The Effect of Unexpected Inheritances on Wealth Accumulation: Precautionary Savings or Liquidity Constraints?

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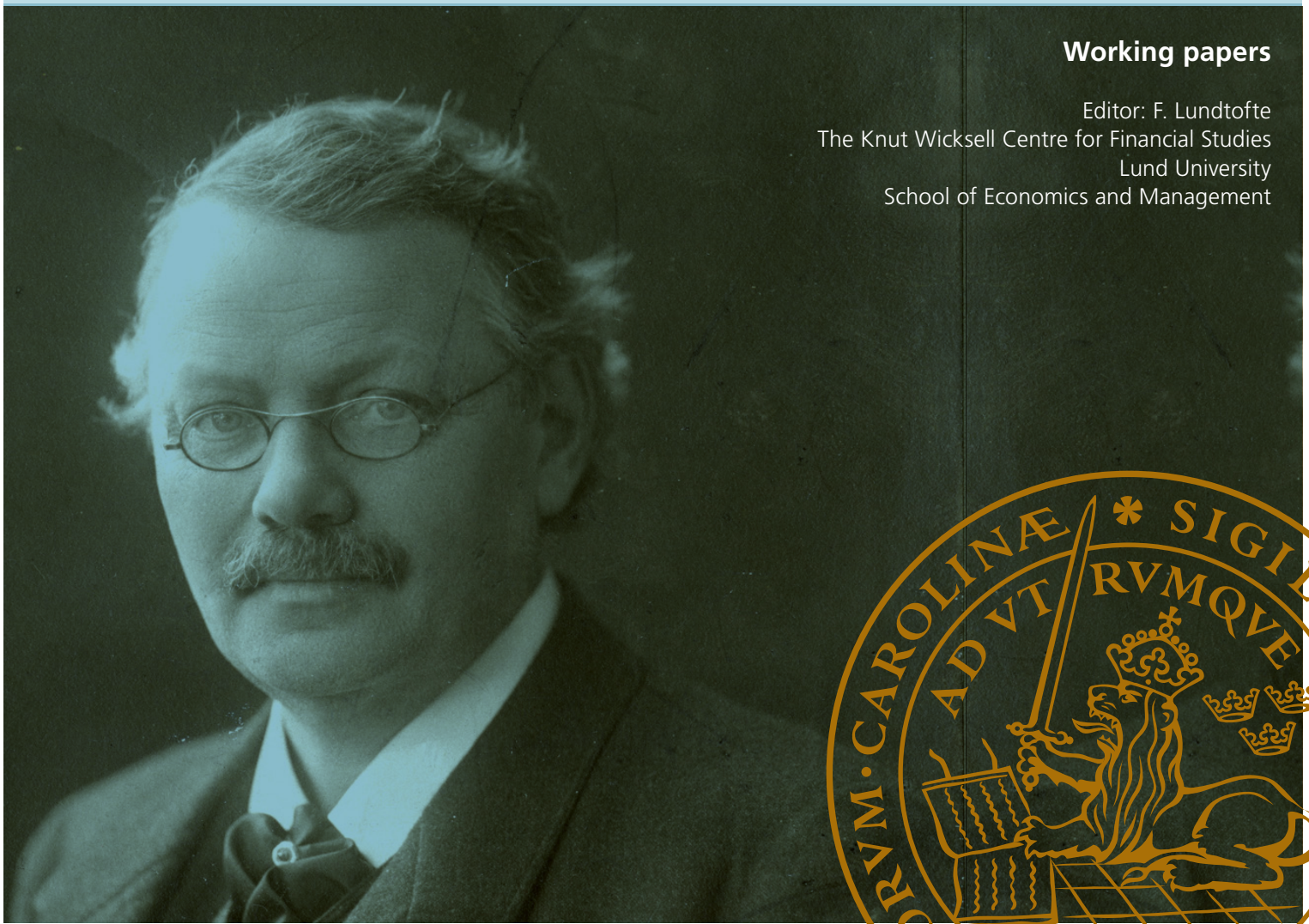

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The Effect of Unexpected Inheritances on Wealth Accumulation: Precautionary Savings or Liquidity Constraints?

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Abstract

Combining a Danish panel of yearly administrative wealth reports with the unexpected timing of sudden parental deaths, I exploit inheritance episodes to characterize wealth accumulation dynamics in the ten years following a financial windfall. Consistent with the predictions of a buffer stock model of consumption, liquid assets quickly converge to pre-inheritance levels. However, real estate and financial investments persist over time. Age and liquidity constraints do not explain these results: Heirs exploit inheritance to accumulate housing equity if young, and precautionary savings if liquidity constrained. These causal estimates highlight the importance of consumption models capable of distinguishing between multiple assets.

Keywords: Inheritance; liquidity; wealth; buffer stock model; housing equity; precautionary savings; sudden death; liquidity constraints

JEL codes: D14, D91, E21, G11

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Online appendix available at www.alemartinello.com/papers/inheritance_appendix.pdf

Individual saving strategies have crucial implications for both economic theory and policy making (Carroll, Overland and Weil, 2000; Deaton and Paxson, 2000). Consumers accumulate wealth not only to prepare for retirement, but also to weather negative income shocks in the short and medium run (Gourinchas and Parker, 2002; Cagetti, 2003). Carroll (1997, 2011) shows that the combination of impatience and uncertainty about the future can create a balance of forces determining saving behavior around a target ratio of wealth to permanent income, a target that serves as a buffer stock of precautionary savings. If, with respect to an individual's permanent income, wealth is below the target, prudence dominates impatience and consumers will save; if wealth over income is above the target, impatience dominates prudence and consumers deplete their savings. This intuitive mechanism can explain many of the stylized facts about aggregate consumption and income growth.

However, little quasi-experimental evidence exists on the effect of an excess of financial resources on the dynamics of individual wealth accumulation. The existing quasi-experimental evidence focuses on different implications of consumption models, such as the propensity to consume out of permanent income (Aaronson, Agarwal and French, 2012), transitory income (Johnson, Parker and Souleles, 2006; Agarwal, Liu and Souleles, 2007; Jappelli and Pistaferri, 2010; Parker et al., 2011; Kreiner, Lassen and Leth-Petersen, 2013), and liquidity shocks (Gross and Souleles, 2002; Leth-Petersen, 2010). Moreover, the majority of these empirical papers focuses on short run reponses.

This paper focuses on the long run wealth accumulation dynamics characterizing buffer stock models of consumption and savings. By exploiting unexpected inheritance episodes and a unique panel dataset drawn from seventeen consecutive years of Danish administrative records on tax returns and individual asset holdings, this paper estimates the causal effect of large shocks to available financial resources on wealth accumulation strategies. I use inheritance as a shock

to available financial resources, and exploit the panel dimension of my data to estimate its effect on individual wealth holdings in the ten following years.

To identify the causal effect of inheritances, I exploit the random timing of sudden parental deaths due to car crashes, other accidents, and heart attacks when no pre-existing diagnosis of cardiac disease exists. I then compare the behavior of individuals receiving an inheritance few years apart from one another.[1] This strategy is similar to that used to identify the effect of tax rebates on consumption (Souleles, 2002; Shapiro and Slemrod, 2003; Johnson, Parker and Souleles, 2006; Misra and Surico, 2011; Parker et al., 2011) and of inheritance on labor market decisions (Holtz-Eakin, Joulfaian and Rosen, 1993, 1994).

The paper presents and discusses three main findings. First, I show that heirs respond to a sudden increase in available financial resources by decreasing their savings efforts in the ten years after inheriting. Consistent with the predictions of a buffer stock model of consumption, the net worth of the heirs converges back towards the level accumulated before parental death.

Second, I show that the convergence patterns after inheritance of different wealth components differ substantially. While heirs quickly deplete their excess of liquid assets, financing consumption or investments in real estate and financial instruments, accumulated wealth in housing equity, stocks, bonds and mutual funds persist over time.

Third, I show that liquidity constraints due to imbalances of human and financial capital or low levels of liquid assets do not drive these results. Young heirs, constrained by not being able to borrow against their future income and human capital, deplete their excess of wealth less rapidly than older households and exploit their inheritance to invest in housing equity. Similarly, heirs who before parental death hold relatively little amounts of liquid assets deplete their excess

[1] Fadlon and Nielsen (2015) exploit a similar identification strategy to estimate the effect of health shocks on household labor supply.

of wealth less rapidly than other heirs, and exploit inheritance to accumulate a larger stock of liquid assets.

This paper is closely related to the literature studying the effect of wealth changes on consumption.[2] Campbell and Cocco (2007) and Paiella and Pistaferri (2016) show that households respond to both unanticipated and anticipated changes in wealth. By splitting my sample across unexpected and potentially expected inheritances, I confirm their findings with the exception of the accumulation of housing equity towards the end of the lifecycle. Heirs receiving an inheritance after age forty and potentially expecting parental death underinvest in housing equity, and use inherited real estate to re-balance their portfolio. Instead, heirs of the same age who do not expect parental death dissipate inherited housing after inheritance.

Most of the literature on wealth effects exploits exogenous changes in real estate and stock prices for estimating consumption responses in the short run.[3] However, Juster et al. (2006) stress the importance of estimating the effect of an increase of financial resources on the accumulation of different asset types. Not only might savers assign assets to separate mental accounts, but specific asset types such as housing equity can have more than one function. Characterizing the role of specific assets within a single savings plan is thus crucial for modeling and predicting individual and aggregate saving behavior.

This paper complements the existing evidence on saving and consumption behavior in two ways. First, by studying saving and wealth accumulation paths, the paper reveals the nature of different wealth components as saving vehicles. I show that different wealth accumulation strategies coexist within single saving

[2]Estimates of wealth effects have been performed with both aggregate (Lettau and Ludvigson, 2001; Lettau, Ludvigson et al., 2004) and household-level data (Juster et al., 2006; Browning, Gørtz and Leth-Petersen, 2013; Paiella and Pistaferri, 2016). Jappelli and Pistaferri (2010) provide a detailed review of the evidence.

[3]Carroll, Otsuka and Slacalek (2011) show that households react to shocks on housing equity more than they do to shocks on financial markets.

plans, and that specific wealth components serve different purposes in these plans. While liquid assets (checking and savings accounts) are the preferred vehicle for precautionary savings in the short run, financial investments (stocks, bonds and mutual funds) are the preferred vehicle for long run wealth accumulation.[4] These results stress the importance of consumption and saving models that allow for different asset types and investment dynamics.

Second, because many shocks studied in the literature (e.g., tax rebates and increases in credit card limits) are dwarfed by other income sources, the analysis horizon is typically limited to the short-run. However, inheritance releases enough financial resources to allow intensive and extensive margin responses in both the financial (Andersen and Nielsen, 2011) and housing markets in the long run. By estimating the effect of large shocks on the long run dynamics of saving behavior, I complement the existing short-run estimates of the elasticity of consumption on wealth (Paiella and Pistaferri, 2016) and housing equity (Mian, Rao and Sufi, 2013; Kaplan, Mitman and Violante, 2016). I also provide a novel sets of moments for the calibration of intertemporal consumption models.

Inheritance not only is a useful tool for identifying how saving behavior reacts to financial windfalls, but also plays a critical role role as a vehicle of intergenerational wealth transmission (Bowles and Gintis, 2002; Boserup, Kopczuk and Kreiner, 2016) and driver of inequality (De Nardi, 2004; De Nardi and Yang, 2014). Shapiro (2004) states that U.S. babyboomers are "in the midst of benefiting from the greatest inheritance of wealth in history", amounting to approximately $9 trillion between 1990 and 2030 (Avery and Rendall, 1993, 2002). Piketty (2011) estimates that in 2010 the flow of inheritance was about 15 percent of national GDP in France. Even excluding the wealthiest 1 percent of the population, between

[4]The difference in how these asset types respond to inheritance is consistent with the results of Jappelli, Padula and Pistaferri (2008) who, by allowing household to use financial investments as precautionary savings, test and reject the implications of the buffer stock model with Italian cross-sectional data.

1995 and 2010 Danes transferred via inheritance an average of 26.5 billions Danish Kroner (DKK) every year, an amount equal to 1.6 percent of the 2010 country GDP. For further comparison, the 2009 Danish SP stimulus policy, designed to stimulate aggregate consumption in response to the 2008 recession, released into the economy 23.3 billion DKK net of taxes (Kreiner, Lassen and Leth-Petersen, 2013). Understanding how inheritances affect individual saving behavior can shed light on the impact of such colossal wealth flows on the aggregate saving rate of an economy.

The remainder of the paper is organized as follows. Section I recalls the implications from consumption theory and the buffer stock model of consumption tested in this paper (Carroll, 2011). Section II describes the data I use in my analysis. Section III illustrates my identification strategy. Section IV describes the results of this paper and relates them to the theoretical implications introduced in Section I. Section V concludes.

I. Implications from consumption theory

The buffer stock model of consumption implies that an impatient consumer facing uncertainty in the future follows a consumption rule $c(m_t)$ that is both increasing and concave in the level of available financial resources (normalized by permanent income) m_t. Carroll (2011) shows that under reasonable assumptions on consumer impatience and human capital wealth,[5] the infinite horizon consumption rule converges to a unique strategy characterized by the existence of a unique target of cash-on-hand ratio $\check{m}$, which is stable. That is, if $m_t = \check{m}$, then

$$\mathbb{E}_t \left[\frac{m_{t+1}}{m_t} \right] = 1 \tag{1}$$

[5]This model incorporates both liquidity constraints and perfect foresight as special cases. More specifically, as $m_t \to \infty$, the consumption rule $c(m_t)$ converges to the perfect foresight case.

and if $m_t > \check{m}$

$$\mathbb{E}_t \left[\frac{m_{t+1}}{m_t} \right] < 1. \tag{2}$$

If cash-on-hand (Deaton, 1991) is higher than the target, consumption increases (at a declining rate) such that precautionary savings converge in time to $\check{m}$. Therefore, if heirs are on average at their steady-state target cash-on-hand ratio, inheritance provides an excess of available financial resources that heirs are impatient to consume, and the amount of wealth held for precautionary savings will converge back to the original target.

This paper tests this hypothesis in two steps. In the first step, I analyze the convergence pattern not only of total net worth but also of different wealth components separately, thereby revealing differences between wealth accumulation strategies of liquid and illiquid assets. In the second step, I assess the role of liquidity constraints due to human capital, approximated by the age at which heirs receive their inheritance and their financial situation before parental death.

Imbalances between human and financial capital can constrain individual consumption choices and lead to high propensity to consume out of liquidity shocks. Gourinchas and Parker (2002) estimate a structural consumption model with cross-sectional survey data from the United States and show that buffer stock behavior differs across the lifecycle. More specifically, they show that while younger households behave as buffer stock agents, the behavior of households whose head is older than 40 is more consistent with a permanent income hypothesis model. In my framework, their findings imply that younger heirs deplete their inheritance faster than older heirs. I test this hypothesis in the second part of Section IV.

Low levels of liquid assets can create similar consumption responses. Kaplan and Weidner (2014) and Kaplan and Violante (2014) show that if the majority of their wealth is held in illiquid assets, even wealthy households can behave like hand-to-mouth consumers and exhibit buffer stock saving behavior . More

generally, both endogenous and exogenous liquidity constraints can explain the quick depletion of inheritance via increased consumption (Johnson, Parker and Souleles, 2006; Leth-Petersen, 2010). In the second part of Section IV, by analyzing separately the convergence patterns of individuals holding relatively low and high levels of liquid assets before parental death, I test whether the financial status of heirs before inheriting explains the results of this paper.

II. Data

This paper exploits Danish administrative register data from 1995 through 2012.[6] In a unique dataset I combine birth and mortality registers, individual tax returns, housing and land registers and yearly third-party reports from financial institutions on individual wealth holdings. For every individual in the sample, yearly reports from financial institutions separately record the December 31 market value of liquid assets held in checking and savings account, debts with and without collateral, and the sum of financial investments in stocks, bonds and mutual funds. The combination of data on collateralized debts (chiefly mortgages) and data from the land and housing registers provides me with a measure not only of wealth held in housing equity, but also of the number of housing units (apartments, houses, summer homes) owned by each individual in the sample. Moreover, I construct a measure of permanent income computed as a moving weighted average of disposable income after tax and transfers during the previous five years.

In my analysis I focus on individuals inheriting more than a year of their permanent income. Danish central authorities do not store information on inheritance. Instead, it's instead collected regionally and for limited periods. Therefore, I use an imputed measure of inheritance to split my sample. More specifically, I follow Andersen and Nielsen (2011, 2012) and impute inheritance transfers

[6]To construct a measure of permanent income I use tax returns from 1991 through 2012 .

by splitting the wealth holdings of a deceased individual equally among his or her children, exploiting the default rule in Danish law for holdings of unmarried individuals in absence of a will.[7] The imputation has the additional advantage of circumventing the potential endogeneity of inheritance if parents allocate bequests strategically among their children (Bernheim, Shleifer and Summers, 1985; Francesconi, Pollak and Tabasso, 2015). The results of the paper do not however depend on this imputation process: Imputed inheritance does not explicitly enter any regression, and serves only to split the sample across heirs likely inheriting either large or small inheritances .

My sample thus consists of children of parents dying single between 1995 and 2012. As I observe heirs for up to ten years after parental death, I focus on individuals inheriting when aged between 25 and 50 years and thus always in working age. I exclude the wealthiest 1 percent of the population because their inheritance structure, saving motives and trajectories differ markedly from those of the general population.

In the first step of the analysis, I study the response of wealth accumulation on unexpected inheritances larger than one year of permanent income. I define unexpected inheritances as those due to a sudden death caused by either violent accidents (e.g. car crashes) or heart attacks for people with no known history of cardiac disease. These deaths, identified according to the WHO's ICD-10 codes, represent about 10 percent of all deaths in the sample.[8]

This step of the analysis exploits a total of 6,286 unique inheritance episodes, 58 percent of which occurr the heir has turned 40. Table 1 describes the character-

[7]For each heir I then calculate the net inheritance after taxes, applying the marginal rate of 15 percent on the portion of inheritance exceeding a tax-free threshold, which varies yearly. The applied tax-free thresholds are reported in the online appendix. This imputation, while introducing substantial measurement error, is particularly appropriate in Denmark not only because a minority of Danes draft a will (Andersen and Nielsen, 2011) but also because under Danish law the surviving children are always entitled to a part of the inheritance, even in presence of a will (Danish Inheritance Act No. 515 of 06 June 2007 Section 5).

[8]The ICD-10 codes defining a death as sudden are I21*-I22*, V*, X*, Y* and R96*.

Table 1
Inheritance and heir characterization, one year before parental death

	All	Unexpected inheritance			
		All	Large inheritance		
			All	Inheriting between 25 and 40	Inheriting between 41 and 50
Imputed inheritance, 1000DKK	208.121	207.988	638.318	561.415	693.602
Disposable income, 1000DKK	212.870	207.581	210.377	193.402	222.580
Inheritance, normalized	1.037	1.064	3.310	3.300	3.318
Net worth	0.250	0.195	0.636	0.147	0.987
Liquid assets	0.229	0.216	0.304	0.264	0.333
Housing equity	0.556	0.509	0.752	0.423	0.988
– Home owner	0.516	0.509	0.580	0.496	0.640
– # units owned	0.579	0.566	0.652	0.537	0.735
Financial investments	0.061	0.056	0.095	0.066	0.115
Uncollateralized debts	0.596	0.584	0.515	0.606	0.449
Liquidity costrained	0.530	0.547	0.439	0.477	0.411
Year of inheritance	2003.666	2002.639	2002.609	2001.826	2003.172
Age at inheritance	39.888	39.307	40.615	34.638	44.911
Age of deceased	70.990	70.635	74.021	68.000	78.342
# episodes	223347	21732	6286	2629	3657

NOTE: Large inheritances are those larger than one year of the permanent income of the heir. Unexpected inheritances are those due to sudden parental death. Imputed inheritance and disposable income are in thousands DKK. In 2012 (December 31), one USD was equal to 5.64 DKK. All other wealth measures are normalized by permanent income.

istics of heirs one year before parental death according to the type of inheritance received. The first column pools all inheritance episodes in the sample. The second and third columns select inheritance episodes that are respectively unexpected and larger than one year of permanent income.

Table 1 shows that while heirs who receive unexpected inheritances receive similar windfalls and are only slightly poorer than heirs receiving potentially expected inheritances, inheritance size is not random in the population. Heirs who are going to receive larger inheritances are wealthier even before a sudden parental death. This difference, while important for correctly interpreting the re-

sults, is both expected and aligned with the goal of this paper. Large inheritances are in general correlated with wealth and socio-economic status (Holtz-Eakin, Joulfaian and Rosen, 1993; Avery and Rendall, 2002; Zagorsky, 2013), and policy makers cannot realistically allocate them at will. Therefore, estimating the average effect of large inheritances on the general population is less relevant than estimating the effect of large inheritances on those who receive them.

The last two columns of Table 1 split the sample among those inheriting before and after turning 40. Older individuals are wealthier, earn more on average, and are less likely to be liquidity constrained. I define an heir as being liquidity constrained if he or she holds fewer liquid assets than a month's worth of permanent income in the year before parental death (Leth-Petersen, 2010). A large fraction of the difference across age in net worth is due to housing: Older individuals are more likely to be home owners and have on average more than twice the amount of housing equity that younger heirs own. However, the average imputed inheritance normalized by permanent income is remarkably similar across the two groups.

III. Identification strategy

Estimating the causal effect of inheritance on wealth accumulation is challenging for three reasons. First, unlike extraordinary transitory income shocks such as lottery winnings (Cesarini et al., 2015; Imbens, Rubin and Sacerdote, 2001), individuals may expect to receive an inheritance at some point in their life. Second, heirs could predict the time of parental death, for example in case of terminal illnesses, and react to it in advance. Third, inheriting from a parent requires parental death, an event that may affect individual wealth accumulation independently from the wealth transfer.

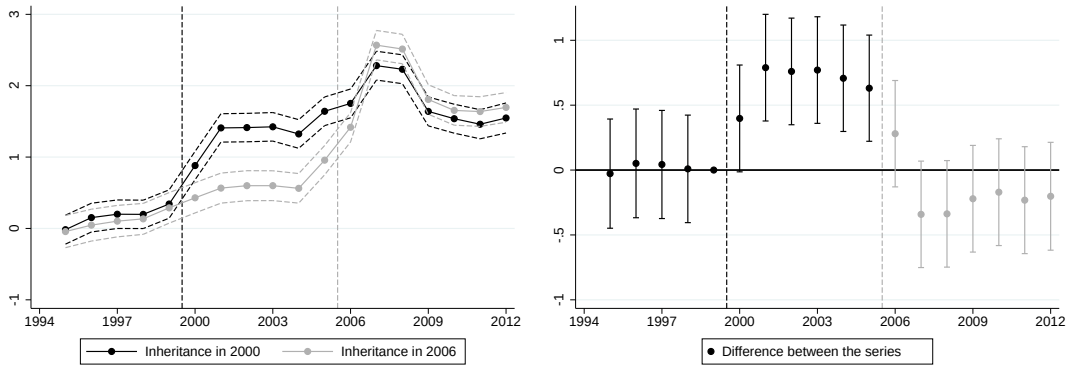
The first challenge stresses the danger of comparing the behavior of heirs

with that of other individuals in the population, some of whom might already have inherited and thus do not expect another such windfall in their lifetime. While Andersen and Nielsen (2011, 2012) use a matching algorithm to find a suitable control group for their sample of heirs, this strategy relies heavily on the conditional independence assumption. To ensure the internal validity of my results, I focus instead on a homogenous sample that by construction has similar expectations. All heirs in my sample inherit a comparable inheritance between 1996 and 2012, and all know that they may inherit at some point in the future. Thus they differ only in the timing of parental death. This identification strategy exploits the randomness in the timing of parental death and is similar to that used by Fadlon and Nielsen (2015) to estimate the effect of health shocks on household labor market supply.

To tackle the second concern and to ensure that heirs do not expect—and and thus react in advance to—parental death, I perform my main analysis on a sample of heirs inheriting because of sudden deaths, as defined in Section II. Moreover, the long panel of yearly wealth observations allows me to check for anticipatory behavior by analyzing wealth accumulation trends in the years preceding parental death.

To deal with the third challenge and show that parental death alone does not affect the wealth accumulation strategies of heirs, I replicate my analysis on a sample of heirs whose parents died with little or no wealth to leave as a bequest. This placebo analysis reinforces the validity of my identification strategy: If my strategy cleanly identifies the effect of inheritances then the placebo should have zero effect on wealth accumulation patterns in the medium and long run.

Figure 1 illustrates my identification strategy. In the left panel of the figure I compare the raw average net worth (normalized by permanent income) of individuals inheriting more than one year of permanent income in 2000 and 2006. In this example, individuals inheriting in 2000 represent the treated group.



(a) Average net worth by year of inheritance

(b) Difference in net worth between groups

Figure 1.—Identification strategy: An example

NOTE: The figure shows the average individual net worth over time of heirs inheriting more than one year of their permanent income in 2000 and 2006 due to a sudden parental death. The units of the vertical axes are years of permanent income.

Individuals inheriting in 2006 act as a natural control group through 2005. Both groups inherit because of a sudden parental death. The right panel of Figure 1 takes the difference between the two groups, effectively identifying the effect of receiving an inheritance in 2000 on wealth accumulation for six years. While after 2005 the control group is contaminated by its own treatment, before 2000 the wealth accumulation paths of the two groups are statistically indistinguishable, showing no evidence of anticipatory behavior.

However, Figure 1 is limited because it only compares two groups of heirs inheriting in two specific years. Using other combinations of heirs inheriting in different years provides more information. For example, by using individuals inheriting in 2010 as a control, I could cleanly identify the effect of inheritance for up to ten years after parental death. By combining all possible comparisons into a single estimation, I can improve both the robustness and the statistical

power of the results. Formally, I estimate the model

$$y_{i,t} = \sum_{\tau=-5}^{9} \beta_\tau \mathbf{1}\left[t - dt_i = \tau\right] + \Lambda_{i,t} + \Psi_i + \varepsilon_{i,t} \tag{3}$$

where Ψ_i and $\Lambda_{i,t}$ are individual and year-by-cohort fixed effects, and dt_i is the year of parental death for individual i. The reference category for the set of coefficients β_τ is one year before parental death, or $\tau = -1$. In all my estimations I allow for arbitrary autocorrelation of errors $\varepsilon_{i,t}$ within individuals.

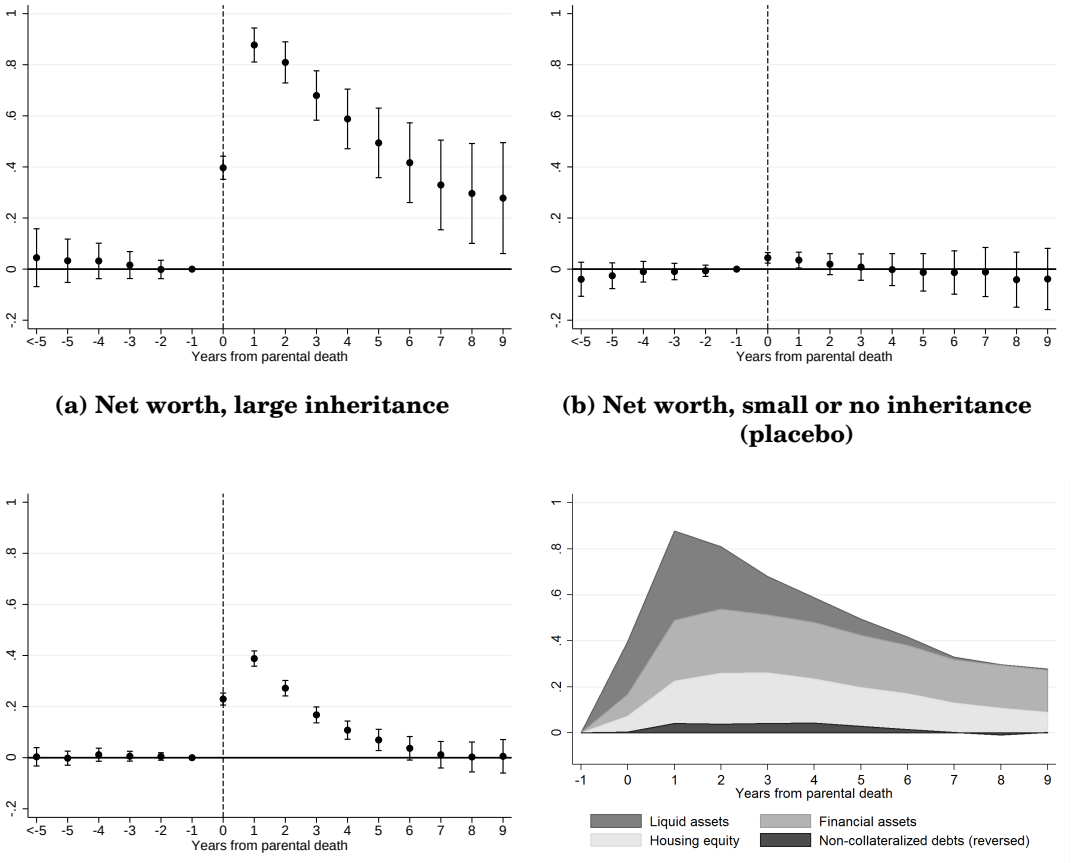
A natural consequence of this identification strategy is that the closer τ is to zero, the more individuals are available for identification, and thus the more precise and robust the estimation of β_τ. I thus focus only on the first ten years after parental death, as after this period of time the estimation is too imprecise for a meaningful interpretation of the results.

IV. Results

This section proceeds in two steps. First, I focus on the sample of heirs receiving an unexpected inheritance worth more than a year of their permanent income, and estimate the causal effect of unexpected large inheritances on wealth accumulation. Then, by splitting the sample between younger and older ages at the time of inheritance and lower and higher liquid assets held before parental death, I assess the role that liquidity constraints play in explaining the wealth accumulation responses.

Figure 2 presents the main results of the paper. The scales of all vertical axes refer to years of permanent income. The top left panel of Figure 2 shows the effect of inheritance on net worth up to ten years after parental death. The graph is the equivalent of the right panel of Figure 1 but is estimated over all possible combinations of parental death years, as shown in Equation (3).

Heirs deplete most of the initial burst of wealth obtained through inheritance



(a) Net worth, large inheritance

(b) Net worth, small or no inheritance (placebo)

(c) Liquid assets, large inheritance

(d) By wealth component, large inheritance

Figure 2.—The effect of inheritance on wealth accumulation

NOTE: The left panels of the figure show the estimated effects and 95 percent confidence intervals of large unexpected inheritances on the accumulation of net worth and liquid assets respectively. The top right panel shows the estimated effects and 95 percent confidence intervals of a small inheritance on wealth accumulation. These effects are estimated according to equation (3) both before and after parental death. Standard errors are clustered at the individual level. The bottom right panel of the figure decomposes the effects shown in the top left panel in the period after parental death into its main components.

within six years from parental death. This response is consistent with the prediction of the buffer stock model. If heirs are on average at their target level of wealth before inheritance, a sudden excess of liquidity increases consumption in the short run and initiates a process of convergence back to the target level of precautionary savings.

The top right panel of the figure further shows that this convergence is not a byproduct of parental death alone. The wealth accumulation of individuals whose deceased parent held few or no asset at the time of death does not respond to the slight increase in net worth held in the short run.

However, total net worth does not fully converge back to the level established before parental death. Because the buffer stock model refers to wealth held for precautionary motives, i.e., wealth upon which a consumer can draw in times of need, I separately analyze the convergence pattern of liquid assets held in checking and saving accounts. The bottom left panel of Figure 2 shows that these assets converge to the level held before inheritance within seven years of parental death. These assets are either consumed or invested in other types of assets. The convergence of liquid assets explains the majority of the convergence of total net worth. The bottom right panel, which decomposes the effect of inheritance on total net worth into its different components, shows that changes in housing equity and financial investments (stocks, bonds, and mutual funds) due to inheritance instead persist over time.

Table 2 expands the results in Figure 2 for all wealth components. The table shows four β_τ coefficients describing respectively anticipatory behavior one year before parental death, the burst of wealth due to inheritance one year after parental death, and the evolution of wealth components in the medium run (five years after parental death) and in the long run (nine years after parental death). The full list of coefficients for all regressions appears in the online appendix. Because imputed net inheritances are imprecisely estimated, the effect of inheri-

Table 2
The effect of inheritances larger than one year of permanent income on wealth accumulation

	Absolute values (thousands of Danish Kroner)				Normalized values (years of permanent income)			
Years from shock	−2	1	5	9	−2	1	5	9
Net worth	1.069	188.093**	126.559**	70.395*	-0.001	0.877**	0.494**	0.278*
	(4.307)	(8.065)	(18.425)	(29.589)	(0.018)	(0.034)	(0.069)	(0.111)
Liq. assets	0.862	80.750**	21.199**	5.964	0.005	0.388**	0.070**	0.006
	(1.615)	(3.119)	(4.964)	(7.830)	(0.007)	(0.015)	(0.021)	(0.033)
Housing equity	1.882	40.703**	44.723**	22.601	-0.002	0.184**	0.169**	0.088
	(3.887)	(6.510)	(15.296)	(24.637)	(0.017)	(0.027)	(0.061)	(0.096)
−# units[a]	0.007	0.111**	0.100**	0.092**				
	(0.005)	(0.008)	(0.020)	(0.031)				
Fin. investments	-1.071	59.315**	57.210**	49.791**	-0.004	0.265**	0.228**	0.183**
	(1.294)	(3.270)	(5.868)	(9.812)	(0.005)	(0.014)	(0.021)	(0.033)
Unc. debts	0.604	-7.326**	-3.427	7.961	0.000	-0.040**	-0.028	-0.002
	(1.681)	(2.588)	(5.673)	(9.742)	(0.008)	(0.014)	(0.030)	(0.047)

NOTE: [a]Total number of housing units that the heir owns at least partially.
The table shows the effect of inheritance on different wealth components two years before and one, five, and nine years after parental death. The full set of coefficients appears in the online appendix. The coefficients are estimated according to equation (3) on a sample of unexpected inheritances larger than one year of the heir's permanent income. The specification includes individual and year-by-cohort fixed effects. Standard errors, clustered at the individual level, are shown in parentheses.

tance on accumulated wealth one year after parental death provides a reference for interpreting the convergence process.

The left part of the table shows the effect of inheritance on nominal wealth in thousands DKK. The right part of the table shows the effect of inheritance on wealth normalized by permanent income. The convergence pattern is the same in both sets of results, demonstrating that these results do not depend on the permanent income normalization.

While heirs deplete most of the initial burst of liquid wealth within five years from parental death, partly consuming it and partly investing it in housing equity, accumulated financial investments persist over time. Andersen and Nielsen (2011) show that financial market participation increases even if the inheritance does not

include stocks held by the parent, suggesting that liquidity constraints prevent financial market participation.

These results suggest that individuals accumulate specific assets for different purposes, using liquid assets and debt holdings as buffers of precautionary savings, and financial instruments as long-term investments. While the buffer stock model accurately describes the accumulation dynamics of liquid assets, the evolution of financial investments follows the behavior of the patient agent of a permanent income hypothesis model.

The effect of inheritance on the accumulation of housing equity is not as straightforwardly interpretable. While inheritance increases the stock of housing equity held in the medium run, heirs dissipate the accumulated stock in the long run. However, the increase from inheritance in the number of housing units that the heir owns persists in the long run. In the second part of this section I show that heterogeneous responses at different stages in the lifecycle drive these results.

To demonstrate that invalid identification or parental death alone do not drive the wealth dissipation patterns shown in Table 2, Table 3 replicates the analysis on a sample of individuals receiving little or no inheritance. Table 3 shows that a parental death associated with an inheritance worth less than a month of permanent income does not affect trends of wealth accumulation, and has only a negligible impact on liquid assets held one year after parental death. I estimate that heirs receiving such small inheritances accumulate an excess worth of 3.5% of yearly permanent income one year after parental death, depleting it within a year.

Similarly, Table 4 shows that households dynamics cannot explain the results shown in Table 2. As a unitary model of household decisions implies that heirs can share their wealth with their spouses, the wealth depletion shown in Table 2 might simply reflect a gradual transfer of resources between spouses. However,

Table 3
Placebo: The effect of inheritances smaller than one month of permanent income on wealth accumulation

	Absolute values (thousands of Danish Kroner)				Normalized values (years of permanent income)			
Years from shock	−2	1	5	9	−2	1	5	9
Net worth	-1.187	6.513^{+}	-5.008	-12.742	-0.006	0.035*	-0.013	-0.039
	(2.578)	(3.687)	(9.296)	(15.014)	(0.011)	(0.016)	(0.037)	(0.061)
Liq. assets	1.214	4.419**	0.341	-2.668	0.007^{+}	0.023**	-0.002	-0.004
	(0.879)	(1.314)	(3.197)	(4.970)	(0.004)	(0.006)	(0.011)	(0.018)
Housing equity	-0.226	-2.677	-12.308	-21.930^{+}	-0.005	0.000	-0.019	-0.043
	(2.451)	(3.465)	(8.200)	(13.292)	(0.010)	(0.014)	(0.032)	(0.052)
−# units[a]	0.005	0.001	-0.009	-0.011				
	(0.003)	(0.005)	(0.013)	(0.020)				
Fin. investments	-0.521	1.789**	1.422	1.247	-0.000	0.010**	0.011*	0.010
	(0.434)	(0.636)	(1.391)	(2.191)	(0.002)	(0.003)	(0.006)	(0.008)
Unc. debts	1.654	-2.982	-5.538	-10.608	0.008	-0.002	0.004	0.002
	(1.445)	(2.060)	(5.520)	(8.965)	(0.006)	(0.009)	(0.021)	(0.034)

NOTE: [a]Total number of housing units that the heir owns at least partially.
The table shows the effect of inheritance on different wealth components two years before and one, five, and nine years after parental death. The full set of coefficients appears in the online appendix. The coefficients are estimated according to equation (3) on a sample of unexpected inheritances smaller than one month of the heir's permanent income. The specification includes individual and year-by-cohort fixed effects. Standard errors, clustered at the individual level, are shown in parentheses.

while the net worth of spouses increases one year after parental death, likely due to joint ownership of newly acquired housing units, I find no evidence of within-household transfers in the following periods that could explain the convergence patterns shown in Table 2. The short-run effect on spousal net worth is imprecisely estimated and disappears in the medium and long run. Inheritance could also drive heirs to change their household composition by marrying or having children, thereby indirectly affecting their consumption needs. However, Table 4 shows that large inheritances do not affect household composition.

Similarly, inheritance could lead to reductions in labor supply. Holtz-Eakin, Joulfaian and Rosen (1993) show that large inheritances can lead to lower labor market participation and thus reduce the inflow of resources to the household.

Table 4
The effect of inheritances larger than one year of permanent income on income and household composition

Years from shock	−2	1	5	9
Disp. Income	0.060	2.112 $^{+}$	8.525 *	8.116 $^{+}$
	(0.751)	(1.114)	(4.098)	(4.149)
# children	0.035	0.012	-0.003	0.035
	(0.035)	(0.027)	(0.052)	(0.094)
Spouse	-0.000	0.009	0.003	0.002
	(0.004)	(0.006)	(0.015)	(0.025)
Spouse net worth^{a}	-2.678	49.131 *	-17.590	-61.585
	(28.689)	(22.360)	(65.079)	(136.833)

NOTE: ^{a}In this set of results the sample is restricted to individuals that are either married or in a registered partnership.
The table shows the effect of inheritance on several outcomes measured two years before and one, five and nine years after parental death. The full set of coefficients appears in the online appendix. The coefficients are estimated according to equation (3) on a sample of unexpected inheritances larger than one year of the heir's permanent income. The specification includes individual and year-by-cohort fixed effects. Standard errors, clustered at the individual level, are shown in parentheses.

However, given the nature of U.S. inheritance taxation, the inheritances they observe are much larger than those in my sample. While Cesarini et al. (2015) and Imbens, Rubin and Sacerdote (2001) show that lottery winnings decrease labor supply, I find no evidence of inheritance reducing yearly disposable income. In my sample disposable income increases slightly because of increased capital gains from financial investments and housing equity.

Nonetheless, the quick dissipation of inherited liquid assets after parental death is consistent not only with the behavior of an impatient buffer stock agent, but also with the existence of exogenous liquidity constraints before parental death. These liquidity constraints could prevent even a patient, forward-looking consumer to achieve the desired level of consumption. Assessing the role of position in the lifecycle and financial status before inheritance in shaping wealth convergence paths after parental death is thus crucial to understanding whether exogenous liquidity constraints alone drive the results of this paper.

A. The role of lifecycle and liquidity constraints

I begin by assessing the role that an individual's lifecycle position has in determining the convergence patterns after inheritance of different wealth component. While younger individuals hold most of their lifetime resources in human capital, their consumption is constrained by the amount of financial assets at their disposal (Guiso and Sodini, 2013). If imbalances between human and financial capital and the resulting liquidity constraints drive the results in Table 2, then the convergence patterns should be more pronounced among younger individuals. However, the top panel of Table 5 shows that despite receiving similar inheritances in terms of their permanent income, younger heirs accumulate more wealth one year after parental death than older heirs, and deplete much less wealth in the following years.

The main driver of this difference in saving behavior is housing equity. While both young and old heirs quickly deplete their liquid assets, younger heirs use part of these assets to invest in housing equity within five years from parental death, maintaining this increase in housing equity in the long run. In contrast, heirs inheriting after 40 years of age sell inherited housing to finance consumption, likely of durables not observed in the data (e.g. cars or boats). The effect of inheritance on the number of housing units owned confirms these results. While younger heirs buy housing units after inheriting, older heirs sell them. Neither group shows signs of anticipatory behavior before parental death.

The bottom panel of Table 5 replicates these results for the sample of heirs whose parent did not die unexpectedly. These heirs potentially expected the inheritance and could thus plan for it. Consistent with the interpretation of unexpected inheritance as a liquidity shock, in this sample the results change less markedly across the age at which heirs inherit. More specifically, individuals inheriting after the age of forty do not sell inherited housing equity.

Table 5
The role of lifecycle position

	Inheriting between 25 and 40				Inheriting between 41 and 50			
Years from shock	−2	1	5	9	−2	1	5	9
	Panel A: Unexpected parental death							
Net worth	-0.050	1.072**	0.885**	0.813**	-0.001	0.798**	0.353**	0.131
	(0.034)	(0.064)	(0.143)	(0.235)	(0.026)	(0.051)	(0.126)	(0.206)
Liq. assets	0.006	0.435**	0.062	-0.039	0.001	0.358**	0.053	-0.016
	(0.014)	(0.029)	(0.051)	(0.083)	(0.010)	(0.019)	(0.037)	(0.062)
Housing equity	-0.010	0.236**	0.378**	0.367+	-0.009	0.165**	0.080	0.045
	(0.029)	(0.053)	(0.128)	(0.211)	(0.024)	(0.042)	(0.108)	(0.178)
−# units[a]	0.002	0.147**	0.179**	0.198**	0.007	0.089**	0.057+	0.048
	(0.010)	(0.018)	(0.045)	(0.072)	(0.006)	(0.012)	(0.034)	(0.054)
Fin. investments	-0.011	0.303**	0.275**	0.266**	-0.008	0.261**	0.254**	0.210**
	(0.010)	(0.025)	(0.045)	(0.073)	(0.006)	(0.019)	(0.037)	(0.061)
Unc. debts	0.035*	-0.099**	-0.170+	-0.218	-0.015	-0.013	0.034	0.108
	(0.017)	(0.037)	(0.093)	(0.151)	(0.010)	(0.017)	(0.040)	(0.068)
	Panel B: Potentially expected parental death							
Net worth	-0.013	1.056**	0.676**	0.446**	-0.015+	0.885**	0.595**	0.404**
	(0.011)	(0.022)	(0.048)	(0.077)	(0.008)	(0.017)	(0.041)	(0.067)
Liq. assets	-0.006	0.457**	0.099**	0.017	-0.003	0.390**	0.086**	0.021
	(0.005)	(0.010)	(0.016)	(0.025)	(0.003)	(0.007)	(0.014)	(0.023)
Housing equity	-0.001	0.306**	0.351**	0.313**	-0.012	0.217**	0.280**	0.264**
	(0.010)	(0.017)	(0.039)	(0.062)	(0.008)	(0.014)	(0.035)	(0.057)
−# units[a]	-0.005	0.126**	0.120**	0.099**	-0.009**	0.096**	0.109**	0.098**
	(0.003)	(0.006)	(0.014)	(0.023)	(0.002)	(0.004)	(0.010)	(0.017)
Fin. investments	-0.010**	0.268**	0.246**	0.176**	-0.011**	0.263**	0.251**	0.178**
	(0.003)	(0.009)	(0.017)	(0.026)	(0.002)	(0.006)	(0.013)	(0.022)
Unc. debts	-0.003	-0.025**	0.020	0.060+	-0.010**	-0.015*	0.022	0.059*
	(0.006)	(0.009)	(0.021)	(0.034)	(0.004)	(0.007)	(0.015)	(0.025)

NOTE: [a]Total number of housing units that the heir owns at least partially.
The table shows the effect of inheritance on different wealth components two years before and one, five and nine years after parental death. The full set of coefficients appears in the online appendix. The coefficients are estimated according to equation (3) on a sample of unexpected (Panel A) and potentially expected (Panel B) inheritances larger than one year of the heir's permanent income. The specification includes individual and year-by-cohort fixed effects. Standard errors, clustered at the individual level, are shown in parentheses.

This finding is consistent with the hypothesis that because adjusting housing equity in wealth portfolio is particularly costly, heirs incorporate expected inheritance in their wealth accumulation strategies and under-invest in housing equity before parental death. Heirs whose inheritance is unexpected do not have this opportunity, and they adjust their portfolio after the shock. An alternative explanation points to heterogeneities in consumption of large durables. If older heirs have a preference for large durables, and if expecting an inheritance decreases uncertainty about the future, then they can anticipate their and produce the patterns observed in Table 5.

Either way, Table 5 shows that liquidity constraints resulting from lifecycle position, while possibly constraining portfolio composition and investment in real estate (Attanasio et al., 2012), do not explain the convergence patterns in Table 2. However, imbalances between human capital and financial net worth are not the only cause of liquidity constraints. Low levels of liquid assets also constrain optimal consumption choices. These liquidity constraints can either be endogenous (Kaplan and Violante, 2014) or exogenous (e.g. due to transitory negative shocks) (Leth-Petersen, 2010). If low levels of liquid assets drive the convergence patterns shown in Table 2, then one would expect individuals who are liquidity constrained before parental death to dissipate wealth more quickly after inheritance, for example, to catch up with postponed consumption of durable goods (Browning and Crossley, 2009).

The top panel of Table 6, however, shows that heirs who hold less than a month of permanent income in liquid assets before parental death do not dissipate the excess of wealth accumulated with inheritance as quickly as those who are not constrained. The difference in these patterns is evident for liquid assets. Even with the mechanical trend in liquid asset accumulation preceding parental death induced by the sample selection, heirs holding relatively little liquid assets before parental death exploit their inheritance to accumulate a buffer stock of liquid

Table 6
The role of liquid assets one year before inheritance

	Less than a month of permanent income in liquid assets				More than a month of permanent income in liquid assets			
Years from shock	−2	1	5	9	−2	1	5	9
	Panel A: Unexpected parental death							
Net worth	-0.032	0.823**	0.565**	0.542**	-0.003	0.963**	0.600**	0.350*
	(0.024)	(0.046)	(0.095)	(0.152)	(0.026)	(0.048)	(0.096)	(0.152)
Liq. assets	0.044**	0.414**	0.225**	0.252**	-0.030*	0.377**	-0.024	-0.133*
	(0.006)	(0.019)	(0.021)	(0.033)	(0.012)	(0.023)	(0.034)	(0.053)
Housing equity	-0.060**	0.142**	0.141+	0.115	0.028	0.240**	0.290**	0.239+
	(0.022)	(0.038)	(0.084)	(0.135)	(0.025)	(0.039)	(0.086)	(0.136)
−# units[a]	0.006	0.089**	0.073**	0.052	0.005	0.132**	0.136**	0.144**
	(0.006)	(0.013)	(0.028)	(0.044)	(0.006)	(0.012)	(0.027)	(0.042)
Fin. investments	-0.001	0.189**	0.127**	0.106**	-0.011	0.332**	0.339**	0.297**
	(0.005)	(0.016)	(0.019)	(0.030)	(0.008)	(0.021)	(0.035)	(0.055)
Unc. debts	0.015	-0.077**	-0.073+	-0.068	-0.010	-0.014	0.006	0.053
	(0.011)	(0.018)	(0.040)	(0.064)	(0.012)	(0.020)	(0.043)	(0.068)
	Panel B: Potentially expected parental death							
Net worth	0.018*	0.819**	0.626**	0.575**	-0.042**	1.059**	0.719**	0.497**
	(0.008)	(0.016)	(0.031)	(0.048)	(0.009)	(0.016)	(0.031)	(0.049)
Liq. assets	0.049**	0.387**	0.214**	0.216**	-0.040**	0.434**	0.016	-0.097**
	(0.002)	(0.006)	(0.008)	(0.011)	(0.004)	(0.008)	(0.012)	(0.018)
Housing equity	-0.039**	0.203**	0.247**	0.263**	0.013	0.295**	0.402**	0.393**
	(0.007)	(0.013)	(0.027)	(0.042)	(0.008)	(0.013)	(0.027)	(0.042)
−# units[a]	-0.006**	0.094**	0.088**	0.069**	-0.008**	0.119**	0.137**	0.133**
	(0.002)	(0.004)	(0.010)	(0.015)	(0.002)	(0.004)	(0.009)	(0.013)
Fin. investments	-0.003	0.177**	0.141**	0.103**	-0.014**	0.324**	0.324**	0.245**
	(0.002)	(0.006)	(0.008)	(0.011)	(0.002)	(0.007)	(0.011)	(0.017)
Unc. debts	-0.011**	-0.052**	-0.024	0.007	-0.000	-0.006	0.023*	0.044*
	(0.004)	(0.007)	(0.015)	(0.023)	(0.004)	(0.006)	(0.011)	(0.018)

NOTE: [a]Total number of housing units that the heir owns at least partially.
The table shows the effect of inheritance on different wealth components two years before and one, five and nine years after parental death. The full set of coefficients appears in the online Appendix. The coefficients are estimated according to equation (3) on a sample of unexpected (Panel A) and potentially expected (Panel B) inheritances larger than one year of the heir's permanent income. The specification includes individual and year-by-cohort fixed effects. Standard errors, clustered at the individual level, are shown in parentheses.

assets in the long run and escape their liquidity-constrained state.

In contrast, heirs holding relatively high amounts of liquid assets before parental death can afford to deplete them after inheritance, either by increasing their consumption or by adjusting their portfolio composition. These responses are consistent with exogenous and temporary liquidity constraints due to negative shocks happening just before parental death. The bottom panel of the table confirms this interpretation, showing that the convergence patterns of liquid assets do not depend on whether the inheritance is expected or not, consistent with the notion of exogenous liquidity constraints.

Tables 5 and 6 show that liquidity constraints alone cannot explain the wealth convergence patterns in Table 2. The quick convergence of liquid assets back to the level accumulated before inheritance is consistent with the behavior of an impatient buffer stock agent. The strategy of heirs who hold relatively few liquid assets before parental wealth and who exploit their inheritance to build a more consistent buffer stock of liquid wealth is consistent with precautionary saving motives.

Nevertheless, heirs accumulate financial investments and housing equity in the first part of their lifecycle as patient agents, investing their wealth with an eye to the long run. The results of this papers clearly shows that different wealth accumulation strategies coexist within the saving plans of single individuals and that specific wealth components serve specific purposes in these plans.

V. Conclusions

This paper estimates the causal effect of unexpected inheritance on the wealth accumulation strategies of heirs. I show that heirs deplete most of the initial burst of liquidity obtained through inheritance within ten years from parental death. Net worth converges quickly towards the level accumulated before inheritance,

consistent with the behavior of an impatient buffer stock agent.

However, convergence patterns differ markedly across wealth components. While liquid assets on average converge quickly to the level accumulated before inheritance, increased financial investments and—in the earlier part of the lifecycle—housing equity persist over time. I show that liquidity constraints due either to imbalances between human capital and net worth or low levels of financial assets before inheritance do not drive these results.

Heirs use liquid assets as buffer stocks of precautionary savings and accumulate financial investments for the long run. Nonetheless I find evidence that young individuals are constrained in their investments in housing equity. This finding is consistent with suboptimal portfolio optimization due to the impossibility of borrowing against human capital or parental wealth. Assessing the importance and the welfare implications of such constraints in real estate investments is left for future research.

This paper shows that while a buffer stock model of consumption accurately predicts how the accumulation of liquid assets responds to a financial windfall, the responses of financial investments and housing equity to inheritance instead match the predictions of a permanent income hypothesis model. Several wealth accumulation strategies coexist within single saving plans, and different wealth components serve specific purposes within these plans. My findings not only highlight the importance of models of savings and consumption capable of distinguishing between different assets but also provide novel, causally estimated stylized facts about individual saving and wealth accumulation strategies across the lifecycle.

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The Effect of Unexpected Inheritances on Wealth Accumulation: Precautionary Savings or Liquidity Constraints?

ALESSANDRO MARTINELLO

Combining a Danish panel of yearly administrative wealth reports with the unexpected timing of sudden parental deaths, I exploit inheritance episodes to characterize wealth accumulation dynamics in the ten years following a financial windfall. Consistent with the predictions of a buffer stock model of consumption, liquid assets quickly converge to pre-inheritance levels. However, real estate and financial investments persist over time. Age and liquidity constraints do not explain these results: Heirs exploit inheritance to accumulate housing equity if young, and precautionary savings if liquidity constrained. These causal estimates highlight the importance of consumption models capable of distinguishing between multiple assets.

Keywords: Inheritance; liquidity; wealth; buffer stock model; housing equity; precautionary savings; sudden death; liquidity constraints

JEL codes: D14, D91, E21, G11

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