ESSAYS IN CONSUMER FINANCE

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Abstract:

This dissertation consists of three chapters, each representing a self-contained research paper within the consumer finance literature. Households that have low net worth have high marginal propensities to consume and, as such, are referred to as hand-to-mouth. In the first chapter, co-authored with Greg Kaplan and Gianluca Violante, we use survey data on household portfolios from multiple developed countries to document households that simultaneously hold very little liquid wealth and sizeable amounts of illiquid wealth. We find that these households have consumption responses to income shocks similar to traditional hand-to-mouth households, despite holding significant illiquid assets. The existence of these households has important implications for macroeconomic modeling and fiscal policy.

In the second chapter, co-authored with Ryota Hara and Takashi Unayama, we use the wealthy hand-to-mouth concept and look at Japanese data on household portfolios. We find that Japan has a very small share of hand-to-mouth households, much smaller than other developed countries. Similar to other developed countries, the lion’s share of hand-to-mouth households have significant levels of illiquid assets. We find that the wealthy hand-to-mouth have similar income and consumption age profiles to the relatively less constrained non-hand-to-mouth households.

In the third chapter, I use survey data and an estimated model of occupational choice to assess the impact of rising student debt on college graduates’ earnings. I document a negative relationship between graduates’ debt and income that is not explained by common joint determinants. The primary mechanism is debt induces graduates to enter employment faster and to select jobs in unrelated fields, resulting in lower income compared to debt-free peers. I also find that the rise in debt has contributed to income stagnation and basing debt repayment on income would likely benefit graduates, as it would be less distortionary on occupational choices.
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Chapter 1

The Wealthy Hand-to-Mouth

1.1 Introduction

The life-cycle permanent income hypothesis is a valuable organizing framework to analyze both household survey and aggregate time-series data on the joint dynamics of income and consumption.1 At the same time, economists have long recognized that certain aspects of these data are at odds with some of the model’s most salient predictions. This is true for both the standard version of the model (Friedman 1957; Hall 1978) and the more recent “buffer-stock” versions (Deaton 1991; Carroll 1997). In particular, both at the micro and macro level, it is common to estimate a large sensitivity of consumption with respect to transitory changes in income, whereas according to the theory these income dynamics should be smoothed.2 It is also common to find that expected consumption growth is uncorrelated with the real interest rate, a result that implies a breakdown of the forward-looking Euler equation holding with equality, if the elasticity of intertemporal substitution is not zero.3

1This chapter has been presented by Greg Kaplan at the BPEA in April 2014 and has been published as Kaplan et al. (2014).
The most direct way to account for these facts is through the existence of a sizable share of hand-to-mouth (HtM) consumers in the population: consumers that spend all of their available resources in every pay-period. HtM consumers have a high marginal propensity to consume (MPC) out of transitory income changes, which can account for the high correlation between consumption and the transitory component of income growth, even for anticipated income shocks. Moreover, HtM consumers are not on their Euler equations, and thus they are a source of misalignment between movements in the interest rate and movements in aggregate consumption growth. The main challenge to this view asserts that standard measurements using micro data on household balance sheets conclude that the fraction of households with near zero net worth, and hence who consume all of their income each period, is too small to quantitatively reproduce the facts discussed above.

Measuring HtM behavior using data on net worth is consistent with the vast majority of heterogeneous-agent equilibrium macroeconomic models. These frameworks either feature either a single asset or two assets with different risk profiles, but the same degree of liquidity. Notable examples are the Bewley models featuring uninsurable idiosyncratic risk and credit constraints, in the tradition of Huggett (1996), Aiyagari (1994), Ríos-Rull, J.V. (1995), and Krusell and Smith (1998), and the spender-saver models that feature impatient and patient consumers with complete markets in the tradition of Campbell and Mankiw (1989). This latter class of models has been revived recently by Galí et al. (2007), Eggertsson and Krugman (2012), and Justiniano et al. (2013), among others, to analyze macroeconomic dynamics around the Great Recession. Models by Krusell and Smith (1997) and Carroll et al. (2014a,b) combine the spender-saver insight of heterogeneity in patience with a standard one-asset incomplete-markets model.

In this chapter, we argue that measurements of HtM behavior inspired by this class of models are misleading because they miss what we call the wealthy hand-to-mouth households. These are households who hold sizable amounts of wealth in illiquid assets (such as housing or retirement accounts), but very little or no liquid wealth. As a result, they consume all of their disposable
income every period. Clearly, such households would not be picked up by standard measurements since they have positive, often substantial, net worth.

To obtain a comprehensive measurement of HtM behavior with cross-sectional survey data about household portfolios, a far better strategy is to use a model with two assets, one liquid and one illiquid, as the guiding framework. The illiquid asset yields a higher return, but it can only be accessed by paying a transaction cost. Recent examples of this two-asset environment are Angeletos et al. (2001), Laibson et al. (2003), Chetty and Szieidl (2007), Alvarez et al. (2012), Huntley and Michelangeli (2014), and Kaplan and Violante (2014a,b). Through the lens of this two-asset model, there are two types of HtM households. The poor hand-to-mouth (P-HtM) hold little or no liquid wealth and no illiquid wealth; the wealthy hand-to-mouth (W-HtM) also hold little or no liquid wealth, but do have significant amounts of illiquid assets on their balance sheet. Just like the P-HtM households, W-HtM households have large MPCs out of small transitory income fluctuations. However, we show W-HtM households are more similar to non HtM (N-HtM) households along many other important dimensions. As a result, the W-HtM cannot be fully assimilated into either group. Rather, they are best represented as a third, separate class of households.

This chapter investigates W-HtM behavior theoretically and empirically, and examines the implications this peculiar but sizable group has for macroeconomic modeling and policy analysis.

First, we ask why households with significant wealth would optimally choose to consume all of their income every period, instead of using their wealth to smooth shocks. To answer this question, in Section 1.2 we develop a stylized model based on Kaplan and Violante (2014a). The model reveals that, under certain parameter configurations, optimal portfolio composition has positive amounts of illiquid wealth and zero liquid wealth. Such wealthy HtM households are better off bearing the welfare loss from income fluctuations rather than smoothing consumption. This is because the latter option requires holding large balances of cash and foregoing the high return on the illiquid asset (and, therefore, the associated higher level of long-run consumption). This explanation is consistent with calculations by Browning and Crossley (2001) who showed that, in a plausibly parameterized life-cycle buffer stock model, the utility loss from setting consumption
equal to income, instead of fully optimizing, is second order. Cochrane (1989) and Krusell and Smith (1996) perform similar calculations in a representative agent environment. The model also provides useful guidance for our empirical strategy. In Section 1.3 we outline this strategy in detail and explain how we approach measurement issues.

Next, we ask how large the share of W-HtM households is in the population, what their demographic characteristics are, relative to the other two groups, how their balance sheets compare with that of the N-HtM, and how persistent their HtM status is over their life cycle. This empirical analysis is based on cross-sectional survey data on household portfolios for eight countries: the U.S., Canada, Australia, the U.K., Germany, France, Italy and Spain. We describe these data in Section 1.4. When the literature on household portfolios has previously examined these data, its emphasis has been on the allocation between risky and safe assets (see Guiso et al. 2002 for a thorough cross-country comparison). Instead, our focus is on the liquidity characteristics of the portfolio. In Section 1.5, we study U.S. data, for which we have several repeated cross-sections between 1989 and 2010, as well as a two-year panel for 2007-2009. In Section 1.6, we present a comparative cross-country analysis with survey data from 2010 and surrounding years.

The analysis of U.S. data leads to six main findings. First, between 25 and 40 percent of U.S. households are HtM, with our preferred estimate at one-third of the population. We find that one-third of HtM households are poor HtM and two-thirds are wealthy HtM, meaning the W-HtM represent the vast majority of this group, and would be missed by measurement of HtM behavior based on net worth. Third, households appear to be most frequently P-HtM at young ages, whereas the age profile of the W-HtM is hump-shaped and peaks around age 40. Fourth, the W-HtM typically hold sizable amounts of illiquid wealth: for example, the median at age 40 is around $50,000. Fifth, W-HtM households appear very similar to the unconstrained N-HtM in terms of their age-profile of income and the shares of illiquid wealth held in housing and retirement account. Finally, we determine W-HtM status is slightly more transient than P-HtM status.

Some interesting findings emerge from a comparison of the U.S. economy with the other countries we study. In all of the other countries, W-HtM households are a much greater share of
the population than P-HtM households, even more so than in the United States. However, the total fraction of HtM households varies significantly across countries. Like in the U.S., HtM households represent more than 30 percent of the population in Canada, U.K., and Germany, but represent 20 percent or less of the population in Australia, France, Italy, and Spain. For the euro area countries, we observe that holdings of consumer debt are minimal, suggesting that the substantial liquid wealth seen, even among the income-poor, may act as a buffer stock that substitutes for expensive and limited access to credit.

In Section 1.7 we show that a household’s HtM status has strong predictive power for its consumption response to transitory shocks. We apply the identification strategy from Blundell et al. (2008) to U.S. income and consumption panel data to measure the MPC out of transitory income shocks for each type of household. We find that W-HtM and P-HtM households have significantly stronger responses than N-HtM households. In contrast, when we split households into HtM groups based on net worth only, we do not find a significant difference in the consumption responses of those two groups.

In Section 1.8, we argue that the W-HtM deserve their own separate status in the cast of characters populating macroeconomic models. We use our empirical estimates of the share of households in each HtM group, together with simulated MPCs from three alternative structural models of consumption behavior, to show that the W-HtM cannot be assimilated into either the P-HtM or the N-HtM. We highlight four areas where frameworks that do not explicitly model W-HtM households provide misguided intuition about the effects of fiscal policy: the degree of MPC non-linearity with respect to the transfer size, the asymmetry of the consumption response with respect to equal-size income windfall and losses, the optimal phasing-out of stimulus payments with income for maximizing the impact on aggregate consumption, and the extent of cross-country dispersion in consumption responses to a fiscal transfer. Section 1.9 summarizes and concludes the chapter.
1.2 Wealthy Hand-to-Mouth: A Simple Model

We start by analyzing a simple three-period model in order to illustrate the determinants of hand-to-mouth behavior. In this section, we keep the presentation to a bare minimum. Appendix 1.A contains a more thorough analysis of the problem. The model is also useful to determine how to detect a household’s HtM status in the data and, as such, it provides guidance for our measurement exercise.

**Household problem.** Consider a household that lives for three periods, \( t = 0, 1, 2 \), but consumes only in the last two periods. Preferences over consumption at \( t = 1, 2 \) are given by

\[
v_0 = u(c_1) + u(c_2),
\]

with no discounting between periods, and with \( u' > 0, u'' < 0 \). The variable \( c_t \) denotes nondurable consumption at date \( t \).

In period 0, the household has an initial endowment \( \omega \) and makes a portfolio allocation decision. Two assets are available as saving instruments. An illiquid asset \( a \) pays off a gross return \( R \) before the consumption decision in period 2, but cannot be accessed at the time of the consumption decision in period 1. A liquid asset \( m \) can be accessed before the consumption decision in both periods, but pays a return \( 1 < R \). For now, we do not allow the agent to borrow, that is, to take a negative position in the liquid asset, but we later relax this assumption.

After the initial portfolio allocation decision, households receive income \( y_1 \) and make their consumption and liquid saving decision at \( t = 1 \). In the last period \( t = 2 \), they receive income \( y_2 \) and consume this amount, their liquid savings from \( t = 1 \), and their savings allocated to the illiquid asset at \( t = 0 \), plus the accrued capital income. Therefore, the only two decisions to analyze are the initial portfolio allocation decision and the consumption/saving decision at \( t = 1 \). Finally, note that since the income path \((y_1, y_2)\) is known at \( t = 0 \), there is no uncertainty.

Our characterization of hand-to-mouth behavior concerns the asset position at the time of the \( t = 1 \) consumption decision. We define a household as not hand-to-mouth (N-HtM) if, after
consuming at $t = 1$, it holds a positive amount of liquid assets, i.e., $m_2 > 0$ and $a \geq 0$. As is clear from (1.1), this household will choose $c_1 = c_2$. We define a household as poor hand-to-mouth (P-HtM) if, after consuming at $t = 1$, it does not hold any liquid or illiquid assets: $m_2 = 0$ and $a = 0$. We define a household as wealthy hand-to-mouth (W-HtM) if, after consuming at $t = 1$, it holds a positive amount of illiquid assets but no liquid assets: $m_2 = 0$ and $a > 0$. Therefore, the $t = 1$ consumption/saving decision determines whether an agent is HtM, and the initial portfolio allocation at $t = 0$ determines whether a HtM agent is poor or wealthy HtM. For both HtM households, $c_1 < c_2$.

**Solution.** We begin with the initial portfolio allocation decision at $t = 0$:

$$
\begin{align*}
    v_0 &= \max_{m_1, a} u(c_1) + u(c_2) \\
    \text{s.t.} & \\
    a + m_1 &= \omega \\
    c_1 + m_2 &= y_1 + m_1 \\
    c_2 &= y_2 + m_2 + Ra \\
    m_1 &\geq 0, a \geq 0
\end{align*}
$$

where the first line is the resource constraint in the portfolio choice; the second and third lines are the budget constraints at $t = 1$ and $t = 2$; and the final line collects the inequality constraints on the choice variables. The first order condition of this problem with respect to $a$ gives

$$
u'(c_1) \left[ 1 + \frac{\partial m_2}{\partial a} \right] \geq u'(c_2) \left[ R + \frac{\partial m_2}{\partial a} \right],$$

(1.2)

where the inequality is strict when $a = 0$. The derivative $\partial m_2/\partial a$ reflects the dependence of the liquid savings decision at $t = 1$ on the level of illiquid assets. The resulting initial portfolio allocation implicitly determines the endowment points $(y_1 + \omega - a, y_2 + Ra)$ prior to the consumption/saving decision at $t = 1$. 

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We now turn to this consumption saving decision at $t = 1$, given the predetermined amount invested in liquid wealth $m_1 = \omega - a$:

$$v_1(a) = \max_{c_1,m_2} u(c_1) + u(c_2)$$

\[ s.t. \]

$$c_1 + m_2 = y_1 + \omega - a$$

$$c_2 = y_2 + m_2 + Ra$$

$$m_2 \geq 0$$

where the first and second lines are the budget constraints at $t = 1$ and $t = 2$, and the third line imposes the nonnegativity constraint on the choice variable. The first-order condition of this problem is:

$$u'(c_1) \geq Ru'(c_2), \quad (1.3)$$

where the strict inequality holds whenever the constraint binds and $m_2 = 0$. For example, when $y_1$ is high enough relative to $y_2$, the agent wants to save some of its income into period 2, and $m_2 > 0$. In contrast, when $y_1$ is low enough relative to $y_2$, the agent would, ideally, like to borrow and it is constrained at $m_2 = 0$. This “short-run” Euler equation in (1.3) states that, at $t = 1$, the relative price of consumption between $t = 1$ and $t = 2$ is equal to one, the return on the liquid asset.

Combining (1.3) with (1.2) yields

$$u'(c_1) \geq Ru'(c_2), \quad (1.4)$$

This is because $u'(c_1) = u'(c_2)$ when $m_2$ is interior, and because $m_2$ is unaffected by a marginal change in $a$ when the household is at a constraint. This long-run Euler equation in (1.4) states that, from the agent’s viewpoint at $t = 0$, the relative price of consuming at $t = 1$ versus $t = 2$ is $R$.

Comparing (1.4) and (1.3), the intertemporal trade-off appears to change between $t = 0$ and $t = 1$ because the illiquid asset is available as a saving instrument only at $t = 0$.  

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The “short-run” Euler equation (1.3) implies

\[ m_2 = \max \left\{ \frac{y_1 + \omega - y_2 - (1 + R)a}{2}, 0 \right\} . \]  

(1.5)

Since we are interested in characterizing HtM behavior, we focus on the case where \( m_2 = 0 \). Equation 1.5 reveals that a sufficient condition for this case is \( y_2 \geq y_1 + \omega \): for a given initial endowment, income in period 2 is so large, relative to period 1, that even when the total endowment \( \omega \) is saved into the liquid asset, the household still desires to consume more at \( t = 1 \).

To make further progress on the solution, we assume that \( u \) is in the constant elasticity of substitution (CES) class with elasticity of intertemporal substitution \( \sigma \). Then, the long-run Euler equation (1.4) gives

\[ a = \max \left\{ \frac{R^\sigma (y_1 + \omega) - y_2}{R + R^\sigma}, 0 \right\} . \]  

(1.6)

From (1.6), we conclude that the household is W-HtM when

\[ R > \left( \frac{y_2}{y_1 + \omega} \right)^{\frac{1}{\sigma}} \]  

(1.7)

and is P-HtM when the opposite (weak) inequality holds.

It is useful to explain the role of the model’s parameters in determining W-HtM behavior. A high relative return \( R \) makes the illiquid asset more attractive by raising its effective return, thereby inducing the agent to tolerate wider consumption differences across periods in order to achieve a higher overall consumption level. Steep income growth \( y_2 / y_1 \) reduces the appeal of the illiquid asset as a saving instrument, as the income path already guarantees high consumption later in life. The higher the elasticity of intertemporal substitution \( \sigma \), the more the household is willing to absorb a jump in consumption across periods, and so the more likely it is to save into the illiquid asset even if \( y_1 \) is low relative to \( y_2 \).

\[ ^4 \text{Equation (1.7) reveals that the model is homothetic in } y_1, y_2, \text{ and } \omega. \text{ In this sense, a high-income household is as likely to be W-HtM as a low-income one, as long as the life-cycle slope of their income profiles is the same.} \]
Since the model is deterministic, W-HtM households choose to invest in the illiquid asset at $t = 0$, even though they know with certainty that they will be constrained in the next period. By acting this way, they consume even less at $t = 1$ and make themselves even more constrained. Put differently, the shadow value of an additional unit of income at $t = 1$ is higher for the W-HtM than for the P-HtM. If we let this multiplier be $\lambda$, for a P-HtM agent $\lambda = u'(y_1 + \omega) - u'(y_2)$ and for a W-HtM agent $\lambda = u'(y_1 + \omega - a) - u'(y_2 + Ra)$, which is larger. Nevertheless, this choice is optimal as the welfare gain from the rise in lifetime consumption more than compensates for the welfare loss from the consumption gap between $t = 1$ and $t = 2$.

**MPC out of a transitory shock.** Suppose that after the initial portfolio allocation decision, but before the consumption decision at $t = 1$, the household receives an unexpected income shock, such as a transfer $\tau$ from the government. What is the household’s MPC out of this transfer? A N-HtM household has an MPC of exactly one-half, since there is no discounting and it smooths the payment equally across the two periods. If the transfer is small enough not to throw the agent off its kink ($m_2 = 0$), then the HtM household’s MPC out of the transfer will be 1. This occurs as long as $\tau \leq y_2 - (y_1 + \omega) + (1 + R)a$. This condition is weaker for a W-HtM than for a P-HtM because, as explained above, the former household is more constrained.\(^5\) Finally, note that all these results carry over to the case of an anticipated transfer, as long as the transfer is small enough that it does not change HtM status at $t = 1$.

**Taking stock.** Our two-period model is an extremely stylized environment that is useful to describe how W-HtM behavior can arise as a result of giving up gains from additional consumption smoothing in exchange for the opportunity of investing in a high-return asset that yields higher levels of average lifetime consumption. This insight survives in more general environments. We briefly discuss five extensions.

First, for some illiquid assets like housing or large durables such as vehicles, the most significant component of their return is the service flow they provide to the owner. At the same time,\(^5\) In fact, Kaplan and Violante (2014a) show that, in a richer life-cycle version of this two-asset model with uninsurable income risk, the average MPC out of transitory income shocks among W-HtM households is larger than the average MPC among P-HtM households. We return to this point in Section 1.8.
they have a consumption commitment component, meaning periodic expenditures that cannot be avoided such as maintenance and repair. Consider a version of our model with the following in period \( t = 1 \). The illiquid asset yields a utility flow \( \phi a \) proportional to the stock, and these services are perfect substitutes with \( c_1 \) (housing can be rented out and thus transformed into \( c_1 \)); and the illiquid-asset’s owner must incur expenditures \( \kappa a \). Then, the counterpart of condition (1.7) is one where \( R \) is simply replaced by \( R/(1 - \kappa + \phi) \), the effective return on the illiquid asset.

Second, when the agent can access unsecured credit, there is a second kink in the budget constraint at the credit limit; this is in addition to the kink at \( m_2 = 0 \). The model in Appendix 1.A shows that in this case, households can be W-HtM and P-HtM either at the zero kink or at the credit limit.

Third, as we show in Kaplan and Violante (2014a), in the presence of income uncertainty, a W-HtM household prefers bearing the welfare loss from income fluctuations rather than holding the large balances of cash required for consumption smoothing. Saving in the liquid asset means foregoing the high return on the illiquid asset and the associated higher level of long-run consumption. This explanation is reminiscent of calculations made by Cochrane (1989), Krusell and Smith (1996), and Browning and Crossley (2001) who demonstrated that in several different contexts the utility loss from setting consumption equal to income, instead of fully optimizing, can be second order.

Fourth, in the model the illiquid asset is inaccessible in the intermediate period. In a more general environment where the illiquid asset can be accessed by paying a fixed transaction cost, the household may decide to deposit an unexpected positive windfall into the illiquid account, or to smooth a negative shock by withdrawing from the illiquid account. This behavior could potentially alter the model’s implications for the MPC of W-HtM agents. In Kaplan and Violante (2014a), we show that this is the case only if the shock is large relative to the transaction cost. We return on this point in Section 1.8.

Finally, in our two-period model, we have abstracted from discounting, but it is easy to see that with geometric discounting between periods, all the qualitative conclusions remain intact.
Hyperbolic discounting introduces an additional reason to save in illiquid assets, since illiquidity protects quasi-hyperbolic households from future consumption splurges (see Angeletos et al. 2001; Laibson et al. 2003), and therefore makes it even easier to generate W-HtM behavior.

1.3 Identifying HtM Households in the Data

The stylized model in Section 1.2 illustrates that there are two types of HtM households: poor hand-to-mouth (P-HtM) who do not hold any illiquid wealth, and wealthy hand-to-mouth (W-HtM) who own positive amounts of illiquid wealth. For each type of HtM household, there are two kinks in the intertemporal budget constraint where MPCs out of small income changes can be large: zero liquid assets and the unsecured credit limit. According to the theory, a household is HtM at the zero kink in period \( t \) if it consumes all its cash-on-hand for the period, and carries zero liquid wealth between \( t \) and \( t + 1 \). Similarly, a household is HtM at the credit limit if, at the end of period \( t \), it has borrowed up to the limit.

Given the theoretical definition of HtM status, ideally, we would observe balances of liquid wealth at the end of the pay-period — the period that starts at income receipt and ends just before the next income receipt. Unfortunately, surveys either report average balances over the period, or balances at a random point in time (the interview date). As a result, HtM status will be measured with error.

To fully understand this issue, think about a continuous-time generalization of the model in Section 1.2 where income is paid discretely at the beginning of the period as liquid wealth, but consumption occurs continuously, and is constant, over the period. Then, given the timing mismatch between the discrete income payment and the continuous consumption expenditures, one expects to observe positive (or above credit limit) balances of liquid wealth even for the HtM

---

\( ^6 \) The unsecured credit limit is always a hard constraint. The zero liquid asset position is a hard constraint for the subset of households who do not have access to credit, and a kink for virtually all others, since the interest rates on credit cards and other non-collateralized loans are typically much larger than the return on liquid assets.
households: this makes their identification especially challenging. In Appendix 1.B, we lay out this enriched version of the model.

We now describe our identification strategy, which builds upon the one used in Kaplan and Violante (2014a), starting with the case where liquid balances observed from the survey are an average over the period.

**Average balances.** Let $y_{it}$ denote the income of household $i$ in pay-period $t$, let $a_{it}$ denote holdings of illiquid wealth, and let $m_{it}$ denote average balances of liquid wealth over the pay period.

Panel (a) of Figure 1.1 depicts a graphical representation of the dynamics of income and average cash-on-hand $m_{it}$ over a pay period for a HtM household who starts and ends the period at the zero kink. Its liquid balances peak at $y_{it}$, when income is paid into the liquid account at the beginning of the pay period, and are depleted constantly until they reach zero at $t + 1$. Average balances over the period are equal to half income.

A conservative criterion to identify HtM agents on the zero kink in the data is to count those survey households whose average liquid wealth balances are positive (to capture the fact they are not borrowing), but are equal to or less than half their earnings per pay-period, where “half” is due to the assumption that resources are consumed at a constant rate. Specifically, a household is P-HtM at the zero kink if

$$a_{it} \leq 0, \quad \text{and} \quad 0 \leq m_{it} \leq \frac{y_{it}}{2} \quad (1.8)$$

and W-HtM at the zero kink if

$$a_{it} > 0, \quad \text{and} \quad 0 \leq m_{it} \leq \frac{y_{it}}{2}. \quad (1.9)$$

The case $a_{it} < 0$ is very rare in survey data. It occurs when housing equity is negative because a decline in house prices has pushed the market value of the house below the residual value of the mortgage. We include these households among the P-HtM because, even though they own illiquid
assets, they effectively have no means of using them to smooth consumption and, as such, these households are more similar to the P-HtM.

This estimator of the number of HtM households provides a lower bound because, although all N-HtM households would always hold average liquid balances above half their earnings, some HtM households may also hold average liquid balances above half their earnings. For example, a household that starts the period with positive liquid savings plus its earnings and ends the period with zero liquid savings is HtM, but its average liquid balance is above half its earnings, and so it would not be counted as HtM by this criterion. Appendix 1.B makes this point formally.

Next, consider a HtM household at the credit limit $-m_{it} < 0$. This is a household that consumes all its cash-on-hand for the period, as well as all its available credit. For consistency with the strategy above, we propose to count a household as P-HtM at the credit limit if

$$a_{it} \leq 0, \quad m_{it} \leq 0 \quad \text{and} \quad m_{it} \leq \frac{y_{it}}{2} - m_{it},$$

(1.10)

and to count it as W-HtM at the credit limit if

$$a_{it} > 0, \quad m_{it} \leq 0 \quad \text{and} \quad m_{it} \leq \frac{y_{it}}{2} - m_{it}.$$

(1.11)
Panel (b) of Figure 1.1 depicts the dynamics of income and average cash-on-hand $m_{it}$ over a pay period for a HtM household that starts and ends the period at the credit limit. It is easy to see that this criterion is also conservative: a household that starts the period at $t$ with liquid wealth above its credit limit and ends the period at $t+1$ having exhausted its borrowing capacity, carries an average balance above the limit, and would escape our criterion based on equations (1.10) and (1.11).

**Balances at a point in time.** Some surveys report balances of liquid wealth at the interview date, which can be thought of as a random point during the pay-period. Is it still true in this case that our estimator based on criteria (1.8)-(1.11) provides a lower bound on the fraction of HtM households? In Appendix 1.B we show that we would always miss some truly HtM households. However, we may mistake a non-HtM households for HtM if its end-of-period liquid balances are less than one-half of its income away from zero or from the credit limit if it is borrowing. For a bi-weekly pay-period, this means that the only problematic households are those with one week or less of income in excess of their kink —households which, for practical purposes, one may want to identify as HtM anyway.

**Consumption commitments.** Recent literature has emphasized the existence of pre-committed consumption expenditures, expenditures that a household is committed to incur every pay-period, unless it pays a transaction cost (either monetary or in terms of time) to modify previous commitments (see, for example, Chetty and Szeidl 2007; Shore and Sinai 2010). These expenditures include rent, mortgages or other loan payments, utility bills, school or club fees, and alimony. The key feature of committed expenditures is that they are bulk expenditures incurred at a point in time that discretely deplete a household’s balance of liquid wealth.

How does the presence of such expenditures affect our identification strategy? Let $\bar{c}_{it}$ be the amount of committed expenditures for household $i$ at date $t$. If $\bar{c}_{it}$ is incurred at the beginning of a pay period, the criterion to identify a HtM household (say, at the zero kink) should be amended as $m_{it} \leq (y_{it} - \bar{c}_{it}) / 2$, while if it is incurred at the end of the period, the criterion should be $m_{it} - \bar{c}_{it} \leq y_{it} / 2$. In the first case, our baseline measurement overestimates HtM status, and in the second case
it underestimates it. Instead, if committed expenditures are incurred smoothly over the period or are paid in the middle of the pay period, then the criterion should be $m_{it} - \bar{c}_{it}/2 \leq (y_{it} - \bar{c}_{it})/2$ which is the same as our baseline measurement. We verify the robustness of our estimates with respect to those consumption commitments that we can measure in our survey data by using these alternative assumptions about the timing of expenditures.

**Definition of HtM in terms of net worth.** For comparison with net-worth based theories of HtM behavior, we also compute the fraction of HtM agents in terms of net worth. Let $n_{it} = a_{it} + m_{it}$ be the net worth of agent $i$ in period $t$. Then, a household is HtM in net worth (HtM-NW) if

$$0 \leq n_{it} \leq \frac{y_{it}}{2} \quad \text{or} \quad n_{it} \leq 0 \quad \text{and} \quad n_{it} \leq \frac{y_{it}}{2} - m_{it}$$  \hfill (1.12)

**Direct survey questions.** Finally, whenever the data allow, we also use direct survey questions as alternate estimates of the fraction of HtM households. These questions typically ask whether expenditures over the last month have exceeded income, abstracting from purchases of large durable goods such as housing or cars, and whether the household usually spends more than its income. Counts of HtM households derived from these questions provide a useful check on the reliability of our identification strategy based on reported liquid wealth and income.

### 1.4 Survey Data on Household Portfolios

The countries included in our study are the U.S., Canada, Australia, the U.K., and the four largest economies in the euro area: Germany, France, Italy, and Spain. Data for the first four countries come from their own separate surveys, the U.S. Survey of Consumer Finances (SCF), the Canadian Survey of Financial Security (SFS), the Household, Income and Labour Dynamics in Australia (HILDA) survey, and the U.K. Wealth and Assets Survey (WAS). Data for the euro area countries come from the Household Finance and Consumption Survey (HFCS), a joint project administered by all of the central banks of the Eurosystem. Appendix 1.C contains a detailed description of all these cross-sectional surveys.
Table 1.1: Summary Information on the Survey Data Used

<table>
<thead>
<tr>
<th>Survey Years</th>
<th>U.S.</th>
<th>Canada</th>
<th>Australia</th>
<th>U.K.</th>
<th>Germany</th>
<th>France</th>
<th>Italy</th>
<th>Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SCF</td>
<td>SFS</td>
<td>HILDA</td>
<td>WAS</td>
<td>HFCS</td>
<td>HFCS</td>
<td>HFCS</td>
<td>HFCS</td>
</tr>
<tr>
<td>1989-2010</td>
<td>35513</td>
<td>5267</td>
<td>7317</td>
<td>18510</td>
<td>3565</td>
<td>15006</td>
<td>7951</td>
<td>6197</td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>2008-10</td>
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<tr>
<td>2008-10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial sample size</td>
<td>35513</td>
<td>5267</td>
<td>7317</td>
<td>18510</td>
<td>3565</td>
<td>15006</td>
<td>7951</td>
<td>6197</td>
</tr>
<tr>
<td>Exclusions</td>
<td>Not age 22-79</td>
<td>2098</td>
<td>373</td>
<td>782</td>
<td>1655</td>
<td>246</td>
<td>1428</td>
<td>846</td>
</tr>
<tr>
<td>Negative income</td>
<td>9</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>All inc. from self empl.</td>
<td>4334</td>
<td>—</td>
<td>202</td>
<td>334</td>
<td>228</td>
<td>228</td>
<td>890</td>
<td>721</td>
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<tr>
<td>Final sample size</td>
<td>29072</td>
<td>4884</td>
<td>6333</td>
<td>18176</td>
<td>3091</td>
<td>12688</td>
<td>6384</td>
<td>4980</td>
</tr>
</tbody>
</table>

Notes: Self employment income is not provided in the SFS for Canada.

In order to categorize a household as W-HtM, P-HtM, or N-HtM, we need information on its labor income and on the amounts of assets and liabilities held in various categories of its balance sheet. In the rest of this section, we discuss sample selection and comparability across surveys. Next, we present some descriptive statistics on the asset and liability distribution across countries.

### 1.4.1 Sample Selection and Data Comparability

Each individual survey is tailored to its own country and, as such, the questions asked and the definitions of particular asset classes vary across surveys. Our main goal is to be as consistent as possible in selecting the sample, and in defining income, liquid, and illiquid wealth across surveys.

**Sample selection.** In all surveys, we restrict our analysis to households in which the head is between 22 and 79 years of age, and drop households only if their income is negative or if all of their income originates from self-employment.\(^7\) Table 1.1 summarizes the survey years we use for each country, the sample selection, and the final sample sizes. Since all these surveys oversample the rich, we always use weights to construct sample statistics.

**Income.** In choosing our definition of income, we make an attempt to include all labor income plus government transfers that are regular inflows of liquid wealth. We exclude interests, dividends, and other capital income because they are realized more infrequently. Income in the SCF is gross

\(^7\)The only exception to our age range is for the U.K. WAS which provides ages in 5 year age bins, so we include households with heads between 20 and 79 years of age.
wages and salaries, self-employment income, regular private transfers such as child support and alimony, public transfers such as unemployment benefits, food stamps, and Social Security Income, and regular income from other sources excluding investment income. Income in the Canadian SFS is after-tax total income. There is no distinction between labor, capital, and self-employment income. In the HILDA, income is wages and salaries, self-employment income, regular private transfers such as child support and alimony, and public benefits such as the Australian Government Parenting Payment. For the U.K. WAS, we define income as net employee earnings, net self-employment income, plus any public benefits such as the Jobseeker’s Allowance and Maternity Allowance. Income in the HFCS is gross income from wages, salaries, and self-employment, unemployment benefits, regular private transfers such as child support and alimony, and regular public transfers.\textsuperscript{8}

The main discrepancy in income measurement across surveys is that income in Canada is reported after taxes, whereas all other countries survey gross income before taxes. For most households, except the self-employed, taxes are withheld at the source and hence the amount paid into the liquid account, and available for spending, is net of taxes. Thus, using income before taxes does somewhat overstate the fraction of HtM households by inflating the liquid wealth threshold. Whenever possible, we verify the robustness of our results to an adjustment for the individual tax liability.

\textbf{Liquid wealth.} In the U.S. SCF, we consider liquid assets to be checking, saving, money market and call accounts plus directly held mutual funds, stocks, corporate bonds and government bonds. Liquid assets in the Canadian SFS are deposits in financial institutions plus holdings in mutual funds, other investment funds, stocks and bonds. In the Australian HILDA, liquid assets include balances in bank accounts, equity investments, and cash investments (bonds). In the U.K.

\textsuperscript{8}The reference period for the income questions differs between surveys. For income variables in the SCF, the survey asks for annual income in the previous year. For example, the 2010 SCF uses 2009 as its reference period for income. The income reference period differs by country in the HFCS. France and Germany both use 2009 as a reference period, Spain uses 2007, and Italy uses 2010. Wave Two of the WAS (2008-2010) asks questions regarding the “usual” amounts for monthly income and benefits. The 2005 SFS uses 2004 as its reference period, and gave its respondents the option of skipping the income questions and using linked data from their 2004 tax return. Wave Ten of the HILDA uses the 2009-2010 financial year which runs from July 1, 2009 to June 30, 2010 for its reference period for income.
WAS, liquid assets include bank accounts, Individual Savings Accounts (ISAs), and holdings of shares, corporate bonds, and government bonds.\textsuperscript{9} For the Euro area HFCS, liquid assets are cash, sight (also called current, draft, or checking) accounts, mutual fund holdings, shares in publicly traded companies, and corporate or government bond holdings.

The main shortcoming in the definition of liquid wealth is the absence of information on cash holdings. To address this problem, we resort to an imputation procedure based on data from the 2010 Survey of Consumer Payment Choice, administered by the Federal Reserve Bank of Boston (see Foster et al., 2013). We compute the ratio of average cash holdings measured in this survey to the median value of checking, saving, money market and call accounts from the 2010 SCF. We then inflate the value of each household’s checking, saving, money market and call accounts by this ratio in all surveys.\textsuperscript{10}

We define liquid debt in the SCF as the sum of all credit card balances that accrue interest, after the most recent payment. Liquid debt in the SFS is credit card and installment debt. Liquid debt in the HILDA is credit card debt. In the U.K. WAS, liquid debt is credit card debt, plus any balances on store cards, hire purchases, and mail orders. In the HFCS, liquid debts are considered to be the balance on credit cards, after the most recent payment, which accrue interest, and any balances on credit lines or bank overdrafts which also accrue interest.

The measure of liquid wealth that we use to compute HtM status is net liquid wealth, or liquid assets minus liquid debt. We also examine a narrower definition of net liquid wealth that excludes directly held mutual funds, stocks, and bonds from liquid assets, and a broader one that includes outstanding debt in home-equity lines of credit as liquid debt.

**Illiquid wealth.** Net illiquid wealth in the SCF includes the value of housing, residential and non-residential real estate net of mortgages and home equity loans, private retirement accounts (such as 401(k)s, IRAs, thrift accounts, and future pensions), cash value of life insurance policies, cash, and all other items.

\textsuperscript{9}ISAs are accounts designed for the purpose of saving with a favorable tax status. A broad range of asset categories, including cash, can be held in ISAs. There are no restrictions to how much and when funds can be withdrawn.

\textsuperscript{10}Average cash holdings, excluding large-value holdings in 2010 was $138. Median checking, saving, money market and call accounts in the 2010 SCF is $2500, making the ratio about 5.5%. In the HFCS, information on cash holdings is available for Spain from a non-core module. We check the median ratio of cash to sight accounts and find it to be about 5% in Spain.
certificates of deposit, and saving bonds. Illiquid wealth in the Canadian SFS is the value of the principal residence and other real estate investment less mortgages on the properties and lines of credit that use property as collateral. It also includes retirement savings such as Registered Retirement Savings Plans, Registered Retirement Income Funds, employer pension plans, and other retirement funds. In the HILDA, illiquid wealth is net equity in home and other real-estate properties plus life insurance policies and superannuation (government-supported, compulsory private retirement funds). In the U.K. WAS, we take illiquid wealth to include the value of the main residence, other houses, and land net of mortgages and land debt, plus occupational and personal pensions, insurance products, and National Savings products. The definition of net illiquid wealth in the HFCS is the value of the household’s main residence and other properties net of mortgages and unsecured loans specifically taken out to purchase the home, plus occupational and voluntary pension plans, cash value of life insurance policies, certificate of deposits, and saving bonds.

We also explore broader definitions of illiquid wealth that include the value of businesses for the self-employed, the resale value of vehicles net of the loans taken out to purchase them, and other non-financial wealth not included in our baseline, such as antiques, artwork, jewels, and gold. Changing the definition of illiquid wealth affects only the split between poor and wealthy HtM, but not the total number of HtM households.

**Reference period.** The reference period for the liquid and illiquid wealth questions varies across surveys. In the SCF, it is the interview date for most assets, but for some, such as checking and saving accounts, when the respondent was unsure, the interview could prompt for an average balance over the month. The Canadian SFS asks for information on assets and debts for “a time as close as possible to the date of the interview.” Both the WAS and HILDA ask for current balances

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11 Superannuation has some features of private retirement accounts, such as 401(k) accounts in the U.S., which we include in illiquid wealth, and some features of public pensions (the compulsory nature of a minimum contribution) which we exclude from illiquid wealth. Because of this ambiguity, we also offer a sensitivity analysis where we exclude superannuation wealth from illiquid assets.

12 In our robustness checks with respect to business equity we include all households whose income is entirely from self-employment as long as they had non-negative income from their business.
or values of assets and liabilities. In the HCFS, France, Germany, and Spain use the interview date, and Italy uses December 31, 2010.

### 1.4.2 Descriptive Statistics

Table 1.2 reports some basic descriptive statistics on household income, liquid and illiquid wealth holdings, and portfolio composition, for each country in the sample.

In all countries, the typical household portfolio structure is rather simple. It comprises a small amount of liquid wealth in the form of bank accounts, some housing equity, and a private retirement account. In particular, the median holdings of other financial assets such as directly held stocks, bonds, mutual funds, and life insurance are zero everywhere. This is a well known fact in the empirical study of household portfolios (see Guiso et al. 2002).

There are, however, some interesting cross-country differences. First, the median net worth to median income ratio varies a lot across countries: from just above one in Germany and the U.S. to over six in the U.K., Italy, and Spain. With respect to net liquid wealth, consumer credit appears a lot less frequent in the Euro area: less than 10 percent of households have credit card debt in France, Italy, and Spain, compared to 30 to 40 percent in the Anglo-Saxon countries. Figure 1.2, which plots the distribution of net liquid wealth to monthly income for the eight countries, reinforces this observation.

Housing equity forms the majority of illiquid wealth for households in every country, with the exception of Germany where median housing wealth is zero, since only 48 percent of the population are homeowners. Germany’s homeownership rate is at least 10 percentage points lower than in all other countries (see also Eymann and Börsch-Supan (2002)). The median value of housing equity relative to median annual income is especially remarkable in Italy and Spain, where it exceeds six.

There are also large differences in the fraction of households with positive private retirement wealth: in the Anglo-Saxon countries, at least half of all households hold a personal retirement account, whereas in France, Italy, and Spain less than one in ten do. Surely, a big part of the
Table 1.2: Summary Statistics.

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>CA</th>
<th>AU</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income (age 22-59)</td>
<td>47040</td>
<td>0.984</td>
<td>49905</td>
<td>1</td>
</tr>
<tr>
<td>Net Worth</td>
<td>56721</td>
<td>0.883</td>
<td>112418</td>
<td>0.877</td>
</tr>
<tr>
<td>Net liquid wealth</td>
<td>1714</td>
<td>0.75</td>
<td>2643</td>
<td>0.716</td>
</tr>
<tr>
<td>Cash, checking, saving, MM accounts</td>
<td>2640</td>
<td>0.923</td>
<td>2873</td>
<td>0.864</td>
</tr>
<tr>
<td>Directly held stocks</td>
<td>0</td>
<td>0.142</td>
<td>0</td>
<td>0.109</td>
</tr>
<tr>
<td>Directly held bonds</td>
<td>0</td>
<td>0.014</td>
<td>0</td>
<td>0.106</td>
</tr>
<tr>
<td>Revolving credit card debt</td>
<td>0</td>
<td>0.382</td>
<td>0</td>
<td>0.412</td>
</tr>
<tr>
<td>Net illiquid wealth</td>
<td>29000</td>
<td>0.761</td>
<td>100713</td>
<td>0.752</td>
</tr>
<tr>
<td>Housing net of mortgages</td>
<td>29000</td>
<td>0.629</td>
<td>64238</td>
<td>0.648</td>
</tr>
<tr>
<td>Retirement accounts</td>
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<td>0.526</td>
<td>871</td>
<td>0.518</td>
</tr>
<tr>
<td>Life insurance</td>
<td>0</td>
<td>0.186</td>
<td>0</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>DE</td>
<td>FR</td>
<td>IT</td>
<td>ES</td>
</tr>
<tr>
<td>Income (age 22-59)</td>
<td>35444</td>
<td>0.994</td>
<td>31518</td>
<td>0.999</td>
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<td>Net Worth</td>
<td>46798</td>
<td>0.949</td>
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<td>0.966</td>
</tr>
<tr>
<td>Net liquid wealth</td>
<td>1319</td>
<td>0.853</td>
<td>1453</td>
<td>0.925</td>
</tr>
<tr>
<td>Cash, checking, saving, MM accounts</td>
<td>1154</td>
<td>0.876</td>
<td>1255</td>
<td>0.953</td>
</tr>
<tr>
<td>Directly held stocks</td>
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<td>Net illiquid wealth</td>
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<td>0.922</td>
</tr>
<tr>
<td>Housing net of mortgages</td>
<td>0</td>
<td>0.476</td>
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<tr>
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<td>Life insurance</td>
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<td>0.493</td>
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<td>0.378</td>
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</tbody>
</table>

Notes: Data for the U.S. are from the 2010 survey only. All figures are in local currency units. Data for Canada is adjusted to 2010 CA$ using the Canadian CPI. From the Federal Reserve Board’s G.5 release, the average exchange rates in the survey years are 1.2 CA$, 1.1 AU$, 0.6 British pounds, and 0.7 euros per U.S. dollar.
Figure 1.2: Distribution of Liquid Wealth to Income Ratios by Country
explanation is in the generosity of the public pension system in these countries: according to the OECD, replacement rates for the median earner are between 60 and 70 percent in these countries, compared to 40 percent in the U.K. and the United States (see OECD, 2013). The size of private retirement wealth in Australia and the U.K. is astonishing. In Australia, this is partly due to the “superannuation” regulations that require all employers to generously contribute to tax-deferred retirement accounts on behalf of their employees.\textsuperscript{13} In the U.K., the Pension Schemes Act of 1993 created tax-free employer-sponsored (defined benefit) occupational pensions and personal (defined contribution) pensions. The Pension Act of 2008 also established that workers must choose to opt out of an employer’s occupational pension plan, rather than opt in (see Banks and Tanner 2002).

Finally, the proportion of households with life insurance in their portfolio is much higher in the euro area than in the Anglo-Saxon countries. We conjecture that solid intergenerational family ties, and a stronger precautionary savings motive linked to the lower female participation rate, may account for these differences.

\section{1.5 United States}

In this section, we report the main findings for the U.S., using data from the 1989-2010 waves of the SCF. We begin by estimating the fraction of HtM households and assessing the robustness of our estimates to a variety of aspects of the definition adopted in Section 1.3. We then analyze the key demographic characteristics of N-HtM, P-HtM, and W-HtM households, and we examine their portfolio composition in more detail.

\subsection{1.5.1 The Share of HtM Households}

Our definition of HtM status is based on equations (1.8)-(1.12). Since the SCF does not report individual data on the frequency of pay, we need to make an assumption that applies to all households. Consumer Expenditure Survey (CEX) data from 1990-2010 reveal that 32 percent of respondents

\textsuperscript{13}In the survey years, the compulsory minimum employer contribution rate was 9 percent of the employee salary.
are paid weekly, 52 percent of respondents are paid bi-weekly, and the rest are paid monthly or at lower frequencies.\textsuperscript{14} Based on these findings, in the benchmark analysis we set the pay-frequency to two weeks. In the benchmark, we also set the household credit limit to one month of income. The SCF asks respondents to report their credit limit, but most of the other surveys do not, and hence for comparability we choose a common limit.\textsuperscript{15}

Panel (a) of Figure 1.3 plots the fraction of HtM households in the U.S. population over the period 1989-2010 and their split between wealthy and poor HtM. Our estimates indicate that, on average, 31 percent of U.S. households are HtM over this period. Of these, roughly one-third are poor HtM and two-thirds are wealthy HtM. This is our first main result: the vast majority of hand-to-mouth households own illiquid assets. Looking at changes over time across the two decades covered by our data, the fraction of HtM households remains fairly stable and the split between poor and wealthy does not change significantly. The first line of Table 1.3 reports that the share of U.S. households that are HtM in terms of net worth is less than 14 percent. Thus looking

\textsuperscript{14}Tabulations based on Zhang (2014).

\textsuperscript{15}The choice of one month of income for the benchmark is consistent with the SCF self-reported limits. When setting the limit for households without credit cards to zero, the median self-reported limit to income ratio is 0.54 in 1989. It grows steadily to 1.7 in 2007 and then drops to 1.2 in 2010. This evolution of credit limits is even more remarkable when conditioning only on credit card holders (around 70 percent of the population): the median limit to income ratio rises from 1.2 in 1989 to 3.4 in 2007, and then drops to 2.8 in 2010.
at the wealth distribution through the lens of net worth misses over half of the HtM households in the United States.\textsuperscript{16}

Panel (b) explores the illiquid asset portfolio of the W-HtM households by plotting the share of W-HtM households that own housing, retirement wealth, or both. About one-half of W-HtM have both, about a third have positive housing but no retirement wealth, and a sixth have positive retirement wealth but no housing. A deeper look into the portfolio of HtM households reveals that, if we condition on homeownership, the leverage ratio is a strong predictor of HtM status. Figure 1.4 shows that the fraction of HtM households doubles from 20 to 40 percent as the leverage ratio rises towards one, as regular mortgage payments absorb a significant fraction of disposable income and leave households with little or no liquid savings.

\textsuperscript{16}HtM-NW are always more numerous than the P-HtM because there are some households with liquid wealth above the threshold, who are therefore not HtM, but with enough negative illiquid wealth (i.e., negative home equity) to push their net worth below the threshold.
Figure 1.5: Time-Series of Fraction HtM in U.S., Alternate Definitions

Robustness

Figure 1.5 and Table 1.3 summarize our sensitivity analyses. Panel (a) of Figure 1.5 plots the shares of poor and wealthy HtM weighted by income. Not surprisingly, the total fraction of HtM households is smaller than its unweighted counterpart: HtM households represent roughly 20 percent of total U.S. income, since their income is below the U.S. average. When we weight by income, the W-HtM represent three-quarters of HtM households. Panel (b) plots HtM shares when the pay-period is set to a month instead of two weeks. The fraction of HtM households increases by 9 percentage points and W-HtM account for most of the difference with the baseline. Symmetrically, the fourth line of Table 1.3 shows that, when the pay-period is set to one week, the
<table>
<thead>
<tr>
<th>Category</th>
<th>P-HtM</th>
<th>W-HtM</th>
<th>N-HtM</th>
<th>HtM</th>
<th>HtM-NW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.121</td>
<td>0.192</td>
<td>0.688</td>
<td>0.312</td>
<td>0.137</td>
</tr>
<tr>
<td>In past year, c $&gt;$ y</td>
<td>0.13</td>
<td>0.309</td>
<td>0.561</td>
<td>0.439</td>
<td>—</td>
</tr>
<tr>
<td>Usually, c $&gt;$ y y</td>
<td>0.089</td>
<td>0.156</td>
<td>0.756</td>
<td>0.244</td>
<td>—</td>
</tr>
<tr>
<td>Financially fragile households</td>
<td>0.173</td>
<td>0.331</td>
<td>0.497</td>
<td>0.503</td>
<td>0.209</td>
</tr>
<tr>
<td>Reported credit limit</td>
<td>0.114</td>
<td>0.147</td>
<td>0.738</td>
<td>0.262</td>
<td>0.126</td>
</tr>
<tr>
<td>1 year income credit limit</td>
<td>0.102</td>
<td>0.118</td>
<td>0.78</td>
<td>0.22</td>
<td>0.108</td>
</tr>
<tr>
<td>Weekly pay period</td>
<td>0.106</td>
<td>0.15</td>
<td>0.744</td>
<td>0.256</td>
<td>0.119</td>
</tr>
<tr>
<td>Monthly pay period</td>
<td>0.141</td>
<td>0.261</td>
<td>0.598</td>
<td>0.402</td>
<td>0.164</td>
</tr>
<tr>
<td>Higher illiquid wealth cutoff</td>
<td>0.131</td>
<td>0.181</td>
<td>0.688</td>
<td>0.312</td>
<td>0.137</td>
</tr>
<tr>
<td>Ret. acc. as liquid for 60+</td>
<td>0.121</td>
<td>0.183</td>
<td>0.696</td>
<td>0.304</td>
<td>0.137</td>
</tr>
<tr>
<td>Businesses as illiquid assets</td>
<td>0.114</td>
<td>0.193</td>
<td>0.693</td>
<td>0.307</td>
<td>0.129</td>
</tr>
<tr>
<td>Direct as illiquid assets</td>
<td>0.12</td>
<td>0.217</td>
<td>0.663</td>
<td>0.337</td>
<td>0.137</td>
</tr>
<tr>
<td>Other valuables as illiquid assets</td>
<td>0.117</td>
<td>0.196</td>
<td>0.688</td>
<td>0.312</td>
<td>0.132</td>
</tr>
<tr>
<td>Excludes cc puzzle households</td>
<td>0.163</td>
<td>0.183</td>
<td>0.654</td>
<td>0.346</td>
<td>0.177</td>
</tr>
<tr>
<td>HELOCs as liquid debt</td>
<td>0.12</td>
<td>0.181</td>
<td>0.699</td>
<td>0.301</td>
<td>0.135</td>
</tr>
<tr>
<td>Usual income</td>
<td>0.119</td>
<td>0.198</td>
<td>0.683</td>
<td>0.317</td>
<td>0.137</td>
</tr>
<tr>
<td>Disposable income - Reported</td>
<td>0.121</td>
<td>0.188</td>
<td>0.691</td>
<td>0.309</td>
<td>0.137</td>
</tr>
<tr>
<td>Disposable income - Single</td>
<td>0.12</td>
<td>0.187</td>
<td>0.693</td>
<td>0.307</td>
<td>0.136</td>
</tr>
<tr>
<td>Comm. cons. - beg. of period</td>
<td>0.102</td>
<td>0.166</td>
<td>0.732</td>
<td>0.268</td>
<td>0.116</td>
</tr>
<tr>
<td>Comm. cons. - end of period</td>
<td>0.149</td>
<td>0.272</td>
<td>0.579</td>
<td>0.421</td>
<td>0.174</td>
</tr>
</tbody>
</table>

Notes: SCF pooled 1989-2010. Financially fragile households includes those households within $2,000 in liquid assets of their income threshold as HtM. Higher illiquid wealth cutoff requires households to have above $1,000 in illiquid assets to be considered W-HtM. Ret. acc. as liquid for 60+ puts retirement accounts into liquid wealth for households above age 60. Businesses as illiquid assets drops the self employment income sample selection and adds business assets to illiquid wealth and self employment income to income. Direct as illiquid assets classifies directly held mutual funds, stocks, corporate and government bonds as illiquid assets. Disposable income subtracts federal income taxes estimated from NBER’s TAXSIM from income. Disposable income - Reported assumes that each household files their actual marital status and number of children as dependents. Disposable income - Single assumes that every household files as single with no dependents. Comm. cons. - beg. of period assumes the household’s committed consumption is incurred at the beginning of the period. Comm. cons. - end of period assumes the household incurs it at the end of the period.

share of W-HtM drops by 5 percentage points. In panel (c) of Figure 1.5, we verify the robustness of our estimates with respect to the tightness of the credit limit. When we use the self-reported credit limit in the SCF, the fraction of HtM households drops by 5 percentage points, with a lower number of W-HtM households accounting for all of the drop. Finally, panel (d) shows that by including vehicles as illiquid wealth, we move roughly half of the P-HtM into the W-HtM group but, by construction, the total share of HtM households in the population is unchanged.
Table 1.3 contains a number of other sensitivity analyses. We begin with direct questions on HtM status. The SCF contains a combination of sequential questions aimed at assessing whether “over the past year, [household] spending exceeded, or was about the same as, income, and such expenditures included purchases of a home or automobile or spending for any investments.”\textsuperscript{17} Based on this definition, the share of HtM households is around 44 percent. W-HtM households account for two-thirds of the total, and fluctuations in this measure over time very closely follow those in the baseline definition of Figure 1.5(a). The third row of Table 1.3 also reports results for another sequence of direct questions in the SCF. The first question asks “Which of the following statements comes closest to describing your saving habits?” We label a household as HtM if it responds “Don’t save - usually spend more than (or as much as) income.” Roughly 24 percent of households are HtM according to this definition.

It is reassuring that our baseline estimate of HtM households sits in between the counts based on these two direct questions, since we interpret the first question as providing an upper bound and the second a lower bound. Our baseline calculations refer to the current HtM status for a household. In the first set of direct questions, households that spent more than their income over the past year because they dissaved or borrowed are not truly HtM, but they would be classified as such based on the first set of direct questions. Conversely, the second set of direct questions asks about the usual HtM status, and therefore those households who are, at the time of the survey, transitorily into a HtM status would answer negatively to the question. The cross-sectional correlation between our indicator of HtM status and the one provided by these two questions is about 0.3 for each.

Our estimates of HtM households are related to calculations of “financially fragile” households by Lusardi et al. (2011). Based on an ad-hoc survey, they document that a quarter of U.S. households report that they would \textit{certainly} be unable to come up with $2,000 in 30 days, and a similar fraction reports that they could \textit{probably} not come up with the funds to deal with an ordinary financial shock of this size. These authors also emphasize that there are many solidly middle-class households in this last group. In line three of Table 1.3, we compute the fraction of

\textsuperscript{17}These questions (X7510, X7509, X7508) were included in the survey starting from 1992.
households who are less than $2,000 away from the liquid wealth thresholds for being defined as HtM. We find that 50 percent of households are “financially fragile” according to this definition. Of these, 17 percent have no illiquid assets, but 33 percent own housing and/or retirement wealth. The P-HtM could be mapped into the Lusardi et al. (2011) survey respondents who would certainly not come up with this amount, and the W-HtM into those that would probably be unable to cope. Overall, our estimates are in line with those of Lusardi et al. (2011), but they also suggest a more nuanced interpretation. Households in the second group have the means to deal with a shock of this size, for example, by using their illiquid wealth as collateral for a loan. They may choose not to do it because the transaction costs involved dominate the welfare gain from smoothing such small shock, but for larger shocks, they will choose to adjust and smooth consumption. We return to this shock-size asymmetry in Section 1.8.18

The other robustness checks in Table 1.3 are conducted with respect to the definition of illiquid wealth, debt, income, and the timing of consumption expenditures. Using a higher illiquid wealth threshold in the definition of W-HtM ($1,000 instead of $1) moves about 1 percentage point of households from W-HtM into P-HtM. Broadening the definition of illiquid wealth to include business equity, or directly held stocks and bonds, or other valuables (artwork, antiques, jewels, etc.) has small effects relative to the baseline.19 Including all private retirement wealth as liquid wealth for households aged sixty and above reduces the share of W-HtM households by less than 1 percentage point.

Around one-quarter of U.S. households simultaneously have positive liquid assets above \( y/2 \) and some revolving credit card debt.20 One may worry that many of these households have net liquid wealth close to zero, and they would therefore be counted as HtM, even though they have slack in both liquid wealth and credit. In Table 1.3 we show that excluding this group does not affect our calculations much because the distribution of HtM status within this group is not too

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18 Pence (2011) makes a similar point in her discussion of Lusardi et al. (2011)
19 When we include business equity, we also include in our sample all those households whose labor income comes entirely from self-employment. These households are excluded from the baseline sample.
20 In the household finance literature, this observation is called the credit card puzzle, see Telyukova (2013) for more information.
different from the population distribution. Home equity lines of credit (HELOCs) were virtually nonexistent before the year 2000, but in the last decade they became a more common instrument to extract liquidity from housing.\textsuperscript{21} Changing the definition of liquid debt by including used up HELOCs —while simultaneously increasing the credit limit by the total available line of credit— decreases the fraction of HtM households, as expected, but by only 1 percentage point.

The SCF collects data on a household’s normal, or usual, income as well as on their actual income. This alternate definition of income has no effect on our calculations. Recall that our definition of income is gross income before taxes and tax credits. Through the NBER TAXSIM, we have constructed, household by household, a measure of after-tax income.\textsuperscript{22} Under this income measure, the total fraction of HtM households declines, but quantitatively this effect is very small. The reason is that, in the U.S., the effective average tax rate is very small at the low end of the income distribution (around zero), mainly because of the EITC: even in the middle quintile it is only 10 percent. Finally, as explained in Section 1.3, accounting for committed expenditures has an ambiguous effect on the share of HtM agents, depending on whether the expenditures occur mostly at the beginning or at the end of the pay-period. Table 1.3 shows that these two opposite timing assumptions bound the share of total HtM households between 27 and 42 percent.

1.5.2 Characteristics of HtM Groups

Demographics. We now turn to the demographic characteristics of the three groups of HtM households. Figure 1.6 plots the share of the population that is W-HtM and P-HtM by age.\textsuperscript{23} The bulk of P-HtM behavior is observed in the early stages of the life-cycle. The fraction of P-HtM households drops sharply until age 30, and keeps falling steadily over the life cycle until reaching

\textsuperscript{21}The fraction of home-owners with HELOCs in 2001 was 7.1%, 12.9% in 2007, and 10.7% in 2010. The average HELOC limit in 2001 was $11,087, in 2007 it was $18,984, and in 2010 it was $19,070. The average percent of the HELOC used was 27.5% in 2001, 31.0% in 2007, and 31.6% in 2010.

\textsuperscript{22}The variables we used in TAXSIM are year, marital status, the number of children, and the breakdown of income into its parts (wages, UI benefits, etc.). We deducted federal taxes from gross income. We assumed each household files their actual marital status and claims all their children living in the household as dependents. As an upper bound, we have also computed the case where they all file as single without dependents.

\textsuperscript{23}These plots are based on pooled data from all surveys and do not control for time or cohort effects. We verified that age profiles are similar in both cases, but become more noisy, and hence we present the raw data.
roughly 5 percent in retirement. The age profile of the fraction of W-HtM households is instead markedly hump shaped: it peaks at around age 40, when over 20 percent of U.S. households are W-HtM, and remains above 10 percent throughout the life cycle. Accordingly, the share of N-HtM individuals increases steadily from 50 percent at age 22 to 80 percent in retirement.

The first three panels of Figure 1.7 report some demographic characteristics of the three HtM groups by age. N-HtM households have on average one more year of education than the W-HtM who, in turn, have one more year of education than the P-HtM. In terms of marital status, N-HtM and W-HtM households are indistinguishable, whereas the figure shows that the P-HtM households are 30 percent less likely to be married. In contrast, P-HtM and W-HtM are both more likely to have children than are N-HtM households.

Figure 1.7(d) shows that P-HtM households are income-poor, with median annual income around $20,000 (in $2010) during the working years, while the N-HtM are high-income households whose median earnings are $70,000 at their life-cycle peak. The most surprising finding is that the W-HtM look a lot like the N-HtM in terms of their income path. The same conclusion holds for the incidence of unemployment and for the likelihood of receiving welfare benefits, which are both much lower for N-HtM and W-HtM households than for the P-HtM.
Figure 1.7: Age Profile of Demographic Characteristics of HtM Households in U.S. Notes: SCF pooled 1989-2010.
Figure 1.8: Age Profile of the Portfolio Composition of HtM in U.S. Notes: SCF pooled 1989-2010. To reduce the sensitivity to outliers, means are computed after trimming the overall top and bottom 0.1 percent of that statistic’s distribution.
Table 1.4: Transition Matrix for the 2007-2009 Panel of the SCF

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>W</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P</strong></td>
<td>0.548</td>
<td>0.127</td>
<td>0.326</td>
</tr>
<tr>
<td><strong>W</strong></td>
<td>0.101</td>
<td>0.455</td>
<td>0.444</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>0.055</td>
<td>0.129</td>
<td>0.816</td>
</tr>
</tbody>
</table>

| Ergodic | 0.126 | 0.191 | 0.683 |

Notes: Fraction of households with the row HtM status in 2007 and the column HtM status in 2009. The last row reports the implied ergodic distribution.

**Portfolio composition.** Figure 1.8 digs deeper into the balance-sheet composition of the three groups of HtM households. Panel (a) shows that median net liquid wealth holdings are zero at virtually every age for both the P-HtM and the W-HtM. Median net liquid wealth for N-HtM households grows steadily from about $2,500 at age 25 until retirement, where it levels off at roughly $15,000. Panel (b) reveals that the W-HtM hold significant amounts of illiquid wealth: for example, median holdings at age 40 exceed $50,000. Hence, W-HtM households are not just P-HtM households with small amounts of savings in less liquid assets. The next two panels of Figure 1.8 articulate this observation further. Panels (c) and (d) plot age profiles of the average fraction of illiquid wealth held in housing and retirement accounts for W-HtM and N-HtM households. The conclusion is striking: the lines are on top of each other, indicating that the portfolio allocation of these two groups is nearly identical.

**Persistence.** How persistent is a household’s HtM status? We answer this question by exploiting the 2007-2009 panel component of the SCF. Table 1.4 reports the 2-year transition matrix across the three HtM statuses for U.S. households. The diagonal elements of the matrix reveal that N-HtM status is by far the most persistent, and W-HtM status the most transient of the three. These transition probabilities imply that the expected length of HtM status is around 3.5 years for the W-HtM, 4.5 years for the P-HtM, and 11 years for the N-HtM.

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24Recall, though, the overall median net liquid wealth across the whole population is less than $2,000 (Table 1.2) and hence, even among the N-HtM, there are households with small amounts of liquid wealth.
1.6 Cross-Country Evidence

The previous section showed that around 30 percent of households in the United States are HtM, one-third of which are P-HtM and two-thirds of which are W-HtM. In this section we use household portfolio data from seven other developed economies to assess whether the prevalence of W-HtM households is a common feature of the wealth distribution across countries and, if so, whether the characteristics of W-HtM in terms of demographics, income, and balance sheets are similar to those in the U.S.

As discussed in Section 1.4, we focus our attention on three other Anglo-Saxon countries, Canada, Australia, and the U.K., and the four largest euro-area economies, Germany, France, Italy, and Spain. While data is available for more than one point in time for most of these countries, in order to keep the discussion manageable we focus on the most recent single cross-section in each country. For Australia and the European countries this is 2010, for the U.K. it is 2009, and for Canada it is 2005. For the sake of comparability, we use only the 2010 wave of the SCF for the U.S.

Figure 1.9(a) shows the fraction of poor and wealthy HtM households in each country. There is a striking similarity in the overall fraction of HtM households, as well as in their breakdown between poor and wealthy, between the U.S., Canada, and the U.K. These three countries have a large share of HtM households, exceeding 30 percent. Australia is an outlier among the Anglo-Saxon countries in two ways: first, the total fraction of HtM is roughly half the fraction in the U.S., the U.K., and Canada; second, 90 percent of HtM households in Australia are W-HtM. Among the euro-area countries, France, Italy, and Spain have smaller shares of HtM households than the U.S., U.K., and Canada, around 20 percent, whereas in Germany this share is closer to 30 percent. Even for the Euro area countries, the fraction of W-HtM among the HtM households exceeds two-thirds. For all eight countries, Figure 1.9(a) shows there are more W-HtM households than P-HtM. Thus a wide-spread feature of international household portfolios is that a complete characterization of the fraction of the population that is likely to exhibit HtM behavior requires going beyond those with just low net worth.
Figure 1.9(b) reveals that there are significant differences in the portfolio composition for the W-HtM across countries. In Italy and Spain, virtually all the W-HtM own some housing wealth. Homeowners are also dominant among the group of W-HtM in the U.S. and Canada. In contrast, around half of the W-HtM in Australia, Germany, and Canada have no housing wealth. Rather, the majority of their illiquid assets are held in private retirement accounts. Table 1.9 in the Appendix provides more information on the cross-country portfolio composition.

What explains the fact that the euro area countries have a smaller fraction of HtM households than the U.S.? In the euro area countries, households hold more liquid wealth relative to their income compared to the United States. As is clear from Figure 1.2, this fact can be partially attributed to differences in liquid debt. The fraction of P-HtM households in the euro area countries with negative liquid wealth is 2 to 4 times smaller than in the Anglo-Saxon countries (see Table 1.9). Presumably, lower access to unsecured credit in Europe implies that there are more incentives for households to hold large balances of liquid wealth for transaction and precautionary reasons. For example, Vandone (2009) documents that, in 2006, the total value of consumer credit amounted to 25 percent of disposable income in the U.K., 15 percent in Germany and Spain, 12 percent in France, and only 10 percent in Italy.
Australia is the country with the largest share of W-HtM among HtM households. Table 1.9 reveals that is due to the very high share of the population with private retirement wealth. As explained in Section 1.4, the high ownership rate of retirement accounts in Australia is largely due to the superannuation regulations. When we exclude superannuation accounts as a component of wealth, the fraction of P-HtM in Australia rises from 3 to 9 percent, and the fraction of W-HtM drops accordingly.

Age profiles. Age profiles of the fraction of poor and wealthy HtM households in each country are shown in Figure 1.10. For most countries, the fraction of P-HtM households declines monotonically with age. The exceptions are Australia and France, who have flat profiles. There are some marked differences in the age profiles of the W-HtM that can be explained by differences in portfolio holdings across countries. In countries where housing wealth is a substantial part of household portfolios, such as the U.S., Canada, and the U.K., the age profile is hump shaped with a peak in the early 40s. In contrast, in Australia and Germany, where a high fraction of W-HtM households hold retirement accounts, the share of W-HtM decreases with age.

An important caveat to these results is that because we infer age profiles from a single cross-section, we necessarily confound age, cohort, and time effects. This could explain, for example, why in Spain the share of W-HtM falls steadily with age. This pattern may reflect time effects, since 25-35 year-olds have faced much harsher economic conditions upon entry into the labor market than earlier cohorts.25

1.6.1 Robustness

Table 1.5 contains an extensive sensitivity analysis on our definitions of P-HtM and W-HtM households that parallels in Table 1.3.

25Figure 1.12 in the Appendix shows age-income profiles for each country by HtM status and confirms our findings from Section 1.5.2. The age-income profile for W-HtM households is much more similar to the profile of the N-HtM than to the profile for P-HtM. The only two exceptions are Italy and Spain, where the age-income paths for all three groups are very similar.
Figure 1.10: Age Profile of Fraction HtM by Country
Table 1.5: Robustness for Fraction P-HtM and W-HtM in each Category

<table>
<thead>
<tr>
<th></th>
<th>P-HtM</th>
<th>W-HtM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US</td>
<td>CA</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.138</td>
<td>0.121</td>
</tr>
<tr>
<td>In past year, c $&gt;$ y</td>
<td>0.157</td>
<td>0.181</td>
</tr>
<tr>
<td>Financially fragile</td>
<td>0.198</td>
<td>0.19</td>
</tr>
<tr>
<td>1 year income credit limit</td>
<td>0.116</td>
<td>0.09</td>
</tr>
<tr>
<td>Weekly pay period</td>
<td>0.119</td>
<td>0.105</td>
</tr>
<tr>
<td>Monthly pay period</td>
<td>0.165</td>
<td>0.149</td>
</tr>
<tr>
<td>Vehicles as illiquid</td>
<td>0.06</td>
<td>0.081</td>
</tr>
<tr>
<td>acc. as liquid for 60+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Businesses as illiquid</td>
<td>0.132</td>
<td>0.115</td>
</tr>
<tr>
<td>Direct as illiquid assets</td>
<td>0.137</td>
<td>0.12</td>
</tr>
<tr>
<td>Other valuables as illiq.</td>
<td>0.174</td>
<td>0.146</td>
</tr>
<tr>
<td>Excludes cc puzzle</td>
<td>0.135</td>
<td>0.127</td>
</tr>
<tr>
<td>Households</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HELOCs as liquid debt</td>
<td>0.137</td>
<td>—</td>
</tr>
<tr>
<td>Disposable income</td>
<td>0.175</td>
<td>—</td>
</tr>
<tr>
<td>Comm. cons. - beg. of period</td>
<td>0.202</td>
<td>0.182</td>
</tr>
<tr>
<td>Comm. cons. - end of period</td>
<td>0.273</td>
<td>0.247</td>
</tr>
</tbody>
</table>

Notes: Financially fragile households includes those households within 2,000 local currency units in liquid assets of their income threshold as HtM. Ret. acc. as liquid for 60+ puts retirement accounts into liquid wealth for households above age 60. Vehicles as illiquid assets includes the value of other valuables for France as the value of vehicles combined with other vehicles. Businesses as illiquid assets drops the self employment income sample selection and adds business assets to illiquid wealth and self employment income to labor income. Direct as illiquid assets classifies directly held mutual funds, stocks, corporate and government bonds as illiquid assets. Disposable income removes taxes from gross income. Taxes for the U.S. are estimated from NBER’s TAXSIM assuming all households file as single with no dependents. Comm. cons. - beg. (end) of period assumes households incur consumption commitments at the beginning (end) of the pay period.
Questions on whether household spending exceeded income in the past year are present in all surveys. Similarly to the U.S., we find larger shares of both P-HtM and W-HtM households when we use these direct questions to measure the incidence of HtM behavior. The difference is especially marked for Italy and Spain where, according to this criterion, over 60 percent of households—and hence three times the baseline estimate—are HtM. Extending the credit limit from one month of income to one year of income has a substantial effect for the Anglo-Saxon countries, but virtually no impact for the euro area countries. This finding is in line with the empirical distribution of liquid assets documented in Figure 1.2, which showed that households with negative net liquid wealth are extremely rare in the euro area countries.\footnote{Recall that, based on the definitions of Section 1.3, changing the credit limit affects HtM status only for households with negative liquid debt.}

The fraction of “financially fragile” households (those with liquid balances lower than the threshold plus 2,000 local currency units) is only 10-15 percentage points larger than the share of HtM in the Anglo-Saxon countries, but in most of the euro area countries it is 30 percentage points larger. This result is consistent with the distributions of liquid wealth reported in Figure 1.2 showing that in euro area countries there is a large mass of households just to the right of the threshold.

Shortening the pay-period to a week (or extending it to a month), from the bi-weekly baseline, has a small impact on the fraction of P-HtM households, but decreases (increases, respectively) the fraction of W-HtM households by 5 percentage points on average. Including vehicles as illiquid wealth shifts HtM households from poor to wealthy in every country, but to a lesser extent than in the United States. In two countries, Canada and Italy, including other non-financial assets (valuables, collectibles, jewels, etc.) in the definition of illiquid wealth shifts 12 and 5 percent of households from poor to wealthy HtM, respectively.\footnote{There are differences in this question across surveys. The SCF and the HFCS ask about the single most valuable asset not previously mentioned. In HILDA, they ask about collectibles. In the Canadian SFS, valuables are meant to include also the content of the principal residence. In light of this, the result for Canada is not surprising.} Including HELOCs among liquid debt has no effect, except in Canada, where the share of HtM increases by 8 percentage points.
Our baseline measure of income is income after transfers but before taxes, except for Canada where it is disposable income. For three countries, the U.S., the U.K., and Italy, we can analyze the effect of netting taxes at the source for every household. In all these three countries, the effect of this correction is minor.

1.7 Consumption Response to Income Shocks

In the previous sections we documented a sizable presence of W-HtM households across a number of countries, but our survey data did not allow us to investigate the consumption behavior of this group of households. In this section we show evidence that, as predicted by the theory presented in Section 1.2, these households have a large MPC out of transitory income shocks. We use data from the Panel Study of Income Dynamics (PSID) to estimate the consumption response to transitory changes in income using the methodology proposed by Blundell et al. (2008), hereafter BPP, and further examined in Kaplan and Violante (2010). The novelties of our empirical analysis, relative to BPP, are that we use a more recent sample period with enriched data and, most importantly, we estimate transmission coefficients of income shocks to consumption separately for different types of HtM households.

**Data source.** Estimating the consumption response to income shocks for households with different types of HtM status requires a longitudinal dataset with information on income, consumption, and wealth at the household level. Starting from the 1999 wave, the PSID contains the necessary data. The PSID started collecting information on a sample of roughly 5,000 households in 1968. Thereafter, both the original families and their split-offs (children of the original family forming a family of their own) have been followed. The survey was annual until 1996 and became biennial starting in 1997. In 1999 the survey augmented the consumption information available to researchers so that it now covers over 70 percent of all consumption items available.

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28 For the U.S., we resort to an imputation based on TAXSIM as explained in Section 1.5.1. The U.K. and Italian surveys ask households about their tax liabilities.
in the Consumer Expenditure Survey (CEX), and also asked a set of additional questions on the household balance sheet in every wave.29

Sample selection. We start with the PSID Core Sample and drop households with missing information on race, education, or state of residence, and those whose income grows more than 500 percent, falls by more than 80 percent, or is below $100. We drop households with top-coded income or consumption. We also drop households that appear fewer than three consecutive times, because identification of the coefficients of interest requires a minimum of three periods. In our baseline calculations, we keep households where the head is 25-55 years old. Our final sample has 39,772 observations over the pooled years 1999-2011 (seven sample years).

Definitions. The construction of our consumption measure follows Blundell et al. (2014). We include food at home and food away from home, utilities, gasoline, car maintenance, public transportation, child care, health expenditures, and education. Our definition of household income is labor earnings of the households plus government transfers. Liquid assets in the PSID include the value of checking and savings accounts, money market funds, certificates of deposit, savings bonds, and Treasury bills plus directly held shares of stock in publicly held corporations, mutual funds, or investment trusts. Before 2011, liquid debt is the value of debts other than mortgages, such as credit cards, student loans, medical or legal bills, and personal loans. In 2011, liquid debt includes only credit card debt. Net liquid wealth is liquid assets minus liquid debt. Net illiquid wealth is the value of home equity plus the net value of other real estate plus the value of private annuities or IRAs and the value of other investments in trusts or estates, bond funds, and life insurance policies.30 Net worth is the sum of net illiquid and net liquid wealth. Given these definitions of income and wealth, the HtM status indicators are constructed exactly as outlined in Section 1.3, where the pay-period is assumed to be two weeks, and the credit limit is one month

29Until 1999, the Wealth Files supplemented the annual survey every five years. Starting in 1999, they became biannual, like the survey itself. In 2009 and 2011, the wealth questions were enriched further with the Housing, Mortgage Distress, and Wealth Data Supplements.

30The two main discrepancies with the SCF definitions are that we do not attempt a cash imputation, and both CDs and saving bonds are in liquid, instead of illiquid, wealth. Since these two saving instruments are not common, we do not expect this discrepancy to affect our results. For example, if we classify CDs and saving bonds as liquid wealth in the 2010 SCF, the fraction of HtM drops by only 1 percentage point.
of income. In our PSID sample, 25 percent of households are W-HtM, roughly in line with the SCF estimates, but the share of the P-HtM is 21 percent, and hence is almost twice as large as its counterpart in the SCF.

**The BPP methodology.** We refer the reader to BPP and to Kaplan and Violante (2010) for a thorough description of the methodology. Here, we only sketch the key steps. As in BPP, we first regress log income and log consumption expenditures on year and cohort dummies, education, race, family structure, employment, geographic variables, and interactions of year dummies with education, race, employment, and region. We then construct the first-differenced residuals of log consumption $\Delta c_{it}$ and log income $\Delta y_{it}$. Recall that, since the survey is biannual, a period is two years. The income process $y_{it}$ is represented as an error component model which comprises orthogonal permanent and i.i.d. components. Hence, income growth is given by

$$\Delta y_{it} = \eta_{it} + \Delta \epsilon_{it},$$

where $\eta_{it}$ is the permanent shock and $\epsilon_{it}$ is the transitory shock. This is a common income process in the empirical labor literature, at least since MacCurdy (1982) and Abowd and Card (1989) who showed that this specification is parsimonious and fits income data well. The BPP estimator of the transmission coefficient of transitory income shocks to consumption, the MPC, is given by

$$\widehat{MPC}_t = \frac{\text{cov}(\Delta c_{it}, \Delta y_{i,t+1})}{\text{cov}(\Delta y_{i,t}, \Delta y_{i,t+1})},$$

(1.14)

The true marginal propensity to consume out of a transitory shock is defined as

$$MPC_t = \frac{\text{cov}(\Delta c_{it}, \epsilon_{it})}{\text{var}(\epsilon_{it})}$$

(1.15)
Table 1.6: MPC out of Transitory Income Shocks by HtM Status

<table>
<thead>
<tr>
<th></th>
<th>P-HtM</th>
<th>W-HtM</th>
<th>N-HtM</th>
<th>HtM-NW</th>
<th>N-HtM-NW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.243***</td>
<td>0.301***</td>
<td>0.127***</td>
<td>0.229***</td>
<td>0.201***</td>
</tr>
<tr>
<td></td>
<td>-0.065</td>
<td>-0.048</td>
<td>-0.036</td>
<td>-0.054</td>
<td>-0.03</td>
</tr>
<tr>
<td>Pre-tax earnings</td>
<td>0.131***</td>
<td>0.223***</td>
<td>0.122***</td>
<td>0.143***</td>
<td>0.164***</td>
</tr>
<tr>
<td></td>
<td>-0.043</td>
<td>-0.035</td>
<td>-0.027</td>
<td>-0.036</td>
<td>-0.023</td>
</tr>
<tr>
<td>Include food stamps</td>
<td>0.217***</td>
<td>0.264***</td>
<td>0.105***</td>
<td>0.203***</td>
<td>0.171***</td>
</tr>
<tr>
<td></td>
<td>-0.059</td>
<td>-0.045</td>
<td>-0.035</td>
<td>-0.05</td>
<td>-0.029</td>
</tr>
<tr>
<td>Cont. married households</td>
<td>0.095</td>
<td>0.193**</td>
<td>0.079*</td>
<td>-0.048</td>
<td>0.157***</td>
</tr>
<tr>
<td></td>
<td>-0.194</td>
<td>-0.079</td>
<td>-0.043</td>
<td>-0.129</td>
<td>-0.042</td>
</tr>
<tr>
<td>Stable marital status</td>
<td>0.239***</td>
<td>0.282***</td>
<td>0.110***</td>
<td>0.190***</td>
<td>0.195***</td>
</tr>
<tr>
<td></td>
<td>-0.085</td>
<td>-0.054</td>
<td>-0.038</td>
<td>-0.07</td>
<td>-0.033</td>
</tr>
<tr>
<td>Households with male heads</td>
<td>0.186**</td>
<td>0.193***</td>
<td>0.073*</td>
<td>0.150**</td>
<td>0.129***</td>
</tr>
<tr>
<td></td>
<td>-0.08</td>
<td>-0.058</td>
<td>-0.04</td>
<td>-0.064</td>
<td>-0.035</td>
</tr>
<tr>
<td>Monthly income</td>
<td>0.229***</td>
<td>0.288***</td>
<td>0.159***</td>
<td>0.236***</td>
<td>0.199***</td>
</tr>
<tr>
<td></td>
<td>-0.068</td>
<td>-0.053</td>
<td>-0.034</td>
<td>-0.057</td>
<td>-0.03</td>
</tr>
</tbody>
</table>

Notes: Bootstrapped standard errors based on 250 replications in parenthesis. Pre-tax earnings: transfers excluded. Include food stamps: food stamps are included among transfers. Cont married households: sample restricted to continuously married households. Stable marital status: sample restricted to households with no change in marital status. Households with male heads: households with female heads (mostly single) excluded from the sample. Monthly earnings: pay-period set to one month instead of two weeks. Levels of Significance: *** = 0.01, ** = 0.05, * = 0.10.

The estimator in (1.14) is a consistent estimator of (1.15) if the household has no foresight, or no advanced information, about future shocks, i.e.:

\[ \text{cov}(\Delta c_{it}, \eta_{i,t+1}) = \text{cov}(\Delta c_{it}, \epsilon_{i,t+1}) = 0, \]  

(1.16)

The estimator is implemented by an IV regression of \( \Delta c_{it} \) on \( \Delta y_{it} \), instrumented by \( \Delta y_{i,t+1} \). Note that \( \Delta y_{i,t+1} \) is correlated with the transitory shock at \( t \), but not with the permanent one. Kaplan and Violante (2010) show that the presence of tight borrowing constraints does not bias the estimate of the transmission coefficient for transitory shocks, an important finding in light of the fact that we are interested in the differential response of HtM households, who may be close to a constraint, and N-HtM households.

Results. Table 1.6 summarizes our results. In our baseline specification, the MPC of the W-HtM group is the highest, around 30 percent. In other words, in the first two years, the W-HtM
households consume 30 percent of an unexpected change in income whose effect entirely dissipates within the period. The point estimate of the MPC for the P-HtM is 24 percent, and for the N-HtM is less than 13 percent. Given the well known measurement error present in survey data, especially for consumption expenditures, and the small sample size, it is not surprising that these estimates are somewhat imprecise. However, the difference between the MPC for the W-HtM and the N-HtM is statistically significant.

When the sample is split between HtM and N-HtM based on net worth, the estimated transmission coefficients are very similar across the two groups. The group of HtM-NW is essentially the same as the P-HtM, and in fact their estimated MPCs are similar. However, among the N-HtM-NW there are also many W-HtM households that artificially inflate the estimate of the MPC. Based on this household classification, one would conclude that there is no evidence of a differential response of consumption to income shocks for households with different HtM status. A classification based on liquid and illiquid wealth, instead, finds economically significant differences.

The remaining rows in Table 1.6 offer robustness analysis with respect to the definition of income and consumption, household composition, and the assumed pay-period. The ranking of MPCs between wealthy, poor, and non-HtM is the same as the baseline specification. As predicted by the theory, the gap between HtM households based on the net worth criterion is always very small or is not statistically significant.

Our key finding that the consumption of the W-HtM displays excess sensitivity to transitory income shocks is in line with some recent findings. Misra and Surico (2013) expand on the research of Johnson et al. (2006) and Parker et al. (2013) on the U.S. fiscal stimulus payment episodes of 2001 and 2008. They conclude that, for both stimulus programs, the largest propensity to consume out of the tax rebate is found among households who own real estate but have high levels of mortgage debt. Cloyne and Surico (2013) exploit a long span of expenditure survey data for the U.K. and a narrative measure of exogenous income tax changes. They also find that homeowners with high leverage ratios exhibit large and persistent consumption responses to tax shocks. Baker (2013) combines several novel sources of household data on consumption expenditures, income,
and household balance sheets to investigate the comovement of income and consumption, at the micro level, around the Great Recession. He finds that expenditures of highly-indebted households with illiquid assets are especially sensitive to income fluctuations. Overall, this body of work confirms our finding in Figure 1.4 that highly-leveraged homeowners are likely to be W-HtM and, hence, to have large MPC out of income shocks.

1.8 Implications for Fiscal Policy

What does the existence of W-HtM households, together with their large propensities to consume out of transitory income shocks, imply for how one should think about fiscal policy? In this section we use a series of policy simulations from three alternative models to argue that W-HtM households should be modelled as a separate group: ignoring them leads to a distorted view of the effects of fiscal stimulus policies on aggregate consumption.

The first model that we use is the two-asset incomplete markets model from Kaplan and Violante (2014a,b), KV hereafter. We label this model SIM-2, since it extends the standard incomplete markets (SIM) life-cycle economy by adding a second illiquid asset that pays a higher return —through both a financial component and a housing services component— but is subject to a transaction cost. For the reasons explained in Section 1.2, the illiquidity due to the transaction cost means that the model generates households of all three HtM types. The version of the model we use here does not allow borrowing and has a transaction cost of $1,000.31

The second model, which we label SIM-1, is a standard one-asset incomplete markets life cycle model. The version that we adopt is the same as in KV, but with the transaction cost set to zero, and recalibrated to data on net worth alone, rather than data on illiquid and liquid assets separately. Since this is a one-asset model, it generates only P-HtM and N-HtM households, and has no W-HtM households.

31We refer the reader to KV for a full description of the model, its calibration, and a comparison of the predictions of the model with life-cycle data, and with the aggregate consumption response to the 2001 and 2008 fiscal stimulus payments as estimated by Johnson et al. (2006), and Parker et al. (2013), respectively.
The third model, which we label SP-S, is a spender-saver model in the spirit of Campbell and Mankiw (1989). In the SP-S model, some households (the savers) act as forward-looking optimizing consumers who can save in a single risk-free asset. The remaining households (the spenders) follow the rule-of-thumb consumption policy of consuming all their income in every period. This class of models is typically calibrated so that the distinction between the spenders and savers is based on their holdings of liquid wealth rather than net worth. Thus, in the SP-S model, the W-HtM and the P-HtM households are lumped together and considered to be the spenders, while the N-HtM households are considered to be the savers.

To summarize, SIM-2 is a two-asset economy in which the W-HtM households are explicitly modeled as a distinct group. SIM-1 is a “net-worth economy” where the W-HtM households are treated as if they were N-HtM households. Compared to SIM-2, SIM-1 greatly understates the fraction of HtM households. SP-S is a “liquid-wealth economy” where both the W-HtM and the P-HtM are treated identically as HtM households with an MPC that is always equal to 1. Thus, compared to SIM2, SP-S has the correct number of HtM households, but it greatly overstates their MPC.

From each of these three models, we simulate a cohort of households. For each household, we compute the quarterly consumption response to a one-time unexpected cash windfall, or cash loss, of different amounts ($50, $500, $2,000). We then divide the simulated cohort into twenty-seven bins, based on three income terciles, three age classes (22-40, 40-60, 60+) and the three HtM groups. For each of these bins we compute the average consumption response from the model. To obtain an aggregate response of the economy, we need shares of the population in each of these twenty-seven groups, which we obtain from our survey data from Sections 1.5 and 1.6.

Table 1.7 reports the quarterly average MPCs out of a $500 windfall in the three models, for the HtM groups and for some sub-groups defined by income and age, using group shares from the 2010 SCF. In the SIM-2 model, MPCs are very small for all N-HtM households, except for those who are income-poor and old. For high-income households who are N-HtM, the average MPC is

---

32 More recently explored in Galí et al. (2007), Eggertsson and Krugman (2012), and Justiniano et al. (2013).
Table 1.7: Quarterly Aggregate MPC out of Unexpected $500 Transfer

<table>
<thead>
<tr>
<th></th>
<th>SIM-2</th>
<th>SIM-1</th>
<th>SP-S</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-HtM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.35</td>
<td>0.06</td>
<td>1</td>
</tr>
<tr>
<td>Low Income</td>
<td>0.34</td>
<td>0.16</td>
<td>1</td>
</tr>
<tr>
<td>Middle Income</td>
<td>0.38</td>
<td>0.09</td>
<td>1</td>
</tr>
<tr>
<td>High Income</td>
<td>0.31</td>
<td>-0.02</td>
<td>1</td>
</tr>
<tr>
<td>Age ≤ 40</td>
<td>0.38</td>
<td>0.08</td>
<td>1</td>
</tr>
<tr>
<td>Age 40-60</td>
<td>0.3</td>
<td>0.01</td>
<td>1</td>
</tr>
<tr>
<td>Age &gt; 60</td>
<td>0.39</td>
<td>0.13</td>
<td>1</td>
</tr>
<tr>
<td>W-HtM</td>
<td>0.44</td>
<td>0.14</td>
<td>0.02</td>
</tr>
<tr>
<td>N-HtM</td>
<td>0.15</td>
<td>0.02</td>
<td>1</td>
</tr>
<tr>
<td>HtM</td>
<td>0.12</td>
<td>0.01</td>
<td>1</td>
</tr>
<tr>
<td>N-HtM</td>
<td>0.04</td>
<td>0.04</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


slightly negative. The intuition for this finding is discussed in detail in KV. It arises because the receipt of a $500 windfall may trigger a household who has already accumulated lots of liquid wealth, and is close to its planned date of deposit, to pay the transaction cost and make an earlier deposit into the illiquid account. Since such a household can effectively save at the rate of return on the illiquid asset, it chooses to consume less and save more than it would have in the absence of the income windfall. This example illustrates how explicitly modeling W-HtM behavior through transaction costs may alter the MPC even for N-HtM households. The MPCs for both the W-HtM and P-HtM households in the SIM-2 economy are substantial. They are slightly larger for the W-HtM than the P-HtM, particularly for households with a high level of income. As explained in Section 1.2, since the W-HtM have higher lifetime incomes than the P-HtM, they have higher target consumption and hence spend more out of an unexpected moderately-sized payment.

In the SIM-1 model, the MPCs for HtM households are almost identical to those for P-HtM households in the SIM-2 model, and the MPCs for N-HtM households are, in general, even smaller than those for N-HtM households in the SIM-2 model. In the SP-S model, by construction, the MPCs for the N-HtM households are the same as in the SIM-1 model and are equal to one for HtM households.

**Policy simulations for the U.S.** We now show that the three models yield very different predictions for the aggregate MPC out of unexpected, one-time, lump-sum transfers/taxes of dif-
Table 1.8: Quarterly Aggregate Consumption Responses.

<table>
<thead>
<tr>
<th>Model</th>
<th>SIM-2</th>
<th>SIM-1</th>
<th>SP-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>$500 Transfer</td>
<td>0.18</td>
<td>0.04</td>
<td>0.35</td>
</tr>
<tr>
<td>Size Asymmetry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$50 Transfer</td>
<td>0.29</td>
<td>0.05</td>
<td>0.35</td>
</tr>
<tr>
<td>$2000 Transfer</td>
<td>0.05</td>
<td>0.03</td>
<td>0.35</td>
</tr>
<tr>
<td>Sign Asymmetry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$500 Tax</td>
<td>0.42</td>
<td>0.14</td>
<td>0.36</td>
</tr>
<tr>
<td>Income Targeting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$500 Transfer, Bottom Tercile</td>
<td>0.26</td>
<td>0.07</td>
<td>0.5</td>
</tr>
<tr>
<td>$500 Transfer, Top Tercile</td>
<td>0.2</td>
<td>0.03</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Notes: Uses group composition from the 2010 SCF. SIM-2: two-asset, life-cycle, incomplete-market model. SIM-1: one-asset, life-cycle, incomplete-market model. SP-S: spender-saver model. All taxes and transfers are lump-sum, one-time, and unexpected.

We begin by analyzing a policy experiment where every household receives a $500 transfer, e.g., a stimulus payment. The aggregate MPC of the SIM-2 economy is 0.18. This value is substantially larger than the MPC of the SIM-1 economy (0.04) because the SIM-1 economy, by treating the W-HtM households as N-HtM, misses a large fraction of the population that have high MPCs. The aggregate MPC is highest for the SP-S economy (0.35) because this model implicitly assumes that all P-HtM and W-HtM households all spend the entire $500. Our discussion of Table 1.7 suggests that this assumption is extreme: in the SIM-2 economy, HtM households spend on average only 35%-45% of their payments in the quarter they are received.

Table 1.8 also shows that the degree of size asymmetry in the aggregate MPC differs remarkably across the three models. In the SIM-2 model, the consumption response to a $50 windfall is 0.29 while the response to a $2,000 windfall is only 0.05. The reason for this large asymmetry is the availability of an illiquid savings instrument subject to a transaction cost. For large enough windfalls, many HtM households in SIM-2 may find it optimal to pay the transaction cost and
make a deposit into the illiquid asset. However, for small windfalls, it is never optimal to adjust the illiquid asset: households thus face an intertemporal tradeoff governed by the (low) return on the liquid asset, and thus have a large incentive to consume. This size asymmetry is absent from both the SP-S and SIM-1 models. In the SP-S model it is absent because of the assumed rule-of-thumb behavior: the HtM households in the SP-S model always consume their entire transfer, regardless of its size. In the SIM-1 model there is only a modest decline in the MPC with the size of the payment because households always face the same inter-temporal trade off when making their consumption decisions.

The degree of sign asymmetry also differs across the three models. In the SIM-1 and SIM-2 models, the response to a lump-sum tax of $500 is substantially larger than the response to a $500 transfer. Even HtM households, who are at a kink in their budget constraints, desire to save some part of a positive windfall if it is large enough to push them off the kink. Negative income changes, however, cannot be smoothed for households at the constraint, and withdrawing from the illiquid account is too expensive to be optimal —recall that in the calibrated SIM-2 model, the transaction cost is $1,000. In the SP-S model, the response to positive and negative income shocks are essentially the same, since the HtM households have an MPC of 1 regardless of the sign of the shock.

Table 1.8 reveals that the models have different implications for the optimal degree of “income targeting” of fiscal stimulus transfers for maximizing the aggregate consumption response. A widely held view is that the aggregate consumption response to a fiscal stimulus policy, per dollar paid out, is strongest when the transfers are targeted to households with the lowest income, that is, stimulus payments should be phased out for middle- and high-income households for maximum effect. This view, which is based on the conjecture that HtM households are income-poor, ignores the W-HtM, a group with significantly higher income, as we showed in Sections 1.5.2 and 1.6. In line with this observation, the SIM-2 model generates only a very modest decline (0.26 to 0.20) between the MPC out of a $500 transfer for households in the lowest income tercile and households in the middle income tercile. The corresponding relative declines across income terciles are much
larger under the SIM-1 and SP-S models. In the SIM-1 model, the only high-MPC households are the low-income P-HtM; in the SP-S model, all HtM households are assumed to have the same MPC, while under the SIM-2 model we saw in Table 1.7 that, among W-HtM households, MPCs are increasing in income.

**Implied cross-country variation in effects of policy.** We now explore what the three models predict for the aggregate response to a $500 fiscal stimulus check in each of the eight countries in our sample. To do this, we use our survey data to estimate the fraction of households in each country who fall into each of the 27 bins, and then apply these country-specific group weightings to the model-generated MPCs. To illustrate the differences in model predictions, Figure 1.11 plots the estimated aggregate MPC under the SIM-2 model against the corresponding MPC under the SIM-1 model (triangles) and the SP-S model (circles).

The figure shows striking differences in the amount of cross-country dispersion in the aggregate MPC predicted by the three models. There is much less dispersion in the SIM-1 model compared to the SIM-2 model because, by treating the W-HtM as N-HtM, the SIM-1 model misses most of the cross-country variation in HtM behavior. In contrast, there is more dispersion in the SP-S model than in the SIM-2 model. This is because, by assigning an MPC of 1 to all the W-HtM households, compared to an MPC of 0.44 in the SIM-2 model, the SP-S model exaggerates existing cross-country heterogeneity in the fraction of HtM households.

These experiments clearly illustrate why it is important to think deeply about the behavior of W-HtM households when considering the design of fiscal policies. With respect to the traditional view based on SIM-1 or SP-S models, we demonstrate three lessons: (i) there is limited scope for stimulating aggregate consumption by increasing the transfer size; (ii) the aggregate consumption response to a lump-sum tax is much stronger, in absolute value, than the response to an equal-size transfer; and (iii) targeting stimulus payments exclusively towards low-income families will miss a substantial fraction of liquidity-constrained households.
Figure 1.11: Estimated Aggregate Consumption Response by Country. Notes: SIM-2 model (x axis), SIM-1 model (triangles, left y axis) and SP-S model (circles, right y axis). The dashed line is the 45 degree line.

1.9 Conclusion

We set out to investigate, theoretically and empirically, the behavior of wealthy hand-to-mouth households, an often overlooked, but highly relevant part of the population, and to reflect on their implications for macroeconomic modeling and fiscal policy design. We conclude by taking stock of what we have learned.

Theoretically, we showed that wealthy hand-to-mouth behavior can occur when households face a trade-off between the long-run gain from investing in illiquid assets (i.e., assets that require the payment of a transaction cost for making unplanned deposits or withdrawals), and the short-run cost of having fewer liquid assets available to smooth consumption.

Empirically, we documented that 30 percent of households in the U.S. are hand-to-mouth, and that this fraction has been relatively constant over the past two decades. The share of hand-to-mouth households varies somewhat across the eight countries in our study, from less than 20 percent in Australia and Spain to over 30 percent in the U.K. and Germany. Given our identification strategy, these estimates are likely to be a lower bound. The key finding is that in all countries, the
vast majority of hand-to-mouth households, at least two-thirds of them, are wealthy hand-to-mouth, not poor hand-to-mouth.

Who are the wealthy hand-to-mouth? We highlight three features. First, unlike poor hand-to-mouth households, the wealthy hand-to-mouth are not predominantly young households with low income. Rather, the frequency of wealthy hand-to-mouth status has a hump-shaped age profile that peaks in the early forties and an income profile that mirrors strongly that of the non hand-to-mouth. Second, they are not simply poor hand-to-mouth households with very small holdings of illiquid assets. Rather, they hold substantial wealth in housing and retirement accounts, in the same proportions as non hand-to-mouth households. Finally, their hand-to-mouth status is somewhat more transient than that of the poor hand-to-mouth.

Why does this group of households deserve the attention of economists and policy makers? Wealthy hand-to-mouth households are important because they have large consumption responses to transitory income shocks —a crucial determinant of the efficacy of many types of fiscal interventions, such as the fiscal stimulus payments that were implemented in the last two recessions. To demonstrate this, we use PSID data to show that the transmission coefficient of transitory income shocks into consumption is significantly larger for wealthy (and poor) hand-to-mouth households than for non hand-to-mouth households.

The wealthy hand-to-mouth thus have consumption responses that, in many ways, are similar to the poor hand-to-mouth, yet have demographic characteristics and portfolio composition that resemble the non hand-to-mouth. This suggests that the three types of hand-to-mouth households each need their own unique place in frameworks that are to be used for analyzing and forecasting the effects of fiscal policy. Macroeconomists need to move beyond one-asset models, such as those in the spirit of Aiyagari (1994), Huggett (1996), and Ríos-Rull, J.V. (1995), since these models assume wealthy hand-to-mouth households are as unconstrained as non hand-to-mouth ones. They also need to move beyond spender-saver models, such as those in the spirit of Campbell and Mankiw (1989), and Eggertsson and Krugman (2012), since these models treat all hand-to-mouth households identically, and thus assume that wealthy hand-to-mouth households are as constrained
as poor hand-to-mouth. In particular, by ignoring the fact that wealthy hand-to-mouth can use illiquid assets to buffer large negative shocks, these models exaggerate the financial fragility of this group. In the last section, we ran several fiscal policy experiments to illustrate where misleading inferences would be obtained by using either of these two simpler models of hand-to-mouth behavior.

**References**


URL: http://ideas.repec.org/a/bin/bpeajo/v42y2011i2011-01p83-150.html


Appendix

1.A A Simple Model of Wealthy HtM Behavior

In this Appendix, we provide a more detailed analysis of the model in Section 1.2.

Consider a household that lives for periods, $t = 0, 1, 2$, but consumes only in the last two periods of life. Preferences over consumption at $t = 1, 2$ are given by

$$v_0 = u(c_1) + u(c_2)$$

with no discounting. In period 0, the household has an initial endowment $\omega$ and makes a portfolio allocation decision. Two assets are available as saving instruments. First, there is an illiquid asset $a$ that pays off a gross return $R$ before the consumption decision in period 2, but cannot be accessed at the time of the consumption decision in period 1. Second, there is a liquid asset $m$ that can be accessed before the consumption decision in both periods, but pays a return $1 < R$. For now, we do not allow the agent to borrow, i.e. take negative a position in the liquid asset, but we relax this assumption in Section 1.A.4. After the initial portfolio allocation decision, households receive income $y_1$ and make their consumption and liquid saving decision in period 1. In the second, and last, period, they receive income $y_2$ and consume this endowment plus their savings in liquid and illiquid wealth. The only two decisions to characterize are therefore the initial portfolio allocation decision, and the consumption/saving decision at $t = 1$.

We make the following normalizations and parametric assumptions. Period utility $u$ is CES with intertemporal elasticity of substitution $\sigma > 0$. We set the initial endowment $\omega$ to 1, so the
initial portfolio allocation \((m_1, a)\) has the interpretation of shares of wealth invested in liquid and illiquid wealth. We set \(y_2 = \Gamma > 1\) and we allow two possible values for \(y_1, \{y_L, y_H\}\) where \(y_L = 0\) and \(y_H > R + \Gamma\). We refer to these two cases as “low-income” and “high-income” paths. The low income path is increasing and the high income path is decreasing.

Our characterization of hand-to-mouth behavior concerns the asset position at the time of the \(t = 1\) consumption decision. We define a household as not hand-to-mouth (N-HtM) if, after consuming at \(t = 1\), it holds a positive amount of liquid assets, i.e. \(m_2 > 0\) and \(a \geq 0\). We define a household as poor hand-to-mouth (P-HtM) if, after consuming at \(t = 1\), it does not hold any liquid or illiquid assets, i.e. \(m_2 = 0\) and \(a = 0\). We define a household as wealthy hand-to-mouth (W-HtM) if, after consuming at \(t = 1\), it holds a positive amount of illiquid assets but no liquid assets, i.e. \(m_2 = 0\) and \(a > 0\).\(^{33}\) Therefore, the \(t = 1\) consumption/saving decision determines whether an agent is HtM, and the initial portfolio allocation determines whether a HtM agent is poor or wealthy HtM.

1.A.1 Solution without Illiquid Asset

We begin by analyzing a special case where there is no illiquid asset. In this case we refer to the liquid asset as *net worth*. We solve the model backwards, starting from the consumption decision at \(t = 1\). The problem faced by the household at \(t = 1\) is

\[
v_1(m_1) = \max_{c_1, m_2} u(c_1) + u(m_2 + \Gamma)
\]

\[
s.t.
\]

\[
c_1 + m_2 = y_1 + m_1
\]

\[
m_2 \geq 0
\]

\(^{33}\)The final case, \(m_2 > 0\) and \(a = 0\), which is another form of N-HtM behavior, is never optimal given the assumptions above, but could be easily accommodated.
which has the solution

\[
m_2 = \max \left\{ \frac{y_1 - \Gamma + m_1}{2}, 0 \right\}. \tag{1.17}
\]

The interior solution for \( m_2 \) implies a perfectly smooth consumption path, \( c_1 = c_2 = \frac{(y_1 + \Gamma + m_1)}{2} \) because there is no discounting and the interest rate on the liquid asset (the only saving vehicle available at \( t = 1 \)) is 1. The corner solution \( m_2 = 0 \) yields an increasing consumption path, \( c_1 = y_1 + m_1, \ c_2 = \Gamma \). Since the liquid asset is the only available asset, the initial portfolio allocation decision is trivial, and \( m_1 = 1 \).

Thus there two cases, depending on the income path. Under the low income path with \( y_L = 0 < \Gamma - 1 \), equation (1.17) reveals that the constraint binds at \( t = 1 \) and the household is P-HtM with an increasing consumption profile. Under the high income path with \( y_H > R + \Gamma > \Gamma - 1 \), the constraint is not binding and the household is N-HtM with a smooth consumption profile.

1.A.2 Solution with Illiquid Asset

We now turn to the general two-asset model. At \( t = 1 \) the consumption decision is

\[
v_1(m_1, a) = \max_{c_1, m_2} u(c_1) + u(m_2 + Ra + \Gamma)
\]

s.t.

\[
c_1 + m_2 = y_1 + m_1
\]

\[
m_2 \geq 0
\]

which has the solution

\[
m_2 = \max \left\{ \frac{y_1 - \Gamma + m_1 - Ra}{2}, 0 \right\}. \tag{1.18}
\]

The interior solution for \( m_2 \) implies the consumption path is perfectly smooth, \( c_1 = c_2 = \frac{(y_1 + \Gamma + m_1 + Ra)}{2} \), while the corner solution yields the consumption pair \( (c_1 = y_1 + m_1, c_2 = \Gamma + Ra) \). Note that under the low income path \( y_L = 0 < \Gamma - 1 \leq \Gamma - m_1 + Ra \) for any feasible pair \((a, m_1)\). Therefore, equation (1.18) implies that the constraint will bind at \( t = 1 \), regardless of the initial portfolio allocation,
and $m_2 = 0$. In this case, the household is therefore HtM. Instead, under the high income path, $y_H > R + \Gamma \geq \Gamma - m_1 + Ra$ for any pair $(a,m_1)$. Hence equation (1.18) implies that the constraint will not bind at $t = 2$, regardless of the initial portfolio allocation, and $m_2 > 0$. In this case, the household is N-HtM.

Next, consider the initial portfolio allocation decision. Under the high income path, when the constraint is not binding, the problem is

$$v_0 = \max_{a,m_1} u \left( \frac{y_1 + \Gamma + m_1 + Ra}{2} \right)$$

subject to

$$1 = a + m_1$$

It is immediate to see that the objective function is steeper in $a$ than in $m_1$ because of the higher rate of return on the illiquid asset. Hence the household invests all of its initial endowment in the illiquid asset and we have a corner solution with $a = 1$. In this case, the household is N-HtM with a perfectly smooth consumption profile $c_1 = c_2 = (y_H + \Gamma + R)/2$.

Under the low income path ($y_1 = y_L = 0$) the constraint binds at $t = 1$ and $m_2 = 0$. The problem becomes

$$v_0 = \max_{a,m_1} u(m_1) + u(Ra + \Gamma)$$

subject to

$$1 = a + m_1$$

which has the solution

$$a = \max \left\{ \frac{R - \Gamma}{R + R_\sigma}, 0 \right\}, \quad m_1 = \min \left\{ \frac{R + \Gamma}{R + R_\sigma}, 1 \right\}. \quad (1.19)$$

Note that the portfolio allocation decision will always imply $m_1 > 0$ since the household needs liquidity at $t = 1$ for consumption. Thus, it only remains to determine when $a = 0$ and when $a > 0$. 

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If \( 1 < R \leq \Gamma^{\frac{1}{\bar{\sigma}}} \), equation (1.19) implies that \( a = 0 \) and the household is P-HtM. In this case the return on the illiquid asset is not large enough for the household to tolerate the large jump in consumption between \( t = 1 \) and \( t = 2 \) that would occur if it were to save some of the initial endowment in illiquid wealth. Hence \( c_1 = 1 \) and \( c_2 = \Gamma \), and therefore \( c_2 = \Gamma c_1 \). When \( R > \Gamma^{\frac{1}{\bar{\sigma}}} \), we instead have an interior solution for the portfolio allocation, and the agent is W-HtM with consumption \( c_1 = (R + \Gamma) / (R + R^{\bar{\sigma}}) \) and \( c_2 = R^{\bar{\sigma}} c_1 > \Gamma c_1 \).

1.A.3 Implications for MPC out of Income Transfers

Suppose that after the initial portfolio allocation decision, but before the consumption decision at \( t = 1 \), the household receives an unexpected transfer \( \tau \) from the government. What is the household’s MPC out of this transfer? A N-HtM household has an MPC of exactly \( 1/2 \), since it smooths the payment equally across the two periods. Next, consider the problem of a household who, in absence of the transfer would be P-HtM, i.e., it faces \( y_1 = y_L = 0 \) and optimally chose the portfolio allocation \((m_1 = 1, a = 0)\):

\[
v_1(1,0) = \max_{c_1,m_2} u(c_1) + u(m_2 + \Gamma) \quad \text{s.t.} \quad c_1 + m_2 = \tau + 1, \quad m_2 \geq 0
\]

which has the solution

\[
m_2 = \max \left\{ \frac{\tau - \Gamma + 1}{2}, 0 \right\}.
\]

For any small payment \( 0 < \tau < \Gamma - 1 \), this household remains P-HtM and has an MPC of 1. Its consumption path is: \( c_1 + 1 + \tau, \quad c_2 = \Gamma \). If, instead, \( \tau \geq \Gamma - 1 \), the household becomes unconstrained, consumption equals \((\tau + \Gamma + 1) / 2\tau\) in both periods and its MPC out of the transfer drops to \((\tau + \Gamma - 1) / 2\tau\) which approaches \(1/2\) as \( \tau \) increases.
Finally, consider the problem of a household who, in absence of the transfer would be W-HtM. In other words, it faces $y_1 = y_L = 0$ and optimally chose $a = a^* = (R^\sigma - \Gamma) / (R + R^\sigma) > 0$:

$$v_1(1 - a^*, a^*) = \max_{c_1, m_2} u(c_1) + u(m_2 + Ra^* + \Gamma)$$

s.t.

$$c_1 + m_2 = \tau + (1 - a^*)$$

$$m_2 \geq 0$$

The solution to this problem is:

$$m_2 = \max \left\{ \frac{\tau - \Gamma + (1 - a^*) - Ra^*}{2}, 0 \right\}.$$ 

This household has a MPC of 1 as long as $\tau \leq \Gamma - 1 + (R + 1) a^*$. This condition is weaker than the condition for a P-HtM to have a MPC of 1 because the income (and consumption) ratio between $t = 1$ and $t = 2$ is higher for a W-HtM than a P-HtM.\textsuperscript{34}

1.A.4 Unsecured Credit

We now extend the model and allow households to access credit to finance consumption at $t = 1$. We assume that households can borrow up to a fraction $\phi \leq 1$ of their future income $\Gamma$ and that the interest rate on borrowing is $R^b > 1$. Hence the credit limit is $m = \phi \Gamma / R_b$. To make the exercise interesting, we impose the additional restriction that $R^b < \Gamma$, which ensures that a household with the low income path will always borrow a positive amount. Indeed, the no-borrowing case studied above can be interpreted as a model where borrowing is allowed but $R^b \geq \Gamma$, and credit is so expensive that no household ever uses it. Since the role of the intertemporal elasticity of

\textsuperscript{34}Put differently, the shadow value of an additional unit of income at $t = 1$ is higher for the W-HtM than for the P-HtM. If we let $\lambda$ be the shadow value of a unit of income in period 1, for a P-HtM agent we have $\lambda = u'(1 + \tau) - u'(\Gamma)$ and for a W-HtM agent we have $\lambda = u'(\tau + (1 - a)) - u'(Ra + \Gamma)$, which is larger.
substitution is well understood from the previous analysis, we impose $\sigma = 1$ (i.e., logarithmic utility) to simplify the exposition.

**Solution without illiquid asset**

Under the high income path, the household is not constrained and chooses to save some of its high income into the liquid asset at $t = 1$. Since the borrowing constraint is not binding, the solution with borrowing is unchanged and $m_2 > 0$.

Under the low income path, the problem is more interesting. In this case, $m_2 \leq 0$ and at $t = 1$:

$$v_1 = \max_{c_1, m_2} \log(c_1) + \log \left( R^b m_2 + \Gamma \right)$$

subject to

$$c_1 + m_2 = 1$$

$$m_2 \geq -\frac{\phi \Gamma}{R^b}$$

which has the solution

$$m_2 = \max \left\{ -\frac{\Gamma - R^b}{2R^b}, -\frac{\phi \Gamma}{R^b} \right\}.$$  

Since $R^b < \Gamma$, the household always borrows a positive amount. Moreover, if $R^b < \Gamma(1 - 2\phi)$, then the credit limit is binding. The household is forced to choose an increasing consumption path, $c_1 = 1 + \phi \Gamma / R^b$, $c_2 = \Gamma(1 - \phi)$. If, instead, $\Gamma > R^b \geq \Gamma(1 - 2\phi)$, the solution for $m_2$ is negative and interior: by borrowing, it can perfectly smooth consumption at the level $c_1 = c_2 = (R^b + \Gamma) / 2$.

In light of the discussion in Section 1.A.3 about MPCs, only the household at the credit limit has a MPC equal to 1, and only if the transfer is small enough not to change its HtM status. For small transfers, a household with an interior negative position is unconstrained and has a MPC equal to $1/2$.  

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Solution with illiquid asset

Once again, under the high income path the household is not constrained at $t = 1$, so allowing for borrowing has no effect on its decisions. Under the low-income path where $y_1 = y_L = 0$, the household may want to borrow at $t = 1$. Its consumption decision at $t = 1$ is:

$$v_1(m_1, a) = \max_{c_1, m_2} \log(c_1) + \log \left( R^b m_2 + Ra + \Gamma \right)$$

s.t.

$$c_1 + m_2 = m_1$$

$$m_2 \geq -\frac{\phi \Gamma}{R_b}$$

which has the solution

$$m_2 = \max \left\{ \frac{R^b m_1 - \Gamma - Ra}{2 R^b}, -\frac{\phi \Gamma}{R_b} \right\}$$

If $R^b < \Gamma$, then for every feasible portfolio allocation $(m_1, a)$, the first argument of the max operator in the above equation is negative, and hence $m_2 < 0$. The credit limit is binding when $R^b < \frac{\Gamma (1 - 2 \phi) + Ra}{m_1}$, i.e., when borrowing is sufficiently cheap. In this case, consumption is given by $c_1 = m_1 + \phi \Gamma / R_b$ and $c_2 = \Gamma (1 - \phi) + Ra$. When borrowing is sufficiently expensive, i.e. $R^b \geq \frac{\Gamma (1 - 2 \phi) + Ra}{m_1}$, the solution for $m_2$ is interior in the negative range and consumption is fully smoothed with $c_1 = c_2 = \left( R^b m_1 + \Gamma + Ra \right) / 2$.

We now analyze the portfolio decision at $t = 0$. Since we are interested in characterizing HtM behavior, we focus on the case where the borrowing constraint binds, i.e. $m_2 = -\phi \Gamma / R_b$. In this case, the portfolio problem is:

$$v_0 = \max_{a, m_1} u \left( m_1 + \phi \Gamma / R_b \right) + u (Ra + \Gamma (1 - \phi))$$

s.t.

$$1 = a + m_1$$
with solution

\[ a = \max \left\{ R + \left[ \frac{(1 + R/R^b) \phi - 1}{2R} \right] \Gamma, 0 \right\}. \]

Using the restriction \( R^b < \Gamma \), it can be shown that \( a = 0 \) if \( R < R^b (1 - \phi) / (1 + \phi) \) and \( a \) is strictly positive if \( R > \Gamma (1 - \phi) / (1 + \phi) \). The former parameter configuration corresponds to a P-HtM household who has borrowed up to the credit limit. The latter parameter configuration corresponds to a household who chooses to save into the illiquid asset and then borrows up to its credit limit. This is a W-HtM household with negative liquid wealth (at the credit limit). Both households will have an MPC of 1 out of a small transfer.

1.B Measurement Bias

Without loss of generality, let the pay-period be the unit interval \([0, 1]\), where 0 is the beginning and 1 the end. Denote a generic point within the pay period as \( t \). Let \( y_0 \) be income paid at the beginning of the pay-period (by definition), \( s_0 \) be the liquid saving transferred from the previous pay-period, and \( s_1 \) be the end of the pay-period liquid saving. Initial and final balances of liquid wealth are therefore:

\[
\begin{align*}
m_0 &= y_0 + s_0 \\
m_1 &= s_1.
\end{align*}
\]

We always assume that, during the pay-period, consumption expenditures \( c_t \) occur at a constant rate. Recall that this is optimal if, as we have assumed so far, there is no discounting and the return on the liquid asset is one. Then, at every \( t \in [0, 1] \), we have that \( c_t = y_0 + s_0 - s_1 \). Moreover, at a point \( t \) the balances of liquid wealth are

\[
m_t = y_0 + s_0 - c_t \cdot t = (y_0 + s_0) (1-t) + s_1 t.
\]
Note that, since $t$ is uniformly distributed over the unit interval,

$$m_t \sim U [s_1, y_0 + s_0],$$

and its mean (average balances of liquid wealth) is

$$\bar{m} = (y_0 + s_0 + s_1) / 2.$$

We start by analyzing the measurement of HtM households when what we observe is average balances of liquid wealth.

### 1.B.1 Measurement through Average Balances

We first analyze the measurement of HtM households at the zero kink, then that of households at the credit limit.

**Kink at zero**

We abstract from debt for now, so $s_0 \geq 0$ and $s_1 \geq 0$. In the model, a household is HtM when $s_1 = 0$. According to our identification strategy of Section 3, a household is HtM when $\bar{m} \leq y_0 / 2$. Given (1.21), this condition that corresponds to

$$s_1 + s_0 \leq 0.$$

Thus, our estimator is a lower bound because, for this condition to be true it must be that $s_0 = s_1 = 0$, whereas the true definition just requires $s_1 = 0$. Put differently,

$$\Pr[\bar{m} \leq y_0 / 2 | s_1 = 0] = \Pr[s_0 = 0 | s_1 = 0] < 1$$
and
\[
\Pr[\bar{m} \leq y_0/2|s_1 > 0] = \Pr[s_1 + s_0 = 0|s_1 > 0] = 0
\]

so, we always underestimate the number of true HtM and never mistake a non HtM agent for a HtM.

**Kink at the credit limit**

Let the credit limit be \( m > 0 \). In the model, a household is HtM when \( s_1 = -m \). According to our identification strategy, a household is HtM when \( \bar{m} \leq y_0/2 - m \), a condition that corresponds to

\[
(s_1 + s_0)/2 \leq -m,
\]

which, once again means our estimator is a lower bound because, for this condition to be true it must be that \( s_0 = s_1 = -m \), whereas the true definition just requires \( s_1 = -m \). Put differently,

\[
\Pr[\bar{m} \leq y_0/2 - m|s_1 = -m] = \Pr[s_0 = -m|s_1 = -m] < 1
\]

and

\[
\Pr[\bar{m} \leq y_0/2 - m|s_1 > -m] = \Pr[(s_1 + s_0)/2 = -m|s_1 > -m] = 0
\]

so, once again, we always underestimate the number of true HtM and never mistake a non HtM agent for a HtM.

**1.B.2 Measurement through Random Balances**

Suppose now we observe balances \( m_t \) at a random point in time \( t \) over the period \([0, 1]\). Recall that in this case \( m_t \) is uniformly distributed as defined by (1.20).
Kink at zero

We identify as HtM a household who has \( m_t \leq y_0/2 \), an event occurring with probability

\[
\Pr [m_t - y_0/2 \leq 0] = \frac{y_0/2 - s_1}{y_0 + s_0 - s_1}.
\]

If \( s_1 = 0 \), then the household is truly HtM, but we would catch it only with probability \( y_0/ [2 (y_0 + s_0)] \), so we are missing some truly HtM households. In other words

\[
\Pr [m_t - y_0/2 \leq 0|s_1 = 0] = \frac{y_0/2}{y_0 + s_0} < 1.
\]

If the household is not HtM, i.e., \( s_1 > 0 \), then we would mistake it for a HtM household only if \( s_1 < y_0/2 \) because

\[
\Pr [m_t - y_0/2 \leq 0|s_1 > 0] = \frac{y_0/2 - s_1}{y_0 + s_0 - s_1}.
\]

To sum up, we may mistake a non HtM household for a HtM only if its end-of period savings are below a half of pay-period income.

Kink at the credit limit

In this case, we call HtM anyone with \( m_t \leq y_0/2 - m \). The probability we identify it as HtM is

\[
\Pr [m_t - y_0/2 + m \leq 0] = \frac{y_0/2 - m - s_1}{y_0 + s_0 - s_1}.
\]

If \( s_1 = -m \), and it is truly a HtM household, then

\[
\Pr [m - y_0/2 + m \leq 0|s_1 = -m] = \frac{y_0/2}{y_0 + s_0 + m} < 1,
\]

since \( s_0 \geq -m \), which means that we miss some truly HtM households.
If the household is not HtM, i.e., $s_1 > -m$, then we would mistakenly call it HtM only if $m + s_1 < y_0/2$ because

$$
\Pr [m - y_0/2 \leq 0 | s_1 > 0] = \frac{y_0/2 - m - s_1}{y_0 + s_0 - s_1}.
$$

To sum up, we may mistake a non HtM household for a HtM only if its end-of period balances of liquid wealth are less than half-income away from the credit limit.

**1.C Survey Data on Household Portfolios**

The countries included in our study are the U.S., Canada, Australia, the U.K., and the four largest economies in the Euro area: Germany, France, Italy, and Spain. In this Appendix, we provide background information on each survey.

**1.C.1 United States: SCF**

The data for the United States come from the Survey of Consumer Finances (SCF). The SCF is sponsored by the Board of Governors of the Federal Reserve System in cooperation with the Statistics of Income Division of the Internal Revenue Service (IRS). The survey has been conducted every three years and collects detailed information on household balance sheets, income, and demographic characteristics for a representative cross-section of U.S. households. We conduct analysis on the 1989 to 2010 surveys.\(^{35}\) While the surveys do not normally follow households over time, there is a panel component to the 2007 survey where a subset of households were contacted and re-surveyed in 2009. See Bricker et al. (2011) for more information on the 2007-2009 panel of the SCF.

The target population for the survey is all private households residing in the U.S. at the time of data collection. The SCF uses a dual frame sample design. Households in the first frame

\(^{35}\)The survey started in 1983, but major technical revisions to the survey were implemented in 1989 and the structure and questions have largely been preserved since then. Since 1992, data have been collected by the National Opinion Research Center at the University of Chicago.
are intended to provide representative coverage of various characteristics of households in the United States. Households in the second frame are drawn from statistical records derived from tax information provided by the IRS and are intended to disproportionally select relatively wealthy households. This oversampling design allows the SCF to more accurately measure the distribution and composition of wealth for the population as a whole, given the extreme right skewness in the distribution of holdings for many asset classes.

The main interviewee is the household head. The head is defined as the core individual in single households, the male in mixed-sex couples, and the older individual in same-sex couples. In the case of couples, either member can be interviewed and the data are rearranged after to define the household head in this way. Summary information is then collected about all other household members. Labor market, pension, and demographic data on the spouse or partner of the respondent are also collected. See Kennickell (2005) for more information of the sample design of the SCF.

1.C.2 Canada: SFS

The data for Canada come from the Survey of Financial Security (SFS). The SFS is a cross-sectional survey implemented by Statistics Canada in 1999 and 2005, and is intended to provide a comprehensive picture of net worth of Canadian households. In our analysis, we use data from 2005. The survey asks questions on the value of all major financial and non-financial assets and liabilities.

The surveyed households are a representative sample of all private households in Canadian provinces. Like the SCF, the SFS uses a dual frame sample design. The main sample is a sample selected from the Labour Force Survey sampling frame. In order to over-sample high income households, the second sample is drawn from geographic areas in which there are a large proportion of family units with total income over a certain threshold.

All individuals older than 15 years of age in the household are asked questions regarding income, demographics, education, and employment. Questions regarding household assets and
liabilities are asked to the household member deemed most knowledgeable on the subject. See Pensions and Wealth Surveys Section (2006) for more information about the 2005 SFS.

1.C.3 Australia: HILDA

The data for Australia come from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The Survey is managed by the Melbourne Institute of Applied Economic and Social Research at the University of Melbourne. HILDA is a broad social and economic longitudinal survey, with particular attention paid to family and household formation, income and work. Wave One of the survey was implemented in 2001, and households have since been interviewed annually.

The original sample for the HILDA survey was a large national probability sample of Australian households occupying private dwellings. All members of the households providing at least one interview in Wave 1 form the basis of the panel to be pursued in each subsequent wave. The sample has been extended to include any new household members resulting from composition changes of the original households.

In addition to regular questions about economic and subjective well-being, the survey features special modules covering specific topics. In particular, Waves Two (2002), Six (2006), and Ten (2010) contain data from the wealth module that examines the composition of household’s balance sheets.

Data for our analysis come from the Household Form and the Person Questionnaire. The Household Form records basic information about the composition of the household. The Household Questionnaire is administered primarily to one member of the household, and covers childcare, housing, household spending, and the wealth modules in Waves Two, Six, and Ten. The Person Questionnaires are asked to all members of the household aged 15 years and older, and collects information on family background, education, employment, and income among other things. See Watson and Wooden (2002) for more information on the HILDA.
1.C.4 United Kingdom: WAS

The data for the United Kingdom come from the Wealth and Assets Survey (WAS). The WAS is a longitudinal survey that is conducted by the Office of National Statistics (ONS). The survey is intended to measure the economic well-being of households in the U.K., by documenting the level of household savings and debt, lifecycle accumulation of wealth, and participation in pension schemes.

For the first wave, the survey aimed to sample all persons living in private households in Great Britain. The WAS also uses a dual frame design, using the first frame to meet precision targets and the second frame to over-sample the top wealth decile. The sample for the first frame was drawn from the Royal Mail’s database of all addresses in the UK. Households where at least one member was likely to have total financial wealth above a certain threshold were flagged by Her Majesty’s Revenue and Customs. Flagged households were sampled in such a way that they had two and a half times higher probability of being sampled than non-flagged households. Wave One was conducted from July 2006 to June 2008, and attempts were made to contact respondents for a follow-up interview two years later for Wave Two. About two-thirds of cooperating households from Wave One completed the Wave Two interview from July 2008 to June 2010. In our analysis, we use data from Wave Two.

The questionnaire is divided into two parts. The first part is the household questionnaire which is completed by one person in the household designated to be the household reference person, and collects household-level information on household demographics, as well as information about household assets and liabilities. The second part of the questionnaire is an individual questionnaire administered to each adult aged 16 or over in the household, and asks in-depth questions about economic status, education, employment, benefits, and individual financial assets. See Daffin (2009) and Black (2011) for more information on the WAS.
1.C.5 Euro area: HFCS

The data for Germany, France, Italy and Spain come from the Household Finance and Consumption Survey (HFCS). The HFCS is a joint project administered by all of the central banks of the Eurosystem and three National Statistical Institutes. The survey provides detailed information on balance sheets, demographics, and other economic variables for households in Euro area countries. Fieldwork in the various countries was conducted between November 2008 and August 2011.

The HFCS is conducted and financed by each participating institution. For some member countries, a previous wealth survey had already existed, and for others, an entirely new survey had to be set up. The HFCS represents an effort towards gradual harmonization of the content of the surveys across the member countries. The survey will be conducted in each country every two to three years.

The core questionnaire, asked in every country, is composed of three parts. The first comprises questions regarding the household as a whole and contains questions regarding household assets and liabilities, transfers, and consumption-saving decisions. This part is answered by one member of the household deemed to be the main respondent. The second part of the questionnaire is asked to all members of the household and collects basic demographic information. The final part of the questionnaire is given only to members of the household over 16 years of age and covers information regarding employment, entitlements, and income.

There are also a set of standardized, non-core extension modules that the member countries are allowed to include at their discretion in addition to the core questionnaire. These non-core questions typically go into more detail on some aspect of the core questionnaire that the member country wishes to explore. For example, Spain asks questions designed to examine methods by which households pay their bills.

The target population for the survey is all private households and their current members residing in the national territory at the time of data collection. The sampling design, however, is chosen by each participating country. France uses a dual frame design, exploiting individual data on taxable wealth to create the wealthy sample. The wealthy sample is divided into four strata and sampled
proportionally according to the relative size of the strata. Germany uses regional level taxable income, and oversamples small municipalities and, in larger municipalities, street sections with average income over a threshold. Spain defines eight wealth strata, based on individual taxable wealth, that are oversampled progressively at higher rates. Italy did not oversample in any way. See Eurosystem Household Finance and Consumption Network (2013a,b) for more information on the HFCS.
1.C.6 Additional Figures and Tables

Figure 1.12: Age Profile of Median Income by HtM Status and Country
Table 1.9: Portfolio Characteristics by Country and HtM Status

<table>
<thead>
<tr>
<th>P-HtM</th>
<th>US</th>
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<th>DE</th>
<th>FR</th>
<th>IT</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median liquid wealth / income</td>
<td>0.001</td>
<td>0</td>
<td>0.023</td>
<td>0</td>
<td>0.059</td>
<td>0.122</td>
<td>0</td>
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<td>-1.167</td>
<td>-0.775</td>
<td>-1.902</td>
<td>-0.019</td>
<td>-0.206</td>
<td>-0.067</td>
<td>-0.266</td>
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<td>0.082</td>
<td>0.105</td>
<td>0.054</td>
<td>0.09</td>
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<tr>
<td>Frac. neg. illiquid wealth</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>1</td>
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<td>0.471</td>
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<td>0.505</td>
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<td>0.933</td>
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<tr>
<td>Median retire / illiquid wealth</td>
<td>0.045</td>
<td>0.242</td>
<td>0.533</td>
<td>0.659</td>
<td>0</td>
<td>0.066</td>
<td>0.044</td>
<td>0.023</td>
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<td>0.175</td>
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<td>0.271</td>
<td>0.02</td>
<td>0.041</td>
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<th>ES</th>
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<td>Median liquid wealth / income</td>
<td>1.707</td>
<td>2.077</td>
<td>3.41</td>
<td>4.69</td>
<td>1.133</td>
<td>0.878</td>
<td>3.701</td>
<td>2.129</td>
</tr>
<tr>
<td>Mean liquid wealth / income</td>
<td>15.177</td>
<td>12.233</td>
<td>34.785</td>
<td>38.504</td>
<td>6.144</td>
<td>4.73</td>
<td>8.918</td>
<td>6.977</td>
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<tr>
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<td>0.065</td>
<td>0.149</td>
<td>0.081</td>
<td>0.042</td>
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<td>0.017</td>
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<tr>
<td>Frac. neg. illiquid wealth</td>
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<td>0.034</td>
<td>0.004</td>
<td>0.004</td>
<td>0.006</td>
<td>0.007</td>
<td>0.001</td>
<td>0.003</td>
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<tr>
<td>Median housing / illiquid wealth</td>
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<td>0.708</td>
<td>0.432</td>
<td>0.534</td>
<td>0.839</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mean housing / illiquid wealth</td>
<td>0.593</td>
<td>0.645</td>
<td>0.597</td>
<td>0.459</td>
<td>0.446</td>
<td>0.604</td>
<td>0.965</td>
<td>0.948</td>
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<tr>
<td>Frac. pos. housing equity</td>
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<td>0.721</td>
<td>0.77</td>
<td>0.785</td>
<td>0.533</td>
<td>0.654</td>
<td>0.77</td>
<td>0.877</td>
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<td>0.274</td>
<td>0.545</td>
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<td>0.029</td>
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<tr>
<td>Mean retire / illiquid wealth</td>
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<td>0.345</td>
<td>0.387</td>
<td>0.524</td>
<td>0.052</td>
<td>0.081</td>
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<td>Frac. pos. retirement account</td>
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<td>0.572</td>
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<td>0.259</td>
<td>0.045</td>
<td>0.107</td>
<td>0.042</td>
</tr>
</tbody>
</table>

Notes: To reduce the sensitivity outliers, means are computed after trimming the overall top and bottom 0.1 percent of that statistic’s distribution.
References


Chapter 2

The Wealthy Hand-to-Mouth in Japan

2.1 Introduction

In this chapter, we apply the empirical methodology of Kaplan et al. (2014), KKVW henceforth, to a Japanese household survey in order to measure the fraction of hand-to-mouth (HtM) households.¹

Standard models in the life cycle/permanent income hypothesis (LCPIH) literature often feature a group of hand-to-mouth (HtM) households that have low net assets relative to their income. Such households behave inconsistently with the LCPIH as they are liquidity constrained. However, Kaplan and Violante (2014) show that there is an additional class of households dubbed “wealthy hand-to-mouth” (W-HtM).

Kaplan and Violante (2014) show, using a two-asset model, that some households may have substantial wealth held in illiquid assets but low levels of net liquid assets relative to their income. Such W-HtM households will behave more like the traditional HtM households (“poor hand-to-mouth” (P-HtM) in their model). In particular, they show that the W-HtM households consume a larger fraction of transitory income shocks than the LCPIH predicts, precisely because they are liquidity constrained.

¹This chapter has been previously published as Hara et al. (2016).
Based on this insight, KVW proposes an empirical methodology to identify this new class of households and applies it to data from common household income and wealth surveys from the US, Canada, UK, Australia, and Europe. We apply this same methodology to data from a Japanese household survey, adding new evidence which verifies the W-HtM concept.

2.2 Data and Methodology

Our data comes from the National Survey for Family Income and Expenditure (NSFIE), which is a national representative household survey conducted by the Japanese Statistical Bureau every five years. The NSFIE collects comprehensive information on demographics, income, expenditure, financial wealth, ownership of durable goods, and characteristics of real estate. We examine the repeated cross-sections of the NSFIE from 1989-2009 for comparability with the results from KVW.

We restrict our sample to be the same as in KVW. We examine households in which the head is between 22 and 79 years of age and not self employed. Additionally, we exclude those who do not report for all interviews, as financial wealth is only surveyed in the final interview.

We define a household as HtM if its liquid wealth balance is: 1) positive and less than or equal to half of its earnings per pay-period; or 2) negative and within half of its per pay-period income from its borrowing limit.\textsuperscript{2} We further categorize HtM households based on the household’s illiquid wealth balance. If the household has a positive illiquid wealth balance, then we consider them W-HtM; otherwise, we consider them P-HtM.

Income includes all labor income, any government transfers, private transfers, public transfers such as public pension payments, and any self-employment income.\textsuperscript{3} In particular, asset income streams, such as those from interest, dividends, and rental properties, are excluded.

\textsuperscript{2}Following the baseline case of KVW, we set the borrowing limit to one month’s income but results are insensitive to the choice of the limit.

\textsuperscript{3}The average self-employment income is almost zero because we already exclude households whose head is the self-employed.
We set the pay-period to one month reflecting the fact that the vast majority of employees are paid monthly in Japan. However, we use a bimonthly pay period for public pensions. Public pensions are paid out on the 15th of even months in Japan, so a HtM household, who has a smooth consumption plan within each pay period, would have a quarter of its pension income left at the survey date, the end of November.\footnote{We use a three month pay period for 1989, since public pension was paid every three months before 1990. See Stephens and Unayama (2011) for a more detailed discussion}

In the NSFIE, financial assets are categorized into five groups that we classify as either liquid or illiquid. We define liquid assets as the sum of demand deposits, time deposits, and securities. We define liquid debt as total debt less mortgage debt; that is, it includes credit card balances and installment debt. Net liquid wealth is therefore liquid assets minus liquid debts.

Life insurance, Deposits in non-financial institutions, and property values of housing are categorized as illiquid assets. Property values (including land) are calculated by the statistical bureau based on characteristics such as size, structure, and vintage. Private retirement accounts, such as 401k’s, are noticeably absent from our calculations, but these are not popular in Japan.\footnote{Retirement accounts called Definite Contribution Pensions have been increasing in take-up over time but, as of now, are not surveyed in the NSFIE.} From illiquid assets, we subtract mortgage debt to calculate illiquid wealth.

The major difference between our taxonomy and that of KVW is that we categorize time deposits as a liquid asset, rather than an illiquid asset. Time deposits correspond most closely to “certificates of deposit” in the US Survey of Consumer Finances, which KVW treats as illiquid. However, in Japan, time deposits are quite liquid so that they can be cancelled and liquidated to cash immediately with no penalty.

\section{Results}

Figure 2.1 plots the fraction of HtM households in Japan from 1989 to 2009. We estimate that about 12.9 percent of Japanese household are HtM over this period of time. The share is slightly increasing over time, but rises only to 13.6 percent in 2009. KVW reports a much larger fraction
of HtM households in other developed countries. In particular, KVV finds that more than 30 percent of households are HtM in the US, Canada, and the UK. On the other hand, the majority of households are considered to be W-HtM as in the other developed countries.

Figure 2.2 shows the share of each age group that are W-HtM and P-HtM. Although the overall level of HtM households is much lower than that in the US, the age profile is quite similar. The fraction of P-HtM households drops sharply until age 30 and then falls steadily over the lifecycle. On the other hand, the fraction of W-HtM is markedly hump-shaped peaking around age 50.

6The share of non-HtM is omitted as it is the difference between one and the sum of W-HtM and P-HtM shares.
Figure 2.2: Share of HtM by Age

Figure 2.3: Average Number of Children by Age
Characteristics of W-HtM, P-HtM, and N-HtM households by age are presented in Figure 2.3, 2.4, and 2.5. Figure 2.3 shows that P-HtM and N-HtM households have a similar number of children on average over their lifecycle, and W-HtM households have an additional half a child on average than those groups. The age profiles of median income for W-HtM and N-HtM households
in Figure 2.4 are almost identical, which is consistent with an important finding of KVW. Figure 2.5 shows age profiles of median overall consumption expenditures for each group, which is a unique result as none of the household surveys used in KVW have data on consumption. The lifecycle consumption path of W-HtM households looks very similar to that of N-HtM households. We see similar lifecycle profiles for each of the groups when we examine durable and non-durable consumption separately.

2.4 Conclusion

This chapter calculates the share of HtM households in Japan following the empirical methodology used in KVW. Although the characteristics of HtM, both wealthy and poor, households are similar to those in US and other developed countries, the overall fraction of HtM households is much smaller in Japan. We leave examination of any particular reasons to future research.

The share of HtM households has important policy implications as theory would predict that households who are at or near kinks in their budget constraint would exhibit larger responses to economic stimulus policies than those who are on their Euler equation. Quantifying the differences in consumption behavior among these different types of households is an important further avenue of research.

References


Chapter 3

Does Student Debt Reduce Earnings?

3.1 Introduction

In the spring of 2016, nearly 2 million Americans graduated with bachelors’ degrees (Hussar and Bailey, 2016). About two-thirds of them will have needed to take out student loans in order to do so, due in part to rising education costs. While the cost of college has nearly doubled, the average student loan debt burden has nearly tripled since the 1990-1991 academic year (see Figure 3.1a). Over this same time period, graduates have seen almost no growth in median wage income in their early career, averaging only 0.1% per year over this time period (Figure 3.1b). These two trends have prompted a large discussion about the effects of student debt on graduates’ outcomes in the wake of the Great Recession.¹

Repayment of debt for recent graduates is likely to be more difficult as compared to graduates from earlier cohorts. Higher debt combined with stagnant income implies a lower buffer stock of assets. Risk averse agents with low buffer stocks are unable to self-insure against risks and will avoid risky, but lucrative choices. Many papers have found negative effects of student debt

¹The weak recovery and large levels of debt post the Great Recession have also led some to speculate about a student debt bubble or crisis. See Avery and Turner (2012), Akers and Chingos (2014), Brown et al. (2014), (Dynarski, 2014), and Looney and Yannelis (2015) for discussions.
consistent with debtors being financially constrained and unable or unwilling to take advantage of risky opportunities.

In this chapter, I examine the impact that debt has on graduates’ income in their early working lives. In particular, I ask four questions. i) Does student debt affect graduates’ income? ii) Does debt affect decisions in the labor market in ways that could lead to lower income? iii) How has the increase in debt since the early 1990s affected graduates’ incomes? and iv) How would less distortionary repayment schemes affect graduates’ income? I answer the first two questions using survey data and the last two questions using a structurally estimated model.

To empirically assess the effect of student debt on graduates’ early labor market outcomes, I use two surveys, each of which allows me to explore different dimensions of graduates’ experiences. The first is the Baccalaureate and Beyond (B&B), a restricted use survey of a nationally representative sample of college graduates in their final year of obtaining a bachelors’ degree. This survey follows up with students in selected years after graduation, allowing me to examine the effect of debt on income in particular years after graduation using an extremely rich set of high quality
information about graduates, such as demographics, test scores, socioeconomic background, and the post-secondary institution attended. The second data set I use is the 1997 National Longitudinal Study of Youth (NLSY97), from which I examine the subset of graduates who received a bachelors’ degree. While the NLSY97 does not have as extensive of a list of controls as the B&B (particularly in regards to post-secondary institutions), survey respondents were interviewed much more frequently, allowing for a more in depth look at labor market outcomes after graduation. In particular, I am able to construct weekly job histories and examine the impact of debt levels on non-employment duration.

I find that debt negatively affects both income and graduates’ decisions in the labor market. In particular, I show that graduates with an additional ten thousand dollars in student loans have about 1-2% lower income one year after graduation. This result is not being driven by a vast set of graduate characteristics that jointly determine income and debt, such as ability, socio-economic background, and the graduate’s post-secondary institution. This effect is scarring, as graduates with debt have lower income the first year after graduation but show no evidence of faster growth rates in subsequent years.

The negative effects of debt on income are driven by a subset of graduates who report changing their behavior in the labor market specifically because of their debt, which I take to be evidence of short-run repayment constraints. An additional ten thousand dollars in debt makes constrained graduates 2.3% more likely to choose jobs that are unrelated to their field of study than their unconstrained peers. Constrained graduates are also more likely to choose unsatisfying and non-professional occupations than unconstrained graduates. I find that these decisions do impact income, as graduates in jobs related to their field of study earn 25% higher income than similar graduates in unrelated jobs one-year after graduation, with about 7.5 percentage points faster income growth between one- and four-years after graduation.2

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2This accords with several studies that examine the returns from matching skills to occupations. Guvenen et al. (2015) who highlight the benefits from correctly matching skills to occupations are large and persistent over workers’ lifetimes. Kinsler and Pavan (2015) document that a large amount of premiums across majors are contingent on working in a job related to that major. Robst (2007) also shows that workers in unrelated jobs earn less than workers in related jobs with the same amount of schooling. The effect varies by field of study, with fields such as engineering that emphasize specific skills suffering more from being in an unrelated field.
Graduates with higher debt are also more likely to exit non-employment faster. In particular, graduates are 0.2% more likely to exit non-employment in a given week for every additional ten thousand dollars in debt. In a McCall (1970) search model, the inability to endure non-employment leads graduates with debt to lower their reservation wages and exit non-employment faster, which implies lower average income conditional on employment for those with debt.

Compared to their debt-free peers, graduates with debt may end up with worse labor market outcomes as they choose less risky but less lucrative job options. Early labor market decisions have been well documented to be crucial for workers’ long term income trajectory. For example, Topel and Ward (1992) show that the majority of earnings growth comes in early working life when workers switch jobs more frequently. However, if finding a new job or switching to a better job is costly or risky, then risk-averse graduates with higher levels of debt are willing to accept worse jobs in expected value because they are unable to self-insure against the worst outcome.

To quantify the effect of student debt on graduates’ income and labor market decisions and evaluate the last two questions, I build a Roy (1951) model of occupational choice that takes into the account the effects that debt has on reservation wages and the graduates’ choice to work in a job related to their field of study. From income and occupational choice data from the B&B, I structurally estimate the parameters from the model and use them to construct income counterfactuals for a simulated sample of graduates.

I use the model income counterfactuals to show that the increase in debt from 1993 to 2008 decreased income one year after graduation by about 1.8% for the roughly 20% of graduates affected by debt. The reservation wage channel is relatively more important as nearly all affected graduates are able to remain in a field related to their major after their debt level increased. The increase in debt from 1993 to 2008 caused income for affected graduates who remained in related jobs to be about 2% lower, whereas those who did switch to an unrelated job only lost about 1%. Based on my empirical results, this short-term loss reduction for graduates who switch comes at

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3Oreopoulos et al. (2012) and Altonji et al. (2016) confirm the importance of early labor market experiences. They show a worker’s initial job placement determines much of her wage trajectory.

4Danforth (1974) shows that reservation wages decrease with asset holdings if the agent has decreasing absolute risk aversion in the Arrow-Pratt sense.
the cost of long-term income gains as they forego the extra income that accrues to those in related jobs later in life.

I also show that repayment schemes that do not distort labor market decisions would increase income for affected graduates by almost 3.5%. Income contingent repayment, loan forgiveness, and bankruptcy protection are three popular policy proposals that have been discussed in the media, and all would build some state-contingency into student debt contracts. Student debt notably lacks this feature, unique amongst other types of consumer debt.\(^5\) Compared with the current fixed payment scheme, an income contingent repayment scheme will be less distortionary in terms of occupational choice.\(^6\)

My results are consistent with other papers documenting the negative effects of debt on graduates’ early working life outcomes, that are consistent with debt repayment inducing constraints. In a series of papers, Elliott et al. (2013a,b,c) use the Survey of Consumer Finances and find that that student debt negatively affects asset levels, particularly home equity and retirement savings. Student debt also lowers homeownership rates, as graduates with debt are less likely to assume the risk of being a homeowner as shown in Mezza et al. (2016), Cooper and Wang (2014), and Houle and Berger (2015).\(^7\) Ambrose et al. (2015) show that counties with higher student debt per capita

\(^5\)A key feature of student loans is that it is particularly difficult for student loans be discharged in bankruptcy proceedings. Before 1990, graduates could file for bankruptcy under Chapter 7 and discharge loan balances with no restrictions. The Student Loan Default Prevention Initiative Act limited discharge to loans originated more than seven years before bankruptcy proceedings or if repayment caused undue hardship (a very high standard to prove). The Higher Education Amendments to the Bankruptcy Code in 1998 removed the seven year discharge basis. Graduates who default are subject to more onerous penalties than if they default on other types of debt. For example, wages and federal tax returns can be garnished and holds may be put on transcripts. See Ionescu (2011) for more information.

\(^6\)Ionescu (2011) finds that allowing student loans to be discharged in bankruptcy benefits graduates with low assets and increases human capital accumulation. This effect is similar to the beneficial impacts of unemployment insurance and bankruptcy in terms of search. Marimon and Zilibotti (1999) show that unemployment insurance allows for better matching of skills between workers and firms. Acemoglu and Shimer (2000) that unemployment insurance can increase aggregate productivity as workers are insured against unemployment risk and are able to search for firms with higher productivity. Herkenhoff et al. (2016) show that unemployed workers with greater access to credit take longer to find a job, but after finding a job they earn more and work at more productive firms. Dobbie and Song (2015) show that after bankruptcy, income and employment increases.

\(^7\)Mezza et al. (2016) use anonymized individual credit bureau data combined with information on Pell Grant and federal student loan histories to show that student debt reduces the homeownership rate in the first five years after graduation. Using the PSID and the 1988 National Educational Longitudinal Survey, Cooper and Wang (2014) find that student debt is associated with lower homeownership rates individuals who were college age in the 1990s even after controlling for measures of ability, family characteristics, and demographics. Houle and Berger (2015) use panel data from the NLSY97 and also show that student loan debt is associated with lower homeownership rates; however they attribute this trend to a secular decline in homeownership rates rather than an inherent effect of debt itself.
have lower rates of small business formation. They hypothesize that graduates with student debt are less able to self-finance small business ventures. Student debt also negatively affects marriage rates, financial stability, and psychological functioning, as shown in Gicheva (2016), Gicheva and Thompson (2014), and Walsemann et al. (2015) respectively.

My results do contradict some recent findings. Two prominent related papers are Rothstein and Rouse (2011) and Field (2009), both of which find evidence that debt increases graduates’ incomes as they select into higher paying occupations. Rothstein and Rouse (2011) examine a policy change at a prestigious university, in which the university virtually eliminated loans from their financial aid packages. They find that this caused graduates to select into lower paying jobs such as teaching or public-service. Field (2009) looks at the random allocation of the generosity of financial aid packages offered to law students at New York University. She finds that recipients of packages with relatively more loans were more likely to go into high paying fields such as corporate law, while recipients of packages with more grants were more likely to go into lower paying public interest fields. The generalizability of these studies to the average college graduate is unclear, as both examine highly selective institutions and professions.

Four recent papers that are closest to mine in terms of scope are Akers (2013), Zhang (2013), Luo and Mongey (2016), and Chapman (2015), all of which use the B&B as well. Akers (2013) finds that while debt increases the likelihood of employment at the expense of the likelihood to attend graduate school for women, it has insignificant effects on income. Zhang (2013) also finds that debt reduces the probability of attending graduate school, but also has limited effects on income and occupational choice. Luo and Mongey (2016) find that graduates with more debt take higher paying jobs with lower non-pecuniary amenities. Chapman (2015) finds that graduates that qualify for merit-aid scholarships (and thus have lower debt) have lower income after graduation. While each of these studies use instrumental variables techniques to overcome omitted variable bias, it is unclear if the instruments used are truly exogenous.\(^8\) In addition, the instrumental

\(^8\)Akers (2013) uses variation in the number of concurrently enrolled siblings and rules regarding Pell Grant awards. Number of siblings in college may affect the type of school a graduate applies to, affecting income through a channel other than debt and violating the exclusion restriction. The instruments used in Zhang (2013) and Luo and Mongey (2016) are based on the generosity of institutional financial aid packages, in terms of the relative balance of grants.
variables approach only identifies the effect of debt on the group affected by the instrument, again limiting generalizability. I take a control variables approach, controlling for an extensive (more so than any other study I am aware of) battery of controls. I also exploit variation across space, time, and institutions to confirm my results.

This chapter is organized as follows. In Section 2, I discuss the datasets I use in more detail, I present my empirical results regarding the effect of student debt in Section 3. In Section 4, I build a model of occupation choice and discuss the estimation of the structural parameters. Using the model, I conduct counterfactual analyses regarding the effect of the increase in student debt over the last 25 years on graduates’ income in Section 5 and the potential impact of different repayment schemes in Section 6. In Section 7, I conclude.

3.2 Data

I examine the effect of student debt on graduates’ income and occupational choices using two datasets. In this section, I discuss their relative strengths and weaknesses.

3.2.1 Baccalaureate and Beyond

The B&B is a set of three longitudinal studies conducted on behalf of the National Center for Education Statistics (NCES). The studies examine the labor market outcomes for a nationally representative sample of individuals receiving bachelors degrees in the United States during the 1992-93, 1999-2000, and 2007-2008 academic years (B&B1993, B&B2000, and B&B2008). Each wave of the survey interviewed about eleven, ten, and fifteen thousand graduates, respectively. Follow up interviews were conducted one year after graduation for all three waves (1994, 2001, (which do not need to be repaid) and loans (which do). If graduates choose their institution based on the financial aid packages the university offered, then the exclusion restriction is violated. Chapman (2015) uses state variation in merit-aid scholarships to estimate the effect of student loans. As merit-aid scholarships are offered by states usually with a stated policy of reducing or preventing “brain drain”, they are often are restricted to be used at in-state schools, particularly the flagship institution. This would cause graduates to make their institution choice based on financial aid packages.

9This data was made available under a restricted use license. See http://nces.ed.gov/pubsearch/licenses.asp for more information.
2009), four years after graduation for the B&B1993 and B&B2008 (1997 and 2012), and ten years after graduation for the B&B1993 (2003). Initial samples were drawn from the National Post-Secondary Aid Study, which provides student information from a variety of sources including interviews and administrative data from government databases and college records. The B&B provides extensive and high-quality information on demographics, measures of ability, family background, education, and labor market outcomes not available in other data sources.

The B&B also includes identifiers for the graduates’ post-secondary institution. From this, I am able to merge in institutional characteristics from the Integrated Postsecondary Education Data System (IPEDS), also compiled by the NCES. IPEDS collects data on all post-secondary institutions in the United States that receive federal funding. This data includes institution characteristics such as type of degrees conferred, selectivity, tuition and other costs, admissions and enrollment, student financial aid, human resources, and more.

### 3.2.2 National Longitudinal Study of Youth 1997

The NLSY97 is a longitudinal survey of about 9,000 individuals born between 1980 and 1984. Survey respondents have been interviewed approximately annually since 1997. The survey collects documents labor market and educational outcomes along with information about the respondents’ family background.

The major limitations of the NLSY97 are sample size and available controls. As the NLSY97 was intended to survey a nationally representative sample of youths in 1997, the majority of the sample will not have received a bachelors’ degree. As I specifically focus on those with a bachelors’ degree, I am limited to less than 20% of the original sample. Also, compared to the B&B, the NLSY97 has a limited set of covariates, particularly as they pertain to graduates’ postsecondary institutions.

While the NLSY97 has far fewer respondents and less extensive controls than the B&B, it does has more detailed information about labor market outcomes. Two dimensions stand out. The first is that weekly job histories are constructed for respondents, which allows me to examine the effect
of debt on labor market transitions. The second is that labor market outcomes are recorded for all surveyed years after graduation, not just the first, fourth, and tenth as in the B&B. This allows a more comprehensive documentation of the effect of debt on income.

### 3.2.3 Sample Selection

My selected sample includes graduates who were less than or equal to 30 years of age and were graduating with a bachelor’s degree at the time of the initial interview. I also only include those who usually worked full time (more than 30 hours per week) in a given year to mitigate any effects from part-time work and graduate school enrollment. All dollar values are deflated to 2009 dollars using the CPI and all regression results are appropriately weighted.

Using the B&B, I examine the effect that debt has on income and occupational choice after accounting for a vast battery of controls and exploiting multiple types of variation. Using the NLSY97, I confirm my results on income from the B&B and use weekly job histories to examine the effect of debt on non-employment duration.

### 3.3 Empirical Results

Using the B&B and the NLSY97, I show that graduates with student debt have 1-2% lower income one year after graduation. This result is remarkably consistent, and remains after applying an extensive battery of controls for joint determinants of debt and income such as ability, family background, and institutional characteristics. This effect is scarring even into later years as graduates with debt have lower initial income but show no faster income growth in subsequent years. Income loss is particularly acute for graduates who are I identify as being constrained by their debt early in their career. I show that graduates with debt exit non-employment faster and are more likely to choose jobs unrelated to their field of study, both of which can explain their lower incomes.

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10Results are similar when I include part-time work, after adjusting for the mechanical effect of increased hours. Duration results from the NLSY97 does not have this restriction.
3.3.1 Short-Term Effect on Income

I find, using the B&B, that student debt is associated with 1-2% lower income one year after graduation. This result is robust to an extensive list of controls and persists even after accounting for trends across institution, space, and time. I also find that debt has a negative effect on income in the NLSY97. The 2008 wave of the B&B is the most recent and features a larger set of controls, as well as specific questions regarding the effect of student debt on labor market decisions. As such, I present results separately for the B&B2008 first. I then present results using all waves of the B&B and the NLSY97.

B&B2008

To examine the effects of student loan debt, \( s_{i,t}^{11} \), on (log) income one year after graduation, \( y_{i,t+1} \), I use the following Mincer-style regression relating income to debt level controlling for graduate characteristics \( X_{i,t+1} \):

\[
y_{i,t+1} = \gamma s_i + \beta X_{i,t+1} + \epsilon_i.
\]

An additional ten thousand dollars in student debt is associated with 1.8% lower income one year after graduation after controlling for demographic characteristics likely to be observed by potential employers. I show my estimates of \( \gamma \) in Table 3.1. In Column 1, I control for the following list of demographic characteristics: a cubic in age, gender and marriage dummies, an interaction term for married females, a set of five dummies for race (white, black, Hispanic, Asian, other), a set of dummies for the number of post-secondary institutions the graduate attended (1, 2, 3, or 4+), and a set of dummies for the graduate’s major (STEM and related fields, social science fields, and other).

\( ^{11} \)The measure of student debt is the self-reported amount of total cumulative debt for undergraduate education, including loans from all sources: federal and state governments, institution, family, friends, and private banks. While self-reported, this measure of cumulative debt is of high quality as it is specifically scrutinized by the NCES for consistency. It is compared to data from the National Student Loan Data System (NSLDS), a complete record for each student who has borrowed federal loans as well as other information on private borrowing.
The exogeneity assumption for this regression is likely violated as omitted variables that jointly determine income and student debt are included in the residual, in particular ability. To address this, I add several proxies for ability in Column 2 of Table 3.1 and find that an extra ten thousand dollars of debt is associated with 1.5 percent lower income. The measures of ability that I use are a cubic in college GPA, a cubic in SAT scores, high school GPA, and an indicator for Advanced Placement or college credit classes in high school.

If there is some measure of unobserved ability not accounted for by this list of proxies, then the exogeneity assumption is still not satisfied and my estimate of the effect of student debt on income may still be biased. I address this by using the extensive set of information in the B&B and adding additional controls for the two major determinants of student loans debt: family socio-economic background and the graduates’ alma mater.

After controlling for graduates’ socio-economic background, the negative effect of debt on income remains, though slightly attenuated to about 1.1 percent. In Column 3 of Table 3.1, I add controls for the graduate’s socio-economic background: dummies for the parents’ education levels, whether the graduate attended a private high school, a cubic in the family’s adjusted gross income, and a cubic in the family’s Expected Family Contribution from their Free Application for Federal Student Aid (a measure of family wealth).

Accounting for the role that post-secondary institutions play in jointly affecting income and debt balances also does not overturn the negative effect debt has on income. Post-secondary institutions can have an effect on income as more selective and prestigious colleges ostensibly admit higher ability students and thus are correlated with higher incomes. This, in and of itself, only affects my estimate of $\gamma$ if institutions affect debt levels as well, which is theoretically unclear. If more prestigious institutions are more expensive and require more loans on average, then ability and loans are positively correlated. However, if more prestigious institutions also have more generous financial aid packages, then ability and student loans are negatively correlated. As such, I control for the effect that institutions may have in two ways: (1) institution characteristics (Column

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12 For example, people with higher ability may correctly forecast higher returns from college in the form of higher future income.
4) or institution fixed effects (Column 5). I prefer the former as variation across the financial aid packages of similar caliber schools is informative about the effect of student debt on income.

Accounting for institution characteristics compares the outcomes of two otherwise identical graduates at similar schools. As I show in Column 4, an extra ten thousand dollars in student loans is associated with 0.9% lower income after controlling for institution characteristics. The set of characteristics that I control for are if the institution is in-state, if it has a regional tuition compact with surrounding states, if it is a state’s flagship institution, dummies for selectivity (for-profit, open, minimally, moderately, and very selective) and the types of degrees granted (given by the school’s Carnegie 2000 code), along with cubics in sticker price, average grant amount per full-time-equivalent student, and number of faculty per 100 full-time-equivalent students.

Rather than compare graduates at similar institutions, I also exploit within-institution variation using institution fixed effects in Column 5. Identification of the effect of debt on earnings comes from comparing two otherwise similar students at the same institution with different levels of student debt.\(^{13}\) The effect of student loans on income barely changes to about -1.5% per ten thousand in student debt.

Using information on graduates’ home states, I also exploit within home state variation to identify \(\gamma\).\(^{14}\) Identification of the effect of debt comes from comparing otherwise identical graduates at similar institutions from the same state. The effect of student loans remains similar, at about 1% lower income for every ten thousand dollars in debt.

Using an extensive battery of controls, I find that the negative effect of student loans to be extremely robust. Graduates with an additional ten thousand dollars in debt have about 1% lower income one year after graduation. This result is also robust to whether I use variation across or within both institution and states. In the next subsection, I exploit additional variation across time using the other waves of the B&B, and show that my result is robust.

\(^{13}\)The number of students and number of institutions omits graduates who come from institutions where only one individual was interviewed. The regression was run including these graduates as they are informative about the other estimated parameters.

\(^{14}\)State of residence is taken from their parents’ state of residence from the graduate’s FAFSA.
Table 3.1: Effect of Additional Debt on 2009 Income

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Notes: Debt in tens of thousands of dollars. Source: B&B2008. See text for list of controls in each specification. Robust standard errors reported except in Columns 5-6. Standard errors are clustered at the institution level in Column 5, and at the state level in Column 6. Sample sizes and number of institutions rounded to the nearest 10 for privacy concerns.

B&B: All Waves

In this subsection, I present results utilizing all three waves of the B&B. This allows me to identify the effect of student debt on income off of variation within-institution and within-state across time. Pooling all waves, my specification becomes

$$y_{i,c,t+1} = \gamma s_{i,c,t} + \beta x_{i,c,t+1} + \phi_c + \epsilon_{i,c},$$

where $\phi_c$ is a cohort fixed effect for each cohort $c \in \{1993, 2000, 2008\}$. For all results, I control for demographic, ability, and socio-economic background.\(^{15}\)

Exploiting variation within similar institutions over time gives a similar result as the 2008 wave only. As shown in Column 1 of Table 3.2, an additional ten thousand dollars in student loans is associated with a 0.8% decrease in income one year after graduation. The effect of student loans

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\(^{15}\)Some control variables in each category are not available in each wave and as such I use a slightly restricted set of control variables. Unavailable covariates are AP classes, high school GPA, SAT scores, EFC, and faculty to student ratio.
is identified primarily off of two otherwise identical people at similar institutions but at different points in time.

The estimated coefficient is similar using institution fixed effects. Changes in financial aid policies or the prestige of the institution over time help identify the effect of debt on income. I show in Column 2 of Table 3.2 the effect of student debt on earnings controlling for institutional fixed effects and find that an additional ten thousand dollars of debt leads to -0.8% lower income one year after graduation.

Instead of exploiting time variation at the institution level, I now use time variation at the state level using state fixed effects in Column 3 of Table 3.2. The effect is identified off of a common time trend exposing graduates in different states differently. Again, the results are remarkably similar with an additional ten thousand dollars in loans corresponding to 0.9% lower income.

The coefficient remains the same allowing for state-specific time trends by including state-cohort fixed effects. As different states have experienced different labor market patterns over the last 15 years, I allow for state specific time trends using state-cohort fixed effects in Column 4, but it has no effect on the estimated coefficient.

To summarize, controlling for an extensive set of graduate characteristics, I find that student debt has a negative impact on income one year after graduation, about 1% per ten thousand dollars in debt. This result is extremely robust to the set of controls and the dimension of variation exploited.

**NLSY97**

I find a similar effect of debt on income one year after graduation in the NLSY97. With this dataset, I cannot control for as many covariates as I can in the B&B, particularly on the institution dimension. I control for a cubic in age, gender, marital status, an interaction term for married females, parent’s education, dummy variables for the graduate’s high school grades, a cubic in the graduate’s score on the Armed Services Vocational Aptitude Battery test (a popular proxy for

---

16The NLSY97 does have information from transcript data for a subset of graduates.
Graduates in the NLSY with an additional ten thousand dollars in student loans have about 4.3% lower income one year after graduation. I show the estimated coefficient of debt on income in each year after graduation in Figure 3.2a, with one and two standard error confidence intervals. This effect is noticeably larger than the coefficient from the B&B, however it is imprecise as there are only about 900 graduates in my sample. The NLSY97 is not a representative sample of graduates but a representative sample of the population as a whole. Only 908 graduates satisfy my sample selection criteria, much lower than the roughly nine thousand from the 2008 wave or nineteen thousand from all three waves of the B&B.

While insignificant, it is reassuring to see that the negative effect of student debt on short-run income is not just a feature of one particular (restricted use) survey.

Table 3.2: Effect of Additional Debt on Short-Run Income.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stud. Loan (10k)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log $y_{t+1}$</td>
<td>$-0.008^{***}$</td>
<td>$-0.007^*$</td>
<td>$-0.009^{***}$</td>
<td>$-0.009^{***}$</td>
</tr>
<tr>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohort FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Demographics</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Ability</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Socio-Economic</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>College Chars.</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>College FE</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>State FE</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Cohort-State FE</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>N</td>
<td>19,060</td>
<td>18,210</td>
<td>19,060</td>
<td>19,060</td>
</tr>
<tr>
<td>N. Institutions</td>
<td>2,170</td>
<td>1,640</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.131</td>
<td>0.297</td>
<td>0.143</td>
<td>0.152</td>
</tr>
</tbody>
</table>

Notes: Debt in tens of thousands of dollars. Source B&B. See text for list of controls in each specification. Robust standard errors reported except in Columns 2-4. Standard errors are clustered at the institution level in Column 2, and at the state level in Columns 3 and 4. Sample sizes and number of institutions rounded to the nearest 10 for privacy concerns.

ability), cubics in the graduate’s family income and net worth, and dummy variables for the year of the survey.
3.3.2 Medium- and Long-Term Effects

In this subsection, I show that graduates with debt have lower incomes in later years of their working life, but similar levels once I condition on income one year after graduation. Taken together with the results from the previous subsection, this suggests that the negative effects of student debt persist even into later working life as graduates with student debt do not have any faster income growth in subsequent years and show no signs of catching up with their debt-free peers.

B&B

I look now at the follow up surveys from the 1993 and 2008 B&B to examine the medium- and long-term effects of student loans on graduates’ income. The negative short-run effects of student debt persist into the medium run (four years after graduation). There seems to be some weak evidence of graduates catching up in the long run (ten years after graduation), but this only comes from the earliest cohort, where debt levels were relatively low.

Using these follow-up surveys, I look at incomes four- and ten-years after graduation, conditional and unconditional on income one year after graduation. The specification I use is

\[ y_{i,t+\tau} = \gamma s_i + \beta X_{i,t+\tau} + \epsilon_i. \]

for \( \tau = \{4, 10\} \), with cohort fixed effects as appropriate. I also estimate a specification with income growth rates between one- and four-years after graduation as the dependent variable. I restrict the sample to those that work full-time each year.

Graduates’ student debt is associated with lower income four years after graduation. As seen in Columns 1 and 2 of Table 3.3, an additional ten thousand dollars in student debt is associated with about 0.8% lower income. Column 1 pools both the 1993 and the 2008 cohort (with a cohort fixed effect), while Column 2 focuses on the 2008 cohort only.
Table 3.3: Effect of Additional Debt on Medium- and Long-Run Income.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log $y_{t+4}$</td>
<td>Log $y_{t+4}$</td>
<td>$\Delta$ Log $y_{t+4}$</td>
<td>$\Delta$ Log $y_{t+4}$</td>
<td>Log $y_{t+10}$</td>
</tr>
<tr>
<td>Stud. Loan (10k)</td>
<td>-0.007</td>
<td>-0.008*</td>
<td>0.004</td>
<td>0.003</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.004)</td>
<td>(0.005)</td>
<td>(0.012)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.137***</td>
<td></td>
<td>0.275***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.021)</td>
<td></td>
<td>(0.036)</td>
</tr>
<tr>
<td>Log $y_{t+1}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log $y_{t+4}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Cohort FE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographics</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Ability</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Financial</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>College Chars.</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Cohort</td>
<td>93 &amp; 08</td>
<td>08</td>
<td>93 &amp; 08</td>
<td>08</td>
<td>93</td>
</tr>
<tr>
<td>N</td>
<td>10,700</td>
<td>6,780</td>
<td>10,700</td>
<td>6,460</td>
<td>3,870</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.112</td>
<td>0.128</td>
<td>0.027</td>
<td>0.045</td>
<td>0.266</td>
</tr>
</tbody>
</table>

Notes: Debt in tens of thousands of dollars. Source: B&B1993,2008. See text for list of controls in each specification. Robust standard errors reported. Sample sizes rounded to the nearest 10 for privacy concerns.

Taken together with the results from Section 3.3.1, debt leaves a permanent scar on lifetime income. Graduates with debt start from a lower income level in the first year of college and show no signs of faster growth after that. I show results from the corresponding specification that estimates the effect of debt on graduates income growth rates between one- and four-years after graduation in Columns 3 and 4 of Table 3.3. The negative effect of debt on earnings one year after graduation is not compensated for by higher growth rates in subsequent years. Graduates with higher debt have 0.1 percentage points faster annualized income growth over these years for every ten thousand dollars of additional debt.

There is some weak evidence of graduates with debt catching up over the longer term. I show the effect of debt on income ten years after graduation for the 1993 cohort, controlling for income one and four years after graduation. As seen in Column 5, the effect of student debt conditional on past income is positive, suggesting that graduates with debt end up with an additional 1% higher income ten years after graduation for every ten thousand dollars in debt, though this is insignificant.
I corroborate the effect of debt on longer run income observations in the NLSY97. Rather than income just at specified years after graduation, the NLSY97 has information for all years after graduation. I examine the effect of debt on income separately for each year after graduation, both unconditional and conditional on income one year after graduation.

I estimate the specification from the previous subsection separately for income in each year after graduation. Figure 3.2 shows the coefficient on student debt for each year after graduation, with one and two standard error confidence intervals. Panel a shows the effect of debt on income each year after graduation, while panel b shows the effect conditional on income one year after graduation. The point corresponding to one year after graduation is the point discussed in the previous section.

Student debt is a permanent drag on income for the entirety of graduates’ early labor market experiences. After graduation, the effect of student debt is negative for every year after graduation, averaging about -3.4% lower income for every ten thousand dollars. While the estimate is extremely negative for the eighth year after graduation, about -9%, only about 150 graduates are included in this regression.

As in the B&B, the effect of student debt on cumulative growth rates is very small. Panel b of Figure 3.2, shows the coefficient on debt is near zero and insignificant for nearly every year after graduation conditional on initial income. Graduates with debt have a permanent scar that does not seem to be mitigated through faster earnings growth in later working life.

Another way to see this is to pool all post-graduation income observations in the following specification:

$$y_{i,t+\tau} = \gamma s_i + \beta X_{i,t+\tau} + \phi_1 \tau + \phi_2 \tau^2 + \phi_3 \tau^3 + \epsilon_{i,t+\tau}$$

\(^{17}\)Debt in the NLSY97 is the cumulative amount borrowed from each term enrolled in college.
Student debt does influence income in later years in a graduate’s working life, but primarily through the effects on income in the first year. I show in Table 3.4 the effect of student debt on deviations in income from a common time trend in years after graduation. Graduates with an additional ten thousand in debt have about 4.6% lower income in the years after graduation (Column 1). As seen in Column 2, this effect is mitigated upon the inclusion of income in the first year after graduation. If graduates were catching up with their debt free peers, the coefficient in Column 2 would again be positive.

The effect of an additional ten thousand dollars in student debt is similar in magnitude to that of an additional ten thousand dollars in initial liquid assets, but with the opposite sign. I replace student debt with the level of financial assets at age 20 to the regression in Columns 3 and 4. An additional ten thousand dollars in initial liquid assets is associated with an additional 1% income.
### Table 3.4: Effects of Additional Debt on Income after Graduation

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log $y_{t+\tau}$</td>
<td>Log $y_{t+\tau}$</td>
<td>Log $y_{t+\tau}$</td>
<td>Log $y_{t+\tau}$</td>
</tr>
<tr>
<td>Stud. Loan (10k)</td>
<td>-0.034***</td>
<td>-0.017</td>
<td>-0.013</td>
<td>-0.019</td>
</tr>
<tr>
<td></td>
<td>-0.013</td>
<td>-0.019</td>
<td>0.319***</td>
<td>0.321***</td>
</tr>
<tr>
<td></td>
<td>0.013***</td>
<td>0.01</td>
<td>-0.085</td>
<td>-0.088</td>
</tr>
<tr>
<td></td>
<td>-0.005</td>
<td>-0.007</td>
<td>0.013***</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>0.013***</td>
<td>0.01</td>
<td>-0.005</td>
<td>-0.007</td>
</tr>
<tr>
<td>Log $y_{t+1}$</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Financial</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Financial</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Financial</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>College Char.</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>4916</td>
<td>3023</td>
<td>4665</td>
<td>2880</td>
</tr>
<tr>
<td>N</td>
<td>1284</td>
<td>817</td>
<td>1205</td>
<td>774</td>
</tr>
<tr>
<td>R^2</td>
<td>0.187</td>
<td>0.321</td>
<td>0.184</td>
<td>0.316</td>
</tr>
</tbody>
</table>

Notes: Debt in tens of thousands of dollars. Source: NLSY97. See text for list of controls.

A person with a higher buffer stock of financial assets would better able to self-insure against the risk that searching for a job entails, whereas a person with higher debt would be less able.

In both the B&B and NLSY97, graduates with debt start with lower income and do not seem to catch up with their debt-free peers with higher income growth later. I present evidence in the next subsections as to the mechanisms relating higher debt to lower income.

### 3.3.3 Constrained Graduates

I show in this section that the negative effect of student debt on income is completely concentrated on a group of graduates who report changing their labor market behavior specifically because of their student debt, which I refer to as constrained graduates going forward. The 2008 wave of the B&B asks graduates with debt if they changed their labor market behavior in any way during the first year after graduation specifically because of their student debt. Graduates are then followed up with question relating to specific behaviors: working more jobs, more hours, taking a job unrelated to field of study, or taking a worse job. I take an affirmative answer to any of these questions as evidence the graduate is constrained by her debt, perhaps because her buffer stock of assets is low.
Table 3.5: Summary Statistics for 2008 Debt Level.

<table>
<thead>
<tr>
<th></th>
<th>% of Debtors</th>
<th>Mean</th>
<th>P10</th>
<th>P25</th>
<th>P50</th>
<th>P75</th>
<th>P90</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Didn’t Change</td>
<td>53.69</td>
<td>2.16</td>
<td>0.46</td>
<td>1.01</td>
<td>1.81</td>
<td>2.78</td>
</tr>
<tr>
<td></td>
<td>Changed</td>
<td>46.31</td>
<td>2.94</td>
<td>0.96</td>
<td>1.7</td>
<td>2.53</td>
<td>3.88</td>
</tr>
</tbody>
</table>


Constrained graduates are a significant group of graduates and are come from all across the debt distribution. Table 3.5 shows some statistics on the distribution of student debt for the constrained and unconstrained groups. About 46% of graduates with debt report being constrained by their debt. The median debt level for constrained graduates is about 25 thousand dollars, compared to about 18 thousand dollars for the unconstrained. While those who are constrained do have higher debt at every point in their respective distributions, it is not just graduates with high absolute levels of debt that end up constrained.

**Short-Run Effects on Income**

The short run effect of student debt is concentrated specifically on constrained graduates. Including an indicator variable taking the value one if the graduate is constrained, \(I_s\), I estimate the effect of student debt conditional on demographics ability, socio-economic background, and college characteristics:

\[ y_{i,t+\tau} = \gamma s_i + \phi s_i I_s + \beta X_{i,t+\tau} + \epsilon_i. \]

Constrained graduates have about 8% lower income than unconstrained graduates. The coefficient suggests that the constrained graduates have 7.7-8.2% lower income than unconstrained, depending on if I include those with no debt as unconstrained (Column 1) or exclude them entirely (Column 2).\(^{18}\) Controlling for whether or not the graduate is constrained or not, student debt has no marginal effect on income, suggesting that debt in and of itself is not necessarily bad.

\(^{18}\)The question I use to categorize graduates as constrained or not is not asked to graduates with no debt due to the skip pattern of the questionnaire.
Table 3.6: Effect of Additional Debt on Short-Run Income by Constraints

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log $y_{t+1}$</td>
<td>Log $y_{t+1}$</td>
<td>Log $y_{t+1}$</td>
</tr>
<tr>
<td>Stud. Loan (10k)</td>
<td>$-0.001$</td>
<td>$0.003$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(0.005)$</td>
<td>$(0.006)$</td>
<td></td>
</tr>
<tr>
<td>Constrained</td>
<td>$-0.082^{***}$</td>
<td>$-0.077^{***}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$(0.019)$</td>
<td>$(0.020)$</td>
<td></td>
</tr>
<tr>
<td>Stud. Loan (10k): Unconstrained</td>
<td></td>
<td>$-0.001$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$(0.006)$</td>
<td></td>
</tr>
<tr>
<td>Stud. Loan (10k): Constrained</td>
<td></td>
<td>$-0.014^{***}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$(0.005)$</td>
<td></td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographics</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Ability</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Financial</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>College Chars.</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>N</td>
<td>8,100</td>
<td>6,110</td>
<td>8,100</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.144</td>
<td>0.14</td>
<td>0.141</td>
</tr>
</tbody>
</table>

Notes: Debt in tens of thousands of dollars. Source: B&B2008. Robust standard errors reported. See text for list of controls. Sample sizes rounded to the nearest 10.

I now allow the effect of student debt to have a differential impact on constrained and unconstrained graduates and find student debt only has a negative effect for unconstrained graduates. I interact the effect of student debt on income with the indicator variable for constrained graduates, $I_s$, and unconstrained graduates, $I_n$:

$$y_{i,t+\tau} = \gamma_s I_s s_i + \gamma_n I_n s_i + \phi_s I_s + \beta X_{i,t+\tau} + \epsilon_i.$$  

Debt has a slight negative and insignificant marginal effect on income, -0.1% per ten thousand, for unconstrained graduates. However, the negative effect of debt on income is fully borne by the constrained group, 1.4% lower income per ten thousand dollars of debt.

The effect of debt on income one year after graduation is completely felt by this group of graduates who report their labor market behavior was affected by their debt burden. Next, I examine the medium term implications of being constrained.
Medium-Run Effects on Income

The negative effect of debt for constrained graduates extends out to four years after graduation. Graduates who were not constrained show basically no effect of student debt in terms of levels or growth rates as compared with graduates with no debt. Constrained graduates show lower levels of income four-years after graduation, but small effect of debt on growth rates.

I use the same specification as in Section 3.3.3, except now I look at income four years after graduation, $y_{i,t+4}$. I show in the first Column of Table 3.7 the effect of an additional ten thousand dollars in student loans on income four years after graduation, allowing for different effects for unconstrained and constrained graduates. As with income one year after graduation, student debt has a small insignificant negative effect on unconstrained graduates. However, constrained graduates have about 1.2% lower income four years after graduation for every ten thousand dollars of debt.

Neither group seems to be affected in terms of the growth rate of income between one-and four-years after graduation, as seen in Column 2 of Table 3.7. Debt seems to affect constrained graduates negatively in their first year after graduation, shifting them on to a lower, parallel income trajectory.

Given that the group of graduates who were report changing their behavior specifically because of their debt are the ones negatively affected, debt seems to distort early labor market decisions, the outcomes of which persist over time. In the next subsection, I examine the effects of debt on graduate behavior in the labor market.

3.3.4 Effect on Labor Market Decisions

The group of graduates whose debt is associated with lower income are those graduates which report changing their behavior specifically because of their student debt. In this subsection, I look at effect of debt on two sets of labor market behaviors, non-employment duration and occupation choice.
Table 3.7: Effect of Additional Debt on Medium-Run Income by Constraints

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Log $y_{t+4}$</td>
<td>$\Delta$ Log $y_{t+4}$</td>
</tr>
<tr>
<td>Stud. Loan (10k): Unconstrained</td>
<td>-0.001 (0.006)</td>
<td>0.000 (0.002)</td>
</tr>
<tr>
<td>Stud. Loan (10k): Constrained</td>
<td>-0.012** (0.005)</td>
<td>0.004 (0.005)</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographics</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Ability</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Financial</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>College Chars.</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>N</td>
<td>6,460</td>
<td>6,460</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.144</td>
<td>0.045</td>
</tr>
</tbody>
</table>

Notes: Debt in tens of thousands of dollars. Source: B&B2008. Robust standard errors reported. See text for list of controls. Sample sizes rounded to the nearest 10.

Using the NLSY, I show that graduates with debt have an increased probability of exiting non-employment, with an additional ten thousand dollars of debt increasing the probability of exit in a given week by 0.2 percentage points. This is consistent with a McCall (1970) model. As graduates repay debt even when not employed, the cost of remaining out of work is higher which lowers reservation wages. A lower reservation wage means that graduates with debt are more likely to exit non-employment and have lower average income conditional upon employment.

With the B&B, I show that student debt has an effect on occupation choice both for constrained and unconstrained graduates. Unconstrained graduates are more likely than debt-free graduates to choose a job that is related to their field of study. Constrained graduates, however are more likely to choose a job that is unrelated. They also are less likely to be satisfied with their jobs and are less likely to choose professional or technical occupations.

Non-Employment Duration: NLSY97

Using the constructed weekly job histories from the NLSY97, I examine the effect of debt on time spent not employed. Conditional on being not employed, graduates with debt are more likely to
exit non-employment in a given week. Non-employed graduates with an additional ten thousand dollars in student loans are 0.2-0.9 percentage points more likely to exit non-employment each week.

I use a duration framework similar to the literature that evaluates the effect of unemployment insurance on unemployment duration, Farber and Valletta (2015) for example. I assume a non-employment spell ends in a given week if an unobserved latent variable $z_{i,t}$ for spell $i$ in week $t$ is positive. $z_{i,t}$ depends on personal characteristics, $X_{i,t}$, and debt $s_i$.

$$z_{i,t} = \gamma s_i + \beta X_{i,t} + \epsilon_{i,t}$$

The hazard function for a spell ending is then

$$h(t) = P(z_{i,t} > 0) = P(-\epsilon_{i,t} < \gamma s_i + \beta X_{i,t}) = F(\gamma s_i + \beta X_{i,t})$$

I take $F$ to be logistic function. I include the covariates discussed in 3.3.1, along with year fixed effects.\(^{19}\)

Graduates with debt are more likely to exit non-employment spells. I show the average marginal effect of an additional ten thousand dollars of student debt on the probability of exiting non-employment in Column 1 of Table 3.8. An additional thousand dollars in student loans is associated with an excess 0.2 percentage point probability of exit in a given week. Student loan debts seem to affect the speed at which the graduate exits non-employment.

The effect of student debt on duration should be larger in the first year after graduation, when presumably the graduate has had less time to pay back her loans or accumulate a buffer-stock of assets. I show in Column 2 the average marginal effect of student debt on the probability of exiting non-employment limiting to spells within the first 52 weeks after graduation. An additional ten

\(^{19}\)As in Farber and Valletta (2015), I recode likely spurious 1 week transitions. Letting $E$ represent employment in a week and $N$ as non-employment, I recode ENE to EEE and NEN to NNN. This affects 55 and 650 spells respectively. I also truncate any uncompleted non-employment spells to end in the last week.
Table 3.8: Average Marginal Effect of Debt Exiting Non-Employment

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pr(Exit)</td>
<td>Pr(Exit)</td>
</tr>
<tr>
<td>Stud. Loan (10k)</td>
<td>0.002*</td>
<td>0.009***</td>
</tr>
<tr>
<td></td>
<td>-0.001</td>
<td>-0.002</td>
</tr>
<tr>
<td>Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographics</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Ability</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Financial</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>College Char.</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>48,104</td>
<td>13,839</td>
</tr>
<tr>
<td>Clusters</td>
<td>1,109</td>
<td>860</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.0299</td>
<td>0.0177</td>
</tr>
</tbody>
</table>

Notes: Debt in tens of thousands of dollars. Source: NLSY97. Standard errors clustered at the individual level.

thousand dollars in debt indeed increases the average probability of exiting non-employment in a given week in the first year by about 0.9 percentage points.

Debt affects the speed at which graduates accept jobs. Next, I examine the impact of debt on characteristics of selected jobs.

**Occupational Choice: B&B**

Using the B&B, I examine the effect of debt on graduates’ occupational choices. I find that student debt does affect occupational choice. Constrained graduates with debt are more likely to be in “worse” jobs, consistent with the phrasing of the question used to identify them. Unconstrained graduates are more likely to be in “better” jobs, even than their debt-free peers.

I use a linear probability model to assess the effect of student loans on characteristics of the graduate’s job. The specification is

$$C_{i,t+1} = \gamma_s s_i I_s + \gamma_n s_i I_n + \beta X_{i,t+1} + \epsilon_i.$$
where $C_{i,t+1}$ is a binary variable with some characteristic of the graduate’s job one year after graduation and $X_{i,t+1}$ are the set of demographic, ability, socio-economic, and institution characteristic controls used in Section 3.3.1.

An additional ten thousand dollars of debt increases the likelihood of unconstrained graduates to choose occupations related to their field of study by 1.3 percentage points, while it decreases the likelihood for constrained graduates by 1 percentage point. In Column 1 of Table 3.9, I show the effect that student debt have on whether or not the graduate’s occupation is related to her field of study.\footnote{I classify a job as related if the graduate reports their job is either strongly or somewhat related to their field of study.} An additional ten thousand dollars in debt increases the probability that an unconstrained graduate’s current job is related to their field of study by 1.3 percentage points, while it decreases that probability by 1 percentage point for unconstrained graduates.

For every ten thousand dollars of debt, constrained graduates are also 4.2 percentage points more likely to choose jobs that are not satisfying. As seen in Column 2, an additional ten thousand dollars in debt increases the probability that an unconstrained graduate is satisfied with her job by 1.7 percentage points, and decreases that probability by 2.5 percentage points for constrained graduates.

Debt increases the likelihood for graduates to choose non-professional jobs by 2.2 percentage points relative to their unconstrained peers. I divide occupation codes into “professional” and “non-professional” and examine the effect of debt on occupational choice.\footnote{A list of SOC codes and how I divide them is in Table 3.12 of Appendix 3.B. Some examples of “professional” occupations are Engineers (11), Healthcare professionals (non-nurses) (14), and Postsecondary Educators (26). Examples of “non-professional” occupations are Construction/mining occupations (9), Food service occupations (13), and Sales occupations (28).} Unconstrained graduates are 1.4 percentage points more likely to be in a “professional” job for every ten thousand dollars of debt. Constrained graduates are 0.8 percentage points less likely for every ten thousand dollars of debt.

These characteristics are very important in terms of income and selecting out of them is costly for graduates. The final two columns show the effect of being in a related job one year after graduation on income one and four years after graduation. I show in Column 4 the income gains


Table 3.9: Effect of Additional Debt on Occupational Choice by Constrained Status

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Job Related $t + 1$</td>
<td>Satisfied $t + 1$</td>
<td>Non-Prof. $t + 1$</td>
<td>Log $y_{t+1}$</td>
<td>Log $y_{t+4}$</td>
</tr>
<tr>
<td>Stud. Loan (10k): Unconstrained</td>
<td>0.013*** (0.005)</td>
<td>0.017*** (0.005)</td>
<td>-0.014*** (0.006)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stud. Loan (10k): Constrained</td>
<td>-0.01** (0.005)</td>
<td>-0.025*** (0.005)</td>
<td>0.008* (0.005)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job Related $t + 1$</td>
<td></td>
<td></td>
<td></td>
<td>0.228*** (0.020)</td>
<td>0.074*** (0.027)</td>
</tr>
<tr>
<td>Log $y_{t+1}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.463*** (0.033)</td>
</tr>
<tr>
<td>Controls</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Demographics</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Ability</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Financial</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>College Chars.</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>N</td>
<td>8,100</td>
<td>7,460</td>
<td>8,100</td>
<td>8,100</td>
<td>6,460</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.094</td>
<td>0.047</td>
<td>0.085</td>
<td>0.175</td>
<td>0.329</td>
</tr>
</tbody>
</table>


from being in a related job. Graduates who are in jobs related to their field of study earn about 25% more than those that are in unrelated jobs. In Column 5, I show the effects on income four years after graduation. Even controlling for initial income, graduates who start in related jobs earn an additional 7.4% in income four years after graduation.

Constrained graduates select into unrelated jobs, presumably because they are easier to find. However, these graduates forgo future income gains they select jobs that are a worse fit for the specialized human capital they developed in their undergraduate studies. The interaction of student debt and financial constraints affects the ability of graduates to sort into jobs that best utilize their particular set of skills.

### 3.4 Model of Occupational Choice

Using income and occupational choice data from the 2008 wave of the B&B, I structurally estimate a Roy (1951) model of occupation choice. I then use the estimated parameters and the empirical distributions of characteristics and debt to construct counterfactual income histories for graduates
to evaluate the impact of the rise in student debt between the 1993 wave and the 2008 wave and the potential impact of income contingent loans.

I use a static model of occupational choice in order to focus on the impact of debt on labor market decisions early in graduates careers. Agents inelastically supply all their time as labor, and choose a job to that maximizes income.

Upon graduation, a graduate enters the labor market with some level of debt, $s$. There are two types of jobs, those related to the graduates’ field of study ($R$) and those unrelated to her field of study ($U$). Given her characteristics, $X$, and level of student debt, a graduate draws a job of each type, $(\epsilon^U, \epsilon^R)$, from a joint distribution $F$, and compares the utility from each job should she choose to work in either job. She then selects the job which gives her the higher utility.

The problem for the graduate is

$$V(s, X, \epsilon^U, \epsilon^R) = \max \{ u(c^R), u(c^U) \}$$

s.t. $c^U - s = Y^U$

s.t. $c^R - s = Y^R$

I assume $u(\cdot)$ is monotone increasing and student debt is non-state-contingent, which implies the graduate’s occupational choice is just based on income maximization.

Log income, $y_i$, is additively separable between characteristics of the graduate, each with its type-specific loading factor $\beta^j$, and the effect of the particular job, $\epsilon^j$

$$y^U_i = X_i' \beta^U + \epsilon^U_i$$

$$y^R_i = X_i' \beta^R + \epsilon^R_i$$
I assume that the distribution of jobs that a graduate faces is

\[
\begin{bmatrix}
\epsilon_i^U \\
\epsilon_i^R
\end{bmatrix}
\sim \mathcal{N}
\left(
\begin{bmatrix}
\gamma_i^U \\
\gamma_i^R
\end{bmatrix},
\begin{bmatrix}
\sigma^2_U & \sigma_{UR} \\
\sigma_{UR} & \sigma^2_R
\end{bmatrix}
\right)
\]

which is a function of her student debt burden. For example, if \( \gamma^R \) is negative, then a graduate with debt faces a worse (in expectation) marginal distribution of \( R \)-type jobs than her debt-free counterpart. This is intended to capture in a reduced form way the effect that debt has on reservation wages for risk averse agents as in Danforth (1974). As reservation wages decrease, lower wages become more acceptable and graduates effectively draw from a worse wage distribution.

Identification of this model from wage and occupational choice data involves uniquely determining \( \beta^U, \beta^R \), and \( F \), which is complicated by the fact that observed wages in each job are conditional on the graduate choosing that job; that is her counterfactual wage in the alternate job is not observed. The structural identification of this model is well documented and relatively simple; see Heckman and Honoré (1990) and French and Taber (2011). Following French and Taber (2011), structural identification proceeds in four steps, 1) a “reduced form” probit intended to determine the probability that graduates choose either job, 2) a wage equation that accounts for the selection into job type that is essentially the second step in a Heckman two-step, 3) a “structural probit” that determines the structural parameters as functions of the reduced form coefficients, and 4) retrieving the variance covariance matrix of the residuals. See Appendix 3.A or French and Taber (2011) for a more detailed description of the strategy.

This model is identified up to a normalization regarding the effect of student debt on the marginal distributions of jobs, \( \gamma^U \) and \( \gamma^R \). For example, if student debt positively affects the marginal distribution of unrelated jobs, the occupational choice and resultant income is indistinguishable in terms from the case where debt negatively affects the marginal distribution of related jobs. As such, I normalize \( \gamma^U \) to zero.

\[22\] As discussed in Heckman and Honoré (1990) and French and Taber (2011), this model is primarily identified off of the normality assumption.
For the wage and occupational choice data, I use the 2008 wave of the B&B. The observables are the full set of regressors used in Section 3.3. The occupational choice data refers to the whether the graduate refers to her job one year after graduation as related or not. The income data is log income one year after graduation. For constrained graduates, $s_i$ is set to their level of student debt. For both unconstrained graduates and graduates without debt, $s_i$ is set to zero. I report in Table 3.10 the salient parameters for the discussion; the estimated value of $\gamma_R$ and the variance-covariance matrix of the joint distribution of jobs across types.

As expected from my empirical results in Section 3.3, debt has a negative effect on the marginal distribution of $R$-type jobs. For a given set of characteristics, a person with higher debt is more likely to draw a worse $R$-type job and thus more likely to choose to accept an unrelated job. The marginal distribution of $U$-type jobs is slightly more variable than $R$-type jobs, but job draws are highly correlated across types, with a correlation coefficient of about 0.82.

In the next section, I use the estimated parameters to construct income counterfactuals for a given sample as I change the environment.

### 3.5 Rise in Student Loan Debt

As discussed in the introduction, the aggregate amount of student loan debt has risen since the early 1990s. In this subsection, I use the estimated parameters to back out how this rise affected graduates’ incomes and occupational choices. While income for most graduates is unaffected by the rise in debt, I find the increase in debt from 1993 to 2008 caused income to decrease by about 1.87% for those affected by the debt increase. Nearly all of these graduates remained in jobs related...
Table 3.11: Summary Statistics of Student Debt

<table>
<thead>
<tr>
<th>Year</th>
<th>Unconditional</th>
<th>Conditional</th>
<th>Unconditional</th>
<th>Conditional</th>
<th>Unconditional</th>
<th>Conditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>41.25 %</td>
<td>0.58</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.4</td>
<td>0.3</td>
<td>0.6</td>
<td>1.21</td>
<td>1.88</td>
</tr>
<tr>
<td>2000</td>
<td>68.13 %</td>
<td>1.72</td>
<td>0</td>
<td>0</td>
<td>1.36</td>
<td>2.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.52</td>
<td>0.55</td>
<td>1.27</td>
<td>2.17</td>
<td>3.17</td>
</tr>
<tr>
<td>2008</td>
<td>65.61 %</td>
<td>1.65</td>
<td>0</td>
<td>0</td>
<td>1.19</td>
<td>2.55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.52</td>
<td>0.56</td>
<td>1.22</td>
<td>2.1</td>
<td>3.31</td>
</tr>
</tbody>
</table>

Notes: Tens of thousands of $2009. Source: B&B.

to their major after the debt increase, but the small group that did switch to an unrelated job had smaller income losses.

From the 1993 cohort to the 2008 cohort of the B&B, debt increased across the entire distribution. I show in Table 3.11 the distribution of student debt for each cohort of the B&B. In 1993 only about forty percent of graduates had student debt, whereas in the 2008 cohort about two-thirds of graduates have some debt. Nearly all of the increase in loan balances occurred between the 1993 and the 2000 cohort, with the distribution of debt remaining relatively stable between the 2000 and 2008 cohort. Graduates in 2008 owed about 16 thousand dollars on average in debt, up from 5.8 thousand in the 1993 cohort. The average conditional on having debt rose by a similar amount.\(^{23}\)

I simulate an economy of graduates with debt by drawing a random sample (with replacement) of 100,001 observations from the empirical joint distribution of characteristics and student debt from the B&B2008. Given their level of debt under the 2008 distribution of debt, I draw jobs for each person from the appropriate joint distribution. I then construct incomes in each type using their job draws, characteristics and estimated loading factors, from which I select the maximum.

I construct the 1993 debt counterfactual by assigning the debt level from the 1993 distribution corresponding to the graduates’ percentile in the 2008 distribution. I then correspondingly adjust the \(R\) type job draw. For example, the person at the 90th percentile in the 2008 distribution had about 40 thousand dollars in debt. This person would be assigned 27 thousand dollars in debt under the 1993 distribution, and her \(R\)-type job draw would be adjusted upwards by 0.143 (13*0.011).

\(^{23}\)This is rise is more muted compared to the rise in average debt per full-time equivalent undergraduate presented from the College Board in Figure 3.1a.
About 80% of graduates have income that is unaffected by the change from the 1993 debt distribution to the 2008 distribution. 40% of graduates will have zero debt in both the 1993 and 2008 case, and only about half of the 60% of graduates with debt are constrained. Of this 30%, less than a third get a good enough draw of the unrelated job that they choose the unrelated job regardless of their debt level, hence the change in debt has no effect on them. Debt causes the remaining 20% of graduates to be in a worse job that is still related to their major or were induced to switch to a unrelated job.

For these graduates affected by the change in debt, increasing debt from the 1993 level to the 2008 level causes income to fall by 1.87% on average. The vast majority, about 97%, of graduates remain in related jobs but receive worse wages because of the increase in debt causes them to select worse jobs. Income for these graduates fell by about 1.95% on average. The graduates who were induced to change to a job in an unrelated field had their income fall by only 1.1%. Graduates who are induced to switch have mitigated income losses in the short run. Though not modeled, smaller income losses likely come at the cost of future income growth, as shown in Table 3.9.

I also divide affected graduates into two groups: those who had no debt in 1993 but positive debt in 2008 and those who had positive debt in 1993 but more debt in 2008. About 75% of the affected are in the latter group, along with larger average income losses. The average income loss from the first group was about 1.2% on average, which those whose positive debt levels increased lost almost double that, about 2.1%.

The rise in debt from 1993 to 2008 reduced income for affected graduates by about 1.87% on average. This change is mostly due to graduates who remain in jobs related to their field of study, but end up with worse jobs. The occupational change attenuates the short-run income loss for those graduates who switched, but likely comes at the cost of longer-run income growth. Graduates who still would have borrowed in the low debt regime in 1993 were the most affected, losing about 2.1% on average.
3.6 Policy Change

Student debt in the United States has two features that make it particularly distortionary in terms of graduates’ early working life decisions: short debt maturity relative to the life of the underlying asset and non-state contingent repayment. In my model, this corresponds to $\gamma^R$, the distortionary effect of student debt on decisions in the labor market. I find that when student loans do not distort decisions in the labor market, affected graduates earn about 3.5% higher income on average.

While the life of the underlying asset, human capital, is an entire lifetime, the maturity of student debt is typically only ten years. Relative to a longer maturity loan, monthly payments are thus larger. Given that graduates are closer to their borrowing constraints in their early working life, a longer maturity loan would ease constraints in early working life allowing for more optimal labor market decisions.

Unlike other categories of consumer debt, student debt is not dischargeable in bankruptcy unless in extreme circumstances, which often is a particularly high legal bar to clear (see Pardo and Lacey 2009). Payments under the standard repayment plan are a fixed value, amortizing the debt over typically ten years. While income-based repayment plans do exist, they are opt-in and take up is low due to high administrative barriers. Current income based repayment plans typically adjust annually and thus are not very responsive to high-frequency income shocks, limiting their state contingency (see Dynarski 2014). The fact that student debt must be repaid, even in the worst state of the world, leads risk-averse agents to avoid that state at all costs. Allowing for more state-contingency into repayment essentially works as insurance for risk-averse graduates and allows them to take the appropriate risks in the labor market.

As the same amount of student loans must be repaid regardless of job draw or chosen occupation, a repayment scheme in my model can be characterized by the distortionary effects it has on occupational choice: $\gamma^R$. A negative $\gamma^R$ (as estimated), makes graduates with student debt more likely to draw a worse related job and more likely to choose jobs unrelated to their major, as compared to if they had no debt. A $\gamma^R$ of zero corresponds to a repayment plan that has no relative distortionary effects on reservation wages or occupational choice. A positive $\gamma^R$ makes it
more likely for graduates to get better jobs related to their major, which is perhaps implementable through directed tax rebates or student debt forgiveness plans.

Using the estimated parameters and the empirical distribution of student loans from the 2008 B&B, I re-run the simulation varying \( \gamma^R \). As in the previous subsection, I draw 100,001 observations from the empirical distribution of graduates from the 2008 wave of the B&B, along with job draws from the estimated distribution. I then calculate the wage each individual would receive in both related and unrelated jobs, of which they select the one with the highest wage.

Changing to a repayment system that does not affect graduates’ labor market decisions would increase income for affected graduates by 3.5% on average. I show in Figure 3.3 the average change in income for affected graduates changing from the estimated value of \( \gamma^R \) to the value on the x-axis. The average income gains are increasing in \( \gamma^R \).

Again, the vast majority of income gains come from affected graduates who remain in jobs related to their fields. Given that they had a good enough related job prior to the income based repayment plan, they capture all of the change to the marginal distribution. Graduates who chose a job unrelated to their field do not capture all of the gains as part of the change goes toward inducing them to choose a related job. As discussed in the previous section, the gains from switching to a related job are likely understated as I do not take into account the longer run benefits of switching to a related job.

A more careful evaluation of the cost and benefits of income contingent repayment schemes, particularly the general equilibrium effects, is incredibly important. Income based repayment plans may change the relative payoffs for going to college and thus would affect college attendance and stop-out decisions. Also, designing the optimal repayment system requires data on lifetime earnings as well as graduates’ ability to borrow in terms of liquid assets in order to smooth through transitory income shocks. The analysis in this section, however, provides an important first step in establishing the scope of the benefits of income-based repayment plans.
Figure 3.3: Change in Income by Distortionary Effect of Debt. Notes: Distortionary effect of debt given by $\gamma^R$. Average change taken over affected graduates only.

### 3.7 Conclusion

In this chapter, I document the effect of student debt on income and labor market decisions for recent college graduates. I find that student debt has a negative effect on income, consistent with repayment of student debt lowering the buffer stock of assets for recent graduates, which constrains their decisions in the labor market. Compared to their debt-free peers, graduates with debt are less willing or able to self-insure against labor market risk, and as such are less likely to take risky but lucrative opportunities. By estimating the parameters from a structural model of occupation choice, I show that the rise in debt from 1993 to 2008 contributed to lower incomes for college graduates.

There are a number of important avenues for future research. First, the rise in student debt in and of itself suggests a need to study the reason why students are borrowing more. While the skill premium is increasing, suggesting prospective college students should be willing to borrow more to finance higher education, overoptimistic expectations of the returns to education may lead graduates to over-leverage themselves. Second, the interaction between household formation and student debt may play an important role. For example, a partner without student debt allows for
some within household insurance, while labor market outcomes may be particularly poor if both partners have student debt. Third, the impact of the effect of debt on income plays an important role for evaluating the returns to education. Are students correctly evaluating the constraining impact that debt potentially has when they make their borrowing decisions? This chapter suggests that early labor market outcomes are incredibly important for graduates, and as such, it is crucial to correctly evaluate the expected returns in order to backwards induct the appropriate college specialization and even attendance decisions.

Finally, at a policy level, the effect of student debt repayment schemes likely affect income over graduates’ entire working life. Optimal repayment schemes should take into account the effect that repayment has on graduates’ risk in the labor market and the accordant decisions graduates make. Research has shown in the micro-finance context (see Field et al. 2013) demonstrating that less strict repayment terms in the short-run allow for more business investment due to relaxed financial constraints. Income contingent loans will likely similarly increase income for graduates as they have a less distortionary effect on graduates’ labor market outcomes.

References


Elliott, W., Grinstein-Weiss, M. and Nam, I.: 2013c, Student debt and declining retirement savings, CSD Working Paper 13-34, Washington University, Center for Social Development.


Appendix

3.A Structural Estimation Procedure

The graduate chooses the occupation which provided the highest income, so the probability of a graduate choosing job $R$ is

$$\Pr(J_i = R | X_i = x, S_i = s) = \Pr(Y_i^R > Y_i^U | X_i = x, S_i = s)$$

$$= \Pr(x'(\beta^R - \beta^U) + s'\gamma > \varepsilon_i^C - \varepsilon_i^O)$$

$$= \Phi \left( \frac{x'(\beta^R - \beta^U) + s'\gamma}{\sigma^*} \right)$$

$$= \Phi (x'\alpha + s'\delta)$$

where $\Phi$ is the CDF of a standard normal, and $\sigma^*$ is the standard deviation of $\varepsilon_i^U - \varepsilon_i^R$. This “reduced form” probit gives us estimates of parameters that are combinations of the underlying structural parameters.

I recover the parameters relating to the $R$ job from estimating a wage equation as a function of worker characteristics and student loans. Since wages are conditional on the graduates’ particular choices, the wage equation needs to be corrected for selection. It is a straight forward derivation to show that

$$\mathbb{E}[Y_i^R | J_i = R, X_i = x, S_i = s] = x'\beta^R + s'\gamma - \tau \lambda (x'\alpha + s'\delta)$$
where $\lambda(\cdot)$ is the inverse Mills ratio for the standard normal distribution. This term corrects for selection into the $R$ job, and is the second step of a Heckman two-step.

Using the estimated parameters from the wage equation, I run the “structural probit” of occupational choice

$$Pr(J_i = R|X_i = x, S_i = s) = \Phi\left(x'\hat{\beta}_R \zeta + s'\hat{\gamma}\eta\right).$$

where $\hat{\beta}_R$ and $\hat{\gamma}$ are the estimated parameters from wage equation. The remaining parameters and the variance-covariance matrix are given by:

$$\hat{\sigma}^* = \frac{\hat{\gamma}}{\hat{\delta}}$$

$$\hat{\beta}^U = \hat{\beta}_R \left(1 - \hat{\zeta}\right)$$

$$\hat{\sigma}^2_R = \frac{1}{N_R} \sum_{i=1}^{N_R} \left[\hat{\epsilon}_i^2 - \hat{\tau}^2 \left(\lambda(X_i'\hat{\alpha} + S_i'\hat{\delta})(X_i'\hat{\alpha} + S_i'\hat{\delta}) - \lambda^2(X_i'\hat{\alpha} + S_i'\hat{\delta})\right)\right]$$

$$\hat{\sigma}_{UR} = \hat{\sigma}^2 - \hat{\tau}\hat{\sigma}^*$$

$$\hat{\sigma}^2_U = \hat{\sigma}^* - \hat{\sigma}^2_R + 2\hat{\sigma}_{UR}$$

where $N_R$ is the number of graduates in the $R$ job and $\hat{\epsilon}$ is the estimated residual from the wage equation. The final step involves backing out the estimates for the variance-covariance matrix.
### 3.B Occupation Codes

Table 3.12: Occupational Codes

<table>
<thead>
<tr>
<th>SOC Code</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“Professional Occupations”</td>
</tr>
<tr>
<td>2</td>
<td>Air transportation professionals</td>
</tr>
<tr>
<td>4</td>
<td>Business managers</td>
</tr>
<tr>
<td>7</td>
<td>Communication professionals</td>
</tr>
<tr>
<td>8</td>
<td>Computer/information systems occupations</td>
</tr>
<tr>
<td>10</td>
<td>Engineering technicians</td>
</tr>
<tr>
<td>11</td>
<td>Engineers</td>
</tr>
<tr>
<td>14</td>
<td>Healthcare professionals (non-nurses)</td>
</tr>
<tr>
<td>15</td>
<td>Information professionals</td>
</tr>
<tr>
<td>16</td>
<td>Legal professionals</td>
</tr>
<tr>
<td>17</td>
<td>Life scientists</td>
</tr>
<tr>
<td>18</td>
<td>Math-related occupations</td>
</tr>
<tr>
<td>20</td>
<td>Nurses</td>
</tr>
<tr>
<td>24</td>
<td>Physical scientists</td>
</tr>
<tr>
<td>25</td>
<td>PK-12 educators</td>
</tr>
<tr>
<td>26</td>
<td>Postsecondary educators</td>
</tr>
<tr>
<td>30</td>
<td>Social scientists</td>
</tr>
<tr>
<td>31</td>
<td>Social service professionals</td>
</tr>
<tr>
<td></td>
<td>“Non-Professional Occupations”</td>
</tr>
<tr>
<td>1</td>
<td>Agriculture occupations</td>
</tr>
<tr>
<td>3</td>
<td>Artists and designers</td>
</tr>
<tr>
<td>5</td>
<td>Business occupations (non-management)</td>
</tr>
<tr>
<td>6</td>
<td>Business/legal support (non-secretarial)</td>
</tr>
<tr>
<td>9</td>
<td>Construction/mining occupations</td>
</tr>
<tr>
<td>12</td>
<td>Fitters, tradesmen and mechanics</td>
</tr>
<tr>
<td>13</td>
<td>Food service occupations</td>
</tr>
<tr>
<td>19</td>
<td>Military</td>
</tr>
<tr>
<td>21</td>
<td>Other educators</td>
</tr>
<tr>
<td>22</td>
<td>Other healthcare occupations</td>
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<td>23</td>
<td>Personal care occupations</td>
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<td>27</td>
<td>Protective service occupations</td>
</tr>
<tr>
<td>28</td>
<td>Sales occupations</td>
</tr>
<tr>
<td>29</td>
<td>Secretaries and administrative assistants</td>
</tr>
<tr>
<td>32</td>
<td>Sports occupations</td>
</tr>
<tr>
<td>33</td>
<td>Transport support occupations</td>
</tr>
</tbody>
</table>

Notes: Tens of thousands of $2009. Source: B&B.