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MPC HETEROGENEITY IN EUROPE: SOURCES AND POLICY IMPLICATIONS

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ABSTRACT

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MPC Heterogeneity in Europe: Sources and Policy Implications *

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September 20, 2018

Abstract

This paper studies household financial choices in four EU countries. The estimation of key parameters uses a simulation method of moments approach to match moments on asset market participation rates, portfolio shares and wealth to income ratios by education group and country. The policy functions based upon the estimation are used to characterize the distributions of the marginal propensity to consume across households for each of the four countries. The distributions are directly related to the presence of hand-to-mouth households. With the estimated distributions, monetary policy, operating through its effects on household income and asset market returns, will have a differential impact on individuals within and across countries.

1 Motivation

This paper studies household financial decisions in four EU countries: Germany, Spain, France and Italy. An important goal of the analysis is to characterize household preferences, stock market participation costs and portfolio adjustment costs at the country level. These estimated parameters generate a distribution of the marginal propensity to consume across heterogeneous households by country.[1] This distribution is used as an input into policy analysis of economies with heterogeneous households facing stock market participation and adjustment frictions.[2]

The parameters of preferences and costs of stock market participation as well as portfolio adjustment are estimated from a life-cycle model of household portfolio choice. The model includes both a stock market participation decision as well as a portfolio adjustment choice. Both of these discrete choices are relevant for understanding household financial decisions.[3]

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[1] Carroll, Slacalek, and Tokuoka (2014) look across EU countries and generate a MPC distribution in an alternative setting which does not emphasize participation and adjustment frictions. Their focus is on the relationship between the wealth distribution and the aggregate MPC.

[2] A leading example in the European context would be Kaplan, Violante, and Weidner (2014). Guerrieri and Mendicino (2018) estimate the MPC across euro area countries from quarterly Household Sector Report data and conclude that the cross country averages of MPC out of financial wealth are between 0.7 and 4.5 cents per euro.

[3] A discussion of our results relative to the literature is postponed until the presentation of our estimates.

Using these estimates, we study household response to both income and stock return shocks. Given the heterogeneity across households within a country, there is a non-degenerate distribution of consumption responses. Joint with the distribution of heterogeneous households, this differential response generates a country specific MPC distribution. The distribution itself will depend on both the nature of the shock and its magnitude. The latter point arises from the nonlinear response of households to income and return shocks. Consistent with the existing studies, the MPCs are largest among hand-to-mouth households.

In this setting, we study the impact of monetary policy on consumption. Similar to Kaplan, Moll, and Violante (2016), a monetary policy innovation influences consumption through stock market returns and income. Having studied the MPC distribution for these shocks, we quantify the effects of monetary policy on the distribution of consumption by country. The key components of household heterogeneity that matter most are permanent income and stock market participation.

The rest of the paper is organized as follows. Section 2 presents basic data facts. Section 3 introduces the lifecycle optimization problem of households. Section 4 shows the exogenous processes that are used as input in the model, as well as the moments used to identify key model parameters. Section 5 discusses the results of structural estimation. Section 6 studies MPC distributions of the four countries, and section 7 quantitatively evaluates the effects of monetary policy on consumption. Section 8 concludes and provides a discussion of potential future studies.

2 Data Facts

This section presents facts about household financial decisions in Germany, Spain, France and Italy. The data come from the Household Finance and Consumption Survey.[4] We focus on the financial portfolio of the household and its relation to income, as shown in Table 1. Participation is defined as the holding of stocks, either directly or indirectly. There are three alternative measures of participation: (i) direct holding of stocks, (ii) direct holdings plus mutual funds invested mainly in stocks and (iii) adding pension plans to (ii). So (ii) and (iii) are a lower and upper bound for indirect stock participation, respectively. For each of these measures, a stock share is reported, which is computed conditional on participation in asset markets. The table also displays two definitions of the wealth to income ratio, one in which wealth includes housing and one in which it does not. For most of the subsequent analysis, wealth is financial wealth, excluding housing. The moments are presented by education group: college or no college attainment.

Participation rates in stocks are well below 100% in all countries. Direct participation is very low, particularly for the low education groups. These rates are somewhat higher for college graduates, but still range between 11%-25%. Indirect participating rates are higher, in particular when we include pensions. Still, there is wide dispersion across country/education level groups: participation is less than 20% in Italy for the low education group and reaches almost 67% in Germany for college graduates.

For the broadest measure of participation, the stock share averages between 40% and 50%. Differences between the two education groups are small, with households without a college degree holding larger shares than college

[4]See `https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html`.

Table 1: Household Facts by Education across Countries

	Germany		**Spain**		**France**		**Italy**	
edu	low	high	low	high	low	high	low	high
part. direct	6.4	19.9	6.5	21.3	11.6	24.7	3.8	10.5
share	18.9	19.2	26.8	26.9	22.7	23.1	28.0	20.5
part. indirect	9.5	31.5	7.0	22.5	13.0	28.2	4.7	12.8
share	12.8	12.1	28.2	28.4	23.2	23.6	30.5	24.0
part. indirect max	45.4	66.7	23.2	47.0	39.2	56.0	19.5	36.0
share	50.0	44.7	50.8	45.1	50.0	44.5	47.3	37.6
WI	0.350	0.749	0.180	0.399	0.303	0.552	0.287	0.519
WI(h)	1.038	3.133	8.039	7.650	4.113	4.794	5.563	6.064
avg. age	52.5	53.0	54.4	47.0	54.8	43.7	56.7	51.0
sample size	2085	1480	3988	2209	10833	4173	7013	938

This table displays the participation rate in stocks (defined in three different ways, row 1: direct, row 3: stocks plus mutual funds invested mainly in stocks and row 5: stocks, mutual funds invested mainly in stocks plus private pension plans), the share of stocks over total liquid assets (for participants), the median wealth income ratio, with and without housing (h) for households in each country by educational attainment, low (no college) and high (college). The moments come from the HFCS. Standard errors for these moments are shown in Table 18.

educated ones. Note that this share is much larger than the direct or direct plus mutual fund holdings of households.

The median financial wealth to income ratio is less than 1 for all countries and is higher for the higher education groups. The increase in the wealth to income ratio when housing is included is much larger in Italy and Spain, countries with higher homeownership rates. Within countries, the difference across education groups in the wealth to income ratio including housing is small except for Germany, and in Spain this ratio is higher for the low education group.

These are important features that a model of household finance must take into account. The model does so by introducing two frictions into the standard life-cycle model: a cost of asset market participation and a portfolio adjustment cost.

The literature on stock market participation has concluded that some level of fixed costs are necessary to improve the empirical fit of lifecycle models. For example, Vissing-Jorgensen (2002), Gomes and Michaelides (2005), Alan (2006) and Cooper and Zhu (2015) study lifecycle models with portfolio choice and fixed stock market entry cost to explain the low stock market participation rates and/or moderate equity holdings of stock market participants. Christelis, Georgarakos, and Haliassos (2013) study the differences in portfolios across countries. The articles in Guiso, Haliassos, and Jappelli (2003) provide a first look into differences in portfolios across countries.

Our analysis is motivated by these same dimensions of household financial decisions. But our approach and hence insights differ both due to the emphasis on estimation of key parameters and the consequent use of these estimates for policy evaluation.

3 Household Dynamic Optimization

The dynamic optimization model for the households is a modified version of that presented in Cooper and Zhu (2015). A household works for T^r periods and survives up to $T > T^r$ periods. The two phases of life are distinguished by income risk. Income is stochastic during working life. Once the households retires, income is deterministic and country-specific.

The household optimization problem entails a number of decisions. First, there is the choice of asset market participation.[5] Second, conditional on participating the agent can choose whether or not to adjust the portfolio, i.e. to change the amount of investment in stock market. In the case of non-adjustment, we assume the return on stocks is automatically reinvested. Finally, there is a continuous choice over consumption and saving.

The optimization problem discussed below is generic. The indices indicating country and education level are dropped. It is understood that the exogenous income process is both country and education specific. Further, the parameters to be estimated are country specific as well.

3.1 Participants

$\Omega = (y, A)$ represents the current state of the household where y is current labor income and $A = (A^b, A^s)$ is the current value of the holdings of bonds and stocks respectively. A household that is currently holding stocks, i.e. $A^s > 0$, is a participant and chooses between (i) portfolio adjustment, (ii) no portfolio adjustment and (iii) exiting the asset markets by selling all stocks. The discrete choice of the household is given by:

$$v_t(\Omega) = \max\{v_t^a(\Omega), v_t^n(\Omega), v_t^x(\Omega)\} \tag{1}$$

for all states Ω.

A household choosing to adjust the portfolio selects the amount of stocks and bonds to solve:

$$v_t^a(\Omega) = \max_{A^{b'} \geq \underline{A}^b, A^{s'} \geq 0} \left\{ (1-\beta)c^{1-1/\theta} + \beta \left[(1-\nu_{t+1}) \left(E_t v_{t+1}(\Omega')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} + \nu_{t+1} \left(E_t B(A')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} \right]^{1-1/\theta} \right\}^{\frac{1}{1-1/\theta}} \tag{2}$$

s.t.

$$c = y + TR + \textstyle\sum_{i=b,s} R^i A^i - \sum_{i=b,s} A^{i'} - F \tag{3}$$

$$A' = R^b A^{b'} + R^{s'} A^{s'} \tag{4}$$

$$TR = \max\{0, \underline{c} - (y + \textstyle\sum_{i=b,s} R^i A^i)\}. \tag{5}$$

where the expectation is taken with respect to future income and asset returns. The probability of surviving into the next period is ν_{t+1} which depends on both age and, implicitly, the education of the agent. There is a consumption floor of $\underline{c}$ representing a transfer from the government to the household.[6] Following Epstein and Zin (1989) and

[5] The model abstracts from the distinction between direct and indirect holdings of stocks, and thus participation can be understood in its broadest sense, i.e., including both direct and indirect participation.

[6] This feature of the model is taken from Hubbard, Skinner, and Zeldes (1995) and DeNardi, French, and Jones (2010). In the empirical implementation, this floor includes transfers beyond UI and those transfers included in the income measure. Based upon the

Weil (1990) we assume a recursive utility representation.[7] Here γ captures the attitude of the agent towards risk and θ parameterizes the substitution effects of a change in the real interest rate. With this specification, the two key aspects of household choice are estimated independently.

$B(A')$ in (2) is the value of leaving a bequest of size w', including the liquidated value of stocks as shown in equation (4). The household chooses a bequest portfolio without knowing the stock return that will determine the full value of the inheritance. The bequest function is given by:

$$B(A') = L(\phi + w'). \tag{6}$$

The curvature over the bequests, parameterized by γ, appears through (2). Here $\phi > 0$ allows for $w' = 0$ while keeping $B'(0)^{1-\gamma}$ a finite number.

In this problem, there is a lower bound to bond holdings, $\underline{A}^b$, which is estimated along with other parameter values via the simulated method of moments. Short sales of stocks are not allowed.

The F in equation (3), the budget equation, represents the cost of portfolio adjustment which includes fees paid as well as time costs incurred. In Bonaparte, Cooper, and Zhu (2012) and Cooper and Zhu (2015), this cost is used, in part, to match portfolio adjustment rates. But no data exists on adjustment rates for the asset market participants in our sample countries. This parameter is identified through portfolio composition: a high value of F discourages households to participate in asset markets or lower the share of stocks in total wealth for participants, thus helping to match these aspects of the data for each country. As discussed further below, this illiquidity of stock investment can create a high MPC even for wealthy households.

If the household chooses not to adjust its portfolio, then the cost F is avoided and there is re-optimization over consumption and bond holdings. The household chooses bonds to maximize:

$$v_t^n(\Omega) = \max_{A^{b\prime} \geq \underline{A}^b} \left\{ (1-\beta)c^{1-1/\theta} + \beta \left[(1-\nu_{t+1}) \left(E_t v_{t+1}(\Omega')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} + \nu_{t+1} \left(E_t B(A')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} \right]^{1-1/\theta} \right\}^{\frac{1}{1-1/\theta}}$$

s.t.

$$c = y + TR + R^b A^b - A^{b\prime}$$

$$A^{s\prime} = R^s A^s$$

$$A' = R^b A^{b'} + R^{s'} A^{s'}$$

$$TR = \max\{0, \underline{c} - (y + \textstyle\sum_{i=b,s} R^i A^i)\}$$

Here we assume that if there is no portfolio rebalancing, any return on stocks is automatically put into the stock account, i.e. $A^{s\prime} = R^s A^s$.

A household currently participating may choose to end its stock holdings. Though there is no flow cost of participating, a household will exit asset markets when a large shock leads to the liquidation of stock holdings.

results reported in Cooper and Zhu (2015) the consumption floor is important for matching the wealth income ratios of low education households.

[7] As reported in Cooper and Zhu (2015), a recursive utility formulation fits the moments for the US best.

The value from exiting the asset markets is given by:

$$v_t^x(\Omega) = \max_{A^{b'} \geq \underline{A}^b} \left\{ (1-\beta)c^{1-1/\theta} + \beta \left[(1-\nu_{t+1}) \left(E_t w_{t+1}(\Omega')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} + \nu_{t+1} \left(E_t B(A')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} \right]^{1-1/\theta} \right\}^{\frac{1}{1-1/\theta}}$$

s.t.

$$c = y + TR + \textstyle\sum_{i=b,s} R^i A^i - A^{b\prime}$$
$$A' = R^b A^{b'} + R^{s'} A^{s'}$$
$$TR = \max\{0, \underline{c} - (y + \textstyle\sum_{i=b,s} R^i A^i)\}.$$

where $w_{t+1}(\Omega')$ denotes the value function of stock market non-participants given the future state Ω'.

3.2 Non-Participants

A household currently not holding stocks can, at a cost, enter into asset markets. Or the household can remain a non-participant. The values for this participation decision are given by:

$$w_t(\Omega) = \max\{w_t^n(\Omega), w_t^p(\Omega)\} \tag{7}$$

for all Ω.

Even if the household remains a non-participant, it can adjust its bond account in response to income shocks. The optimization problem of a non-participant choosing not to enter the asset markets is:

$$w_t^n(\Omega) = \max_{A^{b'} \geq \underline{A}^b} \left\{ (1-\beta)c^{1-1/\theta} + \beta \left[(1-\nu_{t+1}) \left(E_t w_{t+1}(\Omega')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} + \nu_{t+1} \left(E_t B(A')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} \right]^{1-1/\theta} \right\}^{\frac{1}{1-1/\theta}} \tag{8}$$

for all Ω. The budget constraints are:

$$c = y + TR + R^b A^b - A^{b\prime}$$
$$A' = R^b A^{b'}$$
$$TR = \max\{0, \underline{c} - (y + R^b A^b)\}$$

If a household switches its status and decides to purchase stocks, it must pay an entry cost of Γ. There is no lag so that the household can instantaneously trade in the stock market. The value from participating for the first time is given by:

$$w_t^p(\Omega) = \max_{A^{b'} \geq \underline{A}^b, A^{s'} \geq 0} \left\{ (1-\beta)c^{1-1/\theta} + \beta \left[(1-\nu_{t+1}) \left(E_t v_{t+1}(\Omega')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} + \nu_{t+1} \left(E_t B(A')^{1-\gamma} \right)^{\frac{1}{1-\gamma}} \right]^{1-1/\theta} \right\}^{\frac{1}{1-1/\theta}} \tag{9}$$

subject to the following constraints:

$$c = y + TR + R^b A^b - A^{b\prime} - A^{s\prime} - \Gamma$$
$$A' = R^b A^{b'} + R^{s'} A^{s'}$$
$$TR = \max\{0, \underline{c} - (y + R^b A^b)\}.$$

It is noteworthy that the future value in equation (9) is denoted by $v_{t+1}(\Omega')$ which is the value function of stock market participants given the future state Ω'.

4 Quantitative Approach

There are two stages in the estimation. First, income and return processes, by country, are estimated directly from micro data. These processes are used as inputs to solve the household optimization problem so that conditional expectations of exogenous variables are consistent with the data.

Second, the parameters, $\Theta \equiv (\beta_i, \gamma, \Gamma, F, L, \phi, \underline{c}, \theta, \underline{A}^b)$ which characterize households in a country are estimated via the simulated method of moments. The discount factor, β_i, is indexed by education attainment, $i = 0, 1$, for no college and college respectively. The vector Θ is chosen to solve:

$$\pounds = min_{\Theta}(M^s(\Theta) - M^d)W(M^s(\Theta) - M^d)'. \tag{10}$$

Here W is a weighting matrix calculated as the inverse of the variance-covariance of the moments taken from Table 18. The simulated moments, $M^s(\Theta)$, are calculated from simulated data set created by solving the household optimization problem. For each country, the initial distribution of asset holdings, needed as an input into the computation of moments, is taken from the data.

4.1 Exogenous Processes

We estimate household income processes using the European Community Household Panel (ECHP) during the period of 1994-2001 (8 waves). The ECHP is a panel survey collecting internationally comparable data on income and demographics of a representative sample of households year after year in several EU countries.[8] Our income measure is defined as total reported after-tax, non-asset household income. This definition includes labor income received by the household head and all other members of the household, such as income from work (wages, salaries and self-employment earnings) and social cash transfers (government transfers, workers compensation, unemployment insurance and old-age pensions), net of any taxes and social contributions paid. We use a broad definition of labor income to allow for insurance mechanisms other than asset accumulation within each country, such as

[8]In 2001, the ECHP was discontinued, and since 2004, replaced by the EU Statistics on Income and Living Conditions (EU-SILC), a survey which covers similar topics but is not suitable for our analysis due to its different design. Note that the exposition of the estimation of labour income processes follows closely Le Blanc and Georgarakos (2013).

unemployment benefits and other welfare programs present in the European countries we consider. Including only labor income would overstate the variability in income that households face while including also financial asset and capital income would understate the risk coming from earnings.[9] Income from the ECHP relates to the year immediately preceding the survey (e.g. 2000 for wave 8 conducted in 2001), whereas the household composition and the sociodemographic characteristics of household members are those registered at the moment of the interview. To ensure international comparability, income data are PPP-adjusted.

We exclude all households whose heads are younger than 20 years of age, that report annual income greater than zero euro, that have any crucial variable missing or who have not participated for at least two years in the survey.

4.1.1 Income Profiles

As the slope of the deterministic income profiles and the risk properties of labor income differ by education, we split households in each country into a subsample of households whose head has a college degree and a subsample of households with a head without college degree.[10]

For each education group and country, data from various years are pooled together. We then regress log income on household characteristics, an age polynomial of order three and either cohort or time effects. As age, time and birth year are perfectly correlated, we estimate age-income profiles controlling for time effects and assume that cohort effects are fixed:[11]

$$log(Y_{it}) = const. + polynomial(age_{it}) + HHComp_{it} + Time_t. \tag{11}$$

Household composition, $HHComp_{it}$, includes the number of children in the household, the number of dependent adults, the number of heads in the household and time dummies. The ECHP population weights are used in the regression equation (11).[12]

For each country and education group, we estimate this equation twice, once for households in the labor force and once for households above age 65. We assume for now that retirement takes place exogenously at age 65, the statutory retirement age in all countries, which makes the profiles comparable over all ages. To obtain smoothed age-income profiles suitable as ingredients into the model, we fit a cubic age polynomial for our pre-retirement regression and assume that income is linear in age for the post-retirement period.[13]

[9] There are other important insurance mechanisms that our definition does not capture, namely: receipts in kind, transfers paid to and received from other households, negative capital income and imputed rents (i.e. the money value by not having to pay full market rent by living in one's own accommodation) The latter could be meaningful in particular in the Southern European countries where home ownership rates are high.

[10] Ideally, one would define smaller education groups depending on number of years in schooling (see e.g. Cooper and Zhu (2015), Laibson, Repetto, and Tobacman (2001)) or differentiate by highest degree obtained (no high school, high school, college), see e.g. Cocco, Gomes, and Maenhout (2005), Hubbard, Skinner, and Zeldes (1994). Unfortunately, this would make the number of observations in some cells too small.

[11] We also estimated a version of the same equation including cohort instead of time effects. The shapes, levels and growth rates of these estimations are very similar to our profiles. We therefore conclude that our specification is robust to using cohort or time effects.

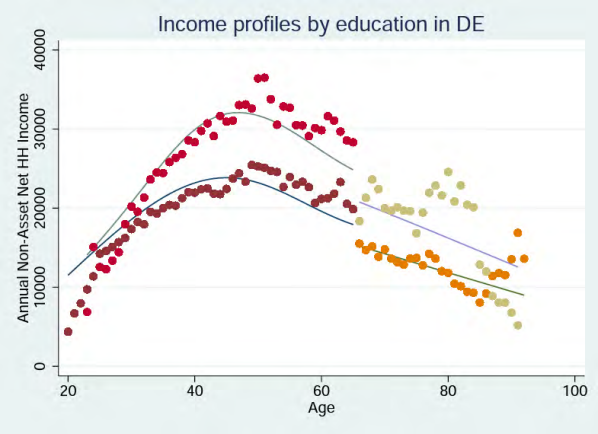
[12] Unweighted results are essentially the same.

[13] Note that the retirement period is left out by most papers and many authors assume a flat income scheme after retirement, e.g. Cocco, Gomes, and Maenhout (2005). We find the resulting age-decreasing pattern more plausible.

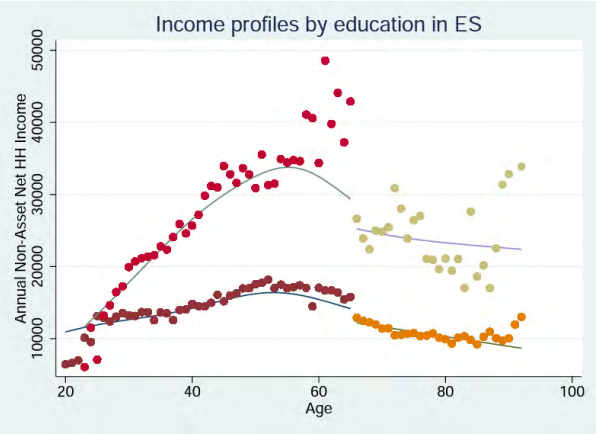
The resulting profiles illustrate age and education-specific variations in expected income over the lifecycle for a household that has a typical life-cycle evolution in household size and has a typical time effect. For details on the exact regressions and robustness checks of the income profiles see Le Blanc and Georgarakos (2013) and the literature therein.

Figure 1 displays the fitted (exponentiated) values of the income predictions for each education group and each country. The dots around the lines in Figure 1 represent the means of observed household income by age, suggesting that we fit the data reasonably well.

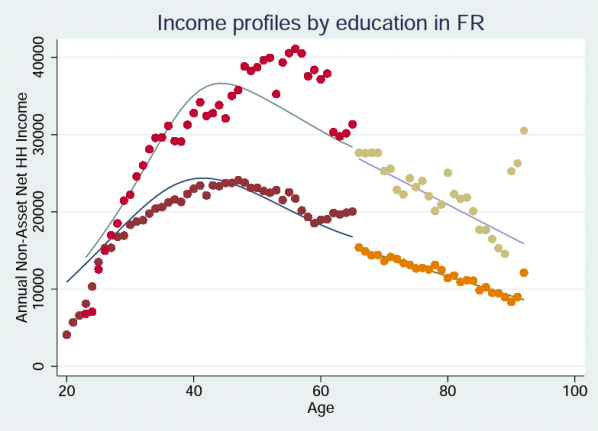
Figure 1: Age-Income Profiles by Education



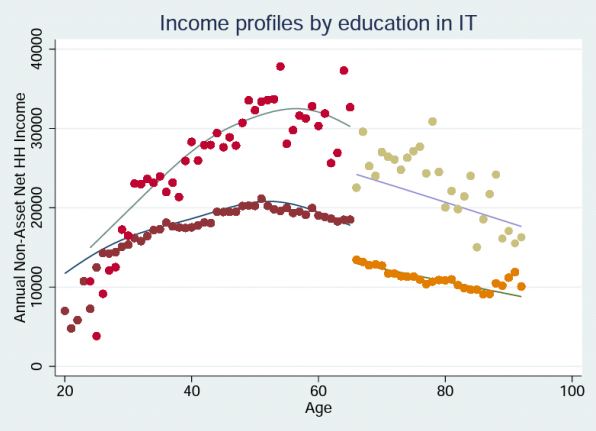
(a) Germany



(b) Spain



(c) France



(d) Italy

Notes: The figures display fitted household income over the life-cycle for those headed by college graduates and those whose heads do not have a college degree. We fit a cubic age polynomial for our pre-retirement regression and assume a linear relation between income and age for the post-retirement period. The higher curve represents higher education households in all countries. The dots represent mean household income by age.

The resulting age-income profiles display heterogeneity with respect to both the steepness and peaks of the income profiles. After a sharp increase in the beginning of working life, income for college graduates peaks in

mid-working life in Germany and France. Households whose heads are without a college degree present relatively flat profiles at a lower level than college graduates, reflecting the education premium of a college degree. In the two Southern countries income of college graduates grows slowly until it reaches a peak late in working life, around age 55 to 60 when the income of households within the same education group already decreases in Germany and France. Households without a college degree in Italy and Spain have on average an even flatter income profile that hardly grows over the lifecycle. The gap between employment income and retirement income varies across countries, reflecting the different generosity of the pension systems and other transfers after retirement. In particular, in Italy and Spain, reaching retirement age is connected to a large loss in income.

4.1.2 Income Shocks

We use the variation in log income residuals from our estimation of the country- and education-specific income profiles from equation (11) to characterize the uncertainty of earnings over the life-cycle. Following Carroll (1992), Guvenen (2009), Laibson, Repetto, and Tobacman (2001), among others, assume that the log income residuals, $\tilde{y}_{i,t}$, reflect income shocks and follow the stochastic process given by:

$$\begin{aligned} \tilde{y}_{i,t} &= z_{i,t} + \epsilon_{i,t} \\ z_{i,t} &= \rho z_{i,t-1} + \eta_{i,t} \end{aligned} \tag{12}$$

where $\epsilon_{i,t}$ and $\eta_{i,t}$ are independent zero-mean random shocks, with variance σ_ϵ^2 and σ_η^2 respectively. The shock $\eta_{i,t}$ is persistent, with a persistence parameter of ρ.

The identification of the structural parameters in equation (12), i.e. $(\sigma_\epsilon^2, \sigma_\eta^2, \rho)$, is achieved by minimizing the distance between the theoretical and the empirical autocovariances of the process using an iterative process that employs an optimal weighting matrix, as proposed by Hansen (1982) and Chamberlain (1984).[14] For details about moments construction and estimation method, see Le Blanc and Georgarakos (2013) and Guvenen (2009).

Table 2 displays the estimates of the variances of the persistent and transitory shocks and the persistence parameter by education level for each country.

Over the whole sample, households in Germany face the lowest persistence of income shocks ($\rho = 0.91$) while Italian and French households have highly persistent shocks (ρ =0.98 and 0.96 respectively). Permanent shocks to income are lower for college graduates than for non-college educated households. This is consistent with the notion that shocks to more educated households are small but they could be very persistent as their human capital is more specific. Also, the transitory component of income is usually lower for households with a college degree (with the exception of France). College graduates Germany display low permanent and transitory shocks. In Italy and Spain, lower educated households face large and very persistent permanent shocks.[15]

[14] In particular, we use a Generalized Method of Moments (GMM) estimator to minimize the distance between the theoretical and empirical autocovariances which has the advantage of requiring strong distributional assumptions while still achieving asymptotic efficiency.

[15] On interpretation of this result is that the economic expansion that started roughly 10 years before the first wave of our data set

Table 2: Stochastic Processes by education and country

	Germany			Spain		
	ρ	σ^2_η	σ^2_ϵ	ρ	σ^2_η	σ^2_ϵ
No college	0.895***	0.022***	0.016***	0.951***	0.092***	0.016***
	(0.005)	(0.001)	(0.001)	(0.007)	(0.004)	(0.002)
College	0.937***	0.020***	0.011***	0.986***	0.058***	0.004**
	(0.008)	(0.001)	(0.001)	(0.007)	(0.004)	(0.002)
	France			Italy		
	ρ	σ^2_η	σ^2_ϵ	ρ	σ^2_η	σ^2_ϵ
No college	0.971***	0.031***	0.006*	0.944***	0.072***	0.020***
	(0.014)	(0.006)	(0.003)	(0.005)	(0.003)	(0.002)
College	0.941***	0.023***	0.018***	0.921***	0.029***	0.022***
	(0.007)	(0.003)	(0.002)	(0.016)	(0.01)	(0.006)

Robust standard errors in parentheses. $***p < 0.01, **p < 0.05, *p < 0.1$

Notes: The estimated model is $\tilde{y}_{i,t} = z_{i,t} + \epsilon_{i,t}$; $z_{i,t} = \rho z_{i,t-1} + \eta_{i,t}$. The dependent variable equals the log of after-tax, after unemployment benefits, non-capital income of the household head and spouse (if present), net of the predictable part of income. Year-dummy variables included in the earnings regression. The error structure is estimated by optimally weighted GMM, minimizing the distance between the theoretical and the empirical first six autocovariances (including the autocovariance of lag 0, i.e. the cross-sectional variance). The reported variances are pooled over the sample period and over cohorts.

4.2 Asset Returns

The real return on bonds is non-stochastic and is set at 2% for all countries. The real return on stock investment, including both dividends and capital gains, is assumed to be i.i.d. at annual frequency, with the return shocks normally distributed. The mean and standard deviation of stock return shocks for each country are given by the following table.

Table 3: Stock Return Processes

	mean	standard deviation
Germany	0.085	0.310
Spain	0.078	0.245
France	0.092	0.291
Italy	0.046	0.290

Note: the mean and standard deviation of real stock returns between 1930-2012.

The annual mean return ranges from a low of 4.6% in Italy to twice that in France. The standard deviation is about the same across countries. To be clear, these are returns by country not by household residing in a country. Given the amount of home bias existing in these households' portfolios, this distinction is not very important.[16]

(in particular in Spain but also in Italy) mostly benefited the more educated while permanent income uncertainty increased for the less educated.

[16]That said, an extension of the model that distinguishes between participation in home vs foreign markets could be of interest in smaller very open economies. Unfortunately, the participation measure in the HFCS data does not distinguish between home and

4.3 Moments

The moments for the structural estimation are shown in the left panel of Table 4.[17] The moments come from country specific regressions of a particular household financial variable on a constant, age, age-squared, a dummy for better education that is set to one for college graduates, and home equity and homeownership status to control for housing which is outside the structural model. Thus the moments used for the estimation go beyond the summary moments presented in Table 1 by allowing the dependence of financial decisions on age and educational attainment.

As the model lacks a distinction between direct and indirect holdings, the participation is taken as the broadest measure and thus includes all types of indirect holdings, as discussed in section 2. As noted earlier, throughout, wealth refers to financial wealth. The model has no housing and thus housing wealth is not studied. Instead, as explained, it is controlled for in the regressions generating the moments.

A couple of points stand out. Education matters for households' financial decisions. It has a significant positive association with participation and a negative association with stock share in all countries. Further, both participation and the stock share exhibit a significant hump-shape in all countries. Finally, the wealth-income ratio is increasing with age in all four countries. The shape is convex in Germany and France and concave in Spain and Italy. An increase in education increases the wealth income ratio in all countries except Italy. For Italy, the wealth income ratio falls with education up to age 55.

Table 4: Data and Model Moments

	con.	age	age^2	$college$ $(*age)$	$college$ $*age^2$	con.	age	age^2	$college$ $(*age)$	$college$ $*age^2$
			Germany: Data					Germany: Model		
Part.	0.250	0.018	-0.00026	0.159		0.276	0.0157	-0.00014	0.164	
Share	0.004	0.023	-0.00024	-0.060		0.025	0.0235	-0.00023	-0.062	
W/I	0.542	-0.008	0.00022	0.037	-0.00036	1.143	-0.0326	0.00031	-0.041	0.000929
			Spain: Data					Spain: Model		
Part.	-0.716	0.035	-0.00034	0.161		-0.157	0.0295	-0.00022	0.178	
Share	-0.116	0.026	-0.00025	-0.049		-0.115	0.0264	-0.00025	-0.049	
W/I	-1.675	0.065	-0.00036	0.013	0.00012	-0.266	0.0396	-0.00027	-0.056	0.001248
			France: Data					France: Model		
Part.	-0.090	0.015	-0.00013	0.148		-0.020	0.0235	-0.00016	0.161	
Share	0.056	0.013	-0.00007	-0.017		0.052	0.0102	-0.00009	-0.017	
W/I	1.344	-0.050	0.0007	-0.004	0.0003	2.753	-0.1060	0.00124	-0.092	0.002534
			Italy: Data					Italy: Model		
Part.	-0.117	0.014	-0.00017	0.089		-0.002	0.0336	-0.00029	-0.002	
Share	0.225	0.015	-0.00016	-0.082		0.098	0.0112	-0.00013	-0.086	
W/I	-0.062	0.023	-0.00018	-0.023	0.00042	1.491	-0.0313	0.00048	-0.073	0.00167

This table reports data and model moments. For the wealth-income ratio regression, the regressors include a constant, age, age-squared, college*age, college*age-squared. For all regressions, controls included home equity and homeownership status.

To illustrate the life-cycle aspects of these moments, Figure 2 shows the age-profile of these moments for

foreign markets.

[17] The standard errors are reported in Table 18.

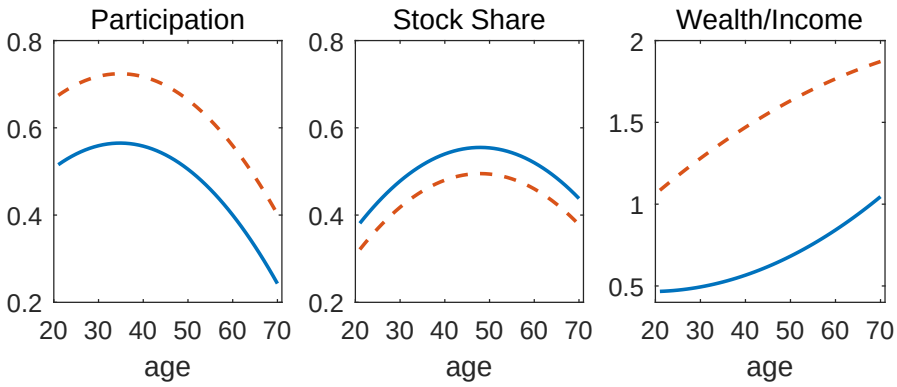


Figure 2: Moments for Germany

This figure shows the average profiles of participation, stock share and the wealth to income ratio for Germany. The high education group is indicated by the broken curves and the low education group by the solid curve.

Germany for the two education groups. There are slight hump-shapes in participation and the stock share. And both are well below 100%. The wealth income ratio is increasing for the high education group and has a slight dip for the low education group

To be clear, these moments summarize patterns in the data. Understanding the features of preferences and the shocks that drive these patterns will come through the estimation of the household dynamic optimization model.

5 Results

The moments from the estimated model are reported in the right panel of Table 4 and the parameter estimates appear in Table 5. The latter table includes a goodness of fit measure, computed using (10).

5.1 Preference Parameters

As Cooper and Zhu (2015) found for the US, the discount factor is considerably lower than conventional value of 0.95 but in line with models of buffer stock saving like Deaton (1991). It averages about 0.79 for the low education group, and it increases with educational attainment. The estimates range from 0.857 in Germany to 0.881 in Italy for the high education group. An important role for the discount factor is to limit the accumulation of savings to match the wealth income ratio that differs by educational attainment, given the high mean returns on stocks relative to bonds. Our estimates are in line with those of Fagereng, Gottlieb, and Guiso (2017), who use Norwegian tax data to estimate a discount factor in the range from 0.77 to 0.82. The authors argue that impatience is necessary to limit liquid asset accumulation and discourage stock market participation in the presence of participation and adjustment costs. Calvet, Campbell, Gomes, and Sodini (2016) use household-level administrative data from Sweden in a lifecycle model with Epstein-Zin-Weil preferences. They estimate the discount factor to be 0.993 when they include real estate as risky investment which makes the risky share of households considerably higher,

and drops to 0.923 when they exclude it. Their model, unlike ours, abstracts from a bequest motive and fixed participation costs which are important in our model to match the lifecycle savings and portfolio choices.

These findings also contrast with the estimates reported in Carroll, Slacalek, and Tokuoka (2014) who allow heterogeneity in discount factors across households and estimate the distribution of discount factors that are around 0.97 with a relatively small variation across households. There the estimates are obtained by matching moments of the liquid asset holdings distribution of households.

The estimated risk aversion, from 12.5 in Spain to 18.5 in France, is considerably higher than the estimated value of around 4 for the US reported in Cooper and Zhu (2015). This is not surprising given the small participation rates in the stock market in our sample countries compared with the US. Increases in risk aversion reduce both participation and stock share in the portfolio. In addition, Cooper and Zhu (2015) abstract from borrowing, which reduces risky investment without imposing higher risk aversion of households. Our estimates are consistent with other estimates for Europe. Fagereng, Gottlieb, and Guiso (2017) estimate a risk aversion parameter of 11 to 14 depending on whether they allow for a small disaster probability and a bequest motive. Calvet, Campbell, Gomes, and Sodini (2016) estimate the average relative risk aversion parameter to be 4.15 when they include real estate as a risky investment and 10.9 when they do not.

Other studies have used information from direct or indirect questions on risk and time preferences from surveys to infer risk aversion parameters (see, for example, Guiso and Paiella (2006), Guiso and Paiella (2008), Bonin, Dohmen, Falk, Huffman, and Sunde (2007)). Making use of a question on households' willingness to pay for a hypothetical risky security in the 1995 Bank of Italy Survey of Household Income and Wealth (SHIW), Guiso and Paiella (2006) and Guiso and Paiella (2008) infer a relative risk aversion measure of 6 which ranges from 1.9 to 13.3 in the data.

The stock market participation cost, Γ, and portfolio adjustment cost, F, are given as fractions of average income in a country. The participation cost of 1.3% in Spain is the highest among the four countries, and the cost is relatively low in Germany. Yet the adjustment cost of 1.1% is relatively high in Germany, though not precisely estimated, and its estimate is relatively low in France. For Italy, neither the adjustment cost nor participation cost is statistically significant. These variations in participation and adjustment costs influence the lifecycle patterns of participation. The adjustment costs also directly impact the stock share since they generate a demand for liquidity through bond holdings.

The point estimates of L indicate a bequest motive and is statistically significant in all countries. Further, there is a positive point estimate of ϕ, the luxuriness of bequest, in all four countries but these are not significantly different from zero.

The elasticity of intertemporal substitution, θ, is also statistically significant in all countries. It is far from the inverse of the risk aversion estimate, thus inconsistent with the CRRA model.

Table 5: Parameter Estimates

	β_0	β_1	γ	Γ	F	L	ϕ	$\underline{c}$	θ	$\underline{A}^b$	Fit
Germany	0.800	0.857	14.920	0.002	0.011	0.032	0.680	0.219	0.445	-0.123	1111.42
	(0.009)	(0.008)	(0.245)	(0.001)	(0.014)	(0.010)	(0.522)	(0.052)	(0.029)	(0.045)	
Spain	0.794	0.865	12.535	0.013	0.006	0.099	0.699	0.312	0.294	-0.062	806.04
	(0.008)	(0.021)	(0.378)	(0.004)	(0.002)	(0.044)	(1.467)	(0.035)	(0.091)	(0.638)	
France	0.792	0.864	18.522	0.008	0.016	0.027	1.55	0.150	0.401	-0.130	7617.63
	(0.006)	(0.005)	(0.023)	(0.003)	(0.004)	(0.004)	(0.155)	(0.020)	(0.009)	(0.040)	
Italy	0.808	0.881	13.947	0.008	0.0003	0.042	1.558	0.336	0.317	-0.069	2702.26
	(0.031)	(0.022)	(3.273)	(0.011)	(0.001)	(0.013)	(2.033)	(0.001)	(0.001)	(0.237)	

This table reports parameter estimates and the corresponding standard errors. The last column is model fit from (10).

5.2 Consumption Floor

The consumption floor, $\underline{c}$, is estimated as relative to a country's average income. For each country $\underline{c}$ is precisely estimated. The estimate is the highest for Italy and lowest for France.

Table 6 provides additional information on the incidence of households hitting the consumption floor by country and education attainment. The consumption floor plays an important role in determining the magnitude of precautionary saving.[18] As seen from this table, the consumption floor is functional only for low education households and only in two countries, Spain and Italy. Perhaps not surprisingly, the estimated consumption floor is larger for these two countries. From Table 1, this is consistent with the lower wealth to income ratio in Italy and Spain relative to Germany and France.

Table 6: Fraction of Households Hitting the Consumption Floor

	Low Ed	High Ed
Germany	0.030	0.000
Spain	0.104	0.002
France	0.000	0.000
Italy	0.087	0.002

The table reports the fraction of households who hit the consumption floor for each of the four countries by education.

5.3 Borrowing Constraints

As detailed in the optimization model, households are allowed to borrow to some limits in the unsecured debt market. The borrowing limits are estimated as relative to the average income in a country. As shown in Table 5, the estimates are statistically significant for Germany and France, amounting to 12.3 to 13.0 percent of average income respectively. The estimates for Spain and Italy are insignificant.

However, as will become clear in the remainder of the text the frequency of households actually being bound

[18] This is made precise in the elasticities of moments with respect to parameters presented in Table 19 and discussed below.

by the borrowing constraint is essentially zero.[19] That is, in simulations of the estimated model, the borrowing constraint does not bind for most of the households.

Of course, this does not mean that the borrowing constraint does not influence behavior. As indicated in Table 19, variations in the borrowing limit influence moments. In particular, an increase in $\underline{A}^b$ increases the share of risky assets in the portfolio and increases the wealth to income ratio, while reducing the participation rate. Intuitively, if households are less able to borrow, then they will save more as a buffer. To the extent they do so by holding bonds, this will reduce the participation rate.

5.4 Local Identification

Another perspective on the link between parameters and moments is given in Table 19 in the appendix. The table shows the elasticity of the model moments, i.e., coefficients in the participation, share, and wealth to income ratio regressions, with respect to a small variation in the structural parameters, one at a time. A large elasticity indicates that a moment is important in identifying a particular parameter. These elasticities are informative about local identification as the variations in parameters are in the neighborhood of the estimated values. This table provides information about local identification for a single country, Spain, as the elasticities are computed at the baseline estimates for Spain.

For example, an increase in the coefficient of relative risk aversion, γ, increases the constant term in the wealth to income ratio regression, but it decreases stock market participation and stock share in wealth. The signs are exactly what is expected and it is clear that this response is key to the identification of γ.

The participation cost has a large negative effect on the constant terms for participation and stock share regressions. These parameters also interact with age and educational attainment, particularly in the participation regression. As mentioned earlier, although we do not observe the frequency of portfolio adjustment in the data, the portfolio adjustment cost, F, is identified through its effects on stock market participation and stock share in wealth. As shown in the table, the negative effects on F on stock share moments are quite significant. F also has a negative effect on the wealth to income ratio, as it lowers the overall effective return on the household's financial investment and hence lowers the savings motives.

The local changes in discount factors exhibit large effects on simulated moments, leading to the precise estimates for both parameters. An increase in β_0 leads to more savings and hence higher wealth to income ratios for the less educated group. This is reflected in the negative elasticities on the coefficients of $age * college$ and $age^2 * college$ in the wealth to income ratio regression, resulting from a small education gap in terms of the wealth to income ratio. As shown in the first row of the table, the elasticities are both negative for the coefficients on education dummies in the participation and stock share regression. The two negative coefficients also indicate a reduced education gap in terms of stock market participation and stock share in wealth. The negative elasticity for the constant term in the participation regression reflects earlier participation of the less educated group.[20] Similarly, an increase in β_1

[19] This is reminiscent of Krusell and Smith (1998) where the presence of a borrowing constraint does not create a nonlinearity as relatively few households are bound by the constraint.

[20] This is confirmed when we compare the participation profiles before and after the local changes in β_0. The comparison also shows

widens the education gap in terms of stock market participation rates and wealth income ratios, which is evident in the last row of the table.

6 MPC Distribution

This section of the paper studies the distribution of the marginal propensity to consume (MPC) across households by country. Heterogeneity in the consumption response of households to variations in income and stock returns is a natural consequence of our model. These differences matter in determining the impact of policies that influence income and returns. The responses to shocks tend to be nonlinear, due to the discrete choices by households and the non-homothetic feature of household preferences introduced through the consumption floor and luxuriousness of bequest. Further, the evolution of the cross sectional distribution across households can generate endogenous persistence. Of course, all of these features may themselves differ across countries.

In particular, the frictions in asset market participation and adjustment matter for the response of households to shocks. As emphasized in Bonaparte, Cooper, and Zhu (2012), the non-convex portfolio adjustment cost implies a non-linear response to income and interest rate variations. Further, borrowing constraints can bind, even for apparently wealthy households due to liquidity shortages, as suggested by Kaplan and Violante (2014). This has policy implications as shown by the recent work of Kaplan, Violante, and Weidner (2014), Kaplan and Violante (2014) and Kaplan, Moll, and Violante (2016).

Beside the discrete choices and the binding borrowing constraint, it is important to note that the consumption floor $\underline{c}$ is much more relevant for low income households than high income households, which also leads to heterogeneity in MPCs. This is related to the discussion in Kaplan and Violante (2014) since households relying on the consumption floor are more likely to be hand-to-mouth households and thus have high marginal propensities to consume. We will characterize these households both in actual and simulated data.

In addition, the parameter ϕ in our model captures the degree of luxuriousness of bequest. For households with low income, it is optimal to run down their wealth as their death probability rises with age. But for high income or high wealth level households, the optimal decision rule is to keep the high level of wealth as bequests. This non-homotheticity in preferences further leads to heterogeneity in MPCs.

Other studies on lifecycle portfolio choice and MPC include Cocco, Gomes, and Maenhout (2005) and Gomes and Michaelides (2005) where older unconstrained households have higher MPC to transitory income (or wealth) shocks, since they consume those gains over a shorter period of time and they face significantly less uncertainty about their lifetime income and wealth. We also fit a realistically calibrated income process to our model and calculate MPCs out of transitory income shocks.

Jappelli and Pistaferri (2014) study MPC heterogeneity of Italian households. They find that households with low cash-on-hand exhibit a much higher MPC than affluent households, which is in agreement with models with

that the the less educated group to leave the stock market earlier given the higher β_0. This is because the higher β_0 causes some low income households to enter the stock market when they are young, and they exit early after retirement as they rely on the consumption floor toward the later stage of life.

Table 7: MPC Distribution: Income Shock

Country	Ed \ Inc	1%						10%					
		All Households			Participants			All Households			Participants		
		low	middle	high	low	middle	high	low	middle	high	low	middle	high
Germany	low	0.438	0.262	0.233	0.331	0.289	0.232	0.399	0.251	0.201	0.270	0.245	0.200
	high	0.311	0.191	0.142	0.258	0.187	0.142	0.295	0.186	0.139	0.237	0.182	0.139
Spain	low	0.647	0.213	0.139	0.272	0.174	0.142	0.658	0.178	0.139	0.203	0.158	0.138
	high	0.282	0.154	0.136	0.198	0.154	0.138	0.247	0.156	0.137	0.191	0.155	0.139
France	low	0.382	0.198	0.149	0.295	0.196	0.155	0.306	0.192	0.147	0.234	0.189	0.153
	high	0.235	0.132	0.086	0.150	0.130	0.145	0.206	0.128	0.100	0.138	0.126	0.164
Italy	low	0.675	0.137	0.115	0.453	0.136	0.115	0.653	0.136	0.113	0.400	0.134	0.113
	high	0.259	0.128	0.117	0.178	0.118	0.119	0.214	0.125	0.117	0.163	0.117	0.119

This table summarizes the distribution of MPC from transitory income shocks. The three columns (low, middle and high) represent three levels of permanent income. The rows, by country, are for low and high educational attainment for all households as well as those participating in asset markets. The left block is for a 1% shock and the right is for a 10% transitory income shock.

precautionary savings where income risk plays an important role. They find that a debt-financed increase in transfers of 1 percent of national disposable income targeted to the bottom decile of the cash-on-hand distribution would increase aggregate consumption by 0.82 percent.

Here we focus on the MPC distribution from transitory income and return shocks. We do so by using the baseline estimates by country. In contrast to numerous other studies, the MPC distribution is computed from the simulated data rather than from a reduced form regression.

6.1 Income Shock

In this sub-section, the experiments come from a 1% and a 10% increase in transitory income. The increase in income is given as a lump sum to all households. Thus differences in consumption responses do not reflect differences in the amount of the transfer. For this exercise, we simulate the consumption of each household in the baseline economy, then we impose an exogenous increase in transitory income to all the households, and re-simulate their consumption. For each household the MPC is calculated as the percentage increase in consumption.

Table 7 presents the MPC by country for each of the three levels of permanent income by education group. Within each experiment, we report the MPC for all households and for stock market participants only. The numbers reported are the mean value of the MPC for each cell.

Table 8 summarizes the distribution by education and permanent income within each country for all households. As we proceed through the various experiments this distribution will remain fixed. For all of the countries, the largest cell is the low education middle income group.

A couple of features are apparent. First, for all countries and education groups, the MPC is highest for the low permanent income group and then falls with the level of permanent income. Second, while the low education, low permanent income group has the highest MPC in each country, the MPC of this group is much higher in Italy and Spain relative to France and Germany. For this cell, the MPC is about two-thirds in the two countries. Interestingly, the lowest MPC is associated with the high education, high permanent income group and there are

Table 8: Household Distribution by Income and Education

Country	Ed \ Inc	low	middle	high
Germany	low	0.146	0.292	0.146
	high	0.104	0.208	0.104
Spain	low	0.180	0.361	0.180
	high	0.070	0.139	0.070
France	low	0.161	0.322	0.161
	high	0.089	0.178	0.089
Italy	low	0.221	0.441	0.221
	high	0.029	0.059	0.029

This table summarizes the distribution of households by education and permanent income for each country in the simulated data.

relatively small differences in this cell across countries. From Table 8, Spain and Italy have the largest fractions of low education, low permanent income and low education middle income households among the four countries. Thus the highest MPC group gets more weight in these two countries.

The large heterogeneity in MPCs across income and education groups is driven by the non-homotheticity in preferences and the discrete choices of households, as discussed earlier. To quantitatively examine this point, we conducted two experiments. The first experiment sets the consumption floor, the luxuriousness of bequest and the portfolio adjustment costs to zero, thus turning off the potential sources of heterogeneity in MPCs with respect to income. The second experiment further sets the discount factor of the less educated group to be the same as the more educated group, thus making the two groups of households equally patient. The results are reported in Table 20 in the Appendix. The first experiment brings the MPCs of the three permanent income groups within each education group close to each other. Within the elements of the first experiment, each contributed to the non-linearity. The second experiment essentially equalizes the MPCs of the two education groups.

Second, in almost all cells, the MPC is lower for stock market participants. But, it is noteworthy that in each country, stock market participants have a higher MPC than non-participants for high education and high income cell. This is particularly apparent in France. In the data as well as in the model, these high education and high income participants have a larger stock share on average. It is likely that they have a high MPC relative to non-participants because in the presence of portfolio adjustment costs, some of these participants may be relatively illiquid. Thus for them a positive income shock leads to a rapid increase in consumption.

To explore this conjecture, we calculate the mean MPCs for both adjustors and non-adjustors in the stock market. In each period, a household is defined as an adjustor if she re-balances her portfolio. To be clear, adjustors and non-adjustors were identified by their behavior in the **absence** of the income shock.

As shown in Table 9, non-adjustors have a higher mean level of MPC in each country, which is constituent with our conjecture. In particular, the MPCs of non-adjustors in Germany and Spain are almost twice as large as those of adjustors. This is then consistent with the finding in Table 7 of higher MPCs for stock market participants with high education and high permanent income.

Table 9: MPC of Stock Market Participants

	1%		10%	
	Adjustors	Non-adustors	Adjustors	Non-adustors
Germany	0.125	0.211	0.124	0.212
Spain	0.142	0.174	0.137	0.151
France	0.102	0.156	0.169	0.140
Italy	0.153	0.297	0.142	0.161

This table reports the mean MPC of stock market participants. Adjustors are the participants who engaged in portfolio re-balancing.

Finally, while the aforementioned patterns are also seen in the 10% shock scenario, the numbers are somewhat overall smaller. This reflects the existence of non-linearities with respect to the shock size.

Table 10: MPC Regressions: Income Shock

						wealth percentile				
	const.	age	age2	income	edu	0-50%	50-70%	70-90%	90-95%	95-100%
1% increase in transitory income										
Germany	0.186	0.017	-0.00020	-0.043	-0.0045	0.000	0.059	-0.069	-0.146	-0.152
Spain	0.271	0.006	-0.00007	-0.017	0.0053	0.000	-0.051	-0.079	-0.113	-0.114
France	0.231	0.017	-0.00021	-0.048	0.0090	0.021	-0.171	-0.198	-0.207	-0.212
Italy	0.272	0.007	-0.00007	-0.034	0.0184	0.044	-0.101	-0.117	-0.131	-0.135
10% increase in transitory income										
Germany	0.204	0.016	-0.00019	-0.041	-0.0057	0.000	0.055	-0.070	-0.146	-0.152
Spain	0.249	0.006	-0.00007	-0.012	0.0050	0.000	-0.045	-0.073	-0.107	-0.106
France	0.194	0.017	-0.00020	-0.040	0.0115	0.000	-0.168	-0.192	-0.195	-0.204
Italy	0.258	0.007	-0.00008	-0.029	0.0181	0.000	-0.098	-0.118	-0.133	-0.136

This table presents regression results of MPCs in response to positive transitory income shocks of 1% and 10%, respectively. The dependent variable is the MPC. The explanatory variables are a constant, age, age-squared, income, education and wealth percentiles.

Table 10 presents regression results that explain the variations in MPC across households within each country. The dependent variable is the household specific MPC as computed above. The explanatory variables are those in the state vector of the dynamic optimization problem. Included are dummies for the household's position in the wealth distribution of that country. The regression has the interpretation of an approximation to (a derivative of) one of the consumption rules.

From these results, there is a slight hump-shape in the MPC, though the variation over the lifecycle is small relative to other household moments. The MPC is falling in income while the effect of education is ambiguous. Note that the big differences across education groups reported in Table 7 are now subsumed by the income and wealth variables.

Most interestingly is the nonlinear relationship between the MPC and relative wealth of the household. Here we see that the MPC falls non-linearly with the wealth percentile. This is true for both a 1% and a 10% increase in transitory income.

The MPC distribution generated by our model can be compared with those reported in Carroll, Slacalek, and

Tokuoka (2014). They report estimates of average MPC values of between 20% and 40%, when matching the liquid wealth distribution. Of our four countries, their estimate of the aggregate MPC for Germany is lowest at 26% and Spain is the largest at 38%.

6.2 Return Shocks

Here we study the response of households to a 1% and a 10% shock in the return to stocks.[21] Note that this shock only affects the choices of households who participate in asset markets. The point of studying both small and large shocks is to understand the non-linearity in response due to the non-convex adjustment costs.

The MPC distribution with respect to these return shocks is reported in Table 11. It is comparable to the response to income shocks reported in Table 7. Higher permanent income households have lower MPCs, across countries and education groups. Further, the MPC is lower for higher education households. The MPCs are generally slightly higher for the larger return shock.

Table 11: MPC Distribution: Return Shocks

Country	Ed \ Inc	1%			10%		
		low	middle	high	low	middle	high
Germany	low	0.307	0.246	0.202	0.311	0.250	0.202
	high	0.274	0.175	0.139	0.278	0.175	0.139
Spain	low	0.224	0.146	0.139	0.227	0.148	0.139
	high	0.182	0.145	0.131	0.185	0.145	0.133
France	low	0.196	0.183	0.160	0.205	0.185	0.162
	high	0.138	0.116	0.156	0.140	0.117	0.158
Italy	low	0.328	0.144	0.112	0.344	0.144	0.112
	high	0.156	0.117	0.111	0.159	0.118	0.113

This table summarizes the distribution of MPC from a 1% and a 10% return shock. The three columns represent three levels of permanent income. The rows, by country, are for low and high educational attainment for all households as well as those participating in asset markets.

Finally, Table 12 presents regression results to summarize how the households' state variables impact the MPC from a stock market return shock. There is no strong dependence of the MPC on age. The MPC falls with both income and with the wealth to income ratio, and in general with education.

Our findings are also related to evidence in a recent paper by Di Maggio, Kermani, and Majlesi (2018) that studies the MPC out of stock market returns for Swedish households participating in stock markets. They regress consumption growth on changes in dividends and capital gains. They find that the MPC out of capital gains for households in the top 50% of the financial wealth distribution is around 5%. On the other hand, it is significantly higher and more than 10% for the bottom 50% of the distribution. Note that over 93% of the stock ownership is by the top 50%.

[21] As the return on bonds is deterministic, it makes no sense to explore the response to a zero probability event.

Table 12: MPC Regressions: Return Shocks

						wealth percentile				
	const.	age	age2	income	edu	5-50%	50-70%	70-90%	90-95%	95-100%
1% increase in stock value										
Germany	0.255	0.024	-0.00029	-0.040	-0.0109	-0.106	-0.200	-0.250	-0.359	-0.376
Spain	0.159	0.015	-0.00017	-0.013	0.0166	-0.091	-0.148	-0.191	-0.245	-0.258
France	0.142	0.011	-0.00014	-0.011	-0.0068	0.000	-0.127	-0.173	-0.197	-0.195
Italy	0.376	0.006	-0.00005	-0.034	-0.0147	0.000	-0.163	-0.201	-0.242	-0.257
10% increase in stock value										
Germany	0.198	0.024	-0.00029	-0.040	-0.0145	0.000	-0.151	-0.208	-0.319	-0.340
Spain	0.109	0.015	-0.00017	-0.013	0.0160	0.000	-0.108	-0.151	-0.202	-0.218
France	0.147	0.011	-0.00013	-0.011	-0.0064	0.000	-0.127	-0.173	-0.197	-0.193
Italy	0.366	0.006	-0.00006	-0.034	-0.0133	0.000	-0.169	-0.204	-0.244	-0.259

This table presents regression results. The dependent variable is the MPC from a return shock. The explanatory variables are a constant, age, age-squared, income, the wealth to income ratio and education.

6.3 Hand-to-Mouth Households

As suggested in Kaplan and Violante (2014), there may be households with relatively high MPC due to binding liquidity constraints. While this may arise due to illiquid housing, portfolio adjustment costs, as in our model, can also generate this result.

Following Kaplan, Violante, and Weidner (2014), Hand-to-Mouth (HtM) households are those whose liquid assets are less than half of their income over a pay period. Some of these households have negative illiquid assets and are termed poor HtM households. Others with positive levels of illiquid wealth, such as a house or illiquid holdings of stocks as in this model, are termed rich HtM households. These latter households are the focus of our analysis since the borrowing constraints, though negative, do not lead to large accumulations of debt and relatively few households are bound by these constraints.

Using simulated data from the estimated model, Table 13 reports the fraction of HtM consumers in each education-income cells and the corresponding average MPC. Clearly less education or lower income households have a higher fraction of HtM consumers. Further, low income HtM consumers generally have higher MPCs. It is interesting to see positive fractions of HtM consumers even among the high education and high income households.

Figure 3 shows the fraction of HtM households in our sample. For each country, the fraction of rich, poor and non-HtM households are indicated.[22] About 20% of household in the Euro Area are classified as HtM. The fraction of HtM households is highest in Germany (DE) and lowest in Italy. In all countries except Spain (ES), there are more wealthy than poor HtM households. The average amount of education is lowest for the poor HtM households and highest for those who are not in the HtM classification.

Table 14 reports on how hand to mouth households respond to return shocks. As in the case of income shocks, the mean MPC for each group is very large, though there are relatively few hand to mouth households.

[22]Kaplan, Violante, and Weidner (2014) restrict the sample to households aged 22-79 while we present numbers for the whole sample in Figure 3, hence the small differences

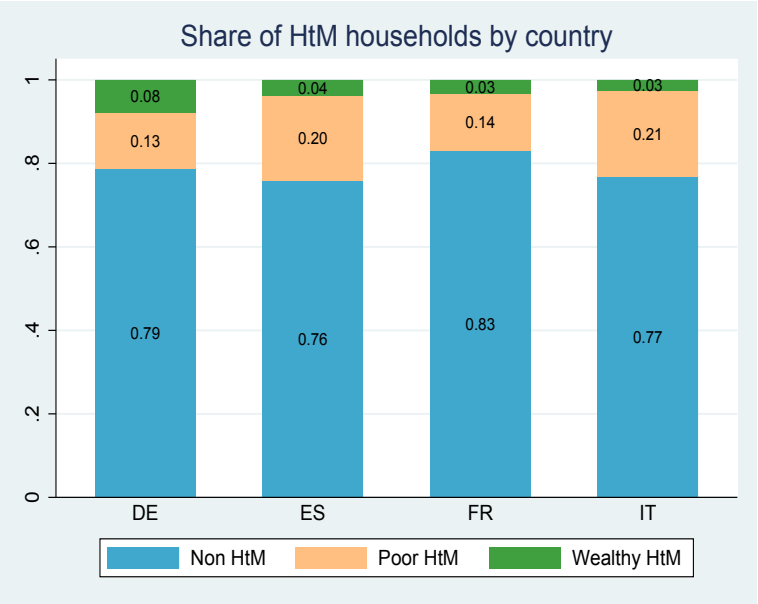


Figure 3: HtM Households

This figure shows the fraction of HtM households in our sample by country. The vertical axis measures the average years of schooling within each of the groups.

7 Monetary Policy Implications

While it is beyond the scope of this paper to fully integrate the household choice problem into a model of monetary and fiscal policy, the differences in response to shocks both across countries and states are certainly relevant for policy analysis. This is the point behind the analysis of fiscal interventions on European countries in Kaplan, Violante, and Weidner (2014). An analysis of monetary interventions for the US is contained in Kaplan, Moll, and Violante (2016).

Here we take an empirical approach to study how monetary policy innovations impact consumption through two channels: income and stock returns. In doing this, we emphasize differences in households within a country as well as country differences in the response to policy innovations.

In general, the different responses across countries come from the different behavior of households, as seen through the different parameter estimates that lead to the differences in the MPCs by state. Further, countries differ in the distributions of households over these states.

The initial effect of a monetary policy innovation on aggregate consumption can be written as:

$$\frac{dC}{dMP} = \int_s \frac{dc(Y, R^s, R^b, \Omega)}{dY} \frac{dY}{dMP} dG(\Omega) + \int_s \frac{dc(Y, R^s, R^b, \Omega)}{dR^s} \frac{dR^s}{dMP} dG(\Omega) \tag{13}$$

where Ω is an index of the individual's state, Y is the current common component of income, R^s is the current return on stocks and dMP_t denotes a period t monetary innovation. This expression is similar to equation (3) in Kaplan, Moll, and Violante (2016) though their formulation explicitly accounts for changes in interest rates and

Table 13: Hand-to-Mouth Consumers: Income Shock

Country	Ed \ Inc		Fraction of HtM'ers				Mean MPC of HtM'ers		
			low	middle	high	total	low	middle	high
Germany	all	low	0.082	0.065	0.013	0.249	0.564	0.357	0.484
		high	0.060	0.027	0.001		0.512	0.323	0.281
	part.	low	0.017	0.037	0.008	0.106	0.434	0.107	0.443
		high	0.021	0.022	0.001		0.491	0.298	0.281
	non-part.	low	0.065	0.028	0.005	0.143	0.597	0.686	0.546
		high	0.039	0.005	0.000		0.524	0.438	0.277
Spain	all	low	0.091	0.036	0.003	0.169	0.795	0.338	0.266
		high	0.031	0.009	0.000		0.516	0.278	0.216
	part.	low	0.008	0.023	0.002	0.053	0.606	0.319	0.274
		high	0.013	0.008	0.000		0.335	0.289	0.196
	non-part.	low	0.083	0.013	0.000	0.116	0.812	0.370	0.218
		high	0.018	0.001	0.000		0.645	0.197	0.570
France	all	low	0.055	0.007	0.000	0.098	0.588	0.328	0.361
		high	0.033	0.003	0.000		0.544	0.321	0.140
	part.	low	0.006	0.005	0.000	0.017	0.511	0.335	0.351
		high	0.005	0.001	0.000		0.333	0.200	0.123
	non-part.	low	0.050	0.002	0.000	0.081	0.597	0.307	0.413
		high	0.028	0.002	0.000		0.585	0.400	0.159
Italy	all	low	0.090	0.011	0.000	0.128	0.802	0.190	0.229
		high	0.024	0.003	0.000		0.665	0.273	0.202
	part.	low	0.046	0.010	0.000	0.065	0.729	0.175	0.228
		high	0.007	0.002	0.000		0.493	0.204	0.148
	non-part.	low	0.043	0.001	0.000	0.063	0.881	0.445	0.265
		high	0.017	0.002	0.000		0.730	0.339	0.253

This table reports the fraction of HtM households and their mean MPC by permanent income and educational attainment.

income over time. These effects are present in our analysis as well as through the policy functions that underlie the calculations of the type-specific MPCs.

There are two components to (13). The first is the response in income created by the monetary innovation. The second is the effect of the monetary innovation on the return to risky assets.[23]

There are two important dimensions to the policy response that this equation makes clear. First, the response is state dependent at the individual level and thus dependent on the cross sectional distribution, $G(\Omega)$, for each country. To the extent that the intervention itself changes the cross sectional distribution, there will be an additional dynamic to the policy response. Second, the response is potentially non-linear. A larger policy action, for example, might create a larger incentive for agents to adjust their portfolios and even change their asset market participation decision.

In contrast to Kaplan, Moll, and Violante (2016), the policy effects on income and interest rates will not be generated by a model. Instead, we take them from empirical analyses of the channels of monetary policy. The

[23] A final channel that accounts for the effect of the policy innovation on the return of the risk free asset is outside of the model since the risk free return is constant.

Table 14: Hand-to-Mouth Consumers: Return Shock

Country	Inc / Ed	Fraction of HtM'ers				Mean MPC of HtM'ers		
		low	middle	high	total	low	middle	high
Germany	low	0.022	0.049	0.010	0.140	0.449	0.308	0.175
	high	0.028	0.030	0.001		0.348	0.334	0.259
Spain	low	0.009	0.027	0.003	0.064	0.523	0.147	0.138
	high	0.016	0.009	0.000		0.248	0.252	0.194
France	low	0.007	0.006	0.000	0.022	0.225	0.132	0.120
	high	0.007	0.001	0.000		0.185	0.156	0.148
Italy	low	0.051	0.011	0.000	0.071	0.284	0.150	0.165
	high	0.007	0.002	0.000		0.321	0.261	0.151

This table reports the mean MPC of stock market participants who are hand-to-mouth consumers in response to a return shock that is 1% of the stock value.

analysis is partial in that other effects of the innovation, say on the tax burden that is reduced by a monetary expansion, are ignored.

Table 15: Aggregate Consumption Response to Monetary Policy (in %)

Country	Income Shocks	Return shocks	Total Response
Germany	0.070	0.075	0.113
Spain	0.171	0.214	0.293
France	0.092	0.770	0.525
Italy	0.072	0.216	0.215

This table reports the average consumption response in % by country induced by income and return shocks coming from a 100 basis points interest rate cut.

From (13), evaluating the impact of a policy requires two inputs. First is the response of income and stock returns to a monetary innovation. Second is the individual consumption response to a return or income shock. The individual response to a return shock will depend on whether the household participates in the stock market and the magnitude of stock holdings conditional on participation.

Our findings, summarized in Table 15 and Figure 4, are discussed in detail below. Table 15 reports the country specific consumption response to monetary policy through the income and return channels and combined.

Of course, beyond the average response there are distributional implications of policy interventions. The consumption of some households will be impacted much more than others. Clearly, those who do not participate in asset markets will not have their consumption influenced by the stock return channel. Figure 4 shows the distribution of MPCs by country for two policy experiments. The income channel pertains to all households while the MPC distribution for stock return shocks is only for participants. These distributional considerations will be brought out as we proceed.

Finally, the response summarized in (13) is static, representing the effects of the policy intervention at the time of its occurrence. There may be dynamic consequences that arise through the evolution of individual states and thus the cross-sectional distribution leading to changes in participation and adjustment status.

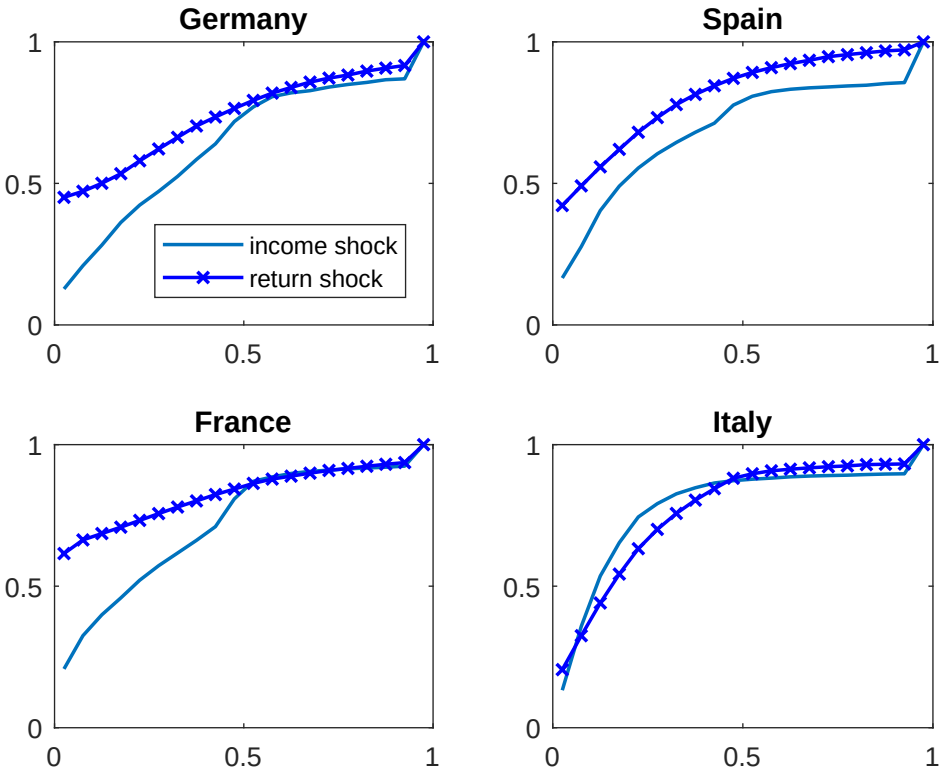


Figure 4: Distribution of MPC from Policy Induced Income and Return Shocks

7.1 Income

Evaluating the effects on consumption of monetary policy through the income channel requires two steps. First is the response of income to the monetary innovation. These are summarized in Table 16. These responses are based on Lenza and Slacalek (2018)[24] Second is the response of consumption to this change in income. Both of these are country specific so that the consumption responses to monetary policy through this channel vary by country.

The results are summarized by the first column of Table 15. The values are the percent changes in consumption from the income channel. So, for example, for Germany, the monetary innovation leads to 0.164% increase in income which implies the 0.072% increase in consumption.

Looking across countries, the largest response is in Spain. For this country, the response of income to the monetary innovation is higher than any other country, and is about three times that of Germany. Further, from Table 7, there are many high MPC households in Spain, particularly the low education, low permanent income group. Italy also has high MPC households but the income response is not as large.

There are distributional consequences of the income response. These are shown by education and permanent income group in Table 7 for the two income innovations. Here we see that the consumption response is largest for low education, low income households, particularly in Italy and Spain.

[24]In particular, we use the 4 quarters after impact response and combine the effect both on employment and wages.

Table 16: Monetary Policy Effect on Income

Country	Effect on Income
Germany	0.164
Spain	0.497
France	0.208
Italy	0.291

This table reports the income response by country for a 100 basis point monetary policy rate reduction. Numbers are taking from Lenza and Slacalek (2018) by combining the effect on wages and employment.

Figure 4 shows the MPC distribution by country for the income response due to monetary policy. So, in contrast to Table 7, this is the MPC distribution induced by the policy. In Italy, there are many households with an MPC below 20% compared to the other countries. France has a large fraction of households with an MPC around 50%. For all countries, there is a non-negligible number of households with a MPC of 1. This will not be the case for the stock return channel.

7.2 Returns

Our assessment of existing empirical evidence is that a 100 basis cut in the monetary policy rate leads to an increase in stock prices by 0.75%. [25] Feeding these into the household decision rules for stock market participants in each country leads to the average consumption response reported in Table 15. So, for Germany, the monetary policy leads to 0.75% increase in stock value which implies the 0.24% increase in consumption.

From Table 11, the MPC from return shocks is higher in Germany than other countries. This is reflected in Table 15, where the consumption response in Germany is higher than other countries.

As seen in Figure 4 a large fraction of households participating in asset markets have an MPC from the stock return between 0 and 0.1. Relatively few households have an MPC about 40%.

Further, one has to keep in mind that these tables and figures are conditional on household participation in asset markets. In each country, there is a large fraction of households not participating in asset markets. In France, for example, in the data nearly 60% of stock market participants have a low MPC and only about half the households are participants.

In fact, as seen in the right part of Table 17, our model overstates the average participation rate in each country. Consequently, it magnifies the response to a return shock.[26]

[25] We take this number as a result of the existing literature on the topic.The key references for the US, Bernanke and Kuttner (2005) and Rigobon and Sack (2004) find an impact elasticity of about 4 (a 25 basis points surprise cut leads to a 1% increase in stock prices). Martin T. Bohl and Sondermann (2008) find a comparable elasticity in Italy (MIB), but larger elasticities in DE, FR, ES and Eurostoxx (all in all, these prices increase between 1.4% and 2.3% after a 25 basis points surprise cut). Given estimation uncertainty, we use 1.5% as an approximate median value (i.e. an elasticity of 6). However, all these are daily estimates. In a separate paper, Gali and Gambetti (2015) report quarterly estimates for the US. For an 80bp shock, stock prices are only up by about 0.4% after one quarter and by roughly the same amount after one year. For a 25bps shock this would imply a reaction by 0.125%, i.e. 12.5% of the estimated impact by Bernanke and Kuttner (2005). We apply this ratio to the results from Martin T. Bohl and Sondermann (2008) and obtain a value of 0.75.

[26] As seen in Table 4, the estimated model produces a constant in the participation rate that exceeds that in the data for each country. This regression constant is not tightly estimated and thus receives relatively little weight in the estimation procedure.

Table 17: Consumption Response to a Monetary Shock

Country	Ed \ Inc	Monetary Policy Response: All Households			Monetary Policy Response: Participants			Participation Rate		
		low	middle	high	low	middle	high	low	middle	high
Germany	low	0.134	0.103	0.112	0.116	0.107	0.119	0.358	0.754	0.863
	high	0.107	0.106	0.132	0.109	0.114	0.136	0.587	0.899	0.964
Spain	low	0.472	0.207	0.217	0.243	0.193	0.217	0.245	0.871	0.993
	high	0.258	0.246	0.603	0.220	0.246	0.603	0.691	0.984	1.000
France	low	0.192	0.159	0.187	0.190	0.171	0.196	0.259	0.806	0.942
	high	0.232	0.596	3.206	0.240	0.599	3.206	0.637	0.983	0.999
Italy	low	0.411	0.111	0.119	0.291	0.111	0.119	0.648	0.997	1.000
	high	0.176	0.229	1.041	0.140	0.228	1.041	0.774	0.940	0.996

This table summarizes the consumption response in percentage from a monetary shock in the left block and participation rates in the right block.

7.3 Distributional Effects

An alternative perspective on the effects of monetary policy is to look at the total effect through both channels on particular groups in the population. A natural starting point is to partition households into groups based upon education and permanent income, along the lines of Tables 7 and 8.

Table 17 summarizes the effects of monetary policy on these households, combining the income and return channels. The left side of the table shows the responses for all households as well as asset market participants. This response is measured as a percent change in consumption. For reference, the right side shows the participation rate by group.

The largest responses, except for France, arise for the low education, low permanent income households. The change in consumption is over 0.4 percentage point in both Spain and Italy for this group.

Note that for France, there is a very large response by high income, high education households. The high consumption response comes from the large wealth accumulation of this group. The median wealth-income ratio is about 7.8, so an increase in stock return of 0.75% leads to a a large increase in total wealth, which results in a large consumption response.

The consumption response of the same group in Germany is much milder. The reason is income shocks are smaller in Germany so that (1) income inequality is smaller; (2) precautionary savings are smaller. As a result, the consumption response to stock return shocks is also smaller. Also note that β_1 is relatively small for German households, which also leads to less wealth accumulation of the high education group, hence smaller consumption responses.

As made clear in Tables 13 and 14, the HtM households have relatively high MPCs and thus respond more to these monetary policy innovations, particularly through the income channel. These are mainly low education and low and middle income types and thus captured by the appropriate blocks of Table 17. This concentration of HtM households is particularly apparent for Spain and Italy.

8 Conclusion

This paper studies household financial choices in four European countries. It does so in a life-cycle framework, emphasizing both participation in risky financial assets and adjustment choices. The model parameters are estimated by country using a simulated method of moments approach. The moments highlight the life-cycle patterns in financial choices.

The estimation uncovers the presence of asset market participation costs as well as portfolio adjustment costs. The estimated discount factors lie between an average of about 0.80 for low education households to between 0.85 and 0.88 for high education attainment households. These estimates are well below traditional calibrations.

The estimated model has implications for the distributions of marginal propensities to consume. Within a country these distributions are not degenerate due to household heterogeneity. Further, reflecting differences in estimated parameters across countries, the distributions of MPC are country specific.

The MPC distributions are studied for both transitory income and stock return shocks. Generally the MPC is higher for low income, low education households. There is no evidence of binding borrowing constraints. There is evidence of a relatively small fraction of so-called hand to mouth households with very large MPCs.

These distributions of MPC are used as an input for policy analysis. We characterize both the average and distributional implications of two channels of monetary policy: (i) the income channel and (ii) the stock return channel. The distributional dimension reflects both differences in responses by market participants and the different asset market participation rates by country. Overall, Germany has the largest response to monetary innovations through the return channel while Spain has the largest response through the effects of monetary innovations on income.

Our analysis identifies several population characteristics which are relevant for the transmission of monetary policy. This should help policy makers to evaluate ex-ante the potential effects of monetary policy decisions.

To be clear, these are the key channels of our model. Other influences of monetary innovation through, for example, spending by households and firms on durables are not yet considered.

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9 Appendix

9.1 Standard Errors of Data Moments

Table 18: Standard Errors of Data Moments

		con.	age	age^2	$college$ $(*age)$	$college$ $*age^2$
Germany	Part.	0.030	0.0012	0.00001	0.007	
	Share	0.003	0.0001	0.000001	0.001	
	W/I	0.211	0.0085	0.00008	0.004	0.00006
Spain	Part.	0.027	0.0011	0.00001	0.006	
	Share	0.004	0.0002	0.00000	0.001	
	W/I	0.459	0.0177	0.00016	0.007	0.00012
France	Part.	0.015	0.0006	0.00001	0.004	
	Share	0.001	0.0001	0.00000	0.000	
	W/I	0.124	0.0049	0.00004	0.003	0.00005
Italy	Part.	0.023	0.0008	0.00001	0.006	
	Share	0.005	0.0002	0.00000	0.001	
	W/I	0.336	0.0123	0.00010	0.007	0.00011

9.2 Local Identification

9.3 Non-linearity of MPC

Table 19: Elasticity of Moments to Parameter Values (Spain)

	Participation				Share				WI				
	con	age	age^2	college	con	age	age^2	college	con	age	age2	age*college	age^2*college
β_0	-39.390	-5.698	-5.942	-7.610	-43.582	-4.510	-1.065	-14.627	1.160	-3.02	-20.831	-2.361	-4.520
β_1	2.620	0.843	1.280	2.352	-10.140	-0.631	0.286	-3.401	-17.953	-4.537	-5.839	10.461	13.473
γ	-14.232	-2.021	-1.887	-1.669	-4.724	-1.350	-1.362	4.168	11.460	3.421	4.562	-0.156	0.043
Γ	-1.198	-0.456	-0.619	0.397	-1.339	-0.479	-0.541	-1.533	0.0001	-0.003	-0.006	-0.003	-0.002
F	-0.283	-0.097	-0.125	0.050	-0.922	-0.335	-0.384	-0.552	-0.115	-0.047	-0.068	-0.022	-0.018
L	-0.027	-0.008	-0.008	0.005	-1.504	-0.283	-0.286	0.496	6.855	2.034	3.160	-0.387	-0.383
ϕ	-0.014	0.000	0.000	0.003	-1.091	-0.223	-0.268	0.411	1.826	0.663	1.229	0.042	0.037
$\underline{c}$	-6.949	-2.285	-2.793	3.169	-12.124	-1.872	-1.675	-0.520	-6.430	-2.391	-2.848	-0.536	-0.155
θ	-3.525	-1.110	-1.370	1.047	-9.820	-1.824	-2.059	1.013	-0.310	0.612	3.819	-0.490	-0.358
$\underline{A^b}$	0.063	0.015	0.020	-0.002	0.054	0.014	0.013	0.028	0.034	0.007	0.005	-0.005	-0.003

This table reports the elasticity of moments with respect to parameters at the baseline estimations for Spain.

Table 20: The Nonlinearity of MPCs (Spain)

		All Households			Participants		
	Inc / Ed	low	middle	high	low	middle	high
baseline	low	0.647	0.213	0.139	0.272	0.174	0.142
	high	0.282	0.154	0.136	0.198	0.154	0.138
$\underline{c} = \phi = F = 0$	low	0.612	0.633	0.623	0.106	0.118	0.127
	high	0.585	0.587	0.601	0.091	0.096	0.102
$\underline{c} = \phi = F = 0$, and $\beta_0 = \beta_1$	low	0.592	0.599	0.609	0.090	0.090	0.114
	high	0.585	0.587	0.601	0.091	0.096	0.102

This table shows the MPCs for Spain under different assumptions. When setting the parameters that cause non-linearity to zeros, households in different income groups have very similar MPCs. If in addition, the discount factor of the low education group is set to the same level as the high education group, then MPCs are similar across differnt education groups.