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Five Facts About the Money Holdings of Individuals and Firms

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Abstract

Using administrative panels from Norway and the Netherlands and the US Survey of Consumer Finances, we document five facts about the cash share – the ratio of money holdings to financial wealth – held by individuals and firms. (i) Deposit rates and the aggregate cash shares of individuals and firms have decreased substantially since the 1990's. (ii) The decline in individuals' aggregate cash share is driven by the wealthiest 10%. (iii) Deposit rates predict the wealthy's cash share. (iv) Interest income no longer represents a significant proportion of income for wealthy individuals. (v) Firms exhibit similar moneyholding dynamics as individuals.

JEL Codes: E41, G11, G32, G51.

Keywords: Money demand, household finance, corporate cash holdings, portfolio choice, low interest rates.

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Global interest rates have experienced a substantial and protracted decline over the past three decades. Economic theory suggests that a fall in interest rates should have a major impact on the financial portfolios of investors. If market participants do not expect risky asset returns to fall as much as interest rates, investors can take advantage of higher risk premia by rebalancing their portfolios away from safe assets and toward stocks and mutual funds (Gollier, 2001; Merton, 1971; Tobin, 1958). Even if risk premia remain constant, lower interest rates can encourage investors to reduce the share of safe assets in their financial portfolios to meet a sustainable level of spending (Campbell and Sigalov, 2020; Cox, 1967).

Investor portfolio decisions are of primary importance for economic policy in part because they determine the demand for money. A measure of money widely used in the macroeconomics literature is M2, which by definition consists of cash, checking deposits, and easily convertible near-money, such as savings deposits, money market securities, and other time deposits. M2 constitutes the economy's main source of safe and liquid assets and plays a central role in transmitting central bank decisions (Drechsler et al., 2017).[1]

A growing literature investigates the empirical impact of interest rates on the money and risky asset positions held by several categories of investors. In response to lower interest rates, fund investors and insurance companies have shifted capital from the money market to equities (Becker and Ivashina, 2015; Daniel et al., 2021; Hau and Lai, 2016), while money market funds themselves have changed their product mix (Maggio and Kacperczyk, 2017). The money holdings of nonfinancial firms are also sensitive to interest rates (Gao et al., 2021). Despite these advances, however, a comprehensive assessment of the properties of money demand and portfolio rebalancing across investor groups has hitherto remained unavailable.

This gap is explained, at least partly, by the data challenge. A reliable study of portfolio rebalancing should go beyond the balance sheets of financial intermediaries and exploit disaggregated data on the money and security holdings of nonfinancial agents, such as individuals and nonfinancial firms. Indeed, individuals are the ultimate owners of capital and therefore key drivers of the demand for financial assets (Bach et al., 2020). Nonfinancial firms have also built up large cash reserves which, despite their nomenclature, are frequently invested in non-cash, risky financial assets such as corporate debt, equity, and mortgage-backed securities (Cardella et al., 2021; Duchin et al., 2017).

In this paper, we comprehensively assess the properties of money demand across multiple

[1] Total bank deposits amounted to $18.1 trillion in the US as of May 2022 according to the Federal Reserve Bank of Saint Louis (series DPSACBW027SBOG). By comparison, the total holding of money market funds and Treasury bonds in July 2022 was $4.6 trillion according to the Investment Company Institute.

investor groups and countries, using four holdings datasets from Europe and the US. Our main data source is a high-quality yearly administrative panel from Norway, which reports the complete asset holdings of every *resident* between 1993 and 2016 and the complete asset holdings of every *nonfinancial firm* between 2004 and 2015. The Norwegian panel allows us to study both the macro- and micro-level patterns of the demand for money over a long sample period during which deposit rates decreased significantly.

To verify the international validity of our findings, we use a Dutch administrative panel containing the comprehensive and disaggregated holdings of every household in the Netherlands between 2011 and 2019. In addition, we exploit US household holdings from the Survey of Consumer Finances (SCF), as well as Eurostat data on the aggregate holdings of the firm and household sectors in euro area countries between 1995 and 2020.

We document five facts about the *cash share*, i.e. the ratio of M2 holdings to financial wealth, of individuals and firms.[2] We primarily focus on individuals and nonfinancial firms because they jointly own most of aggregate M2 and account for most of the time variation in aggregate M2 in our datasets. We establish the following facts on their cash holdings.

First, deposit rates and the average cash shares of individuals and firms decreased substantially over the 1995 to 2020 period.[3] The aggregate cash share of the household sector decreased by 14.8 percentage points (pp) in Norway, by 5.2 pp on average in the euro area, and by 4.1 pp in the US between 1995 and 2020. Similarly, the aggregate cash share of the firm sector decreased by 19.1 pp in Norway and by 3.0 pp in the euro area over the same period.

Second, we document substantial heterogeneity in the cash share dynamics of individuals in different financial wealth brackets. We show that the historical reduction in the cash share of the household sector is driven almost entirely by wealthy agents. In Norway, the decline is concentrated among individuals in the top 10% of the financial wealth distribution, whose cash share decreased by 15.7 pp between 1993 and 2016. By contrast, the cash share only declined by 3.8 pp for the bottom 90%. The patterns are nearly identical in the Dutch panel.

Third, we run predictive regressions of the cash share on deposit rates and control variables. The deposit rate is positively and significantly related to the cash share of the wealthy one year ahead, irrespective of controlling for the current cash share and the dividend-price

[2]Our definition of financial wealth includes M2, mutual funds, listed securities, private equity, and shares of mutual funds held via other investments. See Section Section I.B. for further details.

[3]We document these aggregate facts between 1995 and 2020 because the required datasets are available for all countries over this period.

ratio of aggregate equity. By contrast, we do not find evidence that the deposit rate predicts the cash share for the bottom 90%. We verify that passive rebalancing cannot fully explain this set of results. The cash share of the bottom 90% is therefore much less sensitive to changes in the deposit rate than the cash share of the top 10%.

Fourth, the joint decline of deposit rates and cash shares had a major impact on wealthy individuals' income from cash holdings. For individuals in the top 10% of Norway's financial wealth distribution, income from M2 amounted to a sizable 27% of labor income in 1993. Since then, the cash income-to-labor income ratio has decreased by a factor of 10, reaching 3.1% by 2016. The decline is even more pronounced for the top 1%. By contrast, the bottom 90% of individuals experienced much smaller changes, because cash income never exceeded 2.7% of labor income throughout the sample period in this bracket.

Fifth, the cash share of firms exhibits similar dynamics to the cash share of individuals. For firms in the bottom 90% of the financial wealth distribution, the cash share remains large and constant throughout the sample period. By contrast, the top 10% of firms account almost fully for the decline in the cash share of the firm sector. In addition, the firm sector and the household sector hold comparable and approximately constant shares of aggregate M2 and are therefore both important drivers of fluctuations in M2.

These facts altogether reveal strong empirical regularities on cash share dynamics. Our main finding is that the top 10% of individuals and firms dominate aggregate fluctuations of the cash share, a result that is strongly robust across countries. In addition, time variation in deposit rates can forecast the cash share of the wealthy. Correspondingly, we document strong positive time-series correlations between deposit rates and the cash share of the household and firm sectors in our datasets.[4]

Our findings indicate that the top 10% of individuals and firms use M2 as an investment vehicle to which they elastically allocate funds. By comparison, the bottom 90% hold M2 primarily for cash management purposes, consistent with the work of Lucas (2000), Mulligan and Sala-I-Martin (2000), and Walsh (2017).

Our results inform the conduct of monetary policy by showing that the dynamics of the aggregate cash share is heavily concentrated in a subset of individuals and firms. The dominant impact of large firms is consistent with granular origins of aggregate fluctuations

[4]Since time variation in risk aversion or hedging needs may also drive the cash share, the partial correlation between the deposit rate and the cash share is likely to be more robust than their total correlation to the choice of alternative samples.

stemming from the firm sector (Gabaix, 2011; Hulten, 1978). Our results extend the validity of the granular hypothesis by showing that larger agents are the main drivers of fluctuations in the aggregate cash share.

Our results also contribute to the literature on financial market stability. Reaching for yield has been a concern among central bankers who fear that risk-taking may be an unintended consequence of low interest rates (Borio and Zhu, 2012; Maggio and Kacperczyk, 2017; Rajan, 2006, 2013; Stein, 2013). Our paper shows that this phenomenon is prevalent among the wealthiest individuals and firms, but is less of a concern for other agents.

The paper provides useful guidance for the development of macroeconomic models with heterogeneous agents, such as HANK (Kaplan et al., 2018). Our results suggest that time variation in the cash share of the household sector can be captured by a two-agent model, in which one agent uses a constant cash share and another agent responds elastically to interest rates. A similar approach could be used to model the money demand of the firm sector.

Our work complements the extensive household finance literature that analyzes the determinants of portfolio decisions by investors (Gomes et al., 2020). While much of the literature documents the determinants of risky asset investments, we focus on the relation between interest rates and M2 holdings. The paper confirms that the wealthiest households tend to hold higher yielding assets (Bach, Calvet and Sodini, 2020; Betermier, Calvet and Sodini, 2017; Betermier, Calvet, Knupfer and Kvaerner, 2022). Consistent with the recent model of Aoki et al. (2021), we show that the holdings of wealthier households tend to covary more with investment opportunities than the holdings of less wealthy households.

Finally, our results contribute to the literature on corporate cash holdings. Researchers have documented an increase in the cash holdings held by firms, which they attribute to a mix of precautionary and tax reasons (Faulkender et al., 2019). As Gao et al. (2021) show, this increase is apparent whether one measures cash in absolute terms or as a fraction of corporate assets. We document that, despite increasing their cash holdings, firms have *decreased* the proportion of cash held inside the financial asset portfolio, an effect mainly driven by the largest firms.

The paper is organized as follows. Section I describes the data and defines variables. Section II presents aggregate results. Section III investigates the cash share of individuals and Section IV studies the cash share of firms. Section V concludes. An online Appendix provides further descriptions of the data and additional results.

I Data and Definition of Variables

A. Data

Norwegian micro data on individuals and firms. The Norwegian panel contains the labor income and financial wealth of every resident between 1993 and 2016. For financial wealth, it provides the comprehensive disaggregated holdings and liabilities of individuals at the level of each bank account, security, or private firm at the yearly frequency. The panel is collected by the Norwegian Tax Administration and compiled by Statistics Norway (SSB). The information is highly reliable because banks and other third parties are legally required to provide it to the Tax Administration.

We also retrieve micro data on nonfinancial firms over the 2004-2015 period from the Center for Applied Research at the Norwegian School of Economics. Specifically, we obtain the disaggregated balance sheet of every firm at the yearly frequency.[5]

Additional micro data on households. To address external validity, we use a Dutch administrative panel that contains the assets and detailed decomposition of income of every resident household at the yearly frequency between 2011 and 2019. The definitions of labor income and financial wealth are broadly the same as in the Norwegian panel, with the exception that the unit of analysis is the household instead of the individual.

We also obtain information on the asset holdings of US households from the US SCF, which has been conducted every three years since 1989.

Other datasets. We retrieve from Eurostat the aggregate values of the financial assets held by the household sector and the nonfinancial firm sector, respectively, in Norway and the 11 founding members of the euro area from 1995 to 2020.[6] As in the micro data, financial wealth includes listed stocks and private equity. We use the Eurostat dataset because it

[5]We focus on limited-liability companies, which represent the majority of firms in Norway, as well as firms that use Norway's Generally Accepted Accounting Principles (GAAP), which make up 98.7% of the sample. This filter ensures that our results are not driven by firms switching to International Financial Reporting Standards (IFRS) during the sample period. We verify in the Appendix that our subset of firms generates similar statistics about the cash share as the macroeconomic Eurostat sample.

[6]The 11 founding members are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. We focus on founding members to ensure that the results are not driven by the entry of new countries.

consistently provides the breakdown of financial wealth by sector as well as the firm sector's consolidated financial wealth over the 1995-2020 period.

We obtain the deposit rates earned on individual accounts in Norway from Statistics Norway, in the Netherlands from the Dutch Central Bank, in the euro area from the European Central Bank (ECB), and in the US from Bankrate's national survey. In addition, the ECB provides deposit rates on corporate accounts in the euro area.

B. Definitions

We denote by $M2_{h,t}$ the total amount of M2 ("cash holdings") and by $FW_{h,t}$ the gross financial wealth (henceforth "financial wealth") held by the household sector in year t. Our definition of financial wealth includes M2, money market funds, bond funds, equity funds, listed securities, private equity, and shares of mutual funds held through share savings accounts and other securities. The cash share of the household sector, $c_{h,t} = M2_{h,t}/FW_{h,t}$, quantifies the proportion of cash holdings in the financial wealth of the household sector.

The firm sector consists of all nonfinancial firms ("firms" hereafter). Let $M2_{f,t}$ denote the aggregate holdings of $M2$ and $FW_{f,t}$ the aggregate financial wealth of the firm sector in year t. Our definition of financial wealth includes $M2$, mutual funds, bonds, listed stocks, and private equity. The cash share of the firm sector is $c_{f,t} = M2_{f,t}/FW_{f,t}$.

We include private equity in our definition of financial wealth so that our analysis is informative about the trade-off between safe capital and risky productive capital at the macroeconomic level. In practice, we can calculate the cash share either by using sector-level data from Eurostat or by aggregating up holdings in micro data. In the online Appendix, we verify that both methods produce strongly consistent results. Moreover, since the Norwegian micro data report information on individuals but aggregate up to the household sector, we will refer to the Norwegian household sector in the aggregate analysis of Section II and to Norwegian individuals in later sections.

II Aggregate Results

A. Deposit Rates

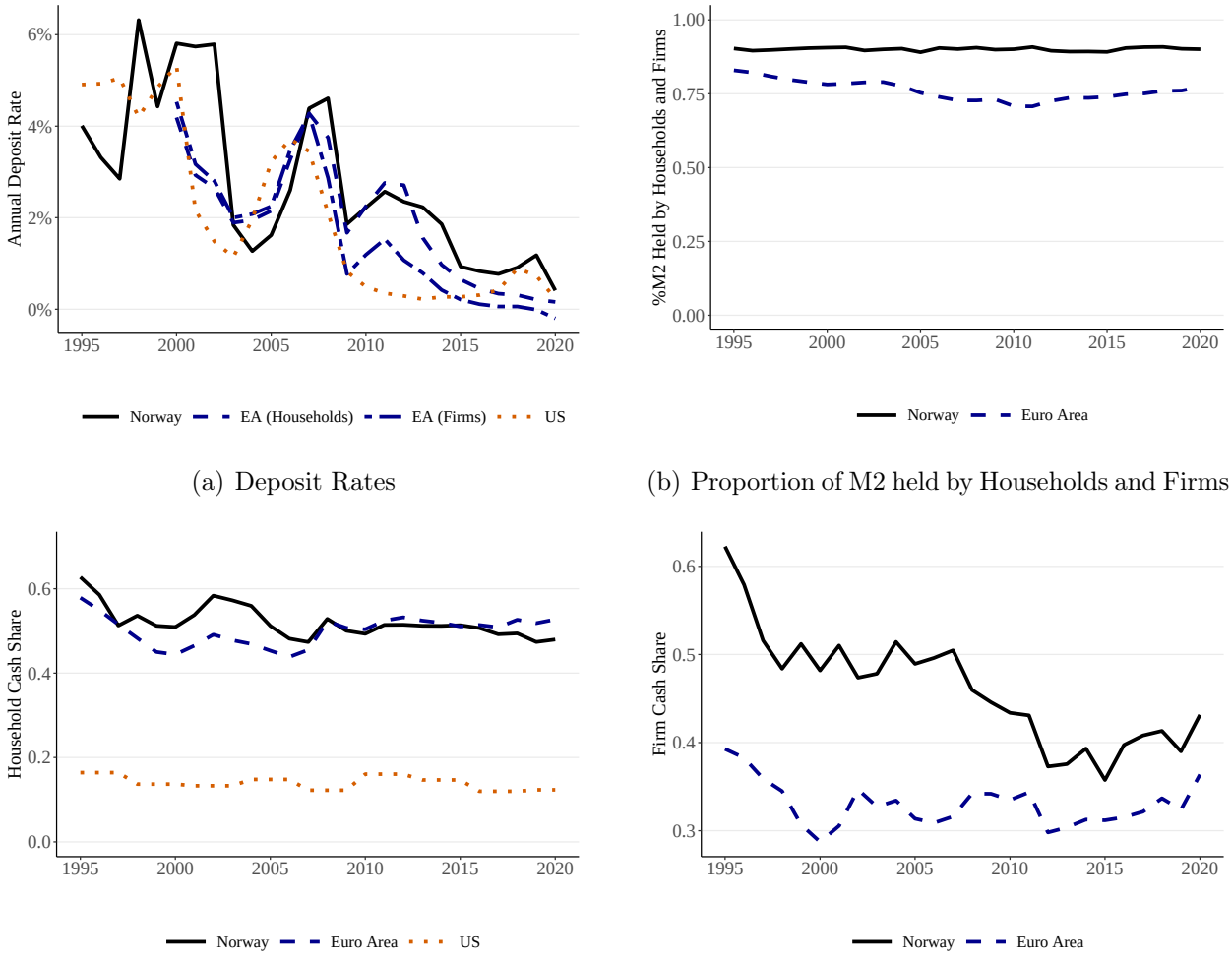
Panel A of Figure 1 plots the average deposit rate on individual accounts in Norway and the US from 1995 to 2020, and the average deposit rate on individual and corporate accounts in the euro area from 2000 to 2020. For convenience, we start the panel in 1995 because it represents the beginning of the Eurostat data used to construct Panels B to D of Figure 1, as we explain below.

The period is characterized by a large decline in deposit rates. The Norwegian average deposit rate drops from 4.0% to 0.4% between 1995 and 2020 and is highly correlated with deposit rates in the euro area and the US.

B. Breakdown of M2 by Sector

Households and nonfinancial firms jointly dominate aggregate holdings of M2, as Panel B of Figure 1 illustrates. The *money holding sector* consists of households, nonfinancial firms, nonprofit organizations, municipalities, and financial corporations other than banks and mortgage companies. In the panel, we plot the proportion of the money holding sector's M2 held by the combined household and firm sectors between 1995 and 2020 in Norway (solid line) and the euro area (dashed line) from the Eurostat data. Households and firms own 90% of the money holding sector's M2 throughout the sample period. The patterns are similar in the euro area. In the online Appendix, we verify that both sectors also explain the variation of the money holding sector's M2 at the yearly frequency. These findings motivate our focus on the household and firm sectors in the remainder of the paper.

The household and firm sectors hold remarkably stable shares of aggregate M2 over time. In Norway, the household sector holds about 60% and the firm sector about 40% of their combined M2, as the online Appendix shows. The breakdown of M2 remains stable even when we consider different wealth brackets of household and firm sectors. For example, consider the top decile and the bottom nine deciles of each sector's financial wealth distribution. The top decile of individuals own 33%, the bottom nine deciles of individuals own 27%, the top decile of firms own 30% and the bottom nine deciles of firms own 10% of combined M2 throughout the sample period.



(a) Deposit Rates

(b) Proportion of M2 held by Households and Firms

(c) Cash Share of the Household Sector

(d) Cash Share of the Firm Sector

Figure 1: Deposit Rates and Cash Shares of the Household and Firm Sectors. This figure illustrates the evolution of the following statistics over the 1995 to 2020 period: (a) the average deposit interest rate in annual units, (b) the proportion of aggregate M2 held by the combined household and firm sectors, (c) the cash share of the household sector, and (d) the cash share of the firm sector. These statistics are reported for Norway (black curves), the euro area (blue curves), and the US (red curves). The cash share is defined as the ratio of M2 holdings to financial wealth. All holdings data are from Eurostat.

C. Cash Share

In Panel C of Figure 1, we illustrate the cash share of the household sector, $c_{h,t}$, in Norway (solid line), the euro area (dashed line), and the US (dotted line) from 1995 to 2020. For the euro area, the reported share is the equal-weighted average across the 11 countries. The cash share of the household sector decreased by 14.8 pp in Norway, 4.1 pp in the US, and

5.2 pp in the euro area over the period.

In Panel D of Figure 1, we plot the firm sector's cash share in Norway (solid line) and the euro area (dashed line). In Norway, the cash share of firms dropped from 62.2% in 1995 to 43.1% in 2020, an even stronger decline than the one observed for households. The cash share of firms exhibits similar patterns in the euro area.

Figure 1 is informative about recent financial history and shows a positive correlation between interest rates and cash shares across countries. We acknowledge, however that since time variation in risk aversion, sentiment, or hedging needs may also drive the cash share, partial correlations between deposit rates and the cash share are likely to be more robust than their total correlation in alternative samples.

To go a step further, we now wish to analyze the behavior of subsets of agents. Survey data, such as the US SCF, are not sufficiently precise to study time variation in the cash share of specific financial wealth brackets. For instance, as we show in the online Appendix, the cash share of the top 10% has a confidence interval of length 4.6 pp in the SCF, which is larger than the variation in the aggregate cash share over our sample period. For this reason, we only use administrative panels in the rest of the paper.

We have shown in this section that deposit rates and the cash shares of the household and firm sectors have declined since 1995 (Fact 1). We next use the micro data to investigate the drivers of these patterns.

III Individuals

A. Summary Statistics in 2015

To provide context on the heterogeneity of moneyholding decisions, we present summary statistics on Norwegian individuals. We refer the reader to the online Appendix for the full set of results. To facilitate international comparison, we express all amounts in euros. We apply a fixed exchange rate of 9.6255 kroner per euro, which corresponds to the exchange rate prevailing on December 31, 2015.

The average Norwegian resident holds 28,000 euros in cash and 58,000 euros in financial wealth at the end of 2015, compared to an annual average income of 31,000 euros. Consistent

with earlier studies, financial wealth is heavily concentrated at the top. Individuals in the top 10% of the financial wealth distribution hold 148,000 euros of cash and 420,000 euros of financial wealth on average. These individuals correspondingly own 54% of the cash and 73% of the financial wealth held by the household sector.

The cash share is highly heterogeneous across financial wealth brackets. For individuals, the bottom nine deciles have an aggregate cash share of 0.82 at the end of 2015, compared to a 0.35 cash share for the top decile.[7] This property confirms earlier evidence that the wealthy tend to hold higher yielding assets than the rest of the population (Bach, Calvet and Sodini, 2020; Betermier, Calvet and Sodini, 2017; Betermier, Calvet, Knupfer and Kvaerner, 2022). These facts motivate us to next analyze the cash dynamics of different wealth brackets.

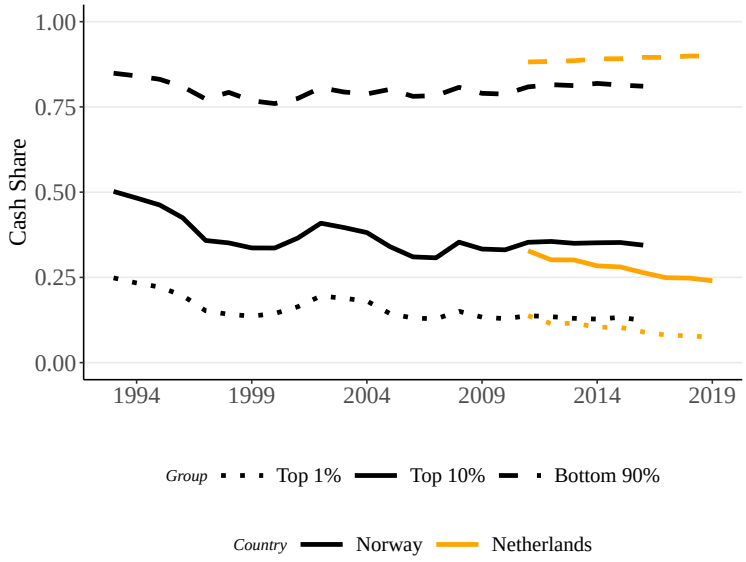
B. Wealthy Individuals Drive the Decline in the Cash Share of the Household Sector

In Panel A of Figure 2, we plot the cash share held by the top 1%, the top 10%, and the bottom 90% of Norwegian individuals sorted by financial wealth at the end of each year. Throughout the 1993 to 2016 sample period, the cash share of the top 1% of individuals is lower than the cash share of the top 10%, which is itself lower than the cash share of the bottom 90%.

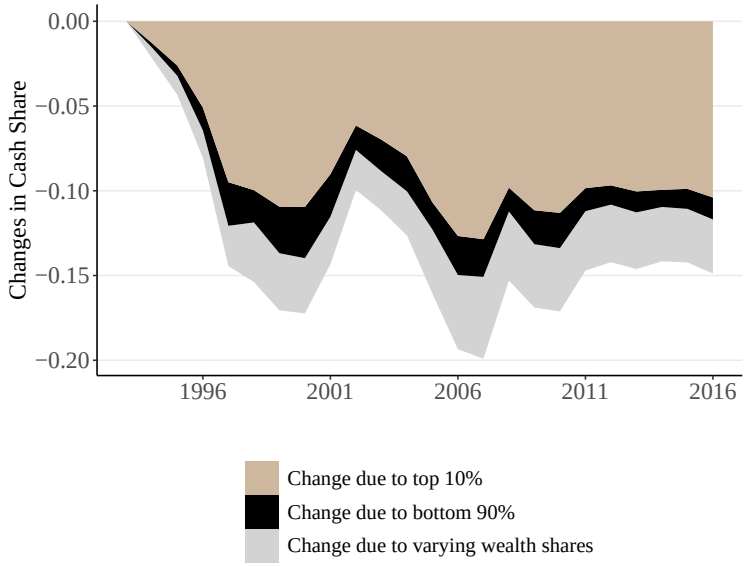
Perhaps more importantly, the panel shows that the cash share of the bottom 90% of individuals remains nearly constant at around 80%, decreasing by only 3.8 pp over the sample period. By contrast, the cash share of the top 10% of individuals decreases from 50.2% to 34.5% over the period, a decline of 15.7 pp. The cash share of the top 1% also declines very sharply. These findings suggest that most individuals have an inelastic cash share and use M2 as a liquidity management tool rather than an investment. Unlike the rest of the population, the top 10% seem to view M2 as an investment that responds elastically to interest rates. We further examine these hypotheses in Section III.C.

The heterogeneity of cash share dynamics across financial wealth brackets comes in sharp contrast with the stable breakdown of M2 ownership reported in Section II.B. While the top 10% and the bottom 90% of individuals own stable *fractions of aggregate M2* over time, the declining *cash share* in the financial portfolio of the top 10% and the constant *cash share* in the financial portfolio of the bottom 90% indicate that rebalancing strategies vary widely

[7] These statistics have similar values in the Netherlands.



(a) Cash Share of the Top 1%, Top 10% and Bottom 90%



(b) Decomposition of the Cash Share of the Household Sector

Figure 2: Cash Share Dynamics of Individuals. Panel A illustrates the cash share held by the top 1%, the top 10%, and the bottom 90% of individuals sorted by financial wealth. The panel is based on micro data from Statistics Norway for the 1993-2016 period (black curves) and micro data from Statistics Netherlands for the 2011-2019 period (orange curves). Panel B plots a decomposition of the cumulative change in the cash share of Norway's household sector into: (i) the change in the cash share of the top 10% of individuals, (ii) the change in the cash share of the bottom 90% of individuals, and (iii) the change in the relative financial wealth of the two groups.

across wealth brackets.

To assess the external validity of our results, we report in Panel A of Figure 2 the cash share held by wealth brackets of Dutch households between 2011 and 2019. The plots confirm the results from Norway. Moreover, we note that *households* in the Netherlands exhibit the same empirical regularities as *individuals* in Norway, which demonstrates that our results are robust to the economic unit we consider.

Decomposing the household sector's cash share dynamics. Portfolio rebalancing by the top 10% of individuals explains almost fully the decline in the cash share of the household sector, as we now show. Let $s_t^{10\%} = FW_t^{10\%}/FW_{h,t}$ denote the share of the household sector's financial wealth held by the top 10% of individuals in year t, and let $s_t^{90\%} = FW_t^{90\%}/FW_{h,t}$ denote the share held by the bottom 90%, where $s_t^{10\%} + s_t^{90\%} = 1$. Moreover, let $c_t^{10\%}$ and $c_t^{90\%}$ respectively denote the cash share of the top 10% and the bottom 90%.

The cash share of the household sector satisfies:

$$c_{h,t} = s_t^{10\%}\ c_t^{10\%} + s_t^{90\%}\ c_t^{90\%}. \tag{1}$$

The household sector's cash share depends on (i) the cash share of the top 10%, (ii) the cash share of the bottom 90%, and (iii) the distribution of financial wealth between the two brackets.

By equation (1), the change in the cash share of the household sector between years t and $t+n$ is the sum of three terms:

$$\Delta_n c_{h,t+n} = s_t^{10\%}\,\Delta_n c_{t+n}^{10\%} + s_t^{90\%}\,\Delta_n c_{t+n}^{90\%} + (c_{t+n}^{10\%} - c_{t+n}^{90\%})\,\Delta_n s_{t+n}^{10\%}, \tag{2}$$

where $\Delta_n x_{t+n} = x_{t+n} - x_t$ for every variable x_t. The first and second terms reflect the change in the cash share of the top 10% and the bottom 90%, respectively. The third term reflects the impact of a change in the wealth distribution.

Panel B of Figure 2 applies this decomposition to the cumulative change in the cash share of the household sector in Norway over the 1993 to 2016 sample period. The 14.9 pp decrease in the household sector's cash share is the sum of (i) a 10.4 pp drop in the cash share of the top 10% of individuals, (ii) a 1.3 pp drop in the cash share of the bottom 90%, and (iii) a 3.2 pp drop due to the top 10%'s growing share of household financial wealth. Hence, 70% of the drop in the household sector's cash share is due to portfolio rebalancing

by the top decile of individuals, while 20% of the aggregate drop stems from an increase in wealth inequality.

Overall, we have established that the decline of the cash share of the household sector is primarily driven by individuals at the top of the financial wealth distribution, while the cash share of other individuals in nearly constant (Fact 2).

C. Deposit Rates Predict the Cash Share of the Wealthy

We next investigate the extent to which the rebalancing behavior of different wealth groups can be explained by deposit rates. This analysis is motivated by portfolio choice theory, which predicts that an investor's cash share should decrease if lower interest rates are associated with the expectation of higher equity premia (Mossin, 1968; Samuelson, 1969; Merton, 1969). Even if expected risk premia remain constant, lower deposit rates can encourage investors to reduce their cash shares to maintain sustainable spending levels (Campbell and Sigalov, 2020).

In Table 1, we regress the cash share of groups of Norwegian individuals on the 1-year deposit rate, r_t, the dividend-price ratio of Norway's stock market, dp_t, and the lagged cash share. The groups are financial wealth brackets. For instance, for the top 1%, we denote by $c_t^{1\%}$ the group's cash share in year t and we estimate

$$\ln(c_{t+1}^{1\%}) = a + b_1\, r_t + b_2\, \ln(dp_t) + b_3\, \ln(c_t^{1\%}) + u_{t+1}. \tag{3}$$

The coefficient b_1 captures the predictive power of the deposit rate. We include the dividend-price ratio because it contains forward-looking information on the equity returns expected by investors (Cochrane, 2011). Controlling for the deposit rate, a high dividend-price ratio is known to predict a high excess return on equity. The lagged cash share controls for investor inertia.

The first two columns of Table 1 focus on individuals in the top 1% of the financial wealth distribution. The deposit rate is positively and significantly associated with the cash share. In column 1, the deposit rate is the only regressor and the R^2 coefficient of 27.1% indicates that more than one fourth of the time-series variation in the cash share is predicted by variation in the deposit rate. In column 2, we expand the set of regressors and also include the dividend-price ratio at the end of year t and the lagged cash share, which increases the R^2 coefficient to 84.4%. Importantly, the slope coefficient of the deposit rate remains positive

Table I – Predictive Regression of the Cash Share

This table reports regressions of the log cash share at the end of year $t+1$ on the deposit interest rate at the end of year t and a set of control variables. The cash share refers to the proportion of M2 holdings in the total financial wealth held by a given group of individuals. Explanatory variables include the deposit rate, r_t, the log dividend-to-price ratio, $\ln(dp_t)$, and the lagged cash share, $\ln(c_t)$. The regression is run by wealth group over the 1994 to 2016 period on the Norwegian panel. Standard errors in parentheses are Newey-West adjusted with a lag length of 2 ($\approx 0.75 \times 23^{1/3}$). Statistical significance is indicated by ***, ** and * for the 0.01, 0.05, and 0.10 levels.

	Dependent variable: Log cash share $\ln(c_{t+1})$					
	Top 1%		Top 10%		Bottom 90%	
	(1)	(2)	(3)	(4)	(5)	(6)
Deposit rate r_t	6.332^{**}	3.390^{***}	2.904^{*}	1.669^{*}	-0.332	-0.185
	(2.529)	(1.218)	(1.532)	(0.916)	(0.433)	(0.278)
Dividend-price ratio $\ln(dp_t)$		-1.802		-0.503		-0.013
		(1.411)		(1.034)		(0.272)
Lagged cash share $\ln(c_t)$		0.667^{***}		0.677^{***}		0.599^{***}
		(0.074)		(0.090)		(0.140)
Constant	-2.093^{***}	-0.708^{***}	-1.111^{***}	-0.380^{***}	-0.214^{***}	-0.085^{**}
	(0.068)	(0.155)	(0.037)	(0.099)	(0.013)	(0.038)
Observations	23	23	23	23	23	23
R^2	0.271	0.844	0.160	0.776	0.042	0.477
Adjusted R^2	0.236	0.820	0.120	0.740	-0.004	0.395

and significant. Moreover, the dividend-price ratio is negatively related to the cash share, as theory predicts, but the empirical relationship lacks statistical significance.

Columns 3 and 4 report the predictability regressions for the top 10% of individuals. Although not as strong, the results are similar to those in columns 1 and 2 and reveal a significant and positive relationship between the deposit rate in year t and the cash share in year $t+1$.

Columns 5 and 6 show that the bottom 90% of individuals behave differently than the

richest. The R^2 of the univariate specification with the deposit rate as a regressor (column 5) is only 4.2%. In either specification, we fail to reject that the deposit rate and the dividend-price ratio are unrelated to the level of the cash share in the next period. All the results of the table are robust to including the Dutch panel, as the online Appendix shows.

We verify in the online Appendix that this set of results cannot be fully explained by passive rebalancing, that is by mechanical changes in the cash share due to realized asset returns. Specifically, we show that the portfolios of the top 1% are significantly more sensitive to deposit rates than passive rebalancing would imply.

These findings altogether confirm the insights from Section III.B. that most individuals are insensitive to variation in deposit rates, whereas the wealthy respond elastically to investment opportunities (Fact 3).

D. Income from M2 No Longer Represents a Substantial Portion of Income for the Wealthy

We have shown that deposit rates have fallen and wealthy households have rebalanced their portfolios away from M2 since 1993. As a consequence, interest income from M2 holdings now represents a much smaller share of the income of the wealthy than it did in 1993, as we now show.

We estimate an individual's *cash income* in year t as the product of (i) the individual's cash holdings at the end of year $t-1$ and (ii) the average deposit rate in year t. Figure 3 plots the ratio of cash income to labor income for individuals in the top 1%, the top 10%, and the bottom 90% of the financial wealth distribution in Norway.

For the top 10%, cash income decreased from 27.2% of labor income in 1993 to 3.1% in 2016, a tenfold drop. Hence, income from M2, which represented a sizable fraction of labor income in 1993, has become almost negligible to the wealthy by 2016. The decline is even more striking for the top 1%: cash income declined from 37.1% of labor income in 1993 to 3.3% in 2016. This decline reveals a major shift in the composition and riskiness of the total income earned by high-wealth individuals. By contrast, the variation in cash income is much more modest for individuals in the bottom 90% of the distribution. Cash income amounted to 2.7% of labor income in 1993 and has since decreased to 0.42% in 2016. For these individuals, cash income has never been an important source of income.

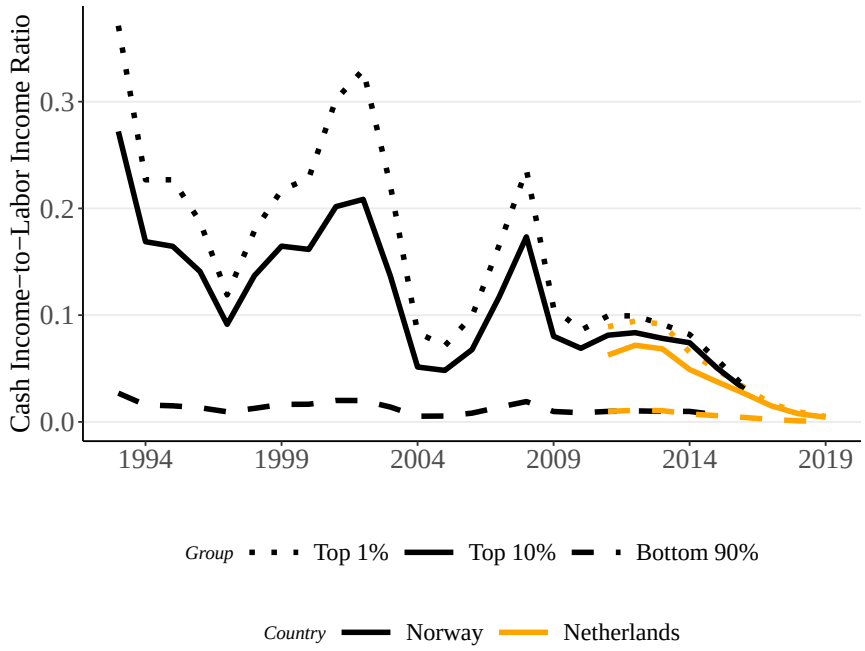


Figure 3: Ratio of Cash Income to Labor Income. This figure illustrates the ratio of M2 income to labor income for the top 1%, the top 10%, and the bottom 90% of the financial wealth distribution. For Norway, we compute the M2 income-to-labor income ratio and financial wealth brackets at the individual level by using the individual micro data from Statistics Norway for the 1993-2016 period (black curves). For the Netherlands, we report all quantities at the household level by using the household micro data from Statistics Netherlands for the 2011-2019 period (orange curves).

The Dutch panel confirms these findings. The orange lines in Panel A correspond to the ratio of cash income to labor income for the top 10% and bottom 90% of households in the Netherlands between 2011 and 2019. The Dutch panel has the advantage of providing the exact income generated by M2 holdings, so that we do not need to impute cash income. The cash income-to-labor income ratio is nearly identical in Norway and the Netherlands, which confirms our previous results and imputation method. Thus, income from cash holdings, which used to be a sizable source of income to the wealthy, now represents only a small share of income (Fact 4).

IV Firms

The firm sector exhibits similar money holding patterns as the household sector, as we now show.

A. *Summary Statistics in 2015*

We begin the analysis with summary statistics on Norwegian nonfinancial firms. There are strong concentration patterns in the firm sector. The average firm owns 370,000 euros of cash and 830,000 euros of financial wealth at the end of 2015, with annual sales of 2.8 million euros. By contrast, firms in the top decile of the financial wealth distribution own 2.6 million euros of cash and 7.1 million euros of financial wealth, with annual sales of 16.6 million euros. The top decile of firms correspondingly hold 71% of the cash and 85% of the financial wealth held by the firm sector. These statistics suggest the importance of the wealthiest firms for monetary policy.

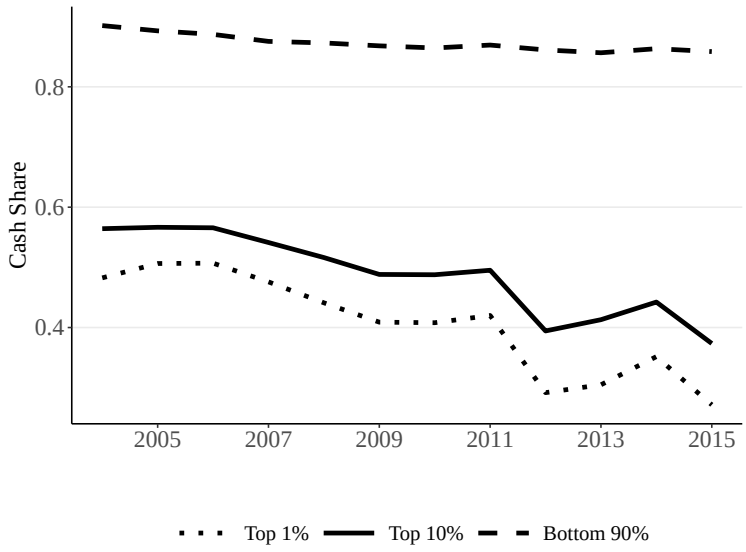
The cash share is lower in the firm sector than in the household sector on average. The aggregate cash share of the firm sector is 41% at the end of 2015, compared to a 48% cash share in the household sector.

B. *Cash Share Dynamics*

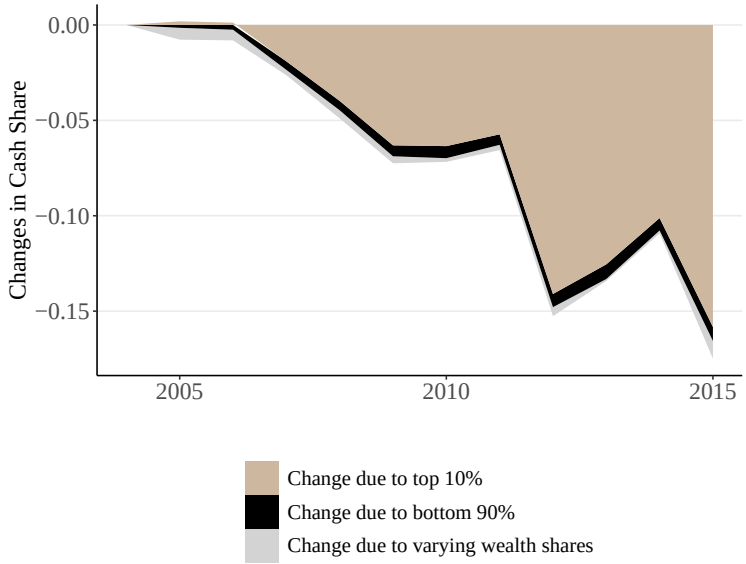
Consistent with the approach followed in Section III, we now consider the cash share dynamics in different brackets of financial wealth. In Panel A of Figure 4, we plot the cash share held by brackets of Norwegian firms sorted by financial wealth at the end of each year between 2004 and 2015. The bottom 90% of firms hold a high cash share of about 90% throughout the sample period. By contrast, the cash share of larger firms takes lower values and drops during the period. For the top 10% of firms, the cash share decreases from 56.4% in 2004 to 37.3% in 2015. The decline is even more pronounced for the top 1%.

Panel B of Figure 4 illustrates how different wealth brackets contributed to the fall in the cash share of the firm sector between 2004 and 2015. The graph applies to firms the decomposition in equation (2). The decline in the cash share of the top 10% of firms accounts for 15.8 pp of the 17.5 pp decline experienced by the firm sector. These findings show that large firms dominate the evolution of M2 in the firm sector, consistent with the fact that the top 10% firms own 71% of M2 and 85% of financial wealth held by the firm sector. These empirical regularities provide further foundations to the granular origins of aggregate fluctuations (Gabaix, 2011; Hulten, 1978).

The decline in the cash share of the firm sector over the past three decades is noteworthy because the corporate finance literature has documented an *increase* in the stock of M2



(a) Cash Share of the Top 1%, Top 10% and Bottom 90%



(b) Decomposition of the Cash Share of the Firm Sector

Figure 4: Cash Share Dynamics of Firms. Panel A illustrates the the cash share held by the top 1%, the top 10%, and the bottom 90% of Norwegian firms sorted by financial wealth over the 2004 to 2015 period. The panel is based on the Norwegian accounting and company information database. Panel B plots a decomposition of the cumulative change in the cash share of Norway's firm sector into: (i) the change in the cash share of the top 10% of firms, (ii) the change in the cash share of the bottom 90% of firms, and (iii) the changes in the relative financial weath of the two groups.

held by firms (Faulkender et al., 2019; Gao et al., 2021). We verify in the online Appendix that holdings of M2 have indeed gone up throughout the sample period, as measured by the value of M2 holdings and by the M2-to-sales ratio. However, the proportion of cash inside the financial portfolio of these firms has decreased for the largest firms, consistent with the trend in the household sector and the use of M2 as an investment asset. Hence the firm sector exhibits the same overall money holding patterns as the household sector (Fact 5).

V Conclusion

Over the past three decades, deposit rates have fallen sharply and aggregate holdings of M2 have become a smaller share of financial wealth. The present study investigates these dynamics by using three decades of high-quality administrative data from Norway and the Netherlands, together with macroeconomic data for a broader sample of European countries and US survey data. Our main result is that the cash share has remained constant for individuals and firms in the bottom 90% of the distribution of financial wealth, while the cash share has decreased significantly in the top 10%.

Our findings suggest that most firms and individuals use cash for daily financial management, so that their cash share is insensitive to changes in interest rates and investment opportunities. In stark contrast, the wealthiest hold elastic shares of M2, which respond positively to interest rates.

These results have several implications for the monetary policy and future research. Our analysis shows that low interest rates tend to increase the supply of risky financial capital and reduce the supply of deposits available to financial intermediaries in proportion to total financial assets. These effects are primarily driven by individual investors and firms in higher brackets of the financial wealth distribution. These agents are therefore the main channels for the transmission of monetary policy. Since M2 and risky financial assets have different risk and return characteristics, our results highlight important interactions between monetary policy, aggregate risk-taking, and wealth inequality dynamics, which we leave for future research.

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Online Appendix for "Five Facts About the Money Holdings of Individuals and Firms"

Sebastien Betermier, Laurent E. Calvet, and Jens Kvaerner*

September 2022

This online Appendix provides details of data construction and additional empirical results. Section I presents the data, the definition of variables, and summary statistics. Section II discusses aggregate results. Sections III and IV present additional results on individuals and firms, respectively.

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Contents

I Appendix to Section I: Data and Definition of Variables

In this section, we describe our data sources, explain the definition of variables, and report summary statistics. Our methodology ensures that the cash share variable is comparable over time and across countries and sectors.

I.A Data on the Holdings of Individuals in Norway

The Norwegian Tax Administration has collected disaggregated data on the asset holdings of individuals since 1993. We obtain the data from Statistics Norway for the 1993 to 2016 period.

We calculate an individual's financial wealth as follows. We start with gross financial capital ("bruttofin"), which includes bank deposits, shares in stock funds, bonds and money market funds, stocks and other securities. We remove life insurance policies ("post 4.5.2") due to changes in reporting practices during our sample period. We also adjust the value of private equity ("post 4.1.8") because its value assessment is impacted by tax reforms in Norway during our sample period.

Our adjustment procedure for the valuation of private equity proceeds in three steps. First, we download the aggregate value of private equity (F512) of the household sector (S14) in Norway from Eurostat. The aggregate valuation of private equity in Eurostat is based on book values and is consistently calculated over time. Second, we define the *annual conversion ratio* as the ratio of the Eurostat aggregate value of private equity to the aggregate value of private equity in the micro data. Third, the adjusted value of private equity of each individual is the individual's reported value of private equity in the micro data multiplied

by the annual conversion ratio.

Labor income is defined as the sum of cash wages and salaries, taxable payments, in-kind benefits, sickness benefits, and parental benefits received during the calendar year.

I.B Data on the Holdings of Norwegian Firms

The Accounting and Company Information on Norwegian Companies database is provided by the Center for Applied Research (SNF) at the Norwegian School of Economics (NHH). All variables refer to those listed in Berner et al. (2015). The accounting database was reorganized in 2003, so we start the analysis in 2004. The last period in our analysis is 2015, which is the last year we observe whether a firm uses GAAP or the IFRS reporting standard.

We restrict the analysis to "AS" and "ASA" firms for reasons we now explain. AS firms are the most common form of commercial companies in Norway and include privately owned limited liability companies. ASA firms consist of public limited liability companies. We exclude firms that operate in the financial sector or in real estate (sn2007 codes between 64 and 69), and firms without industry classification. We require all firms to have cash holdings of at least 100,000 NOK at the end of the year.

We classify firms based on whether they use the GAAP or the IFRS reporting standard. This classification is important for the valuation of private assets because GAAP firms report the book value of private assets while IFRS firms report the estimated market value of private assets. We focus on the sample of GAAP firms because 1) the GAAP sample is longer and covers the vast majority of firms, and 2) the filter ensures that our results are unaffected by firms switching to IFRS during our sample period.

We define a firm's financial wealth as the sum of its cash holdings, short-term financial assets, and long-term financial assets. Cash includes bank deposits, cash, and cash equiv-

alents ("cash"). Short-term financial assets include shares and units in group companies ("aksjkons"), market-based shares ("markbaksj"), and market-based bonds ("markbaobl"). Long-term financial assets include investments in subsidiaries ("invdtr"), investments in associated companies ("andrinv"), investments in shares and units that do not qualify either as an associated company or a subsidiary, and bonds ("oblig").

The micro database provides unconsolidated asset holdings. Since a company can own multiple firms, the aggregation of firm financial holdings does not match aggregate financial wealth due to multiple counting of financial assets. Although cash holdings are counted only once, the multiple counting of long-term financial assets biases the estimation of the cash share of the firm sector. For these reasons, we adjust the value of long-term financial assets to obtain correct aggregates.

Our adjustment procedure proceeds in three steps. First, we collect both consolidated and unconsolidated data on the value of aggregate holdings of debt securities (F3), listed and non-listed equity, and investment fund shares or units (F512, F511, F521) by the nonfinancial firm sector (S11) in Norway from the Eurostat database. Second, we define the *conversion ratio* as the ratio of the aggregate value of consolidated financial assets to the aggregate value of unconsolidated financial assets. This ratio is stable around 0.25-0.3 throughout the sample. Third, we calculate for each firm the adjusted value of long-term financial assets as the reported value of long-term financial assets in the unconsolidated micro data multiplied by the conversion ratio.

I.C Data on the Holdings of Households in the Netherlands

The Dutch panel from Statistics Netherlands provides data on the disaggregated asset holdings of Dutch households from 2011 to 2019. Financial wealth refers to all sources of liquid

wealth (code: VEHW1110FINH) plus substantial interests (code: VEHW1140ABEH). Income is defined as the sum of labor income from INPATAB.

I.D Survey Data on the Holdings of Households in the United States

The US Survey of Consumer Finances has conducted a survey of US households every 3 years since 1989. Participants are selected randomly to ensure the national representativeness of the study, and participation in the survey is voluntary. The latest survey includes about 6,500 households. Safe assets include transaction accounts and certificates of deposits. Financial wealth includes safe assets, savings bonds, bonds, stocks, and pooled investment funds (excluding money market funds), and the value of businesses to be consistent with the definition of financial wealth in the other datasets.[1]

I.E Macroeconomic Data from Eurostat

Eurostat provides country-level data on the aggregate holdings of M2 by nonfinancial firms (S11), insurance companies and pension funds (ICPFs) (S128 and S129), financial corporations except MFIs and ICPFs (S124, S125, S126, and S127), households (S14), and non-profit institutions serving households (S15).

Eurostat also provides data on the consolidated aggregate holdings of risky financial assets. For the nonfinancial firm sector (S11), financial assets include M2, monetary gold and special drawing rights (F1), debt securities (F3), listed shares (F511), unlisted shares (F512) and money-market fund shares of units (F521). For the household sector, financial assets include M2, monetary gold and special drawing rights (F1), debt securities (F3), loans

[1]Specifically, cash is defined as the sum of all types of transaction account (liquid assets) [LIQ] and certificates of deposit [CDS]. Financial wealth is defined as Total financial assets [FIN] minus Quasi-liquid retirement accounts [RETQLIQ] plus Businesses (with either an active or nonactive interest) [BUS].

(F4), and equity and investment fund shares or units (F5). These asset classes are standard and available for the 11 founding members of the euro area from 1995 to 2020. These countries are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain.

I.F Data on Deposit Rates

We obtain the Norwegian deposit rates on individual accounts from Statistics Norway. For the Netherlands, we use deposit rates with maturities up to 1 year available from the Dutch central bank. Deposit rates on individual and corporate accounts for the euro area are available from the European Central Bank. We collect interest rates on deposits from households[2] and firms[3] with a maturity of up to one year (new business). We select the prevailing interest rate in December each year. We download the data using the ECB package in R. The US deposit rates correspond to 1-year CD rates and are obtained from Bankrate's national survey.

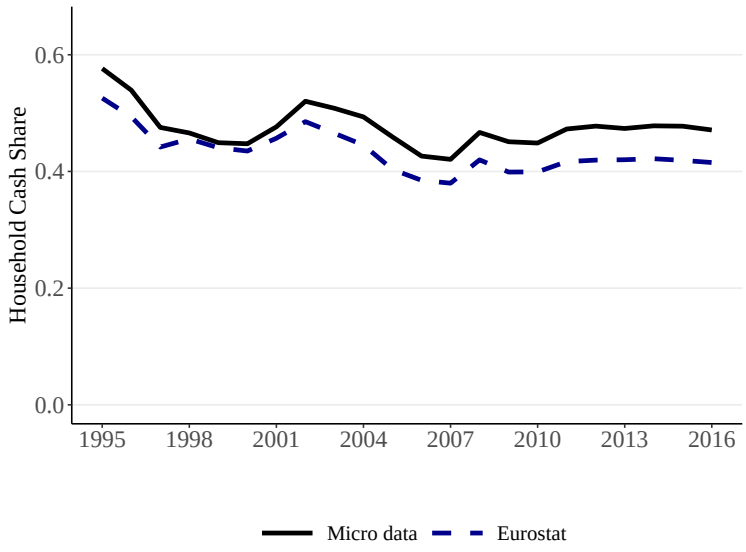
I.G Comparison of Eurostat and Micro Data

We now verify that the cash shares of the household and firm sectors we obtain from Eurostat are comparable to the cash shares we calculate from the micro data in Norway.

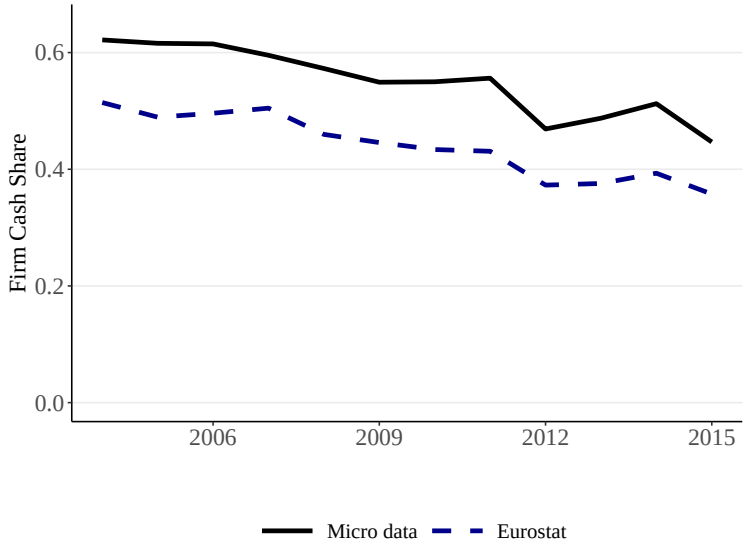
Figure IA.1, Panel A, plots the household sector's cash share obtained from Eurostat (blue dashed curve) and the micro data (black solid curve) over the 1995 to 2016 period. The two time-series are highly correlated and feature a similar change in the cash share from 1995 to 2016: -12.0 percentage points (pp) in Eurostat and -10.5 pp in the micro-data.

Similarly, Figure IA.1, Panel B, plots the cash share of the firm sector in Eurostat (blue

[2]Code: MIR.M.U2.B.L22.F.R.A.2250.EUR.N
[3]Code: MIR.M.U2.B.L22.F.R.A.2240.EUR.N



(a) Household Sector



(b) Firm Sector

Figure IA.1: Comparison of Cash Share from Eurostat and Micro Data. Panel A plots the cash share of the household sector in Norway between 1995 and 2016 computed from Eurostat (blue curve) and the micro data (black curve). Similarly, Panel B plots the cash share of the Norwegian firm sector between 2004 and 2015 from Eurostat (blue curve) and the micro data (black curve).

dashed curve) and the micro data (black solid curve) between 2004 and 2015. Again, the two time-series are highly correlated and feature a similar change in the cash share from 2004 to

2015: -15.7 pp in Eurostat and -17.5 pp in the micro data.

II Appendix to Section II: Aggregate Results

II.A Decomposition of Changes in Aggregate M2

The household and firm sectors are key drivers of *changes* in aggregate M2, as we now show. As in Section II.B of the main text, aggregate M2 designates the total stock of M2 owned by the money holding sector.

In Table IA.1, we regress the logarithmic growth rate of aggregate M2, $\Delta \ln(M2_{t+1}) = \ln(M2_{t+1}) - \ln(M2_t)$, on (i) the growth rate of M2 held by the household sector and (ii) the growth rate of M2 held by the firm sector:

$$\Delta \ln(M2_{t+1}) = \alpha + \beta_h \, \Delta \ln(M2_{h,t+1}) + \beta_f \, \Delta \ln(M2_{f,t+1}) + \epsilon_{t+1}, \tag{IA-1}$$

where α, β_h, and β_f are fixed coefficients and ϵ_{t+1} is a stochastic residual. We estimate the regression for Norway (column 1) and the sample of 11 euro area founding countries (columns 2 to 5).

In Norway (column 1), the household and firm sectors explain 98.2% of aggregate fluctuations in M2. The linear coefficients β_h and β_f are significantly positive and approximately add up to unity.

In columns 2 to 5, we estimate the regression in the euro area for multiple combinations of country and year fixed effects. The R^2 coefficient ranges between 45% and 60% across specifications, which confirms that the two sectors explain the majority of aggregate fluctuations in M2.

Table IA.1
Money Growth Regressions

This table reports OLS regressions of the logarithmic growth rate of M2 held by a country's money-holding sector from year t to year $t+1$ on (i) the logarithmic growth rate of M2 held by the country's household sector and (ii) the logarithmic growth rate of M2 held by the country's firm sector sector over the same time period. The money holding sector consists of households, nonfinancial firms, nonprofit organizations, municipalities, and financial corporations other than banks and mortgage companies. The analysis is based on the annual sector cash holdings from the Eurostat sample. Column 1 focuses on Norway, while columns 2 to 5 focus on the 11 original euro area countries.

	Dependent variable: Growth rate of aggregate M2				
	(1)	(2)	(3)	(4)	(5)
Growth rate of household M2	0.456***	0.567***	0.474***	0.664***	0.549***
	(0.054)	(0.102)	(0.109)	(0.123)	(0.135)
Growth rate of firm M2	0.547***	0.421***	0.435***	0.420***	0.426***
	(0.017)	(0.036)	(0.038)	(0.041)	(0.042)
Constant	0.0003	0.002			
	(0.004)	(0.006)			
Countries	Norway	All	All	All	All
Country fixed effects	No	No	Yes	No	Yes
Year fixed effects	No	No	No	Yes	Yes
Number of observations	26	212	212	212	212
R^2	0.982	0.476	0.500	0.543	0.561

II.B Breakdown of M2 by Sector

Figure 1, Panel B, of the main text shows that the household and firm sectors combined hold a high proportion of the money holding sector's M2. For this reason the rest of the main text focuses on the M2 held by the household and nonfinancial firms sectors ("combined M2").

In Figure IA.2 of this online Appendix, we plot the proportion of combined M2 that is held by the household sector, either in Norway (solid curve) or in the Eurostat sample (dashed

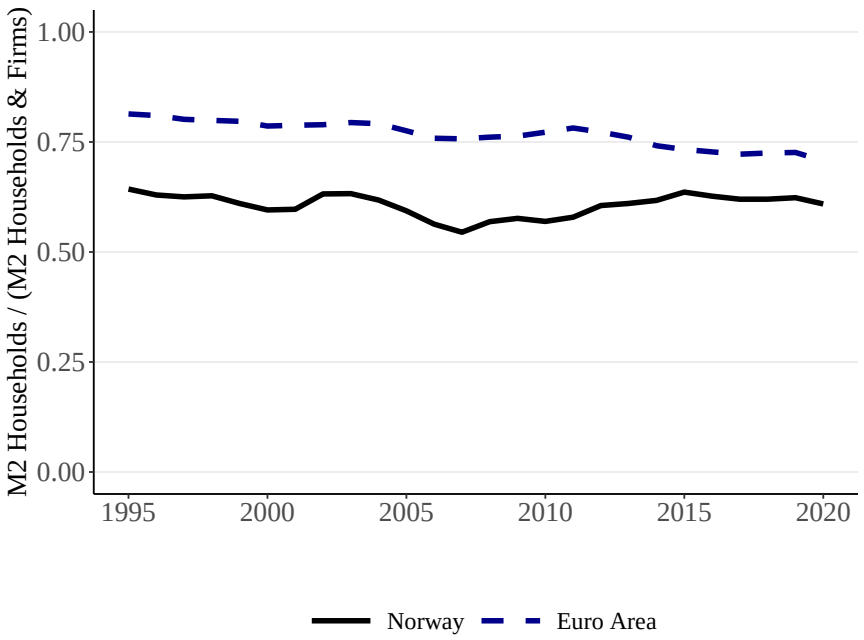


Figure IA.2: Household share of M2. This figure plots the household sector's share of the combined M2 holdings held by the household and firm sectors. We report the household sector's share for Norway (black solid curve) and the 11 founding countries of the euro area (blue dashed curve) between 1995 and 2020. Both curves are based on Eurostat data.

curve). In Norway, the household sector holds about 60% of combined M2 throughout the sample period. In the broader Eurostat sample, the household sector also holds the majority of combined M2, and the proportion remains stable over time.

In Figure IA.3, we next decompose each sector into the top decile and bottom nine deciles of the sector's financial wealth distribution. We do so by using the micro data on individuals and firms in Norway from 2004 to 2015, the period during which the data are available for both sectors.[4] Figure IA.3 shows that the top decile of individuals own 33%, the bottom nine deciles of individuals own 27%, the top decile of firms own 30% and the bottom nine deciles of firms own 10% of combined M2 on average over the sample period. The figure shows that these proportions remain nearly constant over time.

[4]We calculate the share of M2 held by the financial wealth bracket of a given sector by multiplying (i) the sector's share of M2 from Figure IA.2 with (ii) the share of the sector's M2 held by the bracket, which we obtain from the micro data.

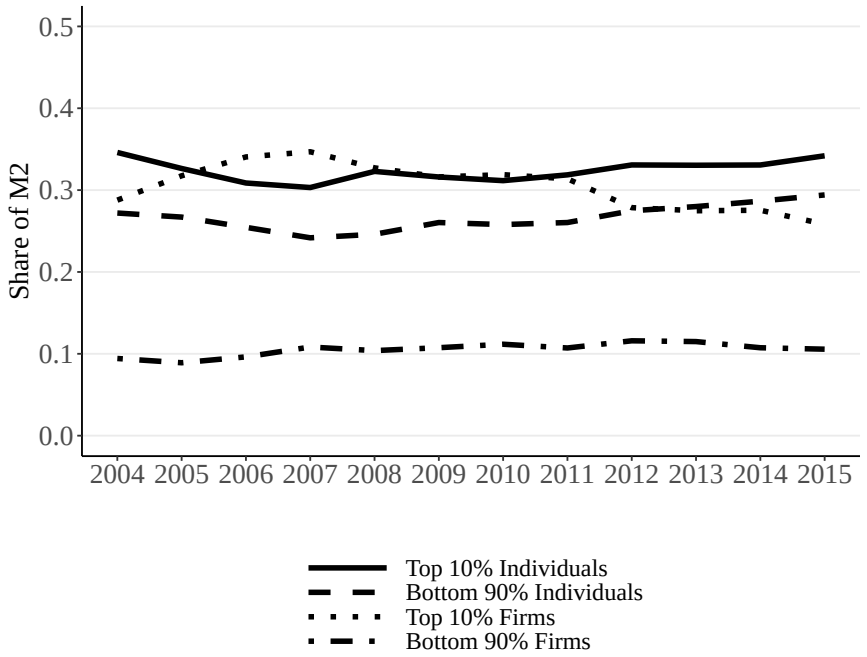


Figure IA.3 : Share of M2 held by brackets of individuals and firms. This figure illustrates the proportion of combined M2 held by (i) the top 10% of individuals sorted by financial wealth, (ii) the bottom 90% of individuals, (iii) the top 10% of nonfinancial firms sorted by financial wealth, and (iv) the bottom 90% of nonfinancial firms. Combined M2 consists of the money holdings of the combined household and firm sectors. We retrieve from Eurostat the M2 holdings of the household and firm sectors in Norway between 2004 and 2015. For each of these two sectors, we obtain the holdings of the top 10% and the bottom 90% of agents over the same period from the micro data.

II.C Measurement Error in the US SCF

We show in this section that, even in large and well-established datasets such as the US Survey of Consumer Finances (SCF), the magnitude of the measurement error makes it challenging to precisely assess the cash share dynamics for different wealth brackets.

Inference on a bracket's cash share from survey data is subject to several types of measurement error. The first source of measurement error is missing data. The SCF uses multiple imputation to address this issue and provides for each household and each year five separate observations ('implicates') of a particular variable. The second type of measurement error is sampling error, that is the fact that estimates of the cash share are based on a sample rather

than the full population. The SCF provides sampling weights to correct for heterogeneity in the response rate of different household groups. More specifically, the SCF provides a primary sampling weight for each household, together with 999 replicate sampling weights to allow for bootstrap standard error calculations. We estimate the standard error of the cash share in the SCF following the method of Barnard and Rubin (1999), which accounts for both multiple imputation error and sampling variability.

We begin by introducing notation and describing the method for calculating standard errors of SCF variables, and then discuss how we apply the method to compute the standard error of the cash share. A particular cross-section of the SCF dataset includes $h \in \{1, ..., H\}$ households, $m \in \{1, ..., M\}$ implicates, and $j \in \{1, ..., J\}$ replicate sampling weights. In our context, $M = 5$ and $J = 999$. We denote by ω_h^0 the primary sampling weight for household h and by ω_h^j the j^{th} replicate sampling weight. The weights are scaled so that they sum up to one, i.e. $\sum_{h=1}^{H} \omega_h^0 = 1$ and $\sum_{h=1}^{H} \omega_h^j = 1$ for every j.[5]

The main variables of interest for the cash share calculation are cash and financial wealth. We denote by $M2_{h,m}$ and $FW_{h,m}$, respectively, the m^{th} implicates of the cash holdings and financial wealth of household h. We stack these variables into the 2×1 column vector $\boldsymbol{\theta_{h,m}}$. Barnard and Rubin (1999) show that the variance-covariance matrix of $\boldsymbol{\theta_{h,m}}$ is the sum of a variance-covariance matrix capturing imputation error and a variance-covariance matrix capturing sampling error, as we now explain.

Imputation variance-covariance matrix. The imputation variance-covariance matrix is calculated using the primary sampling weights. For each implicate m, the sample average

[5]In the US SCF, the (unscaled) primary weight is given by the WGT variable in the Summary Extract Public Data File. The (unscaled) replicate weight is obtained from the Replicate Weight File. For each replicate weight, we multiply the sampling weight (wt1b1) by the number of times the observation is drawn (mm1).

of $\boldsymbol{\theta_{h,m}}$ is given by

$$\bar{\boldsymbol{\theta}}_{\boldsymbol{h,m}} = \sum_{h=1}^{H} \omega_h^0 \, \boldsymbol{\theta_{h,m}}. \tag{IA-2}$$

We then compute the point estimate of $\boldsymbol{\theta_{h,m}}$ as the average value of $\bar{\boldsymbol{\theta}}_{\boldsymbol{h,m}}$ across the M implicates:

$$\bar{\boldsymbol{\theta}}_{\boldsymbol{h}} = \frac{1}{M} \sum_{m=1}^{M} \bar{\boldsymbol{\theta}}_{\boldsymbol{h,m}}. \tag{IA-3}$$

The imputation variance-covariance matrix, $\boldsymbol{B_\theta}$, is calculated as

$$B_{\boldsymbol{\theta}} = \frac{1}{M-1} \sum_{m=1}^{M} (\bar{\boldsymbol{\theta}}_{\boldsymbol{h,m}} - \bar{\boldsymbol{\theta}}_{\boldsymbol{h}})(\bar{\boldsymbol{\theta}}_{\boldsymbol{h,m}} - \bar{\boldsymbol{\theta}}_{\boldsymbol{h}})'. \tag{IA-4}$$

Sampling variance-covariance matrix. The sampling variance-covariance matrix is calculated using the first implicate values of cash and financial wealth, i.e. $m = 1$. For each set of replicate sampling weights, the sample average of $\boldsymbol{\theta_{h,1}}$ is given by

$$\hat{\boldsymbol{\theta}}^{\boldsymbol{j}}_{\boldsymbol{h,1}} = \sum_{h=1}^{H} \omega_h^j \, \boldsymbol{\theta_{h,1}}. \tag{IA-5}$$

The point estimate of $\boldsymbol{\theta_{h,1}}$ is then computed as the average value of $\hat{\boldsymbol{\theta}}^{\boldsymbol{j}}_{\boldsymbol{h,1}}$ across the J sets of replicate weights:

$$\hat{\boldsymbol{\theta}}_{\boldsymbol{h}} = \frac{1}{J} \sum_{j=1}^{J} \hat{\boldsymbol{\theta}}^{\boldsymbol{j}}_{\boldsymbol{h,1}}. \tag{IA-6}$$

The sampling variance-covariance matrix, $\boldsymbol{U_\theta}$, is calculated as

$$U_{\boldsymbol{\theta}} = \frac{1}{J-1} \sum_{j=1}^{J} (\hat{\boldsymbol{\theta}}^{\boldsymbol{j}}_{\boldsymbol{h,1}} - \hat{\boldsymbol{\theta}}_{\boldsymbol{h}})(\hat{\boldsymbol{\theta}}^{\boldsymbol{j}}_{\boldsymbol{h,1}} - \hat{\boldsymbol{\theta}}_{\boldsymbol{h}})'. \tag{IA-7}$$

The total variance-covariance matrix, $\boldsymbol{T_\theta}$, is the sum of the imputation variance-covariance matrix, scaled up to account for a possibly small number of implicates, and the sampling

variance-covariance matrix:

$$\boldsymbol{T_\theta} = \frac{M+1}{M}\boldsymbol{B_\theta} + \boldsymbol{U_\theta}. \tag{IA-8}$$

Delta method. Because the cash share is a function of a household's cash holdings and financial wealth, we obtain the standard error of the cash share by applying the delta method. For a smooth function $g(\,\cdot\,)$, the variance of $g(\hat{\boldsymbol{\theta}}_{\boldsymbol{h}})$ is approximately equal to

$$\sigma_g^2 = \nabla g(\hat{\boldsymbol{\theta}}_{\boldsymbol{h}})' \, \boldsymbol{T_\theta} \, \nabla g(\hat{\boldsymbol{\theta}}_{\boldsymbol{h}}), \tag{IA-9}$$

where $\nabla g(\,\cdot\,)$ is the gradient of $g(\,\cdot\,)$. In the context of the cash share, the function is $g(x, y) = x/y$ and the gradient is equal to:

$$\nabla g(x, y) = \begin{bmatrix} \frac{1}{y} \\ -\frac{x}{y^2} \end{bmatrix}. \tag{IA-10}$$

Univariate method. In addition to using the delta method, we also calculate the standard error of the cash share directly. For each implicate m, we calculate the average cash share as:

$$\bar{\boldsymbol{c}}_{\boldsymbol{h,m}} = \frac{\sum_{h=1}^{H} \omega_h^0 \, \boldsymbol{M2_{h,m}}}{\sum_{h=1}^{H} \omega_h^0 \, \boldsymbol{FW_{h,m}}}. \tag{IA-11}$$

Similarly, for each set of replicate weights j, we calculate the average cash share as:

$$\hat{\boldsymbol{\theta}}_{\boldsymbol{h,1}}^{\boldsymbol{j}} = \frac{\sum_{h=1}^{H} \omega_h^j \, \boldsymbol{M2_{h,1}}}{\sum_{h=1}^{H} \omega_h^j \, \boldsymbol{FW_{h,1}}}. \tag{IA-12}$$

We then proceed with the computation of the imputed variance and sampling variance of the cash share statistic by following the steps above in the univariate context.

Results. We present in Table IA.2 the results of the standard error of the cash share statistic for different samples. We consider both the full sample and the top 10% wealth

Table IA.2
Standard Error of the Cash Share in the US SCF

This table reports point estimates and standard errors of the cash share statistic for different samples of the 2013 US Survey of Consumer Finances. We consider both the full sample of households and the top 10% wealth bracket. The standard error of the cash share is estimated in two ways: (1) the Delta method, in which we first estimate the variance-covariance matrix of the vector of cash holdings and financial wealth, and (2) the Univariate method, in which we estimate the standard error of the cash share directly. Both methods account for multiple imputation error and sampling variability. The last two columns report the width of the corresponding 95% confidence interval for each method.

	Cash Share Statistics				
		Standard Error		95% C.I.	
	Mean	Delta	Univ.	Delta	Univ.
	(1)	(2)	(3)	(4)	(5)
Full Sample	0.1445	0.0076	0.0076	0.0300	0.0300
Top 10%	0.0668	0.0118	0.0118	0.0463	0.0463

bracket. The statistics are based on the 2013 cross-section of the SCF.

The mean cash share in column 1 corresponds to the average cash share across the J sets of replicate weights:

$$\hat{\boldsymbol{c}}_{\boldsymbol{h}} = \frac{1}{J}\sum_{j=1}^{J} \hat{\boldsymbol{c}}^{\boldsymbol{j}}_{\boldsymbol{h,1}}. \tag{IA-13}$$

It is equal to 0.14 for the full sample and 0.07 for the top 10% wealth bracket. The low cash share of the wealthy is consistent with the summary statistics from the Norwegian and Dutch panels.

Columns 2 and 3 report the standard error of the cash share according to the delta and univariate methods, and columns 4 and 5 the width of the corresponding 95% confidence intervals. Both methods yield identical results.

For the full sample, the standard error of the cash share is 0.0076, which results in a confidence interval of length 3 pp ($= 0.0076 \times 1.96 \times 2$). For the top 10% wealth bracket, the cash share has a confidence interval of length 4.6 pp ($= 0.118 \times 1.96 \times 2$), which is larger than the time series variation in the aggregate cash share over the sample period. The large confidence interval of the top 10% makes it challenging to study the cash share dynamics of specific wealth brackets in the SCF.

III Appendix to Section III: Individuals

III.A Summary Statistics in 2015

In Table IA.3, we report summary statistics on the household sector in Norway (Panel A) and the Netherlands (Panel B) at the end of 2015.

Panel A is based on 4.1 million individuals residing in Norway. An individual earns 31,000 euros on average.[6] Her financial wealth of 57,700 euros amounts to almost twice her annual income. Her cash holdings amount to 27,600 euros, which corresponds to 90% of annual income and 48% of financial wealth.

The cash share varies widely across financial wealth brackets. An individual in the top 10% bracket has 420,500 euros of financial wealth on average, which is more than ten times her annual income of 41,200 euros. Her cash holdings of 148,100 euros amount to 3.6 times her annual income but only 35% of her financial wealth.

By contrast, an individual in the bottom 90% bracket has 17,400 euros of financial wealth on average, which amounts to only half her annual income. She invests the majority of her financial wealth in cash (14,200 euros). These statistics are consistent with the evidence that wealthier households tend to have high wealth-to-income ratios and hold higher yielding assets (Bach, Calvet and Sodini, 2020; Betermier, Calvet and Sodini, 2017; Betermier, Calvet, Knupfer and Kvaerner, 2022; Fagereng, Guiso, Malacrino and Pistaferri, 2020).

Panel A of Table IA.3 also reports the ownership breakdown of aggregate income, cash holdings, and financial wealth held by individuals in the micro data. Individuals in the top 10% of the financial wealth distribution hold 13% of total income, 54% of total cash holdings,

[6] Norwegian kroner are converted to euros using the exchange rate of 9.6255 kroner per euro that prevailed on December 31, 2015.

Table IA.3
Summary Statistics on the Household Sector

Panel A reports summary statistics on the top 10% and the bottom 90% of Norwegian individuals sorted by financial wealth at the end of 2015. We convert Norwegian kroner into euros by applying the exchange rate of 9.6255 kroner per euro that prevailed on December 31, 2015. Similarly, Panel B reports summary statistics on the top 10% and bottom 90% of Dutch households sorted by financial wealth at the end of 2015.

	Panel A: Norway				
	Average per individual (thousand euros)			Share of household sector	
	All	Top 10%	Bottom 90%	Top 10%	Bottom 90%
Labor income	31.0	41.2	29.9	0.13	0.87
Cash holdings	27.6	148.1	14.2	0.54	0.46
Financial wealth	57.7	420.5	17.4	0.73	0.27
Number of individuals	4,074,583	407,458	3,667,125		
	Panel B: Netherlands				
	Average per household (thousand euros)			Share of household sector	
	All	Top 10%	Bottom 90%	Top 10%	Bottom 90%
Labor income	38.7	66.9	35.5	0.17	0.83
Cash holdings	39.2	212.1	20.0	0.54	0.46
Financial wealth	95.8	755.8	22.4	0.79	0.21
Number of households	7,538,692	753,872	6,784,820		

and 73% of total financial wealth. The concentrated ownership of financial wealth by the top 10% is consistent with the high levels of wealth inequality reported in Piketty (2022) and others.

Panel B of Table IA.3 provides analogous summary statistics on the Dutch panel. The values of income, financial wealth, and cash are higher than in Panel A because the unit of analysis is the household in the Netherlands, compared to the individual in Norway. Otherwise, the patterns are identical to those in the Norwegian panel.

III.B Predictability Regressions

To further understand the impact of time-varying interest rates on the portfolio rebalancing behavior of individuals, we run additional predictability regressions of the cash share. The growth rate of the cash share from year t to year $t+1$ satisfies:

$$\frac{c_{t+1}}{c_t} = \frac{M2_{t+1}}{M2_t}\frac{FW_t}{FW_{t+1}}. \tag{IA-14}$$

In log terms, we obtain

$$\ln(c_{t+1}) = \ln(c_t) + \ln(M2_{t+1}) - \ln(M2_t) - \ln(FW_{t+1}) + \ln(FW_t). \tag{IA-15}$$

Let r_t denote the deposit rate in year t and r^m_{t+1} the return on the Norwegian stock market between years t and $t+1$.

In Table IA.4 of this online Appendix, we estimate the regression:

$$\ln(c_{t+1}) = \alpha + \delta \ln(c_t) + \gamma \ln(1+r_t) - \beta \ln(1+r^m_{t+1}) + \varepsilon_{t+1} \tag{IA-16}$$

where ε_{t+1} is a stochastic error term. Importantly, the coefficient γ is equal to one if individuals are purely passive in their rebalancing of safe asset holdings, so that $M2_{t+1}/M2_t = 1+r_t$. A value of γ above unity implies that individuals actively decrease their holdings of M2 if the deposit rate decreases, consistent with the elastic supply of M2 and a reach-for-yield motive. By contrast, a value of γ close to zero implies that individuals choose their cash share independently of the deposit rate.

We report the regression results for individuals in the top 1%, top 10%, and bottom 90% of the financial wealth distribution. Each regression is estimated both on the Norwegian panel (columns 1, 3, and 5) and the combined Norwegian and Dutch panels (columns 2, 4, and 6). The R^2 of each regression exceeds 75% and often reaches values above 90%, confirming that

Table IA.4
Predictability Regressions

This table reports the results of regressions of the log cash share at the end of year $t+1$ on the log deposit rate in year t, the log return on the Norwegian stock market from year t to year $t+1$, and the log cash share at the end of year t. The regression is run by wealth group and over the period 1994 to 2016 either on the Norwegian panel (columns 1, 3, and 5) or on the pooled Norwegian and Dutch panels (columns 2, 4, and 6). Standard errors in parentheses are Newey-West adjusted with a lag length of 2 ($\approx 0.75 \times 23^{1/3}$). Statistical significance is indicated by ***, ** and * for the 0.01, 0.05, and 0.10 levels.

	Dependent variable: Log cash share $\ln(c_{t+1})$					
	Top 1%		Top 10%		Bottom 90%	
	(1)	(2)	(3)	(4)	(5)	(6)
Deposit rate	2.642^{***}	3.214^{***}	1.100^{***}	1.462^{***}	-0.290	-0.325^{**}
	(0.608)	(0.610)	(0.394)	(0.361)	(0.195)	(0.160)
Equity return	-0.204^{***}	-0.206^{***}	-0.157^{***}	-0.160^{***}	-0.052^{***}	-0.056^{***}
	(0.032)	(0.028)	(0.020)	(0.016)	(0.012)	(0.011)
Lagged log cash share	0.789^{***}	0.843^{***}	0.797^{***}	0.863^{***}	0.781^{***}	0.949^{***}
	(0.055)	(0.046)	(0.056)	(0.048)	(0.064)	(0.043)
Constant	-0.493^{***}	-0.420^{***}	-0.243^{***}	-0.194^{***}	-0.037^{**}	0.003
	(0.120)	(0.108)	(0.062)	(0.064)	(0.019)	(0.007)
Countries:						
Norway	Yes	Yes	Yes	Yes	Yes	Yes
Netherlands	No	Yes	No	Yes	No	Yes
Observations	23	31	23	31	23	31
R^2	0.913	0.954	0.906	0.955	0.764	0.952

the specification given by (IA-16) does a good job in explaining the dynamics of the cash share. Table IA.5 reports corresponding F statistics of tests that the coefficient γ is equal to either zero or one. We present the results jointly.

Table IA.5
Predictability Regressions: F-statistics and p-values

This table reports the F-statistics and corresponding p-values for the hypothesis that the linear coefficient on the log deposit rate, γ, is equal to zero (Panel A) or unity (Panel B) in the predictability regression of Table IA.4.

A. Restricted model: $\gamma = 0$						
	Top 1%		Top 10%		Bottom 90%	
	(1)	(2)	(3)	(4)	(5)	(6)
F-stat	8.9	12.6	4.2	8.2	2.5	4.0
p-value	0.01	0.00	0.05	0.01	0.13	0.06
Countries:						
Norway	Yes	Yes	Yes	Yes	Yes	Yes
Netherlands	No	Yes	No	Yes	No	Yes
B. Restricted model: $\gamma = 1$						
	Top 1%		Top 10%		Bottom 90%	
	(1)	(2)	(3)	(4)	(5)	(6)
F-stat	3.4	6.0	0.0	0.8	49.0	65.8
p-value	0.08	0.02	0.85	0.37	0.00	0.00
Countries:						
Norway	Yes	Yes	Yes	Yes	Yes	Yes
Netherlands	No	Yes	No	Yes	No	Yes

Column 1 of Table IA.4 considers the top 1% of individuals in Norway and column 2 the top 1% of individuals in Norway and the Netherlands. The linear coefficient γ ranges between 2.6 and 3.2, which is above one and thus implies active portfolio rebalancing. The F tests in Table IA.5 confirm that the γ coefficient is significantly different from one.

We next consider individuals in the top 10% of the wealth distribution in Norway (column 3 of Table IA.4) and in Norway and the Netherlands (column 4). The coefficient γ ranges

between 1.1 and 1.4, which is again above unity. The F tests in Table IA.5 confirm that the γ coefficient is significantly different from zero. However, we cannot reject the hypothesis that γ is significantly different from one.

The remaining columns of Table IA.4 focus on individuals in the bottom 90% of the wealth distribution. Column 5 includes data from Norway and column 6 includes data from Norway and the Netherlands. In each column, the coefficient γ is negative and approximately equal to -0.3, with either little or no significance. These results confirm that the bottom 90% use M2 for reasons unrelated to the deposit rate.

III.C Imputed Cash Income

Fact 4 in the main text documents the evolution of the cash income-to-labor income ratio for different wealth groups in Norway and the Netherlands. In Norway, the value of cash income in year t is imputed as the product of the individual's cash holdings at the end of year $t-1$ and the average deposit rate in year t. We now verify the accuracy of this imputation method by examining the Dutch panel, which provides the exact level of cash income.

Figure IA.4 plots the cash income-to-labor income ratio from 2011 to 2019 for Dutch households in the top 1% and the top 10% of the wealth distribution. The black curves report the exact values provided by the Dutch panel and the blue curves the imputed values of the ratio, which we obtain by using the same imputation method as in Norway. The observed and imputed ratios are virtually identical. Fact 4 is therefore also valid in the Netherlands.

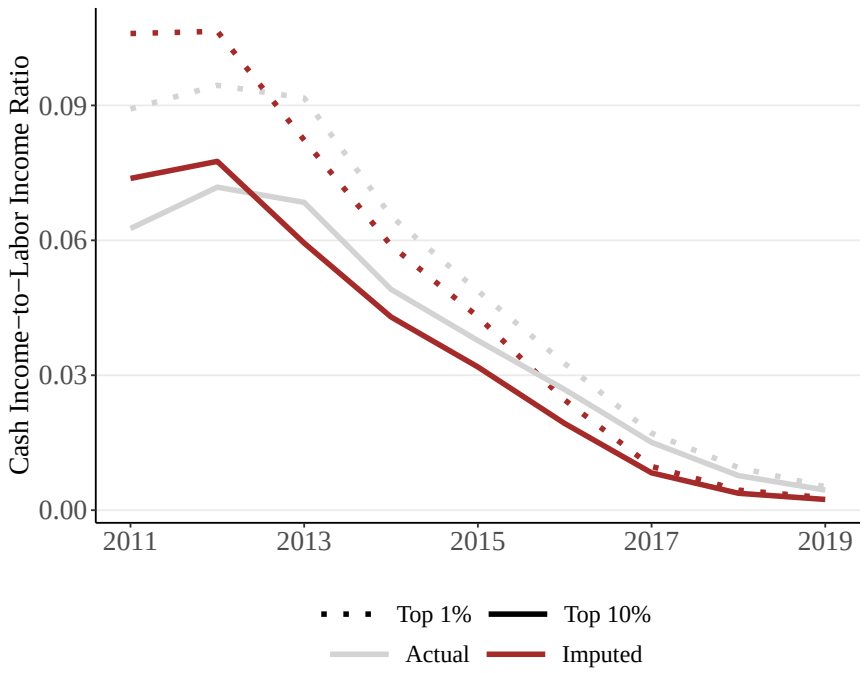


Figure IA.4: Comparison of Cash Income-to-Labor Income Ratio from Eurostat and the Micro Data. This figure compares the cash income-to-labor income ratio obtained from Eurostat and the micro data. The analysis focuses on the top 1% and the top 10% of Dutch households sorted by financial wealth over the 2011 to 2019 period. For each wealth bracket, the black curve corresponds to the actual ratio and the blue curve to the imputed ratio.

Table IA.6
Summary Statistics on Norwegian Nonfinancial Firms

This table reports summary statistics on the top 10% and the top 90% of Norwegian firms sorted by financial wealth at the end of 2015. All amounts are in thousand euros. We convert Norwegian kroner into euros by applying the exchange rate of 9.6255 kroner per euro that prevailed on December 31, 2015.

	Average per firm (thousand euros)			Share of firm sector	
	All	Top 10%	Bottom 90%	Top 10%	Bottom 90%
Annual sales	2,829	16,611	1,298	0.59	0.41
Cash holdings	372	2,641	120	0.71	0.29
Financial wealth	833	7,071	140	0.85	0.15
Number of firms	97,374	9,737	87,637		

IV Appendix to Section IV: Firms

IV.A Summary Statistics in 2015

Table IA.6 reports summary statistics on firms in the Norwegian panel at the end of 2015. The panel includes approximately 97,000 firms. On average, a firm generates 2.83 million euros of sales and holds 372,000 euros in cash and 833,000 euros in total financial assets. As with individuals, the cash share varies widely across the financial wealth distribution and increases with the level of financial wealth.

One key feature of the financial wealth distribution of firms is that it is extremely skewed. The top 10% of firms own 71% of corporate cash holdings and 85% of corporate financial wealth. The predominance of large firms is consistent with the "granular" hypothesis (Gabaix, 2011; Hulten, 1978).

IV.B M2 Holdings

Figure IA.5 plots the total cash holdings of firms in the top 1%, the top 10%, and the bottom 90% of the financial wealth distribution from 2004 to 2015 in Norway. For each group of firms, M2 holdings increased significantly throughout the sample.

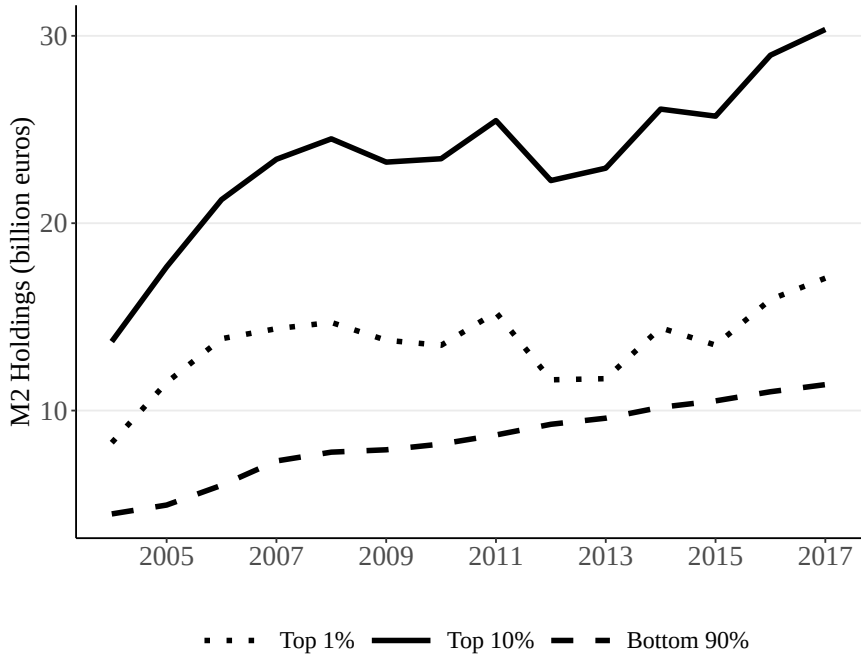


Figure IA.5 : M2 Holdings of Norwegian Firms. This figure plots the total M2 holdings (in billion eurors) of the top 1%, the top 10%, and the bottom 90% of Norwegian firms sorted by financial wealth over the 2004 to 2015 sample period. The results are based on the Norwegian micro data.

IV.C Cash-to-Sales Ratio

In Figure IA.6, we plot the ratio of cash holdings to annual sales for Norwegian firms in different financial wealth brackets. For the bottom 90% of firms, the cash-to-sales ratio steadily increases from 6.8% to 9.2% throughout the sample period. By contrast, the cash-

to-sales ratio of top brackets fluctuates between 15% and 25% with no clear trend. These results contrast with the behavior of the cash share, which steadily decreases for the top 1% and the top 10% and remains constant for the bottom 90% throughout the sample period (see Figure 4 of the main text).

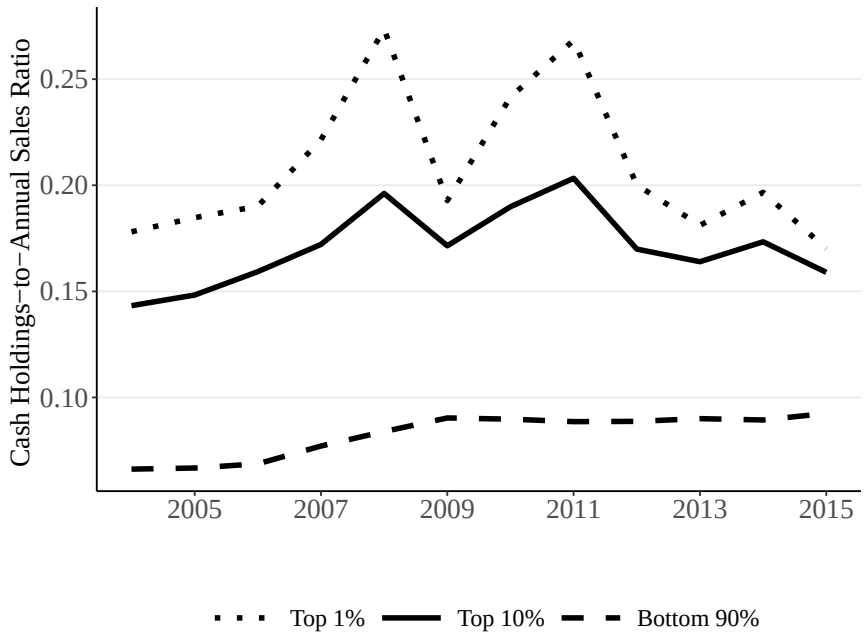


Figure IA.6: Cash Holdings-to Annual Sales Ratio of Norwegian Firms. This figure plots the ratio of cash holdings to annual sales for the top 1%, the top 10%, and the bottom 90% of Norwegian firms sorted by financial wealth over the 2004 to 2015 sample period. The results are based on the Norwegian micro data.

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