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3 Corporate Savings and Shareholder Consumption

Alan J. Auerbach and Kevin Hassett

3.1 Introduction

The 1986 Tax Reform Act markedly altered the relative tax burden of corporations and individuals while also changing the incentives for corporate dividend distributions. Over the period 1987–91, corporate tax revenues were projected to rise by $120.3 billion, with individual taxes being reduced by $121.9 billion (U.S. House of Representatives 1986, vol. 2, table A1). The act also repealed the 60% exclusion previously afforded capital gains and raised the top marginal tax rate from a high of 20% to a high of 33%. At the same time the top rate on dividends was cut from 50% to 33%.

The shift in after-tax income from corporations to individuals combined with the increased tax incentive to pay dividends has led some to predict profound reductions in corporate savings. Since corporate savings typically account for over half of private savings, this has prompted concern that aggregate capital accumulation will be adversely affected. Indeed, a recent Data Resources, Inc., publication predicts that: "Private Savings are likely to decline because of the massive shift of post tax income from businesses to individuals . . . over the 1986–91 interval, personal savings are thus expected to be only $5 billion higher while corporate savings are $24 billion lower" (Brinner and Abraham 1986, 17). This quote reflects the conception that the transfer of cash from corporations to shareholders will alter real activity, a view

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consistent with the impression that shareholders do not "pierce the corporate veil" and recognize the full implications of the transfer. While the belief that transfers from corporations to individuals will have significant real effects may be commonly held, there is very weak supporting evidence for the proposition that *pure* transfer policies have any such effects.

This paper reexamines the implications of changing corporate savings. We begin with the straightforward proposition that the outcome depends crucially on the consumption behavior of shareholders. If, *holding wealth constant,* shareholders are perfectly rational and recognize reductions in corporate savings as a change in their own asset position, then they will counteract any changes in corporate retentions with increased personal savings, leaving private savings unchanged. It is this compensating response to *wealth-neutral* changes in corporate saving that we characterize as "piercing" the corporate veil. We use this simple observation about shareholder savings to develop a new test for the existence of the corporate veil.

The next section discusses the theory behind the corporate veil and argues that much of the previous literature lacked a proper focus. There are several reasons why changes in corporate saving might be associated with changes in national saving that are entirely consistent with a complete piercing of the corporate veil. Section 3.3 outlines and presents an Euler equation test for the existence of the corporate veil. The test supports the hypothesis that no such veil exists. Although the test's power is not strong enough to reject certain plausible alternative hypotheses, this finding still casts doubt on previous results purporting to demonstrate the existence of a corporate veil.

Because the Euler equation test is not powerful enough, by itself, to dispose entirely of the possible existence of a corporate veil, we then consider other approaches to the question. Using a switching-regressions model of consumption based on the Euler equation, we show in section 3.4 that the observed significant excess sensitivity of consumption to predictable changes in disposable income is associated with liquidity constraints rather than myopia or irrational behavior. This is further evidence against the existence of a corporate veil, because such liquidity constraints are almost certain not to apply to consumption supported by corporate wealth. Section 3.5 uses recent advances in the theory of cointegrated processes to shed new light on the time-series properties of consumption behavior and evaluate subtler tests for the presence of the corporate veil. A significant finding in this section is that the aggregate marginal propensity to consume out of corporate wealth is considerably lower than that from other tangible wealth. This could be associated with a corporate veil or with marginal consumption propensities differing across households according to wealth. Section 3.6 concludes the paper.

Because the previous literature has often been obscure on this point, it is useful to provide at the outset a precise statement of what a corporate veil would do. Our view is that a corporate veil would exist if a shift in the distribution of an individual's wealth among corporate and noncorporate forms,

holding his overall wealth constant, affected that individual's consumption. We therefore rule out changes in relative asset values that also affect aggregate wealth or the distribution of aggregate wealth among individuals as useful in the search for a corporate veil.

As we shall discuss, tax-induced changes in corporate behavior can affect individual consumption behavior without a corporate veil: these policies could alter the overall value of private assets or the distribution of wealth among individuals.

3.2 The Corporate Veil

Reductions in corporate savings need not, of course, imply lower aggregate private savings. Corporate savings can be thought of as that investment that is financed out of retained earnings rather than with new debt or equity. Under certain well-specified conditions, this should, as first noted by Modigliani and Miller (1958) and Miller and Modigliani (1961), be of no consequence to the value of the firm. Any increase in dividends can simply be offset by a commensurate increase in the firm's debt or issues of new equity. The Modigliani-Miller analysis will hold in general equilibrium, provided that dividend recipients recognize that their apparent windfall is merely a time reallocation of their asset's dividend stream. Under perfect markets, consumption will not be altered, because the consumer's optimization problem is unchanged. Real behavior will not be affected by a financial version of musical chairs.

This "dividend irrelevance" view relies upon the shareholder's ability to "pierce the corporate veil", that is, to recognize wealth-neutral changes in financial policy for what they are. It further requires that shareholders can act to offset corporate savings decisions. If shareholders were liquidity constrained, then an increase in corporate distributions would relax this constraint and increase consumption, even with no change in perceived shareholder wealth. The case is analogous to consumption increasing without a change in human wealth if current labor income increases. However, there are two significant differences between the two cases. First, shareholders can sell stock or borrow against it to relax liquidity constraints, while such transactions are severely limited with respect to human capital. Second, as we discuss further below, the distribution of share ownership is so concentrated among wealthy individuals that the aggregate importance of liquidity constraints within this group is implausible.

If the value of the firm increases because of some underlying change in fundamentals, then a significant share of the concomitant increase in dividends may be consumed because the wealth or permanent income of the shareholder has increased. If, on the other hand, a firm reduces retained earnings and increases dividends by one dollar without any underlying change in the firm's real prospects, then, according to the permanent income hypothesis, consumption will not change in the absence of taxes because total wealth re-

mains the same.[1] When markets are perfect, financial structure, or, equivalently, the timing of dividends, should have no effect on real economic behavior. This distinction is crucial to the proper understanding of the "corporate veil," and has been overlooked by much of the previous literature, which seems to interpret consumption responses to fluctuating dividends as evidence of a shareholder's inability to see through the corporate veil. To the extent that changes in dividends reflect real changes in the value of the firm, as indeed signaling models would suggest, consumption will, of course, change.

This point lends an interesting perspective to the passage already quoted from Brinner and Abraham (1986, 17). There, the shift in posttax income from corporations to individuals, in the aggregate very close to a wealth-neutral transfer, is predicted to reduce aggregate savings by $19 billion. This view suggests that simply carrying wealth across the corporate threshold induces massive changes in the consumption behavior of shareholders. Since it is implausible that liquidity constraints could explain so large a shift in shareholders' consumption, some other force must be perceived as operating here.

Proponents of this view may simply believe that some fundamental shareholder irrationality exists. Alternatively there may be a different experiment being implicitly considered, one that does not preserve the initial distribution of wealth among individuals. Changes in the distribution of wealth could well alter aggregate consumption, but one needs no corporate veil to explain such effects.[2] A problem one has in interpreting statements relating corporate and personal saving is that the experiment being envisioned is not explicitly specified. This vagueness has permeated the statistical evidence attempting to relate corporate and personal saving, in effect veiling the corporate veil.

The modern empirical study of corporate saving can be traced back to Denison (1958), who found that private saving was much smoother than its components, suggesting that personal and corporate saving may offset each other. Feldstein (1973) extended the inquiry by emphasizing that rational consumers should recognize retained earnings as wealth accruals and consume from them. Using a traditional consumption function, Feldstein found that retained earnings were significantly positively correlated with consumption. He interpreted this as evidence that consumers pierce the corporate veil. Subsequent research has come down on both sides of the issue.[3] An example of recent work finding evidence of a corporate veil is Poterba (1987). Poterba regressed private saving on several macroeconomic indicators and a dividend tax preference variable. A negative and significant coefficient on dividend taxes was interpreted as evidence that consumers do not completely offset changes in corporate saving induced by tax-related changes in dividend policy. A second test using dividend taxes as an instrument for changes in corporate saving, in an attempt to isolate wealth-neutral changes, found corroborative evidence. Since we have no a priori reason to believe that dividend taxes are orthogonal to wealth, Poterba's results are difficult to interpret.

Reexamination of the empirical methods used in existing studies of corporate saving reveals many shortcomings. Perhaps most important, previous studies have failed adequately to describe consumer behavior consistent with shareholder rationality. Because of this there has been an improper focus on simple changes in dividends or retained earnings, which are certainly correlated with changes in wealth. The response of consumption to these cannot be interpreted as a violation of the permanent income hypothesis and, as such, is irrelevant to the investigation of the existence of a corporate veil. In addition, by neglecting the duality of consumption and savings, some studies have needlessly introduced problems of measurement error as researchers have struggled over proper definitions for personal and private savings.[4] This focus on saving has also divorced the inquiry from breakthroughs in the study of consumer behavior and rational expectations which, as we shall illustrate, are particularly useful here.

Another problem with some previous research is from an econometric viewpoint. Results typically based on regressions using levels of aggregate time series are difficult to interpret because of underlying nonstationarity and the well-known accompanying spurious regression difficulties.[5] Significant correlation between corporate retained earnings or dividends and consumption may simply reflect common trends in the data.

In the following sections we illustrate that all of these shortcomings can be addressed through a straightforward application of the modern theory of the rational consumer. We test two related propositions implied by the absence of a corporate veil; first, that changes in dividend policy that are anticipated, and hence provide no new information to shareholders in estimating their wealth, do not affect aggregate consumption; second, that the response of changes in consumption to changes in different forms of wealth (corporate vs. noncorporate) are equal. Each test is based on the idea that, in the absence of a corporate veil, a shift in wealth should not affect consumption.

3.3 Euler Equations and the Corporate Veil

3.3.1 Rational Expectations and the Theory of the Consumer

Assuming a constant real interest rate and quadratic utility, Hall (1978) showed that one implication of the permanent income hypothesis is that consumption follows a random walk. If rational agents maximize a time-separable function of consumption, then all currently available information will already be included in current consumption. Hence, current consumption should provide the best available forecast of future consumption. Subsequent generalizations have allowed for interest rates to change over time.

Following the previous literature (e.g., Grossman and Shiller 1981; Hansen and Singleton 1983), consider a representative agent seeking to maximize the

expected utility of consumption. If this consumer has a CES utility function with an intertemporal elasticity of substitution σ and a pure rate of time preference δ, then his optimal consumption path will obey the Euler equation:

$$E\left[\left(\frac{C_t}{C_{t-1}}\right)^{1/\sigma}\left(\frac{1+\delta}{1+r_t}\right)\right] = 1, \tag{1}$$

where r_t is the after-tax rate of return to savings. Equation (1) may also be written:

$$\left(\frac{C_t}{C_{t-1}}\right)^{1/\sigma}\left(\frac{1+\delta}{1+r_t}\right)\Bigg] = 1 + \varepsilon_t, \tag{2}$$

where ε_t is a stochastic term with conditional mean zero at time $t-1$. Taking logs of both sides of (2), and imposing the approximation that $\ln(1+x) \approx x$, for x small, one obtains

$$\Delta c_t = -\sigma\delta + \sigma r_t + \sigma\varepsilon_t, \tag{3}$$

where $\Delta c_t = \ln C_t - \ln C_{t-1}$. Since r_t and ε_t are potentially correlated, it is useful to decompose r_t into an expected component r_t^e uncorrelated with ε_t and a "surprise" term $r_t - r_t^e$, to obtain an estimable equation:[6]

$$\begin{aligned}\Delta c_t &= -\sigma\delta + \sigma r_t^e + \sigma(\varepsilon_t + r_t - r_t^e) \\ &= \mu + \sigma r_t^e + e_t.\end{aligned} \tag{4}$$

Much recent debate has focused on the observation of Flavin (1981) that consumption seems excessively sensitive to anticipated changes in income, which have a positive and significant effect when included in equation (1). Interpretations of this positive coefficient have emphasized the idea that some fraction of consumers face liquidity constraints and consume their income in each period. To aid in this interpretation, Campbell and Mankiw (1987) consider a general model where λ individuals are liquidity constrained, "Keynesian" consumers, and $(1-\lambda)$ individuals obey the permanent income hypothesis. In this case, if Δy_t^e is defined to be the expected current change in the logarithm of income of the liquidity-constrained group, equation (4) can be rewritten:

$$\begin{aligned}\Delta c_t &= \lambda\Delta y_t^e + (1-\lambda)[\mu + \sigma r_t^e + e_t] \\ &= \mu' + \sigma' r_t^e + \lambda\Delta y_t^e + e_t'.\end{aligned} \tag{5}$$

The implications of the permanent income hypothesis are straightforward in this context. Invoking rational expectations, that is, instrumenting with variables in the information set at the beginning of period t, should yield an estimate of λ insignificantly different from zero. Noting that, as first pointed out by Working (1960), time aggregation could induce an MA(1) error in equation (2), making period $t-1$ variables inadmissible as instruments, Campbell and Mankiw use twice-lagged variables as instruments to obtain

estimates of λ ranging from .413 to .668. They conclude that roughly 50% of income is held by consumers who face liquidity constraints.

Similar reasoning can be applied to consumers as stockholders. Predictable changes in dividends, already in the current information set, should be incorporated into consumption plans. Thus, expected dividends should affect only the consumption of the liquidity constrained. If we divide the income of liquidity-constrained households, Y_t, into dividend income D_t and all other income Y_t^*, then, in logarithms, $\Delta y_t \approx (1-\gamma)\Delta y_t^* + \gamma \Delta d_t$, where γ is the proportion of total income that dividends represent for these households. Thus, equation (5) may be rewritten:

$$\Delta c_t = \mu' + \sigma' r_t^e + \lambda_1 y_t^* e + \lambda_2 \Delta d_t^e + e_t', \tag{6}$$

where $\lambda_1 = \lambda(1-\gamma)$ and $\lambda_2 = \lambda\gamma$.

The notion that liquidity constraints can be significant in explaining consumption out of expected dividends is, as we suggested earlier, difficult to support. Put simply, γ must be very small. Row 1 of table 3.1, taken from the 1983 Survey of Consumer Finances, gives estimates of the proportion of corporate equities held by individuals in different strata of the income distribution.[7] Our measure of income includes all money income received by the members of the sample in 1982. Notably, nearly all stock ownership is by those individuals at the top of the income distribution, with almost 78% of all corporate wealth held by the top 5% of the income distribution. In addition, as mentioned before, if stockholders did face constraints they could easily relax them by selling their stock.

Absent liquidity constraints, the coefficient on expected dividends, λ_2, should be zero unless the corporate veil exists. Since expected changes in dividends are already included in agents' current inferences about their asset positions, they should not affect consumption.[8] This is true regardless of the tax treatment of those dividends and whatever the process is that drives dividend changes. The coefficient on dividends, λ_2, measures the response of consumption to perceived wealth-neutral changes in dividends. If there is a corporate veil, this will be positive and significant.

As a final extension of the Euler equation approach we will further decompose disposable income into components attributable to capital and labor, keeping dividends separate. This will aid in the interpretation of excess sen-

Table 3.1 **Percentage of Total Wealth Held by Different Income Classes (taken from the 1983 Survey of Consumer Finances)**

	Income Class (percentile)						
	0–10	10–25	25–50	50–75	75–90	90–95	95–100
% Corporate wealth	.263	.385	2.511	4.396	7.919	6.866	77.661
% Other wealth	2.108	4.309	10.185	16.192	16.056	10.428	40.722

sitivity as liquidity constraints in the form of an individual's inability to borrow against future labor income. The equation we estimate is:

$$\Delta c_t = \mu' + \sigma' r_t^e + \lambda_1 \Delta y l_t^e + \lambda_2 \Delta y k_t^e + \lambda_3 \Delta d_t^e + e_t'. \tag{7}$$

To guard against a possible aggregation-induced first-order moving average error term, we can estimate this equation using doubly lagged instrumental variables.[9]

3.3.2 The Data

For our estimation we use quarterly and annual data from 1948–85 taken from the Citibase dataset. For consumption, we use aggregate consumption of nondurables and services. Our interest rate variable is the average six-month Treasury-bill rate for the quarter less the inflation rate based on the implicit price deflator for nondurable consumption.[10] Income is defined as aggregate disposable income and excludes after-tax dividends when these are included in the Euler equation. After-tax aggregate labor income, capital income, and dividends are constructed in a manner similar to that used by Blinder and Deaton (1985). Variables are converted to real values with the aggregate deflator for nondurable consumption. Every variable but the interest rate is in logs and per capita. Further discussion of the construction of our variables is available in the data appendix below.

3.3.3 Results

We review first the results from our quarterly regressions. As a starting point, our estimation of equation (5) is reported in table 3.2, which reports the instrumental variable results based upon an instrument set that includes second, third, and fourth lags of consumption and income; the second lag of the six-month Treasury-bill rate; and second, third, and fourth lags of pretax corporate profits and the after-tax return to shareholders of a dollar distributed versus a dollar retained, taken from Poterba (1987).[11] Our finding of a σ insignificantly different from zero agrees with results reported in Hall (1988) and Campbell and Mankiw (1987). Our estimate of λ of .431 is very close to Campbell and Mankiw's reported estimates, which range from .413 to .668. The accompanying t-statistic is 3.56, implying that there is clear excess sensitivity of consumption to expected changes in disposable income.

The estimates of equation (6) are reported in the second row of table 3.2. We use the same set of instruments but include three lags of dividend changes, starting with the second lag. Again, our estimate of σ is insignificantly different from zero. Our estimate of λ_1 decreases slightly to .378 but is again statistically significant. The estimate of λ_2, our measure of the corporate veil, is slightly positive but insignificantly different from zero, indicating that consumption is not excessively sensitive to dividends.

Equation (7), a further generalization of the Euler equation, is reported in the third row of table 3.2. Again, second, third, and fourth lags of the differ-

Table 3.2 **Euler Equation Estimates (*t*-statistics in parentheses); Dependent Variable = Log-differenced Consumption (quarterly, 1947:1–1986:1)**

Equation	Constant	Δyd_t^c	r_t^c	Δdiv_t^c	Δyk_t^c	Δyl_t^c
(5)	.002	4.31	−.002	. . .	. . .	. . .
	(3.01)	(3.56)	(.137)			
D-W = 2.34, R^2 = .111, $\bar{R}^2$ = .093						
(6)	.003	.378	−.010	.065	. . .	. . .
	(3.20)	(2.89)	(−.503)	(1.16)		
D-W = 2.39, R^2 = .121, $\bar{R}^2$ = .095						
(7)	.004	. . .	−.058	.056	−.085	.458
	(4.15)		(−2.45)	(1.17)	(−1.09)	(3.67)
D-W = 2.27, R^2 = .177, $\bar{R}^2$ = .145						

Note: All variables, except the real interest rate, are expressed as differences of the logs of population-deflated variables.

enced variables and the second lag of the interest rate are used as instruments. Here, disposable income is broken down into its labor and capital components. The estimate of λ_1, interpretable as the proportion of labor income held by those who are liquidity constrained, is a statistically significant .458. Both coefficients on capital income are insignificantly different from zero, with the coefficient on nondividend capital income equal to −.085.

The annual results in table 3.3 use the same specification, but are based on instrument sets including once-lagged variables. We include such instruments because some variables are quite hard to predict using instruments lagged at least two years; our test of a corporate veil has little power unless a reasonable prediction of future dividend changes is possible.[12]

In comparing equations (5)–(7) in table 3.3 to those in table 3.2, we see few qualitative differences. The coefficients on disposable income are somewhat higher and those on dividends somewhat lower, but the conclusions are basically the same.

We have estimated these equations using different measures of the interest rate, different sets of instruments, different deflators, and different measures of consumption. In every case, we obtained results of a similar nature: we have found no evidence that consumption is excessively sensitive to changes in dividends, that is, no evidence of the existence of the corporate veil. In each case, the error is serially uncorrelated, making the standard error estimates used to calculate the reported *t*-statistics admissible.[13] All of the variables used in the estimation are difference stationary, so no problems of spurious regression are present.

How conclusive are these results concerning the existence of the corporate veil? The insignificance of the predicted changes in dividends is an important finding in light of previous claims to have "proved" the corporate veil's exis-

Table 3.3 **Euler Equation Estimates (t-statistics in parentheses); Dependent Variable = Log-differenced Consumption (annual, 1947–85)**

Equation	Constant	Δyd_t^e	r_t^e	Δdiv_t^e	Δyk_t^e	Δyl_t^e
(5)	.005	.472	−.017	. . .	. . .	. . .
	(2.39)	(5.42)	(−.284)			
D-W = 2.21, R^2 = .576, $\bar{R}^2$ = .537						
(6)	.008	.554	−.030	.022	. . .	. . .
	(2.414)	(4.888)	(−.453)	(.463)		
D-W = 2.28, R^2 = .586, $\bar{R}^2$ = .527						
(7)	.011	. . .	−.152	.025	.012	.492
	(2.229)		(−2.951)	(.555)	(.169)	(4.832)
D-W = 2.36, R^2 = .693, $\bar{R}^2$ = .631						

tence. The fact that predicted disposable labor income is consistently highly significant in these regressions while being no easier to predict shows that the insignificance of dividends is not due simply to the use of poor instruments.[14]

Yet, one must recognize that the results in tables 3.2 and 3.3 are not powerful enough to reject all alternative hypotheses corresponding to the corporate veil. For example, under the alternative hypothesis that the same fractions of dividend income and labor income accrued to households facing liquidity constraints and having a marginal propensity to consume current income of unity, we would expect the coefficient on expected dividends, λ_2, to equal the fraction of consumption accounted for by such households, λ, multiplied by the ratio of dividends to disposable income. Since this ratio is of the same order of magnitude as the coefficients of predicted dividends, we would be unable to reject the alternative hypothesis. We have already suggested, however, that there are fundamental inconsistencies with an alternative hypothesis based on liquidity constraints. The only plausible alternative must invoke myopia or irrationality to explain excess sensitivity. Thus, it is important to determine the source of the documented excess sensitivity of consumption to predictable changes in labor income. Unless a source compatible with the corporate veil is found, the results will support our conclusion against the veil's existence.

3.4 Credit Crises as Switching Regressions

As we have noted, there is more than one interpretation of the above result that consumption is excessively sensitive to changes in income. In this section we provide further evidence, based on a Markov switching model, that this excess sensitivity does indeed reflect the impact of liquidity constraints. We find that excess sensitivity has been episodic and confined to a relatively small number of postwar years, typically during recessions and/or credit crises.

In their concluding remarks, Campbell and Mankiw remark that the violation of the Euler equation is only a recent phenomenon. "The evidence against the permanent income model comes primarily from the second half of our sample period, 1969–85" (1987, 32). Since a portion of this period is one of increased national debt and higher real interest rates, it is not inconceivable that borrowing behavior somehow changed after 1969, but testing this is not straightforward, because, as Neftci (1984) noted, arbitrarily splitting data and testing for parameter differences may bias results in favor of finding multiple parameter regimes. This observation suggests an alternative specification of the model of the consumer: we consider a model where all consumers consume according to the permanent income hypothesis, except for occasional surprise episodes of nonoptimal consumption caused by economywide "credit crises." Specifically, we estimate the following switching model:

$$
\begin{aligned}
\Delta c_{it}^{*} &= \sigma_i r_{it}^{e} + \lambda_i \Delta y_{it}^{e} + e_{it} \\
\Delta c_{it} &= \Delta c_{1t}^{*} \quad \text{if } i = 1 \\
&= \Delta c_{2t}^{*} \quad \text{if } i = 2,
\end{aligned} \tag{8}
$$

where c_{it} is the logarithm of observed consumption, r_{it}^{e} is the expected interest rate, Δy_{it}^{e} is the expected change in the logarithm income, and e_{it} are independent, normally distributed errors. If liquidity constraints only appear occasionally, there will be two distinct states.[15] The liquidity-constrained state will have a large, positive, and significant coefficient on income. The unconstrained state will look like the random walk predicted by the permanent income hypothesis. Following Goldfeld and Quandt (1973) we model the transition from state 1 to state 2 as a first-order Markov process.

Even with the simplifying Markov assumption, the likelihood function for this model is quite cumbersome, since the likelihood of each possible "trajectory" through the data must be investigated. At first glance, this seems to require the summation of 2^t terms in the calculation of the likelihood, something infeasible even in small samples. But, as Coslett and Lee (1985) have shown, the likelihood function can be rewritten using a recursive relation that takes advantage of the assumed Markov structure and greatly reduces the computational burden.[16] Even with this simplification, the model is a difficult nonlinear estimation problem, with the usual accompanying problem of possible local maxima and minima. To estimate the model we use the same data used in the above Euler equations,[17] but in this case we use only annual data since our earlier results suggests that time aggregation will not alter the results significantly and the use of annual data further reduces the required computation time. Since our analysis is only meant to be suggestive of the benefits of this approach, we further simplify by approximating the expected interest rate with the actual lagged interest rate, and expected income with lagged income, rather than using instrumental variables. The Davidson-Fletcher-Powell nonlinear search algorithm was used to find the optimum. Since the likelihood function is very nonlinear, and may have numerous local maxima, different

starting values were tried in order to assure that the maximum attained is global. Finally, the Coslett-Lee algorithm was started up by assigning the initial probability of being in each state its unconditional value.[18] The estimated matrix of second derivatives is used to construct the standard errors.

The results of the parameter estimation are reported in table 3.4. We find clear evidence of multiple regimes. In regime 1, the unconstrained regime, our estimate of σ is a statistically insignificant .047. The estimate of the coefficient on lagged changes in income is $-.023$, which is also insignificant. Sensitivity to the interest rate is slightly higher in the second regime, with a σ estimate of .082, but this coefficient is, given its standard error, still insignificantly different from zero. The liquidity constraint estimate for the second regime is .526. The accompanying t-statistic of 6.07 is significant at the .999 level of confidence. These estimates mesh quite well with previous estimates of the model's parameters, suggesting that our alternative nonlinear (because of the interaction of the switching model and the linear consumption model) specification and our simplifying assumptions are reasonable. The estimated transition matrix and the accompanying t-statistics are also given in table 3.4. Both regimes are significantly persistent. The probability of the economy being in the unconstrained state, given that it was unconstrained yesterday is .90. The probability of moving from a constrained state to a constrained state is .74. These values imply an unconditional probability of being in the constrained state of only .28.

To gain further insight into the nature of the two regimes, we calculate the conditional inference of the probability that the current year is in the constrained regime. The calculation of these probabilities follows the observation of Hamilton (1989), that time t information can be combined with our inference about the Markov probabilities to construct the best estimate of the state of the world at time t, conditional on our best guess about the state of the world at $t - 1$. For example, if the probability of being in each state at time $t - 1$ is .5, and the transition probabilities are also .5, then the conditional probability of being in state 1 at time t is simply the proportion of the total likelihood attributable to that state. If the Markov probabilities are different from .5, then the likelihoods are reweighed to account for the Markovian in-

Table 3.4 **Maximum-Likelihood Estimation of Switching Regimes Model: Dependent Variable Is Log Change of Consumption (t-statistics are in parentheses)**

	r_t	Δy_{t-1}	σ_i	P_{ii}
State 1	.047	$-.023$	1.079	.896
	(.60)	($-.27$)	(7.52)	(2.28)
State 2	.082	.526	.510	.743
	(1.18)	(6.07)	(3.87)	(2.04)
Log-likelihood = 53.79				

formation about the likelihood of each path through the data. If, for example, we have a strong inference that yesterday was in regime 1, and the Markov probability of remaining in state 1 is very high, than we might classify today as regime 1, even if the state-2 model appeared to fit the current observation better. Starting at time zero, a chain of successive inferences can be used to estimate the most likely trajectory taken through the two underlying models.

Table 3.5 contains the conditional state probability for each year. The prob-

Table 3.5 Conditional Probability of Being in the Constrained State

Year	Probability	Credit Crisis	Average − Prime Rate
1949	.000		.70
1950	.000		.64
1951	.000		.75
1952	.039		.50
1953	.235		.53
1954	.000		.54
1955	.000		.47
1956	.023		.26
1957	.011		.10
1958	.270		.72
1959	.000		.54
1960	.041		.38
1961	.245		.50
1962	.097		.50
1963	.193		.50
1964	.000		.50
1965	.489		.52
1966	.739	*	.40
1967	.637	*	.36
1968	.574	*	.40
1969	.646	*	.25
1970	.668	*	.57
1971	.257		.60
1972	.480		.57
1973	.618	*	.27
1974	.000		.47
1975	.000		.40
1976	.008		.75
1977	.160		.85
1978	.314		.50
1979	.328		−.33
1980	.896	*	2.49
1981	.980	*	1.12
1982	.951	*	2.25
1983	.749	*	−.48
1984	.107		.41
1985	.000		−.03

Note: Asterisks confirm presence of a credit crisis.

ability estimates are in accordance with the view, expressed by Campbell and Mankiw, that liquidity constraints first emerged in that late 1960s. However, if we label a year a "credit crisis year" if the probability of being in the constrained regime is greater than .5, then the first constrained year is 1966, not 1969, with the probability of being in the constrained regime being quite low before that and for sustained periods after 1970 as well. After 1966, the economy switches periodically from a constrained to unconstrained regime. Overall, only 10 years in our sample are in the constrained regime. Table 3.5, column 4, lists an alternative measure of credit tightness, the differential between the average and prime lending rates. On average, this is much larger during the "credit crunch" periods providing further indication that the credit crisis interpretation of liquidity constraints is valid.[19]

3.5 A Time-Series Investigation of Consumption from Assets

3.5.1 The Consumption Function and Cointegration

In section 3.2 we showed that one implication of the piercing of the corporate veil is that wealth-neutral dividend changes should have no effect on consumption. Our findings in section 3.3 confirmed the absence of any such effect. In section 3.4, we supported the plausibility of this result by demonstrating that the observed sensitivity of consumption to other forms of current income than dividends is attributable to liquidity constraints, which are very unlikely to apply to corporate shareholders.

This section considers another implication of shareholders' piercing the corporate veil. We focus our attention on a question that was not easily addressed with our previous methodology: Is the marginal propensity to consume out of corporate wealth as high as the marginal propensity to consume out of other forms of wealth? A lower propensity to consume out of corporate wealth would imply a permanent increase in consumption as a result of a shift in resources from corporations to individuals. This heterogeneity of response could be seen as evidence of a subtler form of corporate veil than we considered above. Our previous test found that a change in the portion of existing wealth held in corporate form does not affect consumption.Our new tests address whether the composition of *changes* in wealth affect consumption. While such differences would be consistent with the presence of a corporate veil, there is at least one other potential explanation. Given the wealth distribution statistics reported in table 3.1, a lower aggregate marginal propensity to consume out of corporate wealth would be consistent with a marginal propensity to consume declining with the overall level of wealth. In such a case, a wealth-neutral transfer from corporations to individuals would increase consumption via distributional effects, not because of an effective corporate veil. This possibility is discussed further below.

The outcome of these new tests cannot be inferred directly from the find-

ings to this point. For example, shareholders could understand and compensate for changes in dividend policy while at the same time being more reluctant to raise their consumption to respond to increases in share prices. This reluctance could be attributable to a lack of faith in efficient markets, for example, a belief that a market that had risen might be above its "true" value.

This distinction helps to clarify the alternative possible sources of a corporate veil. We have already dismissed the idea that shareholders are afflicted by the "bird-in-the-hand" fallacy, that a dollar distributed by corporations is intrinsically more valuable once in their hands (holding taxes and other real differences constant). However, dividend policy is but one very simply mechanism by which corporate share values could change. Shareholders might be reluctant to respond to other changes in corporate wealth, as just suggested. Alternatively, they might respond as we predict to changes in shareholder wealth, but the change in the market valuation of corporate shares may not accurately reflect "true" changes in corporate values. In either case, a corporate veil could exist, although by focusing on responses to changes in the market value of corporate wealth we do not consider the latter case.

To effect these alternative tests of the impact of corporate wealth on consumption, we take advantage of recent results concerning cointegrated time series.

One implication of the permanent income hypothesis is that, holding interest rates constant, consumption is a constant fraction of wealth. The concept of wealth, of course, is total wealth, and includes the present discounted value of returns to human capital, human wealth. According to the theory, there should be an equilibrium relationship between consumption and assets, or, in the terminology of Engle and Granger (1987), consumption and assets should be cointegrated.[20] The error term from the equation

$$C_t = \mu(A_t + H_t) + e_t, \tag{9}$$

where H_t is human wealth, should be stationary. Any deviation from the long-run equilibrium relationship is stationary and short-lived. If current income affects consumption, and is itself not stationary, then the error term in equation (9) will not be stationary. Rather, the equilibrium relationship will be of the form:

$$C_t = \mu(A_t + H_t) + \lambda Y_t + e_t, \tag{10}$$

that is, consumption will be cointegrated with assets and income. If interest rates matter, μ will change over time, and there need be no cointegrating relationship between consumption and assets.

We examine the relevance of the additional explanation of the corporate veil mentioned at the beginning of this section by estimating consumption functions similar to equations (9) and (10). If wealth is decomposed into its corporate, human, and noncorporate components, then we can relax the assumption that the propensities to consume from these are equal.[21]

If we difference equation (10) we obtain:

$$\Delta C_t = \mu(\Delta A_t + \Delta H_t) + \lambda \Delta Y_t + e_t - e_{t-1}. \tag{11}$$

The presence of e_{t-1} could lead to inconsistent estimates because it is correlated with the explanatory variables. An alternative approach, if consumption, assets, and income are cointegrated, is to substitute the lagged estimate of the error from equation (10) as a proxy for e_{t-1}. In this "error-correction" model, we can also obtain consistent estimates of the coefficients on assets because the remaining error is orthogonal to the beginning-of-period explanatory variables.[22] For continuity, we exclude after-tax dividends from disposable income and include these separately in the regression. Notice that in these regressions, the coefficients on dividends no longer reflects simply the existence of a corporate veil. Actual current dividends are likely to include new information about future income and hence current wealth as well. The same is true of actual disposable income. However, our focus in this section is not on these coefficients, and the wealth coefficients should not be affected, since consumption responses to new information are assumed to be orthogonal to beginning-of-period wealth.

3.5.2 The Data

We construct our financial asset measure from the quarterly Flow of Funds tables supplied by the Board of Governors of the Federal Reserve Bank.[23] Noncorporate wealth includes total financial assets net of corporate equities and owner-occupied housing. From this we subtract total liabilities net of installment consumer credit. This is consistent with our exclusion of durables from our consumption measure, which is the same as that used in previous sections. Beginning-of-period values are used for all wealth variables. Corporate wealth is item 26 in the flow of funds table, "corporate equities." Our measure of human wealth is the present discounted value of future expected after-tax labor earnings, calculated as a rolling forecast. These earnings are discounted at the arbitrary rate of .015.[24] Specification tests indicated that this assumption was not crucial to the results. The time period considered is 1952–85.[25] Preliminary testing indicated that all of the variables used are difference stationary.

3.5.3 Results

Table 3.6, row 1, gives the result of the estimation of equation (6) using quarterly data, splitting off corporate equities, and not imposing equality of wealth coefficients. The coefficients on human wealth and noncorporate wealth are very similar, but the coefficient on corporate wealth is small and negative. The test for cointegration is essentially a test for the nonstationarity of the error term, that is, in the simplest case, a test of the null hypothesis the errors are first-order autocorrelated with a unit root. Following Sargan and Bhargava (1983), we test the null that the Durbin-Watson statistic is zero. The

Table 3.6 **Estimates of Consumption from Wealth in Levels and Differences (*t*-statistics in parentheses): Dependent variable = Quarterly Consumption**

Constant	Human Wealth	Noncorporate Wealth	Corporate Wealth	*YD*	DIV
1. Quarterly levels:					
.014	.100	.109	−.016		
(.351)	(29.2)	(18.3)	(−4.31)	. . .	. . .
D-W = .316, R^2 = .99, Dickey-Fuller = −2.75, Adjusted Dickey-Fuller = −3.06					
2. Quarterly levels:					
.286	.044	.067	−.001	.358	.307
(8.55)	(9.46)	(12.55)	(−.319)	(13.65)	(.905)
D-W = .646, R^2 = .99, Dickey-Fuller = −4.56, Adjusted Dickey-Fuller = −4.51					
3. Quarterly differences:					
.019	.007	.027	.006	.243	1.56
(3.56)	(.302)	(1.91)	(1.24)	(6.57)	(2.90)
D-W = 1.82, R^2 = .49, error correction parameter = −.161 (−2.07)					

Durbin-Watson statistic is a very low .316, which is close to the 5% critical value of the test of .28.[26] Since the relevant critical value depends upon the data used, this can only be interpreted as weak evidence of cointegration. Two further tests of cointegration shed more light on the issue. The Dickey-Fuller and augmented Dickey-Fuller tests reported in table 3.6, row 1, both accept noncointegration of assets and consumption. Row 2 of table 3.6 presents an estimate of this model with disposable income and dividends included. The coefficients on noncorporate assets and human wealth are somewhat smaller and more plausible. The coefficient on corporate equities is again small and negative. The inclusion of these variables has increased the Durbin-Watson statistic to .65,[27] leading to a clear conclusion that these variables are cointegrated. The Dickey Fuller and augmented Dickey Fuller tests both accept cointegration at the 10% significant level. (The 10% critical values from Engle and Yoo, 1987, are 4.26 and 4.06, respectively). Row 3 contains the estimates of the differenced error correction model. One lag of the error correction term is reported since no further lags were found to be significant in this specification. With the exception of the coefficients on corporate equities and dividends, the coefficients are all smaller. The large drop in the human wealth coefficient may well reflect the noisiness of our imputation method (see note 21).

Table 3.7 presents results for the same model using annual data. These results are quite similar to those based on quarterly data.[28] The pure life-cycle model rejects cointegration, and the inclusion of income leads to the acceptance of cointegration.[29]

Table 3.7 **Estimates of Consumption from Wealth in Levels and Differences (*t*-statistics in parentheses): Dependent Variable = Annual Consumption**

Constant	Human Wealth	Noncorporate Wealth	Corporate Wealth	*YD*	DIV
1. Annual levels:					
−.042	.105	.104	−.017	. . .	. . .
(.092)	(14.29)	(7.99)	(−2.03)	. . .	. . .
D-W = .95, R^2 = .99, Dickey-Fuller = −2.44, Adjusted Dickey Fuller = −2.73					
2. Annual levels:					
.286	.039	.054	−.005	.412	.817
(3.73)	(3.64)	(4.70)	(−.698)	(6.87)	(1.09)
D-W = 1.32, R^2 = .99, Dickey-Fuller = 3.43, Adjusted Dickey-Fuller = −4.08					
3. Annual differences					
.034	−.007	.039	.009	.412	.938
(1.46)	(−.260)	(1.89)	(1.25)	(5.94)	(.438)
D-W = 1.929, R^2 = .86, error correction parameter = −.813(−3.19)					

The most startling conclusion in both sets of regressions is that the aggregate marginal consumption out of corporate equities is so close to zero.[30] As already suggested, this could simply be a reflection of a declining marginal propensity to consume as wealth increases, combined with the high position in the income distribution of shareholders. The distribution of corporate wealth is indeed more skewed than that of noncorporate wealth. Row 2 of table 3.1, again, taken from the 1983 Survey of Consumer Finances, shows the percentage of noncorporate wealth held by different strata of the income distribution. Contrasting this with the distribution of corporate equities depicted in row 1, it is clear that the distribution of noncorporate wealth is more equal, especially in the top brackets. Strong evidence of a declining marginal propensity to consume out-of-asset wealth is supplied in Hoyt (1988), who shows that differences in the ratio of wealth to permanent income across income classes grow dramatically over the life-cycle. Hoyt concludes that this indicates a much higher saving propensity among the wealthy. Other evidence of different propensities to consume across the income distribution is supplied in Drobny and Hall (1987), who use a relative tax variable to identify distributional effects in an aggregate consumption function. They find that the marginal propensity to consume is much higher among low-rate, that is, low-income, taxpayers.[31]

Given the existing evidence of differing propensities to consume among income classes, combined with the right-skewed distribution of corporate wealth, one may explain the very low observed coefficient on corporate wealth without requiring the presence of a corporate veil, as we have defined it. This

explanation is entirely consistent with our rejection of the corporate veil in section 3.2, because the previous experiment of altering dividend policy holds constant the distribution of wealth across the population, while the current approach need not. Nevertheless, even without a corporate veil, such a low coefficient could still imply important consumption effects of shifts in the distribution of income away from corporate shareholders. However such distributional effects have little to do with the separate existence of corporate entities and depend very much on the particular policy experiment being envisaged.

3.6 Conclusion

This paper has used the modern theory of the consumer to devise a new test for the existence of the corporate veil. We find evidence that consumption is not excessively sensitive to fluctuations in dividends, reconfirming the view that shareholders successfully pierce the corporate veil. This finding is corroborated by other results suggesting that the significant excess sensitivity of current consumption to other forms of income is due to liquidity constraints that, unlike irrationality and myopia, cannot plausibly be associated with consumption from corporate equity wealth.

We find very little consumption from corporate assets in our consumption functions. This could be interpreted as evidence for a corporate veil. However, one may also explain this as representing the presumably very low propensity to consume of shareholders, 77% of whom are in the top 5% of the income distribution. For many purposes, this distinction could be important. Future research, perhaps using panel data to isolate differences in propensity to consume from various assets, should examine these distributional issues more closely.

Data Appendix

The variables used in our analysis are constructed as follows (all variables not taken from the Flow of Funds [FOF] tables are taken from the NIPA section of the Citibase dataset):

1. Consumption is personal consumption expenditures on nondurables and services.

2. Disposable income is broken down into its capital and labor components by assigning proprietors' income and personal income taxes to each according to its factor share. Dividends are also converted to after-tax values in this way. Capital income includes interest payments. Labor income also includes wages and salaries, other labor income, and transfer payments.

3. Human wealth is the present discounted value of all future labor income

(as defined above) and is calculated as a simple univariate forecast of labor income. This forecast is constructed by first regressing full-sample labor income on a constant and a trend, subtracting these, then performing an eight-lag VAR on the detrended series. These VAR coefficients are then used to forecast labor income given period t information, then the constant and trend are added back in.

4. Corporate wealth is item 26 of the FOF sector balance sheets for households. As there is a separate entry for pension fund reserves (item 30), our variable excludes equities held by pension funds. Such pension assets are included in our measure of noncorporate wealth.

5. Noncorporate wealth is also taken from the FOF sector balance sheets for households. It equals owner-occupied housing (item 4) plus total financial assets (item 11), less corporate equities (item 26), and total liabilities net of installment consumer credit (item 35 minus item 40). We exclude installment consumer credit and consumer durables for consistency with our consumption definition, which excludes durables.

6. The interest rates used are quarterly averages of the six-month and three-month Treasury-bill rates.

Notes

1. Even with dividend taxes present, consumption should change only to the extent that the dividend payment reduces the shareholder's wealth. This effect should be small, and under the "new view" of corporate equity valuation (Auerbach 1979) should be nonexistent. In any event, since the tests derived below examine the effects on consumption of changes in dividend policy, holding wealth constant, any effects on wealth of pure financial policy associated with taxes will be purged from the estimated consumption response.

2. Another possible channel for increased consumption effects would be wealth-induced changes associated with the shift in the tax burden. While there is a plausible theoretical argument that the provisions of the 1986 act should have increased the value of corporate shares (Auerbach 1989), this does not seem to be the mechanism the authors have in mind. However, this ambiguity highlights the problem in identifying the source of the perceived impact on consumption.

3. For further evidence of the existence of the corporate veil see Bhatia (1979) or Hendershott and Peek (1987). For recent evidence against the corporate veil see von Furstenburg (1981).

4. Indeed, corporate savings is extremely difficult to define. For example, an increase in share repurchases and reduction in dividends appears as an increase in corporate savings and a concomitant decline in personal savings.

5. See Phillips (1986) for a recent discussion of spurious regressions.

6. Several issues arise in considering whether it is acceptable to apply such "representative agent" equations to aggregate time-series data. Several authors have addressed these questions in the past with no clearly preferable alternative resulting. We do not claim exception from the usual criticisms, but neither do we view the current tests as especially sensitive to the types of aggregation bias involved, since the absence

of a corporate veil implies a particular zero restriction for each individual's consumption behavior.

7. We are grateful to Scott Hoyt for making this table available to us. In principle, one would prefer a distribution of corporate wealth by capital income classes, since individuals with low tangible wealth but high labor income would not be in a position to sell assets in order to consume. However, this change would probably not alter the table's basic message significantly.

8. An alternative test suggested to us would consider whether responses of consumption to *unanticipated* dividends were zero once unanticipated changes in wealth were accounted for. In principle, this test should yield the same results as ours, but it has the considerable disadvantage of requiring us to observe unanticipated wealth changes. (In our specification, this is not needed because observable lagged consumption is assumed to incorporate all information about wealth.) Otherwise, conditional dividend surprises are likely to convey positive information about wealth, and contaminate the test.

9. The use of doubly lagged instruments is also appropriate to correct for the presence of transitory consumption. If transitory consumption is white noise, then it will also cause differencing to introduce an MA(1) error component.

10. Alternative specifications using an after-tax interest rate yielded virtually identical results and are not reported.

11. This variable is only calculated (and only makes sense) annually, so in quarterly regressions the annual value for the corresponding year is used.

12. In the regressions presented, the first-stage $\bar{R}^2$ values for the changes in dividends are in some cases higher than those for other forms of disposable income. For example, in eq. (7) of table 3.2, the $\bar{R}^2$ is .06 for labor income, .05 for nondividend capital income, and .13 for dividends. For eq. (7) of table 3.3, the corresponding values are .33, .17, and .28. The annual estimates using doubly lagged instruments were similar to those reported in table 3.3, except for the coefficient on dividends, which was slightly negative. The fit of the first-stage regressions using doubly lagged instruments were quite poor, however, making the power of our test questionable. While aggregation problems most definitely still exist when using annual data, we report our estimates using singly lagged variables since these results are moderately more favorable to the existence of the corporate veil.

13. In this light, it should be unsurprising that application of the Hayashi-Sims (1983) correction for serial correlation also had little impact on our findings. For this reason, we do not report them.

14. We investigated a second alternative explanation for the insignificance, that dividend changes in general might have little influence on consumption, by including dividend surprises in the second-stage regression. We found the coefficient on unexpected dividends to be positive and significant.

15. Actually, consumer behavior in such a model would be different in the transition years between states, perhaps making a four-state model the proper specification. Unfortunately, the addition of two more states greatly increases the computational burden and will be pursued at a later date.

16. The basic idea is that the model is simply a mixture of two normal distributions, with the relative weight of each depending on all information upon to time T and the Markov probabilities. The algorithm passes through the data, using new information to recalculate the weights given each distribution at each time period.

17. The interest rate used is the annual average of quarterly three-month Treasury-bill rates.

18. For example, the unconditional probability of being in state 1 is: $p21/(p12 + p21)$. See Chiang (1980) for more details.

19. The differential reported is the average rate on short-term commercial loans

minus the prime rate, taken from the Federal Reserve Bulletin. We were unable to obtain a full series of another alternative measure of credit tightness attributable to Jaffee (1971). We interpret the relatively low differential during the 1960s credit crisis as reflective of the well-known quantity rationing in lending markets that occurred at that time, most notable the credit crunch of 1966. In an alternative specification, which interacted the differential with income in an Euler equation, we found that the interaction term had the correct sign but was not significantly different from zero. This is perhaps a reflection of the noisiness of the measure during the 1960s.

20. This assumes, of course, that they are both the same order of integration. All of the variables we use are integrated of the first order, or $I(1)$.

21. Since eqq. (6) and (7) also hold in differences, one might also make inferences about the relative speeds of adjustment to changes in different forms of wealth by comparing the estimates from the levels regressions to those using differences. Since differencing is equivalent to passing the data through a filter that gives little weight to the low frequencies in the data, one would interpret the differenced estimates as "short-run" coefficients and the levels estimates as the long-run coefficients. However, given the errors with which noncorporate assets and, especially, human wealth are computed, one would also expect differences to depress the coefficients of the variables. Separating these two effects (errors in variables and lagged adjustments) is not a simple task.

22. The error correction coefficient can also be interpreted as representing an estimate of $(\rho - 1)$, where ρ is the first-order serial correlation coefficient from the levels regression.

23. The quarterly FOF data were taken from the "Household Net Worth" tables published by the Board of Governors of the Federal Reserve Board, March, 1988.

24. This value of the discount rate might be slightly lower than the actual rate. Increasing the discount rate translates into a slightly higher coefficient on human wealth in our regression. Following Hayashi (1982), it is possible to construct a model to estimate the discount rate of human wealth. Our estimates of Hayashi's model were very unreliable, however, and quite sensitive to the detrending technique and convergence criterion used. Because of this, we omit reporting of these estimates in this paper.

25. We start at the later date of 1952 because that year marks the beginning of the availability of the quarterly wealth numbers from the FOF tables.

26. The choice of the proper test is quite a complicated issue. We use the Durbin-Watson test because of its ease of computation and intuitive appeal. The Dickey-Fuller and augmented Dickey-Fuller tests are also reported.

27. The 10% critical value reported in Engle and Yoo (1987) for a higher order model is .46 for sample size 100.

28. For the annual regressions, we also tried including estimates of social security wealth, kindly supplied by Selig Lesnoy of the Social Security Administration. However, this variable was computed only through 1974. The resulting reduction in degrees of freedom may in part explain the erratic results that followed.

29. The 10% critical values in this case are .83 (Durbin-Watson), 4.42 (Dickey-Fuller) and 3.85 (augmented Dickey-Fuller).

30. This result *is* consistent with earlier findings. Bean (1986) reports similarly small estimates of the impact of corporate wealth on consumption. Blinder and Deaton (1985) report only an estimate based on total net worth as a measure of wealth. Their estimate is approximately equal to our estimated coefficient for noncorporate wealth. In an alternative specification (not reported) that excluded human wealth, we obtained a slightly higher coefficient (.015) for corporate wealth, but interpret this simply as evidence that the stock market is useful in predicting future labor income. One potential explanation of this result in both sets of regressions is that the induced relationship between owner-occupied housing and the imputed rent on such housing raises the coef-

ficient on noncorporate assets above its true value. Leaving these two variables out of assets and consumption, respectively, actually leads to an increase in the gap between the two coefficients on assets. In eq. (3), the coefficient on corporate wealth goes from .009 to .010 and that on noncorporate wealth rises from .039 to .058.

31. Additional evidence on the effects of income redistribution on aggregate consumption is supplied in Borooah and Sharpe (1986).

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Comment

Angus S. Deaton

It is a pleasure to be asked to discuss a paper such as this in which there is a real possibility of using econometric analysis to discover something that is of great significance for economic policy. Auerbach and Hassett quote the Data Resources, Inc. (DRI) prediction that the recent tax changes will reduce private savings by $19 billion, and, although none of us is very likely to accept that estimate, even a much smaller effect would indicate that this is an area where tax policy can have a dramatic effect on saving. Indeed, it is hard to imagine any other way in which apparently minor tax changes could be used

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to have such a large influence on saving and, presumably, capital formation. Unlike many other questions of equal policy import, this also seems to be one where we should have at least a fair chance of discovering something. The theoretical framework is clear and there are plenty of data. And there are also "the modern theory of the consumer" and "recent advances in time-series econometrics" waiting to be applied to give us clearer answers than ever before. I think that this paper does indeed take us further than we have been before, although it also leaves a number of problems and puzzles.

In the first part of the paper, that is "the modern theory of consumption" part, the authors use an Euler equation approach to derive a relationship between changes in consumption and the real interest rate, to which they propose to add anticipated changes in dividends. I think the Euler equation can be safely ignored. First, the relationship (1) is not an Euler equation and cannot be derived from one without ignoring important terms. Second, the authors use a pretax real interest rate, whereas the correct posttax rate behaves very differently. But of course we know that none of this is going to work whether it is done correctly or not; there simply is no relationship in the time-series data between changes in consumption and the real interest rate. The approach here is much more closely related to the literature following Flavin, who found that lagged income was correlated with the change in income, a result that has been widely ascribed to the presence of borrowing constraints for at least a fraction of the population. Auerbach and Hassett set out to show that this effect is not due to dividends. If it were, so that additional dividends significantly relaxed liquidity constraints, then changes in tax policy that discouraged retentions in favor of dividends could certainly decrease private saving.

The paper does not find any such effects. I believe the result, although the evidence in the paper is not overwhelmingly convincing. The problem is largely econometric. In order to avoid time-aggregation effects, only instruments lagged two periods or more are used in the regressions, but, for many of the variables, such instruments have only very poor explanatory power. In consequence the standard errors are large, so that in the conclusion that anticipated dividends do not significantly affect changes in consumption, it is the word "significantly" that ought to be emphasized, not the words "do not." While it is true that the significance of the income term survives the instrumentation, it is a good deal larger to start with, larger than we would expect the dividend term to be, even if we accepted some part of the DRI view, that dividends get spent.

Even so, it is implausible that many dividend recipients are liquidity constrained. Note that liquidity constraints are likely to be binding for those who have low nonhuman wealth and current labor income relative to their future anticipated labor income or inheritances, and such people are not exclusively poor. In consequence, table 3.1, on the fractions of wealth held by income groups, is not quite what we want, but I do not believe that the true picture

would be very different. Of course, we do not really know that the sensitivity of consumption to anticipated income comes from liquidity constraints rather than something else. In the next part of the paper, Auerbach and Hassett buttress the liquidity story, and thus the implausibility of dividends affecting consumption. I have few quarrels with the modeling here, although it seems to me to make more sense to think of their probability that the economy is in a credit crisis as reflecting the proportion of consumers in the economy who are unable to borrow as much as they would like. Such a reinterpretation may require some reformulation, but I doubt that it would be very difficult to do so. The evidence in table 3.5, associating high probabilities of credit crisis with high real interest rates, is less strong than one would like. Indeed, if there really is such an effect, it should have been included in the model that was estimated.

In the last part of the paper, we come to the "recent advances in time-series econometrics." In particular, a good deal of attention is paid to the consequences of regression analysis when some or all of the right-hand-side variables are integrated processes. Although the regressions here look very similar to those that have often been run to test the corporate veil, the interpretations are different, and a good deal of necessary (and welcome) attention is paid to whether and when it is correct to use the OLS standard errors for inference. As Auerbach and Hassett note, the very low Durbin-Watson statistic when consumption is regressed on human wealth, noncorporate and corporate wealth, can be taken as evidence that the variables are not cointegrated, and though the introduction of income and dividends improves the cointegration tests, the distribution of the test statistics is still nonstandard, so that it is hard to infer much from these results. Instead, they focus attention on a first-difference specification with the induced moving average errors dealt with by inclusion of the lagged errors from the levels regression. Although the rapid convergence of the parameter estimates in the cointegrated regression implies that this two-stage procedure is asymptotically valid, recent Monte Carlo evidence suggests that there may still be problems in samples of the size used here.

But econometrics apart, the most surprising feature of these final results is that there is no apparent effect of corporate wealth on consumption. In the paper that Alan Blinder and I wrote for Brookings,[1] almost the only robust result was the effect of unanticipated changes in stock market wealth, and we did not think we were discovering anything that has not been found by many others over many years. Indeed, Hall's original rejection of the "random walk" consumption function concerned the influence of (lagged) stock market wealth on consumption, and others have replicated this result. Why then are

1. See A. S. Blinder and A. S. Deaton, "The Time Series Consumption Function Revisited" (*Brookings Papers on Economic Activity*, no. 2, 465–511).

the results of this paper so different? This seems like an important and urgent task for research.

If I put all three parts of the paper together, I find that there are results that I believe, and results of which I remain skeptical, at least for the time being. But there also remain some real problems in reconciling the results with any coherent story of the way in which changes in corporate wealth get through to households. I am prepared to believe that anticipated changes in dividends do not affect consumption, and I am prepared to believe that the anticipated changes in income that do affect consumption have nothing to do with dividends. But the last negative, that the stock market has no effect on consumption, is hard to swallow, partly because of previous evidence that it does, but also because it removes any link between corporate wealth and its owners. It is possible that stockholders do not accept the stock market's valuation as an accurate measure of corporate wealth, but if not, they must use some other measure, which, if we could identify, would affect consumption levels. We know it cannot be dividends, so what is it? In not providing an answer, the paper leaves us with as many puzzles as it resolves.

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