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Why net worth is the wrong concept for explaining consumption: evidence from Italy*

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Abstract

Most econometric policy models at central banks and elsewhere use an aggregate consumption function based on textbook theory. This assumes that the 'representative household' owns only an aggregate form of wealth, proxied by net worth, and never faces borrowing or liquidity constraints or transactions costs. This is inconsistent with the modern view of heterogeneous agent behaviour under uncertainty in incomplete markets. Based on data from 1980 to 2019, the conventional formulation for an aggregate consumption function for Italy is strongly rejected. The results show that the marginal propensities to consume out of household deposits and semi-liquid financial assets such as T-bills and mutual funds are greater than for less liquid assets. A significant positive effect from housing wealth is substantially offset by the negative effect of affordability measured by the house price-to-income ratio.

JEL Classification: E21, E32, E44, E51

Keywords: financial wealth, liquid and illiquid assets, permanent income, housing wealth.

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1. Introduction, motivation and literature review

The New Keynesian 'Science of Monetary Policy' (Gertler, Gali, and Clarida, 1999) has been challenged as never before (see the special issues in 2018 of the Oxford Review of Economic Policy and Journal of Economic Perspectives). The accumulation of evidence, both macro and especially micro, has undermined key elements of the framework, particularly as expressed in the representative agent, rational expectations New Keynesian DSGE models, incorporating the simple textbook permanent income model of consumption. In that framework, monetary transmission works mainly through the real interest rate and the inter-temporal substitution channel: a higher real interest rate reduces current consumption by raising planned future consumption. As far as the financial sector in NK-DSGE is concerned, credit flows and asset prices are a side-show effectively 'memo items' which just proxy expectations of future growth but play no role in system dynamics or the long-run.

Buffer-stock saving theory (Deaton, 1991; Carroll, 1992) had already explained how rational behaviour under income uncertainty and liquidity constraints radically undermine the simple textbook permanent income model of consumption. Mounting evidence that the marginal propensity to consume out of transitory income was far higher than implied by the simple textbook model (e.g. Johnson et al. 2006, 2009 and Carroll et al. 2017), and heterogeneous across households (e.g. Fagereng et al. 2016 and Crawley and Kuchler, 2023), has shifted views on fiscal policy effectiveness and monetary transmission, The new view of the latter now includes the redistribution (Coibion et al. 2017 and Auclert, 2019) and cash-flow channels, particularly where household borrowing is at adjustable interest rates (e.g. Jackman and Sutton, 1982, La Cava et al. 2016, Cloyne et al. 2016, Cloyne and Surico, 2017 and Di Maggio et al. 2017).

Advances in economic theory have contributed to these shifts in understanding. An early extension of the buffer-stock model to introduce an illiquid asset with a higher return but subject to trading costs, alongside a liquid asset was by Otsuka (2004). Trading costs are also a key feature in Kaplan and Violante (2014) and Kaplan et al. (2014) who present theory and evidence on 'hand-to-mouth' consumption, corresponding to short-horizon behaviour by asset-rich consumers who face trading costs in the illiquid asset and a credit constraint. This household behaviour was integrated by Kaplan et al. (2018) into a general equilibrium model with an otherwise conventional New Keynesian production and pricing side of the economy. Kaplan et al. (2018) - see Kaplan and Violante (2018) for a non-technical overview - show that monetary policy conclusions are radically transformed in their 'heterogeneous agent New Keynesian' (HANK) model compared to the standard representative agent rational expectations life-cycle/permanent income version of the New Keynesian model. Their version of HANK however, does not incorporate endogenous asset prices, e.g. of equities and real estate, through which, in reality, monetary policy also operates.[1]

[1] Garrida and Hedlund (2020) estimate a micro-founded model suggesting that housing liquidity and collateral effects, transmitted to consumption via balance sheets, have a central role in explaining aggregate dynamics.

An extension of a model of optimising behaviour to incorporate housing is due to Berger et al. (2018). They present an optimising model of a household facing collateral constraints and lumpy transactions costs, with a collateral effect of house prices on consumption. Heterogeneity, transactions and search costs, asymmetric information, and credit constraints are especially rife in housing markets (see Glaeser and Nathanson, 2015). Given that housing wealth is, for most European households, their single largest asset, while housing loans account for well over half of household debt, evidence-based research on the size of their effects on aggregate consumption is particularly relevant.

To inform policy decisions at most central banks, more flexible semi-structural econometric policy models, giving scope to learn from data, are now preferred to NK-DSGE models. Since consumption typically accounts for 60 percent or more of GDP in advanced economies, the aggregate consumption function plays a key role in these models. However, most econometric policy models retain a specification of the consumption function based on a simple textbook permanent income form. This assumes that for households the relevant concept of wealth is net worth, which treats liquid and illiquid financial assets and housing[2] as if they were the same. Moreover, these models assume that households never face borrowing or liquidity constraints and that income uncertainty is of little relevance.

A more general approach needs to recognize that these assumptions are not credible. The probability that any household owns something close to the average portfolio is vanishingly small given transactions costs and differences in risks and returns. Instead, for example, heavily indebted households will typically have very different asset holdings from those with low debt to income ratios. And, of course, many households have no direct stock-market participation while substantial proportions are renters rather than owner-occupiers. Aggregate household expenditure reflects the different behaviours of these groups. Aggregate data on household portfolios split into different asset types necessarily carries a great deal of distributional information. Though heterogeneous agent theory suggests that long time-series of microdata on households would be needed to analyse fluctuations in aggregate consumption, many of the policy-relevant insights from this approach can be obtained in a more general formulation of the consumption function based on aggregate data including on the composition of household balance sheets.

Such a formulation was proposed in Aron et al. (2012) and Duca and Muellbauer (2014), also see Muellbauer (2020). They generalised the textbook permanent income model by setting out a 'credit-augmented consumption function'. This extended the stylised textbook model to incorporate qualitative insights from the buffer-stock saving and heterogeneous agent literatures. First, the credit channel is explicitly incorporated by the inclusion of credit conditions indices for unsecured credit and for mortgage credit. This recognises that, given the levels and distribution of income and portfolios, easier lending conditions will tend to increase aggregate consumer spending.[3] Second, household balance sheets are split into liquid assets and debt, illiquid financial assets and housing wealth. This allows the more realistic measurement of different propensities to consume from the components of

[2] To its credit, at the Bank of Italy, BIQM uses net financial wealth, rather than including housing wealth as if it were equivalent. The Bundesbank model also has this feature.

[3] They will also affect household portfolios, e.g. higher debt levels, and may affect asset prices and thus feed into future spending decisions.

wealth rather than combining all into a single net worth sum. Third, a far higher discount rate is applied to future income streams than in the textbook model, though Friedman (1963) himself argued that in aggregate empirical applications, far shorter horizons were relevant.

This does not claim that all households discount cash-flows identically but argues that it is better to control for an average effect rather than ignore such effects altogether. Finally, there are short-term roles for income insecurity, proxied by the change in the unemployment rate or proxies for income volatility, and cash-flow effects on indebted households in floating rate environments are captured by changes in interest rates.

There is widespread disagreement about the influence of housing and financial wealth on households' consumption (Case et al. 2005, Buiter, 2010; De Bonis and Silvestrini, 2012; Cooper and Dynan, 2016). Even the recent pandemic of COVID-19 has renewed the debate on the channels through which housing wealth, as opposed to financial assets, may affect consumer spending. The Italian economy historically shows higher wealth accumulation and saving rates than other countries (Ando, Guiso and Visco 1994; De Bonis and Marinucci, 2023) although with a convergence in more recent years. There is no general consensus about housing wealth effects on consumption in Italy. These are positive and rather small according to Catte et al. (2004) and Guiso, Paiella, and Visco (2006), and sometimes even negative (Boone and Girouard, 2002; Slacalek, 2009). On the other hand, financial wealth effects are stronger and more statistically significant than housing ones (Bassanetti and Zollino, 2010). The ratio of Italian household financial wealth to GDP has increased in the last 40 years. However, housing wealth remains the main asset for Italian households, as in other advanced economies (see Caprara, De Bonis, and Infante, 2020).

In this paper we link quarterly household balance sheets from 1995 with earlier annual data which we interpolate to obtain quarterly statistics (see Bruno 2008 on quarterly disaggregation). Our generalised consumption function controls for overall credit conditions: the ratio to GDP of granted credit lines from the Bank of Italy's Central Credit Register. Income expectations are handled through an econometric model for permanent household income assuming a 10-year horizon.

The present paper provides estimates of this generalised consumption function for Italy that encompasses the conventional form. In addition to permanent income, housing wealth, the effective interest rate on household loans and testing for the relevance of an index of credit conditions, our model splits net worth into liquid, semi-liquid and illiquid assets and debt. It controls separately for housing affordability measured by the house price to income ratio, and for housing wealth. The conventional form of the consumption function implies a set of linear restrictions on this credit-augmented form. Based on quarterly data from 1980 to 2019, the conventional formulation of the consumption function is strongly rejected, while the generalised form tracks the data well with notably stable parameters over different sub-samples.

The paper is structured as follows. Section 2 describes the main data features. Section 3 explains the theoretical and empirical frameworks. The results on the role of the different assets in explaining households' consumption dynamics are reported in Section 4, alongside a wide range of robustness checks. Section 5 concludes.

2. Data background

The ratio of total consumer spending to household disposable income in Italy has gone through a major evolution. Before about 1993 it was rarely above 80 percent, implying a household saving ratio of over 20 percent, well above saving ratios for most other OECD countries (Figure 1).

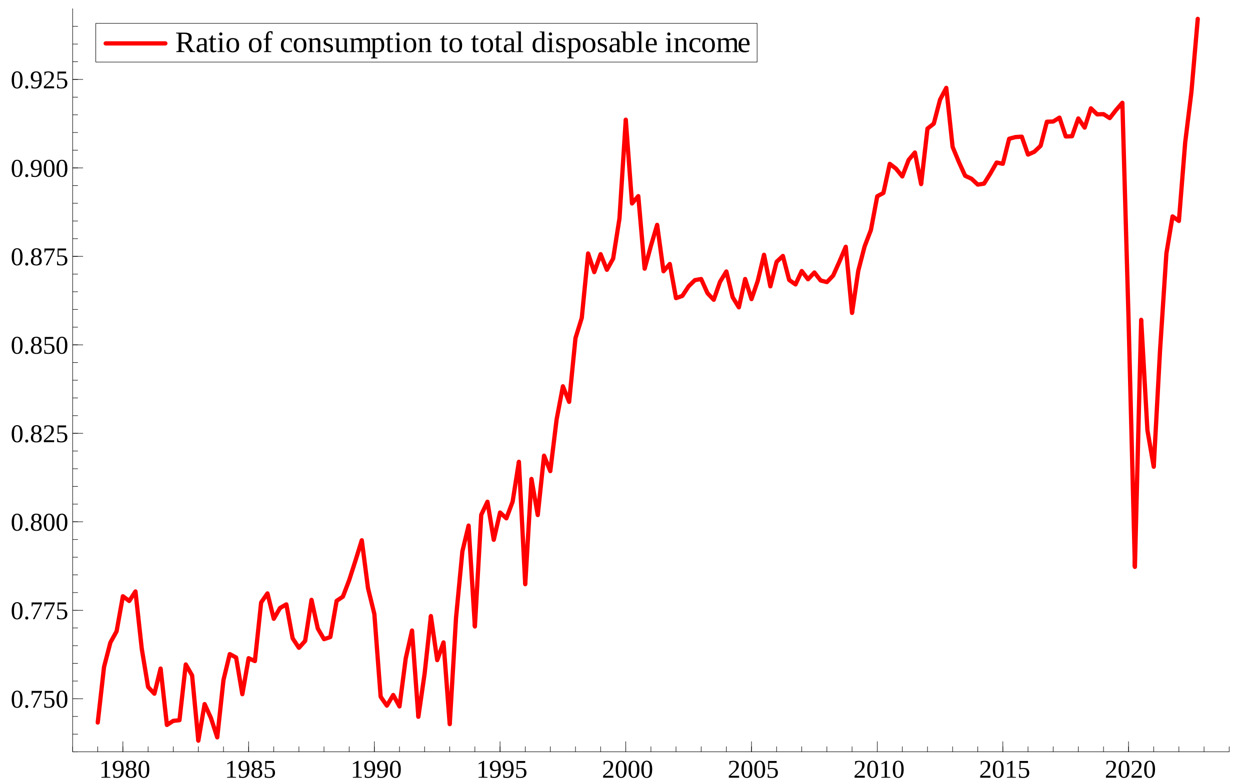

Figure 1: The ratio of consumption to total household disposable income.
Source: National Accounts, ISTAT.

In the later 1990s, the consumption to income ratio rose to levels nearer 90 percent, bringing saving ratios closer to those prevailing in other OECD countries after Italy joined the Eurozone. During the Covid-19 pandemic this ratio fell dramatically, due to a huge drop in Italian private consumption – the sharpest in the euro area together with Spain – while the contraction in disposable income was somewhat smaller, as it was sustained by the generous stimulus package implemented by the government (Guglielminetti and Rondinelli, 2023).

Textbook consumer theory suggests non-property income rather than overall disposable income as the appropriate income concept, with net worth capturing permanent property income. We chose scaled income, defined as the average of labour and transfer income, on the one hand, and overall disposable income, on the other, as our preferred income measure (see the Appendix for details on data sources and definitions). Figure 2 shows the log ratios of consumption to disposable and scaled income, taken as deviations from their values in 1996Q1.[4] The figure shows that they moved closely together from the late 1970s to the mid-2000s but then diverged as interest rates fell and measured property income in the national accounts declined relative to labour and transfer income.

The structure of average consumption spending has also undergone vast changes. Figure 3 shows that the budget share of durable goods, measured in real terms, has approximately doubled since 1980, while in current price terms this has not been the case. Indeed, in the 2000s the budget share in current price terms has declined. The major reason for these divergent trends has been the decline in the relative price of durables to non-durables: it has halved since 1980, see Figure 4. This reflects vast changes in technology, especially in communication and information technology (ICT). Though price indices for durable goods attempt to adjust for quality improvements, they fail

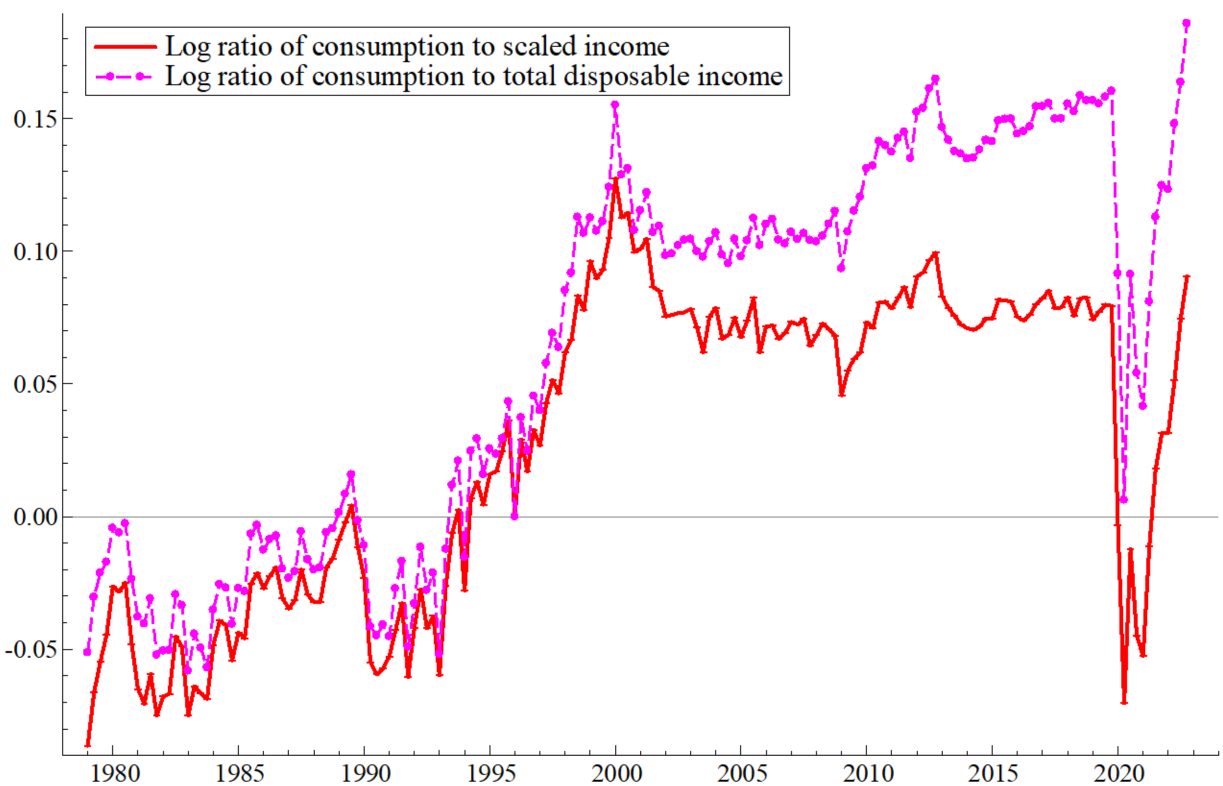

Figure 2: The log ratios of consumption to disposable and scaled income, relative to 1996Q1.
Source: National Accounts, ISTAT, and authors' weighting of raw data.

[4] This reference date reflects the transition of Italy to certainty regarding adoption of the euro.

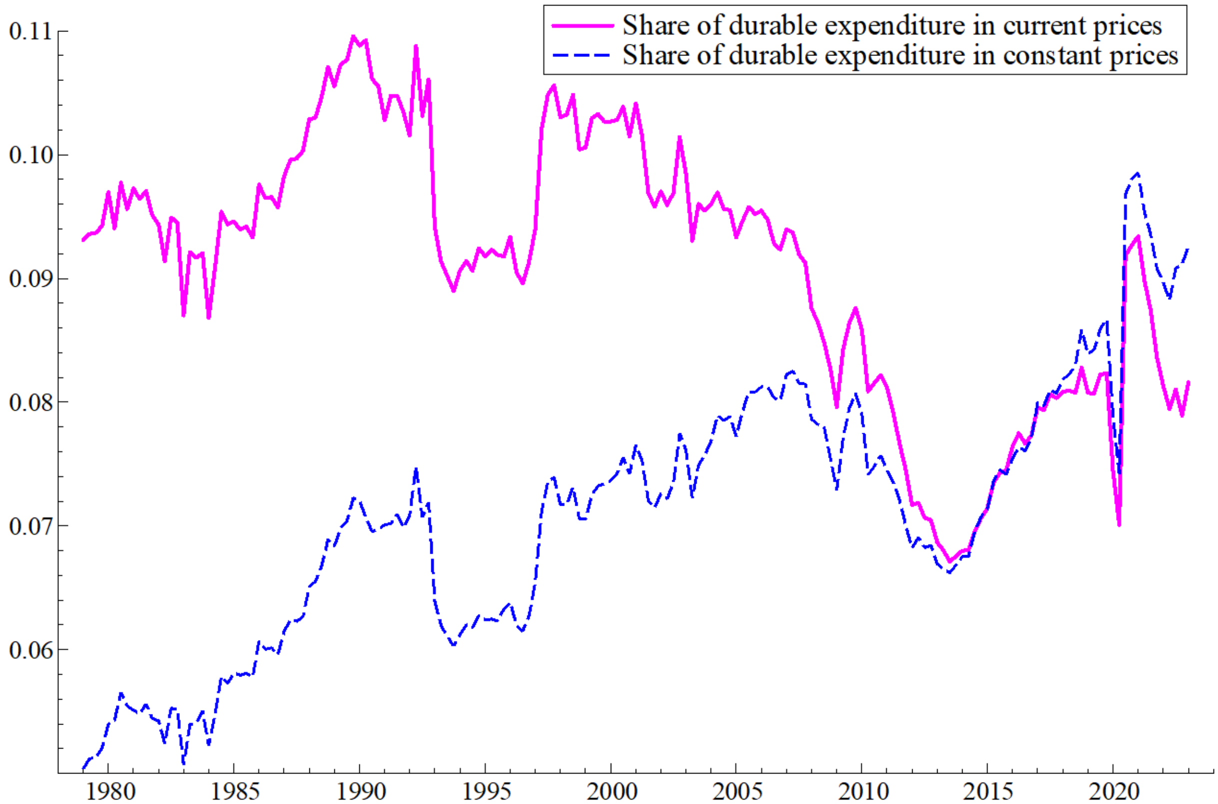

Figure 3: The share of expenditure on durable goods in current and constant prices.
Source: National Accounts, ISTAT.

to fully capture improvements in wellbeing that come from the low-cost access to information, entertainment and culture made possible by the spread of ownership of laptops, mobile phones and other digital devices. While fluctuations in the consumption to income ratio are driven by fluctuations in income, changes in asset prices and the past accumulation of household portfolios, we conjecture that the development of ICT may also have had some influence. It seems possible that, other things equal, households have been able to spend a little less of their income than before to achieve improvements in wellbeing. Though the decline in the relative price of durable goods does not capture all the implications of the ICT revolution, it nevertheless is a useful proxy. We examine whether this relative price had a positive effect on the consumption to income ratio, other things being equal.

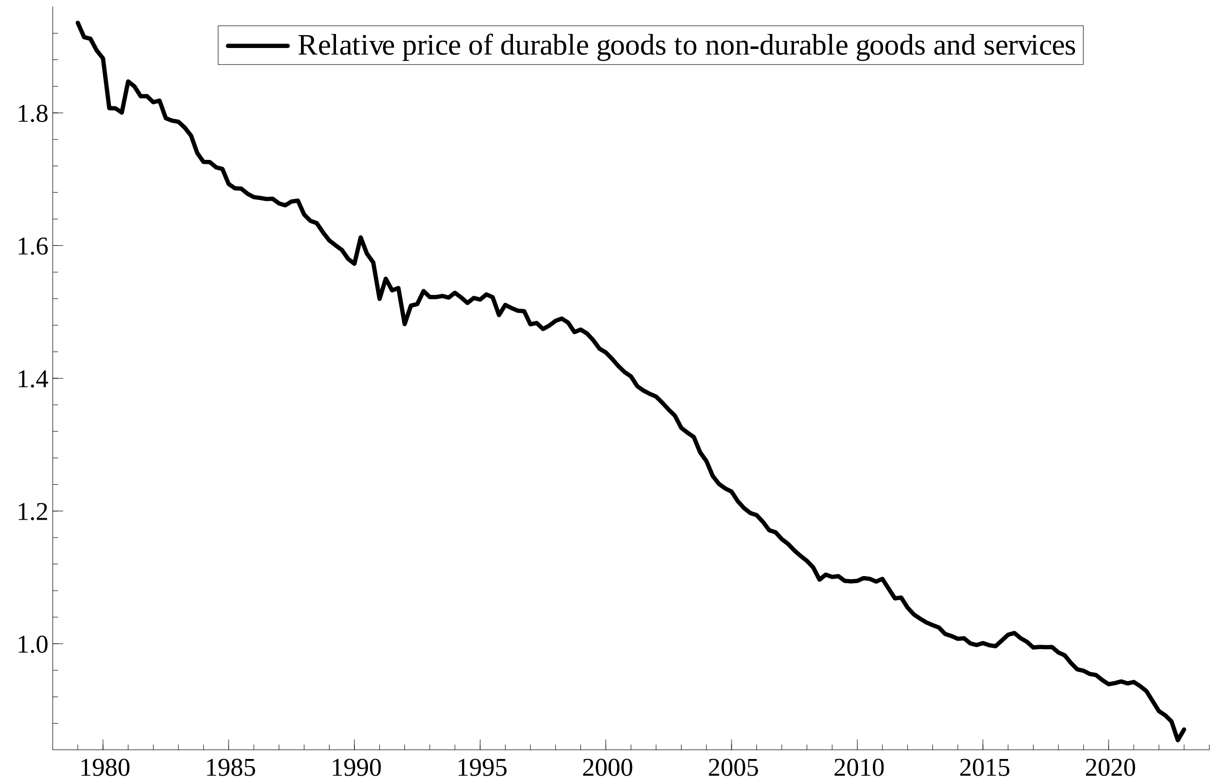

Figure 4: The relative price of durable goods to non-durable goods and services.
Source: National Accounts, ISTAT.

We turn next to the household balance sheet data. From 1995, quarterly financial balance sheets from the Bank of Italy give a detailed breakdown of household portfolios. Before 1995, annual balance sheets from Bonci and Coletta (2008) give a cruder breakdown in which short ('bills') and medium and long-term debt securities ('bonds') are aggregated. The split of total debt securities into bills and bonds before 1995 is based on information collected by the Bank of Italy (see the Appendix). After quarterly interpolation of the data, and adjusting for data breaks[5] in 1995, we obtain continuous quarterly household balance sheets for deposits and cash, bills, bonds, quoted equities, mutual funds, unquoted shares, and life insurance reserves and pensions, and household debt in the form of loans. In addition, estimates of housing wealth and land are obtained from Istat from 2001 and linked with estimates by Cannari, D'Alessio, and Vecchi (2017). These annual data are interpolated to a quarterly frequency, as in Bruno (2008).

Figures 5 to 7 show ratios of these balance sheet data measured at the end of the previous quarter divided by annualised scaled income.

[5] The 1995 European System of Accounts (ESA95) introduced methodological innovations which affected the continuity of the time series of national accounts. In addition, corrections are made for a break in the pensions data in 1984 and in the loans data in 1989, see the Appendix for details.

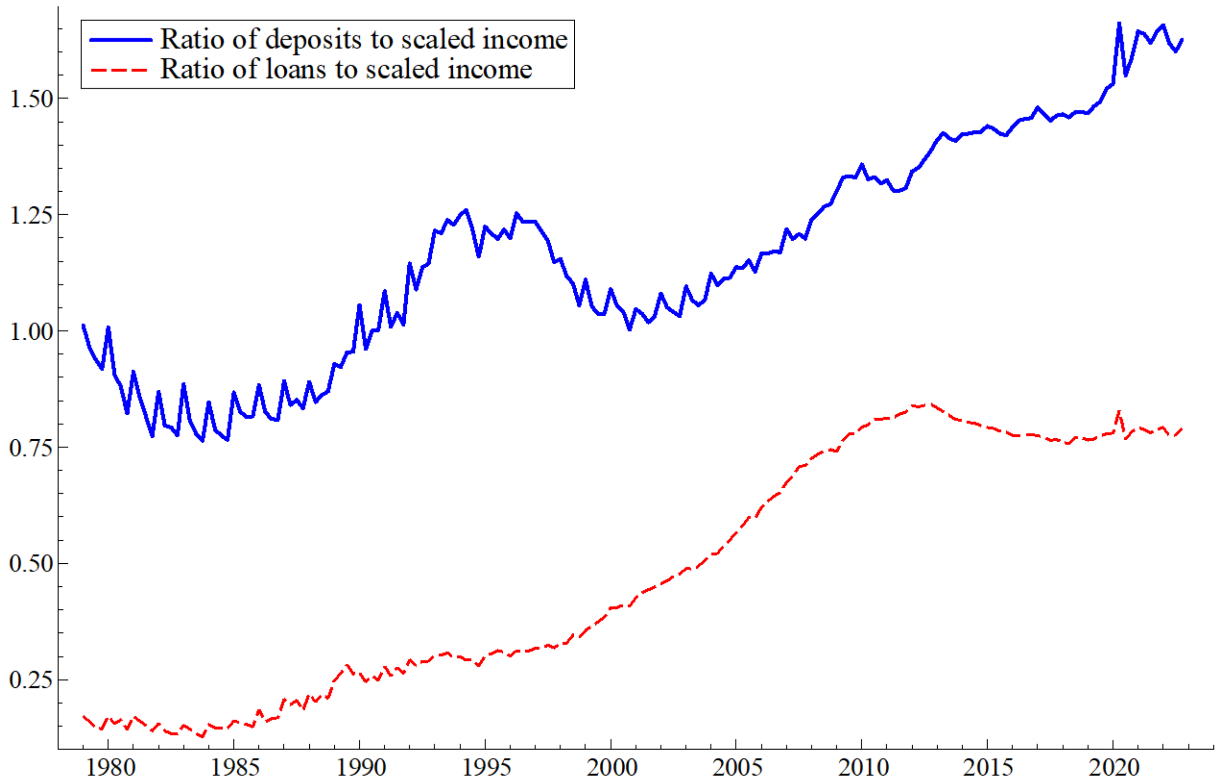

Figure 5: Ratios to scaled income of household deposits and loans.

Source: National Accounts and quarterly household balance sheets, ISTAT. Before 1995, balance sheet data linked with break-adjusted annual data from Bonci and Coletta (2008) and internal Bank of Italy data.

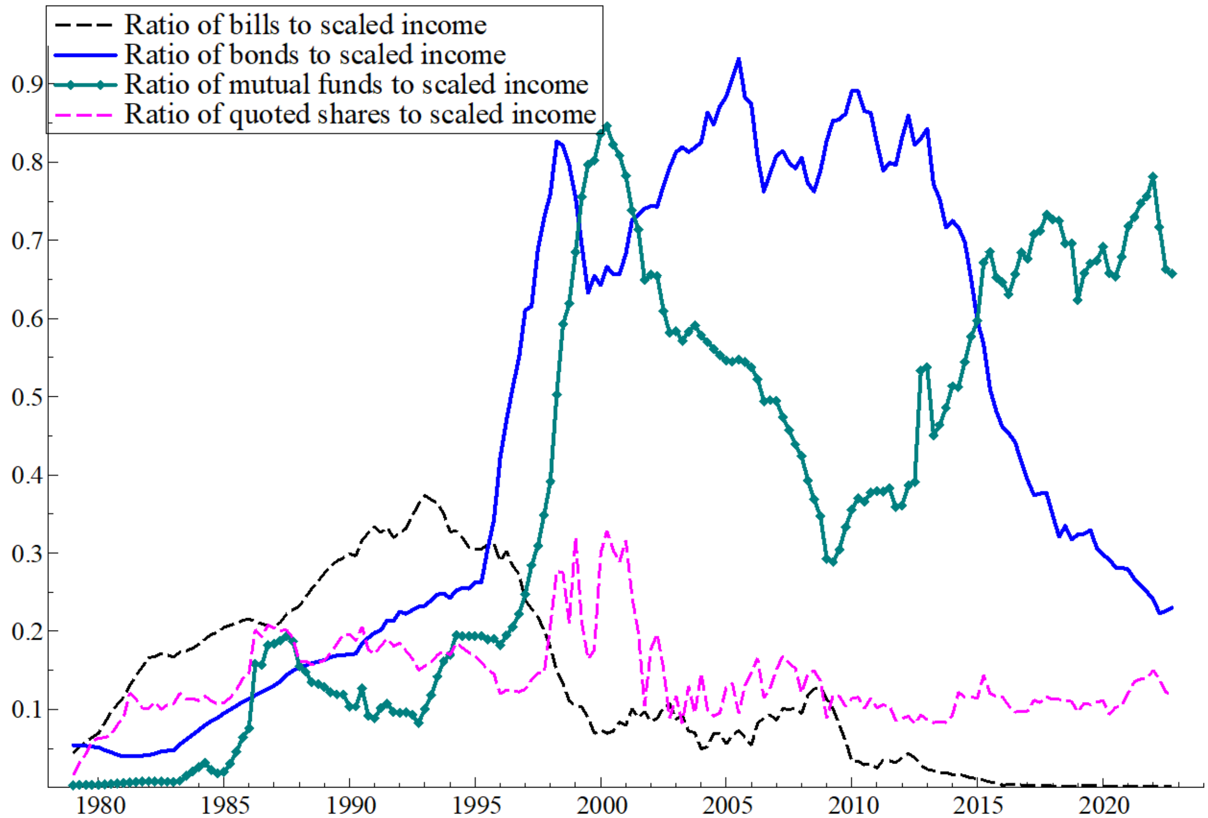

Figure 6: Ratios to scaled income of bills, bonds, mutual funds and quoted shares.
Source: National Accounts and quarterly household balance sheets, ISTAT. Before 1995, balance sheet data linked with break-adjusted annual data from Bonci and Coletta (2008) and internal Bank of Italy data.

Notable features of the data include the surge relative to income in holdings of bonds and mutual funds after 1995, while holdings of bills –short-term securities- declined as certainty increased regarding Italy's membership of the currency union and price inflation fell (see Caprara, De Bonis and Infante 2020); moreover, holdings of bills and bonds decreased because of the low interest rates prevailing from 2014 to 2021. In Italy, mutual funds are dominated by bank-managed funds (Albareto, Cardillo, Hamaui and Marinelli 2020). These come in a variety of forms, including some partially invested in quoted equities. Holdings of mutual funds decreased after the collapse of the dotcom stock market boom in 2001 and bottomed in the financial crisis of 2008-9, but rose again with the low interest rates and stock market recovery that followed. With lower interest rates, and perhaps lack of confidence in Italian government bonds, bond holdings relative to income declined after 2011. More recently, the surge relative to income in deposits and mutual funds in the pandemic and the post-pandemic decline are important data features, with deposits falling notably to the middle of 2023 (not shown in Figure 5).

Figure 7 plots the ratios to scaled income of housing wealth, unquoted shares and pension wealth, showing the dramatic scale of housing wealth relative to other wealth components.

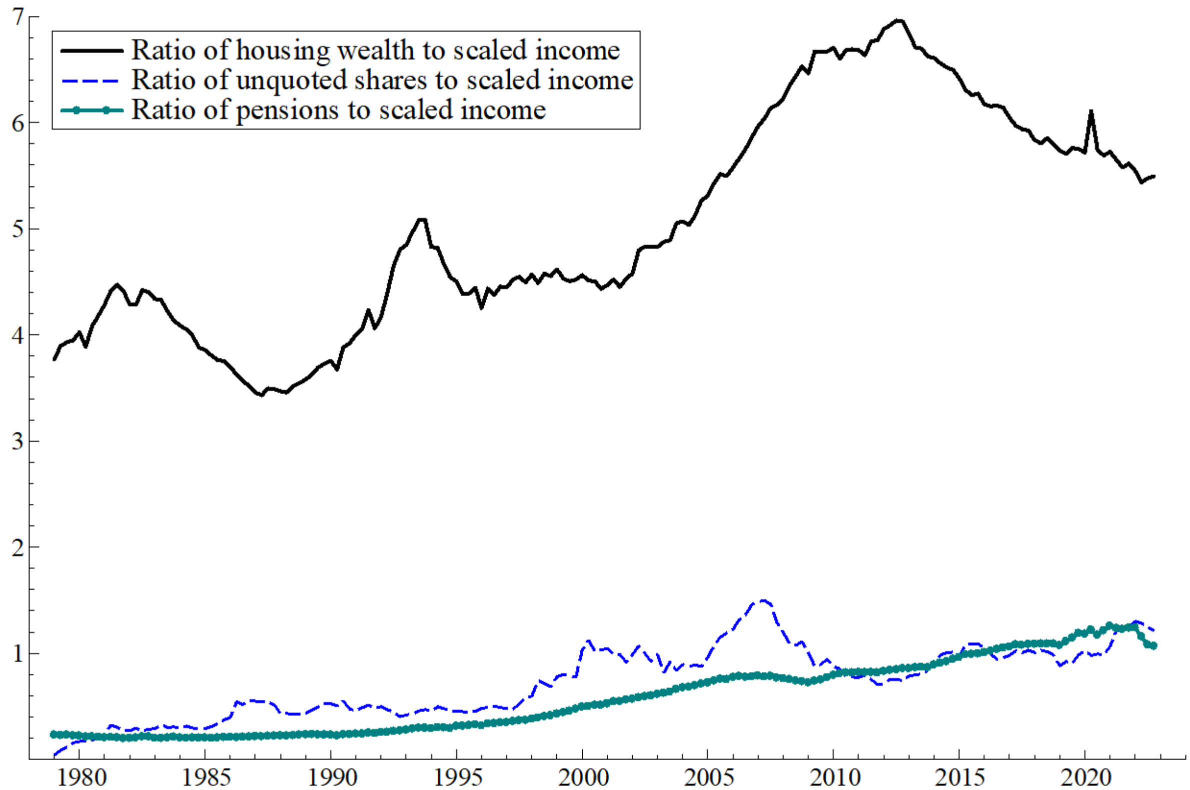

Figure 7: Ratios to scaled income of housing wealth, unquoted shares and life insurance and pension wealth.

Source: National Accounts and quarterly household balance sheets, ISTAT. Before 1995, balance sheet data linked with break-adjusted annual data from Bonci and Coletta (2008) and internal Bank of Italy data.

House prices affect not only housing wealth but also housing affordability measured by the house price to income ratio, i.e. the house price index divided by per capita scaled income in current prices, see Figure 8. Unsurprisingly, it has a cyclical pattern similar to that of the housing wealth to income ratio, but not the upward trend of the latter, reflecting real residential investment. Post-pandemic, house prices fell relative to income and so drove down housing wealth relative to income.

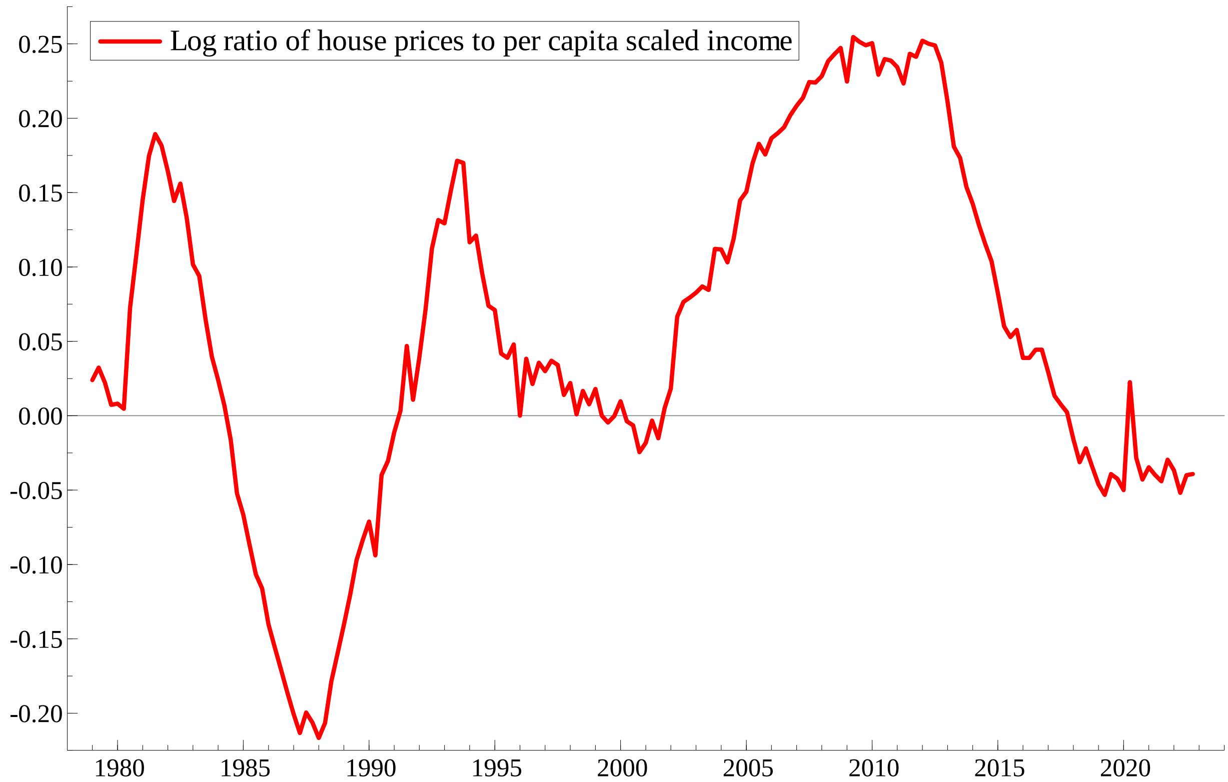

Figure 8: The log ratio of house prices to income, relative to 1996Q1.
Source: National Accounts, ISTAT and house price index from Bank of Italy.

For empirical modelling, it is desirable to group elements of the portfolio into broader groups. A priori, it is plausible that unquoted shares and pension wealth would be the least liquid wealth components, those shown in Figure 6 would be in an intermediate semi-liquid category, with deposits the most liquid of all. However, as we shall see, the empirical findings support an alternative in which the semi-liquid category consists of bills plus mutual funds and the illiquid group contains bonds, quoted shares and pension wealth, while unquoted shares drop out altogether. Liquid assets minus loans can be combined into 'net liquid assets', see Figure 9.

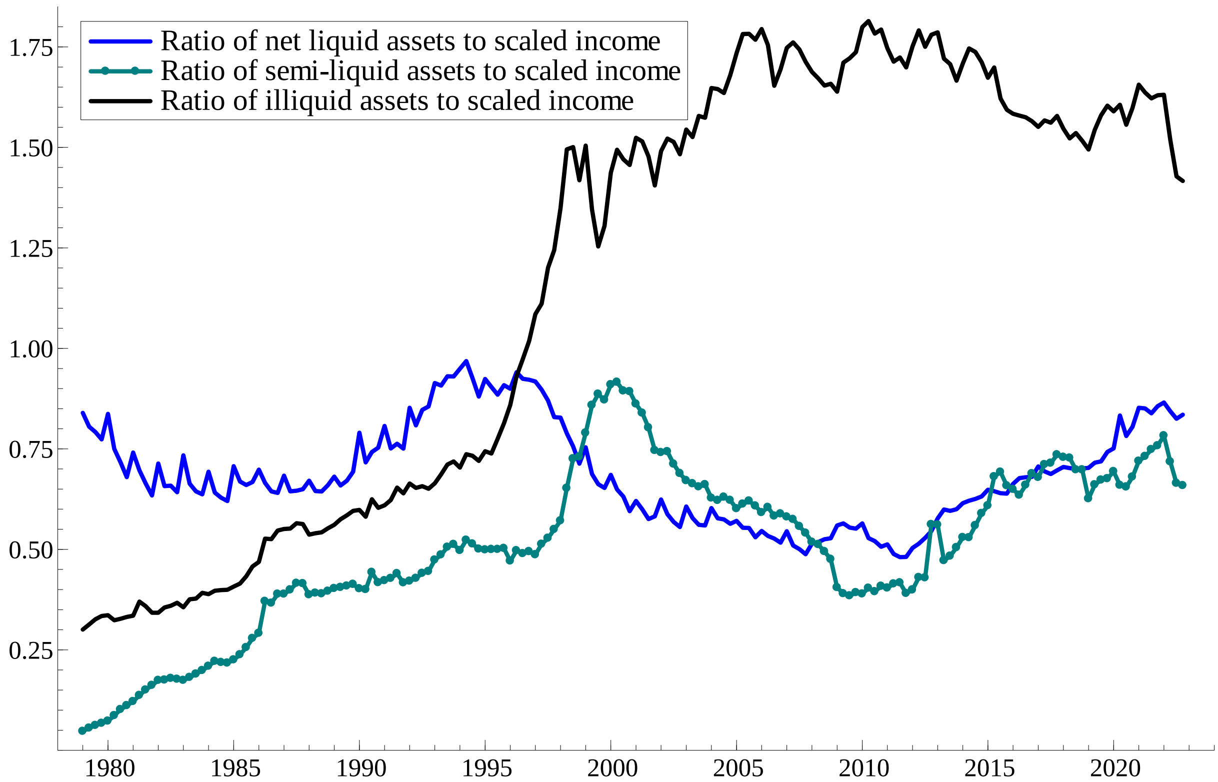

Figure 9: Ratios to income of net liquid assets, semi-liquid assets and illiquid assets.
Source: National Accounts and quarterly household balance sheets, ISTAT. Before 1995, balance sheet data linked with break-adjusted annual data from Bonci and Coletta (2008) and internal Bank of Italy data. Net liquid assets defined as deposits minus loans, semi-liquid assets defined as bills plus mutual funds, illiquid financial assets defined as quoted shares plus bonds plus pension and life insurance funds.

While major evolutions in aggregate balance sheets have occurred, it is important to recognize the heterogeneity of ownership of these assets. In Italy, financial wealth is very concentrated, with almost 80 per cent of financial wealth belonging to the upper 40 per cent of the income distribution. As the data appendix A3 shows, higher income households are far more likely to be holders of the different categories of wealth. Indeed, the proportion of households who own no wealth in a particular asset class varies strikingly by income quantile. Unsurprisingly, liquid deposits are the most universally held type of asset, though, even for this category, poorer households have far lower holdings than higher income households.

Next, we turn to estimates of permanent income, prominent in the classic texts and also important in our generalized consumption function. We define log permanent income as the discounted stream of log income over the next 40 quarters, using a quarterly discount factor of 0.95, implying an annual discount rate of a little over 20%. Following Chauvin and Muellbauer (2018) and Geiger et al. (2016), we use a reduced form forecasting equation[6]. One of the ingredients is the log ratio of the working age population to the total population since our consumption and income data are per capita: a higher proportion in the working age group implies higher per capita incomes. Other ingredients in levels are a measure of international competitiveness, the unemployment rate and the logs of real oil prices, current and recent income and the real stock market index. In terms of changes, the unemployment rate, log real oil prices, the credit conditions indicator and the inflation rate are all included. In the long-run, real per capita incomes trend upwards with improvements in technology and working practices and a time trend is therefore also included.

However, the global financial crisis of 2008-2009 (GFC) put a serious and unforecastable dent into this long-run performance. This appears to have been a mix of a once-off step down in income and a lower level of trend growth. As this would not have been foreseen by households, the fitted values of forecast log permanent income are adjusted beginning 40 quarters earlier to remove the unanticipated break in the income process. The aim here is to replicate what a forecaster would have been likely to forecast before the GFC. This implies that permanent income assessments just before the crisis would have been around 3.5 percent too optimistic. We then assume a mix of quick and gradual learning from 2008Q3. We assume that, given the depth of the financial crisis, half of the learning adjustment was instantaneous. As the European sovereign debt crisis followed the GFC with some delay, we assume two phases of a gradual learning process, with equal weights. The first phase runs from 2008Q3 to 2010Q2 and the second from 2010Q3 to 2012Q2, so that from 2012Q2 the learning-adjusted forecasts are fully based on the model incorporating the structural break, see Figure 10. In this context, the rational expectations approach ignoring the huge forecast error everyone made just before the crisis would not have been a good proxy for realistic income expectations.

The method uses actual data on future income for 40 quarters ahead. As the estimation period ends in 2019Q4, this means that from 2020Q1 we need forecasts of income from some external source to fill in the missing values. We take these from income growth forecasts for the following 40 quarters from vintage forecasts made at the end of 2019 by Oxfordeconomics.com. These rightly do not take into account the unforecastable pandemic that was about to arrive. Robustness is checked by comparing results where these forecast growth rates are reduced by 50%. Details are provided in the Appendix.

[6] The method is a type of 'local projection', Jordà (2005). Instead of forecasting quarterly log income separately at each horizon t+h, where h runs from 1 to 40 quarters, we forecast the weighted average over a horizon of 40 quarters.

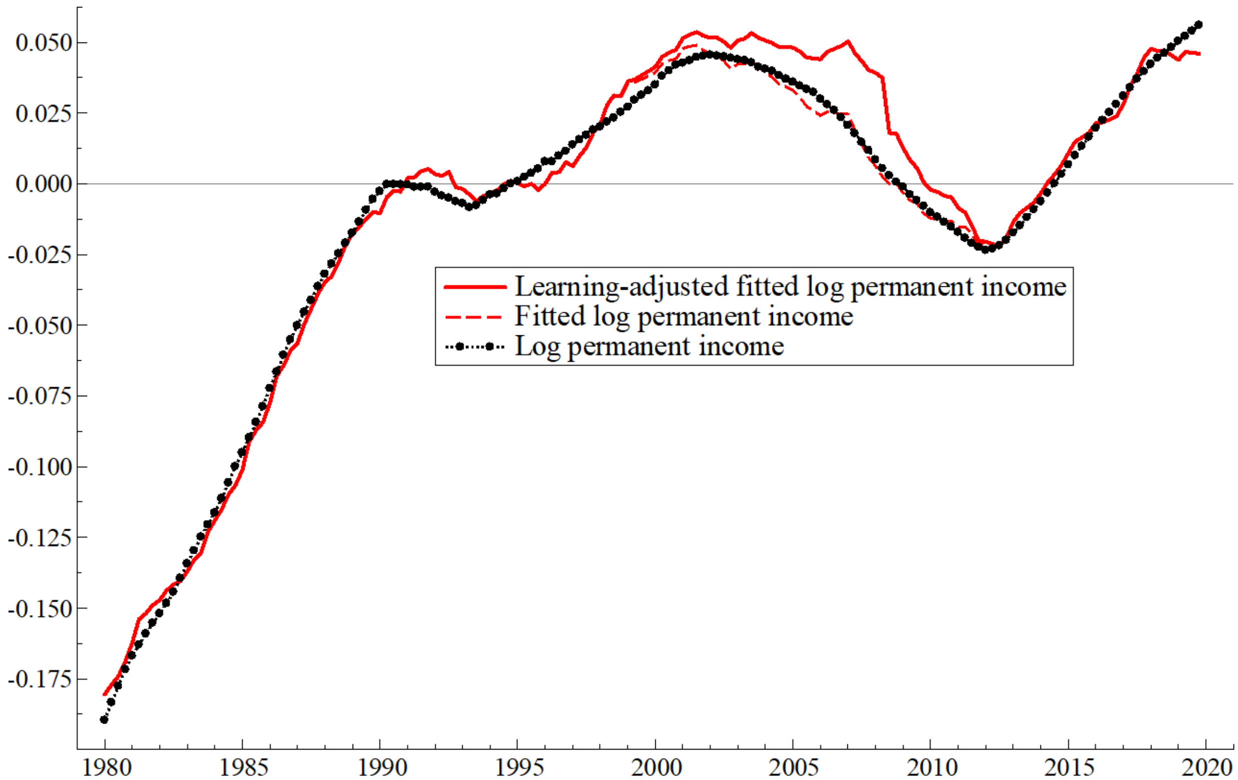

Figure 10: Estimates of log permanent income: actual values, fitted values from an econometric model, and learning-adjusted fitted values, relative to fitted value in 1996Q1.
Source: National Accounts, ISTAT and learning-adjusted permanent income estimates described in the text.

Next, for the data relevant for the consumption function's long-run solution, we turn to interest rates. Textbook theory suggests a negative coefficient in the consumption function for a real interest rate, interpreted in terms of inter-temporal substitution, though there are conditions under which a positive coefficient can occur, see Aron et al. (2012). The Bank for International Settlements (BIS) approach to the measurement of the household debt-service ratio, Drehmann (2017), defines the relevant interest rate for an amortising mortgage with a remaining life of 18-years as follows:

$$adjR = R/(1-(1+R)^{-18})$$

where R is the annual percentage mortgage rate/100. We take 12 years as a better approximation to the average maturity of Italian household debt. Thus $adjR$ is the interest rate for which the stream of payments on debt service and repayment is constant over time. The real interest rate, shown in Figure 11, is defined by subtracting the 4-quarter change in the log of the consumer expenditure deflator. The real rate remained positive even in the high inflation 1980s, turning briefly negative only in the inflation surge following Russia's attack on Ukraine.

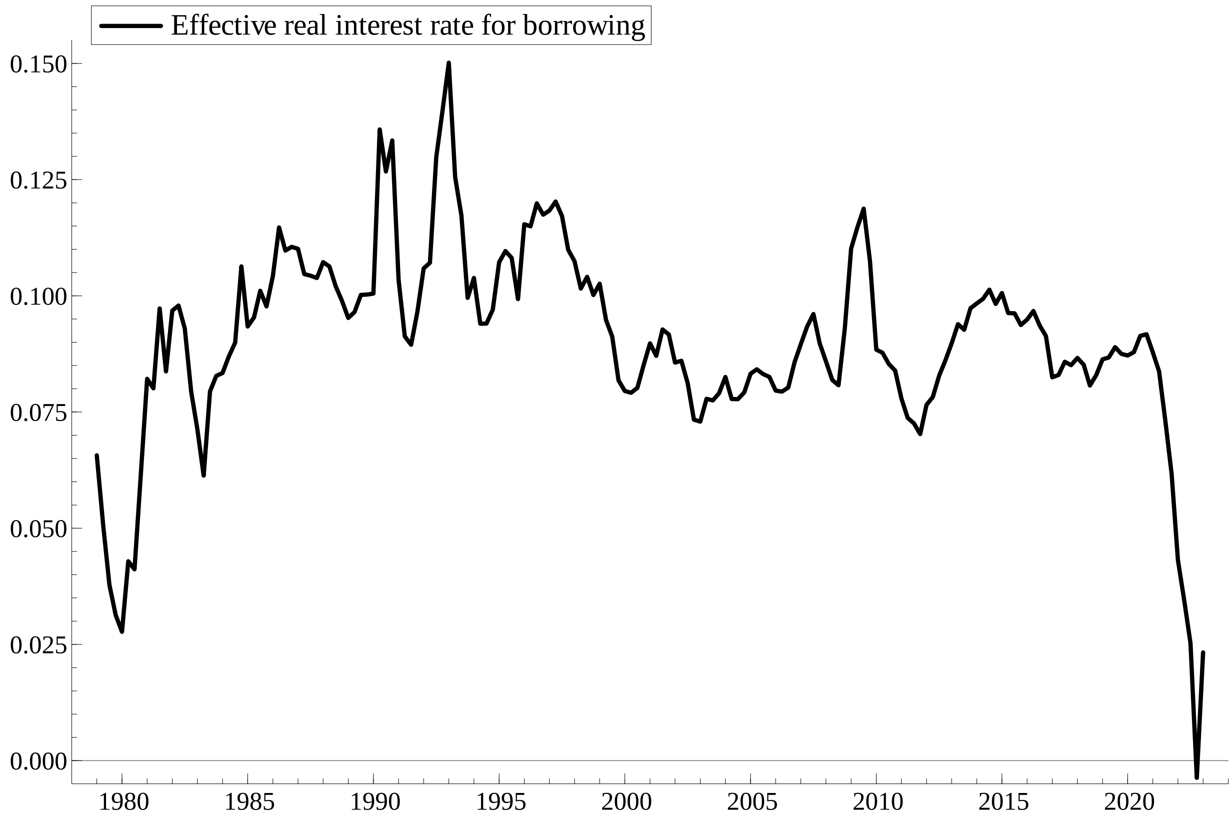

Figure 11: The real interest rate on housing loans.
Source: The interest rate is for housing loans, from Bank of Italy; the BIS definition for the effective rate on a loan with 12 years remaining duration; the real rate is the nominal effective rate minus the 4-quarter change in the log consumer expenditure deflator.

One more element in the model concerns seasonality. While the consumption and income data are meant to be seasonally adjusted, there is a pronounced shift in seasonality in the consumption data before 1990, especially in the third quarters. We control for this with a third quarter seasonal dummy which is zero from 1990Q1.

Finally, the long run solution for the consumption to income ratio is likely to be affected by pension reform. While the 1992 Amato and 1995 Dini reforms, see Hamann (1997), appear to have had little detectable long-run effects on aggregate data, this is not so for the Fornero reforms, passed in 2011 (Fornero 2020). These reforms followed the sovereign debt crisis, which deeply affected Italy The reforms, which came into effect in 2012, appear to have lowered the consumption to income ratio, see Lepinteur et al. (2022).[7] We therefore introduce a shift dummy in 2012, but allow gradual phasing in of its full effects over two years. With the election of a new government seen to be increasingly likely, and realised in May 2018, checking for consumption effects of a softening of these reforms is

[7] They use a difference-in-differences framework based on a firm-size discontinuity and individual data coming from the Italian Survey on Household Income and Wealth to examine the consequences of the 2012 reforms. Their evidence suggests that the resulting greater job insecurity reduced consumption and increased savings.

done with a 2017 shift dummy also phased in over two years.

Controls for short-term dynamics are discussed in the Appendix. These include the growth rate of an indicator of credit conditions, the acceleration of income growth, a measure of income volatility, changes in the unemployment rate and in the log of per capita constant price public consumption – a partial substitute for private consumption.

Finally, four dummies capture outliers in the consumption function. These are negative impulse dummies for 1983Q1, 1993Q1 and 2013Q1 and a dummy, which is 1 for the two years 1992-93. In 1983Q1 the spread between the Italian and German T-bill rate reached an all-time record. Consumer confidence was probably affected by political uncertainty with the forthcoming election. The years 1992-93 saw an exchange rate crisis resulting in Italy's temporary departure in 1992Q3 from the exchange rate mechanism, accompanied by a record jump in the T-bill spread. Measure of consumer confidence available since 1985 show the most pessimistic view of economic conditions and of employment prospects in 1993Q1 with the exception of the sovereign debt crisis in 2012.[8] The 2013 impulse dummy may reflect the large tax rises of that year including the re-introduction of a property tax.

3. Consumption models

The cornerstone of the consumption model is the classical Ando-Modigliani-Brumberg-Friedman consumption function. This has the following form:

$$c_t = \left(\gamma^* A_{t-1} + y_t^p\right) \tag{3.1}$$

Aggregate consumption (c) depends on end-of-period household real net asset endowment (A_{t-1}) and permanent non-property household gross disposable income (y^p). The marginal propensities to consume out of these are, respectively, $\gamma^*$and one. Non-property gross disposable income (y) refers to labour income plus net transfers. In the basic version of the theory $\gamma^*$is the return on net assets (embodying property income such as dividends, rent and interest). Then it is appropriate to exclude property income from other measures of household income used in the consumption function (Blinder and Deaton, 1985). All variables are real per capita levels.

With some manipulation, see Aron et al. (2012), equation (3.1) becomes:

$$\ln c_t/y_t \approx \alpha_0 + \gamma A_{t-1}/y_t + \varphi E_t \ln\left(y_t^p/y_t\right) \tag{3.2}$$

where the log consumption to income ratio, $\ln c_t/y_t$ is driven by three elements. First, there is (time-

[8] It is also possible to incorporate such expectations effects into the model for permanent income. But this is quite complex, with a downward shift in the underlying trend in 1982 and an upward shift in 1984, and corresponding learning mechanisms. As the crisis was temporary, introducing the 1992-3 dummy into the consumption function was the simpler alternative.

invariant) autonomous consumption, α_0. Second, there is the ratio of net household wealth (at end of period t-1) to income, A_{t-1}/y_t, scaled by the marginal propensity to consume out of assets ($\gamma \approx \gamma^*$). Third, there is the log ratio of permanent to current non-property income, $E_t \ln (y_t^p/y_t)$, scaled by (φ) to allow for a generalisation of the strict permanent income hypothesis under which $\varphi = 1$. $\ln (y^p/y_t)$ can be approximated by a weighted moving average of forward-looking income growth rates (see Campbell, 1987), where k is the time horizon and δ is the rate at which households discount future income (see the Appendix):

$$\ln \mathrm{y}^{\mathrm{p}}/y_t = (\textstyle\sum_{\mathrm{s=0}}^{\mathrm{k}} \delta^{s-1} \ln \mathrm{y_{t+s}})/\sum_{\mathrm{s=0}}^{\mathrm{k}} \delta^{s-1}) - \ln y_t \qquad (3.3)$$

With partial adjustment, the dynamic version of equation (3.2) is:

$$\Delta \ln c_t \approx \lambda(\alpha_0 + \gamma A_{t-1}/y_t + \varphi\, E_t \ln (y_t^p/y_t) + \ln y_t/c_{t-1}) \qquad (3.4)$$

where λ is the speed of adjustment to equilibrium. Note that equations (3.2) and (3.4) are homogenous of degree one, so that doubling income and assets doubles consumption. Equation (3.4) assumes constant real interest rates, no distributional effects, homogeneous net assets so that γ is the same for all asset types including liquid and illiquid financial wealth and housing wealth; and that there are no credit constraints.[9]

To introduce controls for time-varying credit access and the real interest rate and to generalise the role of liquid, semi-liquid and illiquid assets, debt and housing wealth, we augment equation (3.4) as follows:

$$\Delta \ln c_t = \lambda(\alpha_0 + \alpha_c CCI_t + \alpha_1 r_t + \gamma_1 DEP_{t-1}/y_t + \gamma_2 LOANS_{t-1}/y_t + \gamma_3 SLFA_{t-1}/y_t + \gamma_4 ILA_{t-1}/y_t + \gamma_5 HA_{t-1}/y_t + \gamma_6 \ln hp_{t-1}/y_{t-1} + \varphi\, E_t \ln (y_t^p/y_t) + \ln y_t/c_{t-1}) + other\ factors \qquad (3.5)$$

Here, CCI is an index of non-price credit conditions index, or loan standards; r is the effective real household borrowing rate; DEP_{t-1}/y_t is the ratio to income of the most liquid assets, namely bank and saving deposits; $LOANS_{t-1}/y_t$ is the ratio to income of debt; $SLFA_{t-1}/y_t$ is the ratio to income of semi-liquid financial assets; ILA_{t-1}/y_t is the ratio to income of illiquid financial assets; HA_{t-1}/y_t is the ratio to income of gross housing assets; and $\ln hp_{t-1}/y_{t-1}$ is the log ratio of real house prices to income. In a number of specifications, we constrain liquid assets and debt to appear in a net liquid assets form, with equal and opposite signed coefficients. This reflects evidence from France (Chauvin and Muellbauer, 2018), and the UK and the US (Aron et al., 2012) which support this constraint. Moreover, the loans to income ratio is a slowly trending variable in Italy, which impedes precise estimation in the presence of other trending variables. As it turned out, for Italy, unlike France, the UK and the US, no long-term effect could be found for our indicator of credit conditions, which was

[9] In an ad hoc extension of the model, one can add a term $\Delta\ln\ y_t$ to represent a fraction of households who just spend income perhaps because they are credit constrained. However, as Deaton (1991) makes clear, there is no micro-foundation for such an interpretation of credit-constrained behaviour.

found to be relevant only for short-term dynamics.[10]

The other long-term factors, discussed in section 2, include a shift in seasonality in 1990 and a 2012 shift dummy to control for the Fornero pension reforms and, in some specifications, the log ratio of the price of durable goods to non-durables.

We now explain Equation (3.5) in more detail. Whereas equation (3.1), (3.2) and (3.4) assumed homogenous assets, equation (3.5) adopts a five-part disaggregation of household net worth[11] whereby the marginal propensity to consume (MPC) out of assets depends on the liquidity of financial assets (see Otsuka 2004) and is different for housing.

Differences in MPCs between different asset types can also reflect the different characteristics of households dominating ownership of the different assets. Indeed, there is a good deal of distributional information buried in the different types of assets. It is likely that many households with mortgage debt have relatively low holdings of deposits and other financial assets. This would make their reaction to higher debt levels more negative than implied by the net worth formulation. The combination of restricted access to further credit and the lack of financial buffers, are likely to make their consumption more sensitive to rises in interest rates. The level of debt and of the debt-service ratio and increases in it therefore capture a distributional effect liable to show up in the aggregate consumption data.

Note that even without liquidity issues and credit constraints, intertemporal optimisation theory shows that because housing is a consumption good as well as an asset, the response of consumption to an increase in house prices is different from the response of consumption to, for example, the share price index (see Aron et al. (2012), Buiter (2010) and Calomiris et al. (2009)). This is one motivation for including in the consumption function the log ratio of house price to income as well as the housing wealth to income ratio. The other reason arises because of mortgage credit constraints, particularly salient in Italy, and because owner-occupiers and renters are likely to have different reactions to housing market developments. For a given loan standard, higher house prices relative to incomes increase the need to save for a deposit to enter the mortgage market. Moreover, renters are likely to see an increase in house prices relative to incomes as sign that future rents will rise and therefore be more cautious in their spending.

It is possible that some of the coefficients in the model could interact with non-price credit conditions. For example, Aron et al. (2012) and Duca and Muellbauer (2014) find that in the US and UK, where home equity withdrawal is common, the MPC for housing wealth increases with easier non-price

[10] The CCI term controls for fluctuations in long run $\ln c/y$ due to shifts in household credit access, particularly mortgage credit access. Due to asymmetric information, lenders tend to rely on non-price constraints such as down-payments ('skin in the game'), debt servicing capabilities and other screening technologies, that in many countries have evolved through time, to mitigate default risk.

[11] This is a more refined disaggregation than adopted in Aron et al. (2012) and Chauvin and Muellbauer (2018), where semi-liquid assets were combined with illiquid financial assets, and, albeit after testing, deposits minus debt were combined into a net liquid asset category.

credit conditions. But this is not the case in France and Germany, Chauvin and Muellbauer (2018) and Geiger et al. (2016), where equity withdrawal has scarcely existed; mortgage equity withdrawal is also absent in Italy. It is possible that if lenders ease the down-payment requirement, the negative effect of higher house prices relative to incomes could moderate. If access to credit in general increases, households should be able to engage in more intertemporal substitution, which would increase the weight φ on permanent income. These are testable propositions.

Salient short-term factors were introduced in the data discussion in Section 2. Among these is the change in the unemployment rate and a measure of income volatility, which capture income insecurity.

An important advantage of the general formulation of the consumption function in (3.5) is that it nests conventional models. With $\alpha_c = 0$, and $\gamma_i = \gamma$, for i=1, 5, and $\gamma_6 = 0$, equation 3.5 reduces to equation 3.4. The more common log-approximation replaces the net worth to income ratio by its log, and in the next section, which discusses empirical findings, we begin with that formulation.

4. Empirical findings.

4.1 Main regressions

Tables 1 and 2 show our main findings for the estimation of a more general consumption function for Italy that encompasses the conventional textbook version, contrasting the different approaches. In Table 1, we follow a step-by-step approach, progressively splitting net worth into liquid and illiquid assets and introducing debt.

We begin by estimating a simple textbook version of the consumption function, where all the assets the household owns are summarised into one variable expressed in the log net worth to income ratio, with no distinction between financial and physical assets, including all the short-term dynamics except for the rate of change of credit conditions.[12] Column 1 shows a poor fit of the model with high levels of residual autocorrelation and poor parameter stability. The speed of adjustment at 0.05 and the log of net worth are only just significant and one could accept the hypothesis of a unit coefficient on permanent income. As suggested by the review in Muellbauer (2022) of structural econometric policy models at some central banks, low speeds of adjustment are a typical symptom of specification problems, especially of omitted variables (see Hendry et al. (1984) and Hendry (1995, ch.7)). Column 2 adds the lagged change in the log of credit conditions to the short-term controls. Though outside the framework of the standard model, it is significant, raises the speed of adjustment a little and improves the fit and the significance of log net worth. However, parameter stability remains very poor and residual autocorrelation very high. Column 3 suggests that replacing log net worth by net

[12] Without most of these controls, there is almost no relationship to be found, suggesting quite erroneously that consumption might well follow a martingale process.

worth causes a deterioration in already poor results. All three specifications so far suggest a positive sign on the real effective interest rate on borrowing.

It is crucial to disaggregate net worth. Column 4 shows a radical improvement when housing wealth is separated from net financial assets. The speed of adjustment rises to 0.10 and is strongly significant. The relative weight of permanent income is now estimated to be 0.7, well below the unity coefficient implied by the permanent income model and the effect of the real effective interest rate on borrowing is now negative, though insignificant. The long-run MPC out of net financial assets is estimated at 0.06 with a t-ratio of 7.7, though the housing wealth to income ratio and the log house price to income ratio are insignificant, but with negative effects. One would conclude from these findings that housing wealth has, if anything a small negative effect on consumption in Italy, as in Boone and Girouard, 2002 and Slacalek, 2009. However, the model still fails the parameter stability test and residual autocorrelation remains very high.

The most dramatic improvement of all shown results comes at the next disaggregation of the household balance sheet, see column 5. We now split net financial assets into three: net liquid assets defined as liquid assets minus debt, semi-liquid assets defined as bills plus mutual funds, and illiquid financial assets defined as bonds plus quoted shares plus pension wealth. The equation standard error falls from 0.0043 to 0.0032, and the speed of adjustment jumps from 0.10 to 0.28. Moreover, parameter stability is excellent and tests for residual autocorrelation are satisfactory. The relative weight of permanent to current income is estimated at 0.61. The marginal propensities to consume are estimated with a relatively high degree of accuracy. That on liquid assets minus debt is estimated at 0.15 (with a t-ratio of 9) while that on illiquid financial assets is 0.12 (also with a t-ratio of 9) and that on semi-liquid assets 0.058 (with a t-ratio of 6.5). There is a strongly significant housing wealth effect but substantially *offset* by the negative affordability of higher house prices relative to income. The evidence suggests that in Italy the MPC out of housing wealth is lower than that out of even illiquid financial assets, strongly contradicting the net worth restriction.[13] The negative real effective interest rate effect is strongly significant, while the negative estimated effect of the Fornero reforms on the long-run consumption to income ratio is large at over 6 percent.

The global financial crisis, morphing into the European sovereign debt crisis with severe domestic consequences for pensions and fiscal policy, is likely to have raised income insecurity among households. Probably households became less forward looking and more focused on current income. A simple way of handling this within the model is to permit a shift in the relative weights of permanent and current income from the GFC onwards. We interact the 2008Q3 shift dummy with the log-ratio of permanent to current income, taken as the deviation from its value in 2008Q2. The effect is significant at the 10 percent level and reduces the relative weight on permanent income from a point estimate of 0.64 pre-GFC to 0.34 post-GFC, see column 6. The speed of adjustment is 0.29

[13] For comparison, the Bank of Italy's consumption equation in BIQM uses net financial wealth (excluding housing wealth) and includes a negative real interest rate effect. The speed of adjustment is around 0.07, but the results are not strictly comparable as the wealth coverage is for the private sector rather than just households and the definition of consumption includes the imputed service flow of durable goods, rather than expenditure on durables.

and the estimated long-run effect of the Fornero reforms a somewhat more plausible 0.048 reduction in the consumption to income ratio, compared with an estimate of 0.066, omitting the post-GFC shift in the weight of permanent income.

Estimating this model over various samples confirms the Chow test for parameter stability. Columns 1 to 4 of Table 2 show results for the periods 1980-1999, 1980-2007, 1980-2010, and 1985 to 2019. All the parameter estimates are within one standard error of the full sample estimates, repeated in column 5 of Table 2. As current household income is potentially endogenous, as strongly argued by Hall (1978), it is helpful to compare results of instrumental variable estimates where current income is instrumented by its fitted value from an equation using lagged data. Column 6 of Table 2 shows these estimates. The results are very close to the OLS estimates.

4.2 Robustness checks

Robustness tests are performed in Table 3. The first column splits loans from deposits showing a negative coefficient on the loan to income ratio, only just below the positive one on the deposits to income ratio. This confirms the validity of the net liquid asset restriction. Column 2 shows results for the alternative grouping of semi-liquid and illiquid financial assets discussed in section 2. The fit is somewhat worse and parameter stability is less stellar, while the speed of adjustment drops to 0.23. The MPC out of net liquid assets is a little higher at 0.17 while that on this definition of semi-liquid assets is 0.09. For this definition of illiquid financial assets, the MPC drops to 0.01 and is not significant. The housing effects are quite similar to those for the preferred split of semi and illiquid financial assets. The post-GFC shift in the relative weights of permanent and current income is confirmed but even sharper. Fundamentally, the key findings of the paper regarding the importance of separate estimation of the MPC for liquid assets and the need to control for housing affordability when estimating housing wealth effects, are upheld even with a less than ideal split between semi- and illiquid financial assets.

The favoured specifications include rich controls for short-term dynamics. One might question the robustness of the long-run relationships to the exclusions of these eight controls. The results shown in column 3, Table 3 are very reassuring. While the fit of the equation is naturally far worse, the speed of adjustment is much the same, at 0.29 and the estimates of the long-run MPCs very similar to those found, for example in Table 2, column 5. The importance of splitting housing effects into two is confirmed, as is the evidence for greater short-termism regarding the more uncertain income outlook since the GFC.

Table 1. Italian Consumption Function Estimates, 1980-2019

$\Delta \ln c_t$	Symbol	(1)	(2)	(3)	(4)	(5)	(6)
				Long-run effects			
Speed of adjustment	λ	0.0531 (0.0219) [2.43]	0.0632 (0.0216) [2.92]	0.0398 (0.0184) [2.16]	0.103 (0.0263) [3.92]	0.278 (0.0289) [9.62]	0.289 (0.0292) [9.88]
$\ln y_t - \ln c_{t-1}$	-	1.00	1.00	1.00	1.0000	1.00	1.00
Constant	α_0	-0.293 (0.180) [-1.63]	-0.299 (0.146) [-2.04]	-0.00999 (0.0155) [-0.0643]	0.151 (0.416) [0.364]	0.323 (0.115) [2.81]	0.235 (0.119) [1.97]
1990 seasonal pattern dummy	α_{0S}	0.105 (0.0568) [1.85]	0.0854 (0.0414) [2.06]	0.139 (0.0816) [1.70]	0.0599 (0.0223) [2.69]	0.0256 (0.00512) [5.01]	0.0242 (0.00486) [4.98]
Adjusted r_t	α_1	0.769 (0.569) [1.35]	0.667 (0.448) [1.49]	0.982 (0.765) [1.28]	-0.0308 (0.272) [-0.113]	-0.343 (0.0728) [-4.71]	-0.313 (0.0713) [-4.39]
$\ln (y_t^p / y_t)$	α_2	1.48 (0.473) [3.13]	1.28 (0.352) [3.63]	1.43 (0.596) [2.41]	0.704 (0.197) [3.56]	0.608 (0.0559) [10.9]	0.643 (0.0574) [11.2]
2008q3 GFC dummy x $\ln (y_t^p / y_t)$	$\alpha_{2,int}$						-0.302 (0.158) [-1.92]
1992 Exchange rate crisis dummy	τ_{1992}	-0.0425 (0.0400) [-1.06]	-.0322 (0.0325) [-0.994]	-0.0385 (0.0528) [-0.729]	-0.02399 (0.0200) [-1.19]	-0.0357 (0.00668) [-5.34]	-0.0348 (0.00637) [-5.47]
2012 Fornero reform dummy	τ_{2012}	-0.0525 (0.0290) [-1.81]	-0.0308 (0.0261) [-1.18]	-0.00545 (0.0462) [-0.118]	-0.0151 (0.0216) [-0.702]	-0.0660 (0.00677) [-9.75]	-0.0485 (0.0111) [-4.36]
$\ln A_{t-1}/y_t$	γ	0.172 (0.0819) [2.10]	0.173 (0.0668) [2.60]				
A_{t-1}/y_t	γ_{NETW}			0.00766 (0.0176) [0.436]			
NFA_{t-1}/y_t	$\gamma_{1,NFA}$				0.0594 (0.00768) [7.74]		
NLA_{t-1}/y_t	$\gamma_{1,NLA}$					0.155 (0.0171) [9.02]	0.147 (0.0164) [9.00]
$SMLB_{t-1}/y_t$	$\gamma_{1,SMLB}$					0.122 (0.0136) [8.95]	0.125 (0.0131) [9.56]
$ILAPEN_{t-1}/y_t$	$\gamma_{1,ILAPEN}$					0.0576 (0.00884) [6.51]	0.0590 (0.00846) [6.97]

HA_{t-1}/y_t	γ_2				-0.00716 (0.0142) [-0.505]	0.0378 (0.00517) [7.32]	0.0354 (0.00509) [6.95]
$\ln HP_{t-1}/y_{t-1}$	γ_3				-0.0305 (0.0760) [-0.402]	-0.102 (0.0213) [-4.81]	-0.0859 (0.0220) [-3.90]
Short-run effects							
$\Delta_2 \ln CCI_{t-2}$	β_0		0.0379 (0.0129) [2.94]	0.0365 (0.0130) [2.82]	0.0114 (0.0153) [0.750]	0.0313 (0.0112) [2.79]	0.0296 (0.0112) [2.65]
$\Delta_2 \ln c_t^P$	β_1	-0.0230 (0.00875) [-2.63]	-0.0237 (0.00853) [-2.78]	-0.0229 (0.00859) [-2.67]	-0.0294 (0.00847) [-3.48]	-0.0163 (0.00657) [-2.47]	-0.0172 (0.00653) [-2.64]
$\Delta\Delta_4 \ln y_t$	β_2	0.0858 (0.0232) [3.69]	0.0879 (0.0227) [3.88]	0.0891 (0.0228) [3.91]	0.0848 (0.0221) [3.84]	0.0818 (0.0168) [4.87]	0.0794 (0.0167) [4.76]
$\Delta_2 \ln ur_t$	β_3	-0.477 (0.0993) [-4.80]	-0.412 (0.0992) [-4.15]	-0.367 (0.101) [-3.64]	-0.155 (0.113) [-1.37]	-0.297 (0.0835) [-3.56]	-0.284 (0.0830) [-3.42]
$\lvert\hat{\varepsilon}_{t-1}\rvert$	β_4	-0.0579 (0.0530) [-1.09]	-0.0437 (0.0518) [-0.843]	-0.0463 (0.0524) [-0.883]	-0.0551 (0.0505) [-1.09]	-0.171 (0.0405) [-4.21]	-0.163 (0.0403) [-4.05]
$d_{1983:q1}$	β_5	-0.0193 (0.00471) [-4.11]	-0.0190 (0.00459) [-4.13]	-0.0185 (0.00461) [-4.01]	-0.0182 (0.00447) [-4.08]	-.0214 (0.00339) [-6.33]	-0.0216 (0.00336) [-6.43]
$d_{1993:q1}$	β_6	-0.01692 (0.00501) [-3.37]	-0.0166 (0.488) [-3.40]	-0.0166 (0.00492) [-3.37]	-0.0154 (0.00475) [-3.23]	-0.0149 (0.00358) [-4.15]	-0.0146 (0.00355) [-4.11]
$d_{2013:q1}$	β_7	-0.0137 (0.00479) [-2.87]	-0.0131 (0.00467) [-2.80]	-0.0133 (0.00470) [-2.83]	-.0134 (0.00454) [-2.96]	-0.01191 (0.00343) [-3.45]	-0.0111 (0.00343) [-3.24]
Diagnostics							
Standard error x 100		0.454	0.442	0.445	0.429	0.324	0.321
Adjusted R^2		0.510	0.535	0.528	0.562	0.751	0.755
LM Het. test (p-value)		0.474	0.822	0.891	0.701	0.165	0.152
Durbin-Watson		1.53	1.53	1.56	1.60	2.16	2.19
AR1/MA1 (p-value)		0.002	0.002	0.004	0.012	0.314	0.214
AR4/MA4(p-value)		0.001	0	0	0	0.505	0.469
Chow test (p-value)		0.005	0.001	0	0	0.986	0.956
RESET2 test (p-value)		0.04	0.139	0.088	0.816	0.969	0.604
F test (p-value)		0	0	0	0	0	0
Schwarz Criterion		-606.1	-608.2	-607.1	-609.1	-650.3	-649.8
Log likelihood		644.2	648.8	647.7	654.7	701.0	703.1

Notes: standard errors in parenthesis; t-stats in square brackets. An ogive dummy based on 8 quarters starting from 2017:q1 is not significant. A 2-quarter moving average transformation is applied to the 1992 exchange rate crisis dummy. Acronyms are as follows: A is net worth, NFA is net financial assets, NLA is net liquid assets, SMLB is semi-liquid assets, ILAPEN is illiquid assets, HA is housing wealth, HP is the real house price index, CCI is the credit conditions index, c^p is public consumption , ur is the unemployment rate, $\hat{\varepsilon}_{t-1}$ is lagged income volatility.

Table 2. Italian Consumption Function Estimates on different sample periods.

$\Delta \ln c_t$	Symbol	1980-1999	1980-2007	1980-2010	1985-2019	1980-2019	$\hat{y}$
				Long-run effects			
Speed of adjustment	λ	0.312 (0.0507) [6.15]	0.295 (0.0382) [7.73]	0.316 (0.0376) [8.41]	0.295 0.0322 [9.17]	0.289 (0.0292) [9.88]	0.283 (0.0304 [9.29]
$\ln y_t - \ln c_{t-1}$	-	1.00	1.00	1.00	1.00	1.00	1.00
Constant	α_0	0.579 (0.380) [1.526]	0.152 (0.181) [0.839]	0.119 (0.150) [0.790]	0.427 (0.206) [2.07]	0.235 (0.119) [1.97]	0.248 (0.127) [1.95]
1990 seasonal pattern dummy	α_{0S}	0.0208 (0.00593) [3.52]	0.0240 (0.00542) [4.42]	0.0222 (0.00497) [4.47]	0.0258 (0.00639) [4.03]	0.0242 (0.00486) [4.98]	0.0247 (0.00501) [4.93]
Adjusted r_t	α_1	-0.212 (0.113) [-1.87]	-0.286 (0.0897) [-3.18]	-0.284 (0.0822) [-3.45]	-0.291 (0.103) [-2.83]	-0.313 (0.0713) [-4.40]	-0.313 (0.0772) [-4.05]
$\ln(y_t^p/y_t)$	α_2	0.588 (0.0856) [6.87]	0.638 (0.0636) [10.0]	0.644 (0.0599) [10.7]	0.601 (0.0626) [9.60]	0.643 (0.0574) [11.2]	0.651 (0.0807) [8.06]
2008:q3 GFC dummy x $\ln(y_t^p/y_t)$	$\alpha_{2,int}$			-0.544 (0.401) [-1.36]	-0.215 (0.181) [-1.19]	-0.302 (0.1585) [-1.92]	-0.238 (0.193) [-1.23]
1992 Exchange rate crisis dummy	τ_{1992}	-0.0440 (0.0115) [-3.831]	-0.0361 (0.00779) [-4.64]	-0.0318 (0.00669) [-4.74]	-0.0330 (0.00652) [-5.06]	-0.0348 (0.00637) [-5.47]	-0.0353 (0.00663) [-5.33]
2012 Fornero reforms dummy	τ_{2012}				-0.0577 (0.0145) [-3.99]	-0.0485 (0.0111) [-4.36]	-0.0532 (0.0134) [-3.98]
NLA_{t-1}/y_t	$\gamma_{1,NLA}$	0.123 (0.0265) [4.62]	0.143 (0.0175) [8.14]	0.147 (0.0167) [8.79]	0.143 (0.0201) [7.13]	0.147 (0.0164) [9.00]	0.151 (0.0188) [8.03]
$SMLB_{t-1}/y_t$	$\gamma_{1,SMLB}$	0.100 (0.0250) [4.01]	0.132 (0.0148) [8.91]	0.124 (0.0138) [8.99]	0.132 (0.0146) [9.02]	0.125 (0.0131) [9.56]	0.124 (0.0134) [9.25]
$ILAPEN_{t-1}/y_t$	$\gamma_{1,ILAPEN}$	0.0512 (0.0159) [3.22]	0.0565 (0.010638) [5.31]	0.0611 (0.00929) [6.57]	0.0591 (0.00877) [6.74]	0.0590 (0.00846) [6.97]	0.0587 (0.00870) [6.75]
HA_{t-1}/y_t	γ_2	0.0657 (0.0259) [2.53]	0.0334 (0.00903) [3.70]	0.0315 (0.00680) [4.62]	0.0390 (0.00602) [6.47]	0.0354 (0.00509) [6.95]	0.0364 (0.00580) [6.29]
$\ln HP_{t-1}/y_{t-1}$	γ_3	-0.162 (0.0783) [-2.07]	-0.0704 (0.0350) [-2.01]	-0.0642 (0.0283) [-2.27]	-0.122 (0.0390) [-3.12]	-0.0860 (0.0220) [-3.90]	-0.0893 (0.0233) [-3.83]
				Short-run effects			

$\Delta_2 \ln CCI_{t-2}$	β_0	0.0446 (0.0181) [2.45975]	0.0349 (0.0142) [2.46133]	0.0389 (0.0138) [2.82294]	0.0214 (0.0128) [1.66855]	0.0296 (0.0112) [2.65021]	0.0306 (0.0114) [2.68439]
$\Delta_2 \ln c_t^P$	β_1	-0.0227 (0.00974) [-2.33]	-0.0178 (0.00747) [-2.38]	-0.0145 (0.00741) [-1.957]	-0.0218 (0.00927) [-2.36]	-0.0172 (0.00653) [-2.64]	-0.0166 (0.00670) [-2.48]
$\Delta\Delta_4 \ln y_t$	β_2	0.102 (0.0249) [4.08]	0.0782 (0.0193) [4.06]	0.0735 (0.0193) [3.80]	0.0842 (0.0186) [4.53]	0.0794 (0.0167 [4.76]	0.0759 (0.0214) [3.54]
$\Delta_2 \ln ur_t$	β_3	-0.332 (0.183) [-1.82]	-0.277 (0.131) [-2.12]	-0.378 (0.1223) [-3.09]	-0.274 (0.0943) [-2.91]	-0.284 (0.0830) [-3.42]	-0.298 (0.0923) [-3.23]
$\lvert\hat{\varepsilon}_{t-1}\rvert$	β_4	-0.169 (0.0603) [-2.80]	-0.149 (0.0472) [-3.15]	-0.177 (0.0468) [-3.79]	-0.166 (0.0418) [-3.96]	-0.163 (0.0403) [-4.05]	-0.165 (0.0405) [-4.07]
$d_{1983:q1}$	β_5	-0.0218 (0.00404) [-5.39]	-0.0215 (0.00361) [-5.96]	-0.0220 (0.00367) [-5.99]		-0.0216 (0.00336) [-6.43]	-0.0215 (0.00337) [-6.39]
$d_{1993:q1}$	β_6	-0.0164 (0.00435) [-3.77]	-0.0147 (0.003841) [-3.81]	-0.0151 (0.00389) [-3.87]	-0.0153 (0.00362) [-4.22]	-0.0146 (0.00356) [-4.11]	-0.0145 (0.00359) [-4.06]
$d_{2013:q1}$	β_7				-0.0111 (0.00343) [-3.24]	-0.0111 (0.00343) [-3.24]	-0.0112 (0.00347) [-3.219]
				Diagnostics			
Standard error x 100		0.377	0.342	0.349	0.319	0.321	0.300
Adjusted R^2		0.674	0.691	0.700	0.747	0.755	0.755
LM Het. test (p-value)		0.289	0.084	0.133	0.381	0.152	0
Durbin-Watson		2.40	2.47	2.21	2.12	2.19	2.20
AR1/MA1 (p-value)		0.074	0.016	0.22	0.447	0.214	0.199
AR4/MA4(p-value)		0.377	0.069	0.38	0.404	0.469	0.422
Chow test (p-value)		0.702	0.98	0.975	0.922	0.956	0.982
RESET2 test (p-value)		0.995	0.554	0.857	0.436	0.604	0
F test (p-value)		0	0	0	0	0	0
Schwarz Criterion		-305.0	-445.7	-491.4	-568.0	-649.8	-700.3
Log likelihood		344.4	488.2	537.2	617.4	703.1	702.9

Notes: standard errors in parenthesis; t-stats in square brackets. An ogive dummy based on 8 quarters starting from 2017:q1 is not significant. A 2-quarter moving average transformation is applied to the 1992 exchange rate crisis dummy. Acronyms are as follows: A is net worth, NFA is net financial assets, NLA is net liquid assets, SMLB is semi-liquid assets, ILAPEN is illiquid assets, HA is housing wealth, HP is the real house price index, CCI is the credit conditions index, c^p is public consumption , ur is the unemployment rate, $\hat{\varepsilon}_{t-1}$ is lagged income volatility.

Table 3. Italian Consumption Function Estimates, 1980-2019: robustness checks.

$\Delta \ln c_t$	Symbol	Deposits vs loans	Different asset grouping	No short-run controls	Price Ratio durable and-durable consumption	Demography	Further asset split
				Long-run effects			
Speed of adjustment	λ	0.294 (0.0321) [9.17]	0.230 (0.0270) [8.50]	0.292 (0.0379) [7.71]	0.283 (0.0288) [9.83]	0.288 (0.0292) [9.86]	0.296 (0.0297) [9.98]
$\ln y_t - \ln c_{t-1}$	-	1.00	1.00	1.00	1.00	1.00	1.00
Constant	α_0	0.165 (0.206) [0.801556]	0.394 (0.157) [2.51300]	0.339 (0.152) [2.23503]	0.473 (0.158) [2.98405]	0.408 (0.204) [2.00406]	0.535 (0.160) [3.33405]
1990 seasonal pattern dummy	α_{0S}	0.0239 (0.00484) [4.94]	0.0312 (0.665) [4.70]	0.0290 (0.00672) [4.31]	0.0245 (0.00489) [5.01]	0.0244 (0.00488) [5.00]	0.0236 (0.00463) [5.08]
Adjusted r_t	α_1	-0.302 (0.0754) [-4.01]	-0.484 (0.0960) [-5.04]	-0.351 (0.0920) [-3.81]	-0.298 (0.0719) [-4.15]	-0.339 (0.0753) [-4.50]	-0.170 (0.0934) [-1.82]
$\ln (y_t^p / y_t)$	α_2	0.664 (0.0760) [8.73]	0.601 (0.0796) [7.55]	0.541 (0.07030) [7.71]	0.512 (0.0786) [6.52]	0.610 (0.0647) [9.42]	0.470 (0.0782) [6.00]
2008: q3 GFC dummy x $\ln (y_t^p / y_t)$	$\alpha_{2,int}$	-0.316 (0.159) [-1.99]	-0.518 (0.214) [-2.41]	-0.505 (0.209) [-2.45]	-0.325 (0.158) [-2.05]	-0.387 (0.178) [-2.18]	-0.146 (0.189) [-0.770]
1992 Exchange rate crisis dummy	τ_{1992}	-0.0339 (0.00665) [-5.10]	-0.0313 (0.00766) [-4.08]	-0.0354 (0.00823) [-4.30]	-0.0363 (0.00645) [-5.62]	-0.0348 (0.00638) [-5.45]	-0.0351 (0.00639) [-5.50]
2012 Fornero reforms dummy	τ_{2012}	-0.0488 (0.0110) [-4.45]	-0.00664 (0.0164) [-.404]	-0.0243 (0.0139) [-1.76]	-0.0306 (0.0136) [-2.26]	-0.0359 (0.0163) [-2.19]	-0.0533 (0.0178) [-2.99]
$\ln P_{DUR,t-1} - \ln P_{NDUR,t-1}$	τ_{RP}				0.113 (0.0497) [2.26]		0.0894 (0.0935) [0.957]
Demography	τ_{DEM}					-0.219 (0.209) [-1.05]	
NLA_{t-1}/y_t	$\gamma_{1,NLA}$		0.169 (0.0231) [7.33]	0.125 (0.0176) [7.07]	0.143 (0.0163) [8.76]	0.145 (0.0165) [8.77]	0.154 (0.0188) [8.21]
DEP_{t-1}/y_t	$\gamma_{1,DEP}$	0.147 (0.0161) [9.14]					
$LOANS_{t-1}/y_t$	$\gamma_{1,LOANS}$	-0.128 (0.0503) [-2.54]					

$SMLB_{t-1}/y_t$	$\gamma_{1,SMLB}$	0.125 (0.0129) [9.71]		0.121 (0.0170) [7.12]	0.128 (0.0132) [9.75]	0.126 (0.0131) [9.58]	
$ILAPEN_{t-1}/y_t$	$\gamma_{1,ILAPEN}$	0.0577 (0.00893) [6.46049]		0.0756 (0.0112) [6.72644]	0.0670 (0.00916) [7.30279]	0.0603 (0.00856) [7.03975]	
$SEMILA_{t-1}/y_t$	$\gamma_{1,SEMILA}$		0.0908 (0.00584) [15.5]				
ILA_{t-1}/y_t	$\gamma_{1,ILA}$		0.00903 (0.00852) [1.06]				
$BILLS_{t-1}/y_t$	$\gamma_{1,BILLS}$						0.0776 (0.0513) [1.51]
MUT_{t-1}/y_t	$\gamma_{1,MUT}$						0.144 (0.014944 [9.63]
$BONDS_{t-1}/y_t$	$\gamma_{1,BONDS}$						0.0513 (0.0122) [4.22]
QSH_{t-1}/y_t	$\gamma_{1,QSH}$						0.00410 (0.0339) [0.121]
PEN_{t-1}/y_t	$\gamma_{1,PEN}$						0.0484 (0.0439) [1.10]
HA_{t-1}/y_t	γ_2	0.0309 (0.0118) [2.620]	0.0370 (0.00539) [6.87]	0.0239 (0.00635) [3.77]	0.0514 (0.00877) [5.86]	0.0379 (0.00566) [6.70]	0.0522 (0.0108) [4.86]
$\ln HP_{t-1}/y_{t-1}$	γ_3	-0.0720 (0.0401) [-1.79]	-0.111 (0.0287) [-3.88]	-0.0948 (0.0281) [3.37]	-0.147 (0.0349) [-4.22]	-0.0991 (0.0254) [-3.90]	-0.155 (0.0407) [-3.81]
			Short-run effects				
$\Delta_2 \ln CCI_{t-2}$	β_0	0.0280 (0.0119) [2.36]	0.0337 (0.0124) [2.71]		0.0335 (0.0111) [3.02]	0.0291 (0.0112) [2.61]	0.0394 (0.0113) [3.50]
$\Delta_2 \ln c_t^P$	β_1	-0.0171 (0.00656) [-2.60]	-0.0154 (0.00696) [-2.21]		-0.0216 (0.00669) [-3.23]	-0.0183 (0.00661) [-2.77]	-0.0249 (0.00707) [-3.53]
$\Delta\Delta_4 \ln y_t$	β_2	0.0783 (0.0169) [4.62]	0.0766 (0.0178) [4.30]		0.0831 (0.0165) [5.04]	0.0784 (0.0167) [4.69]	0.0813 (0.0179) [4.53]
$\Delta_2 \ln ur_t$	β_3	-0.283 (0.0834) [-3.39]	-0.319 (0.0927) [-3.44]		-0.282 (0.0817) [-3.46]	-0.275 (0.0834) [-3.30]	-0.282 (0.0835) [-3.38]
$\lvert\hat{\varepsilon}_{t-1}\rvert$	β_4	-0.163 (0.0404) [-4.03]	-0.148 (0.04211) [-3.53]		-0.162 (0.0397) [-4.09]	-0.161 (0.0404) [-3.98]	-0.154 (0.0393) [-3.91]

$d_{1983:q1}$	β_5	-0.0216 (0.00337) [-6.40]	-0.0212 (0.00355) [-5.97]		-0.0215 (0.00331) [-6.49]	-0.0214 (0.00336) [-6.37]	-0.02138 (0.00326) [-6.52]
$d_{1993:q1}$	β_6	-0.01465 (0.00356) [-4.09]	-0.0139 (0.00377) [-3.68]		-0.0155 (0.00351) [-4.41]	-0.0145 (0.00355) [-4.09]	-0.0168 (0.00353) [-4.77]
$d_{2013:q1}$	β_7	-0.0112 (0.00344) [-3.25]	-0.0118 (0.00364) [-3.24]		-0.0115 (0.00337) [-3.40]	-0.0113 (0.00343) [-3.29]	-0.0111 (0.00334) [-3.33]
			Diagnostics				
Standard error x 100		0.322	0.340	0.436	0.315	0.320	0.311
Adjusted R^2		0.754	0.726	0.548	0.763	0.755	0.770
LM Het. test (p-value)		0.16	0.311	0.13	0.109	0.161	0.183
Durbin-Watson		2.19	2.16	1.97	2.26	2.22	2.25
AR1/MA1 (p-value)		0.214	0.305	0.907	0.098	0.155	0.096
AR4/MA4(p-value)		0.461	0.329	0.174	0.168	0.377	0.064
Chow test (p-value)		0.727	0.708	0.551	0.862	0.634	0.494
RESET2 test (p-value)		0.601	0.483	0.114	0.54	0.465	0.406
F test (p-value)		0	0	0	0	0	0
Schwarz Criterion		-647.3	-640.6	-616.5	-650.4	-647.9	-646.8
Log likelihood		703.1	693.9	649.5	706.2	703.7	710.3

Notes: standard errors in parenthesis; t-stats in square brackets. An ogive dummy based on 8 quarters starting from 2017:q1 and the ratio between unquoted shares and income are not significant. Moving average transformations apply to the 1992 exchange rate crises dummy (MA2) as well as to the log ratio between the prices of durable and non-durable consumption (MA4), and to demography (MA8). See notes to tables 1 and 2 for main acronyms. Additional acronyms: MUT is mutual funds, QSH is quoted shares, PEN is pension wealth. SEMILA is semi-liquid assets defined as bills+bonds+mutual funds+quoted shares; ILA is illiquid assets defined as unquoted shares + pension wealth.

Another robustness check is to compare results for the conventionally defined real interest rate on borrowing with those for the effective real interest rate as defined by the BIS. The estimates and the goodness of fit are very similar but parameter stability is slightly superior for the effective rate.

Throughout, tests for the relevance of generalized credit conditions as part of the long-run solution showed an insignificant effect, in contrast to the important role played by credit conditions in France (Chauvin and Muellbauer, 2018) and the US and UK (Aron et al. 2012). It is noteworthy that household debt relative to income has grown only slowly in Italy and remains at far lower levels than in these countries; Italy has one of the lowest ratios of household debt to income among OECD countries. This suggests little change in credit conditions relevant for households in Italy by comparison with many other economies. Nevertheless, the rate of change of credit conditions plays a role in our models, helping to forecast income growth in the permanent income equation and directly in the consumption equation. Parameter estimates for the long-run coefficients are quite robust to the exclusion of the rate of change of credit conditions.

In section 2, we put forward an argument that long-run changes in technology, taking advantage of huge economies of scale made possible by ITC, might have reduced the need to save to acquire goods and services that improve consumer well-being. We suggested the relative price of durables to non-durables as an indicator for these changes in technology. We introduce the lagged moving average of the log relative price of durables in the specification shown in column 4, Table 3. It is significant and positively signed, implying a negative trend effect on the consumption to income ratio, given all the other controls. It has the effect of lowering the estimated long-run effect of the Fornero reforms from around 4.8 percent to a reduction in the consumption to income ratio of about 3 percent.

With a variable as strongly trending as the relative price of durable goods, there is a possibility that it could be proxying some other trend, of which the effects of demography are obvious contenders. Improving life expectancy, whether at birth or from young adulthood, seems a trend that could raise the saving ratio, i.e. reduce the consumption to income ratio. However, in the 2000s, life expectancy has been improving more slowly. The effect is not significant, and moreover, results in estimates of the Fornero reforms that begin to look implausibly high.

While simple life-cycle models suggest that in retirement, households should de-cumulate assets, the well-known saving in retirement puzzle is a stylized fact. The elderly appear to cumulate non-pension wealth: their discretionary saving is positive and quite often increasing with age, see Börsch-Supan (2001). Saving for retirement should be at its peak in the decade before retirement. Together the two arguments suggest that the trend increase in the fraction of adults over about 53 could be a factor in a higher saving ratio, other things being equal. Replacing the log relative price by the 8-quarter moving average of the ratio of people aged 53 and over, to those aged 25 and over, gives results shown in column 5, table 3. The demographic variable is not significant, t=-1.05. The fit and parameter stability are not quite as good as for the relative price specification, but the estimated effect of the Fornero reforms is around 3.6 percent, more plausible than the 4.8 percent implied by the specification without either the log relative price or a demographic variable.

Another robustness test is to estimate the consumption function and the permanent income equation as two-equation system. Then, instead of using the fitted value of the log permanent income, the log permanent income function is substituted into the jointly estimated consumption equation. The latter fits slightly less well as the consumption parameters are influenced by the need to satisfy the cross-equation restrictions, but the parameter estimates and even the estimated standard errors are only a whisker away. It is encouraging that joint estimation gives very similar estimates for the coefficients of the permanent income equation to the single equation estimates as it suggests that the selected model captures reasonably well the average income outlook of households.

Another robustness issue concerns the impact of the income growth projections made in 2019Q4 on the estimates. As consumer confidence data in 2019 show some deterioration relative to 2018, one might wonder whether the Oxfordeconomics.com income projections are over-optimistic relative to the actual expectations of Italian households. As a check, the growth rate of the projections was halved, otherwise retaining the cyclical pattern. This has remarkably little impact on the estimates, including of the permanent income equation. The fit of the consumption equation actually improves by a whisker, though the change in the log likelihood is only 0.2 and the estimated coefficients are almost the same.[14] Previously reported estimates above for a range of different models for the reduction in the consumption to income ratio following the Fornero reforms are reduced by around 7 percent. In other words, a previously reported estimate of 4.8 percent falls to 4.5 percent, while a previously reported 3.0 percent falls to 2.8 percent.

To help interpret the quantitative relevance of the long-run solution implied by the preferred specification shown in Table 3, column 4, we examine the fitted contributions to the log consumption to income ratio in Figures 12 and 13. Figure 12 shows the fitted contribution of the effective real interest rate on borrowing, the log ratio of permanent to current income, the log ratio of the moving average of the price index for durables relative to non-durables, the 1992-3 step dummy and the Fornero reform dummy. Figure 13 shows the fitted contributions of the key portfolio ingredients. These are the ratios to income of net liquid assets, semi-liquid assets, illiquid financial assets and the combined effect of the ratio to income of housing wealth and the negative offset of housing affrodability, measured by the log house price to income ratio.

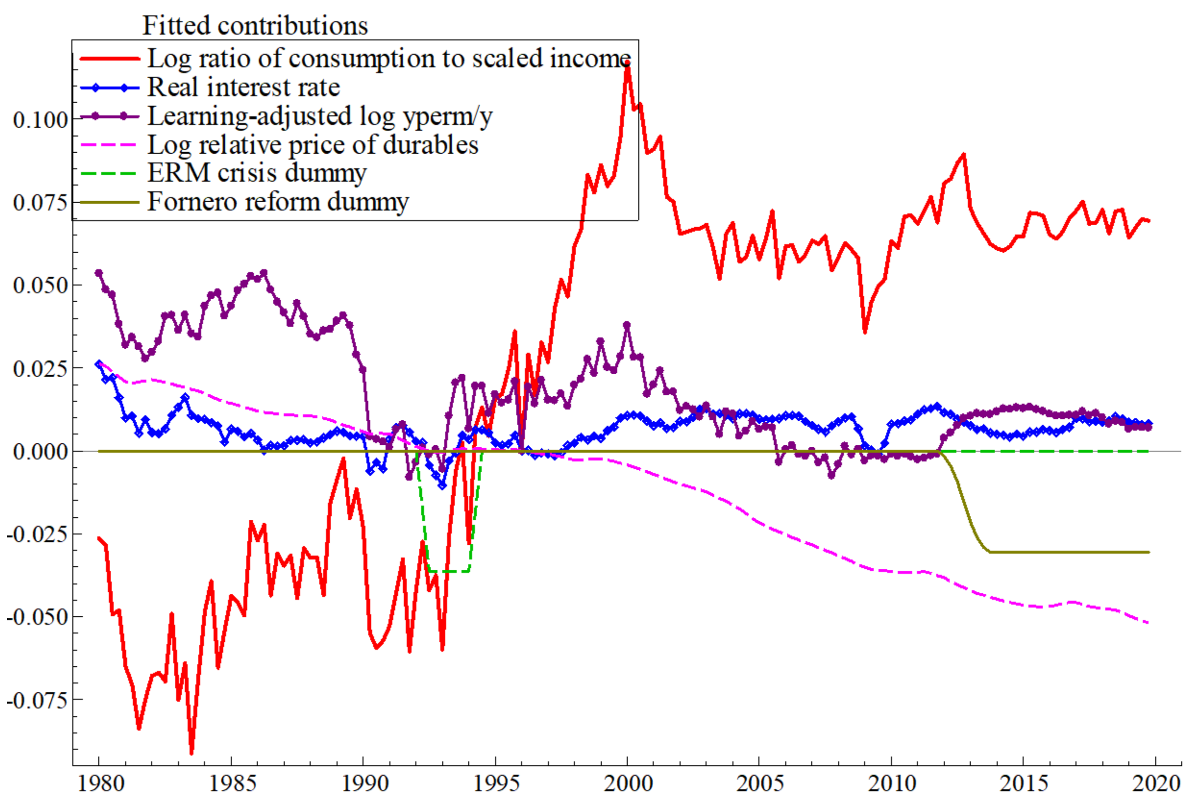

Figure 12: Fitted long-run contributions to log ratio of consumption to scaled income, part 1.

[14] While we could have chosen results tables for this variant, it seemed preferable simply to take the more standard projection as the basis for end-of period permanent income estimates. In regular updating of the model estimates, one would typically be using the most recently available income growth projections, whether from the Oxford source or the 5-year ahead forecasts from the IMF. Alternatively, if this consumption equation were incorporated in a revised version of BIQM, the income forecasts from the model would produce an approximation of 'model consistent expectations'.

Notes: Fitted contributions are for the effective real interest rate, the deviation of log permanent income from current income, the log of the relative price of durables, the 1992-3 step dummy and the Fornero reform dummy.

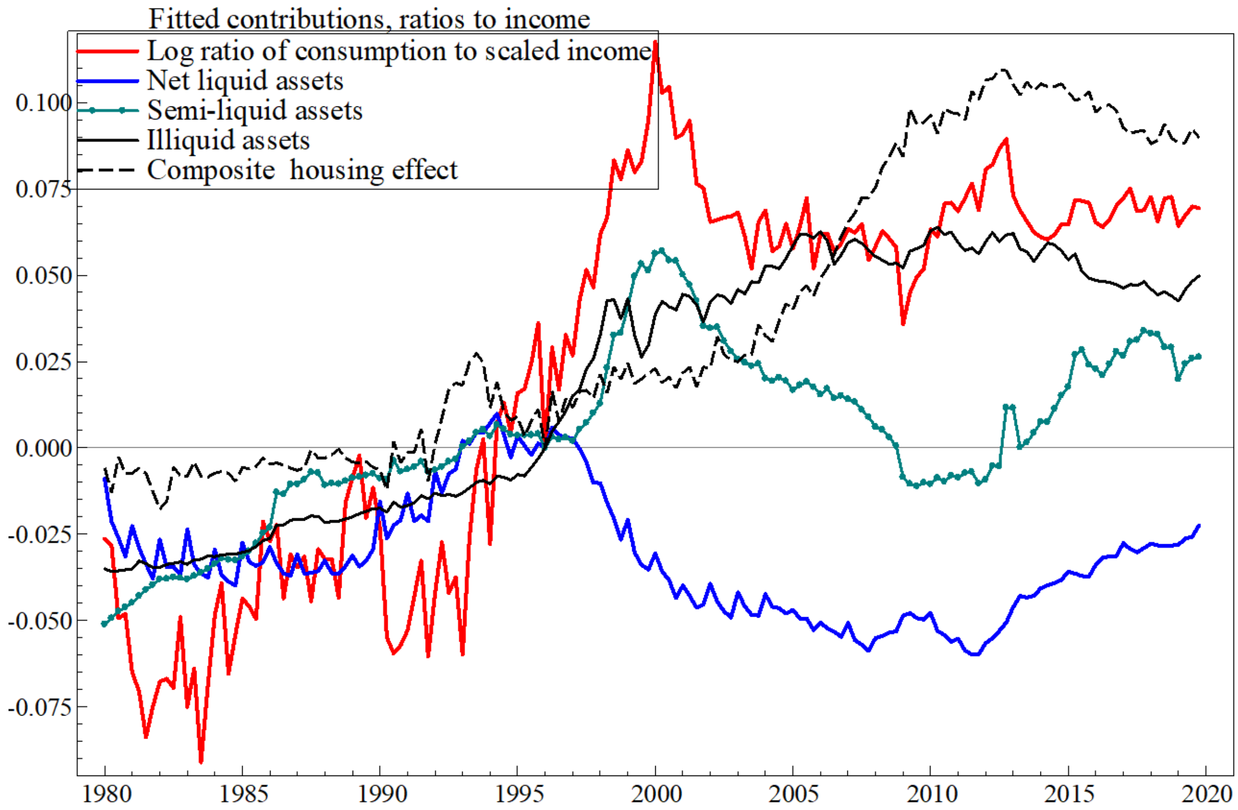

Figure 13: Fitted long-run contributions to log ratio of consumption to scaled income, part 2.
Notes: The fitted contributions are for the ratios to income of net liquid assets, semi-liquid assets, illiquid financial assets and the combined effect of the ratio to income of housing wealth and the log house price to income ratio.

The two graphics together suggest that the early 1990s fall in the consumption to income ratio was mainly driven by the fall in income relative to permanent income, abetted by the 1992-3 step dummy (see the discussion in section 2 of the ERM crisis). The rise that followed was partly due to the ending of the ERM crisis, and rises in the contributions of housing wealth, illiquid financial wealth and semi-liquid financial wealth, led by mutual funds. However, after around 1997 the faster rise of household debt than household deposits, caused the ratio to income of net liquid assets to decline, offsetting some of the upwards drivers of other parts of the portfolio. After the peak consumption to income ratio in early 2001, the ratio stabilised at a lower level with the fall in the ratio to income of semi-liquid assets triggered by the bursting of the dotcom stock market boom.

After 2011, one would have expected consumption to rise relative to income, given some recovery in ratios to income of permanent income and in net liquid and semi-liquid assets. The fact that it failed to do so and instead fell moderately, the model attributes to the Fornero reforms of 2011.

Some of the fluctuations in the log ratio of consumption to income are sharper than can be accounted for by the long-run drivers pictured here. This is partly because of dynamic adjustment to shifts in these drivers and partly because short-run factors such as changes in the unemployment rate, the acceleration of income and income volatility also play a role, often at turning points.

5. Conclusions

The modern view of heterogeneous agent behaviour under uncertainty in incomplete markets has implications for the formulation of an aggregate consumption function, a central feature of semi-structural econometric policy models. These implications are radically different from the text-book model based on a representative consumer following the life-cycle permanent income hypothesis. In that model, complex household portfolios are summarized in a single net worth measure, treating liquid and illiquid financial assets and housing as if they were the same. Credit constraints or variations in loan standards, and uncertainty are disregarded. Based on Italian data from 1980 to 2019, the conventional formulation for an aggregate consumption function for Italy based on net worth is tested in this paper and strongly rejected. It is hard even to find a significant net worth effect. An alternative formulation in which net worth is replaced by net financial wealth as in BIQM does less badly, but is still strongly rejected against our more disaggregated specifications. Our results show that the marginal propensities to consume out of household deposits at 0.15 and semi-liquid financial assets such as T-bills and mutual funds at 0.12 are greater than for less liquid assets, at around 0.065. A significant positive effect from housing wealth is substantially offset by the negative effect of affordability measured by the house price-to-income ratio.

Implications for monetary transmission differ notably from those of the conventional form. One reason is that the well-specified model presented here has a far higher speed of adjustment to changes in interest rates and income, as well as the shocks affecting household portfolios. And because portfolio composition matters and because house prices and housing wealth have separate implications, interest rate changes operating through asset prices, inflation and income, have different implications than if portfolio effects are channeled only through net worth, or indeed financial net worth excluding housing. The full implications for monetary transmission need to be explored in a comprehensive model that, inter alia, also endogenises interest rates on borrowing, household debt, liquid assets, house prices and housing investment (see Muellbauer (2022) for the six main housing related channels). In Italy, housing investment is likely to be an important channel.

Because heterogeneity is an important issue and these consumption models are estimated on aggregate data, one needs to exercise an element of caution in their policy application. Micro evidence discussed earlier suggests that the marginal propensity to spend out of liquid assets as well as current income varies by income and asset class, with lower marginal propensities for those with higher income and greater wealth. Data from the Survey of Household Income and Wealth suggest that the top income quintile accounts for over half of all liquid deposits and even higher fractions of total household holdings of other financial assets. In the pandemic, at least by the end of 2020, there was a surge 'excess savings', see Colabella et al. (2023). Much of this would have been seen in increases in total holdings of deposits and semi-liquid assets. However, data from the survey suggest little change in the distributional pattern by income quintile. There is therefore little prima facie evidence for notable changes in Italy in marginal propensities to consume for aggregate holdings of these assets because of the pandemic.

It is possible that some of the post-pandemic increases in consumption had elements of a ‘catch-up’, for example in vacation travel, because of restrictions on this kind of spending during the pandemic. Or private health spending may have increased compared to pre-pandemic levels. A more detailed examination of pattern of spending on different goods and services may give indications that could help understand changes in total consumption compared with the pre-pandemic period. Nevertheless, there is little doubt that net worth is a very poor approximation to the effects of household portfolios on aggregate consumption.

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Data Appendix

A1. Consumption and income data.

Constant price consumption data comes from the Bank of Italy Quarterly Model (Bulligan et al., 2017) based on National Accounts (ISTAT). Basically, it is the sum of constant price expenditure on non-durable goods and services and expenditure on durables. The ratio of the current price sum to the constant price sum defines the consumer expenditure deflator and the respective current to constant price data define the price indices for non-durables and durables. Per capita data are defined by deflating by quarterly population.

Total household disposable income also comes from the national accounts. Quarterly estimates of labour income based on payroll data plus transfer income data (mainly state pensions) are tax-adjusted using more detailed breakdowns of categories in the annual accounts. We implicitly assumed the same tax rate for each form of income. The current price income data are deflated by the above consumer expenditure deflator and converted to a per capita basis.

A2. Adjusting for breaks in the asset data

As explained in section 2, consistent quarterly portfolio data begin in 1995. Before then, annual data from Bonci and Coletta (2008) are quarternalised; most of the statistics are taken from the Italian financial accounts published by the Bank of Italy. Because of the move from the 1979 System of National Accounts (ESA79) to the 1995 System of National Accounts (ESA95, implemented in 2000 with time series starting in 1995), there are breaks in some series. Two general principles are followed in break-adjustment, the first being to adjust earlier data to match later data. The second is to use the average of immediate pre and post break growth rates to estimate what the value for the last pre-break observation would have been if it had grown at that rate relative to the first post-break observation. That value is then used to splice to the pre-break data. For example, there is a break in the pension data in 1984, when the data jumped from 16.53 at the end of 1983 to 47.56 in at the end of 1984 (Lire converted into Euros). The average of the pre and post break growth rates is 11.6%. Projecting back gives a revision of the end of 1983 observation from 16.53 to 42.63, so that the earlier data are revised up by 42.63/16.53 to be continuous with the post-break data.

Another break is in the loans data in 1989. As Bonci and Coletta (2008) point out, from 1989 to 1994, due to the new standards of ESA95 the sector consisting of households and non-profit institutions serving households was extended to include sole proprietorships with at most 20 workers. The increase in household loans from 93,426 to 202,975 from 1988 to 1989 is clearly not a genuine increase in household loans. The fact that NFC loans actually decrease in the same year against a strongly rising upward trend is a symptom of the reclassification. The average of the pre and post-break growth rates is 18.3% which suggests an upward revision of 78,150 to the end of 1988 loans data from 93,426 to 171,577. As a check, the same methods applied to NFC loans data would imply a closely consistent downward revision of 77,289.

From 1995Q1, consistent quarterly balance sheet data have been published by ISTAT and the Bank of Italy. These data, for the first time split debt securities into short term – 'bills' and long term – 'bonds', both mainly in the form of government debt. As bills carry very little revaluation risk, one would expect them to be more liquid than bonds, which with Italy's volatile inflation in interest rate history, are far more risky. Internal data from the Bank of Italy on end of year levels of short-term and medium- and long-term securities add to the information in Bonci and Coletta (2008).

There are breaks in the quarterly balance sheet data relative to the pre-1995 data from Bonci and Coletta (2008). These were corrected using the principles outlined above. This resulted in upward adjustments of pre-1995 data on deposits, mutual funds and quoted shares and downward adjustments for bills, bonds, unquoted shares and pension assets.

A3. Heterogeneity in asset ownership

Based on the data of the Survey of Household Income and Wealth (Bank of Italy, 2018), at the end of 2016, almost 70 per cent of Italian households owned their main residence; this proportion remained fairly stable compared with 2006. The percentage point drop, to 52 per cent, in the share of property owners among households headed by someone 45 years or younger was offset by the sharp decline in the percentage of these households out of the total, from 37 to 27 per cent, continuing the trend that began in the early 1990s.

Regarding financial assets, the SHIW suggests that households belonging to the poorest quartile of the income distribution primarily have bank or post office deposits; the share of government securities, private sector bonds and managed investments (mainly investment funds) rises gradually across the income distribution; the richest 25 per cent of households are the ones most likely to directly own stocks and to entrust the management of a significant portion of their financial assets to investment professionals (Figure A1).

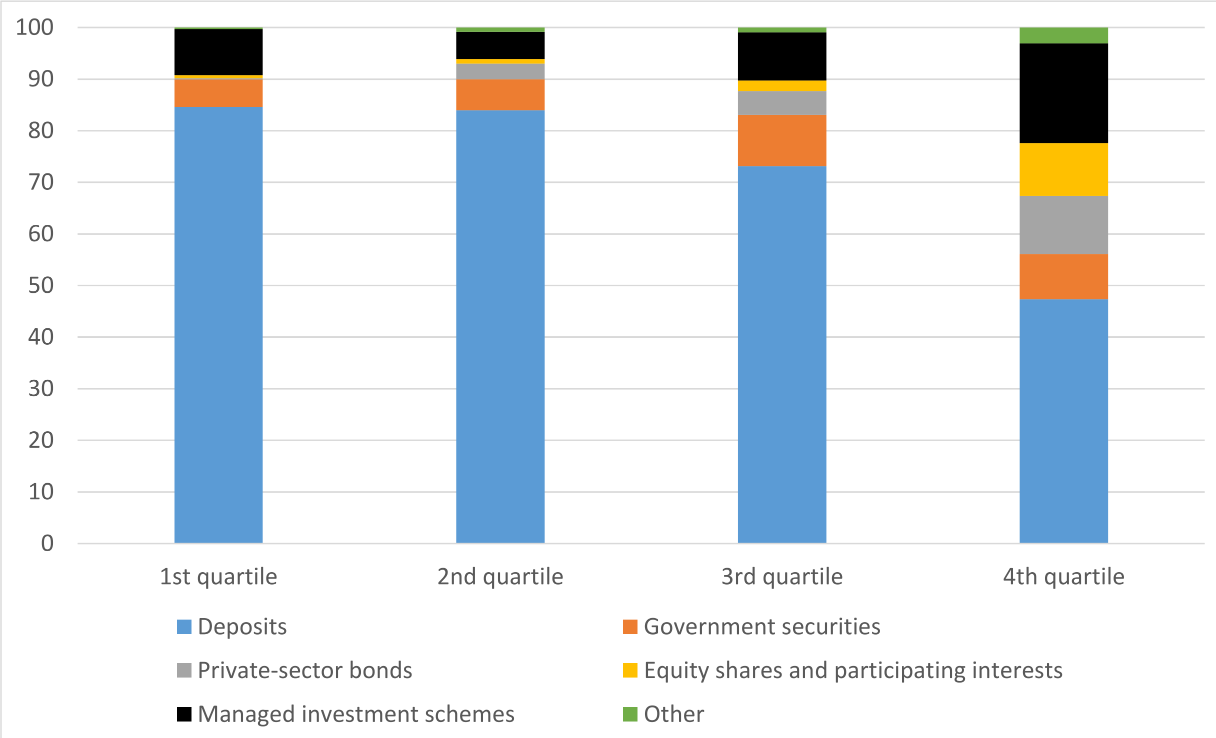

Figure A1: Breakdown of financial assets by income quartile distribution in 2016
Source: Author's calculation from Survey of Household Income and Wealth (Bank of Italy)

Colabella et al. (2023) estimate that at the beginning of 2023 the amount of financial assets accumulated due to the pandemic exceeded 130 billion euros. While all households, including less affluent ones, managed to accumulate excess savings the majority of these funds (more than 60%) is held by the higher-income households. Figure A2 plots the distribution of financial assets at the end of 2020 (figures are taken from the SHIW in 2020, last wave available; Bank of Italy, 2022) by income quartile. It shows that for more affluent households, there was a substantial rise from end-2016 to end-2020 in the fraction of total financial wealth held in managed investment schemes. For the top income group, this displaced mainly government securities, private sector bonds and equity shares.

For aggregate behaviour, an interesting question is whether, for each asset aggregated across households, there was a notable change in the distribution by income group. For example, suppose that the share of liquid asset holdings by the top income group had increased sharply in the pandemic. Given that the MPC out of liquid assets is almost certainly lower for the top income group than for lower incomes, this would imply a fall in the aggregate MPC for liquid assets. Table A1 provides information from the SHIW for the asset classes used in that survey comparing end-2016 with end-2020. It shows little change in the distribution across income quintiles in liquid deposit holdings. For managed investment schemes and for 'equity shares and participating interests', there were falls in the share of the top quintile compensated by increases in the shares of the 3rd and 4th income quintiles. If anything, this would point to slight increases in the aggregate

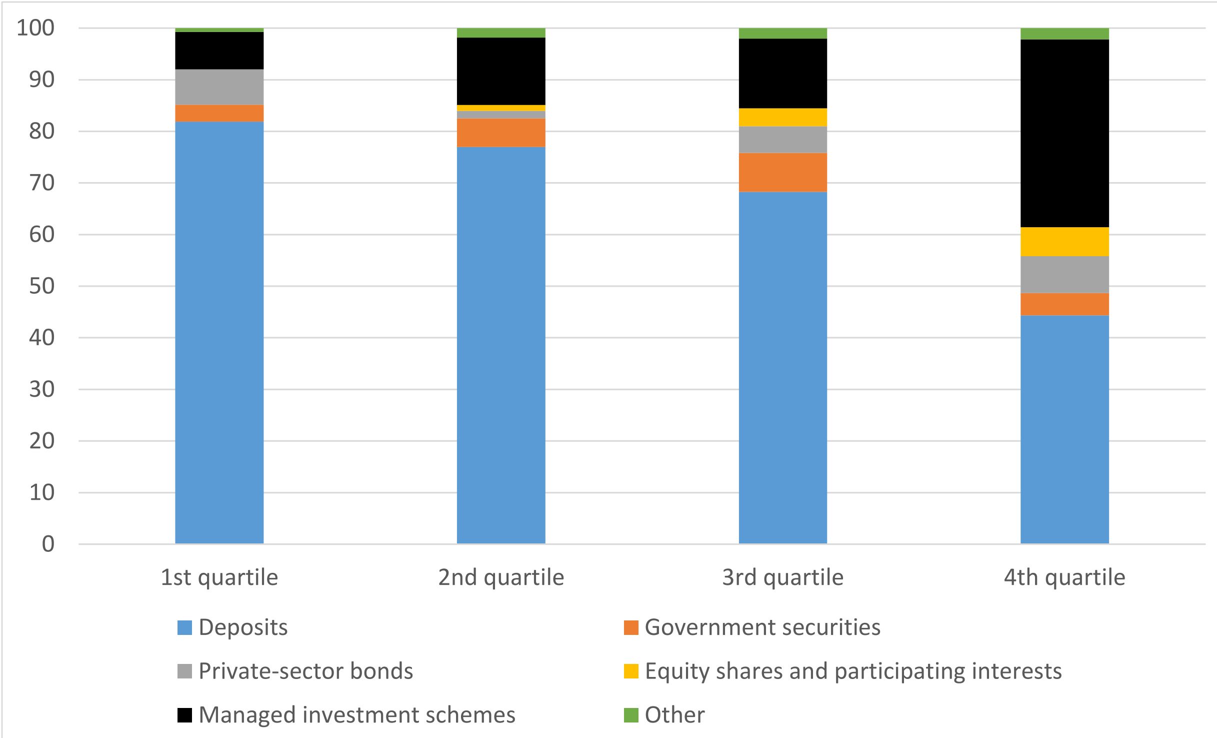

Figure A2: Breakdown of financial assets by income quartile distribution in 2020

Source: Author's calculation from Survey of Household Income and Wealth (Bank of Italy)

MPCs associated with these less liquid assets. It does suggest that there are no reasons to suppose that aggregate MPCs out of all financial assets have fallen as a result of the large changes in the structure of asset holdings due to the pandemic. However, evidence from the SHIW needs to be interpreted cautiously given the differences between balance sheet totals implied by the micro data and the national balance sheets. For example, for liquid deposits in 2016 and 2020, under 40 percent of the national balance sheet totals can be accounted for by the survey totals.[15] Shifts in the representativeness of the SHIW in the pandemic could have affected conclusions about changes in the distributional pattern of asset holdings.

Battistini et al. (2023) investigate potential composition effects on aggregate spending from the savings accumulated during the pandemic, comparing the US and Euro area. In the US, data suggest that the surge in savings was mostly accumulated in liquid assets, while in the Euro area the accumulation in illiquid financial assets was greater than in liquid assets. This would imply, other things being equal, a smaller post-pandemic consumption response in the Euro area than in the US. Battistini et al. (2023) combine aggregate balance sheet and distributional survey data to simulate potential compositional and distributional effects on aggregate consumption. They divide assets into two: deposits and illiquid financial assets minus debt. Our evidence from Italy

[15] Though some of the difference is likely to be due to the inclusion of non-profit institutions serving households in the national balance sheets.

is that grouping of semi-liquid assets and debt with illiquid financial assets would likely have distorted the conclusions of such a study in the case of Italy.

Table A1: **Comparing 2016 and 2020 shares of each asset held by different income quintiles**

	Deposits		Government securities		Private-sector bonds		Equity shares and participating interests		Managed investment schemes		Other	
WAVE IBF	2016	2020	2016	2020	2016	2020	2016	2020	2016	2020	2016	2020
1st quintile	3.94	3.22	0.52	1.73	0.03	2.99	0.24	0.03	1.91	0.26	0.38	0.53
2nd quintile	7.81	7.12	4.14	5.83	1.09	0.9	0.62	1.13	1.18	2.06	0.07	4.43
3rd quintile	13.99	13.68	8.82	12.17	2.86	4.65	0.51	5.14	3.88	5.99	5.49	11.28
4th quintile	22.07	22.44	21.02	20.27	20.94	15.07	6.21	15.82	11.65	17.57	7.42	9.61
5th quintile	52.19	53.54	65.5	59.99	75.08	76.4	92.41	77.88	81.39	74.12	86.63	74.15
	100	100	100	100	100	100	100	100	100	100	100	100

Source: Author's calculation from Survey of Household Income and Wealth (Bank of Italy)

A4. Measuring credit conditions

We have quarterly data on the ratio of granted to used credit lines for the whole period but regard the ratio of granted credit lines to a moving average of GDP as a better indicator of credit availability. From 1996, we have data on used credit lines, which we fit to data on the stock of bank credit advanced to the private sector at t and the change relative to t-4 indicating a mix of level and change effects. The adjusted R-squared is 0.983. We estimate granted credit lines before 1996 by multiplying the ratio of granted to used credit lines by the fitted value of used credit lines. Our credit indicator is estimated by credit lines divided by the lagged 8-quarter moving average of GDP in current prices. As granted credit lines is more of a stock affected by past economic conditions than a flow, this avoids temporary fluctuations in GDP distorting the measure. Figure A4 compares the ratios of granted credit lines respectively to used credit lines and to a moving average of GDP.

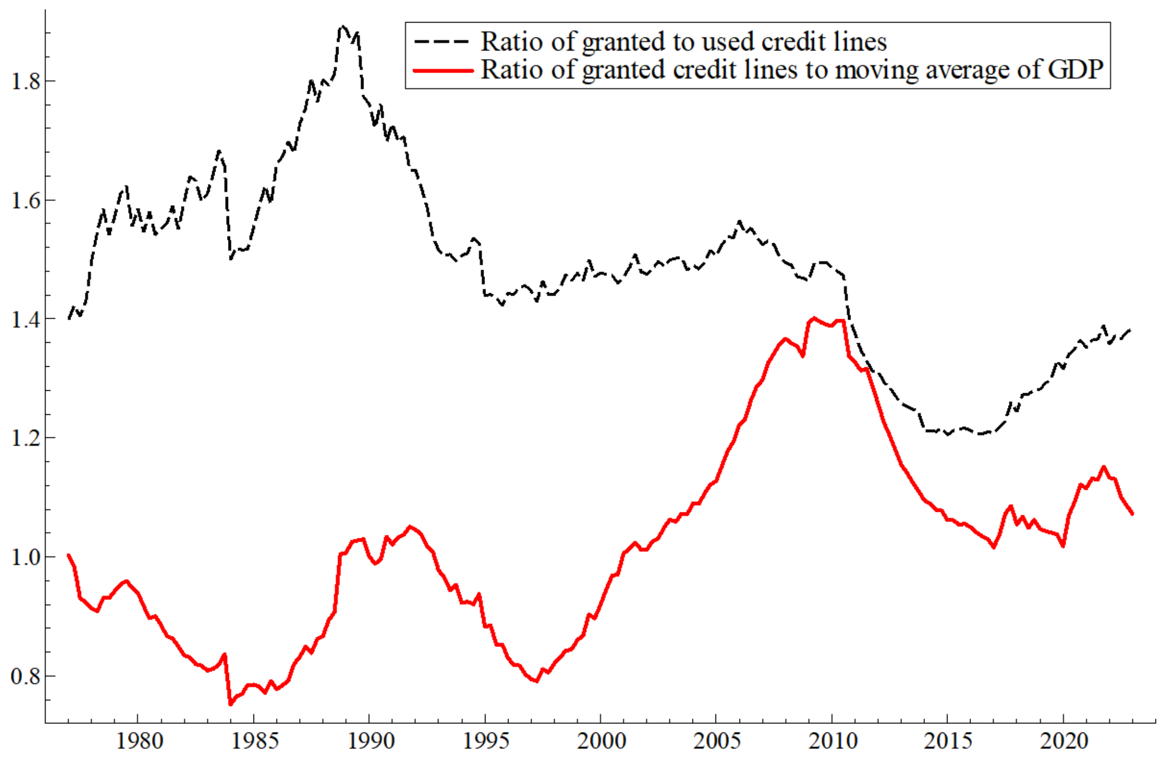

Figure A4: The ratios of granted credit lines to used credit lines and to a moving average of GDP.

Source: Credit register, Bank of Italy and national accounts data from ISTAT

The empirical evidence is that the lagged rate of change in the latter measure helps explain short-term fluctuations in consumption.

A5. Other short-term controls.

Turning to controls for the short-term dynamics, these include the 2-quarter change in the log of the credit conditions measure, in the log of the per capita measure of public consumption – a partial substitute for private consumption, and in the unemployment rate, see Figure A5.

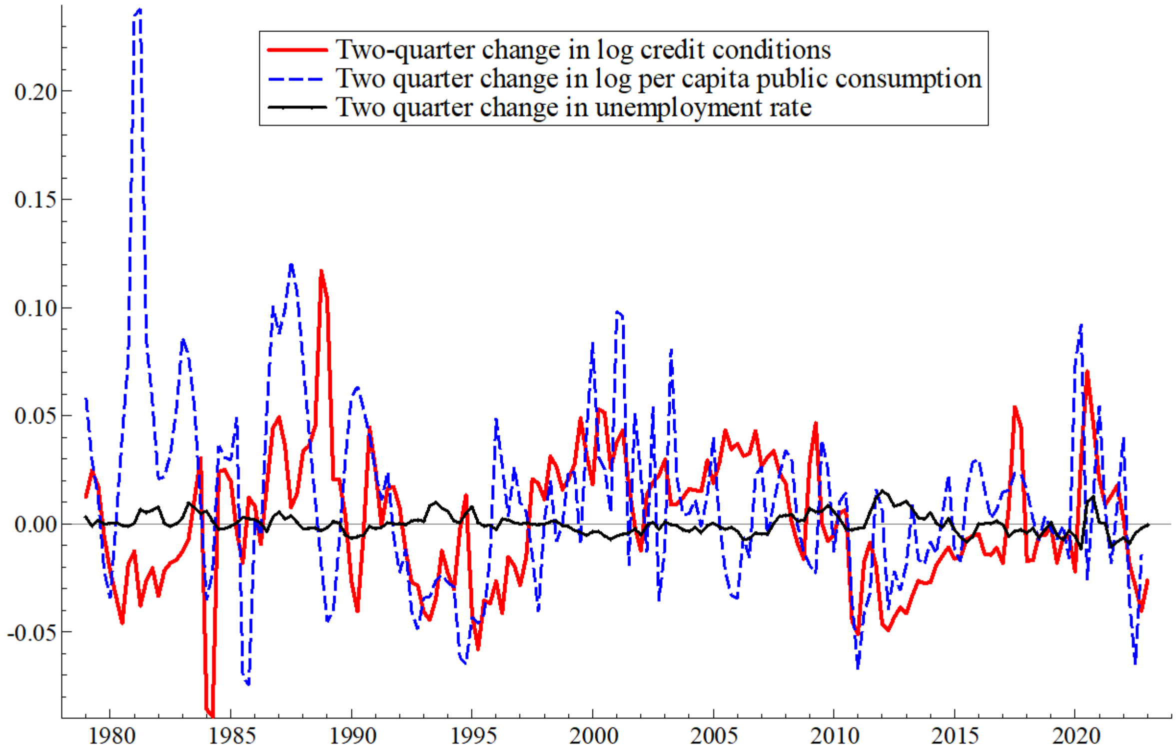

Figure A5: Two-quarter changes in the log of credit conditions, the log of per capita public consumption, and in the unemployment rate.
Source: See Figure 3, and ISTAT.

Other short-term controls include the change in the annual growth rate of income and a measure of income volatility (Figure A6). Income volatility is defined as the absolute value of the residual of the change in log income from an AR2 autoregressive process.

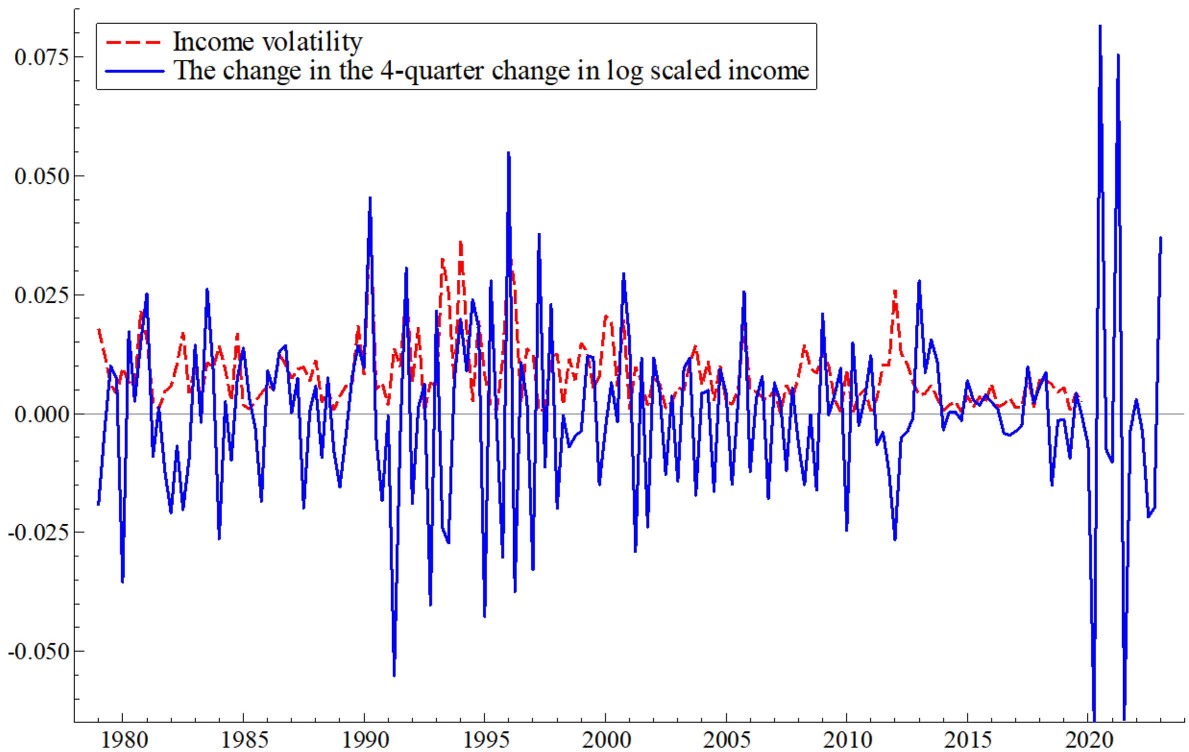

Figure A6: Income volatility and the change in the 4-quarter growth rate of income.
Sources: National Accounts data from ISTAT; income volatility is the absolute value of the residual from an AR8 process for log scaled income.

A6. The model for permanent income

The definition of log permanent income was given in equation 3.3 with the horizon k=40 quarters and the discount factor δ=0.95. A summary of the findings was given in section 2. The following equation was estimated:

$$\begin{aligned}\ln \mathrm{y}^{\mathrm{p}} = a_{y0} + a_{yt}t + a_{y08}t_{perm}^{2008:q3} + a_{yd08}dt_{perm}^{2008:q3} + a_y \ln y_{t,ma} \\ + (1-a_y)\ln\left(\frac{labor_{t-1}}{pop_{t-1}}\right)_{ma} + a_{yMIB}\ln MIB_{t-1} + a_{yCOMP}COMP_{t-4,ma} \\ + a_{yOIL}\ln OIL_{t-4,ma} + a_{yUR}UR_{t-1} + a_{yCCI4}\Delta_4 \ln CCI_{t-1} + a_{yUR4}\Delta_4 UR_{t-1} \\ + a_{yOIL4}\ln OIL_t\end{aligned}$$

The dependent variable is the log of permanent income. In order, the regressors include a time trend, the present discounted values of a trend shift in 2008Q3 and of a step change in the mean of the long-run solution in 2008Q3, both with significant negative coefficients. Next come the 4-quarter moving averages of log real per capita scaled income and of the log ratio of the labour force to the population. The latter coefficient is restricted so that the long-run effect of the latter on log income – combining permanent with current- is unity. This makes economic sense as our income variable is per capita relative to the population but the capacity to produce of the economy is constrained by the labour force, not population. The latter explains a good deal of the slow-down of permanent income growth in the early 1990s, as the figures below will show. The next regressor is the log of the real stock market index, followed by the moving average of a measure of competitiveness of the Italian firms, strongly related to the real exchange rate. It enters at a lag of 4 quarters, implying a slow response of future real household incomes to this factor. The log of real oil prices enters with a similar lag structure. High real oil prices damage the terms of trade of the economy for an oil importing economy and therefore affect living standards. The final term in the long-run solution is the level of the unemployment rate. This has a *positive* coefficient, which is at first sight surprising as one might have expected workers to have weaker bargaining power when unemployment is high and therefore have a lower wage share in GDP. However, GDP is not one of the controls in the equation. What the term suggests is that when the unemployment rate is high, there is a tendency for policies to be enacted that eventually stimulate growth in order to bring unemployment down. Similarly, when the unemployment rate is very low, policies tend to reverse to stabilise the business cycle.[16]

However, in the short-term dynamics, the lagged 4-quarter change in the unemployment rate has a significant negative effect probably because in the short run it results in lower wage growth, which, other things being equal lowers the growth rate of household income in the near future. The other terms in the short-term dynamics are the lagged 4-quarter change in the log of the credit conditions indicator and the 4-quarter change in the log of real oil prices. As large energy price shocks feed into the inflation rate faced by households and there tends to be nominal inertia in wages, near term real household incomes are negatively affected.

[16] It is also possible that endogenous mechanisms such as wage and price dynamics are affected by the unemployment rate and eventually feed into the growth rate of real incomes.

Table A2 Model for permanent income, 1980-2019

Parameter	Estimate	Standard Error	t-statistic
a_{y0}	1.479	0.060	24.59
a_{yt}	0.000	0.000	12.00
a_{y08}	-0.000	0.000	-3.17
a_{yd08}	-0.033	0.004	-7.63
a_{y}	0.206	0.022	9.33
a_{yMIB}	0.011	0.002	6.48
a_{yCOMP}	0.026	0.010	2.77
a_{yOIL}	-0.008	0.002	-3.94
a_{yUR}	0.383	0.047	8.14
a_{yCCI4}	0.053	0.011	4.88
a_{yUR4}	-0.419	0.070	-5.98
a_{yOIL4}	-0.005	0.001	-3.83
Diagnostics			
Standard error x 100	0.433		
Adjusted R^2	0.995		
LM Het. test (p-value)	0.11		
Durbin-Watson	0.22		

In this formulation, it is assumed that the structural break in the income process that occurred in 2008Q3, was fully anticipated and became more and more relevant in permanent income from 1998Q3 as the global financial crisis approached. The estimated model benefits from post crisis hindsight as the structural break is then incorporated in the formulation. To capture what might have been more feasible beforehand, we need to remove the over-optimism represented by the fitted estimated present value of the structural break before 2008Q3 to simulate information of which a sophisticated household proxied by an econometrician might have been aware. However, we then need to posit a learning mechanism. The failure of Lehman Bros in September 2008 and the global financial turmoil that followed was a profound shock that must have made households far less optimistic about future income growth. However, it would have taken some time to arrive at a view of whether this was more of a step change or a change in the underlying growth rate. Both factors are in the equation. We assume that learning was split equally between an instant reaction and gradual learning over the following 16 quarters. In the first 8 quarters before the sovereign debt crisis became serious, learning follows an ogive or S-shaped curve, were learning is initially slow but speeds up near the mid-point of the period and then asymptotes towards completion towards the end. In response to the sovereign debt crisis, from 2010Q3, it follows a new sigmoid curve to 2012Q2. Thus, gradual learning takes into account the two phases of the crisis, the GFC followed by the debt crisis. Learning is implemented by attaching a time-varying weight *w* to the formulation of fitted permanent income from which the present value of the structural break has been removed, and a weight of 1-*w* to the ex-post formulation that includes the structural break. The weight is zero before 2008Q3 and 1 from 2012Q2 and looks like this:

Table A3 Weights for learning adjustment

Quarter	Weight	Quarter	Weight
2008:q2	0.0000	2010:q3	0.7625
2008:q3	0.5125	2010:q4	0.7875
2008:q4	0.5375	2011:q1	0.8250
2009:q1	0.5750	2011:q2	0.8750
2009:q2	0.6250	2011:q3	0.9250
2009:q3	0.6750	2011:q4	0.9625
2009:q4	0.7125	2012:q1	0.9875
2010:q1	0.7375	2012:q2	1.0000
2010:q2	0.7500		

Thus, by 2012Q2, over-optimism has been eliminated and the model has fully incorporated the down-shift in the path of income. Instead of an equal weight on fast and slow learning, variations in the range 0.3 to 0.7 on the relative weight of the two have almost no impact on the estimated parameters of the consumption function and only a marginal effect on the goodness of fit.

The contributions of the different regressors to the fitted, learning adjusted log permanent income are shown in Figures A7 to A9. Figure A7 shows that much of trend movement of log permanent income is accounted for by the time trend, the log of the labour force relative to the population and some by the movement of actual log current income. Much of the abrupt fall following 2008Q3 is accounted for the learning adjusted split trend.

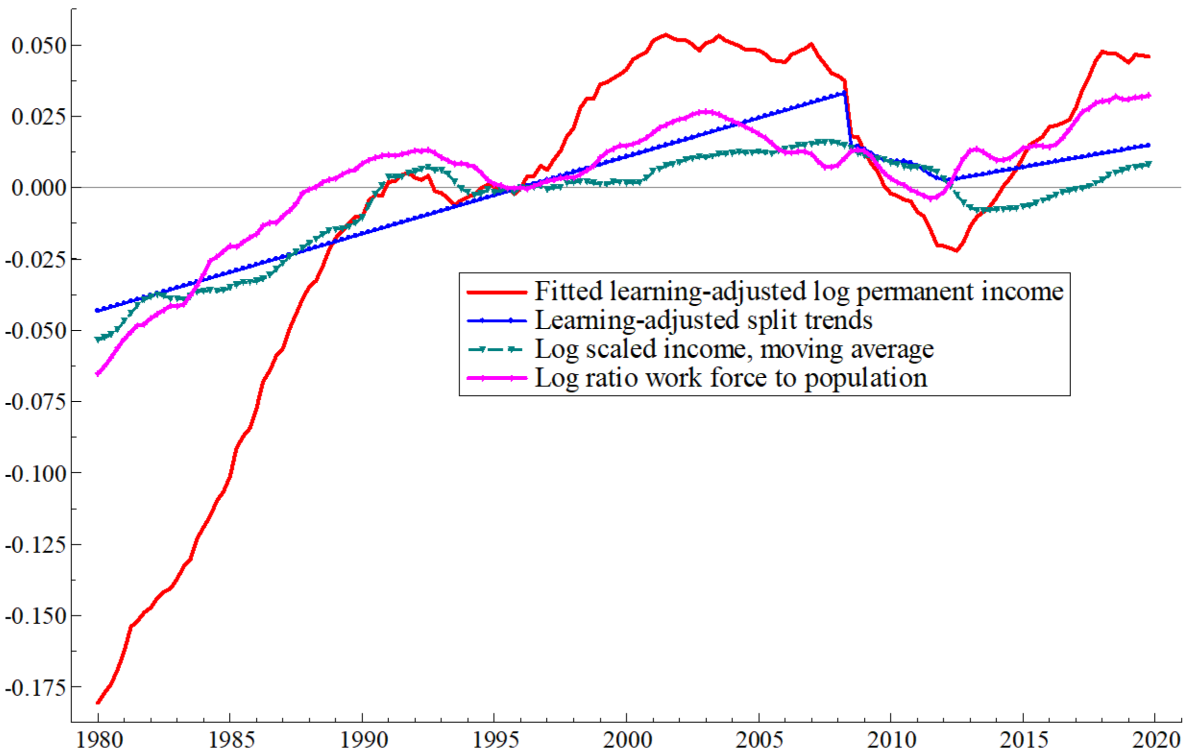

Figure A7: The fitted contributions to log permanent income of shifting trends, log scaled income and the log ratio of work force to population.

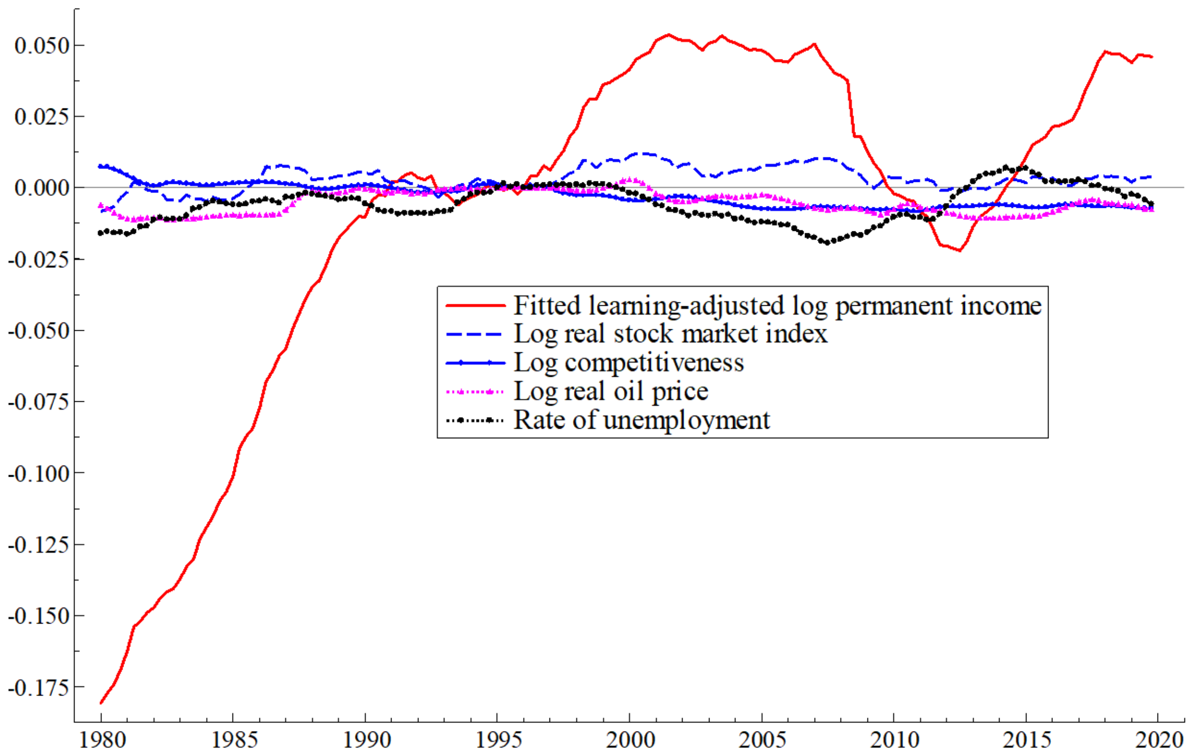

Figure A8: The fitted contributions to log permanent income of the stock market index, competitiveness, the real oil price and the unemployment rate.

Figure A9 shows the fitted contribution of the three short-term regressors: the rate of growth of credit conditions, the change in the unemployment rate and the rate of change of real oil prices.

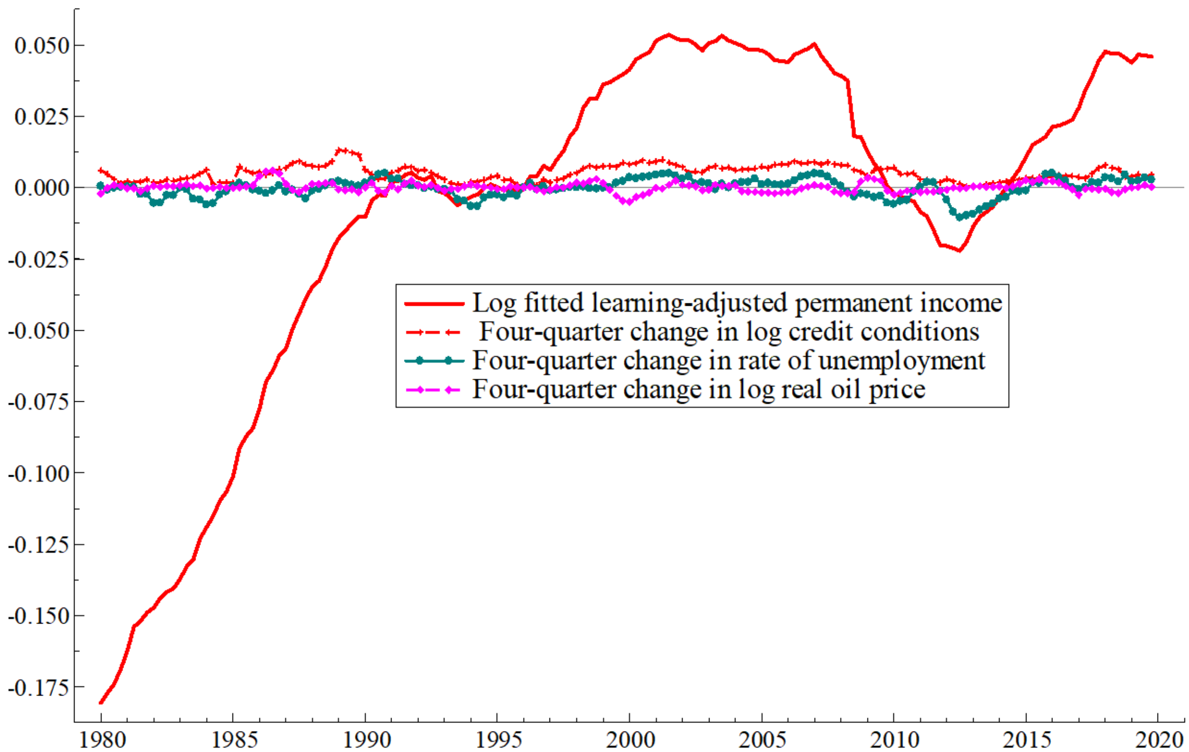

Figure A9: The fitted contributions to log permanent income of three short-term regressors.

A7. Instrumenting current income

The log of current real per capita scaled income was instrumented using a regression on its lag, and lags of log consumption, the unemployment rate, the log of the labour force to population ratio, competitiveness and in the acceleration of inflation. When log current income is instrumented in the consumption function, it is instrumented by its fitted value. Where the level of current income appears, for example, in ratios of assets to income, current income is replaced by the exponential of fitted log income.

$$\ln y = a_0 + a_y \ln y_{t-1} + a_c \ln c_{t-1} + a_{UR} UR_{t-1} + a_{LAB} \ln\left(\frac{labor_{t-3}}{pop_{t-3}}\right) + a_{COMP} COMP_{t-6,ma} + a_{\pi 2}\Delta\pi_{t-2} + a_{\pi 3}\Delta\pi_{t-3}$$

Table A4 Model for instrumenting income, 1980-2019

Parameter	Estimate	Standard Error	t-statistic
a_0	0.418	0.102	4.09
a_y	0.781	0.039	20.03
a_c	0.102	0.026	3.86
a_{UR}	-0.205	0.064	-3.20
a_{LAB}	0.344	0.079	4.33
a_{COMP}	0.041	0.011	3.78
$a_{\pi 2}$	-0.226	0.105	-2.15
$a_{\pi 3}$	-0.314	0.105	-3.00
Diagnostics			
Standard error x 100	0.010		
Adjusted R^2	0.986		
LM Het. test (p-value)	0.36		
Durbin-Watson	2.27		
AR1/MA1 (p-value)	0.054		
AR4/MA4(p-value)	0.180		
Chow test (p-value)	0.019		
RESET2 test (p-value)	0.000		
F test (p-value)	0.000		
Schwarz Criterion	-493.3		
Log likelihood	513.6		

A8. Descriptive statistics

Table A5 Descriptive statistics 1980-2019

Variable	Mean	Std. Dev.	Minimum	Maximum
Raw data before transformations (current prices, billions)				
Consumption	170.9	76.2	30.5	272.4
Disposable income	199.0	79.4	39.1	297.4
Labour and transfer income	103.7	47.4	19.0	179.4
Deposits	741.3	398.3	107.6	1448.2
Loans	343.2	267.0	18.5	737.8
Mutual funds	272.1	218.8	0.5	677.3
Bonds	346.8	262.0	5.5	755.8
Bills	66.8	52.1	1.8	182.2
Pensions and life insurance	404.5	330.3	25.2	1119.4
Quoted shares	84.5	39.1	7.6	208.8
Unquoted shares	506.9	343.2	20.4	1242.4
Data for consumption equations				
Log per capita consumption	1.388	0.130	1.092	1.529
Log per capita scaled income	1.291	0.084	1.054	1.393
Change in log per capita consumption	0.0026	0.0065	-0.0158	0.0211
Change in log per capita scaled income	0.0018	0.0114	-0.0337	0.0448
Real effective borrowing rate	0.094	0.017	0.028	0.150
Log learning-adjusted permanent income	1.316	0.061	1.144	1.378
Net liquid assets/scaled income	0.674	0.122	0.481	0.968
Semi-liquid assets/scaled income	0.501	0.192	0.073	0.916
Pension wealth/scaled income	1.157	0.543	0.324	1.814
Housing assets/scaled income	5.030	1.055	3.431	6.962
Log ratio of house prices to income	5.923	0.121	5.645	6.116
Net worth/scaled income	8.080	1.835	5.219	10.585
Net financial assets/scaled income	3.051	0.929	1.326	4.361
Data for short term controls				
Two-quarter change in log credit conditions	0.0011	0.0311	-0.0889	0.1170
Two-quarter change in log per capita public consumption	0.0121	0.0460	-0.0746	0.2381
Change in 4-quarter change in log scaled income	0.0002	0.0163	-0.0551	0.0549
Two-quarter change in unemployment rate	0.0003	0.0044	-0.0084	0.0152
Income volatility	0.0080	0.0074	0.0000	0.0414
Data for permanent income equation				
Log permanent income	1.31	0.06	1.14	1.38
Log scaled income (4-quarter MA)	1.29	0.09	1.05	1.39
Log labour force/population (4-Quarter MA)	-0.88	0.03	-0.96	-0.84
Log real stock market index	9.83	0.39	8.82	10.64
Competitiveness (4-quarter MA)	1.10	0.14	0.91	1.39
Log real oil price index (4-quarter MA)	3.75	0.52	2.71	4.54

Unemployment rate	0.10	0.02	0.06	0.13
4-quarter change in log credit conditions	0.00	0.05	-0.09	0.15
4-quarter change in unemployment rate	0.001	0.008	-0.012	0.025
4-quarter change in log real oil prices	-0.01	0.30	-1.12	0.96