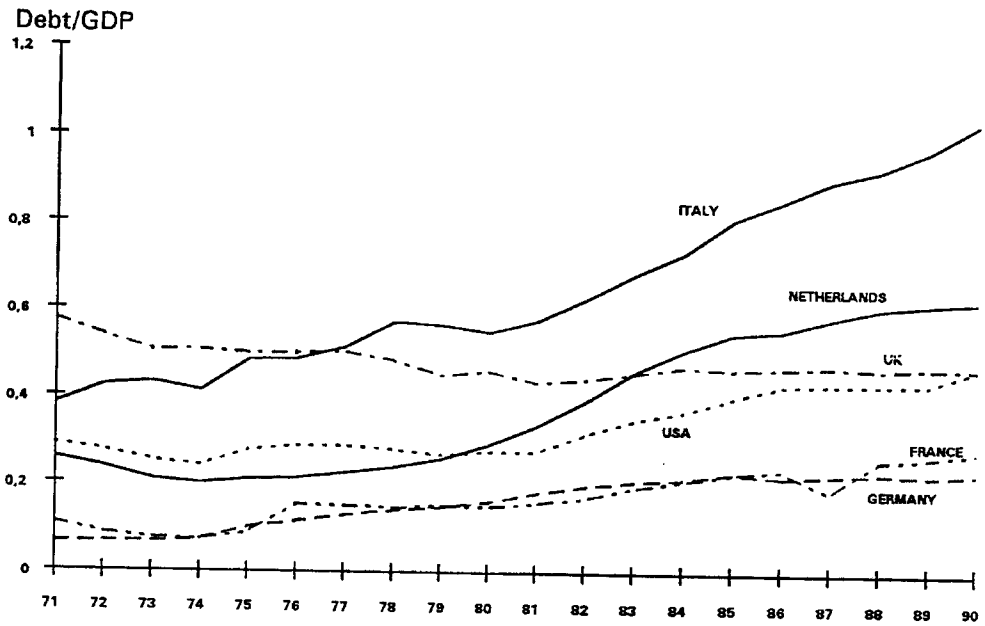

FIGURE 1

Graphs of the debt-income ratios.

The empirical procedure to be used for testing the main hypothesis is to estimate first the system of equations (8), (14) and (15), subject to the set of restrictions (16), by the method of full-information maximum likelihood to acquire estimates of the sixteen free parameters (α_0, ..., α_3, θ_0, ..., θ_6, δ_0, .., δ_4) of the system of equations (5), (11) and (12). The method allows for nonlinear parameter restrictions within and across equations. To this end, the iterative hill-climbing technique to maximize the likelihood function was employed, as developed by Davidson-Fletcher-Powell (TROLL computer package). The results of this estimation are reported in Table 2.

TABLE 2

FIML Estimation of the Unconstrained and Constrained Forms of the Consumption, Output and Government Expenditure Functions

	Unconstrained [system of equations (8), (14), (15)]					
	Germany	France	USA	Netherlands	U.K.	Italy
Consumption						
cons. ε_0 .	58.10(6.90)	328.50(11.6)	118.90(84.2)	–5.20(1.07)	0.34(0.08)	20.30(6.97)
Y_{t-1}, ε_1 .	0.128(2.06)	0.329(3.67)	0.516(7.23)	0.239(3.83)	0.436(4.48)	0.288(5.11)
Y_{t-2}, ε_2 .	0.120(1.81)	–0.078(0.88)	–0.075(0.99)	0.156(2.33)	0.208(1.84)	0.070(1.26)
M_t, ε_3 . .	0.022(1.59)	0.014(1.61)	–0.010(0.36)	0.028(2.02)	0.057(3.16)	0.021(1.20)
M_{t-1}, ε_4 .	–0.004(0.27)	0.0001(0.01)	0.026(0.98)	–0.006(0.40)	–0.042(2.42)	0.005(0.30)
π_{t-1}, ε_5 .	70.20(0.79)	–201.2(1.81)	–1454(2.82)	–45.8(2.01)	–24.56(2.35)	27.50(2.45)
τ, ε_6	–0.735(3.82)	3.33(10.7)	2.30(5.36)	–0.091(1.13)	–0.021(0.65)	0.38(6.80)
G_{t-1}, ε_7 .	0.404(3.05)	0.448(2.04)	0.128(0.64)	0.931(2.93)	0.172(0.65)	0.233(1.84)
G_{t-2}, ε_8 .	0.462(3.40)	–0.072(0.34)	0.491(2.48)	0.036(0.82)	–0.287(1.05)	–0.034(0.27)
B_t, ε_9 . . .	0.160(5.21)	0.012(2.02)	0.081(1.67)	0.017(0.92)	–0.076(1.90)	–0.012(2.32)
R^2	0.987	0.996	0.996	0.955	0.978	0.998
DW	1.73	1.81	1.67	2.13	2.01	1.94
Income						
cons. θ_0 .	21.40(1.49)	92.80(2.88)	194.20(2.43)	7.90(1.15)	4.10(0.84)	8.25(1.52)
Y_{t-1}, θ_1 .	0.699(6.56)	1.02(9.17)	1.18(11.3	0.706(5.44)	0.804(6.80)	0.935(8.52)
Y_{t-2}, θ_2 .	0.291(2.54)	–0.120(1.08)	–0.218(2.03)	0.192(1.38)	0.160(1.16)	–0.161(1.45)
M_t, θ_3 . . .	0.032(1.09)	0.016(1.89)	0.054(1.35)	0.063(2.08)	0.038(1.75)	0.138(4.03)
M_{t-1}, θ_4 .	–0.023(0.83)	–0.008(0.91)	–0.048(1.26)	–0.042(1.30)	–0.032(1.50)	–0.087(2.46)
π_{t-1}, θ_5 .	–134.3(0.81)	–253.7(2.02)	–2499(3.44)	–16.30(0.33)	–19.50(1.64)	63.70(3.09)
τ, θ_6	–0.014(0.12)	0.404(1.64)	0.418(0.67)	–0.014(0.26)	0.013(0.46)	0.355(3.81)
R^2	0.986	0.997	0.995	0.943	0.985	0.997
h	1.45	0.83	1.69	0.61	0.08	0.37
Govern. Exp.						
cons. δ_0 . .	17.70(7.24)	2.90(0.77)	4.72(0.58)	3.02(2.46)	0.34(1.11)	–0.46(0.93)
G_{t-1}, δ_1 .	0.60(5.54)	0.802(7.42)	1.01(9.01)	0.522(4.37)	0.913(8.01)	0.755(6.63)
G_{t-2}, δ_2 .	0.26(2.39)	0.147(1.38)	–0.016(0.14)	0.323(2.85)	0.007(0.06)	0.169(1.50)
Y_{t-1}, δ_3 .	–0.087(1.82)	–0.021(0.53)	0.017(0.67)	0.051(2.52)	–0.013(0.45)	0.046(1.28)
Y_{t-2}, δ_4 .	0.120(2.39)	0.030(0.75)	–0.015(0.63)	–0.053(2.49)	0.027(0.90)	–0.031(0.83)
R^2	0.964	0.995	0.990	0.707	0.978	0.990
h	0.64	1.13	0.13	0.28	1.32	1.02

	Constrained [system of equations (5), (11) and (12)]					
	Germany	France	USA	Netherlands	U.K.	Italy
Consumption						
const., α_0 .	56.50(6.96)	83.70(4.96)	–266.8(3.75)	–7.80(4.10)	–4.60(3.76)	2.70(2.11)
$E_{t-1}Y_t$, α_1.	0.301(8.80)	0.441(15.9)	0.558(30.1)	0.437(11.4)	0.765(22.8)	0.544(36.8)
$E_{t-1}G_t$, α_2.	0.994(8.23)	0.300(3.99)	0.619(3.81)	1.297(4.55)	–0.445(3.15)	0.429(5.49)
B_t, α_3 . .	0.048(5.05)	0.042(4.98)	0.005(1.39)	0.008(1.28)	–0.103(2.14)	–0.102(2.06)
R^2	0.986	0.992	0.994	0.947	0.975	0.997
DW	1.75	1.83	1.69	1.94	2.11	1.89

Income						
cons. θ_0	26.30(1.89)	60.60(1.95)	−116.7(1.97)	10.80(1.66)	0.67(0.17)	−6.50(1.48)
Y_{t-1}, θ_1	0.650(7.40)	1.10(10.5)	1.35(18.7)	0.871(8.17)	0.915(10.6)	1.22(15.2)
Y_{t-2}, θ_2	0.324(3.48)	−0.159(1.52)	−0.381(3.85)	0.005(0.04)	0.080(0.99)	−0.353(4.52)
M_t, θ_3	0.043(1.74)	0.013(1.60)	0.064(2.46)	0.065(2.58)	0.028(1.66)	0.219(8.66)
M_{t-1}, θ_4	−0.031(1.23)	−0.04(1.54)	−0.051(2.01)	−0.059(2.28)	−0.025(1.58)	−0.160(6.18)
π_{t-1}, θ_5	−116.2(0.80)	−216.5(1.84)	−2553(5.23)	33.90(0.85)	−14.60(1.58)	57.10(3.65)
τ, θ_6	0.029(0.26)	0.156(0.65)	1.77(4.29)	0.056(1.16)	0.021(0.85)	0.188(2.64)
R^2	0.986	0.997	0.994	0.938	0.983	0.996
h	0.74	0.98	1.66	0.21	0.42	0.64
Govern. Exp.						
cons. δ_0	17.80(7.27)	2.50(0.66)	5.0(0.61)	3.30(2.68)	0.37(1.18)	−0.62(1.26)
G_{t-1}, δ_1	0.635(5.97)	0.785(7.36)	1.01(9.18)	0.459(4.30)	0.884(7.79)	0.742(6.41)
G_{t-2}, δ_2	0.229(2.14)	0.159(1.51)	−0.032(0.28)	0.376(3.77)	0.060(0.54)	0.158(1.39)
Y_{t-1}, δ_3	−0.109(2.45)	−0.022(0.56)	0.029(1.13)	0.068(3.82)	0.002(0.05)	0.066(1.86)
Y_{t-2}, δ_4	0.141(3.06)	0.032(0.81)	−0.023(0.99)	−0.071(3.80)	0.007(0.25)	−0.046(1.26)
R^2	0.964	0.995	0.990	0.701	0.978	0.990
h	0.55	0.46	1.15	1.23	0.76	0.38

Notes: t-estimates are shown in parentheses. h is Durbin's test statistic for serial correlation in the residuals in the presence of lagged dependent variables. R^2 is the coefficient of determination corrected for the degrees of freedom. DW is the Durbin-Watson statistic.

TABLE 3

Hypothesized Values of the Consumption, Output and Government Expenditure Functions

	Germany	France	USA	Netherlands	U.K.	Italy
ε_0	82.10	111.2	−328.8	1.20	−4.30	−1.10
ε_1	0.087	0.479	0.771	0.469	0.699	0.692
ε_2	0.238	−0.061	−0.227	−0.090	0.058	−0.212
ε_3	0.013	0.006	0.036	0.028	0.021	0.119
ε_4	−0.009	−0.018	−0.028	−0.026	−0.019	−0.087
ε_5	−34.98	−95.50	1424.6	14.80	−11.20	31.10
ε_6	0.009	0.069	0.988	0.024	0.016	0.102
ε_7	0.631	0.236	0.625	0.595	−0.393	0.318
ε_8	0.228	0.048	−0.020	0.488	−0.027	0.068
ε_9	0.048	0.042	0.005	0.008	−0.103	−0.102
θ_0	26.30	60.60	−116.7	10.80	0.670	−6.50
θ_1	0.650	1.10	1.35	0.871	0.915	1.22
θ_2	0.324	−0.159	−0.381	0.005	0.080	−0.353
θ_3	0.043	0.013	0.064	0.065	0.028	0.219
θ_4	−0.031	−0.040	−0.051	−0.059	−0.025	−0.160
θ_5	−116.2	−216.5	−2553	33.90	−14.60	57.10
θ_6	0.029	0.156	1.77	0.056	0.021	0.188
δ_0	17.80	2.50	5.02	3.30	0.370	−0.620
δ_1	0.635	0.785	1.01	0.459	0.884	0.742
δ_2	0.229	0.159	−0.032	0.376	0.060	0.158
δ_3	−0.109	−0.022	0.029	0.068	0.002	0.066
δ_4	0.141	0.032	−0.023	−0.071	0.007	−0.046

The values of the Durbin-Watson statistic and the Durbin h-statistic in Table 2 do not indicate the presence of a significant amount of autocorrelation in the estimated residuals of the equations. In order to further assess the robustness of the results, three additional tests were conducted:

(i) A Gorringe's test that indicated the absence of heteroscedasticity.

(ii) A Chow test to detect whether the true coefficients have remained constant over the period examined. The hypothesis of no structural break could not be rejected for any of the equations at the one percent significance level, the only exception being with the Netherlands [5]. For this reason, the system of equations for the latter country was estimated for the shorter period of 1977.I-1991.II, over which the coefficients proved to be constant.

(iii) The autocorrelation functions of the residuals were examined and Box-Leung Q-statistics calculated to ascertain whether these residuals were white noise. None of the χ^2 tests based on the Box-Leung Q-statistics rejected the hypothesis of white noise residuals in any of the estimated equations.

According to the central postulate of the rational expectations approach, the set of the cross-equation restrictions (16) must be satisfied if expectations are to be consistent with the model and the effects of economic policy. Therefore, this set restricts the way in which debt may influence private consumption. In particular, if the Keynesian view is true, debt should have (positive) explanatory power for consumption. In contrast, if the alternative Ricardian equivalence proposition holds, debt should not affect or should reduce consumers'spending. Accordingly, a finding that the estimates of the constrained and unconstrained models in Table 2 do not violate the restriction set (16) lends support to the argument that the joint assumption of rational expectations and the traditional view (or the alternative equivalence theorem) is closer to describing the real world.

Before turning to a more thorough analysis of the consumption function, it seems most appropriate to highlight some aspects of the estimated output equation. The analysis covers the constrained form of the equation system but it may apply to the unconstrained form as well.

- The estimates of θ_1 and θ_2 indicate that the aggregate output function is stable for fixed values of the other explanatory variables. The value of accelerator is determined by properly manipulating lagged income. For example, writing the terms $1.22\,Y_{t-1} - 0.35\,Y_{t-2}$ for Italy as $0.87\,Y_{t-1} + 0.35^*$ $(Y_{t-1} - Y_{t-2})$ shows the magnitude of the acceleration component which is added to the first-order autoregression.

– Most of the estimated coefficients of each of the real money balance terms are different from zero at the 5 or 10 percent significance levels, as is their sum $\theta_3 + \theta_4$. Note that the coefficient of θ_4 is negative with absolute values less than θ_3. This is consistent with a partial adjustment hypothesis on the money demand equation, that is with a partial adjustment of money balance to changes in interest rates and income.

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5. As indicated by one of the referees, the structural break for the Netherlands in 1977 is due to the fact that its national accounts data were substantially revised during that year.

As the focus of this paper is on investigating consumers'reaction to an increase in debt, we turn to the constrained estimates of the free parameters of the consumption function. The point estimate for the substitutability of government expenditure for private consumption is significantly different from zero at the 5 percent level in all the sample countries. The sign however of the corresponding coefficient is negative for the U.K. and positive for the remaining five countries [6]. This diversification in sign has the following meaning:

– The estimate for the coefficient on expected government outlay suggests a substantial degree of substitutability between government and private goods and services in the U.K. This is in conformity with the proposition of fiscal neutrality, whereby an increase in government spending induces a (total or partial) *ex ante* crowding out of private consumption expenditure.

– In Germany, France, Netherlands, Italy and the U.S., government expenditure substitute poorly for private spending, which in turn implies that increases in government purchases of goods and services have important expansionary effects on private consumption.

Turning to the debt variable, we note that the point estimate α_3 is significantly positive for Germany and France and significantly negative for the U.K. and Italy (at the 5 percent level). Consequently, government bonds appear to be viewed as positive net wealth for countries with low debt-income ratios and as negative net wealth for countries with high debt-income ratios. For economies lying at an intermediate stage of indebtedness (USA, Netherlands), government bonds are viewed as neither positive nor negative net wealth, as statistical insignificance of the coefficients on debt suggest that debt has relatively little influence on current private consumption decisions.

As becomes evident from the comparison of the empirical results reported in Table 2, significantly different estimates of the consumption equation are obtained with "solvent" developed countries than with "insolvent" developed countries, particularly with respect to the parameters associated with the debt variable:

– When the consumption equation is estimated for the United States and the Netherlands, the debt parameter, α_3, is small in magnitude with a relatively low *t*-value. The hypothesis that the parameter estimate is significantly different from zero is accepted at only about the 80 percent level of confidence and the point estimate indicates that a one dollar (guilder) increase in debt would yield less than one tenth of a cent increase in consumption expenditures. Hence, substantial Ricardian results occur in this group of countries characterized by a moderate debt-income ratio.

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6. In general, the impact of an increase in government expenditure on private consumption depends upon whether the increase is composed of consumption-type or investment-type goods and how substitutable these goods are for private consumption. For example, if all government purchases were consumption-type goods and government output were fully valued by the private sector, then a one dollar tax-financed increase in government spending should lead to a corresponding one dollar decrease in private consumption. As government output becomes less than perfectly valued or includes investment goods, the coefficient on government spending becomes less than unity.

– As far as the "insolvent" countries (Italy, U.K.) is concerned, the (negative) debt parameter becomes absolutely larger in magnitude with a relatively high *t*-value. KORMENDI [1983] points out that a negative effect of debt on private consumption is not at odds with the Ricardian view, because uncertainty about the individual's share of future taxes and the timing of these taxes may induce agents to save more than the present value of the income streams associated with bonds issued to finance a deficit.

– At the other extreme, the (positive) debt parameter of the "solvent" countries (Germany, France) grows further in statistical significance, thus producing substantial non-Ricardian results.

The apparent differences among the coefficient estimates, associated with the debt variable in the above three groups of countries, are consistent with the view expressed in the present paper that an improved measure of debt illusion should be devised. In particular, consumers in countries with a high debt-income ratio are well acquainted with the problems involved in a debt-expansion policy, so that no room for debt illusion is left, and Ricardian equivalence seems to prevail. On the contrary, the adverse consequences of an expansionary fiscal policy on the future welfare standing, through the creation of a sequence of debt obligations, are not well perceptible at the first stages of public indebtedness. Therefore, consumers tend to interpret the issue of government bonds as an addition to private net wealth. Consequently, a debt-illusion induced increase in consumption comes out as a result of an increase in debt and the traditional (Keynesian) view appears to hold.

Substitution of the constrained estimates into the set of restrictions (16) yields the hypothesized values reported in Table 3. If there are no substantial differences between the unconstrained parameter estimates and the hypothesized parameter values, then there is much ground on which to argue that the data do not contain serious evidence against either the joint Ricardian equivalence-rational expectations hypothesis for the countries with high debt-income ratios or the joint Keynesian-rational expectations hypothesis for the countries with low debt-income ratios. A comparison of the corresponding columns in Tables 2 and 3 indicates that over 80 percent of the most crucial parameters carry the same sign and are roughly of the same order of magnitude.

Turning to a formal statistical test of the above joint null hypotheses, we estimate the log-likelihood ratio statistic. Given the number of both the unconstrained regressors (22) and the free parameters (16) in the two systems, the statistic $-2\ln(L_c/L_u)$ is distributed as χ^2 (6), with L_c and L_u being the values of the log-likelihood function under the constrained and unconstrained maximization, respectively. For the countries under consideration, the values of the log-likelihood ratio statistic range between 0.034 and 0.149, substantially below the 10 percent critical value of the χ^2 (6) distribution, 10.64. Accordingly, the data are incapable of rejecting the null hypothesis that the constrained model is true. These results reinforce the validity of the aforementioned preliminary conclusions, derived from the comparison of the unconstrained and hypothesized values, thus lending additional credibility to the argument that consumers'attitude towards the true

nature of the debt is greatly diversified at the various levels of public indebtedness.

Lastly, in checking whether the implications of different debt-income ratios for consumer's behaviour are sensitive to the particular lag structure adopted for government expenditures and income, we reestimated the model for the case of three and four lagged values of G and Y [7]. The results are not substantially different from those reported in Table 2, thus lending additional credence to the preceding analysis.

As shown in Table 4, the constrained coefficient estimate, a_3, maintains nearly the same values and levels of statistical significance for all the countries, except for the Netherlands, which seems to move slowly from a positive to a negative Ricardian-equivalence status, as the number of lags increases.

TABLE 4

Estimates of a_3 and Log-Likelihood Ratio Test Statistic

Country	lags	a_3	$-2\ \ln(L_c/L_u)$
Germany	3	0.053(5.13)	1.24
	4	0.045(3.89)	0.63
France	3	0.039(3.85)	0.04
	4	0.048(4.52)	0.48
USA	3	0.009(1.55)	2.35
	4	0.004(1.22)	1.43
Netherlands	3	0.001(0.75)	3.25
	4	–0.003(0.89)	0.96
UK	3	–0.116(2.11)	0.48
	4	–0.118(2.43)	2.01
Italy	3	–0.107(3.12)	0.03
	4	–0.104(2.25)	0.76

Note: The 10 percent critical value of $\chi^2(k)$ is 13.36 for k=8 (3 lags) and 15.99 for k=10 (4 lags).

5 Conclusions

The empirical evidence generated in this paper strikes a balance between the debt neutrality position of the equivalence theorem and the traditional view of contemplating debt as a demand-stimulating factor. Estimated consumption functions derived from an explicit rational expectations

7. In order to conserve space and to focus upon the effect of debt on private consumption, Table 4 presents only the estimates of α_3 (coefficient on debt in the constrained consumption function) and the log-likelihood ratio test statistic.

optimizing framework for six developed countries reveal that debt-financed tax cuts curb consumption expenditures in countries with high debt-income ratios but encourage consumers'spree in countries with low debt-income ratios, according to a modified version of the debt-illusion hypothesis. Thus, our model implies that the prevalence of the level of indebtedness yields indirect evidence on the Ricardian controversy: if countries are heavily indebted, Ricardian equivalence seems to hold ; if they are not, individuals will generally act in a non-Ricardian way. Put differently, it is the position of a country in the indebtedness scale which determines whether consumers' behaviour will be closer to the Keynesian value that ignores the future taxes or to the Ricardian value that treats the future taxes as if they were lump sum.

The empirical results reported here, though consistent with the implications of the conceptual framework, have been obtained from a small sample of six industrialized countries. As other sets of data could possibly convey different inferences, wide margins still exist for additional econometric research, in addition to further exploration into the theoretical foundations of debt illusion.

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