The Case of the Missing Interest Deductions: Will Tax Reform Increase U.S. Saving Rates?

by David Altig

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Introduction

Beginning in tax year 1991, U.S. taxpayers may no longer deduct personal interest expense when calculating taxable income, thus completing the transition from the unlimited deductibility provisions that existed prior to enactment of the Tax Reform Act of 1986 (TRA86). In tax-speak, personal interest expense comprises interest payments not associated with mortgages on qualified residences or certain income-generating activities. Generally speaking, personal interest expense amounts to interest payments on consumer loans not secured by real estate.

Although a large share of household interest payments are associated with mortgage-related interest payments, which remain deductible under TRA86, disallowing deductions for personal interest expense is likely to have a substantial impact on consumer behavior.[1] Indeed, eliminating the deductibility of personal interest expense may, in the final analysis, be one of the more important legacies of TRA86.

It is certainly obvious that personal interest deductions had been increasingly exploited in the years preceding passage of TRA86. After trending upward during the 1950s, the growth of nonhousing interest deductions stabilized through the mid-1970s, fluctuating between 0.8 and 1.1 percent of GNP. After 1976, however, this percentage increased steadily, from 0.85 percent in 1977 to 1.7 percent in 1986 (see figure 1).

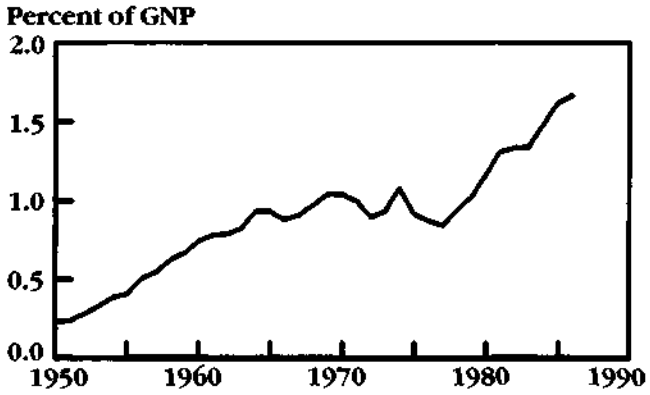
The period subsequent to 1976 was also distinguished by a downward trend in personal, private, and national saving rates (see figure 2). The coincidence of decreasing personal saving rates and increasing personal interest deductions can also be seen in figure 3, which plots personal saving (as a percentage of GNP) against nonhousing interest deductions (as a percentage of GNP).

While the negative relationship that appears in figure 3 does not necessarily imply that eliminating the deductibility of nonhousing interest

■ 1 The ratio of housing to nonhousing interest deductions on personal tax returns was 1.19 in 1966, 1.78 in 1976, and 1.78 again in 1986. The largest value of this ratio over the 1964-1986 period was 1.94, which was realized in 1983. Unfortunately, the Internal Revenue Service's *Statistics of Income*, from which these numbers are calculated, does not generally distinguish among the categories of nonhousing interest deductions. The nonhousing interest measures used in this paper therefore include interest expense associated with personal investment. Fortunately, available data suggest that investment interest expense claimed by individuals is small relative to personal interest expense. In 1977, for example, 65 percent of total household interest deductions were associated with home mortgages, 34 percent were associated with personal interest expense, and only 1 percent was associated with interest expense from investment activity.

FIGURE 1

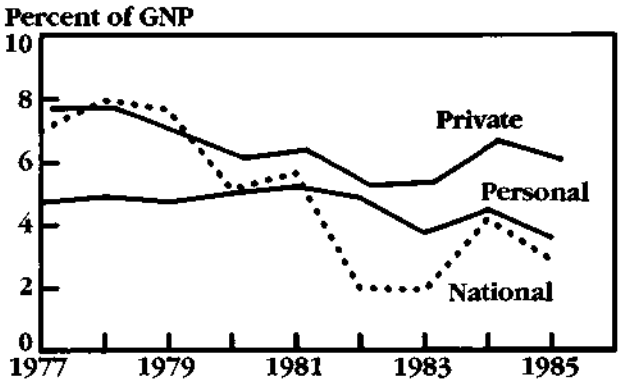
Nonhousing Interest Deductions



SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis, and Internal Revenue Service.

FIGURE 2

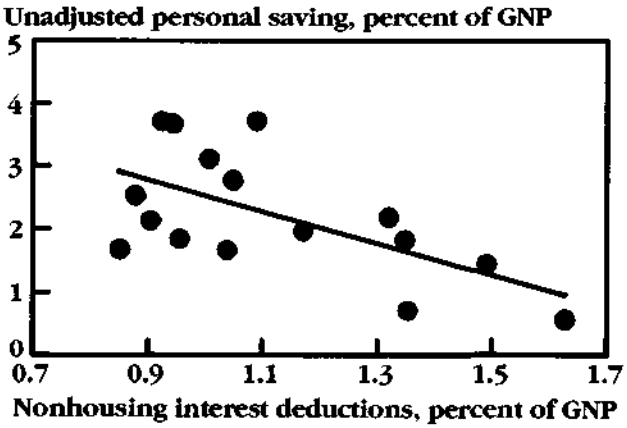
Saving Rates



SOURCE: Carroll and Summers (1987).

FIGURE 3

Personal Saving vs. Nonhousing Interest Deductions



SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis, Internal Revenue Service, and Carroll and Summers (1987).

expense will cause an increase in the U.S. saving rate, it is commonly believed that removing incentives to dissave does indeed result in higher savings relative to income. To a large extent, this belief arises from the simple intuition that increasing the price of an activity—in this case, borrowing—will naturally lead to a decrease in that activity. Economic theory thus leads us to conclude that more restrictive tax treatment of personal interest expense will lead to less consumption and more saving.

Although empirical evidence is limited, it appears that the negative relationship between household borrowing subsidies and saving behavior suggested by economic theory can be found in real-world economies. Tanzi (1987) has shown that personal saving as a percentage of disposable income has tended to be lower in countries with the most generous tax treatment of personal interest expense (this evidence is also presented in Sheshinski [1990]). In a provocative comparison of U.S. and Canadian saving rates, Carroll and Summers (1987) argue that part of the historical divergence between observed saving rates in these two very similar economies is likely because, unlike taxpayers in the United States, Canadian taxpayers were unable to deduct personal interest expense.[2]

In this paper, I consider further some of the evidence presented by Tanzi and Carroll and Summers. Specifically, I ask two simple questions. First, do private saving rates tend to be higher, on average, in countries that prohibit the deductibility of personal interest expense? Second, do tax subsidies to borrowing help explain U.S.–Canadian saving rate differentials?

The empirical evidence I present gives affirmative answers to both questions. With respect to the first question, I examine private saving rates from 1975 to 1986 in a sample of 15 member countries of the Organisation for Economic Co-operation and Development (OECD). I find that private saving rates were indeed higher on average in countries without tax subsidies to consumption loans. These results confirm for private saving the observations made by Tanzi with respect to personal saving.[3]

■ **2** Limitations on interest deductions available to Canadian taxpayers also apply to interest expense from home mortgages. See the discussions in Carroll and Summers (1987) and Tanzi (1984).

■ **3** Private saving is the sum of saving by households, or personal saving, and saving by corporations.

Of course, simply comparing aggregated cross-country saving rates provides only casual evidence. Like the relationship in figure 3, such comparisons do not control for other causal factors. A more detailed analysis, which builds on the Carroll and Summers work, is provided in section III. The empirical models in this section add proxies for the U.S. subsidy rate on consumption loans to the Carroll and Summers regression equations for U.S.–Canadian saving differentials. The subsidy variables consistently appear with statistically and economically significant negative effects on private saving, a result that is remarkably robust across different specifications of the empirical model.

Even the more sophisticated analysis of section III has serious limitations — the data include only 24 annual observations, no attempt is made to control for simultaneity bias, and the subsidy proxies are admittedly crude, to name just a few. Furthermore, the effect of the borrowing subsidy variable is not consistently significant in regression models of the U.S. saving rate alone. Nonetheless, the results reported here are generally supportive of the assertion that consumption-loan subsidies may have important negative effects on saving behavior, and hence important implications for the long-run performance of the U.S. economy in the wake of TRA86.

I. A Simple Analytical Framework

Although the intuition for a negative relationship between favorable tax treatment of household borrowing and personal saving is readily apparent, introducing a simple analytical framework will help to organize the issues.

The framework presented here is a simple, perfect-certainty, overlapping generations model in which each generation lives three periods. Every generation consists of identical individuals who inelastically supply one unit of labor in the first two periods of life, retiring in the third. Utility is assumed to be a logarithmic, time-separable function of consumption given by

$$(1) \qquad U_t = \sum_{i=1}^{3} \beta^{i-1} \ln(C_{it}).$$

The variable β is the individual subjective time-discount factor, and the subscript t indexes each generation by date of birth.

Savers in the model have access to two types of assets: physical capital, denoted by a_{ij} for an age i individual of generation j, and private debt, which takes the form of consumption loans between generations.[4]

To make the model interesting, it is necessary that some generation chooses to borrow. I therefore assume that each generation is endowed with an identical, exogenous life-cycle labor productivity profile given by $(\varepsilon_1, \varepsilon_2, 0)$, where ε_2 is sufficiently larger than ε_1 to ensure that the young always choose to borrow. Let borrowing by a young household born at time t be given by s_{1t}. Abstracting from population growth, market clearing in the consumption loans market requires that $s_{1t} = b_{2,t-1}$, where $b_{2,t-1}$ is lending by the generation that is middle-aged in time t.[5]

With these definitions in hand, the budget constraints for each generation are defined as

$$(2) \qquad C_{1t} = \varepsilon_1 w_t + s_{1t},$$

$$(3) \qquad C_{2t} = \varepsilon_2 w_{t+1} - [1 + r^d_{t+1}(1 - \delta_{t+1})]\, s_{1t} - a_{2t} - b_{2t},$$

and

$$(4) \qquad C_{3t} = (1 + r_{t+2})\, a_{2t} + [1 + r^d_{t+2}(1 - \rho_{t+2})]\, b_{2t},$$

where r is the rate of return to physical capital, r^d is the return to private debt, δ is the subsidy rate on borrowing (or, alternatively, the marginal tax rate on nonwage income for age 2 individuals), and ρ is the tax rate on interest income earned from the purchase of private debt. Equations (2), (3), and (4) embody the assumption that the young choose to borrow, the condition that all generations will consume their full lifetime resources (so that only middle-aged individuals save), and the simplifying assumption that the marginal tax rate on income from physical capital is zero.

Assuming interior solutions for individual saving and dissaving decisions, utility maximization implies the first-order conditions

4 Because the analysis here abstracts entirely from transaction costs, nothing essential is lost by ignoring the role of intermediaries and assuming that loan contracts are directly traded between generations.

5 The model abstracts from bequest motives and uncertainty, so all generations choose to "die" with no assets. The old will therefore never choose to accumulate capital or lend in the consumption loans market.

TABLE 1

Crowding-Out Effects of Increasing the Subsidy to Consumption Loans

Percentage Reduction in Steady-State Capital

δ	Benchmark	Population growth = 0	Productivity profile = (0, 10, 0)
0.01	0.5	0.6	0.8
0.02	1.0	1.1	1.6
0.03	1.6	1.7	2.4
0.04	2.1	2.3	3.3
0.05	2.6	2.9	4.2
0.06	3.2	3.5	5.0
0.07	3.7	4.1	6.0
0.08	4.3	4.7	6.9
0.09	4.8	5.3	7.8
0.10	5.4	6.0	8.8
0.11	5.9	6.7	9.8
0.12	6.5	7.3	10.8
0.13	7.0	8.0	11.9
0.14	7.6	8.7	12.9
0.15	8.2	9.4	14.0

NOTE: Each entry gives the percentage reduction in the steady-state capital stock when the subsidy rate on borrowing, δ, is increased from zero. The benchmark case assumes $\beta = 0.778$, $\theta = 0.25$, zero population growth, $(\varepsilon_1, \varepsilon_2, \varepsilon_3) = (1.5, 8.5, 0)$, and $\rho = 0.11$. The other cases maintain the benchmark assumptions, with the exception of the indicated parameters.
SOURCE: Author's calculations.

(5) $$C_{2t} = \beta [1 + r^d_{t+1}(1 - \delta_{t+1})] C_{1t},$$

(6) $$C_{3t} = \beta [1 + r^d_{t+2}(1 - \rho_{t+1})] C_{2t},$$

and

(7) $$C_{3t} = \beta (1 + r_{t+2}) C_{2t}.$$

Equations (6) and (7) imply that, in asset-market equilibrium, $r_t = r^d_t(1 - \rho_t)$.

The long-run effect of changes in the subsidy variable δ can be demonstrated by a few simple simulation exercises. Table 1 reports the reduction in the steady-state capital stock caused by increasing the subsidy rate δ for particular parameterizations of the model.[6] In the benchmark case, which is described in table 1, increasing δ from 0 to 10 percent causes the steady-state capital stock to fall by 5.4 percent.[7] By extension, interest rates rise and per capita income falls.[8]

Table 1 also shows how factors that increase the demand for consumption loans amplify the crowding-out effects of allowing personal interest expense to be deducted for tax purposes. Thus, an increase in either the rate of population growth or the steepness of the productivity profile between young and middle ages results in larger percentage decreases in steady-state capital for a given change in δ. (See Bryan and Byrne [1990] and the references therein for a general discussion of the effects of demographics on aggregate saving in a life-cycle context.)

Because substantial disagreement persists among economists concerning the appropriate model of aggregate saving behavior, it is important to note that the qualitative results of the model presented here are not dependent on life-cycle assumptions. Altig and Davis (1989) show that changes in the subsidy rate on consumption loans can also have significant long-run negative effects on aggregate savings in models where parents and children are altruistically linked, as in Barro (1974). In fact, under the plausible assumption that the tax rate on interest income exceeds the subsidy rate on borrowing, Barro-type models predict that changes in subsidy rates can have large long-run effects on the size of the capital stock even when changes in the tax rate on interest income do not (see Altig and Davis [1989] for a full treatment of this issue).

II. Do Private Saving Rates Tend to Be Higher in Countries Without Borrowing Subsidies?

Table 2 answers this question directly. The answer is yes, at least for the subset of OECD countries examined here.[9] The results in table 2

■ **6** The simulations reported in table 1 assume that all revenues raised (or lost) through distortionary taxation are rebated (or recovered) via lump-sum subsidies (or tax levies) to the affected generations.

■ **7** In general, the direction of change in aggregate savings depends on the nature of the assumed preference structure. Under "standard" preferences, however, changes in the subsidy rate will have effects that are qualitatively the same as the ones reported here. The seminal discussion of this issue in an overlapping generations framework can be found in Diamond (1965).

■ **8** The simulations reported in table 1 assume a Cobb-Douglas production technology, expressed in effective labor units as $y = k^\theta$. The steady-state rate of return to capital is therefore given by $\theta k^{\theta - 1}$. Thus, y is increasing in k, and r and r^d (by the asset-market clearing condition) are decreasing in k.

■ **9** The countries are Australia, Austria, Belgium, Canada, Denmark, France, Ireland, Japan, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, the United States, and West Germany. The data are from *OECD National Accounts*.

TABLE 2

Average Private Saving Rates, 1975–1985

	Group Averages	
	Consumer interest not deductible	Consumer interest deductible
Simple average	10.68	8.65
Weighted average	11.14	8.38

Individual Country Averages

Consumer interest not deductible	Average saving rate
Australia	5.65
Austria	9.83
Belgium	12.73
Canada	11.81
France	9.74
Ireland	14.80
Japan	15.73
United Kingdom	7.33
West Germany	8.53

Consumer interest deductible	Average saving rate
Denmark	7.45
Netherlands	12.24
Norway	5.04
Sweden	5.23
Switzerland	13.72
United States	8.22

NOTE: Entries represent averages for subsets of 15 OECD countries. Countries are classified into deductible and nondeductible groups according to the information provided by Tanzi (1984). Weighted averages are constructed using within-group relative shares of real GDP. Real GDP figures are obtained from Summers and Heston (1988). Saving rates are expressed as percentages of GNP.
SOURCE: Organisation for Economic Co-operation and Development, *National Accounts of OECD Countries*, 1975-1987, Volume II.

were obtained by first averaging private saving as a percentage of gross domestic product (GDP) over the sample period 1975 to 1985 for each of the 15 countries considered.[10] The countries were then grouped according to whether tax subsidies were provided to interest expense from general (nonhousing) consumer credit.[11] Two sets of group-average measures are reported in table 2—one based on simple averaging and one obtained by weighting the individual country averages by within-group relative shares of real GDP.[12]

The average private saving rate for the sample period was 10.68 percent in countries without favorable tax treatment of personal interest expense and 8.65 percent in countries with favorable tax treatment of personal interest expense (11.14 percent and 8.38 percent, respectively, when country-specific saving rates are weighted by GDP shares). To put the magnitude of this difference in some perspective, the U.S. current account deficit was 5 percent of GDP in 1988. A 2 percent increase in the private saving rate for 1988 could therefore have financed more than one-third of the U.S. current account deficit, an amount equivalent to about $44 billion in 1988 dollars.

Table 2 also clearly shows that, in the chosen sample, average saving rates varied substantially among countries with similar tax treatment of personal interest expense.[13] It is impossible to know how much of the variation can be accounted for by economic, demographic, and policy variables without a more detailed investigation of the data. Unfortunately, the information that is necessary to conduct a more detailed

10 The savings measures used here are net of depreciation. See Aghevli et al. (1990) for a general discussion of the OECD saving measures.

11 Countries are classified into subsidy and nonsubsidy groups according to information reported in appendix III of Tanzi (1984). Updated information in Tanzi (1987) indicates that these classifications were still valid in 1985.

12 Relative GDP shares are obtained using real GDP at international prices calculated by Summers and Heston (1988).

13 There were also significant differences in the trend of saving rates for countries within the two groups. In the subsidy group, for instance, Norway, Sweden, and the United States experienced declining saving rates over the sample period, while Denmark, the Netherlands, and Switzerland all experienced fairly strong upward trends.

inquiry is difficult to come by.[14] Because of this difficulty, the balance of this paper focuses on a comparison between two countries for which data are more readily available: the United States and Canada.

III. Has the Subsidy Rate on Consumer Loans Reduced U.S. Saving Relative to Canadian Saving?

Following Carroll and Summers (1987), the starting point of the analysis in this section is a simple saving equation given by

$$(8)\quad S_t = \alpha_0 + \alpha_1\pi_1 + \alpha_2 UN_t + \alpha_3 SURP_t + \alpha_4 SHELT_t + \alpha_5 NW_t + \alpha_6 R_t^{at} + \eta_t,$$

where S_t is the time t differential between the U.S. and Canadian private saving rate (as a percent of GNP), π_t is the differential in inflation rates for consumer prices, UN_t is the differential in unemployment rates (as a percent of the total labor force), $SURP_t$ is the differential in net government saving (as a percent of GNP), $SHELT_t$ is the differential in the level of saving in tax-sheltered assets (as a percent of personal disposable income), NW_t is the differential in household net worth (as a percent of GNP), and R_t^{at} is the differential in weighted averages of after-tax returns to sheltered and nonsheltered saving.

Before proceeding to a discussion of my empirical work, it will be useful to introduce the rationale for including the particular regressors shown in equation (8). The inflation variable is included to control for the tendency of national income-account saving measures to overstate actual saving when inflation increases. The idea is that standard measures of income are distorted by changes in nominal interest rates that arise solely from changes in the rate of inflation or, more precisely, from the expected rate of inflation. This issue is examined in detail by Jump (1980). The expected sign of α_1 is positive if the type of measurement problem Jump identifies is the primary channel through which inflation rates help to explain aggregate savings.

The unemployment variable is a proxy for differences in cyclical conditions across the two countries. Assuming that changes in unemployment primarily reflect deviations from the equilibrium rate of unemployment, an appeal to the reasoning underlying the permanent-income hypothesis implies that $\alpha_2 < 0$. In other words, we expect higher unemployment and more dissaving when income is temporarily low.

The coefficient α_3 measures the relationship between public saving and private saving. In the simplest scenario, we expect to find $\alpha_3 = -1$ if the conditions necessary for Ricardian equivalence are true and $\alpha_3 > -1$ if those conditions are not true.[15] However, unambiguous predictions for the value of α_3 are complicated by the fact that equation (8) does not control for independent effects associated with government expenditures (see Aschauer [1985]).

The significance of the sheltered saving variable is the key finding of Carroll and Summers. $SHELT_t$ specifically measures the U.S.–Canadian differential in total personal saving in tax-sheltered forms (as a percentage of disposable personal income). In the United States, sheltered saving is represented by contributions to individual retirement accounts (IRAs). The Canadian equivalent of IRAs are registered retirement savings plans.

Carroll and Summers estimate values of α_4 that range between 1 and 2, implying that increases in the amount of saving in tax-sheltered assets are associated with greater than one-to-one increases in total private saving. Although this impact seems large, it is qualitatively consistent with microdata evidence presented by Venti and Wise (1987), who estimate that 80 to 90 percent of IRA contributions represent net increases in personal saving.

The final two variables, NW_t and R_t^{at}, are expected to enter equation (8) with negative and positive coefficients, respectively. The net-worth variable is included to capture the possibility that private saving, as measured on a national income accounts basis, changes as households seek to maintain target wealth-to-income ratios. Thus, as net worth rises relative to GNP, private saving tends to fall.

14 I did examine many cross-sectional regressions with variations of the empirical specification employed by Feldstein (1980). In particular, I attempted to find whether this type of cross-sectional empirical saving model tends to underpredict the average private saving rate for countries without borrowing subsidies and overpredict the saving rate for countries with borrowing subsidies. For some of the models, I found regression errors were uniformly positive for the no-subsidy countries and uniformly negative for the countries with subsidies. However, the results were so sensitive to sample size, choice of regressors, and sample period that it was impossible to make a convincing case one way or the other. The general nonrobustness of Feldstein-like empirical saving models is also reported by Slemrod (1990) and Bosworth (1990).

15 The literature on Ricardian equivalence is massive. Good general discussions can be found in Bernheim (1987, 1989) and Barro (1989a, 1989b).

TABLE 3

Regression Results

Coefficient Values	Model 1	2	3	4
CONST	−.027	.004	.004	.016
	(3.3)[a]	(.45)	(.43)	(2.3)[b]
INFL	.231	.197	−.017	.156
	(.95)	(1.1)	(.04)	(.43)
UN	.290	.506	.430	.404
	(.62)	(1.4)	(1.1)	(1.3)
SURP	−.837	−.267	−.281	−.365
	(3.4)[a]	(1.2)	(1.2)	(1.8)[c]
SHELT		1.74	1.98	−.665
		(4.2)[a]	(3.2)[a]	(.64)
R^{at}			−.254	.228
			(.55)	(.54)
NW				.179
				(2.9)[a]
Adj. R^2	.559	.760	.751	.824
ρ	.585	.408	.407	.226

a. The null hypothesis that the corresponding coefficient is zero can be rejected at the 99 percent confidence level.
b. The null hypothesis that the corresponding coefficient is zero can be rejected at the 95 percent confidence level.
c. The null hypothesis that the corresponding coefficient is zero can be rejected at the 90 percent confidence level.
NOTE: The dependent variable is the U.S.–Canadian differential in private saving relative to disposable income. All other variables are as defined in equation (8). The variable ρ is the first-order autocorrelation coefficient of the residual series. The numbers in parentheses are the absolute value of the t statistics for the corresponding coefficient estimate.
SOURCE: Author's calculations.

The after-tax real interest rate is included to capture the effects of changes in the return to saving. The expectation that $\alpha_6 > 0$ assumes that preferences cause substitution effects to dominate income effects and that ex post real rates are reasonable proxies for ex ante real rates.

An important consideration in discussing the expected signs of the coefficients in equation (8) is that I have described the relationships that would arise in an explicitly structural saving function. Equation (8) is, of course, decidedly nonstructural. Thus, coefficient estimates derived from regression analysis on equation (8) cannot be viewed as decisive indicators of the structural relationships between U.S.–Canadian saving differentials and the explanatory variables.[16] The appropriate interpretation of the approach taken here is that of an investigation into whether partial correlations of saving differentials and included regressors are consistent with structural–theoretical predictions.

Table 3 presents the results of several regressions based on equation (8). The data are annual and, with a few exceptions, are from Carroll and Summers (1987).[17] Model 1 in table 3 includes inflation, unemployment, and government surplus differentials as regressors. The coefficients on the inflation and government surplus variables have the anticipated sign, but only the government surplus variable is statistically significant.[18] The coefficient on the unemployment differential has the "wrong" sign, but is not statistically different from zero.

Models 2–4 in table 3 all include the differential in sheltered saving as a regressor. Models 2 and 3 essentially replicate the crucial Carroll and Summers result — the coefficient on *SHELT* is positive, large, and statistically significant. The coefficient on *SHELT* does become statistically insignificant when the U.S.–Canadian net wealth differential is added to the basic regression model.

■ **16** The problems in interpreting coefficient estimates from equation (8) are twofold. First, the coefficients in equation (8) are almost certainly "mongrel parameters," that is, unspecified functions of the underlying structural parameters. Second, no attempt is made to control for biases that may arise if the regressors are correlated with the error term η_t, a situation that seems likely. With respect to this latter problem, I did some limited experimentation with instrumental variables (IV) estimation. Unfortunately, the standard errors of the IV estimates were so large that no interesting inferences were possible.

■ **17** Unemployment rates are taken from the OECD *Labor Force Statistics*. The *SHELT* variable was constructed from data graciously provided by Chris Carroll (for Canada) and from data reported in Carroll and Summers (for the United States).

■ **18** The tables indicate coefficients that are statistically nonzero at the 90 percent, 95 percent, and 99 percent confidence levels. In the Carroll and Summers paper, reported t statistics are corrected for serial correlation. Although such corrections were made for all of the models reported in this paper, I have chosen not to report corrected t statistics for two reasons. First, almost all of the models estimated yield Durbin-Watson statistics that fall within the "inconclusive" range. Furthermore, although many of the models estimated yield "large" values of the first-order correlation coefficient of the residual series (ρ), the null hypothesis $\rho = 0$ is rarely rejected at the 95 percent confidence level. Second, work by Mishkin (1990) indicates that the type of correction employed by Carroll and Summers has undesirable properties in small samples. In most cases, the basic message is independent of whether t statistics are corrected or uncorrected.

TABLE 4

Regression Results Including Subsidy Variable

Coefficient Values	Model 5	6	7	8
CONST	.100	.092	.093	.064
	(6.1)[a]	(4.8)[a]	(4.7)[a]	(1.8)[b]
INFL	–.018	.004	.060	.108
	(.14)	(.03)	(.21)	(.36)
UN	–.077	.010	.025	.081
	(.32)	(.04)	(.09)	(.29)
SURP	–.260	–.210	–.206	–.247
	(1.8)[b]	(1.4)	(1.3)	(1.5)
SHELT		.353	.273	–.372
		(.89)	(.50)	(.44)
R^{at}			.069	.185
			(.21)	(.54)
NW				.062
				(1.0)
SUB	–4.25	–3.76	–3.80	–3.19
	(8.0)[a]	(4.9)[a]	(4.7)[a]	(3.2)[a]
Adj. R^2	.893	.891	.885	.885
ρ	–.128	–.150	–.170	–.232

a. The null hypothesis that the corresponding coefficient is zero can be rejected at the 99 percent confidence level.
b. The null hypothesis that the corresponding coefficient is zero can be rejected at the 90 percent confidence level.
NOTE: *SUB* is measured as the ratio of nonhousing personal interest deductions to adjusted gross income reported on itemized returns. See table 3 for other definitions.
SOURCE: Author's calculations.

Note also that the sign on the net wealth coefficient is positive and statistically significant.[19]

Table 4 presents results of regressions that add to models 1–4 a variable measuring the average borrowing subsidy. The subsidy variable is constructed as the ratio of total nonhousing interest deductions on personal tax returns to the adjusted gross income of all taxpayers with itemized deductions. This series on average subsidy rates is constructed from various issues of the *Statistics of Income for Individuals* (published by the Internal Revenue Service).[20]

The results in table 4 are striking. In every case, the null hypothesis that the subsidy variable has zero effect on private saving is easily rejected at the 99 percent confidence level. As would be expected, the explanatory power of the saving models also increases when the subsidy variable is included—in some cases, substantially.

It is necessary to bear in mind, however, that the average subsidy variable included in these regressions is at best a crude proxy for the variable that is theoretically important — namely, the *marginal* subsidy rate on consumption loans. In fact, it is difficult to distinguish movements in the subsidy variable that result from changes in tax incentives for borrowing from movements that result from shifts in the demand for consumption loans that are not associated with tax distortions.

For example, suppose that an individual, facing no change in borrowing subsidies, simply decides to borrow an extra $10 at the margin. Suppose further that the rate of interest on this loan is 10 percent. Then the individual's saving falls by $10 while his or her interest expense rises by $1. This single episode would suggest that the coefficient on the subsidy variable constructed from reported interest expense is –10, even though the borrowing behavior had nothing to do with tax-related borrowing subsidies.[21]

The regressions reported in table 5 replicate the regressions reported in table 4, with the subsidy variable calculated as 20 percent of the average nominal annualized return on three-month Treasury bills. Because personal interest deductibility provisions did not change during the sample period, exogenous changes in borrowing subsidies arose through two channels—changes in structural marginal tax rates and changes associated with variation in the rate of inflation in the context of a tax code that allowed for the deductibility of *nominal* interest expense. The subsidy variable used for the regressions in table 5 is designed to capture the effects of the latter channel.[22]

■ **19** Carroll and Summers do not find the same sensitivity of the *SHELT* coefficient in their empirical analysis. The differences between their results and mine apparently result from the data. As subsequent results make clear, I find that no stable inference can be made about the relationship between U.S.–Canadian private saving differentials and differences in the amount of sheltered saving in the two countries.

■ **20** Values for personal interest deductions are interpolated for the odd years from 1961-1971 and for 1974 by assuming that total interest deductions and mortgage-related interest deductions increase from the previous tax years at the same rate as total itemized deductions.

■ **21** I am grateful to Chris Carroll for suggesting this example, as well as the alternative subsidy variable discussed in the subsequent paragraphs

■ **22** Twenty percent is chosen as a rough approximation to the average marginal subsidy rate on borrowing in accordance with the numbers reported in table 1 of Altig and Davis (1989).

TABLE 5

Regression Results with Alternative Subsidy Variable

Coefficient Values	Model 9	10	11	12
CONST	.016	.017	.017	−.012
	(2.1)[a]	(2.2)[a]	(2.1)[a]	(.72)
INFL	.227	.221	.142	.214
	(1.7)	(1.6)	(.43)	(.70)
UN	.072	.138	.113	.167
	(.28)	(.49)	(.37)	(.59)
SURP	−.506	−.438	−.441	−.458
	(3.5)[b]	(2.5)[a]	(2.4)[c]	(2.7)[a]
SHELT		.326	.428	−.873
		(.69)	(.69)	(1.0)
R^{at}			−.094	.171
			(.26)	(.48)
NW				.111
				(2.0)[c]
SUB	−2.94	−2.60	−2.58	−2.00
	(6.9)[b]	(3.9)[b]	(3.8)[b]	(2.9)[a]
Adj. R^2	.867	.864	.856	.877
ρ	−.074	−.068	−.064	−.232

a. The null hypothesis that the corresponding coefficient is zero can be rejected at the 95 percent confidence level.
b. The null hypothesis that the corresponding coefficient is zero can be rejected at the 99 percent confidence level.
c. The null hypothesis that the corresponding coefficient is zero can be rejected at the 90 percent confidence level.
NOTE: *SUB* is measured as 20 percent of the average annualized return on three-month Treasury bills. See table 3 for other definitions.
SOURCE: Author's calculations.

The results in table 5 do not differ appreciably from those reported in table 4. Although the coefficients on the subsidy variables decrease in magnitude, they remain large in absolute value and are always statistically different from zero. Furthermore, as in the regressions reported in table 4, inclusion of the subsidy variable renders the *SHELT* variable insignificant in all cases.[23]

Table 6 presents the results of regressions based on other variations of the model given in equation (8) for each of the two subsidy variables used in tables 4 and 5. Models 13–16 report the results of estimated models in which demographic and income-growth variables are included as explanatory variables, extensions suggested by the theoretical model in section I. Models 13 and 14 include the U.S.–Canadian differential in the percentage of the population aged 15-65. Models 15 and 16 report results in which the real GNP growth-rate differential is included as a regressor.[24]

Models 17 and 18 of table 6 report results with personal saving taken as the dependent variable and corporate saving introduced separately as a regressor. Analogous to the observations made about the government surplus variable in equation (8), corporate saving, after controlling for total wealth, should have a one-for-one negative effect on personal saving if individuals "pierce the corporate veil."[25]

In every case, including numerous regressions not reported in the tables, the result is the same. With the arguable exception of the government surplus variable, the borrowing subsidy, however measured, is the only explanatory variable that consistently shows up with a statistically significant effect on the U.S.–Canadian saving differential. Furthermore, the effect is always negative, and strongly so.

One further set of tests is reported in table 7. Because borrowing subsidies are zero for Canada, all variation in the subsidy variable arises from the U.S. data. The regressions in table 7 are therefore based on U.S. data alone.[26] Although the models with the subsidy variable constructed from Treasury bill rates yield results that are consistent with regressions based on U.S.–Canadian saving differentials, it is apparent

■ **23** The subsidy proxy included in the table 5 regressions is, of course, subject to some of the same potential endogeneity problems as the subsidy variable employed in the table 4 regressions. For example, suppose that individuals in the economy anticipate better times ahead (and that these expectations are not closely related to effects that are controlled for by the inclusion of unemployment or GNP growth differentials). Permanent-income theory then tells us that the response will be an average increase in the desire to borrow. The resulting shift in the aggregate saving curve will drive up both real and nominal interest rates (holding expected inflation fixed).

■ **24** If faster GNP growth means steeper life-cycle productivity profiles, the results of the simulations in section I suggest that coefficients on the GNP growth differential should be negative. However, the growth-rate differential may also pick up changes in cyclical conditions not captured by the unemployment-rate differential. This latter interpretation seems more likely in light of the significant positive coefficient estimates reported in table 6.

■ **25** The necessity of controlling for total wealth is emphasized in the empirical studies by Auerbach and Hassett (1989) and Poterba (1989). The results in these papers suggest to me that individuals do indeed internalize corporate saving when making personal consumption decisions. However, the evidence is, as usual, ambiguous.

■ **26** I am grateful to Randall Eberts for suggesting these regressions.

TABLE 6

Regression Results with Alternative Models

Coefficient Values	Model 13	14	15	16	17[a]	18[a]
CONST	.065	−.056	.082	−.057	.071	.015
	(1.8)[b]	(2.0)[b]	(2.3)[c]	(.30)	(3.9)[d]	(2.5)[c]
INFL	.111	.293	.271	.289	.263	.380
	(.36)	(.88)	(.90)	(.87)	(.99)	(1.3)
UN	.078	−.822	.294	.285	.102	.193
	(.27)	(1.4)	(.98)	(.84)	(.45)	(.80)
SURP	−.242	−1.26	−.306	−.481	−.192	−.439
	(1.4)	(2.9)[c]	(1.9)[b]	(2.7)[c]	(1.4)	(2.6)[c]
CORP					−.193	−.075
					(.74)	(.28)
SHELT	−.364	−2.4	.144	−.617	.64	.442
	(.42)	(2.0)[b]	(.16)	(.64)	(1.3)	(.70)
R^{adj}	.186	.401	.283	.222	.034	.131
	(.52)	(.98)	(.85)	(.60)	(.14)	(.47)
NW	.059	.104	−.005	.084	−.014	.002
	(.87)	(1.6)	(.07)	(1.2)	(.34)	(.05)
POPRAT	.031	−.011				
	(.13)	(.05)				
YGROW			.204	.097		
			(1.6)	(.65)		
SUB 1	−3.19		−3.24		−2.65	
	(3.1)[d]		(3.4)[d]		(3.4)[d]	
SUB 2		−1.88		−1.89		−1.82
		(2.6)[c]		(2.6)[c]		(2.8)[c]
Adj. R^2	.878	.871	.924	.873	.910	.896
ρ	−.221	−.383	−.276	−.193	−.122	−.009

a. The dependent variable is the personal saving rate differential.
b. The null hypothesis that the corresponding coefficient is zero can be rejected at the 90 percent confidence level.
c. The null hypothesis that the corresponding coefficient is zero can be rejected at the 95 percent confidence level.
d. The null hypothesis that the corresponding coefficient is zero can be rejected at the 99 percent confidence level.
NOTE: *POPRAT* is the differential in the percentage of the population aged 15-65; *YGROW* is the differential in real GNP growth rates; *CORP* is the differential in private minus personal saving rates; *SUB* 1 is the subsidy variable as defined in table 4; and *SUB* 2 is the subsidy variable as defined in table 5. See previous tables for other definitions.
SOURCES: Author's calculations and *OECD National Accounts*, various issues.

TABLE 7

Regression Results for U.S. Personal Saving

Coefficient Values	Model 19	20	21	22	23	24
CONST	.060	.079	.107	.085	.066	.079
	(2.8)[a]	(8.1)[c]	(5.9)[c]	(8.5)[c]	(3.5)[c]	(8.2)[c]
INFL	−.675	.499	.028	.103	−.489	.325
	(2.8)[a]	(2.4)[a]	(.36)	(2.1)[b]	(2.2)[a]	(1.3)
UN	−.515	.086	−.071	.007	−.472	−.024
	(1.8)[b]	(.52)	(.24)	(.04)	(1.9)[b]	(.13)
SURP	−.271	−.643	−.106	−.373	−.444	−.636
	(1.3)	(3.2)[c]	(.42)	(2.3)[a]	(2.3)[a]	(3.2)[c]
SHELT	−1.21	−1.19	−.194	−.466	−1.52	−1.31
	(1.5)	(2.3)[a]	(.21)	(1.2)	(2.1)[a]	(2.6)[a]
R^{at}	−.771	.463			−.492	.322
	(3.0)[c]	(2.0)[b]			(2.0)[b]	(1.2)
NW	.002	.009	.006	.008	.001	.007
	(.54)	(3.2)[c]	(1.4)	(2.7)[a]	(.25)	(2.1)[a]
YGROW					.175	.090
					(2.6)[a]	(1.2)
SUB 1	2.80		−1.18		1.68	
	(1.8)[b]		(1.2)		(1.2)	
SUB 2		−3.44		−1.91		−2.60
		(4.0)[c]		(4.6)[c]		(2.4)[a]
Adj. R^2	.655	.791	.490	.756	.745	.797
ρ	−.195	−.012	.310	−0.18	.040	.052

a. The null hypothesis that the corresponding coefficient is zero can be rejected at the 95 percent confidence level.
b. The null hypothesis that the corresponding coefficient is zero can be rejected at the 90 percent confidence level.
c. The null hypothesis that the corresponding coefficient is zero can be rejected at the 99 percent confidence level.
NOTE: All variables refer to the U.S. values of the variables defined in earlier tables. The dependent variable is U.S. personal saving as a percentage of disposable income. See table 6 for other definitions.
SOURCE: Author's calculations.

that the effects of borrowing subsidies are far less consistent when included as regressors in the U.S. private saving-rate models. Note also that the sheltered saving variables are in some cases negative, large, and statistically significant. Explaining these anomalies is an important topic for future investigations.

IV. Concluding Remarks

The United States is not alone in recent attempts to mitigate the attractiveness of consumption loans through less-favorable tax treatment of personal interest expense. Recent tax reforms in Denmark and Sweden, for instance, have included provisions that effectively restrict the value of personal interest-expense deductions. Informative discussions of these changes and others can be found in Tanzi (1987) and Pechman (1988).

The evidence presented in this paper, though cursory by design, does indeed point toward important effects on aggregate saving behavior as a result of changes in the tax treatment of personal interest expense. In addition, as noted in section I, quite disparate models of intertemporal consumption behavior predict that changes in the degree to which consumption loans are subsidized through the tax system can have substantial effects on aggregate saving. The combination of these observations suggests that no assessment of U.S., or world, tax reform is complete without careful scrutiny of the treatment of personal interest expense.

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