BANCA D'ITALIA

Temi di discussione

del Servizio Studi

Durables and Nondurables Consumption: Evidence from Italian Household Data

by Agar Brugiavini and Guglielmo Weber

Numero 184 - Dicembre 1992

BANCA D'ITALIA

Temi di discussione

del Servizio Studi

Durables and Nondurables Consumption: Evidence from Italian Household Data

by Agar Brugiavini and Guglielmo Weber

Numero 184 - Dicembre 1992

The purpose of the «Temi di discussione» series is to promote the circulation of working papers prepared within the Bank of Italy or presented in Bank seminars by outside economists with the aim of stimulating comments and suggestions.

The views expressed in the articles are those of the authors and do not involve the responsibility of the Bank.

This paper – presented at the Workshop on "Saving in Italy: Past and Future Trends, Household and Government Behaviour", held in Rome on 16-17 January 1992 – is part of a research project undertaken at the Bank of Italy. The Italian versions of all the contributions will be published in a special issue of "Contributi all'analisi economica".

Durables and Nondurables Consumption: Evidence from Italian Household Data[1]

by Agar Brugiavini (*) and Guglielmo Weber (**)

Abstract

This paper uses survey information on a cross-section of Italian households to investigate the effects of credit availability on the choice between expenditure on durable goods (vehicles) and nondurable goods.

On the basis of simple regressions, we establish two stylized facts: nondurable expenditure strongly correlates with the value of the stock of vehicles; and reported credit availability has major, ambiguous effects on this tradeoff. We show that both findings can be explained in a utility-consistent, forward-looking framework, where the stock of durables can be used as collateral for credit. We then argue that estimating the structural relations predicted by this model is preferable to estimating simple regressions, as the latter cannot always be interpreted in an economically meaningful way.

Our structural estimates broadly confirm the existence of credit-market effects, and reveal much variability of elasticities within the sample. They also allow to show how the shadow price of the liquidity constraint varies according to observable household characteristics and how it relates to reported credit availability.

(*) Università di Venezia
(**) University College London, IFS and IGIER

[1] We are grateful for the comments made by our discussants, Andrea Bollino and Giuseppe Marotta, and by other workshop participants. The data have been read and skillfully prepared by Margherita Borella. Cindy Miller provided outstanding editorial assistance. The early stages of this research took place at the Institute for Fiscal Studies (under the ESRC Functioning of Markets Initiative, project W102251009), where we received much support and advice, and benefited from discussions with Rob Alessie, Orazio Attanasio and Costas Meghir. We are also grateful for comments from seminar audiences at University College London, ZEW (Mannheim), ESEM92 (Brussels) and Cambridge, but remain responsible for any errors. Guglielmo Weber thanks Olivetti S.p.A. for providing financial support towards his IGIER fellowship.

Introduction

Much empirical analysis of consumption and saving decisions abstracts from the existence of durable goods. Yet consumer durables represent an important part of personal sector wealth and decisions to purchase and sell durables have a major impact on overall consumer expenditure (and contribute to its marked procyclical nature).

One reason for the relative neglect of consumer durables may be that satisfactory data are hard to come by. Aggregate purchase data are normally available but make little economic sense: no distinction can usually be made between changes in the number of consumers who own, and in the average stock owned. Also, no direct information is available on the value of the stock. Hence, few studies have taken the representative agent paradigm down the path of modeling consumption in durable goods (one exception is Dunn and Singleton, 1986). However, household-level data do not normally contain information on durables, beyond ownership and (at best) net purchases. This severely limits the scope for microeconometric research.

The ideal data set for the econometric analysis of durable goods consumption is a long panel, with high quality information on all types of expenditure and retrospective questions concerning durable purchases and sales. Such a data set does not exist, and indeed is unlikely ever to exist: detailed questions on expenditure normally involve filling in diaries, and this is time-consuming. The ideal data set would likely suffer from serious attrition problems.

The data set available to us is an Italian cross-section (the 1987 Bank of Italy survey on Household Budgets), which includes questions on one group of durable goods, transport equipment, plus some retrospective questions on past purchases, detailed information on current credit availability, nondurables purchases, income and socio-demographic characteristics. The cross-sectional nature of the data limits the scope of our analysis: age and cohort effects cannot be separated; uncertainty cannot be fully taken into account.

In this paper we ask the following question: how can we model the tradeoff between durable and nondurable goods? In particular, is this tradeoff strongly influenced by the availability of consumer credit? And is this influence in practice distinguishable from a high degree of heterogeneity in preferences?

The paper is organized as follows: Section 1 describes the data, and sets out the major stylized facts that our theoretical model should explain. Section 2 derives some first order conditions that can be used in estimation and discusses the effects of borrowing restrictions on the decision to purchase consumer durables. Section 3 deals with identification and estimation issues, while Section 4 presents empirical results and Section 5 draws some conclusions.

1. The data and some stylized facts

The Bank of Italy Survey of Household Budgets covers some 8,000 households, and has been run on a rather regular basis for well over a decade. The survey on which this paper is based was conducted in 1987 and contains a particularly rich array of questions on financial and non-financial wealth. Detailed questions were asked not only about durable expenditure, but also about the value of vehicles, of the housing stock, and of other valuables. The data also contain information about financial wealth, both in discrete form (possession or otherwise of specified assets) and in value terms (where some use has been made of other financial surveys). Finally, much is asked about credit availability: for those who applied for consumer credit, we know if they were successful, and at what terms. For the others, we even know why they chose not to apply.

In our application, we concentrate on the choice between nondurables consumption and vehicle services consumption. The latter variable we assume to be proportional, for vehicle owners, to the value of the vehicle stock. Vehicle services are particularly attractive on two grounds: they are a well-defined yet sizable commodity, and the sample information on vehicles is particularly detailed (with a high response rate). In the sample, 7655 households provide valid answers to the question : How much was your vehicle stock worth? Of these 5830 are strictly positive.[1] The average stock value for vehicle owners was 11.15 million lira (about $10,000 at 1987 prices) with a standard deviation of 12.92 million.

In Figure 1 we plot the average value of the stock against the age of the head of household. This type of variable is what one normally uses on aggregate data, where the total stock value (somehow imputed) is expressed in *per capita* terms. There is a pronounced hump over the life cycle, with a sudden decrease around retirement age (which is 60 for most men in Italy). However, Figures 2 and 3 suggest that much of the action in later years comes from decreased ownership levels: once ownership is controlled for, the post-retirement drop is less strong. The mid-fifties peak is however more marked.

---

[1] In fact, the number of valid responses is even higher. However, for a few households other key variables had a missing value.

The drop in ownership after retirement seems mostly due to a decrease in the number of purchases during the year (from about 20% to less than 10% on average, as shown in Figure 4). Few people report selling their cars, and even fewer report an outright sale (i.e., no purchase of a replacement vehicle). This is a puzzling feature often found in micro data sets (like the British FES and the American CEX). Either owners forget having very old, hardly usable cars, or else they fail to report selling them for scrap. (Another possibility is that they let their grandchildren use them!) Finally, the average value of purchases declined very gently with age.

A final picture is of some interest. In Figure 5 we plot the average expenditure on nondurables and the average vehicle stock value against age. The two variables correlate very strongly - the correlation coefficients of their averages by age is 0.88, but even in the raw data their simple correlation exceeds 0.53. Part of this correlation will be due to wealth effects (age and cohort effects are not separately identified here), while some may reflect shifts in life cycle preferences (due to changes in demographic characteristics, say). Finally, some could be due to inability to borrow.

In order to investigate the effect of borrowing ability on the relationship between durables and nondurables consumption, we constructed two credit-market indicators. The first ("cred1") takes value 1 if the household has been refused credit or did not apply for it in the expectation of a denial ("discouraged borrowers"). (This is similar to the variable used by Jappelli, 1990, and has a sample mean of 3.46%. See also Jappelli and Pagano, 1988). The second ("cred2") takes value 1 if the household did borrow funds towards a vehicle purchase (it has a sample mean of 1.21%).

If we run a simple OLS regression for vehicle owners of the *ln* of the vehicle stock on the *ln* of nondurable consumption and cred1 we obtain (standard errors in parentheses):

$$ln(\text{stock}) = -\underset{(.266)}{2.167} + \underset{(.0274}{1.133}\ ln(\text{consumption}) \quad \underset{(.080)}{-.3599}\ \text{cred1}$$

Number of observations = 5830 R^2 = 0.234.

Hence, the inability to borrow decreases vehicle stocks, for a given level of nondurable consumption (or *vice versa*!). If we introduce the ability to borrow against vehicles in the equation, we find:

$$ln(\text{stock}) = -\underset{(.265)}{2.180} + \underset{(.0273}{1.133}\ ln(\text{consumption}) \quad \underset{(.080)}{-.3482}\ \text{cred1} + \underset{(.107)}{.7229}\ \text{cred2}$$

Number of observations = 5830 R^2 = 0.241

which again suggests the potential importance of credit availability in this tradeoff. We obtained very similar results when household size was included in the regressions run. Whether this type of correlation is of economic interest or simply a statistical artifact will be established by estimating a structural model.

These are the stylized facts that our model should be able to predict:

1) expenditure on nondurable goods and the value of the vehicle stock strongly correlate over the life cycle. This correlation is also present (but to a lesser extent) within age groups (i.e., controlling for age-cohort effects);

2) the operation of credit-markets appears to be important. Households that are denied credit own less vehicle stock, for a given level of nondurables consumption. Households that have access to collateralized credit own more;

3) the effects described in 1) and 2) persist when household size.

However, we stress that our "stylized facts" could well be due to other factors such as simultaneity bias, sample selectivity bias, preference heterogeneity, or functional form misspecification.

2

2. A theoretical framework

The decision to purchase a durable good is inherently dynamic. Hence we need to set up the analytical representation in a forward-looking, dynamic context. The life-cycle approach seems the most suitable: therefore we assume that the h-th consumer solves the following optimization problem (h superscripts are omitted for notational convenience):

$$\max E_t \left[\sum_{\tau=t}^{L} \frac{u_\tau(c_\tau, S_\tau)}{(1+\rho)^\tau} \right] \tag{1a}$$

s.t.

$$A_\tau = (1+r_{\tau-1})A_{\tau-1} + y_\tau - p_\tau c_\tau - v_\tau d_\tau \tag{1b}$$

$$A_\tau \geq \Phi_o + \Phi_1 v_\tau S_\tau \qquad \tau = t,\ldots,L-1 \tag{1c}$$

$$S_\tau \geq 0 \qquad \tau = t,\ldots,L \tag{1d}$$

$$A_L \geq 0 \tag{1e}$$

$$S_{t-1},\ A_{t-1} \text{ given} \tag{1f}$$

$$S_\tau = (1-\delta)\ S_{\tau-1} + d_\tau \qquad \tau = t,\ldots,L \tag{1g}$$

where we implicitly assume the existence of an aggregate nondurable good ("nondurables") and of just one durable good, and the following notation applies:

c_τ = nondurable good in period τ

S_τ = stock of the durable good at the end of period τ, in efficiency units

A_τ = net liquid assets at the end of period τ

r_τ = interest rate on liquid assets in period τ

y_τ = labor income in period τ

p_τ = price of the nondurable good in period τ

v_τ = price of the durable good in period τ (per efficiency unit)

d_τ = quantity of the durable good purchased in period τ (in efficiency units)

δ = depreciation rate of the durable good

ρ = time preference parameter.

Equation (1b) is the standard asset accumulation constraint. By using equation (1g) we can substitute out d_τ:

$$A_\tau = (1+r_{\tau-1})A_{\tau-1} + y_\tau - p_\tau c_\tau - v_\tau(S_\tau-(1-\delta)S_{\tau-1}) \tag{1b'}$$

This model differs from the standard neoclassical model of durables consumption in the introduction of the borrowing constraint (1c). Thus, not only do we assume that net wealth cannot fall below a certain threshold, but we also allow for the possibility that this threshold depends on the value of the stock of durables itself. In other words, S_τ acts as collateral *via* the Φ_1 coefficient. Inspection of (1c) reveals that Φ_1 should be negative, and will normally be less than unity in absolute value if S_τ is less than fully collateralized. Note also that Φ_1 may well be a function of observable characteristics (type of occupation, household composition, home ownership, etc.).

The rest of the constraints of the optimization problem are standard. Note, however, the non-negativity condition (1d): as the durable good is not essential for survival, but negative holdings are not feasible (barring home production), we must allow for the possibility that some consumers may perceive the zero lower limit to their stock as a binding constraint.

The first order conditions of this optimization problem are:

$$\frac{\partial u_t}{\partial c_t} = \lambda_t p_t \tag{2a}$$

$$\frac{\partial u_t}{\partial S_t} = \lambda_t v_t - E_t\left[\frac{\lambda_{t+1}(1-\delta)v_{t+1}}{1+\rho}\right] + \mu_t \Phi_1 v_t - \nu_t \tag{2b}$$

$$E_t\left[\frac{\lambda_{t+1}(1+r_t)}{1+\rho}\right] = \lambda_t - \mu_t \tag{2c}$$

$$\mu_t(A_t - \Phi_0 - \Phi_1 v_t S_t) = 0, \qquad \mu_t \geq 0 \tag{2d}$$

$$\nu_t S_t = 0, \qquad \nu_t \geq 0 \tag{2e}$$

When liquidity constraints are ignored, equations (2a) and (2c) can be combined to produce an estimable dynamic equation for nondurables consumption (as in Hansen and Singleton, 1982, for example). The presence of (possibly binding) liquidity constraints invalidates this procedure. However, an estimable equation can be derived, by using (2b) to substitute μ_t out of (2c) (this is the approach taken by Alessie, Devereux and Weber, 1992, who extend to durable goods the framework proposed by Alessie, Melenberg and Weber, 1988).

When credit-market information is available, either equation (2b) or equation (2c) can be estimated over the subsample of consumers who are not currently affected by the liquidity constraint (as is argued by Zeldes, 1989, for an equation like (2c)). This could be our case, given that we have plenty of information on credit status and financial wealth, but we are still faced with the problem that both equations involve quantities dated t and t+1. If we want to use this approach in our application, we need to eliminate quantities dated (t+1) from the estimable equation.

A simple way is to use equation (2c) to substitute λ_{t+1} out of equation (2b). This however requires assuming that λ_{t+1} is uncorrelated with both v_{t+1} and r_t, given information dated t. A sufficient condition for this to hold is that both v_{t+1} and r_t are known at time t. On these assumptions, we obtain:

$$\frac{\partial u_t(c_t,S_t)}{\partial S_t} = \frac{\partial u_t(c_t,S_t)}{\partial c_t}\frac{v_t^*}{p_t} + \mu_t\ (\Phi_1 v_t + (1-\delta)v_{t+1}(1+ r_t)) - \nu_{2t} \qquad \text{(2b')}$$

where $v_t^* = v_t - v_{t+1}(1-\delta)/(1+r_t)$, i.e the user cost.

This equation can be estimated on cross-sectional data, as long as consumers face an identical price for the durable good (i.e., v_{t+1} is not individual-specific), and sample separation information is available on both credit-market status and durables ownership. This we take to be our case.

Equation (2b') lends itself to an intuitive interpretation. For non-liquidity-constrained consumers the c-S tradeoff is fully captured by the user cost relative to the price of nondurables. However, for liquidity constrained consumers other considerations come into play: if S_t has a poor role as collateral, such consumers will shun the durable good in favor of nondurables, and *vice versa* when S_t is "fully collateralized". In analytical terms, the former case corresponds to the inequality:

$$-\Phi_1 < \frac{v_{t+1}\,(1-\delta)}{v_t\,(1+r_t)} \,,$$

i.e., to the case in which lenders allow S_t to be used as collateral for less than its end-of-period discounted value. The latter case corresponds to the inequality being reversed, i.e. to lenders giving the stock of the durable good a positive signaling role of credit worthiness.

3. Estimation issues

In order to estimate an equation like (2b') on cross-sectional data, we need to specify a functional form for preferences. We choose the following extended translog direct utility function (see Meghir and Weber, 1992):

$$u^h(c_t,S_t) = a_1^h S_t + a_2^h \ln S_t + a_3(\ln S_t)^2 + b_1^h c_t + b_2^h \ln c_t + b_3(\ln c_t)^2 + \gamma \ln c_t \ln S_t$$

where:

$$a_1^h = \varepsilon^h$$
$$b_1^h = \eta^h$$
$$a_2^h = a_{2,0} + a_2' z^h$$
$$b_2^h = b_{2,0} + b_2' z^h,$$

with z^h a vector of socio-demographic characteristics, and ε^h and η^h two idiosyncratic error terms (random preferences). This utility function is flexible enough to accommodate a high degree of non-homotheticity, and, *via* its demographic-dependent parameters, of preference heterogeneity.

Flexibility in preference specification is an important requirement in our context. Given the wide variety of behavior at the individual level, an inflexible functional form would imply a poor fit for many households at the tails of the wealth and income distribution. Hence the error term would depend on the very variables that are likely to most affect the shadow price of the net wealth constraint, μ_t. In this case, if in estimating a relation like:

$$\frac{\partial u_t(c_t,S_t)}{\partial S_t} = \frac{\partial u_t(c_t,S_t)}{\partial c_t} \frac{v_t^*}{p_t}$$

for the subsample of car owners, one found violations of the overidentifying restrictions tests, this would not necessarily imply that μ_t is non-zero for some consumers. However, given that the term involving μ_t can be either negative or positive, identification of (2b') requires that we specify some exogenous criterion to separate possibly constrained consumers from the rest.

We assume the error term (which reflects unaccounted-for heterogeneity) to be uncorrelated with age, household composition, income and financial wealth variables, but explicitly acknowledge its effect on both nondurable and durable goods consumption by treating all variables involving transformations of S and c as endogenous in the estimation. The exclusion of financial variables from (2b'), at least for the unconstrained group, provides the necessary restrictions for identification.

The chosen functional form rules out zero consumption of either c or S. We reconcile this restriction with our data (where zero vehicle stock is often reported) as follows: all households consume some transport services. For those who do not own a vehicle, or whose vehicle stock is worth very little (less than 500,000 lira, i.e. $400), transport services are misclassified (public transport is included in c). For the remaining households, public transport is of negligible importance, and transport services are proportional to the value of the stock.[2] Hence we estimate (2b') on the subsample of vehicle owners, but correct for selectivity bias by standard econometric methods (the probit estimates for vehicle ownership are reported in Appendix A).

---

[2] Public transport is relatively cheap and of low quality in most Italian cities. It is normal for Italian car-owners to drive to work every day.

4. Results

Our estimates of equation (2b') are reported in Table 1. The first column presents estimates which refer to the whole sample of vehicle owners. The second column refers instead to the subsample of households who satisfy the following criteria: they are not poor (i.e., their financial wealth is above the first quartile), they were not denied credit (cred1=0) and they did not receive credit for the purchase of vehicles (cred2=0). The first two criteria are self-explanatory. For the third, we want to rule out those households who may be borrowing against purchases of the durable good in order to alleviate the severity of their borrowing limit (see our theoretical model above).

All variables involving c, S or their transformations were instrumented, to correct for simultaneity bias due to random preferences. The full list of both explanatory variables and instruments is given in Appendix B. Instruments involve a number of financial variables, further demographic indicators and their interactions with financial indicators, plus some variables which reflect (albeit imperfectly) previous years' vehicle purchases and sales. The equation also contains a Mill's ratio, which corresponds to the Probit estimates reported in Appendix A - it is worth noting that some explanatory variables in that equation (locational dummies, *ln* of total income) are not included in the instrument list, thus giving the Mill's ratio genuine additional variability.

Neither equation is rejected by the Sargan test of overidentifying restrictions, even though there is a noticeable decrease in the test statistic in going from the full to the subsample. Estimates of the demographic invariant parameters are little affected by the sample choice, while some of the demographic interactions (entering a_2 and b_2) change by larger and more significant amounts (see the estimates of $b_{2,12}$, $a_{2,2}$, $a_{2,10}$, $a_{2,12}$, e.g.). However, a formal test of parameter equality across the two samples is unlikely to reject the null. As argued by Jappelli (1990), sample selection criteria based on financial wealth end up selecting out many unconstrained households, and therefore reduce the power of statistical tests of structural stability.

Another way to gauge the presence of liquidity constraints is to use the subsample parameter estimates to evaluate the value of the term involving μ_t (see equation 2b') for those households who own vehicles but are potentially liquidity-constrained (i.e. for the 987 households included in the "full sample" but excluded from the "subsample").

On the subsample of vehicle owners, equation (2b') can be written as:

$$\frac{\partial u_t(c_t,S_t)}{\partial S_t} = \frac{\partial u_t(c_t,S_t)}{\partial c_t}\frac{v_t^*}{p_t} + \mu_t(\Phi_1 v_t + (1-\delta)v_{t+1}(1+r_t)) = \frac{\partial u_t(c_t,S_t)}{\partial c_t}\frac{v_t^*}{p_t} + \mu_t^*.$$

Table 1 contains all the terms needed to evaluate marginal utility of c and S. If we now simulate the equation on the "constrained" subsample, we can evaluate a composite term which involves both the random preference error, ω (say) and μ^*. By construction, ω is orthogonal to the instruments, hence it can be removed by projecting $(\omega + \mu^*)$ on the instruments and taking the fitted value.

By this method, we obtain an estimate of μ_t^*, which can be regressed against credit and demographic variables, to try and establish who the liquidity-constrained households are, and what effect the constraint has on their durables-nondurables tradeoff. This is done by means of several regressions reported in Table 2. In column (1) we see that "cred1" has a positive, significant impact on μ^*, while "cred2" has a negligible one. Thus, for cred1 we can confirm the finding reported in section 2: other things being equal, credit-constrained households consume less of the durable good. However, the strong effect found in simple-minded regressions for cred2 effectively disappears once a more structural approach is adopted, thus suggesting that it may have been a statistical artifact. Column (3) shows that this type of result comes out much stronger if we concentrate on "poor" households (some of the households included in the "potentially constrained subsample" because they meet the cred2=1 condition have high wealth). In column (2) we look at the effect of demographic characteristics on μ^* (age and regional indicators), while columns (4) and (5) do the same for the "poor" subsample. The most noticeable effect is the differential impact of age: for young consumers μ^* is on average smaller. Even in the most general specification (5) "cred1" has a positive and significant effect on the multiplier while, other things being equal, young consumers are more easily offered credit

3

for a vehicle purchase.

Figures 6 and 7 provide a graphical illustration of the μ^*'s. Figure 6 presents a histogram of μ^*: for most "potentially constrained" consumers μ^* is close to zero. This is not surprising, given our conservative selection rules, whereby households are classified as non-liquidity-constrained if they consider themselves not credit-rationed and are relatively wealthy. However, the histogram reveals that for some households μ^* is far from zero. In view of the regression results presented in Table 2, we expect the μ^* distribution to vary significantly across age groups. Therefore, in Figure 7 we plot the mean of μ^* by age of the head of the household. This picture reveals quite clearly that μ^* is negative for younger households, and positive for older ones.[3] This is consistent with the hypothesis that lenders offer higher credit limits to younger customers, with a view to establishing a long term business relation, but are reluctant to offer good credit terms to older customers.

Finally, Figures 8 and 9 plot conditional own price elasticities for both c and S. An attractive, if arbitrary, way to interpret these is as intertemporal elasticities of substitution (this is equivalent to ruling out general monotonic transformations of our "within period" utility function).[4] If we follow this path, and therefore label these price elasticities as "Frisch", we can see that Italian consumers appear more

---

[3] The curve in Figure 7 is smoothed by means of cubic spline interpolation, allowing for 10 flex points. This procedure reduces the influence of outliers, except at the extremes of the age distribution (where the underlying sample size is much reduced). In our discussion, we therefore disregard the left and right tails of the plot.

[4] For instance, the conditional elasticity of nondurable consumption is defined as $\partial \ln c/\partial \ln p$, keeping λ and S constant. Simple computations show that this equals $(\partial u/\partial c)/[c\ \partial^2 u/\partial c^2]$, which is (-) the elasticity of intertemporal substitution for a given S if u is the utility index which enters life-time utility, as defined in equation (1a). Meghir and Weber (1992) provide derivations of elasticity formulae for the extended direct translog utility function, and discuss their interpretation in greater detail.

willing to engage in intertemporal substitution when we use vehicle stock equations, rather than nondurables consumption ones. Unconditional own-price and cross-price elasticities (still of the λ-constant type, barring monotonic transformations of the utility function), and budget elasticities are reported in Figures 10-15. It is perhaps surprising to note that for most consumers the stock of vehicles is a necessity, and nondurables are a luxury (out of a composite budget, defined as the sum of the vehicle stock and nondurable purchases).

Table 1 - Instrumental variable estimates

DEPENDENT VARIABLE = ln c

sargan test	29.2457	sargan test	26.309368
degrees of freedom	30	degrees of freedom	29
observations	5587	observations	4600

coeff.	variable	full sample estimate (s.e.)	subsample estimate (s.e)
$-b^*_{2,0}$		-1.8021 (0.3658)	-1.9178 (0.3444)
$a_{2,0}$		1.1239 (0.1071)	1.1332 (0.1042)
a_3		0.2227 (0.0217)	0.2084 (0.0246)
γ		-0.1127 (0.0449)	-0.0978 (0.0540)
$-\gamma^*$		0.7201 (0.0785)	0.7077 (0.0892)
$-b^*_{2,1}$	YOUNG	0.1740 (0.2215)	0.2364 (0.2487)
$-b^*_{2,2}$	AGE	0.0715 (0.0470)	0.0848 (0.0452)
$-b^*_{2,3}$	OLDWIF	-0.0317 (0.2278)	-0.0382 (0.1926)
$-b^*_{2,4}$	OLDCOUP	-0.0684 (0.2490)	0.1155 (0.2294)
$-b^*_{2,5}$	HUSBWOR	0.1756 (0.1212)	0.1919 (0.1181)
$-b^*_{2,6}$	NKIDS	-0.0024 (0.0504)	0.0209 (0.0513)
$-b^*_{2,7}$	KID20	-0.0196 (0.0514)	-0.0386 (0.0548)
$-b^*_{2,8}$	MC	-0.0498 (0.0826)	-0.0094 (0.0888)
$-b^*_{2,9}$	NEARN	0.0462 (0.0301)	0.0475 (0.0301)
$-b^*_{2,10}$	SOUTH	-0.1148 (0.0587)	-0.1532 (0.0610)
$-b^*_{2,11}$	INVLD	0.6965 (1.1053)	-1.0898 (3.0341)
$-b^*_{2,12}$	EDU	0.0756 (0.0622)	0.1197 (0.0585)
$-b^*_{2,13}$	SECJB	0.1037 (0.1313)	0.1767 (0.1245)
$-b^*_{2,14}$	CENTR	0.0235 (0.0849)	0.0026 (0.0770)
$-b^*_{2,15}$	INDUST	-0.0620 (0.0524)	-0.0803 (0.0550)

$a_{2,1}$	YOUNG	-0.0584	-0.0901
		(0.0807)	(0.1015)
$a_{2,2}$	AGE	-0.0217	-0.0267
		(0.0141)	(0.0141)
$a_{2,3}$	OLDWIF	-0.0000	0.0078
		(0.0582)	(0.0504)
$a_{2,4}$	OLDCOUP	0.0258	-0.0258
		(0.0667)	(0.0660)
$a_{2,5}$	HUSBWOR	-0.0590	-0.0617
		(0.0350)	(0.0356)
$a_{2,6}$	KIDS	0.0016	-0.0062
		(0.0144)	(0.0164)
$a_{2,7}$	KID20	0.0055	0.0127
		(0.0148)	(0.0178)
$a_{2,8}$	MC	0.0162	0.0026
		(0.0253)	(0.0294)
$a_{2,9}$	NEARN	-0.0151	-0.0158
		(0.0098)	(0.0102)
$a_{2,10}$	SOUTH	0.0361	0.0504
		(0.0187)	(0.0208)
$a_{2,11}$	INVLD	-0.1719	0.3933
		(0.2664)	(1.0509)
$a_{2,12}$	EDU	-0.0244	-0.0409
		(0.0225)	(0.0216)
$a_{2,13}$	SECJB	-0.0319	-0.0642
		(0.0462)	(0.0456)
$a_{2,14}$	CENTR	-0.0037	0.0027
		(0.0289)	(0.0274)
$a_{2,15}$	INDUST	0.0216	0.0292
		(0.0169)	(0.0190)
MILL'S RATIO		0.0105	0.0067
		(0.0326)	(0.0368)

Note: b_3^* is normalized to unity. All starred coefficients are the product of the user cost (v^*) and the corresponding unstarred coefficients. For a description of the explanatory and instrumental variables used see Appendix B.

Table 2 - Explaining the Kuhn Tucker multiplier

dependent variable : $\mu_t \; v_t \; [\Phi_1 + (1-\delta)v_{t+1}/(1+r_t)v_t]$

Ols regressions

	(1)	(2)	(3)	(4)	(5)
obs	987	987	834	834	834
R^2	0.0033	0.0307	0.0106	0.0550	0.8036
mean dep. var.	0.2022			0.2131	
variables					
constant	.1644	-.0787	.1646	-.0727	-.2608
	(.0519)	(.1019)	(.0522)	(.1082)	(.0762)
cred1	.2321	.2482	.5183	.5182	.2020
	(.1277)	(.1262)	(.1751)	(.1730)	(.0810)
cred2	.0335	.0814	.1901	.2608	.1370
	(.1576)	(.1572)	(.3853)	(.3790)	(.1807)
south		.1946		.1815	-.4071
		(.0932)		(.1035)	(.0759)
young		-.3206		-.5200	-.7730
		(.1481)		(.1605)	(.0758)
middle aged		.2829		.3318	.2022
		(.0989)		(.1076)	(.0543)
grown children					.2383
					(.0412)
young children					.9648
					(.0777)
married					.4652
					(.0795)
owner-occ. house					-.4878
					(.0834)
invalid head of h.					9.3108
					(.1908)
working wife					-.4085
					(.0492)
second job					-1.1524
					(.1543)
house size					.0046
					(.0007)
previous purchases					.2114
					(.0410)
(young children*earnings)					-.0566
					(.0056)
(grown children)*(earnings)					-.0052
					(.0024)
(married)*earnings					-.0149
					(.0045)
(south)*(earnings)					-.2608
					(.0762)

Note: columns 1 and 2 refer to the whole sample of potentially liquidity-constrained households (for whom either cred1=1, or cred2=1, or financial wealth is low). Columns 3, 4 and 5 concentrate on households whose financial wealth is low.

5. Conclusions

In this paper, we have tackled the issue of the effects of credit constraints on durable goods consumption. We have shown that, if the borrowing limit facing forward-looking consumers depends on the value of the collateral, i.e. on the resale value of the stock of durables, then the tradeoff between the consumption of durable and nondurable goods is affected by liquidity constraints. In particular if the extra credit made available for purchasing an extra unit of a durable good is less then the present value of its future resale value, then liquidity-constrained consumers will be induced to purchase less of that durable good and more nondurables (and *vice versa*, if the extra credit exceeds that amount).

On the basis of this theoretical model, we have derived an equation which can be estimated on cross-sectional data, and shown what type of violations to expect from credit-constrained households. In our empirical application, we have used a large survey of Italian households, which contains high quality consumption, income and financial wealth data, as well as some direct questions on access to credit and the value of the stock of vehicles. We have specified a highly flexible utility function, estimated preference parameters on the subsample of unconstrained consumers, and then evaluated the shadow price of the borrowing restrictions for potentially liquidity-constrained households. Our results suggest that households who are denied credit normally purchase less vehicles. However, for younger households the opposite effect prevails. This is consistent with the hypothesis that lenders offer higher credit limits to younger customers, with a view to establishing a long term business relation.

In future work, we shall attempt to evaluate whether our results are robust to the presence of adjustment costs for the stock of durables. Given the cross-sectional nature of our data, we can only try simple exercises, such as estimating the equation on a subsample of consumers who have recently purchased a vehicle, and test for parameter equality with the full sample result. The relatively high proportion of current or recent purchases in our data (about a fourth of households) gives us hope that adjustment costs may have a relatively small impact.

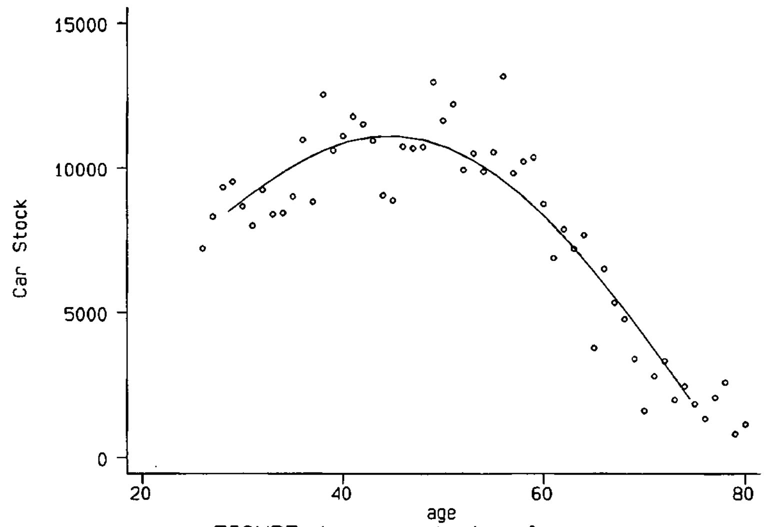


FIGURE 1 car stock value

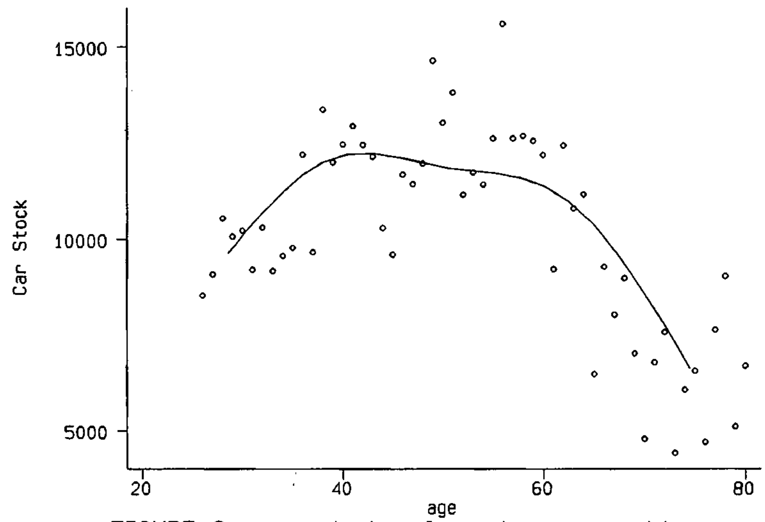


FIGURE 2 : car stock value, given ownership

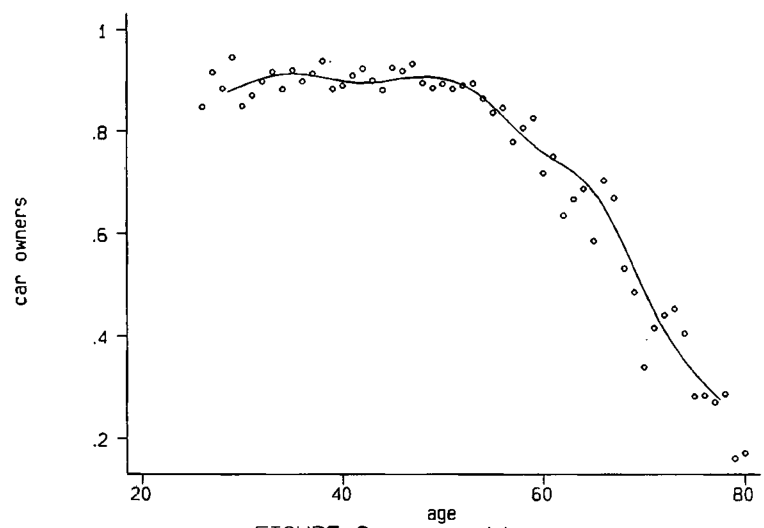


FIGURE 3 : ownership

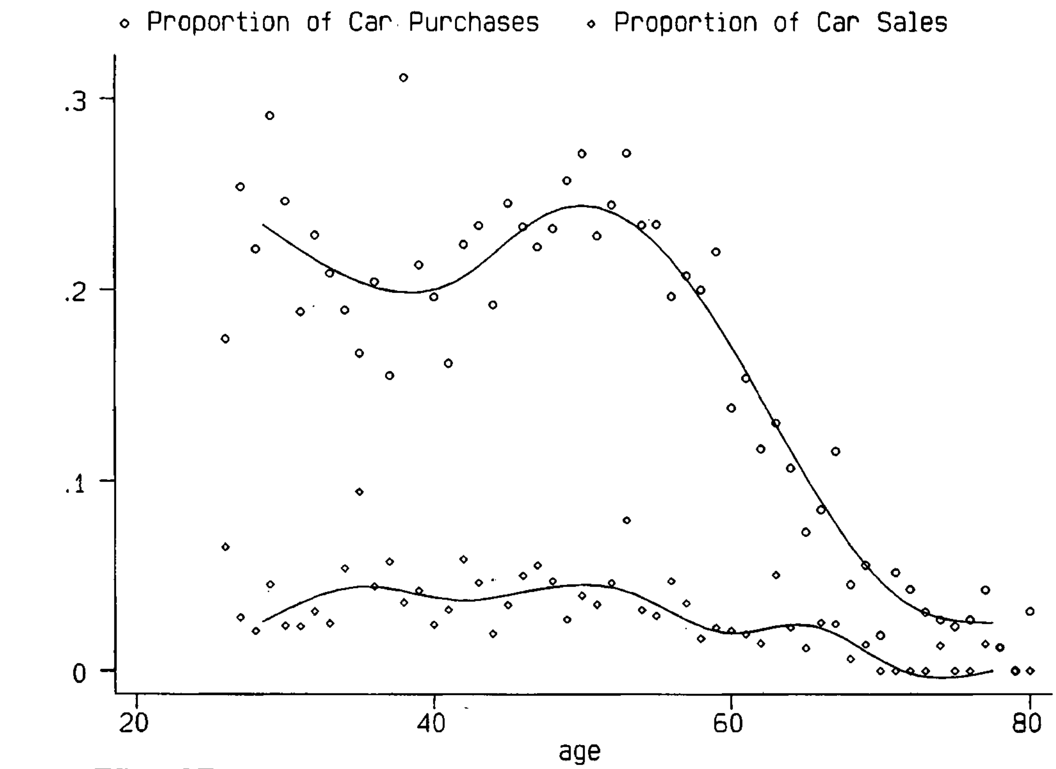


FIGURE 4 : proportions of purchases and sales

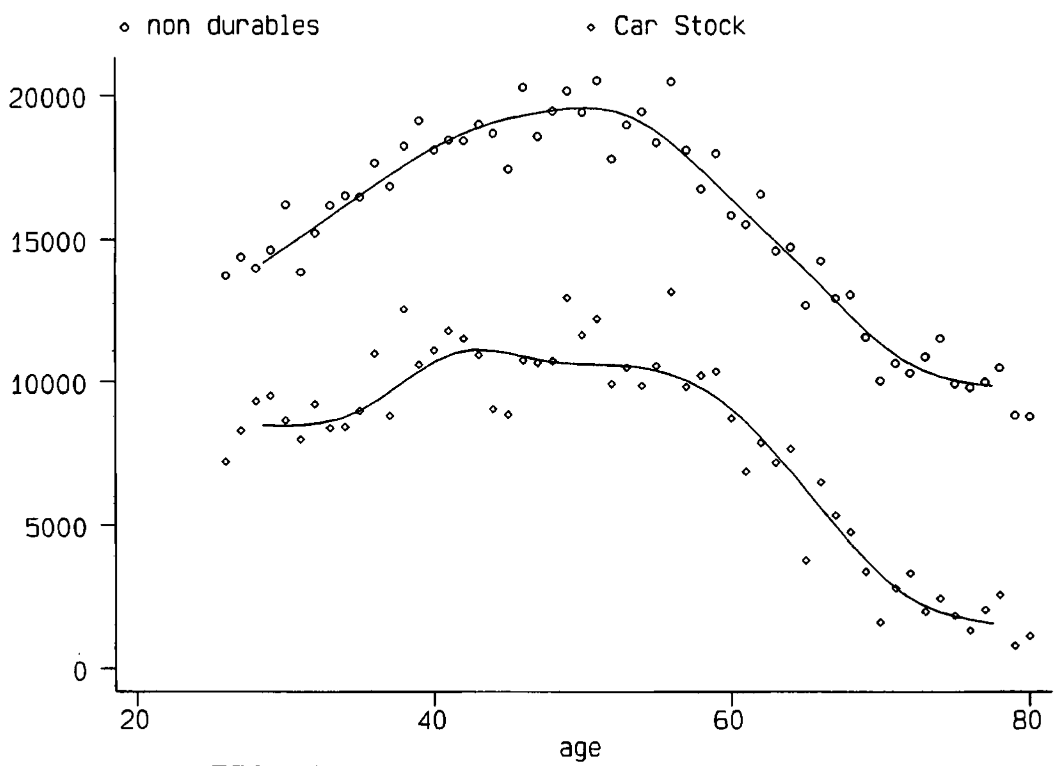


FIGURE 5 expenditure and stock

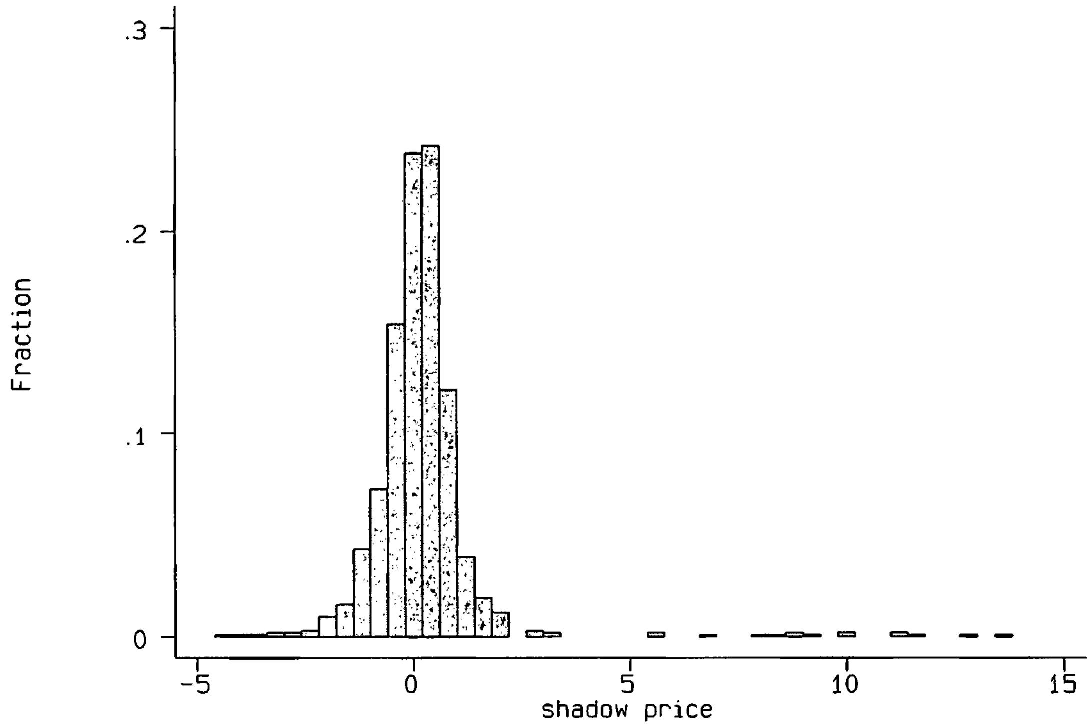
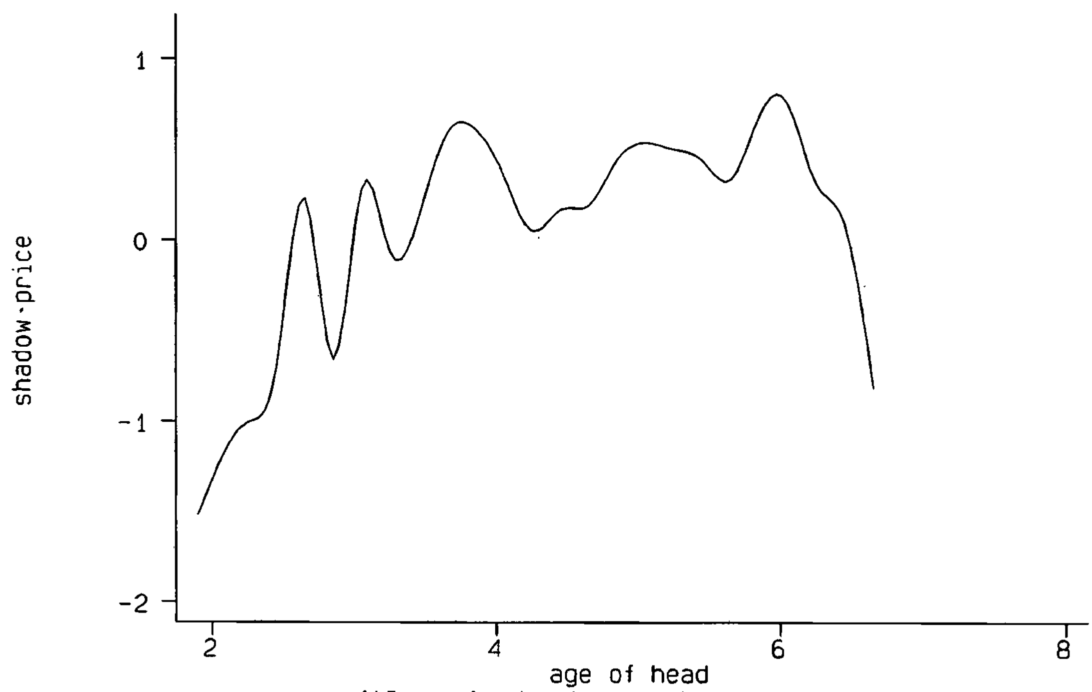
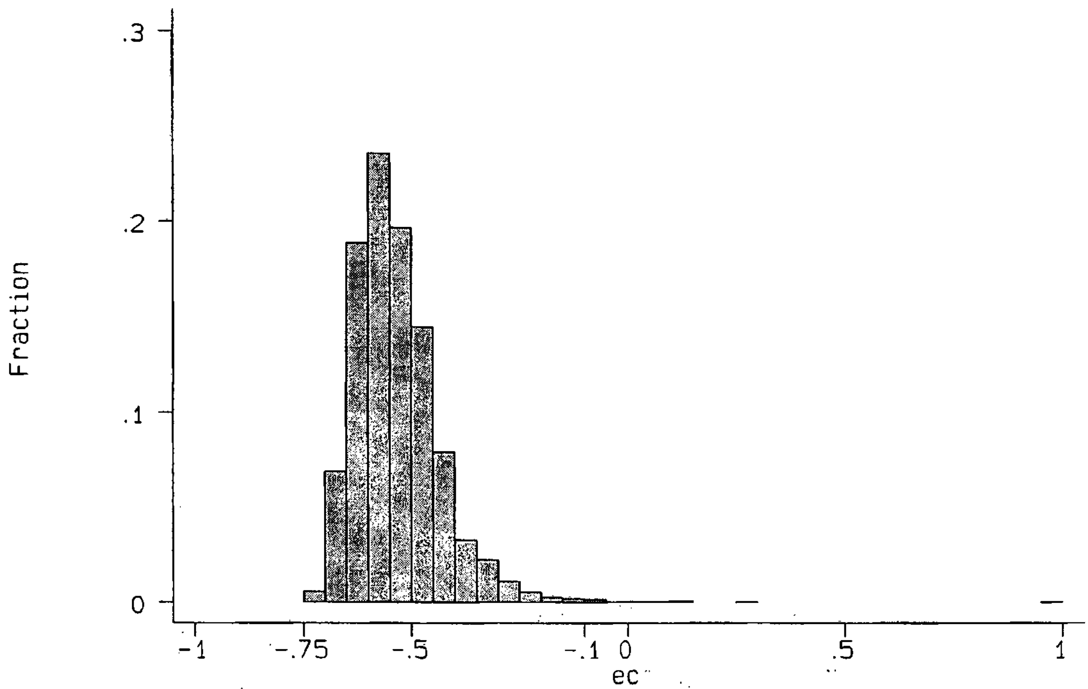


FIGURE 6



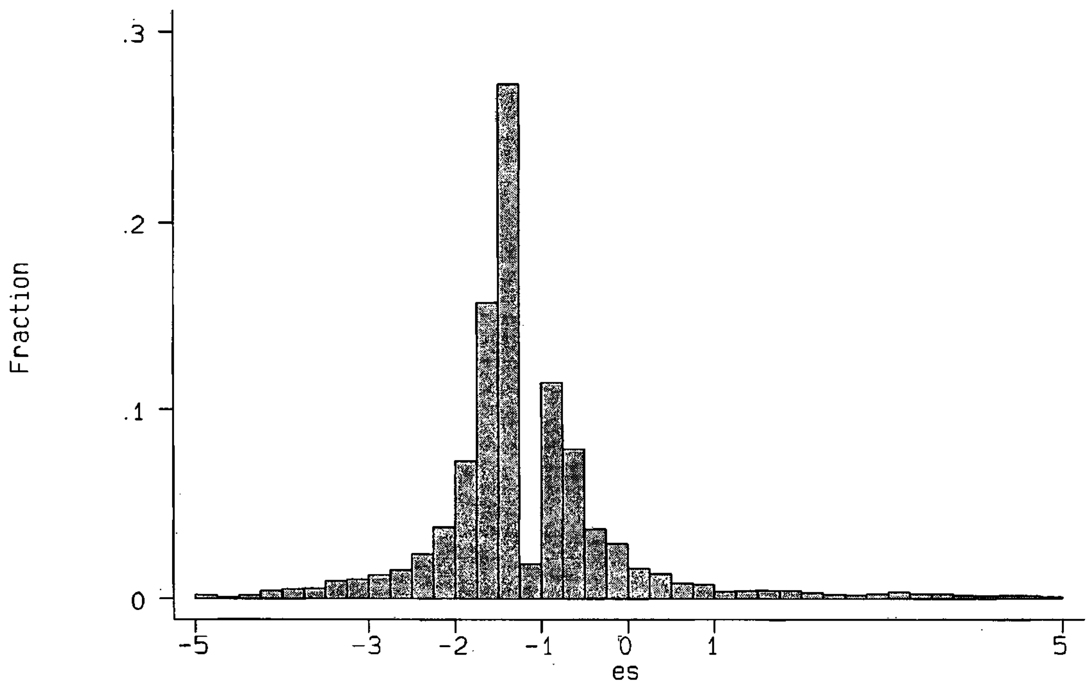
age profile of shadow price - means

FIGURE 7



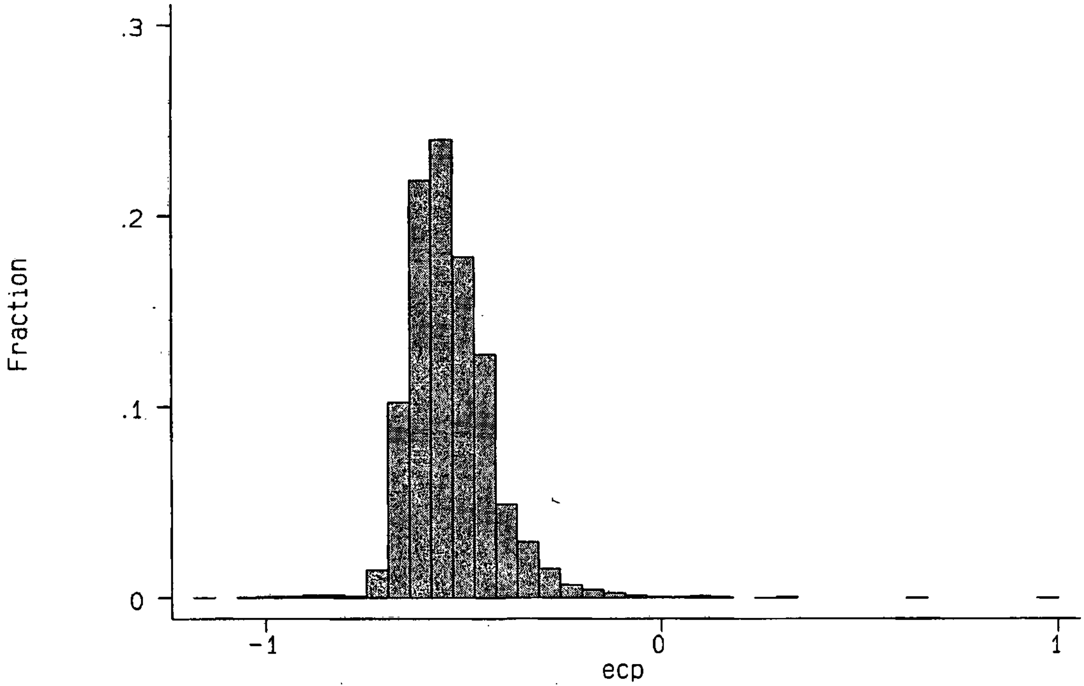
Conditional Frisch own elasticity: c

FIGURE 8



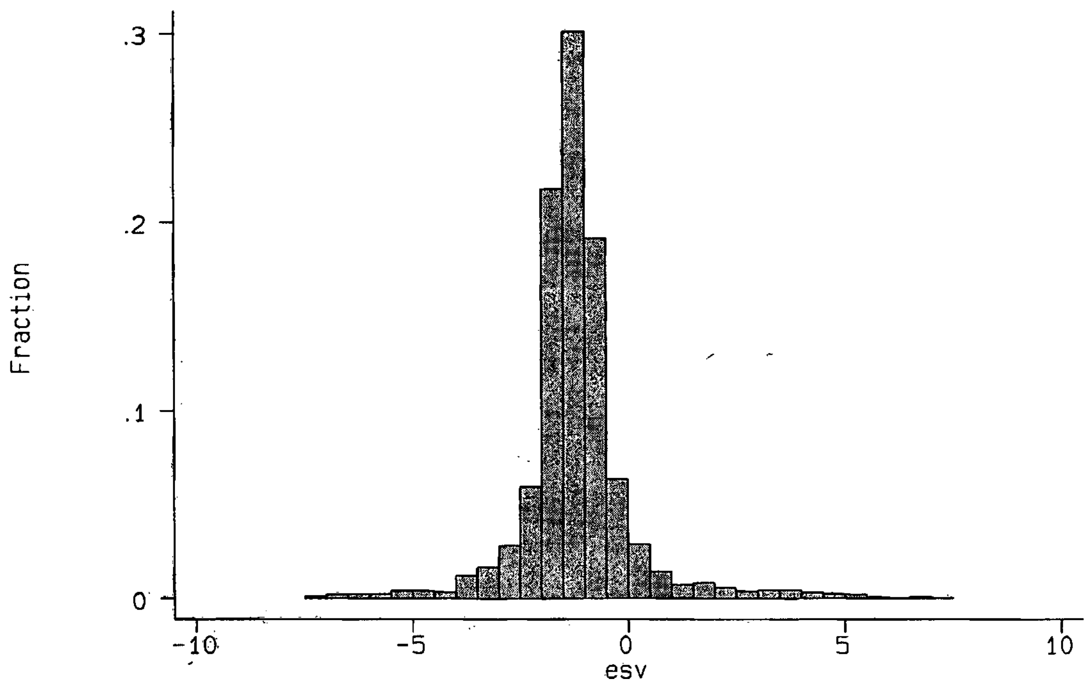
Conditional Frisch own elasticity: S

FIGURE 9



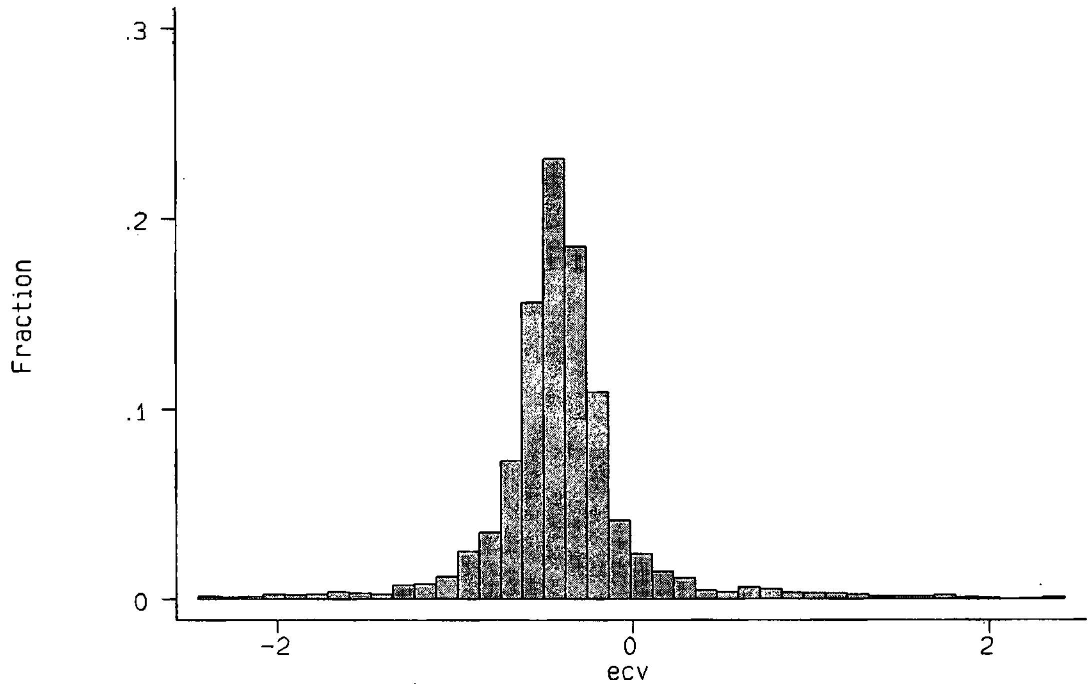
Frisch own elasticity: c

FIGURE 10



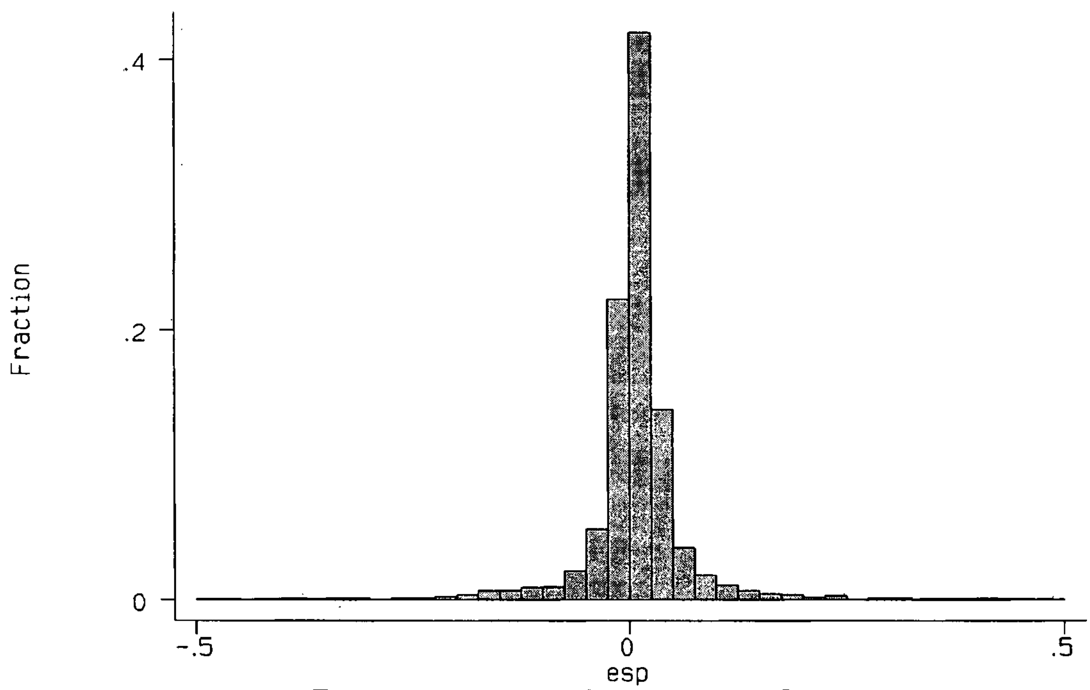
Frisch own elasticity: S

FIGURE 11



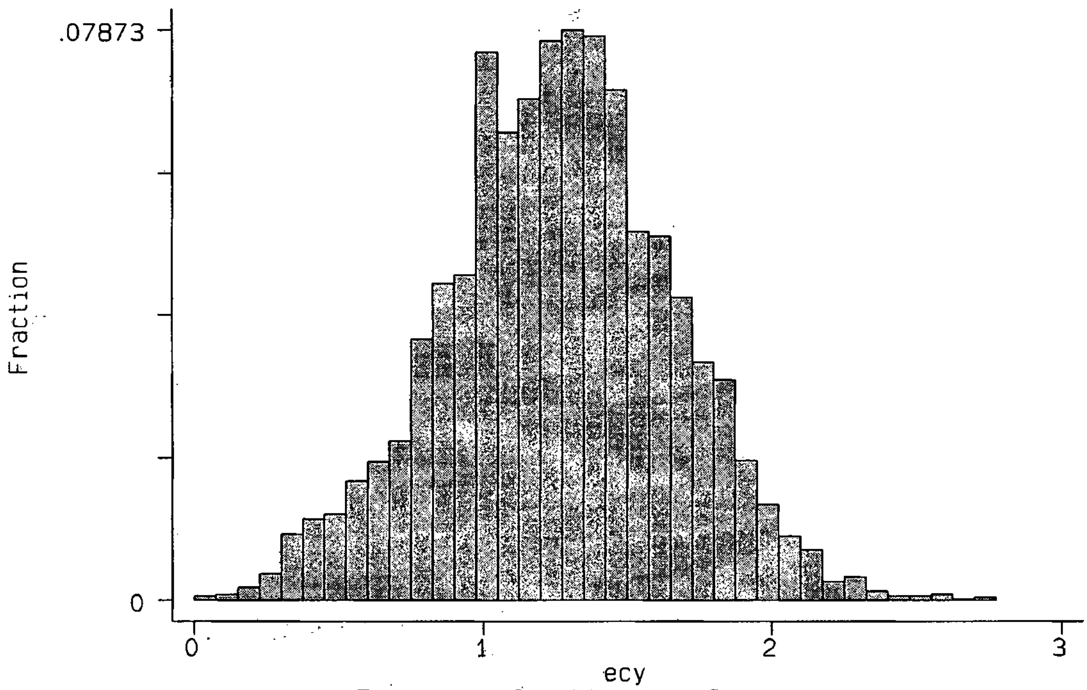
Frisch cross elasticity: c

FIGURE 12



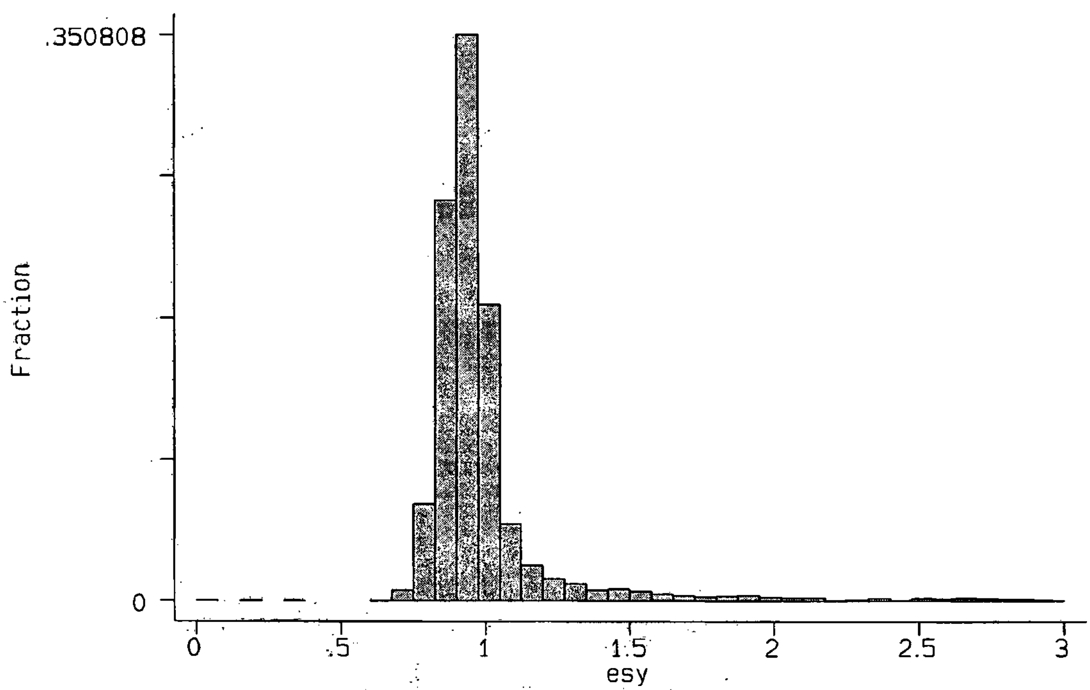
Frisch cross elasticity: S

FIGURE 13



Budget elasticity: C

FIGURE 14



Budget elasticity: S

FIGURE 15

Appendix A

PROBIT EQUATION ESTIMATES : vehicle ownership indicator = 1 if vehicle stock value exceeds 500,000 lira

	ZERO	ONE	
PROPORTION	0.2703	0.7297	obs = 7655

Variable	Probit Estimate	Std. Error	t-value
CONSTANT	-5.41326	0.5796	-9.34
YOUNG	-0.12974	0.1196	-1.08
AGE4065	0.08764	0.0971	0.90
AGE65+	0.31434	0.1398	2.25
AGE	-0.02699	0.0072	-3.73
AGESQ	-0.00045	0.0002	-2.76
OLDWIF	-0.19465	0.0927	-2.10
WIDOW	-0.90978	0.0963	-9.45
OLDCOUP	-0.24521	0.0801	-3.06
HUSBWRK	-0.02508	0.0891	-0.28
NPENSIO	-0.26577	0.0586	-4.53
NUMP	0.00664	0.2967	0.02
LOGINCOM	0.67212	0.0553	12.15
CITY	-0.57918	0.1559	-3.71
TOWN	-0.08260	0.0649	-1.27
TOT_KIDS	-0.04997	0.0281	-1.78
KIDS18+	0.15185	0.0402	3.78
KIDS06	-0.05826	0.0568	-1.03
MC	0.29134	0.0562	5.19
NEARN	0.14801	0.0416	3.56
SOUTH	0.13704	0.0452	3.03
OO	-0.69947	0.1607	-4.35
SELF	-0.23218	0.0568	-4.09
EDU	0.12082	0.0509	2.37
WRKW	0.04087	0.0456	0.90
SECJOB	0.04170	0.1474	0.28
SHDEP	0.37911	0.0564	6.72
SHTIT	-0.28476	0.3308	-0.86
SHOBB	0.20849	0.1977	1.05
INVLD	0.24540	0.2948	0.83
FINWEL	-0.00479	0.0018	-2.62
AGE-CIT	0.00689	0.0027	2.54
AGE-TIT	0.01906	0.0053	3.61
AGE-OO	0.00672	0.0027	2.46
SHAREOWNER	0.36447	0.1459	2.50
BOTOWNER	-0.26701	0.1009	-2.65
HOMEDIMEN	0.00113	0.0006	1.94
HOMEVALUE	0.00412	0.0040	1.02
POSWEALTH	0.58602	0.0619	9.47

MEASURES OF FIT:

Likelihood Ratio Chi-square:	3491.2451
Percent Correctly Predicted:	85.8393
Maddala's pseudo R-square:	0.3662
McFadden's pseudo R-square:	0.3908
Cragg and Uhler's pseudo R-square:	0.2612

TABLE OF OBSERVED AND PREDICTED OUTCOMES:

Observed	Predicted ZERO	Predicted ONE	Total
ZERO	1287	782	2069
ONE	302	5284	5586
Total	1589	6066	7655

NORMALITY STATISTICS: (1% Sig.Level)

Skewness	: 45.8161	(6.635)
Kurtosis	: 19.1255	(6.635)
Normality	: 47.0976	(9.210)

Appendix B

The list of variable names used in the main regression of Table 1 is as follows:

YOUNG	= dummy: the head of the household has age below 30
AGE	= age of the head of the household
OLDWIF	= dummy: the wife has age above 65
OLDCOUP	= dummy: the household is composed of an old couple (65+)
HUSBWOR	= dummy: head of the household working
NKIDS	= number of children
KID20	= dummy: presence of children older than 20
MC	= dummy: married couple
NEARN	= number of earners in the household
SOUTH	= dummy: southern regions and islands
INVLD	= dummy: head of the household is invalid
EDU	= dummy: head of the household has higher education
SECJB	= dummy: head of the household has a second job
CENTR	= dummy: household lives in the centre of city or town
INDUST	= dummy: head of the household works in industrial sector

The instrumental variables used for the regression are:

YOUNG, AGE4065 (dummy: age between 40 and 65), AGE65+ (dummy: age above 65), AGE, AGESQ (age to the square), OLDWIF, OLDCOUP, HUSBWRK, NUMP (number of unemployed members of the household), CITY (living in a city), TOWN (living in a town), CENTR, NKIDS, KIDS20, KIDSY (dummy: children below age 6), MC, NEARN, SOUTH, OO (dummy: owner occupied house), SELF (dummy: head of the household in self employment), AGRI (dummy: head of the household working in agricultural sector), PAMM (dummy: head of the household is civil servant), INDUST, INVLD, EDU, WRKW (dummy: working wife), SECJB, SHDEP (share of liquid assets as percentage of total financial wealth), SHTIT (share of government bonds and other bonds), DBOT (dummy: ownership of government bonds), DAZI (dummy: ownership of shares), FWEL (financial wealth), VALP (value of the first house), WELD (dummy: positive total wealth), SUPP (size of the first house in square meters) PREV1 (amount paid in 1987 for purchases previous to 1987), PREV2 (amount outstanding in 1987 of purchases previous to 1987), MILL'S Ratio, EARN (earnings from employment), YSELF (earnings from self-employment). Interacted terms: AGE-CITY, AGE-SHTIT, AGE-OO, AGE-CENTR, P-KIDS20, P-KIDSY, P-MC, P-NEARN, P-SOUTH, P-OO, P-SELF, P-INDUST, P-EDU, P-WRKW, E-KIDS20, E-KIDSY, E-MC, E-NEARN, E-SOUTH, E-OO, E-SELF, E-INDUST, E-EDU, E-WRKW, where "P-" indicates the variable (PREV1+PREV2) and "E-" indicates the variable "earnings from employment".

References

Alessie, R., M. Devereux and G. Weber (1992) "Intertemporal Consumption, Durables and Liquidity Constraints: A Cohort Analysis", IFS, mimeo.

Alessie, R., B. Melenberg and G. Weber (1988) "Consumption, Leisure and Earnings-Related Liquidity Constraints: A Note", *Economics Letters*, 27, 101-4.

Dunn and Singleton (1986) "Modeling the Term Structure of Interest Rates under Non-Separable Utility and Durability of Goods", *Journal of Financial Economics*, (17), 27-55

Jappelli, T. (1990) "Who is Credit Constrained in the US Economy", *Quarterly Journal of Economics*, CV(1), 219-34.

Jappelli, T. and M. Pagano (1988) "Consumo, indebitamento delle famiglie e razionamento del credito", *Giornale degli economisti*, 11-12, 545-573.

Meghir, C., and G. Weber (1992) "Intertemporal Non-Separability or Borrowing Restrictions? A Disaggregate Analysis Using a U.S. Panel", UCL and IFS, mimeo.

Zeldes, S. (1989) "Consumption and Liquidity Constraints: An Empirical Investigation", *Journal of Political Economy*, 97, 305-46.

RECENTLY PUBLISHED «TEMI» (*)

n. 158 — *Demand and Supply Shocks in Industrial Output,* by A. GAVOSTO - G. PELLEGRINI (novembre 1991).

n. 159 — *I* futures *e le opzioni sui titoli di Stato. Un'analisi del mercato e delle prospettive in Italia,* di A. SCALIA - L. TORNETTA (novembre 1991).

n. 160 — *Earnings Uncertainty and Precautionary Saving,* by L. GUISO - T. JAPPELLI - D. TERLIZZESE (febbraio 1992).

n. 161 — *Migrazioni in Europa: andamenti, prospettive, indicazioni di politica economica,* di G. GOMEL - S. REBECCHINI (febbraio 1992).

n. 162 — *Monetary Aggregates and Monetary Policy Coordination on the Way to Economic and Monetary Union: the Role of Cross-Border Deposits,* by P. GIUCCA - A. LEVY (febbraio 1992).

n. 163 — *Cross-Border Deposits and Monetary Aggregates in the Transition to EMU,* by I. ANGELONI - C. COTTARELLI - A. LEVY (marzo 1992).

n. 164 — *Young Households' Saving and the Life Cycle of Opportunities. Evidence from Japan and Italy,* by A. ANDO - L. GUISO - D. TERLIZZESE (marzo 1992).

n. 165 — *Bequests and Saving for Retirement. What Impels the Accumulation of Wealth?,* by F. BARCA - L. CANNARI - L. GUISO (marzo 1992).

n. 166 — *The Microeconomics and Macroeconomics of the Permanent Income Hypothesis,* by A. DEATON (marzo 1992).

n. 167 — *Why is Italy's Saving Rate so High?,* by L. GUISO - T. JAPPELLI - D. TERLIZZESE (aprile 1992).

n. 168 — *Waiting for EMU: Living with Monetary Policy Asymmetries in the EMS,* by L. BINI SMAGHI (aprile 1992).

n. 169 — *Income and Saving in Italy: a Reconstruction,* by G. MAROTTA - P. PAGLIANO - N. ROSSI (giugno 1992).

n. 170 — *Finance and Development: The Case of Southern Italy,* by R. FAINI - G. GALLI - C. GIANNINI (giugno 1992).

n. 171 — *Generational Accounting: The Case of Italy,* by D. FRANCO - J. GOKHALE - L. GUISO - L. J. KOTLIKOFF - N. SARTOR (giugno 1992).

n. 172 — *Mancate interviste e distorsione degli stimatori,* di L. CANNARI - G. D'ALESSIO (giugno 1992).

n. 173 — *Inflazione attesa, tassi reali e la struttura per scadenza dei tassi d'interesse,* di R. CESARI (luglio 1992).

n. 174 — *Economie di scala e di diversificazione nell'industria bancaria: il ruolo dell'eterogeneità tra imprese,* di G. PARIGI - P. SESTITO - U. VIVIANI (luglio 1992).

n. 175 — *L'economia italiana nella prospettiva europea: terziario protetto e dinamica dei redditi nominali,* di F. BARCA - I. VISCO (luglio 1992).

n. 176 — *Struttura finanziaria e riforme nei paesi dell'Europa centrale e orientale,* di P. CATTE - C. MASTROPASQUA (settembre 1992).

n. 177 — *Creazione e distruzione di posti di lavoro in Italia,* di B. CONTINI - A. GAVOSTO - R. REVELLI - P. SESTITO (settembre 1992).

n. 178 — *Saving and Government Deficits (1951-1990),* by N. ROSSI - I. VISCO (settembre 1992).

n. 179 — *Implementing Stochastic Optimal Control of Nonlinear Models: a Comparison with Alternative Solution Methods,* by A. CIVIDINI - S. SIVIERO (ottobre 1992).

n. 180 — *Rischio di tasso d'interesse e coefficienti patrimoniali: un'analisi dei regolamenti SIM,* di F. DRUDI - F. PANETTA (novembre 1992).

n. 181 — *Mean Reversion Test with Reflecting Barriers: An Application to European Monetary System Exchange Rates,* by C. A. BALL - A. ROMA (novembre 1992).

n. 182 — *Concorrenza e discriminazione di prezzo nel mercato del credito in Italia,* di G. FERRI - G. GOBBI (novembre 1992).

n. 183 — *Inflazione e dispersione dei prezzi relativi,* di M. CARUSO (dicembre 1992).

(*) Requests for copies should be sent to:
Banca d'Italia - Servizio Studi - Divisione Biblioteca e Pubblicazioni - Via Nazionale, 91 - 00184 Rome.

BANCA D'ITALIA - CENTRO STAMPA