Consumption and Capital Market Imperfections: An International Comparison

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The excess sensitivity of consumption to current income fluctuations is higher in countries where consumers borrow less. Low levels of consumer debt can result either from capital market imperfections or from a low demand for loans. The evidence suggests that the former view is more appropriate than the latter, and thus supports the hypothesis that excess sensitivity may be attributed to liquidity constraints, rather than to other factors.

The most important implication of the Life-Cycle Permanent Income Hypothesis (LC-PIH) is that individual consumption depends on the resources available to the consumer over his entire lifetime (Franco Modigliani, 1986). Recently this view has been challenged by substantial empirical evidence pointing to the role of current disposable income in explaining consumer behavior (Marjorie Flavin, 1981; Robert Hall and Frederic Mishkin, 1982; Fumio Hayashi, 1982). Of the assumptions required by the LC-PIH, the postulate of perfect credit markets has been almost naturally indicted for the empirical failure of the theory. If a consumer cannot borrow and lend at the same interest rate whatever amount he needs to carry out his optimal consumption plan, at some stage his desired consumption will probably be constrained by current resources (especially by disposable income and financial assets).

If the excess sensitivity of consumption to income stems from liquidity constraints, the implications for fiscal policy can be far-reaching: (i) a switch from taxes to debt may be non-neutral even if all consumers optimize over an infinite horizon;[1] (ii) one should reconsider well-known results in the theory of optimal taxation, such as the desirability of labor versus capital income taxes, and of proportional versus progressive taxation (see Glenn Hubbard and Kenneth Judd, 1986); (iii) the response of consumption to transitory taxes and transfers is greater than that predicted by the LC-PIH, giving larger scope for anticyclical fiscal policy.

In principle, however, one cannot rule out that the excess sensitivity of consumption derives from the failure of other assumptions of the LC-PIH, such as the consumers' ability to make rational forecasts of future income. Excess sensitivity may also be due to test mis-specification. For example, it can arise from improper aggregation over agents or over time or from imposing auxiliary restrictions on preferences, like the separability between consumption and leisure in the utility function.[2]

In this paper we provide new evidence on the role of liquidity constraints in explaining the excess sensitivity of consumption. If capital market imperfections are at the root of

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[1]Recent research has provided important qualifications to the statement that public financial policy is non-neutral when credit markets are imperfect: see Hayashi (1985) and Toshiki Yotsuzuka (1987).

[2]Hall (1987) surveys a substantial body of literature investigating why empirical tests so often reject the predictions of the LC-PIH.

the excess sensitivity, one would expect the departures from the predictions of the LC-PIH to be larger in countries with imperfect capital markets than in countries where they are well developed and highly competitive.[3] Thus, as a first step, we check whether there are discernible differences in the excess sensitivity of consumption across countries. We find that these differences are large, and that the overreaction of aggregate consumption to disposable income is more pronounced in countries where consumers borrow less from capital markets (Section I).

One could argue that a low ratio of consumer debt to aggregate consumption per se signals widespread liquidity constraints in that country. This is not necessarily true. The extent to which consumers borrow in order to finance their spending does not depend only on the terms at which banks are willing to lend (the supply side), but also on the amount that consumers themselves want to borrow (the demand side). Thus, our second step is to examine the measurable factors that affect the supply and the demand for consumer loans in the countries considered, in order to check whether international differences in consumer debt can be attributed to differences in the stringency of liquidity constraints rather than in the demand for loans (Section II). On the supply side, we concentrate on the wedge between borrowing and lending rates and on indicators of credit rationing. On the demand side, the observable factors that are likely to affect the amount of consumer debt include tax incentives to borrow, the age structure of the population, the earnings profiles of consumers, and their preferences.

On the whole, the evidence suggests that interest rate wedges and demand factors can hardly explain the international pattern in the recourse to consumer credit and mortgage loans. This pattern results instead from different degrees of rationing by financial intermediaries. We conclude (Section III) that the fact that consumer debt is low in countries where the excess sensitivity of consumption is high can be interpreted as evidence that liquidity constraints in the form of quantity rationing are at the source of the empirical failures of the LC-PIH in time-series tests.

[3] The approach is similar to that used by Bradford DeLong and Lawrence Summers (1986), who exploit institutional change in the history of the U.S. credit market rather than cross-country variation to analyze this issue. They compare evidence on U.S. aggregate consumption for the prewar and postwar period, and suggest that the substantial decline in the excess sensitivity of consumption to income may be due to the much easier access to consumer credit by households after the war.

I. The Excess Sensitivity of Consumption and the Market for Consumer Debt

In this section we face two questions. First, we investigate if the deviations from the predictions of the LC-PIH differ significantly across countries. Second, we check whether the countries characterized by high excess sensitivity of consumption are also those where consumer debt is low. As mentioned, a low level of consumer debt may reflect either severe liquidity constraints or little desire to borrow. This issue is taken up in Section II.

A. *Excess Sensitivity*

To provide an answer to the first question, we follow the steps of Hall (1978), who has shown that the first-order conditions for intertemporal maximization impose testable restrictions on the time-series properties of aggregate consumption, if one also assumes that consumers (i) can freely borrow and lend at the same rate of interest, (ii) form expectations rationally, (iii) have identical, time-separable preferences, with a quadratic or isoelastic instantaneous utility function, and (iv) cannot die in debt. The representative consumer's problem is then

$$(1) \qquad \text{Max } E_0 \sum_{t=1}^{T} [1/(1+\delta)]^t U(c_t)$$

$$(2) \qquad \text{s.t. } A_{t+1} = (1+r)(A_t + w_t - c_t), \quad \text{for } t = 1, \ldots, T-1,$$

$$(3) \qquad A_T \geq 0,$$

where T is the length of life, δ is the constant rate of time preference, c_t and w_t are consumption and labor earnings, respectively, A_t are asset holdings and r is the constant rate of return on assets.[4] Assuming that instantaneous utility is quadratic, that is, that $U(c_t) = -(\alpha - c_t)^2$, the first-order conditions for an optimum are

$$(4) \quad c_t = \left(1 - \frac{1+\delta}{1+r}\right)\alpha + \frac{1+\delta}{1+r}c_{t-1} + e_t \quad \text{for} \quad t = 1, \ldots, T,$$

where the error term e_t is uncorrelated with all variables known to the consumer at time $t-1$, including of course c_{t-1} and the expected component of disposable income y_t^d. If y_t^d is generated by

$$(5) \quad y_t^d = X_{t-1}\beta + u_t,$$

X_{t-1} being a set of variables known to the consumer at time $t-1$ and u_t a white-noise expectational error, the model predicts that the conditional expectation of disposable income $E(y_t^d | X_{t-1}) = X_{t-1}\beta$ should not affect current consumption c_t. In other words, the coefficient of any variable belonging to X_{t-1} should not be significantly different from zero in a regression of consumption on a constant and its own first lag. Flavin (1981) and Hayashi (1982), upon performing variants of this test, found that the null hypothesis could be rejected, implying that consumption is more sensitive to disposable income than implied by the theory.

Following Hall (1978) and Hayashi (1982), one can place an interesting interpretation on the coefficient of disposable income in such a regression. Suppose that the population consists of two groups, receiving shares $1-\lambda$ and λ of total disposable income. Consumers in the first group behave according to the LC-PIH (i.e., equation (4)), while consumers in the second spend their entire disposable income, because they are liquidity constrained.[5] The consumption of the first group is then

$$(6) \quad c_{1t} = a_0 + a_1 c_{1t-1} + e_t,$$

where

$$a_0 = \left(1 - \frac{1+\delta}{1+r}\right)\alpha,$$

$$a_1 = \frac{1+\delta}{1+r},$$

and that of the second group

$$(7) \quad c_{2t} = \lambda y_t^d.$$

Using equations (6) and (7), total *per capita* consumption $C_t = c_{1t} + c_{2t}$ can be written as

$$(8) \quad C_t = a_0 + a_1 C_{t-1} + \lambda\left(y_t^d - a_1 y_{t-1}^d\right) + e_t,$$

which involves a nonlinear constraint on a_1. According to equation (8), one can interpret the *degree* of excess sensitivity of consumption to current income (λ) as the share of income accruing to consumers who do not behave according to the LC-PIH.

Since the transitory consumption disturbance e_t in (8) is likely to be correlated with the income innovation u_t in (5), least squares estimation of equation (8) can produce inconsistent estimates. The two common approaches to overcome this problem are (i) the nonlinear instrumental variables (NLIV) procedure employed by Flavin (1985) on time-series data and by Joseph Altonji and Aloysius Siow (1987) on panel data, using the variables in X_{t-1} as instruments; (ii)

[4] Earnings are the only source of uncertainty, although the model can also accommodate a stochastic return on assets (Hall, 1987).

[5] This is to be considered as an approximation. In a model where consumers take into account the probability of being liquidity constrained at some future date, liquidity constraints show up as a nonzero value of the Lagrange multiplier associated with the borrowing constraint (see Stephen Zeldes, 1989). The value of this Lagrange multiplier will vary over time and across consumers, but it will almost invariably correlate with current disposable income.

the full-information maximum-likelihood (FIML) estimation of (8) and (5) imposing cross-equation restrictions. The first method allows one to test the nonlinear restriction implied by (8), and the second to test also the cross-equation restrictions on β. Each method has its drawback. FIML is more efficient than NLIV in estimating the parameters of equation (8) if the forecasting equation (5) is specified correctly, but leads to inconsistent estimates if (5) is mis-specified. To strike a balance between the inefficiency of NLIV and the potential inconsistency of FIML, the model has been estimated with both methods, testing the restriction on the coefficients of (8) by NLIV and also the cross-equation restrictions by FIML.

The validity of the NLIV and FIML estimates and tests rests on the assumption of trend-stationarity of the regressors. If one instead believes them to be nonstationary, one could still estimate equation (8) in levels, relying on the results proved by Kenneth West (1986). He has shown that linear instrumental variables estimators are consistent and asymptotically normal even if some of the regressors are nonstationary, provided they have a nonzero drift. Since this result has been established solely for linear regressions, it applies to equation (8) only when it is estimated in its unconstrained form, that is, by IV rather than by NLIV.[6] Alternative estimation strategies for the nonstationary case have been suggested by John Campbell and Angus Deaton (1987) and Campbell and Greg Mankiw (1987) (who both assume $a_1 = 1$). In the former article, the authors transform the model in terms of saving (that is stationary under the PIH) and of changes in income (that are stationary if income has a unit root). With this approach one can again test whether *anticipated* changes in income affect changes in consumption, and interpret the coefficient of the anticipated income component—the excess sensitivity parameter—precisely as we interpret λ.[7] Campbell and Mankiw, instead, estimate a first-differenced version of (8), where λ reduces to the coefficient of the changes in disposable income.

The model has been estimated for seven countries: Sweden, United States, United Kingdom, Japan, Italy, Spain, and Greece. The choice of countries has been suggested by two considerations: (i) to investigate whether excess sensitivity bears a systematic relationship to the diffusion of consumer credit and mortgage loans, one must analyze countries where these markets have reached different degrees of development; (ii) data limitations have imposed the exclusion of developing countries, where information on consumer debt is unavailable and series for consumption of nondurables and disposable income are often unreliable. All series are on a yearly basis, and the estimation period varies somewhat from country to country, according to the availability of data. The dependent variable is real *per capita* consumption of nondurables,[8] and the instruments (the variables in X_{t-1}) are a linear trend and the first lag of consumption, dis-

[6] The unconstrained estimates of the coefficient of current income in equation (8) yield approximately the same ranking of the seven countries as that resulting from the constrained estimates reported in Table 1 below. We take this as a sign that the ranking may be unchanged even if the assumption of nonstationarity were violated.

[7] A closely related implication of excess sensitivity to *anticipated* income changes is that *unanticipated* changes in income will affect consumption by less than predicted by the PIH, resulting in what has been labeled "excess smoothness" of consumption. As explained by Campbell and Deaton, "there is no contradiction between excess sensitivity and excess smoothness: they are the same phenomenon" (p. 33). Both of them can be generated by the existence of liquidity constraints. Incidentally, since these authors proceed under the assumption that $a_1 = 1$, the identification of λ in their estimation approach requires disposable income not to be a pure random walk, but a more complex nonstationary process where there is some predictability to income changes. The same remark applies to Campbell and Mankiw (1987).

[8] The LC-PIH applies to the consumption of nondurables *plus* the service flow from durables. Since the latter series is unavailable for most countries, we have excluded it from our measure of consumption. This practice is appropriate if the relative price between durables and nondurables is constant or if utility is separable in the two types of consumption goods.

TABLE 1—THE EXCESS SENSITIVITY OF CONSUMPTION AND THE MARKET FOR CONSUMER DEBT

	Excess Sensitivity Estimates				Consumer Debt Scaled by Total Consumption		
	NLIV method		FIML method				
	λ	L.-L. Ratio	λ	L.-L. Ratio	Personal Consumer Loans	Housing Mortgage Loans	Total Consumer Debt (D/C)
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = (5) + (6)
Sweden	0.12	4.0	−0.05	5.6	36.7	80.3	117.0
1965–83	(1.1)		(−0.4)				
USA	0.21	0.6	0.17	5.2	22.0	61.7	83.7
1961–84	(2.3)		(2.0)				
U.K.	0.40	7.0*	0.51	21.9**	9.9	46.4	56.3
1961–83	(7.6)		(11.5)				
Japan	0.34	2.6	0.52	7.4	1.1	32.7	33.8
1971–83	(5.0)		(11.3)				
Italy	0.58	13.0**	0.58	0.4	2.1	7.8	9.9
1961–85	(22.4)		(33.0)				
Spain	0.52	8.4**	0.72	10.0	5.9	7.7	13.6
1961–84	(5.2)		(21.2)				
Greece	0.54	2.2	0.60	0.2	0.2	9.9	10.1
1965–82	(15.3)		(71.6)				

NLIV: Nonlinear instrumental variables, FIML: full-information maximum likelihood.

The L.L. (Log-Likelihood) ratio in column 2 refers to the test on the constraint on the coefficients of equation (8) in the NLIV estimates, in column 4 to the joint test of this constraint on the coefficients of equation (8) and of the cross-equation restrictions on this β in the FIML estimates. One asterisk (*) indicates rejection at the 5 percent significance level ($\chi^2_1 = 5.0$, $\chi^2_4 = 11.1$), two asterisks (**) rejection at the 1 percent level ($\chi^2_1 = 7.9$, $\chi^2_4 = 14.9$).

The values in columns (5), (6), and (7) are 1980–85 averages, unless otherwise stated in Appendix A2, which also reports sources and definitions.

posable income, government expenditure, and exports. Sources and definitions for all the variables are reported in Appendix A1.

Table 1 displays the results, both for the NLIV estimates (columns 1–2) and for the FIML estimates (columns 3–4). For brevity, in each case we report only the estimate of λ and the log-likelihood ratio test statistic for the two above-mentioned set of restrictions. The NLIV estimates in column 1 show that the excess sensitivity parameter λ is significantly different from zero for all countries except Sweden, and that its magnitude varies widely from country to country, attaining the highest values for Italy, Spain, and Greece, the lowest for Sweden and the United States, and intermediate ones for Japan and the U.K. This overall ranking hardly changes when one turns to the FIML estimates in column 3, even though Italy and Spain switch places in the high-λ group and the U.K. and Japan do the same in the middle-λ group.

Comparing the estimates of λ with those reported in the literature is of some interest. The estimate for the United States is quite close to those provided by Hall and Mishkin (1982) using the Michigan Panel Survey of Income Dynamics ($\lambda = 0.20$) and by Randall Mariger (1986) using the *1963 Survey of Consumer Finances* ($\lambda = 0.19$). Ricardo Caballero (1986) reports estimates of λ for the United States and Italy that are very similar to those presented in Table 1.[9] Our estimate for Japan, on the other hand, is considerably higher than that obtained by Hayashi (1985b) on the basis of the Japanese Survey of Family Consumption (0.15). How-

[9]He finds substantial cross-country variation in the excess sensitivity parameter in a set of ten countries (Switzerland, United States, Germany, Italy, Ireland, South Africa, Chile, Korea, Thailand, and Honduras). Interestingly, in his study λ attains the lowest value for the United States.

ever, given the limited number of observations used for Japan, our estimate must be taken with caution. To the best of our knowledge, the values of λ for the remaining countries are not comparable with other existing evidence.

The constraints imposed in estimating λ are in most cases consistent with the data. As shown by the value of the log-likelihood ratio in column 2, the constraint on the coefficients of (8) is rejected for Italy and Spain at the 1 percent confidence level and for the U.K. at the 5 percent level. As indicated by the log-likelihood ratios in column 4, the nonlinear constraint on the coefficients of (8) and the three additional cross-equation constraints imposed in the FIML estimation are not rejected, with the exception of the U.K.

Overall, the results of the Euler equations indicate that in virtually all countries the strict LC-PIH is rejected and, even more importantly, that the *degree* of excess sensitivity λ varies substantially across countries. As discussed above, λ can be interpreted as the fraction of income accruing to consumers who do not behave according to the LC-PIH. In the literature it is often taken for granted that these consumers face binding liquidity constraints. However, in principle there are other reasons that could account for excess sensitivity: nonrational expectations about future income, misspecified preferences, improper aggregation over agents or over time (see Hayashi, 1985a and Hall, 1987). To check if the degree of excess sensitivity of consumption can be actually explained by liquidity constraints, it is necessary to investigate the features of the credit markets in which these constraints could arise. As a first step in this direction, we relate the ranking of λ to the amount that consumers borrow in each country.

B. *The Size of the Market for Consumer Debt*

Statistical sources do not treat consumer debt as a homogeneous stock, and always respect the institutional distinction between the market for personal consumer loans and that for housing mortgage loans. This distinction is useful because it reflects important differences between the two types of loans. Personal consumer loans are generally not collateralized and often subject to different tax provisions relative to mortgage housing loans. Governments tend to intervene more pervasively in the market for mortgages than in that for personal loans. However, the distinction between the two markets should not be overrated. In the countries where they have been more carefully analyzed (the United States and the U.K.), there is evidence that consumers tend to arbitrage between them, often obtaining credit more easily or cheaply in the market for mortgages in order to finance their current consumption rather than the purchase of a house.[10] Based on these considerations, we report in Table 1 separate measures of the outstanding stock of personal consumer loans (column 5) and of housing mortgages (column 6), as well as their sum (column 7), scaling each of them by total consumption expenditure.

In reading the numbers in columns 5 to 7, it should be kept in mind that national statistics on the outstanding stock of consumer debt are difficult to compare, so that these numbers should be regarded as approximate measures of the existing differences in national markets for consumer debt (see Appendix A2 for data sources, definitions, and direction of potential biases). Still, international differences are so large that measurement errors may hardly reverse the

[10] In Britain, where the market for housing mortgages has been booming in the 1980s under the impact of deregulation, "it seems certain that a sizable amount of new lending has gone indirectly to finance spending on goods or other real or financial assets, rather than additions or improvements to the owner-occupied housing stock" (*Bank of England Quarterly Bulletin*, September 1982, p. 395). In 1982–4, for example, the excess mortgage borrowing from this market (the net cash withdrawal from the housing market) has been "roughly equivalent to 3.5 percent of total consumers' expenditure" (*Bank of England Quarterly Bulletin*, March 1985, p. 87). This development in the U.K. during the 1980s parallels the U.S. experience of the 1970s, when borrowers took advantage of a much freer mortgage market to switch from uncollateralized borrowing to borrowing on mortgage.

ranking of the seven countries. The ratio of personal consumer credit and housing mortgages to consumption (hereafter denoted by D/C) in Italy and Greece is about 12 times smaller than in Sweden and 8 times smaller than in the United States!

The most striking feature of Table 1 is that the ranking of D/C in column 7 has an almost exact relationship to that of λ in columns 1 and 3. The countries where aggregate consumption exhibits more pronounced excess sensitivity to current income are also those where consumers borrow less from capital markets, the only exception being the U.K. It would be inappropriate, however, to infer from this correlation alone that in the countries where one observes small debt-consumption ratios people face severe liquidity constraints. One cannot rule out that in countries such as Italy or Spain consumers might *want* to borrow less than their U.S. or Swedish counterparts. The next step is to check whether the large international differences in consumer debt are indeed due to the fact that consumers are rationed more severely or simply less inclined to borrow in some countries than others.

II. Are Cross-Country Differences in Consumer Debt Due to Liquidity Constraints?

The factors that can explain cross-country variation in the amount of consumer debt naturally fall in two groups: those concerning the *supply* of loans to consumers (the wedge between lending and borrowing rates and the existence of rationing schemes) and those that affect the *demand* for loans by consumers (the fiscal incentives to borrow, the shape of the typical earnings profile, the age structure of the population, and the preferences of consumers). In this section, we provide a quantitative or qualitative assessment for most of these factors.

A. *The Supply of Consumer Loans*

As noted by Mervyn King (1986) and Hayashi (1985a), the *wedge between borrowing and lending rates* is an important piece of evidence on credit market imperfections. In itself, of course, this wedge is consistent with an equilibrium model of the credit market as well as with a rationing model. In an equilibrium model where the wedge arises from imperfect competition or transaction costs, one would expect the equilibrium volume of loans to be a decreasing function of the wedge. This, however, need not be the case in other models. For instance, in a rationing model where the consumer loan rate is pegged below the market-clearing rate under some regulation, and the rate at which banks borrow is exogenous, there is a positive correlation between the wedge and the actual supply of loans. On the other hand, in the asymmetric information model of Joseph Stiglitz and Andrew Weiss (1981), the wedge is independent of the volume of lending as long as there is excess demand for loans.[11]

Accurate information on the terms at which banks are willing to lend to consumers is hard to obtain in most countries, and using it to draw international comparisons is even harder. As shown in Table 2 (column 1), the United States and Italy are the only countries for which we have been able to collect data on the wedge between the rate on personal loans to consumers and the T-Bill rate of corresponding maturity. The wedge is higher in the United States, but this difference could reflect measurement problems.[12]

A more complete picture can be obtained if one turns to the mortgage market, where the wedge between the borrowing rate and

[11] To show that the relationship between the size of the wedge and the volume of lending is ambiguous, however, there is no need to resort to models with rationing. The paper by King (1986), for instance, proposes a market-clearing model with asymmetric information and endogenous wedge determination, where there may be a positive correlation between the wedge and the volume of lending.

[12] In Italy the borrowing rate refers only to banks. In 1986 (the only year for which we have information comparable to that provided in Table 2) nonbank intermediaries accounted for 1/3 of the market for personal consumer loans, and charged a rate between 4 and 8 percentage points higher than that charged by banks. When this is taken into account, the spread becomes 3 points higher than that reported in Table 2 (*Source*: *Bollettino Statistico*, no. 3-4, 1988, Bank of Italy).

TABLE 2—INDICATORS OF IMPERFECTIONS ON THE SUPPLY SIDE OF THE MARKET[a]

	Interest Rate Wedge on Personal Consumer Loans (1)	Interest Rate Wedge on Housing Mortgage Loans (2)	Down-Payment Ratio for Housing Mortgage Loans (3)	Proportion of Home-Owners in Selected Cohorts (4)	
Sweden	–	0.77	20–25	–	
United States	6.97	1.78	10–25	< 29	46.9
				30–39	73.7
				Total	75.6
U.K.[b]	–	0.51	0–20	< 29	45.9
				30–39	–
				Total	53.2
Japan	–	0.87	40	< 29	17.0
				30–39	46.0
				Total	60.4
Italy	4.93	3.00	40	< 29	24.1
				30–39	37.6
				Total	49.4
Spain	–	–	30–40	–	

[a]All figures are percentages. For data definitions and sources, see Appendix B.
[b]Data for the 30–39 age bracket are not available for the U.K. The proportion of home-owners in the 30–44 bracket is 63.0, that compares with a figure of 75.6 for the same age bracket in the United States.

an appropriate long-term lending rate is available for a larger number of countries (column 2). Italy turns out to be the economy with the largest wedge (3 percent), followed by the United States (1.78 percent), whereas in Japan, Sweden, and the U.K. the wedge is substantially lower (less than 1 percent). In contrast with the huge cross-country variation in the size of the mortgage market, the differences among the interest rate wedges are negligible. Moreover, there is no clear relation between lending volumes and wedges. For example, while in the cases of Italy and Sweden the size of the wedge seems to be inversely related to the volume of lending, in the United States both the mortgage market and the wedge are large relative to international standards.[13] Thus, any framework that predicts a positive or negative correlation between these two magnitudes seems ill-suited to fit the actual pattern. Conversely, a model where the interest rate wedge is independent of the actual amount of lending has a better chance at explaining the data. In this sense, the rationing model of Stiglitz and Weiss appears appropriate, and indicators of rationing may be more relevant than interest wedges to explain the international pattern in consumer debt.

In the remaining part of Table 2 we report data on two indicators of rationing in the market for housing mortgages. Column 3 displays the average *down-payment ratio* (the down-payment required from a mortgagor as a proportion of the price of the house) and in column 4 the *proportion of home-owners in young cohorts* and in the population at large.

The down-payment ratio is a direct indicator of liquidity constraints. If a household cannot provide enough cash for the down-payment, it is denied the mortgage, irrespective of its future ability to repay the loan.[14]

[13]The interest wedges reported in Table 2 are not adjusted for the different marginal tax rates existing in each country. If one proxies these marginal tax rates with the average tax rates and computes the after-tax wedge, taking into account the interest deductibility provisions to be discussed in the next paragraph, the ranking of Table 2 is unaffected.

[14]The importance of this form of liquidity constraints is highlighted by Fumio Hayashi, Takatoshi Ito,

It is remarkable that, according to this indicator, the countries split neatly in two groups: those where the down-payment ratio is between 0 and 25 percent—United States, U.K., and Sweden—and those where it is between 30 and 40 percent—Spain, Japan, and Italy.[15] These numbers are very telling when they are related to those measuring the proportion of home-owners in different age brackets. They suggest that in Italy and Japan home-ownership is on average attained considerably later in life than in the United States and the U.K.[16] In the former two countries the percentage of home-owners below 29 years is much lower than in the other two. In Italy and Japan the probability of owning a house for a person between 30 and 39 is substantially lower (37.6 and 46.0 percent, respectively) than in the population (49.4 and 60.4 percent), whereas in the United States the two probabilities are almost the same (73.7 and 75.6 percent).

To summarize, the wedge between borrowing and lending rates seems to offer little promise as an explanation of the observed cross-country differences in the financial liabilities of households. On the other hand, indicators of liquidity constraints on mortgage markets suggest that rationing is more pervasive in Japan, Italy, and Spain than in Sweden, the United States, and the U.K. In this respect, the international comparison so far supports the view that, at least for the mortgage market, countries with high excess sensitivity and small volume of lending exhibit severe liquidity constraints.

The only country for which this is not true is the U.K., where the estimate for λ is rather large, but the mortgage market is quite developed and the down-payment required for a mortgage is extremely low. It is important to note, however, that the estimate of λ for the U.K. is not very meaningful because in this country the restrictions implied by our specification are rejected by the data both in the NLIV and the FIML estimation (see Table 1). Another reason to discount the value of our estimate of λ for the U.K. is that it is based on data from a period when the British mortgage market was heavily regulated and featured extensive credit rationing by building societies. The data on the size of the mortgage market and on its characteristics refer instead to the 1980s, when entry by commercial banks has eliminated quantity rationing and the market has rapidly evolved toward meeting demand shifts by interest rate changes.[17]

B. *The Demand for Consumer Loans*

When people borrow to finance their current consumption, they dissave. Not surprisingly, their demand for consumer debt depends on the interaction of the same set of variables that affect their supply of saving. In this section we single out some of these variables and try to assess their individual contribution to the observed cross-country variation in consumers' liabilities. We concentrate mainly on differences in the fiscal incentives to borrow, in the typical profile of lifetime income and in the age structure of the population. At the end of the section we discuss briefly the potential contribution of international differences in tastes and intergenerational transfers.

Taxes affect the amount consumers want to borrow in several ways. First, in a number of countries the tax code allows deductions or tax credits for interest costs incurred in the purchase of consumer goods or owner-occupied dwellings. Table 3 contains a sum-

and Joel Slemrod (1987) in a study that compares its effect on the housing tenure and saving choices of Japanese and American households.

[15] These figures become even more significant if one adds that in Italy it takes at least six months to process an application for a mortgage loan whereas in the United States it takes a few days.

[16] Liquidity constraints obviously affect the *timing* of the purchase of a house, rather than the decision of buying a house over one's entire lifetime. The wide cross-country variation in *overall* home-ownership rates results presumably from factors other than liquidity constraints, and thus falls outside the scope of this paper.

[17] See *Bank of England Quarterly Bulletin*, September 1982, pp. 390–98, and March 1985, pp. 80–91.

TABLE 3—FISCAL INCENTIVES TO CONSUMER DEBT

	Personal Consumer Loans (1)	Housing Mortgage Loans (2)	Total Tax Elasticity (3)
Sweden	Interest Fully Deductible	Interest Fully Deductible (Until 1985[a])	2.33 (Until 1985[a])
U.S.A.	Interest Fully Deductible (Until 1987[b])	Interest Fully Deductible	1.55
U.K.	No Incentives	Interest Deductible on Loans Up to 25,000 Pounds (30,000 Pounds Since 1983)	1.72
Japan	No Incentives	Tax Credit of 18 Percent of the Yearly Repayment of the Loan Exceeding 300,000 Yen (for an Amount Up to 150,000 Yen per Year) for 3 Years after the Purchase of Qualified Housing for Owning-Occupation, If Loan Qualifies	1.88
Italy	No Incentives	Interest Deductible up to 4.000.000 Lit. per Year (7.000.000 per Year for First-Time Buyers and in Other Cases Specified by the Law)	1.63
Spain	No Incentives, Except for Loans to Purchase Approved Securities (Fully Deductible) and Stock by Employees in Their Own Company (15 Percent Tax Credit)	Interest Fully Deductible	
Greece	No Incentives	Interest Fully Deductible	1.86

[a]After 1985, interest is not fully deductible for households with tax rates above 50 percent.
[b]With the Tax Reform Act of 1986, this tax provision has been eliminated.

mary of the tax incentives to borrow for current consumption (column 1) and for the purchase of a house (column 2) in each country. The benefits of these provisions depend clearly on the tax rates faced by borrowers, because the interest cost of consumer debt is reduced by an extent that is proportional to the marginal tax rate. A summary measure of marginal tax rates is hard to devise, especially because their impact depends on the distribution of income. An index that may be useful in this respect is the total tax elasticity (column 3), which measures the proportional change in total tax liabilities divided by the proportional change in total income and provides an indication of the progressivity of the tax system. Other things equal, the higher the tax elasticity, the greater the incentive to borrow (a tax elasticity of one corresponds to a proportional tax: see Appendix A6 for details).

The table shows that national tax codes do not encourage personal consumer loans, except in Sweden and the United States, where interest was fully deductible until the recent tax reforms. On the contrary, incentives to borrow on mortgage are widespread. Mortgage interest is fully or partly deductible in all countries except Japan. In this country, however, mortgagors can qualify for a tax credit. Finally, the highest total tax elasticity is found in Sweden (2.33) and the smallest in

the United States (1.55), while the elasticity attains very similar values in the other countries.

Thus the tax deductibility of interest on personal consumer loans may go partly toward explaining why consumer credit is so widespread in Sweden and the United States.[18] In the Swedish case, probably this effect is reinforced by the high degree of progressivity of the tax system, while for the United States the reverse appears to be the case. Since no fiscal incentives to borrow exist in the other countries, taxes cannot explain the differences in the volume of consumer credit among them, and in particular between the U.K. and the remaining four countries.

Similarly, the uniformity of the tax treatment of mortgage interest across countries suggests that there is little hope of explaining the large international differences in mortgage lending by fiscal incentives alone. Indeed, the market for mortgages appears more sizable in the U.K., where interest can be deducted only partly, than in Spain or Greece, where it can be deducted entirely.[19]

A wholly different factor that may explain why consumer debt varies widely across countries is the interaction between the time profile of lifetime income, the age structure of the population, and preferences. The limited availability of cross-sectional data on earnings has forced us to limit our analysis on this issue to a subset of four countries: United States, U.K., Japan, and Italy (see Appendix A7–A8 for data sources).

The *age structure* of the population is considerably different across these four countries. In the United States and Japan the proportion of young people (the ratio of those between 20 and 35 to those between 20 and 75) is 40 and 35 percent, respectively. Conversely, this proportion is 32 percent in Italy and the U.K. The economic implication of different age structures is ambiguous, depending on whether young people are net borrowers or net lenders. If their earnings profiles and preferences lead them to be net borrowers and if capital markets are well functioning, one should observe a greater D/C ratio in countries where the age structure is skewed toward the young (as in the United States and Japan) than in countries where the elderly have a larger weight in the population (as in the U.K. and Italy).

The typical *earnings profile* varies even more than the age structure of the population across countries. Figure 1 displays estimated earnings profiles for the countries considered, obtained by fitting a fourth-order polynomial to the observed cell entries from age 20 to age 75 in national cross-sectional surveys, and normalizing the entries so as to be 100 at age 20.[20] The figure highlights, in particular, that the peak of Japanese earnings is more than 4 times as high as earnings at age 20, while the corresponding ratio is 3 in the U.K., 2.5 in the United States and 2 in Italy. Further, in Japan and in the United States the peak occurs at the same age (be-

[18] Even for Sweden and the United States, the importance of the deductibility of interest on consumer credit should not be overestimated. As Summers (1986) suggests, there is evidence that in the United States "the quantitative significance of tax incentives on private sector financing decisions... may not be very large." He points out that although the institutional changes of the last decade "should have provided significant impetus to the use of debt,... there has been little or no acceleration in the long-run trend toward the increased use of debt over this period" (p. 31). On the other hand, as far as Sweden is concerned, it should be noticed that the high tax progressivity in that country tends to redistribute income toward the young, low-income households, thereby reducing their need to borrow. This may counteract the positive effect that deductions and high marginal tax rates have on borrowing. Thus the overall effect of taxation on consumer debt is ambiguous, even for the Swedish case.

[19] As a matter of fact, since the stock of houses is fixed in the short run, governmental incentives to mortgage loans are capitalized largely in house prices (John Kay and Mervyn King, 1980, p. 12). If the elasticity of the demand for houses is greater than unity, tax incentives are unlikely to translate into major increases in the demand for houses and thus for mortgage loans.

[20] This is just one of the possible normalizations. We have chosen it because it brings out most graphically the difference in the shape of the profiles. As an alternative, one could have standardized each profile by permanent income, equalizing the areas below the four profiles and thus eliminating altogether differences in scale factors across countries. In any event, the simulation results reported below are scalefree.

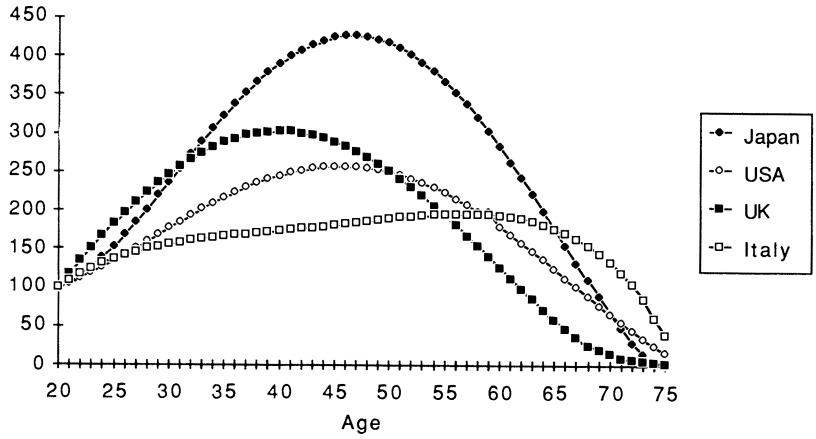

FIGURE 1. EARNINGS PROFILES (VALUE AT 20 YEARS = 100)

tween 45 and 50), whereas in the U.K. it occurs before (early 40s) and in Italy much later (around 55).

Both the curvature of the earnings profile and the location of its peak over the working life are important determinants of the amount of borrowing that a life-cycle consumer demands in his youth. The greater the curvature and the earlier the peak of the earnings profile, the larger the area between the optimal consumption path and earnings in the early stages of the working life, and thus the larger the demand for consumer credit by the young, other things being equal. An informal discussion is clearly insufficient to sort out the effect of the complex interaction among demographics, typical earnings profiles, and preferences. To summarize the overall effect that these factors have on the demand for loans, we employ simple simulations to compute the amount of consumer debt that should be observed in each country *if capital markets were perfect*.[21] We assume that all consumers behave according to the strict life-cycle model, with no bequest motive and no uncertainty[22] (see Appendix B for details).

The output of the simulations (Table 4) is a set of theoretical debt-consumption ratios (D^*/C^*), each corresponding to a combination of the rate of time preference (δ) and the intertemporal elasticity of substitution ($1/\theta$).[23] The ratio D^*/C^* aims only at pro-

[21] Reliance on simulations to check the explanatory power of the life-cycle model is by now standard in applied economics. James Tobin's (1967) pioneering work has been followed by several attempts to replicate the observed wealth-income and saving ratios for the U.S. economy. Recently, Hayashi (1986) has used simulations to examine if the life-cycle model can account for the saving behavior of the Japanese, and Hubbard and Judd (1986) have performed similar exercises on U.S. data imposing liquidity constraints.

[22] In the simulation we do not allow for the effect of productivity growth and progressive taxation on the time profile of individual earnings. We also rule out the presence of bequests, whether intentional or accidental. While allowing for progressive taxation would lead to a lower desired debt, the effect of productivity would probably pull in the opposite direction, in the presence of concave earnings such as those displayed in Figure 1. This effect of productivity growth, although seemingly in contrast with one of the most famous predictions of the life-cycle model, is actually quite obvious if the hump in earnings does not occur when the consumer is young, but when he is middle-aged. This point has been highlighted by Hayashi (1986), analyzing Japanese data. As he explains, if the middle-aged do most of the savings, then "as the secular productivity rate goes up, aggregate saving becomes dominated by a younger and wealthier generation, whose saving rate is lower than the saving rate for older generations" (p. 172).

[23] Most estimates of δ and $1/\theta$ refer to the U.S. economy, and even for this country there is consider-

TABLE 4—SIMULATED DEBT-CONSUMPTION RATIOS (D^*/C^*) WITH PERFECT CAPITAL MARKETS, IN PERCENTAGE[a]

United States				
$1/\theta$	*0.5*	*0.25*	*0.16*	*0.10*
δ				
0.015	59	91	104	114
0.025	104	117	122	125
U.K.				
$1/\theta$	*0.5*	*0.25*	*0.16*	*0.10*
δ				
0.015	19	32	37	42
0.025	37	43	45	47
Japan				
$1/\theta$	*0.5*	*0.25*	*0.16*	*0.10*
δ				
0.015	151	200	218	233
0.025	218	237	243	248
Italy				
$1/\theta$	*0.5*	*0.25*	*0.16*	*0.10*
δ				
0.015	21	60	78	95
0.025	79	100	107	113

[a] $1/\theta$ = Intertemporal elasticity of substitution; δ = rate of time preference. See Appendix B for details.

viding a summary measure of the likely impact of age structure and earnings on the demand for consumer debt, while holding other factors constant, rather than at replicating the observed D/C.

If differences in age structure and earnings profiles are at the root of the observed variation in consumer debt, one should find that in countries where the observed D/C is *comparatively* low, also the simulated D^*/C^* is *comparatively* low. In other words, for given tastes, the ranking of D^*/C^* in Table 4 should roughly match that of D/C in Table 1 (column 7). It turns out that, for given δ and $1/\theta$, D^*/C^* is highest in Japan and lowest in the U.K., while in Italy and the United States it attains intermediate values. Instead, as shown by Table 1, Japan and Italy have both relatively low D/C, while the opposite occurs for the United States and the U.K. Since there is no systematic relationship between the ranking of the simulated values and that of the actual values, differences in age structure and earnings profiles can be dismissed as a valid explanation of the observed differences in D/C.

Preferences are the only factor affecting the demand for consumer loans that we have neglected so far. Other things equal, the desire to borrow is an increasing function of (i) the values of δ and $1/\theta$, (ii) the taste for big-ticket items (mainly durables), and a decreasing function of (iii) the gift and bequest motives, insofar as they induce transfers targeted toward liquidity constrained households.

To account for our cross-country evidence, the taste parameters δ and $1/\theta$ should be lowest in the countries where excess sensitivity of consumption is highest. At an empirical level, little is known on how these parameters vary across countries. At a theoretical level, however, there is no presumption that preferences should be in any way related to excess sensitivity. More can be said about differences in the desire to acquire durable goods, which presumably induces households to go into debt. The data show no relation between the share of durables in personal consumer expenditure and the level of D/C. For example, the U.K., Sweden, and Italy feature similar shares of expenditure on durables but differ widely in terms of D/C.[24] Finally, intergenerational transfers (whether or not altruisti-

able disagreement. We let the two parameters vary over a wide range of values, choosing for $1/\theta$ the range of variation currently regarded as plausible in empirical studies of the U.S. consumption behavior. As for the real rate of interest, our presumption is that, at least in the long run, its value should not be substantially different across relatively open economies. The simulation assumes a 3 percent real interest rate for all countries. While the assumption of an exogenous real rate may be questionable for an economy as large as that of the United States it appears quite reasonable for the other three countries.

[24] The proportion of durables (excluding semi-durables) in total consumption expenditure is 9.8 in the U.K., 9.3 in Sweden, 8.6 in Italy, 4.9 in Japan, and 5.6 in Greece (*OECD National Accounts*, 1980–2 averages). Comparable data for the United States are not available.

cally motivated) could help young households to overcome borrowing constraints. For this to be the case, transfers must be timed correctly. Bequests do not satisfy this criterion, since they generally accrue too late in life to replace borrowing by young households. *Inter vivos* transfers are instead potentially important if targeted toward liquidity-constrained households. Cross-sectional data show that the proportion of households receiving transfers from relatives or friends is 9.8 percent in the United States and 4 percent in Italy.[25] This is *prima facie* evidence against the view that *inter vivos* transfers overcome capital market imperfections.

III. Conclusions

It is time now to relate the evidence provided in the last section with the stylized facts that have emerged from the analysis of Section I. The main finding was that the countries characterized by high excess sensitivity of consumption to current income are also those where consumers borrow little from capital markets. Roughly speaking, the countries of our sample can be partitioned into three groups. In Sweden and the United States, aggregate consumption displays low excess sensitivity to current income and consumers' liabilities are relatively large. In Italy, Spain, and Greece, the opposite is true. The U.K. and Japan are in an intermediate position, with the U.K. having a substantially larger amount of consumer liabilities than Japan.

It would be tempting to give a causal interpretation to this correlation, in the sense of concluding that capital market imperfections are at the root of the small amount of consumer debt observed in some countries, and that this in turn is reflected by the time-series of consumption via the excess sensitivity parameter. In reality, in order to draw this conclusion, one must first clear the ground from two possible objections: (i) excess sensitivity may not originate from liquidity constraints; (ii) cross-country variation in consumer debt could be due to the different desire to borrow by households rather than to capital market imperfections. To sort out these issues, we provide a detailed analysis of the factors that may affect the supply and demand of consumer debt in the countries considered in this study.

On the supply side, the wedge between borrowing and lending rates has very little explanatory power, as one would expect in rationing models à la Stiglitz and Weiss. Instead, indicators of rationing, such as the down-payment required for home mortgages, hold a close correlation with the excess sensitivity of consumption.

On the demand side, tax incentives to borrow provide no clue to explain the differences in the size of the mortgage markets across countries, but may go somewhat toward accounting for the huge difference in the size of the market for personal consumer loans between Sweden and the United States on the one hand, and all the other countries of the sample on the other.

Since the life-cycle hypothesis suggests that differences in borrowing should be tightly related to the profile of lifetime income and to the age structure of the population, we use simple simulations to summarize the likely impact of these two factors on consumer borrowing. For given preferences, earnings profiles and age structures do nothing to explain the observed borrowing patterns across countries. The evidence we have on the potential impact of preferences on the demand for loans also suggests that tastes hold little promise in explaining cross-country variations in borrowing.

Thus no major observable demand factor appears to explain the large international differences in consumer debt. Pure credit rationing may instead account for such differences, especially for mortgage markets. We conclude that the low levels of consumer debt observed in countries where the excess sensitivity of consumption is high can be interpreted as evidence that liquidity constraints are at the root of the empirical failures of the LC-PIH in time-series tests.

[25] We have computed these figures on the basis of the 1983 *Survey of Consumer Finances* for the United States and of the 1988 *Indagine sui bilanci delle famiglie* for Italy.

APPENDIX A. DATA SOURCES

A1. *Data Used for the Euler Equation Estimates (Table 1, columns 1–4)*

For Sweden, United Kingdom, Japan, Italy, Spain, and Greece private consumption expenditure, disposable income, government expenditure, and exports are drawn from *National Accounts*, OECD, Vol. II, Detailed Statistics, 1986. Consumption excludes expenditure on durables, defined as the sum of appliances, furniture, and means of transportation. Each variable is multiplied by the deflator of private consumption of nondurables (1980 base-year) and divided by total population. Data for the United States are from *The Economic Report of the President* (1986).

A2. *Consumers' Liabilities*

2.1 Consumer Credit (Table 1, column 5)

Sweden: Total consumer credit (*Financial Accounts*, OECD, Vol. II, 1985).

U.S.A.: Total consumer credit (*The Economic Report of the President*, 1986, Table B72).

U.K.: Total consumer credit (*Financial Statistics*, Central Statistical Office, July 1987, Table 9.3).

Japan: Sum of debt for consumer credit held by banking and trust accounts, mutual loans and credit banks, and credit associations (*Japan Statistical Yearbook*, 1986, Table 12-20, p. 413). Figures do not include loans made by retailers and by the so-called salary-loan companies (whose weight has rapidly increased in recent years), so that the number reported in Table 1 may be downward biased.

Italy: Total consumer credit (*Bollettino Statistico*, No. 3-4, Appendix, Table 1a, 1988). The figure in Table 1 is the average for 1984–5.

Greece: Total consumer credit (*Monthly Bulletin of the Bank of Greece*, February 1987, Table 23, p. 41).

Spain: Total consumer credit (*Boletino Estadistico*, Bank of Spain, October 1987, Table V-37).

2.2 Mortgages (Table 1, column 6)

Sweden: Advances to nonbank public by mortgage institutions and credit companies, including government loans (*Statistical Abstract for Sweden*, 1987, Table 296, p. 281).

U.S.A.: Outstanding mortgages on 1-to-4 family houses and on multifamily properties, including government underwritten mortgages (*The Economic Report of the President*, 1986, Table B-70).

U.K.: Outstanding mortgages to households for the purchase of houses, including public sector loans (*Financial Statistics*, Central Statistical Office, July 1987, Table 9.3).

Japan: Sum of all housing loans, including those provided by the Housing Loan Corporation, a public sector agency (*Japan Statistical Yearbook*, 1986, Table 12-20).

Italy: Long- and medium-term liabilities of the household sector (*Annual Report of the Bank of Italy*, various issues, Table aD35).

Greece: Total bank credit to the housing sector (*Monthly Bulletin of the Bank of Greece*, February 1987, Table 18, p. 35). This variable provides an upper bound for the stock of mortgage loans, but could overestimate it substantially.

Spain: Outstanding loans for housing, excluding those provided by the Mortgage Bank of Spain (*Boletino Estadistico*, Bank of Spain, October 1987, Table V-37). The figure reported in Table 1 does not include government-financed mortgages. An assessment of their importance is given by Mark Boleat (1985) who states that "...state intervention is limited to the Mortgage Bank of Spain, a government-owned agency which accounts for 20 percent of the market for housing loans in 1983 (p. 229)." In Table 1 this would bring the estimate of mortgages loans to an average of 9.2 percent of consumption expenditure.

A3. *Interest Rates (Table 2, columns 2 and 3)*

In computing the average wedge we have tried to reconcile two aims: matching maturities between lending and borrowing rates and selecting the same maturity for all countries. Each interest wedge is an average of the 1982–86 period and refers to the December rate, unless otherwise specified.

3.1 Consumer Credit Rates

U.S.A.: 24-month personal rate as of November of each year (*Federal Reserve Bulletin*, various issues, Table 1.56).

Italy: rate charged by Banco di Napoli on 24-month personal loans to employed workers (data obtained upon request from Banco di Napoli).

3.2 Short-Term Lending Rates

U.S.A.: Treasury notes and bonds, constant maturities of 2 years, November rates (*Federal Reserve Bulletin*, various issues, Table 1.35).

Italy: 12 months Treasury Bill rate (*Financial Statistics Monthly*, hereafter *FSM*, OECD, Part I, various issues, Table R.2/12).

3.3 Mortgage Rates

Sweden: Rate on mortgage loans in residential buildings extended by commercial banks, up to 75 percent of estimated values, September values (*Sveriges Riksbank Statistisk Arsbok*, 1986, Table M:9).

U.S.A.: Mortgage rate (*FSM*, Part I, OECD, various issues, Table R.2/07).

U.K.: Nominal rate on building societies mortgage loans (*FSM*, Part I, OECD, various issues, Table R.2/17).

Japan: Reference rate on housing loans by city banks (*Economic Statistics Annual and Monthly*, Bank of Japan, October 1986).

Italy: ABI reference rate on housing loans (Associazione Bancaria Italiana). Data for each year refer to subsequent January rather than to December. The average is for the 1983–87 period.

3.4 Long-Term Lending Rates

Sweden: Rate on 10-year government bonds, September value (*FSM*, Part I, OECD, various issues, Table R.2/18).

U.S.A.: Rate on 10-year government bonds (*FSM*, Part I, OECD, various issues, Table R.2/07).

U.K.: Rate on 10-year government bonds (*FSM*, Part I, OECD, various issues, Table R.2/18).

Japan: Rate on 10-year central government bonds (*FSM*, Part I, OECD, various issues, Table R.2/21).

Italy: Rate on fixed-yield government bonds up to 20 years to maturity (BTP), January value (*FSM*, Part I, OECD, various issues, Table R.2/12).

A4. *Down-Payment Ratio (Table 4, column 3)*

Data for Japan are reported by Hayashi, Ito, and Slemrod (1987). For all other countries the source is Boleat (1985).

A5. *Home-Ownership (Table 2, column 4)*

U.S.A.: Data refer to 1980 (*Current Population Report*, Series P-20, No. 398, *Households and Family Characteristics*, March 1984, U.S. Department of Commerce).

U.K.: Data refer to 1980 (*Social Trends*, No. 12, 1982).

Japan: Data refer to 1978 (Boleat, 1985, p. 403).

Italy: Data refer to 1981 (*I bilanci delle famiglie italiane nell'anno 1981*, *Supplemento al Bollettino*, Bank of Italy, March 1983, Rome, Table a4, p. 44).

A6. *Total Tax Elasticities (Table 3, column 3)*

Data, figures, and methods of computations are reported in *OECD Tax Elasticities of Central Government Personal Income Tax Systems*, OECD Studies in Taxation. Taxes include Central Government income taxes only. The elasticities differ slightly due to different definitions of income and number of income classes used to compute them. Data refer to 1979 for Sweden, U.K., and Greece, and to 1980 for other countries. For Italy we have computed the value of the elasticity directly from tax return data using the same method described in the OECD study.

A7. *Age Structure*

For the United States, Japan, and Italy data refer to 1980; for the U.K. they refer to 1981 (*United Nations Population and Vital Statistical Report*, *Special Supplement*, 1984).

A8. *Earnings (Figure 1)*

U.S.A.: Interviews refer to 1982 (our computations based on the 1983 *Survey of Consumer Finances*).

U.K.: Interviews refer to 1983–4 (our computations based upon *Family Expenditure Survey*). Households are excluded if self-employed, for whom data on hours worked are unavailable, or reside in Northern Ireland, for whom data are unreliable.

Japan: Data refer to 1978 (Hayashi, 1986, Table 3, p. 170).

Italy: Data refer to 1984 (*Indagine sui bilanci delle famiglie italiane nell'anno 1984*, *Bolletino Statistico*, Bank of Italy, July–December 1985, No. 3–4, Table 13a).

APPENDIX B. SIMULATION OF DESIRED CONSUMER DEBT (TABLE 4)

We suppose that individual preferences are described by a time-additive isoelastic utility function

$$(B1) \qquad E_0 \sum_{t=1}^{T} [1/(1+\delta)]^t c_{jt}^{1-\theta}/(1-\theta),$$

where δ denotes the rate of time preference, θ the inverse of the intertemporal elasticity of substitution, the subscript j ($j=1,\ldots,J$) the individual's cohort, and T the length of life. In the simulation T is set at 55, on the assumption that on average people enter the labor force and start their consumption plan at 20, and die when they are 75. Under the assumption of no liquidity constraints, the consumer maximizes (B1) only subject to the lifetime budget constraint

$$(B2) \qquad \sum_{t=1}^{T} 1/(1+r)^t w_{jt} = \sum_{t=1}^{T} 1/(1+r)^t c_{jt},$$

w_{jt} being the labor earnings of consumer of cohort j at time t and r the real rate of interest. The optimal time path for individual consumption is then

$$(B3) \qquad c_{jt}^{*} = \left(\frac{1+r}{1+\delta}\right)^{t/\theta} c_{j0}^{*},$$

where

$$(B4) \qquad c_{j0}^{*} = \frac{1-\left(\frac{1+r}{1+\delta}\right)^{1/\theta}\frac{1}{1+r}}{1-\left(\frac{1+r}{1+\delta}\right)^{(T+1)/\theta}\left(\frac{1}{1+r}\right)^{T+1}} \times \sum_{t=1}^{T}\left(\frac{1}{1+r}\right)^{t} w_{jt}.$$

The implied expression for individual wealth at time τ is

$$(B5) \qquad A_{j\tau}^{*} = \sum_{t=1}^{\tau} (w_{jt} - c_{jt}^{*})(1+r)^{\tau - t},$$

starred variables indicating throughout values that would be selected in the absence of liquidity constraints.

Aggregate consumption C_t^* and aggregate wealth A_t^* are then computed as a weighted sum of the consumption and wealth of all cohorts:

$$(B6) \qquad C_t^* = \sum_{j=1}^{J} v_j c_{jt}^*, \quad A_t^* = \sum_{j=1}^{J} v_j A_{jt}^*,$$

where v_j denotes the weight of cohort j in the population. Summing only over the negative terms in the expression for aggregate wealth A_t^*, one obtains the amount of consumer lending that would be demanded if capital markets are perfect, D_t^*. Thus, our calculations of C_t^*, A_t^*, and D_t^* make use of a set of exogenous parameters (r, δ, and θ) and of information on v_j (the age structure of the population) and on w_{jt} (the earnings profiles plotted in Figure 1).

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