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BUDGET POLICY AND THE DECLINE OF NATIONAL SAVING REVISITED

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Introduction

The world saving rate declined significantly in the 1980s,[1] raising questions about the potential for a world saving "shortfall". The concern is that the level of saving and consequent rate of capital accumulation may not be adequate to support desired increases in standards of living over the medium and long-term time horizons. The Chairman of the Board of Governors of the Federal Reserve System in the United States recently stated, for example, that "... there is no question that the decline in the US national saving rate has been costly, and that the recovery of that saving rate should be a national priority" (Greenspan (1991)).[2] Similar views have been expressed by policy-makers and others in many countries and the global nature of the potential problem has also been emphasised

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[1] One study estimates that average world saving rates in the 1980s were 2¼ percentage points of world GNP below their average levels of the 1970s and also lower than the 1960s (Elmeskov et al. (1991)).

[2] Harris and Steindel (1991), for example, estimate that the US capital stock would have been 15% greater, and potential output 5% higher, had national saving not declined in the 1980s. The high correlation between saving rates and both per capita income and real wage growth in an international context supports this (BIS (1991)). Similarly, Evans (1990) finds that the average US net saving rate in the 1980s was far below that needed to attain the maximum sustainable per capita consumption in the long run.

(e.g. IMF (1991) and BIS (1991)).[3] Moreover, the concern is heightened by the higher projected demands for capital in some countries – particularly the demand for new capital investment from eastern European countries, for rebuilding infrastructure damaged by the war in the Persian Gulf, to meet the needs of developing countries and to repair neglected infrastructure in several industrial countries. Although the present cyclical downturn may postpone the visible effects of a shortfall – a falling-off in investment and a rise in precautionary saving are typical at this stage of the business cycle – greater demands on worldwide saving may nonetheless arise over the medium term. One estimate suggests that the additional demand for saving might well exceed $100 billion in the years to come (Camdessus (1991)).[4]

At the centre of the world saving shortfall discussion is the role played by government policy. In a purely accounting sense, the lion's share of the decline in national saving in many countries may be directly attributable to the fall in government saving in the 1980s, due both to the rise in budget deficits and a shift in government expenditure away from investment and towards consumption and transfers. However, budget actions also influence private saving through a variety of indirect channels, so that their net effect on

[3] For example, the EC Commission also argues that national saving rates and productive investment should be higher so as to fill the "full employment capital stock gap" – the additional capital necessary to generate employment opportunities up to the full-employment level (1989, p. 168). The saving decline in the industrial countries has also adversely affected developing countries – net capital outflows from the large industrial countries (net national saving less net capital formation) averaged 0.6% and 0.2% of national income annually in the 1960s and 1970s respectively, and gave way to average net capital inflows of 0.3% in the 1980s.

[4] The persistently high level of real long-term interest rates compared with earlier periods highlights the continuing pressure of demand for investible funds and is also consistent with the perception of a "saving shortfall". Long-term real interest rates in the major industrial countries averaged about 5% in 1990 and over 4% in the 1980s, compared with 3% in the 1960s and below 1% in the 1970s.

national saving cannot be determined a priori. On one level, a direct linkage between private and public saving is often hypothesised. Proponents of the Ricardian equivalence hypothesis hold that a rise in the budget deficit due to a tax cut will be entirely offset by a rise in private saving - as households associate additional government debt issuance (due to the deficit) with higher future taxes, they increase saving to offset the anticipated liability. The conventional view, in contrast, holds that private saving will only partially respond to a rise in budget deficits - perhaps because households are not "forward-looking" or altruistic, do not attempt to smooth consumption over time, or because of institutional factors, such as liquidity constraints - and the result is lower national saving.

In this paper we argue that the response of private saving to government budget policy is much more complicated than generally recognised, and that private saving cannot be expected to automatically offset the adverse effect on national saving arising from large budget deficits. Changes in the structure of government expenditure and taxes typically influence private decisions in a variety of ways, each of which may have an impact on private saving. The combination of these factors - both the direct demand on saving represented by government budget deficit finance and their indirect effect on private saving working through incentives created by changes in the level and composition of government tax and expenditure policy - may either reinforce or tend to offset each other in terms of the overall impact on national saving.[5] Our analysis also questions whether there is a stable and reliable private saving response to government policy, either over time or across countries. This is partly due to the changing nature of government policy and institutional features of economies. But a more fundamental problem is our limited understanding of what determines private saving and the weak empirical support for even the most basic

[5] The government budget deficit includes borrowing associated with government investment. Government investment does not affect government saving or dissaving.

theories of saving behaviour.[6] The analysis also considers several potential shortcomings in the measurement of deficits, and focuses on the growth of government contingent liabilities, implications for measures of the private saving offset to deficits and the potential intergenerational consequences.

In addition to surveying existing evidence, we present our own estimates of the response of private saving to government budget deficits for five major industrial economies, taking into account both the structure of the deficit and the composition of government expenditures. These estimates support the intuitive idea that the private sector response to changes in government budgets will depend crucially upon the underlying policy generating the change and that, in general, a strong private saving offset to a decline in government finances cannot be relied upon to support national saving. In particular, we find that when the deterioration in government finances is attributable to expenditure increases, rather than tax reductions, national saving is reduced. Since most of the fall in government saving during the past two decades is associated with the growth of government expenditures, it follows that budgetary policies have been a primary cause of the fall in national saving.

This argument is strengthened by the analysis of government contingent liabilities. We find that conventional empirical estimates of the private saving response to budget deficits based on national income statistics greatly exaggerate the extent of private saving offset. Most importantly, the rise in massive government contingent obligations, typically off-budget and unfunded, has led to a significant underestimation of the growth of total government liabilities, implying a significant "intergenerational burden" on future generations. This is additional evidence supporting the view that the deterioration of public finances represents a significant drain

[6] Weil (1991), for example, suggests that "... while theory has advanced to study many of the subtleties of possible determinants of savings, examination of empirical literature here and elsewhere leaves one feeling that we cannot be sure of the veracity of even the simplest theory's assumptions or consequences" (p. 169).

on national saving and imposes real economic costs on future generations.

In the first section we review some of the broad trends in private and public saving over the last three decades. In section II we discuss the basic theoretical issues, review the empirical evidence and present estimates of the private saving offset to government budget deficits for five major industrial economies. In section III we present estimates of an expanded model taking into account both the structure of the deficit and the composition of government expenditure. We also discuss the plausibility and stability of the underlying model of saving behaviour and compare our results with other empirical studies. In section IV we present evidence on the growth of government contingent liabilities and discuss its implications. A concluding section draws some policy implications from the analysis. Two technical appendices present some of the theoretical arguments more rigorously, describe the empirical methodology and present some of the preliminary statistical results.

I.
Accounting for saving

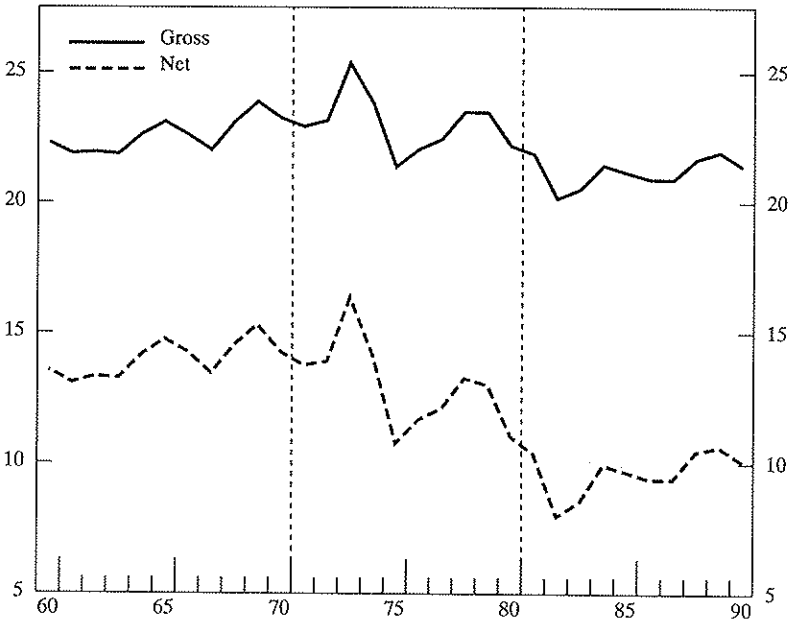
The general decline in national saving rates in the 1980s raises numerous issues as regards its sectoral composition, fundamental causes and consequences for capital accumulation, capital flows and so on. The limited objective of this section, however, is to document the decline across the major industrial economies, evaluate its sectoral composition and consider various alternative measures of saving.

Decline in national saving

Measured by the System of National Accounts (SNA), net national saving as a percentage of national income declined by almost 4 percentage points between the 1960s and 1980s in the major industrial countries. Declines of similar or larger magnitude were

Graph

Saving in the Group of Seven countries *



Note: Calculated using GDP weights and exchange rates.

* Gross saving as a percentage of GNP, net saving as a percentage of national income.

Source: OECD National Accounts.

evident in most smaller industrial and developing countries. Although an upswing has been observed in the past few years, as shown in the graph above, net national saving nonetheless remains far below the average values observed in the 1960s and 1970s.

Averages of national saving rates over three decades as a percentage of national income, broken down into public and private components, are shown in Table 1 for the major industrial countries. The decline in net national saving between 1960–69 and 1980–89 is evident in all of these countries, with the sharpest drop in Germany (8¼ percentage points) and the smallest in Canada (1½ percentage

Table 1

National saving rates in major industrial countries

Countries and periods	Gross national saving[1]	Net national saving	of which				Memo: General government net lending[1]
			Public[2]	Private			
				Total	Households	Business enterprises[3]	
	as a percentage of national income						
United States							
1960–69	19.7	10.8	0.8	10.0	6.2	3.8	– 0.4
1970–79	19.4	9.1	–1.2	10.3	7.6	2.6	– 1.2
1980–89	16.3	4.0	–3.8	7.8	6.0	1.9	– 3.4
Japan							
1960–69	34.5	25.2	6.6	18.6	11.9	6.6	1.0
1970–79	35.3	25.6	5.0	20.6	16.5	4.1	– 1.7
1980–89	31.6	20.9	5.1	15.7	13.1	2.6	– 1.4
Germany							
1960–69	27.3	19.9	6.3	13.5	7.6	6.0	0.7
1970–79	24.3	15.2	3.7	11.5	9.7	1.7	– 1.7
1980–89	22.5	11.6	1.5	10.1	8.9	1.2	– 2.0
France							
1960–69[4]	26.2	19.2	4.5	14.7	11.1	3.6	0.4
1970–79	25.8	17.0	2.7	14.4	11.9	2.5	– 0.4
1980–89	20.4	8.9	–0.4	9.3	7.9	1.4	– 2.1
United Kingdom							
1960–69	18.4	10.9	2.7	8.2	4.3	3.9	– 1.0
1970–79	17.9	8.3	1.4	6.8	4.3	2.5	– 2.6
1980–89	16.6	5.5	–0.8	6.3	3.7	2.6	– 2.4
Italy							
1960–69[4]	28.1	19.8	1.6	18.2	15.9	2.3	– 1.9
1970–79[4]	25.9	16.2	–5.2	21.4	21.3	0.1	– 7.0
1980–89	21.9	11.0	–7.7	18.7	15.9	2.8	–11.1
Canada							
1960–69	21.9	11.3	2.6	8.7	4.0	4.8	– 0.4
1970–79	22.9	13.1	1.4	11.7	6.0	5.6	– 0.9
1980–89	20.7	9.9	–3.4	13.3	9.2	4.2	– 4.8
Average[5]							
1960–69	22.3	13.8	2.3	11.5	7.4	4.1	– 0.3
1970–79	23.4	13.6	0.8	12.8	10.1	2.7	– 1.7
1980–89	21.5	10.0	–0.9	10.9	8.8	2.1	– 3.2

[1] As a percentage of GNP. [2] General government. [3] Includes public enterprises. [4] Based on the old system of national accounts. [5] Calculated using GDP weights and exchange rates in 1963 for the 1960–69 period, in 1975 for the 1970–79 period and in 1988 for the 1980–89 period.

Source: OECD National Accounts.

points). The average decline for the group as a whole was 3¾ percentage points, and would have been much larger had it not been for the higher GDP weight of Japan in the later period.

Another feature of the data is the persistent wide variation of the level of national saving across countries. Japan had by far the highest saving rate in the 1980s, at 21% of national income, while the United States had the lowest at 4%. Japan's net national saving rate in 1960–89 was almost double the Group of Seven average. The United States and the United Kingdom, by contrast, were continually at the low end of the spectrum over the three-decade period, while Germany, France and Italy had quite similar net national saving rates, falling in the middle of the spectrum.

The dominant role played by the government sector in saving movements in most industrial countries is also noteworthy. The contraction in government net saving between 1960–69 and 1980–89, at 3¼ percentage points, accounted for most of the decrease in national saving, while the fall in private saving accounted for only about ¼ percentage point. The decline in public sector saving (current revenue less current expenditure) was almost entirely reflected in the deterioration in the overall financial balance (i.e. net lending: total revenue less total expenditure). In several industrial countries, however, the decline in net lending (or rise in public borrowing) was less than the drop in net saving because of a fall in the share of total expenditure devoted to investment, i.e. a shift from capital to current expenditure.[7]

The deterioration in public finances in most industrial countries was largely concentrated in the middle and late 1970s following the first oil shock, but continued in most cases in the 1980s despite some progress in consolidating budgetary positions in the latter part of the decade. Wide variation is observed in the level of government saving

[7] The OECD national accounts data base, based on the SNA and from which most of these statistics are derived, allows the distinction between government consumption and government investment. The main difference between government net saving and government net lending is investment expenditure. The NIPA (National Income and Product Accounts) statistics of the United States, in contrast, do not distinguish between government consumption and investment expenditure, leading to an underestimation of government saving (or overestimation of dissaving).

rates internationally. Japan and Germany maintained positive government net saving positions throughout the three-decade period, while the United States and Italy experienced public dissaving in both the 1970s and 1980s. In the 1980s public dissaving was marked in the United States, France, the United Kingdom, Italy and Canada, and all of the major industrial countries were substantial net borrowers. In the 1960s, in contrast, most industrial countries recorded substantial public net saving, used the funds to finance public investment and still had negligible government borrowing requirements.

A statistical artefact?

A large body of literature has grown up, devoted both to refining national accounts measures of saving and to providing alternative measures based on wealth accumulation. Of course, problems of measurement in either income or consumption will directly affect the calculation of national saving rates. Important adjustments to conventional saving rate measures include the treatment of: (i) depreciation allowances; (ii) government expenditure classification between consumption and investment, particularly in areas of education, research and infrastructure development; (iii) consumer durables; and (iv) capital gains on property, equities and other assets.

Two primary conclusions of interest may be gleaned from the bulk of studies which have addressed these measurement issues. First, the decline of saving rates in the 1980s suggested by the national accounts data is still present after these adjustments, although it may be exaggerated somewhat by a number of shortcomings in the conventional estimates. Secondly, part of the seemingly wide variation in saving rates internationally is attributable to differences in the national treatment of investment, depreciation and so on.[8]

[8] See Cullison (1990) for a review of studies which compare US saving relative to other industrial countries, attempting to standardise the approach in the measurement of saving rates.

Elmeskov et al. (1991), for example, adjust conventional national accounts measures of saving in the OECD countries for valuation effects (general inflation and other factors), reclassify certain categories of spending between output components (especially education and consumer durables) and also consider different coverage effects (e.g. household production, underground economies, depletion of natural resources and environmental degradation). The conclusions which emerge from their efforts include the observation that "... the general picture of the 1980s as a period of weak saving in the OECD area, at least until the last years of the decade, seems relatively robust" (p. 24).

With respect to international differences in national saving rates, Lipsey and Kravis (1987) make adjustments in the data to incorporate spending on consumer durables, education and research and development. These adjustments in many cases tend to narrow the differences in conventionally measured national saving rates. Using a similar methodology on a larger group of countries, Elmeskov et al. (1991) nonetheless conclude that large differences in saving ratios remain despite refinements in measurement. Hayashi (1986 and 1989) also attributes a major part of the seemingly high Japanese saving rate to measurement problems – an underestimation of depreciation and government consumption – bringing its saving rate much closer to the industrial countries' average. Dekle and Summers (1991) argue that Hayashi's work underestimates the Japanese saving rate, and the high saving rate of Japan in international comparison is "reaffirmed" in their adjustments. Japan's high saving rate also is captured by measures which take into account the market value of assets (Bradford (1990)).

Public/private saving linkages

In principle, a decline in public saving need not lead to a fall in national saving if the private sector responds by increasing its saving. Indeed, a sharp rise in saving by the household sector in the 1970s more than offset a decline in government saving in the major industrial countries. In the 1980s, by contrast, average private saving

declined to 11% of national income, which, on top of the drop in public saving, resulted in a sharp fall in national saving. Overall, average net private saving rates in the past decade were somewhat lower than in the 1960s and significantly less than in the 1970s.

II.
Budget deficits and national saving

Private saving offset to budget deficits

The extent to which national saving is influenced by government budget deficits continues to be a controversial issue despite the voluminous theoretical and empirical research that has been undertaken on the topic. On the one hand, the Ricardian equivalence hypothesis holds that private saving rises equi-proportionately to a tax-cut-induced rise in the government budget deficit (Barro (1974)).[9] According to this view, national saving is little changed by fluctuations in the government saving balance because of the induced offset changes in private saving. This argument is based on the idea that the balance sheet of the government sector is incorporated into private saving decisions. That is to say, households essentially view the net asset or liability position of the government sector as extensions of its own net wealth. A new government bond issue therefore is not seen as an addition to household wealth because the obligation to repay the debt ultimately rests with taxpayers. The upshot of the Ricardian view is that households are likely to view the tax decrease and associated budget deficit as temporary and likely to be followed by higher taxes (and budget surpluses) later. The predicted response is that households attempt to smooth consumption over time by saving the current tax rebate, an amount which exactly offsets the anticipated future tax hike (in present value

[9] The term Ricardian equivalence is somewhat of a misnomer. Although Ricardo considered a complete private saving offset to swings in government saving a theoretical possibility, he rejected it on practical grounds.

terms). In essence, this paradigm suggests that the impact of government fiscal policy on real magnitudes is through the present value of expenditure and that "... the rearrangement of the timing of taxes – as implied by budget deficits – [has] no first order effects on the economy" (Barro (1989), p. 51). Appendix A derives this neutrality result, and its implied assumptions, in the context of a formal model.

A seemingly less controversial proposition in economics holds that the household sector incorporates business sector saving (retained earnings and depreciation), or more precisely the balance sheet of the business sector, into its spending and saving decisions – it is assumed to "pierce the corporate veil" and recognise that retained earnings of the business sector represent an increase in household wealth. The Ricardian hypothesis goes one step further in assuming that the household sector "pierces the government veil" as well. Indeed, it is analogous to the well-known Modigliani and Miller (1958) neutrality theorem of corporate finance – in the presence of perfect capital markets and certain other assumptions (e.g. no bankruptcy costs or taxes) the particular financing pattern (debt or equity) chosen by firms to fund their investment projects does not affect the value of the firm. As households own the firms, the method of corporate financing should not affect private sector wealth. Similarly, as government liabilities must ultimately be borne by the private individuals, government financing decisions (tax or bonds) to fund a particular pattern of expenditure may also be neutral with respect to household wealth.

Competing models

Two main competing models of saving behaviour may be identified in the modern economics literature. The Ricardian equivalence hypothesis fits into the "dynasty model", which posits that each successive generation is linked to the next by altruism so that all generations act as if they form a single immortal dynasty. The competing model is the life-cycle hypothesis, which views the economy as consisting of overlapping generations with little or no

altruistic behaviour. The basic idea of the life-cycle model is that individuals save (and accumulate wealth) during their working lives in order to finance retirement, during which time wealth is drawn down – hence the term life cycle to describe different saving behaviour during different phases of life. The term overlapping generations comes from the idea that at any point in time different generations (age cohorts) are alive and are trading with one another and that each generation trades with different generations in different periods of its life.[10] If the population and incomes are growing over time, aggregation across generations would give a positive link between the private saving rate (ps_t) and real income growth (inc_t), and a negative link between the private saving rate and the percentage of the elderly in the population (age_t):

$$ps_t = \alpha_0 + \alpha_1 trend_t + \alpha_2 age_t + \alpha_3 inc_t \qquad (1)$$

A time trend ($trend_t$) captures other factors influencing the evolution of private saving over time.

The primary distinction between the dynasty and life-cycle models is the strength of the bequest motive. The bequest motive is an important link between present and future generations. The extreme form of the life-cycle model is when individuals have no bequest motive (which may be interpreted as the simplest form of the life-cycle model), which in the no-uncertainty case implies that the older generation eventually exhausts its wealth. Rational individuals may recognise that a government bond issue associated with a tax-cut-induced rise in the budget deficit must eventually be paid off by a rise in future taxes if the government is to remain solvent, i.e. satisfies its intertemporal budget constraint and does not default on the debt. But if the burden of the rise in future taxes is expected to be

[10] See Chapter 3 of Blanchard and Fischer (1989) for a comprehensive review of overlapping generations models and their implications for the Ricardian equivalence hypothesis.

borne by another generation, then the budget rise would not induce an exact offset in private saving and would lower national saving.[11]

On the other hand, the extreme form of the dynasty model, embodying the Ricardian proposition, posits that the bequest motive linking generations is sufficiently strong that individuals essentially act as if they lived forever. In this case, the tax cut would induce individuals to increase saving in order to smooth consumption over time when faced with an expected future tax liability, either their own or that of their heirs. This part of the rise in saving would allow a larger bequest to be passed on to future generations, an amount sufficient to pay their additional tax burden.

Neither of the extreme positions is likely to hold in actual practice, however. A private saving offset between zero and negative unity would generally be anticipated. Beyond limited planning horizons and bequest motives, other factors which could significantly reduce the private sector offset to budget deficits are substantial uncertainty in the economy, widespread credit constraints, tax-induced distortions and limits in households' attempts to smooth consumption over time. Under these circumstances, a fall in government saving would only be partly offset by an increase in private saving, leading to a fall in national saving.[12] In terms of the basic model:

$$ps_t = \alpha_0 + \alpha_1 \, trend_t + \alpha_2 \, age_t + \alpha_3 \, inc_t + \alpha_4 \, nll_t \qquad (2)$$

where net lending by the general government as a percentage of national income (nll_t) is added to the basic model. If α_4 is negative

[11] In his Nobel Prize lecture delivered in 1985, Modigliani argues, in contrast to the Ricardian position, that government budget deficits crowd out domestically owned capital formation and hence shift the burden of paying for government expenditure to future generations (Modigliani (1986)).

[12] Although recognising these qualifications, Barro (1989) nonetheless argues that deviations from Ricardian equivalence tend to be only of second-order importance and suggests that the logic behind this approach is so compelling that it will eventually become the benchmark model for assessing fiscal policy.

unity then this supports pure Ricardian equivalence. A partial offset is indicated by $-1 < \alpha_4 < 0$.

Our discussion suggests that the extent to which government dissaving is offset by private saving is fundamentally an empirical question, and that the offset coefficient may vary from country to country and through time depending upon the institutional characteristics of the economies in question. The next two sections present the methodology and data used to test this proposition and some estimates of the private saving offset coefficient in the context of the model represented by equation (2).

Methodology and data

Given the non-stationary characteristics of much of the data and the complicated dynamic structures, we employ the co-integration/error correction model methodology in the analysis and distinguish between (i) long-term equilibrium relationships between private saving and government saving (co-integration) and (ii) the short-term dynamic responses (error correction). The basic objective of this approach is to model the dynamics of saving behaviour while at the same time attempting to capture information on long-term relationships imbedded in the levels of non-stationary variables. A short description of this methodology is contained in Appendix B. It also contains the results from some of the preliminary statistical analysis associated with this methodology, i.e. unit root tests to determine the order of integration of the variables.

We follow the two-step estimate procedure of Engle and Granger (1987) under which a co-integrating vector is estimated first (and the coefficients interpreted as the long-term relationship between the variables). The estimation of the dynamic system is then subject to the steady state from the first stage. In particular, the dynamic specification (error correction model) includes the lagged error term (EC_{t-1}) from the estimate of the co-integrating vector. The coefficient on the EC_{t-1} variable measures the speed at which deviations from the long-term equilibrium relationship (co-integrating vector) are corrected. A value of -0.5, for example, means that, on average,

50% of the difference between the actual and equilibrium private saving rate (determined by the realised values of the other variables in the co-integration vector) is eliminated in each period. In the specification of the error correction model we follow Hendry and von Ungern-Sternberg (1981) and others by including contemporaneous values in the estimated equations.[13]

We estimate private saving equations for five major industrial economies (the United States, Japan, Germany, the United Kingdom and Canada). Data were collected for the seven major industrial countries (Group of Seven), but Italy and France were excluded from the sample because revisions in their national accounts did not allow a sufficiently long time series with comparable data for the regression analysis. Annual data from 1960 to either 1987 (Germany and the United Kingdom) or 1988 (the United States, Japan and Canada) are employed in the study, and are derived from the OECD National Accounts (detailed tables).

Offset coefficient results

The estimates of the equilibrium equation (co-integrating vector) and the co-integration tests are presented in Table 2. The basic private saving equation (equation 2) suggested by the life-cycle model is estimated. The ADF statistic at the foot of the column is a test of the existence of a co-integration relationship among the variables in the equilibrium equation. Using the ADF test, some evidence indicating the existence of a co-integrating relationship among the variables is found for the United States, the United Kingdom and Canada.

[13] In contrast, Engle and Granger (1987) employ only lagged regressors in their error correction model specifications. Their approach does not distinguish between exogenous and endogenous variables, though it may allow some inferences about Granger causality, and they interpret error correction models primarily as statistical representations rather than attempting a structural or behavioural interpretation. See Alogoskoufis and Smith (1990) for an interesting and informative comparison of the various approaches to error correction models.

Table 2

Equilibrium equation and co-integration: private saving and budget deficits

	United States	Japan	Germany	United Kingdom	Canada
constant	0.54	0.42	0.14	0.16	0.31
	(6.86)	(7.28)	(3.91)	(1.87)	(5.04)
trend	0.001	0.007	-0.002	0.000	0.004
	(3.28)	(3.47)	(-3.52)	(0.30)	(5.99)
age	-2.90	-3.13	-0.06	-0.53	-1.93
	(-5.46)	(-4.19)	(-0.29)	(-1.08)	(-3.79)
inc	0.17	0.24	0.20	0.31	0.15
	(2.92)	(1.95)	(1.64)	(2.44)	(1.42)
nl1	-0.18	-0.17	-0.04	-0.39	-0.39
	(-1.66)	(-1.18)	(-0.23)	(-2.25)	(-3.20)
R^2	0.76	0.61	0.69	0.38	0.78
SEE	0.007	0.017	0.011	0.015	0.012
Co-integration test:					
DW	1.58	0.71	0.75	0.75	0.85
ADF	-2.98	-2.36	-2.19	-3.04	-3.46

Note: The t-statistics in parentheses are provided for reference only – they are not reliable indicators of statistical significance in the equilibrium regressions.

The point estimates of the fiscal variables in the equilibrium equations vary greatly across countries and generally indicate a rather weak private saving offset to government net lending (negative coefficient on nl1). The range is from -0.04 for Germany to -0.39 for the United Kingdom and Canada, providing little support, even in an equilibrium situation, for the one-for-one trade-off predicated by the Ricardian hypothesis.

The error correction model estimates are given in Table 3. The short-run adjustments to government net lending were negative in every case, and statistically significant in most cases, with estimated offset coefficients ranging from -0.24 (Japan and the United Kingdom) to -0.30 (Germany). These results, with coefficient estimates significantly below unity in absolute value, are also evidence against the Ricardian position. However, support for the error correction model is suggested by the negative and statistically significant EC_{t-1} terms. The most rapid adjustment process is

Table 3

Error correction model: private saving and budget deficits

First difference specification

	United States	Japan	Germany	United Kingdom	Canada
constant	0.00	-0.00	-0.00	0.00	0.00
	(0.12)	(-0.80)	(-1.54)	(0.38)	(1.49)
Δ age$_t$	-1.26	0.31	0.64	-1.25	-1.66
	(-0.94)	(0.30)	(1.37)	(-1.26)	(-1.25)
Δ inc$_t$	0.14**	0.13*	0.22**	0.30**	0.12*
	(3.13)	(2.02)	(3.52)	(4.13)	(1.84)
Δ nll$_t$	-0.26**	-0.24	-0.30**	-0.24	-0.25**
	(-2.79)	(-1.39)	(-2.42)	(-1.65)	(-2.14)
EC_{t-1}	-0.77**	-0.46**	-0.45**	-0.40**	-0.40**
	(-3.92)	(-3.40)	(-2.30)	(-2.28)	(-2.27)
R^2	0.58	0.54	0.48	0.59	0.38
SEE	0.006	0.010	0.008	0.011	0.010

Note: t-statistics are given in parentheses; *(**) denotes significance at 90% (95%) or higher level of confidence.

indicated in the case of the United States, where 77% of the deviation from equilibrium is corrected each period, e.g. if the private saving rate was initially one percentage point above its equilibrium value, it would decline by 77 basis points the first year, 18 basis points (0.23×-0.77) the second year, and so on until reaching its equilibrium value.

III.
Private saving and the composition of government spending and taxation

A number of factors may account for the relatively small private saving offset to budget deficits estimated. One factor may be the neglect of the specific expenditure policies driving government deficits – policies which in turn have varied significantly over time and across countries – which may have led to misleading inferences about private saving behaviour. Tests of private saving offsets need

to control for the level of government expenditure (gel_t) in order to be able to distinguish between effects arising from the particular financing of government (debt/taxes) and the effects arising directly from expenditure policies.[14] To test this proposition our basic equation is modified:

$$ps_t = \alpha_0 + \alpha_1 trend_t + \alpha_2 age_t + \alpha_3 inc_t + \alpha_4 nll_t + \alpha_5 gel_t \quad (3)$$

The coefficient α_4 measures the effect of a tax increase with government expenditure held constant, leading to a rise in net lending. α_4 in equation (3) is a more appropriate test of the Ricardian hypothesis (predicting $\alpha_4 = -1$) than the α_4 coefficient in equation (2) because the former measures the extent to which the *method of financing* (debt/taxes) government expenditure is important.[15] α_5 measures the effect of a balanced budget rise in government expenditure (net lending is held constant), i.e. an equal rise in government expenditure and taxes. The effect of a debt-financed rise in government expenditure is measured by $\alpha_5 - \alpha_4$. The Ricardian hypothesis does not directly address the linkage between private saving and government expenditure. A number of factors will in principle influence this linkage, including the extent to which government expenditure substitutes for private consumption or increases private wealth (see Aschauer and Greenwood (1985)).

[14] The Ricardian hypothesis posits the irrelevance of the time pattern of the tax/debt mix, given a pattern of spending over time, as long as the government satisfies its budget constraint. Hence, in principle the present level and expected future pattern of government expenditure should be controlled for in testing the Ricardian hypothesis, i.e. the expected present value of government expenditure. This is the relevant factor entering the government budget constraint and, if the Ricardian hypothesis holds, is incorporated into the consolidated private sector budget constraint (as is shown in Appendix A). In practice, of course, one observes only the current and past values of government expenditure. Testing the Ricardian hypothesis with only the current value of government expenditure implicitly assumes that the present level is a good proxy for expected future levels.

[15] In contrast, α_4 in equation (2) does not distinguish between tax and expenditure-induced changes in the budget balance.

A second potential reason for divergent offset coefficient estimates may be in the treatment of social security. The work of Feldstein (1977), Modigliani and Sterling (1983) and others either explicitly or implicitly suggests that a rise in the total budget surplus (nl1) associated with a rise in the current social security (public pension) balance (sss) may have a different effect on private saving from a rise in other components of the budget (nl2; total budget surplus less social security surplus). More specifically, if social security is viewed as a fully-funded system by the private sector, then a rise in the social security surplus may in large part simply substitute for private saving targeted for retirement purposes. In the extreme case, it could result in an exact offset in private saving, keeping national saving unchanged, i.e. exact Ricardian equivalence.

By contrast, if social security operates as a pay-as-you-go transfer scheme, whereby the working age population makes contributions which are simply transferred to retired beneficiaries and no public saving is undertaken, then a rise in the surplus would most likely only be partly offset (Blanchard and Fischer (1989)). Modigliani and Sterling (1983) and others have pointed out that higher social security benefits may also encourage early retirement, tending to raise private saving and partly offsetting the decline in saving associated with the reduction in the need to save for retirement (Modigliani (1986)). This suggests that a number of complex factors may in practice cause a differential response to fluctuations in the social security fund as opposed to other budget items, indicating that a decomposition between these two elements should be undertaken. To explore these potentially differential effects on private saving, we disaggregate total net lending (nl1) into its two basic components, the social security fund (sss) and other net lending (nl2), and include these separately in the saving equation:

$$ps_t = \alpha_0 + \alpha_1 \, trend_t + \alpha_2 \, age_t + \alpha_3 \, inc_t + \alpha_4 \, nl2_t + \alpha_5 \, sss_t + \alpha_6 \, gel_t \qquad (4)$$

Finally, a third reason for divergent offset coefficients may be due to the composition of government expenditure. In particular, different compositions of government expenditure as between investment (gni_t) and consumption/transfers ($ge2_t$) should in principle produce quite different effects on private saving. Similarly, private saving should also in principle respond much less to a deficit-financed rise in public investment than to a rise in either consumption or transfers. To the extent that a rise in public investment earns an expected future return, any implicit net public sector liability (and hence expected rise in future taxes) would be correspondingly reduced, thereby limiting perceived future increases and, presumably, the immediate private sector saving response. Although other work has considered the effects of government spending and its composition on consumption and saving behaviour, our innovation in this respect is to focus on the effects of government investment spending.[16] Modifying the basic life-cycle model to take this point into account, as well as that of the social security decomposition, gives the fully specified model:

$$ps_t = \alpha_0 + \alpha_1 \, trend_t + \alpha_2 \, age_t + \alpha_3 \, inc_t + \alpha_4 \, nl2_t + \alpha_5 \, sss_t + \alpha_6 \, ge2_t + \alpha_7 \, gni_t \qquad (5)$$

where ($ge2_t$) is government expenditure on consumption and transfers (including interest payments) and (gni_t) is government net investment spending. Again, the government expenditure coefficient

[16] Bailey (1962), for example, emphasises the potential for government expenditure to substitute for private consumption though a number of channels. Focusing on the composition of expenditure, Kormendi (1983) analyses potential differential effects on private consumption arising from government expenditure on goods and services, transfers and debt interest payments. He does not consider the breakdown of goods and service expenditure between consumption and investment, however. Modigliani (1986) notes the importance of the composition of the deficit between investment spending and other expenditure categories for intergenerational equity considerations, but does not test the importance of this distinction for either private consumption or saving behaviour. Bisignano (1985) considers the extent to which government consumption is a substitute for private expenditure in US consumption and money demand functions.

values (α_6 and α_7) will in principle vary with institutional and other factors.

Composition of expenditure and budget positions

Although shifts in the composition of government expenditure and budgetary positions may be important in principle, are they large enough to materially effect estimates of the link between public and private saving? Table 4 shows a detailed decomposition of spending categories for the major industrial economies. This table shows the significant differences in the composition of expenditure across countries, indicates the large swings in the factors contributing to the growth in aggregate government spending over the past three decades and, in particular, highlights the significant changes in the composition of government expenditure.

Average government expenditure in the Group of Seven countries, calculated by decadal averages, rose by more than 9 percentage points of GNP between the 1960s and 1980s, almost entirely owing to increased transfers and interest payments. These outlays accounted for 8.7 percentage points of the 9 percentage point rise, while government consumption expenditure climbed only 0.5 percentage point. In contrast, gross and net investment expenditure for the Group of Seven countries declined slightly (0.1 percentage point) as a share of output over the period. Of the Group of Seven countries, only Japan and Italy experienced increases in net government investment. Net government investment in the other countries declined by 1 percentage point or more between the 1960s and 1980s. These data suggest that misleading inferences could be drawn from the aggregate expenditure figures when private saving responds differently to government investment spending and other spending categories.

Although rapid growth in government outlays driven by transfers (including social security benefits) and interest payments was common to all the major industrial economies from the 1960s, a large variation across countries is nonetheless evident. Japan, for example, had the smallest percentage of GNP among the Group of Seven

Table 4

Structure of general government outlays in major industrial countries

As a percentage of GNP

Countries and periods	Total	of which						Memorandum items	
		Consumption	Investment		Transfers	Interest[1]		Net lending	Net saving
			gross	net		gross	net		
United States									
1960–69	29.0	17.6	2.9	1.6	6.6	1.9	1.5	– 0.4	0.7
1970–79	32.2	17.7	2.0	0.6	10.1	2.4	1.7	– 1.2	–1.0
1980–89	35.8	17.9	1.6	0.3	11.8	4.5	3.1	– 3.4	–3.3
Change[2]	6.8	0.3	–1.3	–1.3	5.2	2.6	1.6	– 3.0	–4.0
Japan									
1960–69	18.4	7.9	4.8	4.3	5.3	0.5	–0.2	1.0	5.8
1970–79	25.2	9.0	6.2	5.7	8.7	1.3	0.1	– 1.7	4.4
1980–89	33.0	9.7	6.3	5.7	12.9	4.1	1.4	– 1.4	4.4
Change[2]	14.6	1.8	1.5	1.4	7.6	3.6	1.6	– 2.4	–1.4
Germany									
1960–69	36.7	15.0	5.8	5.4	15.2	0.7	–0.6	0.7	5.8
1970–79	45.0	18.6	6.0	5.5	19.1	1.2	0.3	– 1.7	3.3
1980–89	47.7	19.8	4.4	3.7	20.8	2.7	1.2	– 2.0	1.3
Change[2]	11.0	4.8	–1.4	–1.7	5.6	2.0	1.8	– 2.7	–4.5
France									
1960–69[3]	38.3	13.2	4.9	4.2	19.0	1.2	0.4	0.4	4.2
1970–79	42.1	16.0	4.9	3.7	20.1	1.1	0.0	– 0.4	2.4
1980–89	51.4	19.0	4.5	2.7	25.5	2.5	1.3	– 2.1	–0.4
Change[2]	13.1	5.8	–0.4	–1.5	6.5	1.3	0.9	– 2.5	–4.6
United Kingdom									
1960–69	35.4	16.8	4.5	3.5	10.1	3.9	2.5	– 1.0	2.5
1970–79	42.5	19.4	5.6	4.4	13.5	4.0	2.1	– 2.6	1.3
1980–89	45.1	20.9	3.2	2.0	16.5	4.5	2.5	– 2.4	–0.7
Change[2]	9.7	4.1	–1.3	–1.5	6.4	0.6	0.0	– 1.4	–3.2
Italy									
1960–69[3]	30.4	13.0	3.7	3.3	12.4	1.4	0.8	– 1.9	1.2
1970–79[3]	37.0	13.9	3.9	3.7	15.8	3.3	2.5	– 7.0	–3.7
1980–89	49.5	16.4	5.1	4.8	20.4	7.6	6.9	–11.1	–6.7
Change[2]	19.1	3.4	1.4	1.5	8.0	6.2	6.1	– 9.2	–7.9
Canada									
1960–69	30.8	15.5	4.3	3.0	8.0	3.1	1.1	– 0.4	2.3
1970–79	38.6	19.3	3.7	2.3	11.4	4.2	0.0	– 0.9	1.3
1980–89	46.5	20.4	3.3	1.8	14.8	8.0	1.9	– 4.8	–3.0
Change[2]	15.7	4.9	–1.0	–1.2	6.8	4.9	0.8	– 4.4	–5.3
Average[4]									
1960–69	30.4	15.9	3.7	2.7	9.0	1.8	1.2	– 0.3	2.0
1970–79	35.0	16.3	3.8	2.8	12.6	2.2	1.1	– 1.7	0.7
1980–89	39.6	16.4	3.6	2.6	15.1	4.4	2.5	– 3.2	–0.8
Change[2]	9.2	0.5	–0.1	–0.1	6.1	2.6	1.3	– 2.9	–2.8

Note: Figures for 1989 are partly estimated.

[1] Property and entrepreneurial income. [2] Change from 1960s to 1980s. [3] Based on the old system of national accounts. [4] Calculated using GDP weights and exchange rates in 1963 for the 1960–69 period, in 1975 for the 1970–79 period and in 1988 for the 1980–89 period.

Source: OECD National Accounts.

countries devoted to government outlays in the 1980s (33%, with interest and transfers comprising half of the total), but by far the highest share devoted to government investment. Compared with the European countries and Canada, government outlays in the United States were also relatively small (36%). Unlike Japan, however, the United States had the lowest share of GNP among the Group of Seven devoted to government investment in the 1980s (net investment was only 0.3 percentage point).

Similarly large swings have also occurred in the social surplus and "other net lending" (the budget balance net of social security) over the past three decades and, most important for our purposes, these balances frequently moved in opposite directions. An aggregate net lending measure would not pick up important movements in the individual components. For example, between 1980 and 1988 the social security balance (as a percentage of national income) in the United States moved from a 0.6% deficit to a 0.7% surplus, while other net lending moved in the opposite direction (from a deficit of 1.1% to a deficit of 4.7%).

Empirical results

The estimates for equation (3), controlling for the level of government expenditure, are presented in Table 5 (co-integration tests and equilibrium equations) and Table 6 (error correction model). The ADF test provides some support that the variables are co-integrated, i.e. that there exists a co-integrating vector and therefore equilibrium relationship between the variables. Controlling for the level of government expenditure also markedly increases the estimated long-run equilibrium offset coefficient, which now ranges from -0.63 (the United Kingdom) to -1.62 (Japan). The error correction model estimates are also significantly improved by the addition of the government spending variable (Table 6). In particular, the short-run offset coefficients are larger than previously, ranging from -0.55 to -1.07, and display high levels of statistical significance. Moreover, the error correction term indicates a strong and stable adjustment mechanism in every case.

Table 5

Equilibrium equation and co-integration: private saving, budget deficits and government spending

	United States	Japan	Germany	United Kingdom	Canada
constant	0.89	0.38	0.36	0.23	0.64
	(11.19)	(10.56)	(10.35)	(2.68)	(6.94)
trend	0.005	0.007	0.002	0.002	0.009
	(7.56)	(5.09)	(3.44)	(1.37)	(6.51)
age	-3.38	2.34	0.43	-0.04	-2.82
	(-9.57)	(2.34)	(3.38)	(-0.09)	(-6.35)
inc	0.03	-0.13	0.13	0.13	0.05
	(0.62)	(-1.30)	(1.95)	(0.96)	(0.55)
nl1	-0.88	-1.62	-0.84	-0.63	-0.94
	(-6.26)	(-6.43)	(-5.59)	(-3.37)	(-5.80)
gel	-0.92	-2.01	-0.77	-0.40	-0.68
	(-5.75)	(-6.16)	(-7.50)	(-2.37)	(-4.16)
R^2	0.90	0.86	0.92	0.51	0.88
SEE	0.005	0.010	0.006	0.013	0.009
gel-nl1	-0.04	-0.39	0.07	0.23	0.26
Co-integration test:					
DW	1.88	0.83	0.86	0.70	1.17
ADF	-3.29	-2.74	-2.82	-2.40	-3.60

Note: The t-statistics in parentheses are provided for reference only – they are not reliable indicators of statistical significance in the equilibrium regressions.

As noted above, the estimate of the coefficient on nl1 (α_4) – the "offset" coefficient – measures the private saving response to a rise in government lending due to a tax increase (as government expenditure is held constant). The private saving response to a tax-cut-induced fall in government net lending (rise in the budget deficit) is simply the nl1 coefficient (α_4) with the opposite sign. The private saving response to a rise in the budget deficit associated with an increase in government expenditure ($\alpha_5 - \alpha_4$), by contrast, is shown in Tables 5 and 6 as gel – nl1 and Δgel – Δnl1, respectively. These results indicate that an expenditure-induced rise in budget deficits elicits little or no private saving offset. The error correction model estimates (Table 6), for example, indicate a statistically significant private saving offset (positive response) in only one case (Germany, with a net offset of 0.17).

Table 6

Error correction model: private saving, budget deficits and government spending

First difference specification

	United States	Japan	Germany	United Kingdom	Canada
constant	0.00**	0.00	0.00	0.00	0.00**
	(2.40)	(1.17)	(0.63)	(0.90)	(3.21)
Δ age$_t$	-2.01**	2.11**	0.77**	-0.87	-2.61**
	(-2.16)	(2.59)	(3.01)	(-0.94)	(-2.22)
Δ inc$_t$	0.03	-0.06	0.18**	0.16*	0.06
	(0.87)	(-0.95)	(4.64)	(1.95)	(0.92)
Δ nli$_t$	-0.84**	-1.07**	-0.94**	-0.55**	-0.75**
	(-6.53)	(-5.09)	(-8.49)	(-3.01)	(-4.26)
Δ gei$_t$	-0.38**	-1.46**	-0.77**	-0.44**	-0.57**
	(-5.04)	(-5.58)	(-6.50)	(-2.75)	(-2.89)
EC$_{t-1}$	-0.89**	-0.41**	-0.65**	-0.35**	-0.51**
	(-3.85)	(-2.49)	(-3.39)	(-1.74)	(-2.18)
R^2	0.76	0.75	0.83	0.68	0.56
SEE	0.004	0.007	0.004	0.010	0.008
Δ gei$_t$-Δ nli$_t$	-0.02	-0.39**	0.17**	0.11	0.18

Note: t-statistics are given in parentheses; *(**) denotes significance at 90% (95%) or higher level of confidence.

The estimates for the most comprehensive model considered here, equation (5), are presented in Table 7 (co-integration tests and equilibrium equations) and Table 8 (error correction model). These estimates decompose the budget position into its social security fund and other net lending components, and decompose the level of government expenditure into investment spending and consumption plus transfers. This is the preferred model in the sense of attempting to capture, even at the most rudimentary level, some of the forces generating budget deficits.

The fully specified model represented by equation (5) clearly dominates the other private saving equations. All of the five private saving equations satisfy the test for co-integration at the 90% level or greater (the ADF statistic ranges from -2.89 for Japan to -4.94 for the United Kingdom), suggesting that a longer-term equilibrium relationship among the variables exists. The estimated long-term private saving offset to a tax-increase-induced rise in government net

Table 7

Equilibrium equation and co-integration: private saving, budget deficits and the composition of government spending

	United States	Japan	Germany	United Kingdom	Canada
constant	0.88	0.19	0.45	0.17	0.63
	(15.84)	(1.68)	(8.47)	(2.22)	(6.26)
trend	0.002	0.002	0.001	0.000	0.008
	(3.68)	(0.93)	(0.91)	(0.07)	(4.49)
age	- 3.11	2.99	0.59	0.21	-2.87
	(-11.34)	(2.18)	(3.50)	(0.49)	(-5.59)
inc	0.04	-0.05	0.15	0.21	0.02
	(1.41)	(-0.40)	(2.19)	(1.90)	(0.26)
nl2	- 1.08	-1.37	-1.18	-0.54	-0.84
	(- 8.85)	(-3.90)	(-5.09)	(-3.50)	(-4.66)
sss	0.23	2.86	-0.18	-2.14	-0.85
	(0.98)	(2.33)	(-0.67)	(-2.64)	(-2.01)
ge2	- 1.03	-2.03	-1.42	-0.39	-0.76
	(- 7.74)	(-2.96)	(-6.89)	(-2.41)	(-3.59)
gni	- 1.94	-1.18	-1.48	-0.91	-0.63
	(- 3.12)	(-1.53)	(-2.88)	(-3.30)	(-0.67)
R^2	0.95	0.82	0.92	0.74	0.87
SEE	0.003	0.012	0.006	0.010	0.010
ge2-nl2	0.05	-0.66	-0.24	0.15	0.08
gni-nl2	- 0.86	0.19	-0.30	-0.37	0.21
Co-integration test:					
DW	2.52	1.39	1.07	1.45	1.26
ADF	- 4.06	-2.89	-3.73	-4.94	-3.85

Note: The t-statistics in parentheses are provided for reference only - they are not reliable indicators of statistical significance in the equilibrium regressions.

lending is also quite high (unity or larger in the United States, Japan and Germany) - substantially above all of the estimates associated with the basic model (equation (2)) and larger than the previous model (equation (3)) in three cases.

The appropriateness of even a crude decomposition is also evident in the other results. Large differences between the point estimates for other government expenditures (ge2) and government investment (gni) are evident in the United States, Japan and the United Kingdom. In the United States, Germany and the United Kingdom the point estimates for gni are larger in absolute value than ge2. This indicates that over longer periods a tax-financed rise in investment spending tends to be associated with a larger decline in private saving

Table 8

Error correction model: private saving, budget deficits and the composition of government spending

First difference specification

	United States	Japan	Germany	United Kingdom	Canada
constant	0.00	0.00	0.00	0.00	0.01**
	(1.52)	(0.00)	(0.41)	(0.50)	(3.15)
Δ age$_t$	-2.76**	1.89*	0.86**	-0.41	-2.34**
	(-4.07)	(1.86)	(3.06)	(-0.49)	(-2.09)
Δ inc$_t$	0.06**	-0.05	0.19**	0.15*	0.06
	(2.33)	(-0.69)	(4.90)	(1.82)	(0.97)
Δ nl2$_t$	-0.97**	-0.79**	-1.17**	-0.49**	-0.73**
	(-9.83)	(-2.91)	(-8.02)	(-2.69)	(-3.96)
Δ sss$_t$	0.22	0.06	-0.58*	-1.72	-0.20
	(1.24)	(0.07)	(-2.09)	(-1.53)	(-0.54)
Δ ge2$_t$	-0.83**	-1.67**	-1.31**	-0.48**	-0.52**
	(-5.61)	(-3.29)	(-6.77)	(-2.79)	(-2.40)
Δ gni$_t$	-2.27**	-0.58	-1.02**	-1.13**	0.56
	(-3.74)	(-1.03)	(-2.67)	(-2.15)	(0.72)
EC$_{t-1}$	-1.34**	-0.65**	-0.74**	-0.70**	-0.76**
	(-5.62)	(-3.39)	(-3.42)	(-2.23)	(-3.36)
R^2	0.88	0.72	0.84	0.75	0.65
SEE	0.003	0.008	0.005	0.009	0.008
Δ ge2$_t$-Δ nl2$_t$	0.14	-0.86**	-0.14	0.01	0.21
Δ gni$_t$-Δ nl2$_t$	-1.30**	0.21	0.15	-0.64	1.29*

Note: t-statistics are given in parentheses; *(**) denotes significance at 90% (95%) or higher level of confidence.

than a rise in other spending categories. This is consistent with the view that a rise in investment spending would be expected to bring about a significant return and relatively lower future taxes.

Turning to the fiscal policy coefficients in the error correction model (Table 8), we find that other net lending (nl2) is negative and statistically significant at the 95% level of confidence or greater for every country represented. By contrast, the social security surplus variables (sss) in four of the five cases (with the exception of Germany) are not statistically different from zero. The government expenditure variable net of investment (ge2) was significantly negative for each of the five countries and the government investment expenditure variable (gni) was negative for four of the five countries and statistically significant in three cases. The private saving offset to government investment was estimated to be larger than other

government expenditure in two cases. Finally, the error correction term (EC_{t-1}) is statistically significant and negative in every case.

The results from the extended models, both equations (3) and (5), suggest a high private saving offset to government budget deficits. The five long-term offset coefficients (nl2) from our preferred model average -1.00, and range from -0.54 (the United Kingdom) to -1.37 (Japan). The budget balance and private saving seem to vary inversely and rather closely over longer periods of time. Moreover, the short-term response average is -0.83 and individual offset estimates range from -0.49 (the United Kingdom) to -1.17 (Germany) and are statistically significant in every case. This is strong evidence of both a large long-term and short-term inverse relationship between tax-induced changes in public saving and changes in private saving, and provides some support for the Ricardian hypothesis.

The response to an expenditure-induced change in the budget deficit, through either investment spending or consumption/transfers, is also shown in Tables 7 and 8. The response to an investment-expenditure-induced rise in the budget deficit is given by gni - nl2 (Δgni - Δnl2 in the error correction model). The response to a rise in the deficit induced by other government spending is given by ge2 - nl2 (Δge2 - Δnl2 in the error correction model). In contrast to a tax-induced increase in the deficit, our results suggest little or no private saving offset to an expenditure-induced rise in the budget deficit. The error correction model estimates (Table 8), for example, indicate a significantly positive (at the 90% level of confidence) offset in only one case (Canada for investment spending).

Interpreting the results: stability and plausibility of the basic model

One message to be gleaned from the foregoing empirical analysis is that the private saving offset to fluctuations in the government budget will depend on the particular policies driving these changes, and that these policies are likely to vary over time and across countries. Indeed, cross-country estimates typically display wide variation, perhaps owing to the particular institutional circumstances

facing households and the structure of the policies being followed. Once some rudimentary factors are taken into account, more precise estimates of the private saving offset are obtained. Our attempts to control for these factors suggest a substantially higher private saving offset to tax-induced changes in government budget deficits than the more simplistic model. On balance, the results support a somewhat weaker version of the Ricardian hypothesis (high but not complete offset). Nonetheless, we find almost no private saving offset to changes in the budget balance which are induced by expenditure shifts.

The results should be interpreted cautiously, however. Even the preferred model (equation (5)) treats taxes in a uniform way without distinguishing between differences in the form of taxation or its evolution over time. In addition, simply controlling for current government expenditure – and its composition – may not capture the effects on saving arising from expected future changes in government spending patterns. In particular, theory suggests, as shown in Appendix A, that the expected present discounted value of expenditure (and its composition) is the relevant variable influencing private saving behaviour. Without some way to model the formation of expectations regarding future policy, predicting the private saving offset response will continue to prove difficult.

An even more fundamental problem concerns the validity of the basic model of analysis. We attempt to estimate the private saving offset to budget deficits within the context of a general model of saving behaviour. If the underlying model of saving behaviour is incorrect, serious biases in the offset estimates could result. For example, high offset coefficients could simply be attributable to misspecification of the equation, owing, say, to the exclusion of important explanatory factors which are correlated with budget deficits.

The problem in this regard is that only mixed support for the general life-cycle model employed in this study is suggested by our estimates. Indeed, the equilibrium equation estimates of our preferred model (Table 7) suggest a negative longer-term influence of

an ageing population on the aggregate private saving rate only in the United States and Canada.[17] There is evidence of a longer-term positive relation between private saving and the percentage of the elderly in the total population in Japan, Germany and the United Kingdom. Mixed results both in terms of sign, magnitude and statistical significance of the age variable are also present in the error correction model estimates (Table 8).

Comparison with other empirical studies

Although the life-cycle model enjoys the greatest popularity in the economics profession, empirical support for this framework is rather mixed. The large variation we found in the demographic effects across countries, for example, is consistent with Bosworth (1990), Auerbach, Cai and Kotlikoff (1991) and others. Hayashi (1989) suggests that demographics play a different role in different countries. In particular, Hayashi (1989) argues that Japan fits the dynastic model (the elderly do not seem to run down assets after retirement), and the United States fits the life-cycle model (the elderly typically hold very low assets with their consumption financed mainly by pension benefits).

More complicated modelling of demographic and labour force characteristics may provide somewhat better results. Graham (1987), using a pooled sample of the OECD countries, finds that the rate of income growth, the labour force participation rate and the female participation rate in particular are important determinants of household saving.[18] He also finds, however, that neither the

[17] The estimated coefficient values of the co-integration vector are consistent, but not their estimated standard errors, so direct statistical inferences may not be made. Moreover, the co-integrating vector may not be unique, so that interpreting individual coefficient values may also be problematic. See Engle and Granger (1987).

[18] Our results suggest that the "pooling" assumption, imposing the restriction that private saving in each country responds identically to changes in the explanatory variables, does not appear to be warranted. As this restriction is not tested, it is not clear that Graham's (1987) results would hold in private saving equations for individual countries.

percentage of the population over the age of sixty-five nor more generous social security benefits seems to reduce household saving as the life-cycle model predicts.[19] These results are consistent with our findings for both the age and social security surplus variables.

Similarly wide-ranging results have also been obtained in studies estimating the private saving offset to budget deficits. Bernheim (1987 and 1989) attempts to evaluate and reconcile the seemingly disparate results from US consumption function studies which have used different methodologies, time periods, variable definitions and so on. He finds that most studies find a marginal propensity to consume out of a tax-induced rise in the budget deficit in a range between 0.2 and 0.5.

Investigating private and national saving equations, Summers and Carroll (1987) also reject the Ricardian equivalence hypothesis as an empirical proposition about US budget deficits. Similarly, Bosworth (1990) finds that the US private saving rate would rise by less than 0.25 percentage point in response to a 1 percentage point rise in the government deficit, while Andersen (1990) finds an offset of more than 0.65. Bosworth's estimates range from a low of 0.14 for Germany to a high of 0.53 for Canada.[20] In our simplest model (Table 2), we find long-term offset coefficients ranging from 0.04 for Germany to 0.39 for the United Kingdom and Canada. Estimates from our preferred model suggest a higher offset, ranging from 0.54 (United Kingdom) to 1.37 (Japan).

[19] Feldstein (1977 and 1980) argues, in contrast, that more generous social security benefits reduce private saving. Koskela and Viren (1983) re-estimate Feldstein's model under slightly different assumptions and find that the social security benefit variables are no longer significant. They also question the empirical robustness of the life-cycle approach to explain saving behaviour.

[20] Although an equation was reported for Japan, no government budget surplus variable was included. As the results reported in Bosworth's study were pre-tested (dropping independent variables which did not add explanatory power), the surplus variable was presumably dropped because it was insignificantly different from zero. Andersen (1990), however, finds an offset coefficient for Japan equal to 0.70.

Not surprisingly, Barro (1989) argues for the general plausibility of the Ricardian equivalence proposition but recognises that the results from empirical studies on this issue are "... all over the map, with some favouring Ricardian equivalence, others not" (p. 49), which he suggests is attributable to identification problems. Using annual consumption for nineteen OECD countries, Evans (1991) also finds that support for the Ricardian equivalence hypothesis varies greatly by country and that the tests have little power to distinguish between the conventional view and the Ricardian hypothesis. When the data are pooled, however, the Ricardian hypothesis is strongly rejected.[21] Evans suggests that departures from Ricardian equivalence may not be economically important in some circumstances, but that "... long-lived tax cuts may increase consumption appreciably in the short run and decrease the capital stock and consumption appreciably in the long run" (p. 14).

Expenditure-induced budget deficits

In Tables 7 and 8 we find a high private saving offset to tax-induced changes in budget deficits. This supports the Ricardian hypothesis. We also find, however, that an expenditure-induced rise in the budget deficit is generally not offset by a significant increase in private saving. Indeed, in only one instance in Table 8 was a government expenditure offset estimated to be positive and statistically significant. Since almost all of the fall in government saving during the past two decades is attributable to rising expenditure levels rather than tax reductions (Table 4), our results suggest that private saving has not offset a large part of the deterioration in government finances. Hence, support for Ricardian equivalence is not inconsistent with our conclusion that expenditure-induced increases in budget deficits have decreased national saving.

[21] In earlier studies, however, Evans (1985, 1986 and 1989) presents evidence supporting the Ricardian equivalence hypothesis.

IV.
Contingent liabilities and government budget policy

Almost all empirical tests of the private saving offset, including the evidence presented above, rely on either cash flow or national account measures of the government budget balance. These deficit measures are dominated by current net borrowing of the government, i.e. the issuance of government non-contingent liabilities such as interest-bearing debt. However, the creation of non-contingent liabilities, i.e. liabilities where the nominal obligation and the settlement date are fixed at the date of issue, represents only part of the government's fiscal actions. An increasing share of government activity in the post-war period has involved contingent liabilities, obligations which are dependent both in timing and amount on the occurrence of a particular event. Pay-as-you-go public pensions are the most important implicit liability of most governments because the present value of the expected benefit outlays typically exceeds expected receipts by a wide margin. Other important contingent liabilities of governments include deposit insurance, health insurance and loan guarantees.[22] Although these contingent items may not immediately show up in the conventional cash flow budget accounts, they are nonetheless real liabilities of the government and, when they are called, budget costs can be large. Only when contingent liabilities are funded, i.e reserves are placed and accumulated to offset the expected future expenditure demands, do they not represent an additional net liability of the government.

A number of problems arise from the creation of unfunded contingent liabilities.[23] Firstly, there is a lack of transparency - the future costs of programmes associated with unfunded contingent liabilities may not be fully realised. Contingent liabilities often forgo the usual discipline of the budgetary process because their visibility is

[22] See Towe (1991) for a detailed theoretical analysis of the budgetary control aspects and the fiscal impact of government contingent liabilities.

[23] OECD (1991) contains a clear and concise discussion of some of these issues.

typically obscured.[24] They often are treated off-budget altogether. Consider, for example, the expansion of government medical insurance coverage in a society with a rapidly ageing population. In this instance, the present and future beneficiaries of the programme will pass on relatively larger costs to future taxpayers (future working-age population). Secondly, the creation of contingent liabilities often gives rise to incentives which were not intended and which may lead to undesired economic behaviour. For example, increasing deposit insurance limits may induce the banking sector to take on greater loan risk. Thirdly, economic behaviour that may be induced by the creation of contingent liabilities does not usually coincide with the consequent budgetary costs. For example, government-guaranteed export credits encourage the sale of merchandise, particularly to only marginally creditworthy purchasers, but the costs of the programme are not realised until actual defaults take place. Similarly, premiums paid on deposit insurance are counted as current government revenue, while the cost of the programme is only counted when the government bails out the financial institution or pays off the depositors.

The magnitude of government contingent liabilities

Governments in virtually all industrial countries have substantial contingent liabilities, the size of which varies according to country-specific political, cultural and institutional factors, such as the extent to which the government assumes direct responsibility for the material welfare of its citizens. In most industrial countries, the

[24] Webb (1991) discusses the political economy of unfunded contingent liabilities. He argues that there are strong incentives to create programmes with contingent liabilities, rather than immediate budgetary costs, largely because they obscure the true costs. Similarly, Towe (1991) argues that, because unfunded contingent liabilities do not immediately enter the budget, they promote the substitution of non-cash for cash expenditure and increase future financing requirements. Serious concerns about the growth of contingent government liabilities, as well as nominal government debt, in conjunction with German unification are expressed by Schlesinger et al. (1991).

largest unfunded contingent liability of the government sector is the pay-as-you-go or only partially funded social security system (primarily retirement pensions and health benefits).[25] This is because a significant increase in the share of the elderly relative to the working-age population, as shown in Table 9, is expected to occur in almost all industrial countries over the next three decades.[26] Heller (1989), Masson and Tryon (1990), Hagemann and Nicoletti (1989a and 1989b) and others have undertaken model simulations suggesting that ageing populations will severely strain public financing of pensions and health care as well as lower national saving rates.[27] In particular, when the population is ageing, the unfunded (pay-as-you-go) or only partially funded social security systems prevalent in most industrial countries imply a need for higher taxes on future wage earners in order to pay for increased pension and health care outlays. Without pure Ricardian equivalence, this implies an intergenerational distribution of wealth as the present generation benefits from a relatively low tax burden (paying for a relatively smaller proportion of the elderly in the population) at the expense of

[25] See, for example, Masson and Tryon (1990), Börsch-Supan (1991), Cutler, Poterba, Sheiner and Summers (1990), Erdevig (1990), Heller (1989), Hagemann and Nicoletti (1989a and 1989b) and Auerbach, Kotlikoff, Hagemann and Nicoletti (1989).

[26] Cutler et al. (1990) stress the substantial uncertainty inherent in demographic projections and in calculating population dependency ratios (e.g. the ratio of the non-working population to the working population). The range of historical experience in the United States, for example, far exceeds the range in projections given by the Social Security Administration. Sources of uncertainty include immigration, life expectancy, labour force participation and retirement age.

[27] The projected change in the demographic profile is crucial. A pay-as-you-go system in a steady state with constant population growth would not shift the burden of pensions to future generations. Auerbach et al. (1989) also note, however, that higher real wages and a lower youth (below working age) dependency ratio associated with this demographic transition (presumably translating into lower government youth-oriented outlays and associated taxes) may partly offset the higher budgetary costs associated with a higher proportion of the elderly. They nonetheless conclude that the welfare costs of population developments, particularly their distribution across cohorts, pose serious challenges for policy-makers.

Table 9

Old-age dependency ratios in OECD countries: population aged 65 and over as a percentage of population aged 15–64

	1990	2000	2010	2020
United States	18.5	18.2	18.8	25.0
Japan	16.2	22.6	29.5	33.6
Germany	22.3	25.4	30.6	33.5
France	20.9	23.3	24.5	30.6
United Kingdom	23.0	22.6	22.3	25.5
Italy	20.1	22.9	25.7	29.3
Canada	16.8	19.0	21.4	28.9
Australia	16.6	17.5	18.7	23.6
Austria	21.7	22.6	26.6	30.4
Belgium	21.1	22.0	23.5	26.9
Denmark	22.6	21.5	24.3	30.5
Finland	19.4	21.2	24.9	34.8
Greece	18.2	22.6	25.7	27.4
Iceland	16.0	16.1	16.1	20.9
Ireland	18.5	16.9	16.3	18.7
Luxembourg	21.6	25.5	27.5	31.9
New Zealand	16.2	16.3	17.5	23.0
Netherlands	18.4	19.7	22.1	28.9
Norway	24.9	22.8	22.4	27.9
Portugal	17.9	20.8	21.4	23.7
Spain	19.4	21.8	23.0	25.3
Sweden	27.3	25.1	26.6	33.1
Switzerland	21.6	25.0	31.7	39.9
Turkey	6.6	8.0	8.2	10.3
Averages*				
Major seven	19.7	21.9	24.7	29.5
Small countries	19.3	20.3	22.1	26.9
Total OECD	19.4	20.8	22.9	27.6

* Unweighted averages.

Source: OECD (1988), Ageing Populations, The Social Policy Implications, Table 14 (page 32).

Table 10

Estimates of unfunded public pension obligations

As a percentage of GNP/GDP

United States	158%
Japan	217%
Germany	355%
Sweden – unindexed	183%
– indexed	228%

Note: Includes only men and women with own pension rights, and excludes benefits of dependent spouses, survivors and disability payments.

Source: Hagemann and Nicoletti (1989b), Table 16.

the relatively high tax burden imposed on the next generation of workers (paying for a relatively large proportion of the elderly in the population).[28]

Hagemann and Nicoletti (1989b) estimate a very large "inter-generational burden" arising from the unfunded public pension obligations for several industrial countries. This is measured as the difference between the present value of the future pension benefits and future contributions from current living generations under existing legislation, net of the accumulated trust fund. This is essentially a measure of the extent to which the pension fund is undercapitalised. Table 10 presents these estimates, which range from 158% of GNP in the United States to 355% of GNP in Germany (where by law the trust fund is set roughly equal to one month's benefits).[29] Supporting evidence is provided in Table 11, which shows the estimated rate of depletion of social security trust funds under existing national legislation (tax rates and benefit levels). The depletion date for the trust funds ranges from the early 1990s (for Germany, which essentially operates a pay-as-you-go social security system) to up to five decades hence (for the United States, benefiting both from much slower population ageing and the gradual phase-in

[28] Cutler et al. (1990) point out that a short-term decline in national saving and rise in consumption would be consistent with the US demographic picture as relatively fewer workers need less capital. The United States experienced an increase in fertility in the 1940s, followed by a decline in fertility beginning in the early 1960s. In the context of a simple growth model, this would optimally call for an initial rise in the national saving rate (to provide capital for the "baby boomers" in their working years), followed by a decline in the saving rate as baby boomers retired and a relatively smaller workforce replaced them. The point is that a demographic trend toward an ageing population cannot alone justify a rise in national saving. However, Akerlof (1990) notes that saving did not increase as it should have when fertility increased, which partly accounts for the inadequacy of the current capital stock. He suggests that the problem is that the United States did not save enough when the fertility rate rose, and that as a consequence the saving rate should increase now to prepare for the rise in the dependency ratio.

[29] See Hagemann and Nicoletti (1989b), p. 21. Note that these estimates do not include the additional pension obligations assumed by the Federal Republic of Germany when it absorbed the new eastern Länder.

Table 11

Estimated trust funds given legislated tax rates

As a percentage of taxable payroll

Year	United States (a)	Japan	Germany	Sweden
1987	2.37	52.46	1.45	72.94
1990	5.20	59.15	0.16	68.61
1995	11.38	65.15	*(b)	56.87
2000	18.31	63.80	*	49.89
2005	27.28	50.71	*	45.65
2010	38.78	23.00	*	36.55
2015	46.59	*(b)	*	12.98
2020	51.02	*	*	*(b)
2025	45.69	*	*	*
2030	30.80	*	*	*
2035	9.74	*	*	*
2040	*(b)	*	*	*

(a) Incorporates phase-in of increase in retirement age. (b) * indicates the fund is depleted.
Source: Hagemann and Nicoletti (1989a).

of an increase in the retirement age). Another indication of the intergenerational burden is provided by estimates of how much payroll taxes would have to increase in the future to finance projected social security benefit outlays.[30] For several of the Group of Seven countries, as shown in Table 12, Heller, Hemming and Kohnert (1986) estimate very large required payroll tax increases over the 1980–2025 period. The estimates range from only 0.7% of total wages in Canada to more than 20% in Japan.

Another example of the prevalence and, in some cases, substantial size of government contingent liabilities is given by guaranteed medium and long-term export credits, as shown in Table 13. While in some countries this potential exposure to default risk is quite small, in others, such as France and the United Kingdom, it is substantial. Indeed, the costs of France's export guarantee programmes added substantially to its budget deficit in 1990 and 1991 (primarily owing to a failure by Iraq to pay some of its obligations to France). In terms of absolute magnitude, however, the recent budgetary costs of the

[30] Payroll taxes are the primary funding source of social security benefits in most industrial countries.

Table 12

Potential increase in payroll tax burden to finance higher social security expenditure, 1980–2025

As a percentage of total wages

United States	2.9%
Japan	20.6%
Germany	14.0%
France	7.4%
United Kingdom	6.4%
Italy	16.8%
Canada	0.7%

Source: Heller, Hemming and Kohnert (1986), page 4.

Table 13

Total medium and long-term government-guaranteed export credits

In billions of US dollars, mid-1990

	Estimated amount
United States	26.65
Japan	20.81
Germany	25.41
France	59.86
Italy	20.08
United Kingdom	37.10
Canada	0.34
Australia	1.51
Belgium	4.48
Denmark	1.34
Finland	2.33
Ireland	0.32
Netherlands	3.59
Portugal	0.37
Spain	8.03
Sweden	7.65
Switzerland	5.91
Total of above countries	225.52

Source: OECD (1991), page 22.

savings and loan crisis in the United States are the most striking example of the enormous budgetary costs which may be associated with contingent liabilities (primarily deposit insurance) incurred over several decades. The substantial credit guarantees currently being underwritten by Germany's Treuhandanstalt are another indicator of

the prevalence of unfunded contingent liabilities amongst the industrial countries.[31] Schlesinger, Weber and Ziebarth (1991) analyse various budgetary and debt aspects of German unification, inter alia pointing out the growth of contingent liabilities, which in large part are dependent on the success of the ongoing privatisation efforts. The liabilities of the German government's Debt Processing Fund, which took over the debt of the former GDR, will be transferred to the Treuhandanstalt at the end of 1993. Schlesinger et al. question the ability of the Treuhandanstalt to take over these debts, leaving the Federal Government with a substantial net liability. They also argue that "... the liabilities of the 'German Unity' Fund, which (as a new special fund of the Federal Government, instead of an all-German Länder Government revenue equalisation scheme) likewise provides funds outside the core budgets to perform public functions in the territory of the former GDR, must be regarded from the start as an integral part of public sector indebtedness" (p. 49).

Internationally comparable information on the total contingent liability exposure of industrial countries is not available. For the United States, however, Webb (1991) attempts a rough estimate of the total net contingent liabilities of the federal government in the United States in 1989 (Table 14). In present value terms, net contingent liabilities were estimated to be in excess of $4 trillion, compared with the conventionally stated gross federal debt of less than $3 trillion (Webb (1991)).[32] Consistent with the evidence presented above, the social security component of estimated US federal government contingent liabilities makes up the lion's share of the total, due primarily to retirement, disability and health benefit commitments to the general public. The obligation to meet unfunded federal employee retirement and disability benefits is the other major

[31] See OECD (1991) for brief analyses of the budgetary costs of the US savings and loan situation, the French government's export credit programme and the credit guarantees of Treuhandanstalt.

[32] Webb (1991) terms these contingent liabilities the "stealth budget" - a budget unseen by most observers that will generate future taxing and spending.

Table 14

Unfunded contingent liabilities of the US federal government

In billions of US dollars, end-1989 fiscal year

	Estimated amount*	
Savings and loan deposit insurance		130
Social security		2,494
Retirement and disability benefits	1,052	
Health benefits	1,412	
Other	30	
Federal employee retirement and disability benefits		1,435
Pension benefits guarantee fund		16
Crop insurance		25
Flood insurance		5
Defence nuclear waste disposal		68
Loans and loan guarantees by government agencies		77
Total		4,250
Memorandum item: gross federal debt		*2,900*

* Estimated present value at the end of the government's 1989 fiscal year of expected real spending net of any offsetting receipts.

Source: Webb (1991), page 25.

part of US federal government contingent liabilities, although nuclear waste disposal, loans and loan guarantees are also substantial. Although these estimates should be interpreted cautiously, they nonetheless provide some rough indication of the scope and magnitude of the unfunded contingent liabilities of the US federal government. And the evidence presented above suggests that many industrial countries are facing unfunded contingent liabilities of similar magnitudes.

Implications for national saving

The existence of government contingent liabilities, and particularly their rapid growth, has an important implication for attempts to measure the private saving offset to budget deficits. Namely, existing empirical work has only measured the private saving offset (accumulation of assets) to part of the increase in government liabilities – those represented by non-contingent claims. In principle, however, changes in the total net liability position (non-contingent and contingent liabilities) are the relevant measure of changes in the government's true fiscal position. The implication is

that existing measures of the private saving offset overstate the extent to which the private sector incorporates the government sector's budget constraint into its decision-making. Even if the private sector fully discounts government non-contingent liabilities and increases saving sufficiently to allow the purchase of new government debt issues, this amount nonetheless falls far short of that needed to cover the government's total liability position.

Consider a situation where the government creates non-contingent and contingent liabilities roughly proportionately, and the measured private saving offset on the conventional cash flow deficit is negative unity. Rather than indicating "pure" Ricardian equivalence, however, only about half of the private saving increase needed to fully offset the rise in total government liabilities is forthcoming.

One of the basic predictions of the Ricardian equivalence hypothesis is that current generations do not allow the creation of government liabilities to impose a burden on future generations. This calculation is very complex, and a complete picture would need to take into account projections of future productivity growth, environmental degradation, non-renewable resource usage and so on, as well as government contingent liabilities. In contrast to the Ricardian equivalence hypothesis, it appears that government contingent claims are not fully taken into account by the private sector, i.e. they are likely to impose a significant burden on future taxpayers when they become due. This, of course, presumes that implicit or explicit "intergenerational contracts" will be honoured. For example, if currently legislated levels of social security benefits are to be maintained (in terms of real purchasing power), higher taxes on future generations of workers will probably be necessary in most industrial countries. This suggests that a cautious interpretation of results based on conventional budget measures, where a major part of the government's liability position is excluded, would be appropriate. The budgets upon which these estimates are based do not include a major part of the government's liability position, and hence exaggerate the empirical support for the Ricardian equivalence hypothesis.

Budget policy

The creation of large contingent liabilities of the government sector casts doubt on the relevance of the conventional short-run, cash flow approach to fiscal budgeting.[33] Moreover, a simple rule of thumb such as a balanced budget over the course of the business cycle would be inappropriate under conventional budget practices if at the same time substantial government unfunded contingent liabilities were being accumulated. Indeed, a "neutral" policy stance with respect to intergenerational equity considerations would be to run current budget surpluses and set aside reserves to fund the contingent liabilities of the government. This function – the accumulation of reserves against government contingent liabilities so as to limit the risk of passing on a higher tax burden to future taxpayers – cannot be reliably pushed onto the private sector.

The intergenerational aspect of government policy is a growing area of policy and academic interest. The basic policy prescription is to place more emphasis on measuring the present value of contingent liabilities with a view to setting up appropriate reserve funds. Indeed, a number of efforts in this line have been undertaken. For example, the recent large tax increases in Germany may be interpreted as an attempt to distribute the costs of national unification to both current taxpayers and, through borrowing, future taxpayers. Similarly, part of the rationale behind the 1983 reform of the social security system in the United States was to provide for the accumulation of significant reserves over an extended period of time with the view that they would be drawn down subsequently to pay off future beneficiaries. But at the same time the accumulation of reserves in the social security trust fund was counted as part of the general unified budget, effectively reducing the perceived budget deficit and delaying recognition of the actual size of the deficit in other government

[33] See Auerbach, Gokhale and Kotlikoff (1991a and 1991b) for a discussion of some of these issues and their relation to the effects of fiscal policy on saving. They suggest a "generational accounting" framework which focuses on the intergenerational redistributive effect of alternative fiscal policies.

operations.[34] The budget agreement in 1990 was a positive development in that it placed the social security fund off-budget, recognising that the accumulation of these reserves was for the most part offsetting contingent liabilities – the government's obligation to pay off future beneficiaries. Moreover, the government enacted measures aimed at making fully explicit the subsidy component of its direct loans and guarantees.

An argument for a rise in government saving is implicit in much of the above discussion. Rather than simply appeal to the observed fall-off in private saving or a decline in national saving relative to historical trends, the creation of significant large government contingent liabilities (as well as non-contingent liabilities) without the simultaneous creation of reserves strongly suggests that intergenerational equity questions are at stake. Quite simply, rates for future taxpayers will need to be higher – or benefits from government programmes less than they otherwise would be – to pay off both the unfunded government contingent liabilities as well as nominal issues of government debt.

V.
Conclusions

Our review of the facts and empirical literature on the role of government policy in influencing national saving, as well as our own empirical evidence, leads to several conclusions. Firstly, macro-economic judgements on the government saving/national saving link have not paid sufficient attention to the specific expenditure policies driving government deficits – policies which in turn have varied significantly over time and across countries – and this has led to

[34] See Erdevig (1990) for a clear and concise discussion of the evolution of the social security system in the United States. He argues that the previous policy of counting social security reserves in the federal government budget deficit delayed the necessary adjustment to other spending and tax policies to reduce the deficit in other operations.

misleading inferences about private saving behaviour. Not only must the level of government expenditure and taxation be considered when measuring the budget deficit/national saving link, but also the particular composition of the expenditure/tax structure (e.g. the composition of expenditure between consumption, transfers and investment). Once these policies are taken into account, our results indicate fairly high private saving offsets to government budget deficits, conventionally measured, when they are caused by tax reductions. Our estimates are significantly higher than estimates which do not take into account these factors. When government budget deficits are generated by an increase in expenditure (rather than a reduction in taxes), however, we find little evidence of a private saving offset. Since almost all of the decline in government saving over the past two decades is attributable to rising expenditure, our results suggest that the fall in national saving is mainly due to the deterioration in government finances.

Secondly, widely divergent empirical estimates of the private saving response to various government policies, including the results reported in this paper, are not surprising in light of the lack of consensus on the determinants of private saving generally. There remains considerable debate over the most appropriate theoretical paradigm for modelling saving behaviour, and the empirical literature on saving has identified very few determinants which are both statistically reliable and economically meaningful. Our own results, for example, suggest that the effect of demographic factors on saving varies greatly across countries.

Thirdly, determining the appropriate level of the government budget balance goes far beyond simple rules of thumb such as a balanced budget over the business cycle. Rather, calculations of this nature must also consider the contingent liabilities of governments incurred through existing legislation (pensions, social security, health care, and so on). Contingent liabilities are often unfunded, typically off-budget, and their magnitude depends on factors such as the extent to which the government assumes direct responsibility for the material welfare of its citizens and the evolution of demographic

characteristics over time. These factors vary over time and across countries, limiting the value of normative judgments on the appropriate level of government saving based on simple comparisons of previous national or international experience. The available statistical evidence suggests that these government liabilities are very large and may overwhelm conventionally measured government debt. The implication is that existing measures of the private saving offset overstate the extent to which the private sector incorporates the government sector's budget constraint into its decision-making. Even if the private sector were to increase its saving by the full amount of new government debt issues, measured, say, by the conventional deficit, this amount would nonetheless fall far short of that needed to cover the overall rise in the public sector's total liability position.

Fourthly, and perhaps most importantly, the evidence suggests that in most cases governments would be well-advised to consolidate budget finances over a medium-term perspective to a greater extent than previously. The contingent liabilities of the governments in most industrial countries, in large part driven by demographic characteristics and the need in some cases to divert more funds from consumption and transfers to infrastructure investment, suggest that rather than aiming at balanced budgets, substantial surpluses should be run. The alternative, of course, is reduced government services and higher taxes for future generations.

Appendix A
Model of the private saving response to government spending and taxation

The main points may be formally demonstrated within the context of an illustrative small-country, two-period model (the results also hold in a multi-period context).[35] The model has two points in time: period 1 is the "present" and period 2 is the "future". Subscript 0 denotes historical private sector asset and government sector liability positions already established when period 1 begins. The representative private household produces an exogenously given quantity of output (Y_t) and pays (T_t) lump sum units of taxes in each period t ($t = 1, 2$). At the beginning of the first period, households hold real government assets (B_0) and real foreign assets (F_0). What is not consumed by the household in the first period is lent to the domestic government (B_1) or abroad (F) or paid out in taxes (T_1). Part of the taxes in the first period (δT_1) are paid into a fully funded social security system, earning the market rate of interest, which is then paid out as a lump sum payment to the household sector in the second period. All assets are "consumed" in the second period. The household's first, second and "intertemporal" or present value budget constraints, respectively, are:

$$C_1 + B_1 + F = Y_1 + B_0 + F_0 - T_1 \qquad \text{(A1)}$$

$$C_2 = Y_2 + (1+r)(B_1 + F + \delta T_1) - T_2 \qquad \text{(A2)}$$

[35] See Frenkel and Razin (1987) for an extension of the two-period model to a multi-period framework. They also extend the model to allow for investment, traded and non-traded goods, tax distortions and so on. Glick and Hutchison (1990) introduce risk premium into a two-country extension of this framework. Tabellini (1988) and Masciandaro and Tabellini (1988) introduce monetary assets into a small country version of the model, while Glick and Hutchison (1991) consider the fiscal implications of European Monetary Union in a two-country framework with monetary assets.

$$C_1 + RC_2 = Y_1 + RY_2 - ((1-\delta)T_1 + RT_2) + (B_0 + F_0) = W^H \quad (A3)$$

where r is the exogenously given real interest rate, following the small-country assumption, R is the discount factor equal to $1/(1+r)$, and W^H is household wealth. Household wealth is equal to the present value of income and initial asset holdings less the present value of taxes net of social security payments. The present discounted value of consumption equals wealth in this framework.

The government sector spends in both periods (G_t), with a portion of first period spending on public capital investment (βG_1) giving a rate of return e. It also makes a lump sum transfer to the household sector in the second period which exhausts the social security fund $(1+r)\delta T_1$. In terms of units of output, the return on public investment in the second period is equal to $(1+e)\beta G_1$. While government spending and taxes are given from the point of view of households they are linked through the first period, second period and intertemporal budget constraints, respectively:

$$G_1 + B_0 = T_1 + B_1 \quad (A4)$$

$$G_2 + (1+r)(B + \delta T_1) = T_2 + (1+e)\beta G_1 \quad (A5)$$

$$(1-(1+e)\beta R))G_1 + RG_2 = (1-\delta)T_1 + RT_2 - B_0 \quad (A6)$$

Fully informed, rational agents "see through" the government budget constraints and recognise the dependence between the levels and composition of government spending and the implied tax liabilities. Consolidation of the government sector budget constraint (A6) into household wealth (A3) gives:

$$Y_1 + RY_2 - (G_1(1-(1+e)\beta R) + RG_2) + F_0 = W^H \quad (A7)$$

Using a conventional model where current consumption positively relates to household wealth, inspection of equation (A7) illustrates

the basic points. Firstly, social security benefits in the second period ($(1+r)\delta T_1$), which are directly tied to contributions in the first period (δT_1), do not affect household wealth, and therefore do not affect current consumption. A rise in the current social security surplus (with the expectation of a higher future benefit) would be offset by a decline in private saving with the expectation of a future pension receipt. This is essentially a form of the Ricardian equivalence hypothesis. But as Modigliani and Sterling (1983) point out, several factors would tend to work against the Ricardian equivalence outcome (a one-for-one offset), distinguishing the social security budget balance from other components of the budget. For example, the expectation of more generous future social security benefits could encourage earlier retirements, and at the same time provide an incentive to increase current saving during the shorter working lives.

Secondly, equation (A7) also illustrates that the time pattern, level and composition of government expenditure affect household wealth and hence private consumption. By time pattern we mean the distribution of government spending between the two periods. For example, a given amount of government consumption spending in period one has a greater impact on household wealth than the same amount expended in period two. Only if the present discounted value of the spending in each of the two periods is the same will the effect on household wealth be identical. Most important for our purposes, the composition of government expenditure between consumption and public investment influences private consumption behaviour and saving. A rise in the proportion of current government expenditure (β) devoted to public investment or its rate of return (e) increases household wealth. This is because the private sector recognises that more government resources are available in the future following the investment in public infrastructure, and anticipate lower future taxes (and a lower overall tax burden in present discounted value terms needed to support the same level of total government expenditure). As part of the consumption "smoothing" process, the private sector will respond to the expectation of a rise in the net-of-tax future

income (representing current private wealth) by reducing current saving. This underlines the importance of taking into account the composition of government expenditure when attempting to test the private saving response to government policy.

Appendix B
Empirical methodology and unit root test results

Engle and Granger methodology

We employ the Engle and Granger (1987) approach and estimate our model using the co-integration and error correction methodologies. If the data in level form are co-integrated (non-stationary individually, but some linear combination of the variables is stationary), then information about longer-run tendencies or co-movement between variables that would generally be lost in a first-difference specification of the model may be incorporated via an error correction term. For example, the hypothesised negative linkage between private saving and government net lending may be difficult to detect in short-term movements in the data if both are subject to major cyclical influences. Nonetheless, "equilibrium" relationships may still be evident and identifiable in longer-term data movements.

The methodology proceeds in three steps. The first step is to determine the order of integration of the variables of interest. If the variables are stationary in level form, then a standard regression model may be employed. On the other hand, if the variables are integrated of order 1 (not stationary in levels, but stationary in first differences; I(1)), it is possible that they are co-integrated - individually not stationary in levels, but a linear combination of the variables is stationary. This indicates that the variables of interest tend to move together over longer periods of time - because they do not move too far away from each other, the error term from a linear combination of the variables is stationary. If it is determined that the variables are co-integrated, then the parameters from the levels

equation – the "equilibrium" equation – may be interpreted as the long-term relationships between the variables. Although estimates of the coefficient parameters are consistent, standard tests of statistical significance of the coefficient estimates are not valid. In addition, there is a problem of uniqueness of the parameter estimates when a multivariate system is being investigated.

The third step is to estimate an error correction form of the model. This amounts to specifying a dynamic form of the model in first differences and including the lagged error term calculated from the equilibrium equation – hence the term error correction. Both the estimated coefficients and standard errors of the error correction model may be interpreted in the standard way because all of the variables are stationary. The coefficient on the lagged error term represents the speed at which a deviation from the equilibrium vector is corrected within one period.

Dickey-Fuller and Augmented Dickey-Fuller tests

Engle and Granger (1987) suggest several specific tests for determining whether a vector of time-series variables is co-integrated. Following the determination of the order of integration for the individual time series, all of these tests involve regressing the private saving ratio (ps_t) on the set of explanatory variables (the equilibrium equation) and examining the characteristics of the estimated residual, μ_t. The first test proposed involves the Durbin-Watson statistic (DW) from μ_t. If the DW statistic is sufficiently large (significantly above zero; a non-stationary series will have a DW statistic approaching zero), the variables are co-integrated because the residual from the equilibrium equation is stationary. In this case a co-integrating vector represented by the regression coefficients exists. Similarly, Dickey-Fuller type regressions (Dickey and Fuller (1979)) may be employed to test whether the estimated residual series (μ_t) has a unit root. If there is a unit root, μ_t can take on arbitrarily large values (it is non-stationary), which means that there is no long-run constraint on the movements between ps_t and the other variables, i.e. they are not co-integrated.

Specifically, the Dickey-Fuller (DF) test is based on the regression:

$$(\mu_t - \mu_{t-1}) = p\,\mu_{t-1} + e_t \qquad \text{(B1)}$$

and examines the significance of the p coefficient. If p equals zero, μ_t is non-stationary and co-integration is rejected for the hypothesised equilibrium equation. If p is significantly negative in value, a unit root in μ_t is rejected and the co-integration hypothesis is accepted. In order to control for the possibility of higher order dynamics than assumed by the DF test (the null is a first order model), an augmented DF (ADF) may be estimated which allows for more lags but still tests for a unit root:

$$(\mu_t - \mu_{t-1}) = p\,\mu_{t-1} + \sum_{j-1}^{k} b_j\,(\mu_{t-j} - \mu_{t-j-1}) + e_t \qquad \text{(B2)}$$

If the true model is the first order case, then the ADF test is over-parameterised and has lower power than the standard test. However, it is the correct test for higher order cases.[36] We present the stationarity tests and co-integration tests in the Table A1.

Unit root test results

The DF and ADF unit roots tests were calculated on both levels and first differences of the variables included in equations (2) and (5) in the text for each of the five countries and are reported in Table A1. The objective is to determine the order of integration for the individual time series. The null hypothesis is that there exists a unit root and failure to reject the null indicates that the variable is non-stationary. The first two columns report DF and ADF tests on the variables in level form, respectively. The third and fourth columns of the table report the DF and ADF tests on the variables in

[36] Engle and Granger (1987) estimate critical values for the DW, DF and ADF statistics by simulation methods. Their results indicate that the ADF test has essentially the same critical values as the DF test and is recommended in most cases.

Table A1

Unit root tests

	Levels		First differences	
	Dickey-Fuller	Augmented Dickey-Fuller*	Dickey-Fuller	Augmented Dickey-Fuller*
United States				
ps	-1.35	-0.72	-6.38	-3.88
age	3.96	3.97	-3.68	-2.14
inc	-3.88	-3.98	-6.12	-5.43
nl1	-2.10	-2.11	-5.29	-5.52
gc1	-1.00	-1.12	-4.46	-4.75
nl2	-1.58	-1.55	-5.24	-5.41
sss	-2.15	-2.44	-4.79	-4.56
gc2	-0.78	-0.94	-4.39	-4.56
gni	-0.72	-0.73	-4.19	-2.06
Japan				
ps	-0.64	-0.74	-4.95	-3.08
age	4.02	2.84	-5.11	-3.08
inc	-2.78	-2.16	-6.94	-6.93
nl1	-0.98	-1.19	-3.74	-2.63
gc1	-0.53	-0.62	-3.47	-2.73
nl2	-0.47	-0.84	-3.87	-2.67
sss	-0.04	0.26	-5.55	-2.85
gc2	-0.82	-0.94	-3.29	-2.68
gni	-1.37	1.64	-4.21	-3.22
Germany				
ps	-1.36	-1.22	-5.54	-3.78
age	-3.16	-2.25	-1.55	-1.69
inc	-3.70	-3.84	-5.82	-6.30
nl1	-2.41	-2.39	-5.05	-5.25
gc1	-1.46	-1.33	-3.70	-3.47
nl2	-1.64	-1.60	-5.01	-5.33
sss	-0.57	-0.70	-4.30	-3.51
gc2	-1.21	-1.13	-4.11	-3.43
gni	-0.30	-0.93	-3.73	-3.39

first difference form, respectively. A statistic of -2.5 is close to the 10% significance level.

The DF and ADF test statistics do not reject the unit root null hypothesis for the variables in level form in 78 out of 90 cases at the 90% level of confidence, and the remaining cases are confined to the age and inc variables. Unit roots cannot be rejected for all of the fiscal and saving variables, and the low absolute values of the DF and ADF statistics provide strong evidence of non-stationarity. In contrast, the unit root null hypothesis for the variables in first difference form were rejected by either the DF or the ADF statistics in

Table A1 (continued)

Unit root tests

	Levels		First differences	
	Dickey-Fuller	Augmented Dickey-Fuller*	Dickey-Fuller	Augmented Dickey-Fuller*
United Kingdom				
ps	-2.37	-3.16	-4.44	-4.89
age	-2.19	-1.81	-2.94	-2.09
inc	-4.00	-4.32	-6.03	-6.12
nl1	-2.13	-1.82	-5.87	-3.42
ge1	-1.71	-1.71	-3.93	-2.78
nl2	-1.94	-1.81	-5.34	-3.19
sss	-1.42	-1.51	-4.55	-3.46
ge2	-1.30	-1.30	-4.42	-2.94
gni	-0.07	-0.70	-3.13	-2.80
Canada				
ps	-1.50	-1.61	-4.30	-4.36
age	7.41	2.22	-1.38	-0.35
inc	-4.19	-3.03	-8.04	-5.67
nl1	-1.44	-1.27	-5.46	-3.41
ge1	-0.89	-0.98	-4.23	-3.41
nl2	-1.68	-1.64	-5.05	-3.41
sss	-1.10	-1.07	-5.07	-3.57
ge2	-1.01	-1.15	-3.82	-3.18
gni	-0.88	-0.84	-5.29	-6.03

* Augmented Dickey-Fuller is calculated with one lag.

Variables definitions:

ps = private net saving (households plus business sector, as a percentage of national income)
age = percentage of population over 64 years of age divided by percentage of population between 15 and 64 years
inc = real national income growth (first difference in log national income deflated by GDP deflator)
nl1 = net lending of general government (as a percentage of national income)
ge = total general government outlays (as a percentage of national income)
sss = social security surplus (social security contributions less benefit payments as a percentage of national income)
nl2 = government net lending less social security surplus (as a percentage of national income)
ge2 = government expenditure on consumption and current transfers (less social security benefit payments, as a percentage of national income)
gni = government fixed capital formation less consumption of fixed capital (as a percentage of national income)

all but one case (the age variable for Germany). In the light of these results, we proceed to the co-integration tests on the assumption that the variables are integrated of order 1. This conclusion is consistent with most studies using aggregate economic time series data.

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