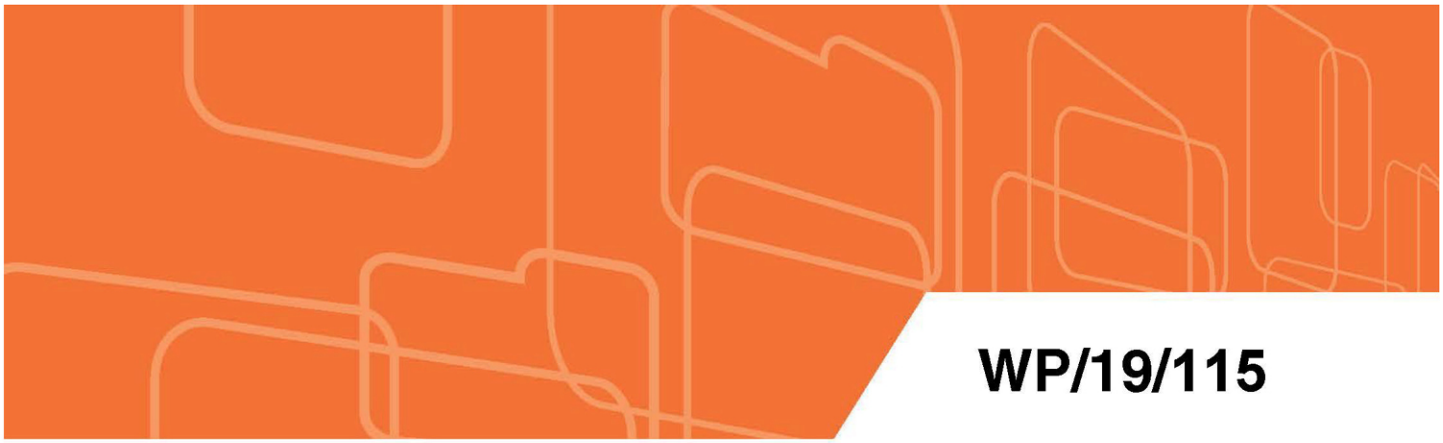

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IMF Working Paper

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by Carlos Caceres

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Western Hemisphere Department

Analyzing the Effects of Financial and Housing Wealth on Consumption using Micro Data

Prepared by Carlos Caceres[1]

Authorized for distribution by Nigel Chalk

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Abstract

This paper analyzes the existence of "wealth effects" derived from net equity (in the form of housing, financial assets, and total net worth) on consumption. The study uses longitudinal household-level data—from the Panel Study of Income Dynamics (PSID)—covering about 7,000-9,000 households in the U.S., with the estimations carried over the period 1999-2017. Overall, wealth effects are found to be relatively large and significant for housing wealth, but less so for other types of wealth, including stocks. Furthermore, the analysis shows how these estimated marginal propensities to consume (MPC) from wealth are closely linked to household characteristics, including income and demographic factors. Finally, underlying structural changes in household characteristics point to potentially lower aggregate MPCs from wealth going forward.

JEL Classification Numbers: housing and financial wealth; consumption; household surveys.

Keywords: D12, D14, D19, D31, D90, E21, J10, R20.

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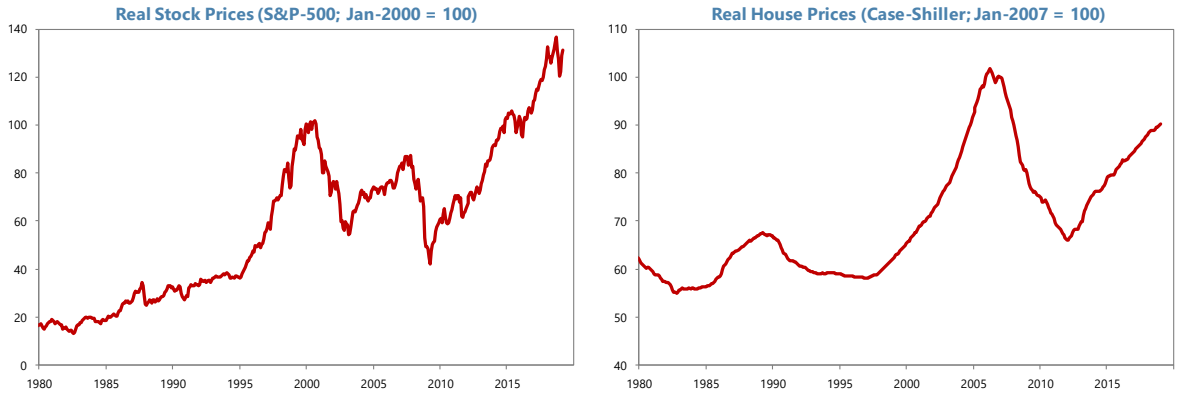
I. INTRODUCTION

Financial asset prices tend to experience significant swings. Stock prices were subject to two significant boom-bust episodes over the past quarter of a century, with the U.S. stock market losing about half of its value following the collapse of the "dot com bubble" and the global financial crisis of 2008-09. House prices are not immune to this phenomenon. Real house prices in the U.S. fell by over a third between 2006 and 2012 (see Figure 1).

Moreover, the refinancing trends in "boom years" preceding the global financial crisis, supported by low mortgage rates as well as innovations in financial and mortgage markets, enabled households to liquify their housing net equity in cheaper, faster ways. At the same time, consumption remains an important driver of growth, accounting for almost 70 percent of total output in the U.S., and an average 1.6 percent contribution to annual GDP growth over the last decade. With the recent large increases in stock and house prices, there has been a renewed widespread media attention and economic policy debate regarding the consumption effects of fluctuations in household financial and housing wealth. In other words, would a potential correction in asset prices have a significant impact on consumption?

Figure 1: Real Stock and House Prices in the U.S.



Sources: Bureau of Economic Analysis; Standard & Poor's; Thomson Reuters Datastream; and IMF staff calculations.

The existence of relationship between households' income and consumption has long been established in the economic literature, even if under different variants (see, for instance, the seminal works of Keynes, 1936; Modigliani and Brumberg, 1954; Hall, 1978; Engle and Granger, 1987; and Campbell and Mankiw, 1990; among many others). Nevertheless, an important question is whether beyond the effects of income (including expected income) on consumption, households also base their consumption decisions, in part, on the value of their net assets or wealth. That is, is there a positive and significant marginal propensity to consume (MPC) out of net wealth?

A well-developed literature in macro-finance has established an empirical link between aggregate consumption and wealth (e.g. Poterba and Samwick, 1995). A related literature has argued that shocks to different forms of wealth can elicit varying consumption responses,

with empirical results generally confirming this (e.g. Case *et al*, 2005; Benjamin *et al*, 2004). Much of the empirical evidence comes from time-series multivariate models (e.g. vector autoregressive models) that include aggregate consumption and measures of wealth, and often, other macroeconomic variables (e.g. aggregate income). Another strand of this literature uses theoretical-based models for measuring wealth effects on aggregate consumption. For instance, Carroll *et al* (2011) introduced a model with "habit formation" to estimate the short-term (next quarter) and long-term marginal propensity to consume out of housing and financial wealth. Overall, these papers rely on the use of macro-level data to establish a relationship between aggregate consumption and measures (or proxies) of housing and equity wealth.[2]

However, an important drawback in the literature using aggregate time series or macro-based approaches is that the nature and drivers of the relationship between consumption and wealth are difficult to interpret. For example, such analysis does not allow us to distinguish between direct causality versus common factors affecting both financial/housing wealth and consumption or to identify the determinants behind this relationship and how these have evolved over time.[3]

To overcome some of these issues, this paper relies on micro data—that is, individual or household-level data—which include an important cross-sectional dimension. This additional variation along another dimension of the data facilitates inference on the different determinants and alternative hypotheses behind the observed relationship between aggregate consumption and wealth. In this sense, granular data enables a richer characterization of the MPCs, by allowing these to be conditioned on key household characteristics (see e.g. Paiella, 2009). For instance, aggregate propensity to consume out of housing wealth estimated using macro data might hypothetically appear to be insignificant. However, such an estimation might mask a reality in which homeowning households increase their consumption following an increase in house prices, whereas households renting a home respond to the increase in house prices by saving more (either because rents are also likely to go up or to save more in order to buy a house in the future). These two effects then net out at the aggregate levelIn other words, MPCs out of wealth might depend not only on the type of wealth, but also on the characteristics of the household (e.g. income, type of asset holdings, socio-economic characteristics, demographics, etc).

[2] An application of macro-based analysis is also presented in this paper as an illustration, to set the scene for the micro-based empirical estimation.

[3] Certainly, time series estimations can be carried over different sub-periods or even using rolling windows. However, these estimations still rely on having a sufficiently long time series to conduct inference over temporal variation. Moreover, it is often difficult to attribute changes in the relationship (elasticities) between two or more variables to specific factors. For instance, estimated MPCs before and after the global financial crisis might be statistically different, but it would be difficult to differentiate the role played by, say, changing lending standards relative to changes in any other factor that can potentially affect consumers' behavior (e.g. preferences, demographics, other macroeconomic conditions, or other structural or regulatory changes). There are simply not enough degrees of freedom.

The empirical literature of wealth effects using micro-level data remains limited, mainly reflecting limited sources of data to explore this issue. Ideally, in order to determine the quantitative importance of wealth effects, the data should include a comprehensive measure of household consumption and detailed data on household balance sheets. Moreover, the data should be sampled at frequent intervals and over a sufficiently long period to explore any changes in MPCs over time (see Paiella, 2009, for a more detailed discussion). A few examples of studies using micro-level data include Paiella (2007) for Italy; Bover (2005) for Spain; Attanasio and Weber (1994), and Campbell and Cocco (2007) for the UK; and Parker (1999), Maki and Palumbo (2001), Juster *et al* (2006), and Bostic *et al* (2009) for the U.S. This literature finds a relatively wide range of MPC estimates. In the U.S., an additional dollar in housing wealth would translate into an increase in consumption ranging from 1 cent to 15 cents. Similarly, estimates for total wealth MPCs are concentrated in the 3-5 cent range.

The main objective of this paper is to assess and quantify the existence of an MPC out of household wealth. For this purpose, the estimation uses household-level survey data, covering over 7,000 U.S. households over the period from 1999 to 2017. The paper also analyzes whether different forms of wealth—particularly housing wealth and wealth in the form of financial assets—have different MPCs. Finally, the paper quantifies some of the main determinants behind these MPCs.

This paper is organized as follows: Section II presents the main data used, as well as the empirical strategy to estimate the MPCs. Section III describes results obtained using macro data; whereas Section IV presents and discusses the main the estimation results from the micro-based evidence analysis. Section V concludes.

II. Data and Empirical Methodology

This section is divided in two sub-sections. The first one describes the household-level data which is the workhorse of this paper for the estimation of micro-based MPCs. The second one presents the empirical strategy used to estimate these MPCs.

A. Household-level Survey Data

The estimation of the MPCs at the household level relies on the use of longitudinal survey data from the Panel Study of Income Dynamics (PSID), maintained by the Institute for Social Research at the University of Michigan. Our data sample derived from the PSID includes approximately 7,000-9,000 households, depending on the year, across all U.S. states. The sample period goes from 1999 to 2017, every other year.[4]

The PSID database includes a large number of socio-economic and demographic characteristics of U.S. households. In particular, it includes details on households' income as well as their assets and liabilities. In addition, it contains details of households' various consumption and spending items. This enables a fairly detailed characterization of household

[4] The PSID has data going back to the late 1960s, but specific modules—in this case the detailed household expenditure module—are only available for later years.

flows and balance sheets. Moreover, for every household, the PSID collects a large number of demographic characteristics for the head of the household—including age, gender, marital status, birth place, ancestry details, ethnicity, among others—as well as for other family members.

Measures of household income and wealth, as well as measures of household spending, are key to the analysis. All nominal values are converted to 2017 real dollars using the personal consumption expenditure (PCE) price index.[5] Table 1 presents some descriptive statistics for selected variables of wealth, income, and consumption. These variables all appear to be positively—and significantly—correlated with each other.

Table 1: Measures of Household Wealth, Income, and Consumption

Panel A: Descriptive statistics of selected variables

Variable	Number of obs.	Average	St. deviation	Minimum	Maximum
			(in 2017 U.S. dollars)		
Net nonfinancial wealth	83,831	165,190	974,819	-882,048	113,000,000
Net housing wealth	83,831	72,424	170,124	-1,261,683	8,431,338
Financial wealth	83,831	101,021	598,028	-3,898	55,800,000
Stock holdings	83,831	36,701	478,819	-10,286	53,200,000
Net total wealth	83,831	249,667	1,210,201	-3,132,147	113,000,000
Net wealth, excluding housing	83,831	177,243	1,135,826	-3,352,558	113,000,000
Total household income	83,771	74,191	104,792	0	7,121,339
Total household consumption	83,649	42,789	34,236	0	2,019,594

Panel B: Cross-correlations of selected variables

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Net nonfinancial wealth	**(1)**	1						
Net housing wealth	**(2)**	0.412 ***	1					
Financial wealth	**(3)**	0.163 ***	0.333 ***	1				
Stock holdings	**(4)**	0.107 ***	0.225 ***	0.914 ***	1			
Net total wealth	**(5)**	0.868 ***	0.494 ***	0.624 ***	0.5375 ***	1		
Total household income	**(6)**	0.273 ***	0.402 ***	0.276 ***	0.180 ***	0.3474 ***	1	
Total household consumption	**(7)**	0.224 ***	0.397 ***	0.202 ***	0.123 ***	0.271 ***	0.540 ***	1

Notes: *** denotes statistical significance at the 1 percent level. Negative income values were converted to zeros.
Sources: PSID; and IMF staff calculations.

[5] Deflating all nominal series using the Consumer Price Index (CPI) leaves all estimation results virtually unchanged.

Income, consumption, wealth, and most other variables in the PSID are 'reported' measures—i.e. their values are based on households' estimates of their own income, consumption, wealth, etc. There is a possibility that households would under or over-report (even if inadvertently) some of these items. Nevertheless, it is in fact the effect from changes in perceived household wealth that the study is aiming to capture, as households would not respond to actual changes in wealth unless they are aware (or believe) that such changes occurred.

In the PSID, different variables related to a similar concept (e.g. consumption expenditure) tend to be bundled together in a given module. For instance, the module for household wealth includes several measures of gross wealth, namely: *(i)* housing wealth (primary home); *(ii)* any other real estate assets; *(iii)* farm or private business; *(iv)* motor vehicles (including trucks, a motor home, a trailer, or a boat); *(v)* checking or savings account, money market funds, certificates of deposit, government bonds and T-bills; *(vi)* stock in publicly-held corporations, stock mutual funds, or investment trusts (excluding IRAs); *(vii)* other savings such as cash value in a life insurance policy, a valuable collection for investment purposes, or rights in a trust or estate; and *(viii)* value of Individual Retirement Accounts (IRAs). The first four wealth items relate to nonfinancial wealth, and the last four wealth items are defined as financial wealth. Total net wealth is the aggregation of these eight wealth types minus total household debt, whereas net housing wealth is the home value minus any outstanding mortgage debt.

Household consumption expenditure includes: *(i)* food expenditure (both at home and away); *(ii)* housing-related expenditure (including rent, mortgage payments, property tax, insurance, utilities and internet charges, home repairs, and home furnishings); *(iii)* transportation expenditure (including vehicle loan and lease payments, insurance, repairs, gasoline, parking, bus and train fares, taxicabs, and other transportation costs); *(iv)* education expenditure; *(v)* childcare expenditure; *(vi)* healthcare expenditure (including hospital and nursing home, doctor visits, prescriptions, in-home medical care, and special facilities expenditures); *(vii)* clothing expenditure; and *(viii)* vacation (including transportation and accommodation) and other recreation expenditures.[6]

B. Empirical Analysis

Micro-based estimation

The estimation of the MPCs at the household level is carried out using standard regression analysis. The core estimation model can be expressed algebraically as follows:

$$C_{i,t} = \alpha + \rho\, I_{i,t} + \beta\, W_{i,t} + \boldsymbol{\gamma}\, \boldsymbol{Z}_{i,t} + \epsilon_{i,t} \qquad (1)$$

where $C_{i,t}$ is the consumption of household i in period t, $I_{i,t}$ denotes total household income (including taxable income and social transfers), $W_{i,t}$ is a measure of wealth, $\boldsymbol{Z}_{i,t}$ is a vector of controls (which can include dummies and time fixed effects), α, ρ, β, and $\boldsymbol{\gamma}$ are parameters

[6] Items *(vii)* and *(viii)* were included in the PSID after 2003.

to be estimated, and $\epsilon_{i,t}$ is an error term. In particular, the parameter β denotes the MPC out of wealth type W, and is thus the main parameter of interest in the regression analysis.

In the above regression model, the parameter β is assumed to be constant, and not directly linked to household characteristics (although $\boldsymbol{Z}_{i,t}$ can include household-specific variables). However, one of the main objectives of using micro-data is to analyze the determinants of MPCs using household-level variation and characteristics. Therefore, in a second stage, the parameter β is allowed to be function of household characteristics: $\beta = \beta_{i,t} = \Phi(\boldsymbol{H}_{i,t})$, where $\boldsymbol{H}_{i,t}$ is a vector of household characteristics, such as income, demographics, and socio-economic conditions. In most cases, the relationship between the MPC parameter β and household characteristics $\boldsymbol{H}_{i,t}$ is established by including interaction terms in the regression.

An important point to note is that most of these household characteristics tend to exhibit a relatively high persistence across time for a given household. In fact, some of these characteristics—such as gender or race—are pure "fixed effects", in the sense that they do not vary across time. But even other characteristics, such as income, education, or residency, tend to exhibit a high correlation across time for a given household, and thus would correlate significantly with a cross-section fixed effect. Given that determining the role of household characteristics on MPCs is a key part of the analysis, the core estimations omit the fixed-effect term, to minimize the potential multi-collinearity with the various household characteristics. However, a caveat related to this modeling choice is that fixed-effect terms could also capture differences in preferences, unobserved credit differences, differences in exposure to labor market risk, or any other factor imperfectly correlated with the observable variables included in the regression analysis.

Another important methodological aspect is that MPCs are estimated based on a combination of cross-sectional and time-series variation. In particular, the analysis of the changes in MPCs across time (Section IV.A) rely purely on cross-sectional variation between households and—by design—it assumes that, conditional on the controls included in the regression, changing wealth would lead households to change their consumption in the same manner. In the literature, estimation of MPCs usually rely mainly on time-series variation, though other studies (see e.g. Bostic *et al*, 2009) also rely on cross-sectional variation. In any case, the cross-sectional dimension in the PSID, which comprise of households and not of single individuals, should be seen as fluid entities, whose composition can change through time. For instance, a household in the PSID could comprise a single person in one period (i.e. the household head), that then gets married the following period, and the resulting couple then have children in subsequent periods. Thus, changes in consumption patterns of that household are not necessarily only linked to changes in the preferences of the household head (or any of its members) but can be due to changes in household composition and other household characteristics. Hence, the importance of defining the household in terms of its characteristics rather than a fixed cross-sectional unit.

Macro-based estimation

To complement the household-level estimations, this study also includes the estimation of MPCs using aggregate time series of real private consumption (from national accounts), as well as the time series of real stock and house price indices.

For this purpose, a standard vector autoregressive (VAR) model is used. Algebraically, the model can be expressed as:

$$\Delta \boldsymbol{X}_t = \boldsymbol{B}_0 + \sum_{i=1}^{L} \boldsymbol{B}_i \, \Delta \boldsymbol{X}_{t-i} + \boldsymbol{\epsilon}_t \qquad (2)$$

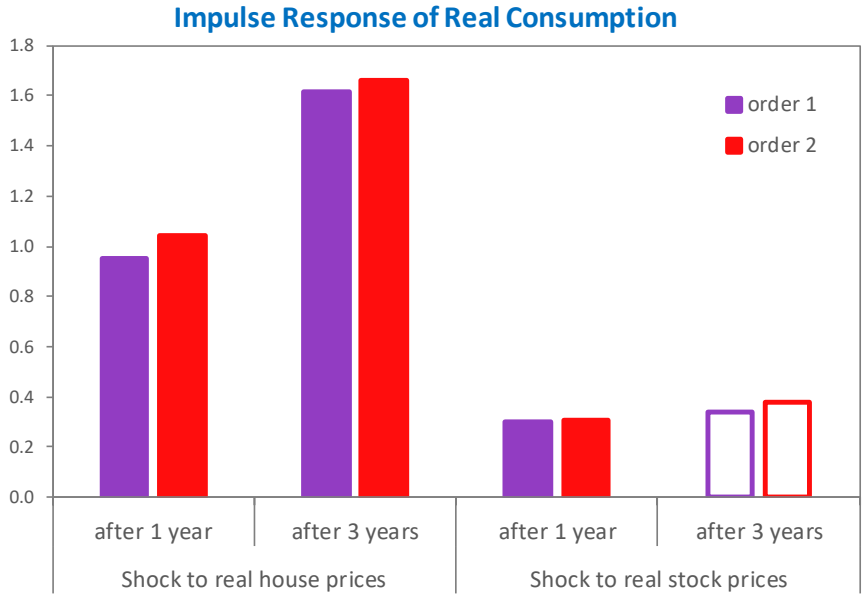
where $\boldsymbol{X}_t$ is a vector containing the real series of private consumption, the S&P-500 stock price index, the Case-Shiller house price index, and aggregate household disposable income, at time t. $\boldsymbol{B}_0$ and the $\boldsymbol{B}_i$'s are matrices of parameters to be estimated, and $\boldsymbol{\epsilon}_t$ is an error term assumed to be a martingale difference sequence with respect to the natural filtration $\mathcal{F}_t$ with bounded second moment.
Then, based on the estimation results from the model described in equation (2), the impulse response function of real consumption to stock price and house price shocks are used to determine the sensitivity of aggregate consumption to these variables.

III. MACRO-BASED EVIDENCE

Figure 2 presents the resulting impulse response of real consumption to a 10 percent shock to house prices and stock prices, respectively, estimated over the period 1999-2017 at a quarterly frequency. These impulse responses show that a shock to house prices tend to have a larger effect on consumption than a commensurate shock to stock prices. Moreover, the house price shock appears to be longer-lasting, with the overall consumption response increasing between the first and the third year after the initial shock. In fact, in the case of a stock price shock, the response of real consumption is statistically significant four quarters after the initial shock, but it is no longer significant (based on the 5 percent confidence bands) after 3 years.

Overall, evidence using aggregate time series data suggests that changes in house prices, and thus in housing wealth, tend to play an important role in explaining changes in aggregate consumption. This is not the case regarding stock prices, which appear to have only a small and temporary effect on aggregate consumption. To shed more light on these relationships, the study turns to micro data in the next section and presents the estimation results of MPCs based on household-level data.

Figure 2: Response of Consumption to Stock and House Price Shocks



Notes: Bars represent the impulse response function of real private consumption to shocks that raises real house prices and real stock prices by 10 percent after one and three years, respectively. Filled bars denote that the lower and upper 5-percent confidence bands of the response function are both positive. Cholesky decomposition method is used, showing two different orderings: the shock variable ordered just before private consumption, but 'less exogenous' than the other two variables (order 1), and the shock variable ordered as the 'most exogenous' of the four variables included in the model (order 2). In all specifications, income, house prices, and equity prices are allowed to impact consumption both through lags and simultaneously.

Source: IMF staff calculations.

IV. Micro-Based Evidence: Main Results

A. Estimated MPCs

This section presents and discusses the results of the MPCs estimated using household-level survey data. These estimations are based on the model described in equation (1), where the effects of different types of wealth on consumption are assessed. Table 2 shows the resulting MPC estimates, controlling for household income.

Net housing wealth, which is the gross value of any primary home minus any mortgage debt related to that property, is found to have a relatively large and statistically significant—at the 1 percent level—MPC associated to it. Indeed, these results suggest that every additional dollar in housing wealth would lead to an increase in household consumption of about 4

cents.[7] An important channel appears to be the increase in consumption derived from home-related debt. Indeed, the MPC out of gross housing wealth is larger than its net counterpart, suggesting that households would 'liquify' a portion (but not necessarily all) of the increase in gross home wealth, resulting in higher home-related debt and higher consumption, and still potentially higher net wealth.

Other forms of wealth, including aggregated nonfinancial wealth (physical assets including housing) and financial wealth (bank accounts, stock holdings, fixed income holdings, and other financial investments, including IRAs), are also found to have a much lower MPC relative to that of housing wealth. Although these are all found to have a statistically significant MPC, their values are relatively small, corresponding to a fraction of a cent of additional consumption as a result of a 1-dollar increase in wealth. The same applies to total net wealth, as well as net wealth excluding housing. In the case of wealth in the form of stock holdings, the corresponding MPC is fairly small and not statistically significant.

These results are robust to the inclusion of additional controls, other than household income, in the core regression model. Controlling for household income is crucial, as there is a strong positive correlation between income (flows) and net wealth (stocks), given that households with larger earnings tend to exhibit higher asset values (e.g. more expensive houses, cars, and larger financial investments). Household reported income mainly comprises of taxable income (including labor income and investment rents) and official transfers. Moreover, there is a very strong relationship between income and consumption. The average household consumption spending is about two thirds of total household income, with lower-income households consuming more than their overall reported income (Figure 3).[8] Thus, failing to include household income in the regression could lead to significant bias in the estimated MPCs. Tables A1 to A3 present several robustness checks, including using a number of household-specific characteristics usually found in the literature as additional controls.

[7] This estimate falls within the range of housing MPCs found in the literature. See, for instance, Bostic *et al* (2009), Cooper (2013), Mian *et al* (2013), and Aladangady (2017).

[8] An important caveat is that the PSID only includes details on pre-tax income. In reality, effective tax rates would be different across income brackets. However, as most of these estimations rely on splitting households across income percentiles, their pre-tax and after-tax ranking within the income distribution is likely to be virtually the same.

Table 2: Estimated MPCs for Selected Types of Wealth

	Core estimation model											
	Estimation period: 1999-2017											
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Total family income	0.176***	0.148***	0.108***	0.118***	0.169***	0.163***	0.171***	0.175***	0.166***	0.159***	0.169***	0.169***
	(0.014)	(0.014)	(0.011)	(0.011)	(0.014)	(0.014)	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)	(0.015)
Net home equity		0.043***										
		(0.003)										
Gross home assets			0.062***									
			(0.003)									
Gross home-related debt				0.131***								
				(0.004)								
Net nonfinancial assets					0.003***							
					(0.001)							
Gross nonfinancial assets						0.004***						
						(0.001)						
Financial assets							0.003**					
							(0.001)					
Stock holdings								0.002				
								(0.002)				
Total net wealth									0.003***			
									(0.001)			
Total gross wealth										0.004***		
										(0.001)		
Net wealth, excluding home equity											0.002***	
											(0.001)	
Gross wealth, excluding home equity												0.002***
												(0.001)
Constant	29,685.983***	28,648.125***	26,827.835***	26,503.581***	29,753.208***	29,813.267***	29,737.687***	29,733.287***	29,814.752***	29,873.472***	29,834.173***	29,822.326***
	(1,019.502)	(805.258)	(571.868)	(629.276)	(981.617)	(952.334)	(1,003.387)	(1,021.826)	(975.448)	(940.376)	(1,003.373)	(997.347)
											0.002***	
Observations	83,589	83,589	82,028	81,247	83,589	82,028	83,589	83,589	83,589	82,028	83,589	83,589
R-squared	0.292	0.330	0.412	0.430	0.298	0.304	0.295	0.292	0.300	0.306	0.296	0.296

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff calculations.

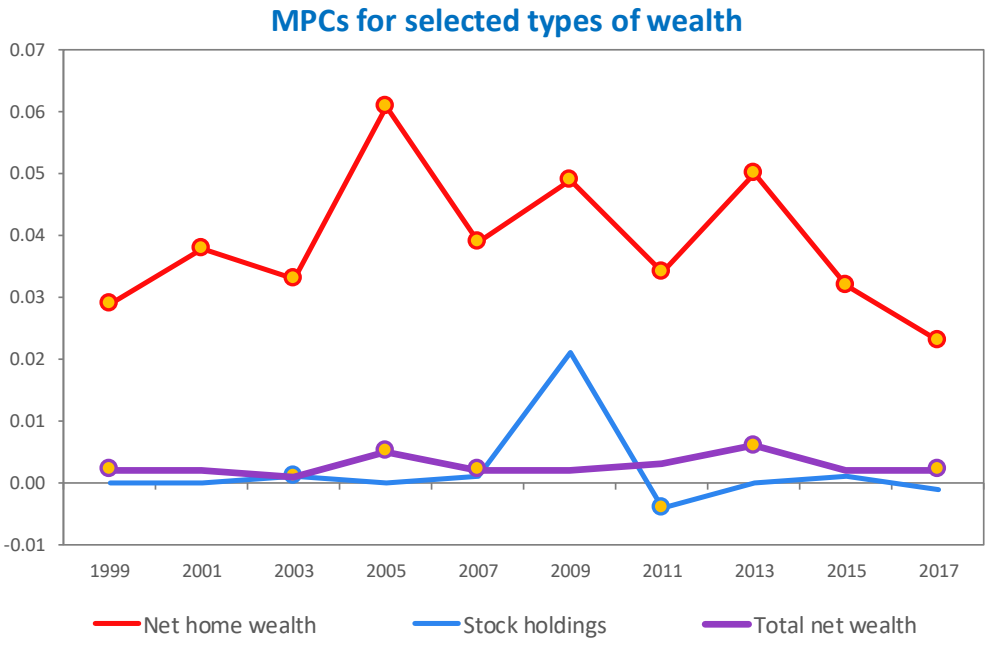
MPCs over time and across states

Another interesting issue is regarding the evolution of these MPCs over time. An important advantage of using longitudinal household-level data is that it enables the estimation of these average MPCs at every period when the PSID survey was conducted.

Figure 4 shows the evolution of the MPCs for housing wealth and stock holdings, as well as that of total net wealth. These estimations confirm the results presented in Table 2, that is, the MPCs for housing wealth are statistically significant and noticeably larger than the MPCs related to other forms of wealth. In particular, MPCs for stock holdings are found to be close to zero and are not statistically significant for most periods. In the case of MPCs for housing wealth, these appear to have increased around the turn of the century and through the early 2000s, but—despite some volatility—have been following a broad downward trend over the past 12 years or so. This is an aspect of these MPCs that will be further analyzed once the effects of household characteristics on MPCs are taken into account.

In addition, the PSID also includes details of households' current location. Therefore, the study also estimates these MPCs for each U.S. state.[9] Figure 5 shows the corresponding results for the state-level MPCs out of net housing wealth, stock holdings, and total net wealth.

Figure 4: Changes in MPCs Across Time



Notes: markers denote statistically significant MPCs at the 10 percent level.
Source: IMF staff calculations.

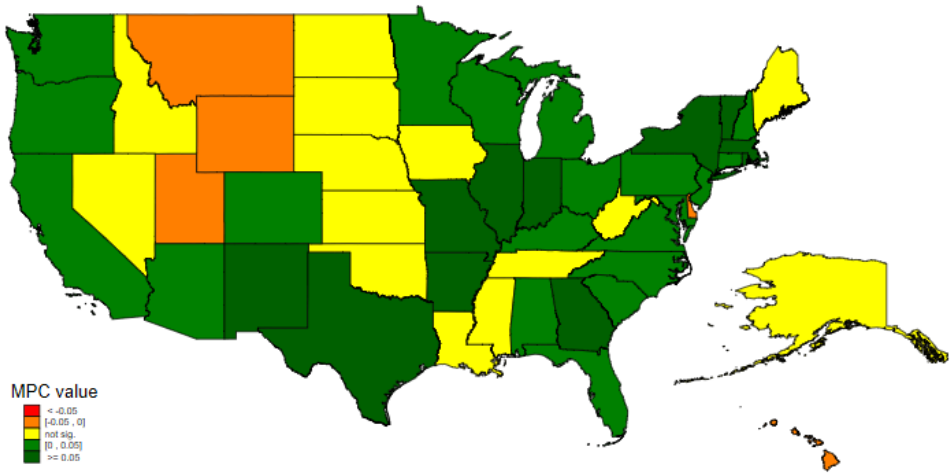
[9] The sample includes the 50 U.S. states in addition to the District of Columbia (DC).

Housing wealth MPCs appear to be significant in several states, including those located around both coastal areas (and particularly in states such as Georgia, Massachusetts, New York, and Vermont on the East Coast) as well as southern states such as Arkansas, New Mexico, and Texas. As expected, estimated MPCs for stock holdings are not found to be statistically significant for most states. These MPCs are positive and significant only in a few states on the North-Eastern Coast and a few southern states (Arizona, New Mexico, Texas). Moreover, the magnitude of the estimated MPCs is relatively large—i.e. exceeding 5 cents in increased consumption out of every dollar of additional stocks wealth—only in two states (Vermont and Wyoming). A similar picture is obtained in the case of total net wealth. Overall, based on the estimated MPCs, these results also suggest that housing wealth is relatively more important than other forms of wealth for consumption.

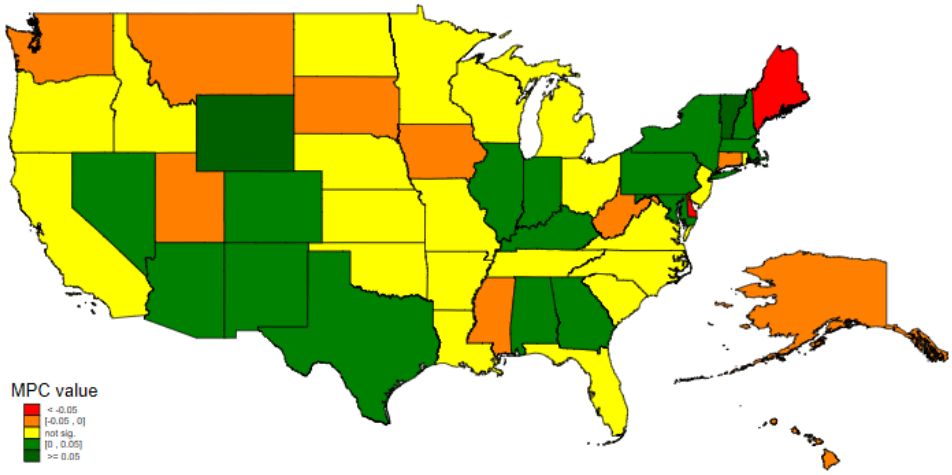
An important remaining question is thus, what determines the evolution of these MPCs both over time and across states? In fact, households across state lines tend to have different socio-economic and demographic characteristics, which can—in part—explain the observed differences in MPCs. Moreover, these household characteristics can also evolve over time. Indeed, the relationship between MPCs and household-specific characteristics is the main focus of the next sub-section.

Figure 5: Estimated MPCs Across U.S. States

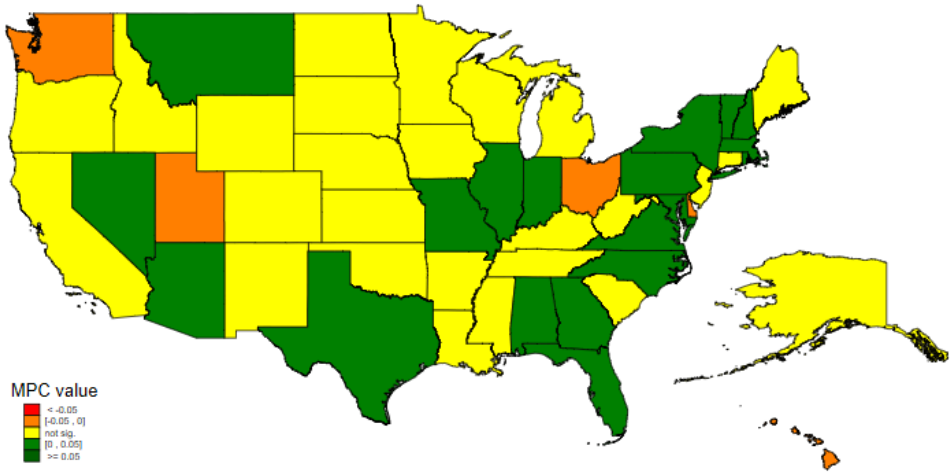
Panel A: MPC for net housing wealth



Panel B: MPC for stock holdings



Panel C: MPC for total net wealth



Source: IMF staff calculations.

B. The Role of Household Characteristics

Thus far, MPCs for each type of wealth were only allowed to vary across U.S. states and over time. However, one could envisage that MPCs tend to vary from household to household, based on a set of key household characteristics. Therefore, this section explores the role of several household characteristics in determining the magnitude of the estimated MPCs. In other words, the MPCs are modeled as a function of household-specific characteristics. In particular, the effects of demographic and socio-economic (including income distribution) are analyzed in more detail.

Table 3 exhibits the estimated MPCs for net housing wealth, stock holding, and total net wealth (including and excluding net housing wealth), as a function of key household characteristics. These results are derived by modifying equation (1) to allow for the interaction of different types of wealth with 'dummy' variables for different household groups, split along certain household characteristics (e.g. home ownership, age groups, employment status, etc). Algebraically, this can be written as:

$$C_{i,t} = \sum_g \alpha_g \, d_g + \rho \, I_{i,t} + \sum_g \beta_g \, d_g \, W_{i,t} + \boldsymbol{\gamma} \, \boldsymbol{Z}_{i,t} + \epsilon_{i,t} \qquad (3)$$

where d_g is the 'dummy' variable for a given household group g, with $\sum_g d_g = 1$.

These results confirm, once again, that the MPC for housing wealth is significantly larger than that of other forms of wealth, even accounting for household-specific characteristics. In fact, the MPC for holdings of stocks is not found to be statistically significant across almost all household characteristics.

Focusing on the MPC related to housing wealth, where most of the action seems to take place, provides some interesting insights (Figure 6). First, as expected, housing wealth effects only act through those that own a home, and thus do not have any impact on those renting a home.[10] Second, younger individuals tend to have a significantly larger MPC compared to older cohorts. For instance, those aged 25-44 years would tend to increase their consumption by almost 8 cents for every additional dollar of net housing wealth, compared to less than 4 cents for those aged 65 years or older.[11] Third, those currently working have a larger MPC than those not working (including those retired, unemployed, students, or disabled). Other socio-economic characteristics also seem to matter. For instance, those that did not attend college tend to have a higher MPC compared to those that did; married individuals tend to have a higher MPC (and higher average consumption levels) than those currently not married; and those reporting higher life satisfaction have a higher MPC than those reporting less satisfaction in life; etc.

[10] This is also found in, for instance, Aladangady (2017).

[11] Note, however, that the average level of consumption spending is a concave function of age (see Figure 6, Panel B). This is in line with most findings in the literature and, in addition, it relates to the fact that income is also a concave function of age.

Table 3: Estimated MPCs Based on Selected Household Characteristics

Panel A: MPC for net housing wealth

	Estimation period: 1999-2017												
		Home ownership		Age group				Employment status		Education		Marital status	
VARIABLES	core model (1)	yes (2)	no (3)	25-44 (5)	45-54 (6)	55-64 (7)	> 65 (8)	working (9)	not working (10)	college (11)	no college (12)	married (13)	not married (14)
Total family income	0.148***	0.141***	0.141***	0.137***	0.137***	0.137***	0.137***	0.133***	0.133***	0.142***	0.142***	0.130***	0.130***
	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.012)	(0.012)
Net home equity	0.043***	0.033***	0.002	0.075***	0.058***	0.042***	0.039***	0.053***	0.037***	0.040***	0.052***	0.039***	0.035***
	(0.003)	(0.003)	(0.023)	(0.007)	(0.005)	(0.005)	(0.004)	(0.004)	(0.002)	(0.003)	(0.005)	(0.003)	(0.003)
Constant of group	28,648.125***	34,582.105***	23,993.359***	30,793.913***	32,001.316***	29,537.772***	19,737.295***	32,895.317***	21,148.469***	33,132.293***	24,451.421***	38,093.019***	23,262.204***
	(805.258)	(1,022.534)	(568.073)	(797.502)	(963.335)	(1,013.999)	(747.095)	(894.847)	(452.935)	(990.609)	(612.005)	(1,063.396)	(498.771)
Observations	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589
R-squared	0.330	0.746	0.746	0.748	0.748	0.748	0.748	0.750	0.750	0.744	0.744	0.756	0.756

Panel B: MPC for stock holdings

	Estimation period: 1999-2017												
		Stock Holdings		Age group				Employment status		Education		Marital status	
VARIABLES	core model (1)	yes (2)	no (3)	25-44 (5)	45-54 (6)	55-64 (7)	> 65 (8)	working (9)	not working (10)	college (11)	no college (12)	married (13)	not married (14)
Total family income	0.175***	0.166***	0.166***	0.168***	0.168***	0.168***	0.168***	0.165***	0.165***	0.166***	0.166***	0.151***	0.151***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)
Stock holdings	0.002	0.001	0.004	0.027	0.000	0.000	0.004**	0.002	0.003**	0.000	0.038**	0.002	0.008***
	(0.002)	(0.001)	(0.010)	(0.020)	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.019)	(0.002)	(0.003)
Constant of group	29,733.287***	39,102.476***	28,780.677***	30,986.440***	34,273.353***	32,048.935***	23,441.157***	33,636.689***	22,616.483***	34,615.474***	25,267.841***	40,060.699***	23,489.331***
	(1,021.826)	(1,821.804)	(881.892)	(1,010.720)	(1,298.692)	(1,236.411)	(846.547)	(1,164.846)	(617.358)	(1,270.486)	(753.634)	(1,350.735)	(581.693)
Observations	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589
R-squared	0.292	0.728	0.728	0.732	0.732	0.732	0.732	0.732	0.732	0.734	0.734	0.744	0.744

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Constant of group is the estimated coefficient for the 'dummy' variable (without interaction) corresponding to a particular group. It can be interpreted as the average level of consumption spending for that particular group.

Source: IMF staff calculations.

Table 3: Estimated MPCs Based on Selected Household Characteristics (Cont'd)

Panel C: MPC for total net wealth

	Estimation period: 1999-2017												
		Stock Holdings		Age group				Employment status		Education		Marital status	
	core model	yes	no	25-44	45-54	55-64	> 65	working	not working	college	no college	married	not married
VARIABLES	(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Total family income	0.166***	0.159***	0.159***	0.159***	0.159***	0.159***	0.159***	0.155***	0.155***	0.158***	0.158***	0.143***	0.143***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)	(0.015)	(0.015)	(0.013)	(0.013)
Total net wealth	0.003***	0.001**	0.004**	0.007***	0.003***	0.002**	0.003**	0.003***	0.003**	0.003***	0.003*	0.002***	0.005***
	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant of group	29,814.752***	39,068.209***	28,658.902***	31,188.699***	34,349.750***	32,059.139***	22,650.768***	33,886.989***	22,504.870***	34,492.941***	25,745.506***	40,117.950***	23,463.058***
	(975.448)	(1,709.747)	(870.429)	(998.830)	(1,206.927)	(1,165.139)	(961.403)	(1,107.619)	(626.271)	(1,179.192)	(752.656)	(1,271.740)	(568.768)
Observations	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589
R-squared	0.300	0.731	0.731	0.733	0.733	0.733	0.733	0.735	0.735	0.733	0.733	0.747	0.747

Panel D: MPC for net wealth, excluding home equity

	Estimation period: 1999-2017												
		Stock Holdings		Age group				Employment status		Education		Marital status	
	core model	yes	no	25-44	45-54	55-64	> 65	working	not working	college	no college	married	not married
VARIABLES	(1)	(2)	(3)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Total family income	0.169***	0.162***	0.162***	0.163***	0.163***	0.163***	0.163***	0.159***	0.159***	0.161***	0.161***	0.146***	0.146***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)	(0.015)	(0.015)	(0.013)	(0.013)
Net wealth, excluding home equity	0.002***	0.001	0.003**	0.006**	0.002*	0.001*	0.003**	0.002***	0.002**	0.002***	0.002	0.002***	0.004***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant of group	29,834.173***	39,148.335***	28,780.783***	31,192.528***	34,365.524***	32,003.629***	23,035.429***	33,832.097***	22,626.773***	34,552.537***	25,709.267***	40,166.239***	23,539.925***
	(1,003.373)	(1,750.536)	(882.613)	(1,013.868)	(1,247.258)	(1,191.531)	(886.493)	(1,140.214)	(618.290)	(1,221.592)	(750.805)	(1,311.256)	(575.052)
Observations	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589	83,589
R-squared	0.296	0.729	0.729	0.731	0.731	0.731	0.731	0.734	0.734	0.731	0.731	0.746	0.746

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Constant of group is the estimated coefficient for the 'dummy' variable (without interaction) corresponding to a particular group. It can be interpreted as the average level of consumption spending for that particular group.

Source: IMF staff calculations.

In addition to demographic characteristics, income distribution is also likely to play an important role in determining the magnitudes of MPCs. To assess this, an interaction term between household income and housing wealth is introduced in the regression framework represented by equation (1). Table 4 suggests that the estimated housing MPC falls as household income raises, which is a result often found in the literature. In other words, it seems that lower-income households tend to have a higher MPC out of housing wealth compared to higher income households.

Table 4: MPC for Net Housing Wealth as a Function of Household Income

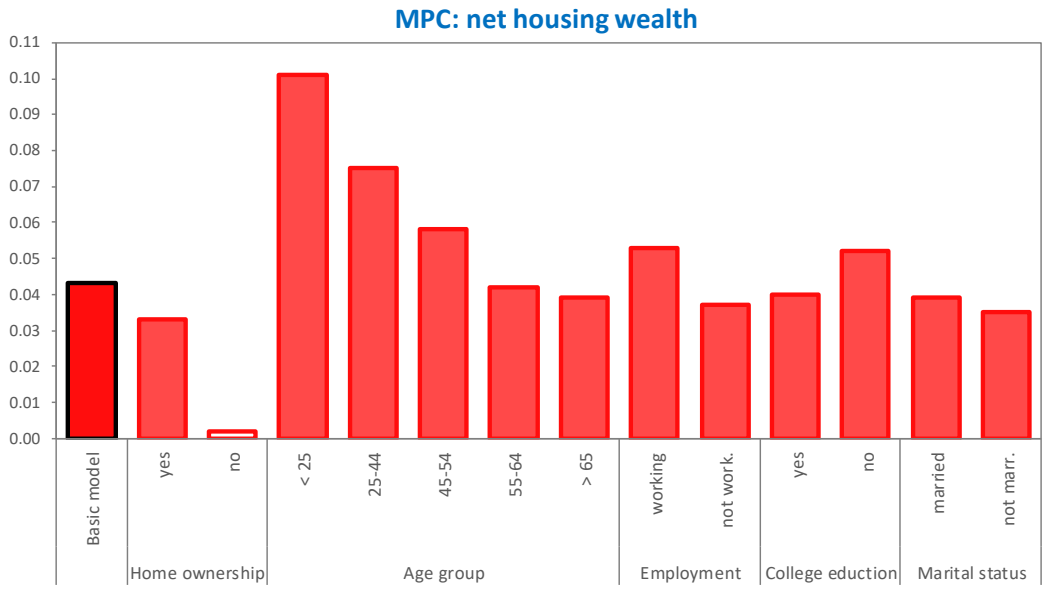
	Estimation period: 1999-2017			
VARIABLES	entire sample (1)	entire sample (2)	entire sample (3)	truncated sample (4)
Total family income	0.176***	0.148***	0.165***	0.329***
	(0.014)	(0.014)	(0.014)	(0.003)
Net home equity		0.043***	0.053***	0.036***
		(0.003)	(0.004)	(0.002)
Total family income x net home equity			-2.75E-08***	-1.08E-07***
			(0.000)	(0.000)
Constant	29,685.983***	28,648.125***	27,061.551***	17,825.111***
	(1,019.502)	(805.258)	(799.523)	(167.909)
Observations	83,589	83,589	83,589	81,923
R-squared	0.292	0.330	0.340	0.389

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. "truncated sample" excludes the lowest and highest 1 percentiles of the income distribution.
Sources: PSID; and IMF staff calculations.

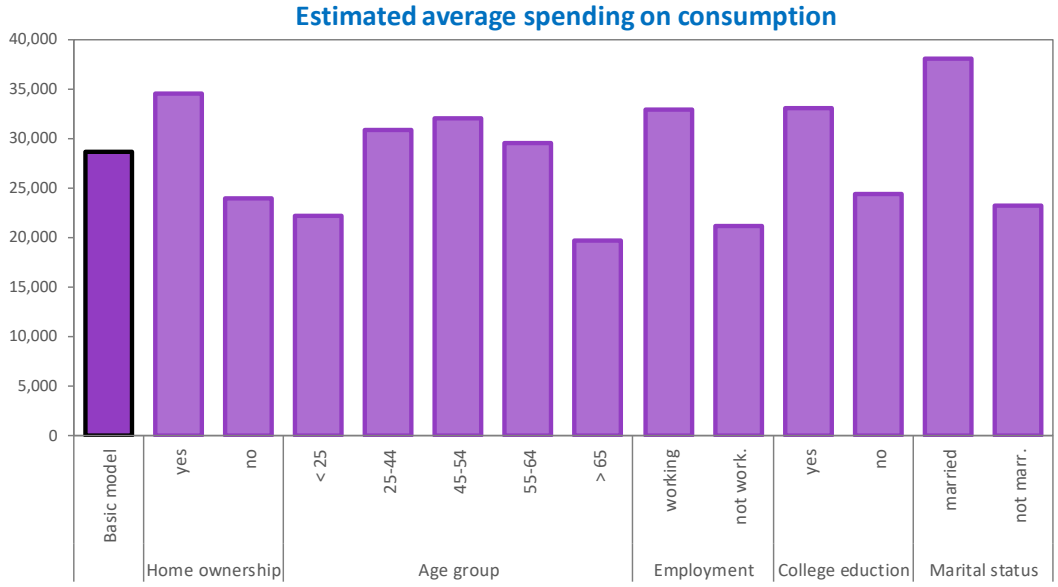
However, the relationship between MPCs and household income might go beyond a simple interaction term between these two measures. In particular, there might be strong non-linearities which are not well captured with the simple interaction term presented in Table 4. Thus, to further analyze the relationship between income and MPCs and to allow more flexibility in the estimation model, individual 'dummy' variables are created for different income groups. These are interacted with housing wealth in the same fashion as for the other household characteristics analyzed earlier, described in equation (3). Figure 7 presents the main results of the MPCs out of housing wealth (in both net and gross terms) for different income groups.

Figure 6: Estimated Housing Wealth MPCs Based on Selected Household Characteristics

Panel A: Effect of selected demographic characteristics on estimated MPCs



Panel B: Effect of selected demographic characteristics on consumption

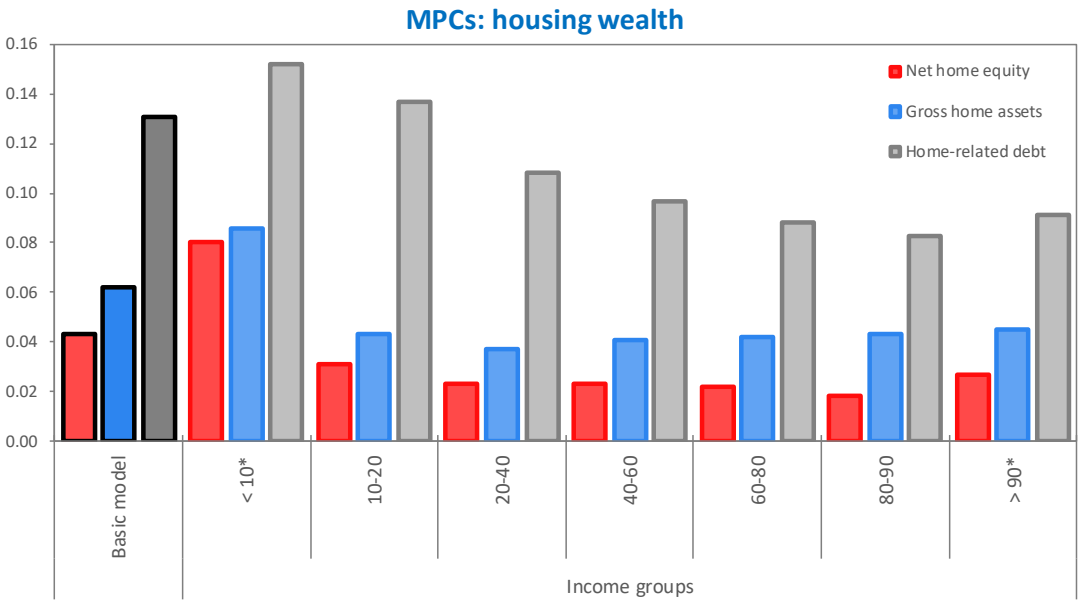


Notes: filled bars denote statistically significant MPCs at the 1 percent level. Empty bars denote that MPCs are not statistically significant at the 10 percent level.

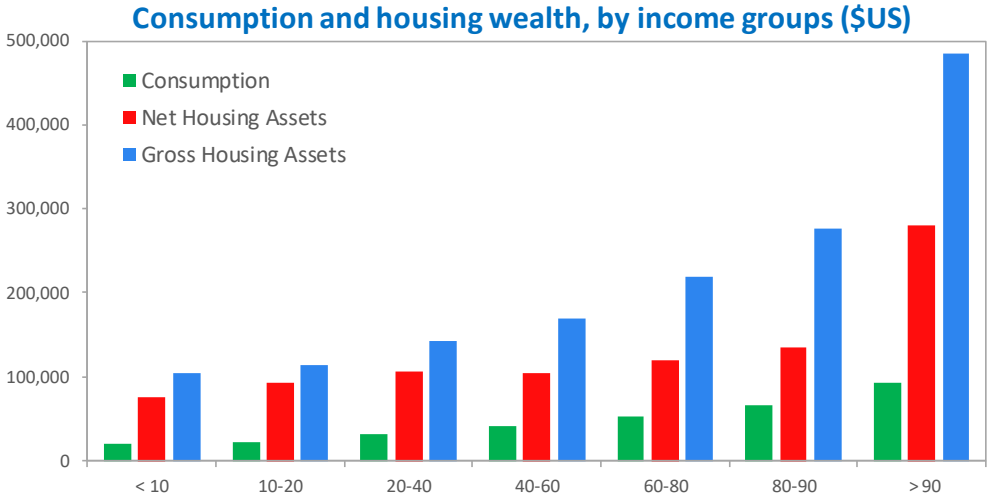
Source: IMF staff calculations.

Figure 7: Housing Wealth MPCs, Income, and Consumption, by Income Groups

Panel A: Effect of household income on estimated MPCs



Panel B: Housing wealth and consumption, by income groups



Notes: filled bars (in Panel A) denote statistically significant MPCs at the 1 percent level. * sample excludes the bottom 1 percent and the top 1 percent of the income distribution.
Source: IMF staff calculations.

Although the lowest-income households exhibit once again a higher MPC out of housing wealth relative to other income groups, the relationship between income and MPC appears to be non-monotonic. In particular, MPCs derived from net housing wealth appear to be larger at both end of the income spectrum relative to most of the income groups in the middle. In the case of high-income households, a possible explanation is that these households tend to have more access to credit—as they have more reported (taxable/official) income that can be used in any loan application—and are thus able to derive higher consumption out of their housing assets as they "liquify" part of the equity gains in the house. Indeed, the highest-income group (above the 90th income percentile) exhibits higher MPCs out of gross housing assets as well as gross home-related debt compared to all other income groups above the median income.[12] Thus, these results are likely the combination of two coexisting effects, where the intrinsic MPC tends to fall with income but it also tends to increase with the ease of access to credit, which itself tends to be higher for wealthier individuals.

For low-income households, different dynamics might be at play. An important point to note here is that the lowest income tier in the PSID includes several households reporting 'zero' or negative income— where income essentially comprises taxable income and social transfers. In some years, these zero-income households represent more than 10 percent of the total number of households included in the lowest 10th percentile of the income distribution. However, one can think of the possibility of having well-off individuals, which are not currently earning any income (for instance, small business owners reporting zero or negative profits, or rich students, or rich individuals currently not working and not receiving any official transfers), but that hold significant amounts of net assets. Thus, the presence of these zero-reported-income households is likely to affect the estimated MPCs for the lowest income group in our sample and are thus removed from the estimated results.[13]

A possible explanation for the relatively large estimated MPC at the lower end of the income distribution is that low-income households that would experience an increase in wealth (for instance, a gift or inheritance) would be more prone (relative to other income groups) to use that additional wealth for consumption purposes (and would thus have a higher MPC) either through disposal of the asset or—when possible—through increased borrowing. Indeed, the amount spent on consumption by lower-income households tends to exceed the amount they report as income (Figure 3), suggesting that these households tend to also spend out of other sources of funds (i.e. other than their official or reported income). In addition, splitting the effects of an increase in gross housing assets from that of an increase in home-related liabilities, it is found that debt-driven MPCs also tend to be larger. This is true for all

[12] A limitation in the identification of these dynamics is that each PSID vintage provides a snapshot of households reported wealth and consumption at a point in time. The analysis presented here relies mainly on cross-sectional variation rather than temporal variation.

[13] Indeed, there is a positive and significant correlation between income and wealth for the entire household sample (as evidenced in Table 1), which also holds for all income groups except for the bottom-income group (lowest income decile), for which this correlation is negative (although not statistically significant). This suggests that there is not a clear link between income and wealth (net assets) for very low-income individuals in our sample.

(continued…)

households, and particularly for low-income households (Figure 7, Panel A).[14] This is in line with other finding in the literature. For instance, Mian *et al* (2013) find that ZIP codes in the U.S. with poorer and more levered households have a significantly higher MPC out of housing wealth. Cooper (2013) finds that house price appreciations affect household spending through the borrowing collateral channel, with most of the increase in consumption coming from borrowing-constrained households. Indeed, following Cooper (2013), the sample is split between households with above median cash-to-income ratio and those with a below median ratio (as a proxy for household liquidity), and the estimations confirm that households with higher cash-to-income ratio tend to have lower MPCs (for all, net and gross housing wealth, and home-related debt). Similarly, Aladangady (2017) finds that additional home equity collateral can loosen borrowing constraints, increasing spending for households that value their current endowment of housing highly, and that looser borrowing constraints are a primary driver of the MPC out of housing wealth.

Finally, regarding the effects of total net wealth, results suggest that—in general—those MPCs tend to be lower for households with more income resources, although the estimated magnitudes tend to be fairly small (see Figure A1).[15] This is also in line with earlier results in the literature, that use different estimation methodologies. For instance, analytic results by Carroll and Kimball (1996) and numeric simulations by Zeldes (1989) show that the consumption function is concave, which is also supported empirically by Parker (1999).

It is worth noting that estimates of MPCs varying by household characteristics—such as age or income—may also reflect differences in portfolio composition, risk preferences, planning horizons, etc., which are not explicitly included in the regression, but indirectly captured through the different household measures reported in the PSID.

Implications of demographic changes

Another important factor in linking MPCs to household characteristics is that one can predict potential changes in MPCs going forward, based on the underlying trends observed in key household characteristics. Indeed, previous sections in this study showed that MPCs are closely related to demographic and socio-economic characteristics, such as age, marriage status, and employment, among others.

Moreover, several housing characteristics are directly or indirectly related to population ageing. Older cohorts not only tend to exhibit a lower MPC—perhaps as their ability to

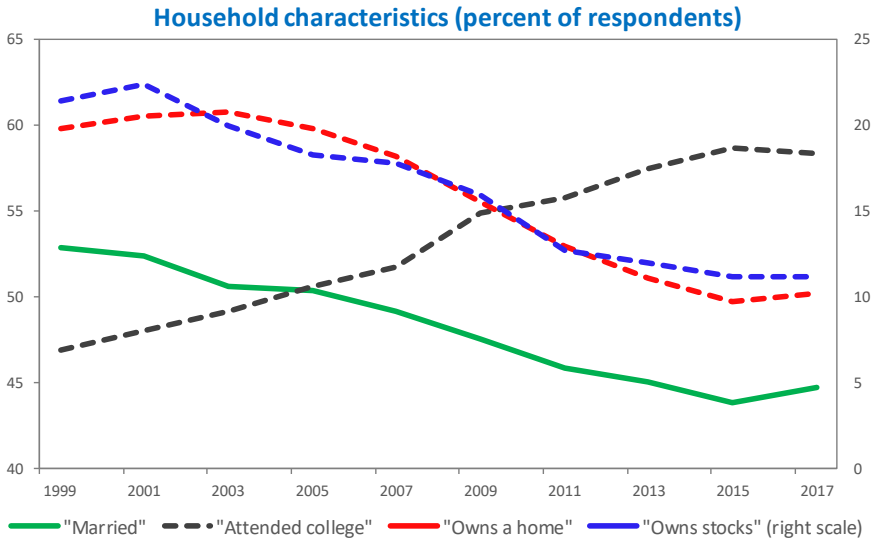
[14] Although the value of assets and liabilities for lower-income households tend to be small in absolute terms relative to that of higher-income households, these assets and liabilities are non-negligible and tend to be large relative to their own income (Figure 7, Panel B).

[15] This is also consistent with the finding that the MPC out of stock holdings is small—i.e. not different from zero from a statistical viewpoint—given that stocks tend to be held by higher-income households that also tend to have a lower MPC. Indeed, only 2 percent of households in the lowest income decile report to hold any stocks compared to almost half in the highest decile.

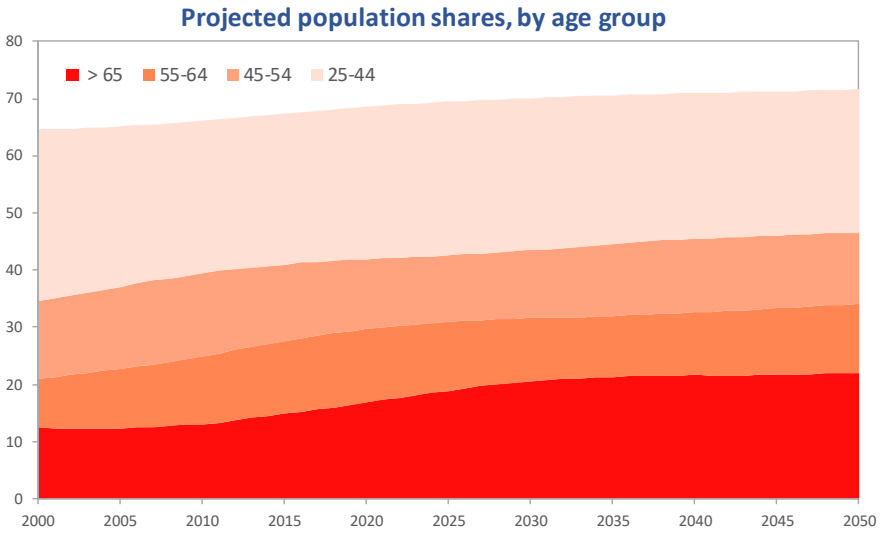
generate future income is lower (and/or they might believe that future health-related expenditure could be higher than anticipated), and thus would have a higher propensity to save relative to younger cohorts—but also as populations age, labor force participation tends to be lower, which would in turn also lowers the MPC.

Figure 8: Underlying Trends in Household Characteristics

Panel A: Changes in selected household characteristics



Panel B: Long-term demographic trends in the U.S.



Sources: PSID; U.S. Census Bureau; and IMF staff calculations.

Even though it is not straightforward to disentangle the different effects of population ageing (as the different factors are not necessarily orthogonal to each other), what it is clear is that most of these effects are moving in the same direction (Figure 8). In other words, underlying demographic trends point to potentially lower MPCs going forward. The direct effect of population aging is estimated to lower the housing MPC by about 0.3 cents out of every additional dollar in net home wealth every decade.

V. CONCLUSION

This study aims to quantify the marginal propensity to consume (MPC) out of total net wealth, as well as out of different types of wealth. Overall, empirical results suggest that the marginal propensity to consume out of net housing wealth is relatively large and significant, indicating an increase in household consumption of about 4 cents for every additional dollar of housing equity. Nevertheless, the MPCs for other types of wealth are found to be rather small and, when significant, these tend to be just a fraction of a cent for every additional dollar of net wealth. MPCs related to households' holdings of stocks are not found to be statistically significant.

MPCs are closely linked to household demographic and socio-economic characteristics. For instance, working age individuals tend to have a larger MPC for net housing wealth compared to older cohorts, as do those working relative to those not working. Similarly, individuals who are married or with a college degree tend to have a higher MPC compared to those that do not, or that are not currently married. Taken all together, underlying structural changes in household characteristics—particularly those related to an ageing population—point to increasingly lower MPCs out of wealth going forward.

Income distribution also plays an important role in determining the magnitude of housing MPCs, which are found to be larger at both ends of the income spectrum. Lower income households appear to derive significant consumption if they are able to borrow on the value of their home. Finally, using the estimated MPCs across income groups, results suggest that a sustained 10 percent fall in house prices would lead to a fall in aggregate consumption of about 1-1.4 percent. Thus, a large correction in house prices could still pose significant downside risks to consumption. However, the recent increase in the value of financial assets appears to have done little to support aggregate consumption.

APPENDIX

Table A1: Estimated MPCs for Net Housing Wealth – Robustness Checks

	Estimation period: 1999-2017				
VARIABLES	core model (1)	household-specific controls (2)	time fixed effects (3)	both sets of controls (4)	fixed household composition (5)
Total family income	0.148***	0.128***	0.149***	0.129***	0.145***
	(0.014)	(0.012)	(0.014)	(0.013)	(0.015)
Net home equity	0.043***	0.044***	0.042***	0.043***	0.039***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Age of head		1,221.801***		1,251.075***	
		(62.764)		(63.061)	
Age of head ^ 2		-13.349***		-13.638***	
		(0.637)		(0.640)	
Education level (years)		1,788.567***		1,704.952***	
		(99.379)		(101.691)	
Year 2001 dummy			1,151.333***	1,108.121***	
			(396.194)	(401.347)	
Year 2003 dummy			1,512.868***	1,158.753***	
			(375.188)	(382.367)	
Year 2005 dummy			11,843.393***	11,420.756***	
			(481.663)	(485.375)	
Year 2007 dummy			12,991.528***	12,463.063***	
			(443.114)	(449.246)	
Year 2009 dummy			10,888.920***	10,269.908***	
			(440.157)	(441.946)	
Year 2011 dummy			10,470.604***	9,726.710***	
			(445.676)	(455.324)	
Year 2013 dummy			9,246.891***	8,397.960***	
			(388.221)	(394.583)	
Year 2015 dummy			8,796.566***	7,783.572***	
			(363.684)	(375.134)	
Year 2017 dummy			8,824.157***	7,776.006***	
			(354.983)	(365.914)	
Constant	28,648.125***	-17,762.215***	20,800.094***	-24,648.193***	28,432.515***
	(805.258)	(1,862.021)	(890.614)	(1,842.438)	(921.413)
Observations	83,589	80,837	83,589	80,837	52,089
R-squared	0.330	0.369	0.347	0.383	0.336

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff calculations.

Table A2: Estimated MPCs for Stock Holdings – Robustness Checks

	Estimation period: 1999-2017				
VARIABLES	core model (1)	household-specific controls (2)	time fixed effects (3)	both sets of controls (4)	fixed household composition (5)
Total family income	0.175***	0.152***	0.175***	0.153***	0.171***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.016)
Stocks	0.002	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age of head		1,322.632***		1,350.327***	
		(77.761)		(77.852)	
Age of head ^ 2		-13.142***		-13.439***	
		(0.736)		(0.736)	
Education level (years)		2,120.600***		2,038.611***	
		(129.745)		(132.566)	
Year 2001 dummy			1,315.414***	1,237.955***	
			(406.354)	(410.344)	
Year 2003 dummy			2,092.061***	1,673.112***	
			(379.924)	(385.218)	
Year 2005 dummy			13,150.832***	12,632.357***	
			(485.887)	(491.232)	
Year 2007 dummy			14,487.742***	13,841.619***	
			(450.044)	(454.212)	
Year 2009 dummy			11,394.260***	10,562.939***	
			(453.939)	(457.840)	
Year 2011 dummy			10,720.042***	9,716.542***	
			(452.031)	(465.687)	
Year 2013 dummy			9,381.789***	8,205.665***	
			(399.493)	(414.758)	
Year 2015 dummy			9,150.849***	7,774.207***	
			(367.995)	(386.798)	
Year 2017 dummy			9,362.516***	7,933.929***	
			(358.451)	(373.541)	
Constant	29,733.287***	-25,799.556***	21,327.479***	-32,965.259***	29,760.400***
	(1,021.826)	(2,499.637)	(1,066.820)	(2,486.231)	(1,187.596)
Observations	83,589	80,837	83,589	80,837	52,089
R-squared	0.292	0.333	0.311	0.349	0.298

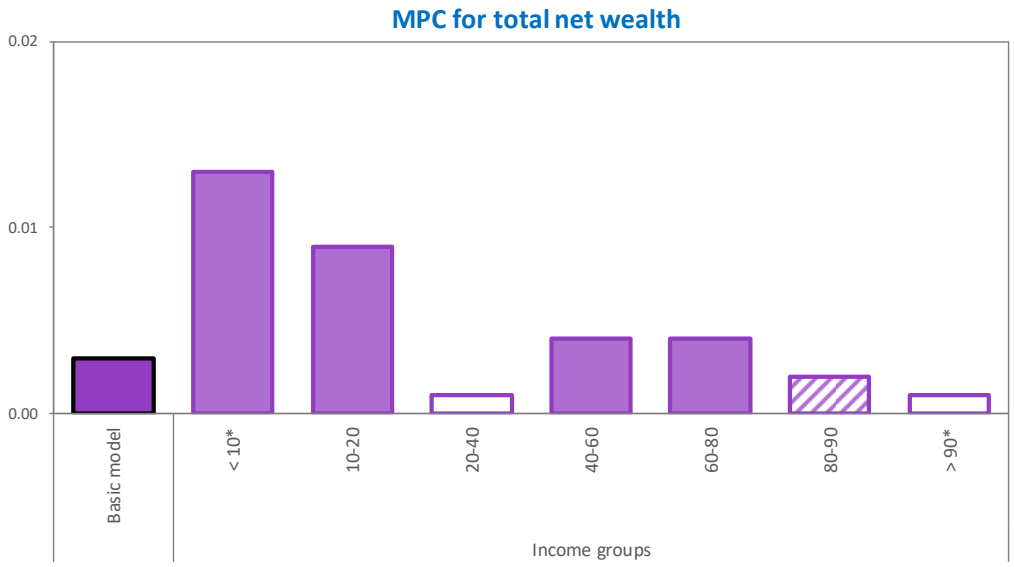
Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff calculations.

Table A3: Estimated MPCs for Total Net Wealth – Robustness Checks

	Estimation period: 1999-2017				
VARIABLES	core model (1)	household-specific controls (2)	time fixed effects (3)	both sets of controls (4)	fixed household composition (5)
Total family income	0.166***	0.143***	0.166***	0.144***	0.163***
	(0.015)	(0.014)	(0.015)	(0.014)	(0.017)
Total net wealth	0.003***	0.003***	0.003***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age of head		1,325.237***		1,352.557***	
		(73.283)		(73.461)	
Age of head ^ 2		-13.397***		-13.686***	
		(0.713)		(0.714)	
Education level (years)		2,076.525***		1,994.333***	
		(120.061)		(122.768)	
Year 2001 dummy			1,344.084***	1,274.777***	
			(404.446)	(408.438)	
Year 2003 dummy			2,081.784***	1,671.521***	
			(378.608)	(384.092)	
Year 2005 dummy			13,052.887***	12,550.489***	
			(483.302)	(488.372)	
Year 2007 dummy			14,319.077***	13,707.371***	
			(447.138)	(452.410)	
Year 2009 dummy			11,290.852***	10,506.429***	
			(444.310)	(448.431)	
Year 2011 dummy			10,706.514***	9,746.266***	
			(449.478)	(462.179)	
Year 2013 dummy			9,416.990***	8,295.589***	
			(394.823)	(406.722)	
Year 2015 dummy			9,129.048***	7,812.583***	
			(366.397)	(382.261)	
Year 2017 dummy			9,342.577***	7,979.088***	
			(356.311)	(369.443)	
Constant	29,814.752***	-24,693.723***	21,442.735***	-31,859.658***	29,795.042***
	(975.448)	(2,290.947)	(1,028.036)	(2,278.339)	(1,124.562)
Observations	83,589	80,837	83,589	80,837	52,089
R-squared	0.300	0.340	0.318	0.356	0.305

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff calculations.

Figure A1: Estimated Effects of Total Net Wealth on Consumption, by Income Groups



Notes: filled bars denote statistically significant MPCs at the 1 percent level. Pattern bar denote statistically significant MPCs at the 5 percent level. Empty bars denote that MPCs are not statistically significant at the 10 percent level. * sample excludes the bottom 1 percent and the top 1 percent of the income distribution.

Source: IMF staff calculations.

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