How Did Low Interest Rates Impact the Cash Holdings of Individual Investors and Firms?

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

October 7, 2021

Abstract

Global interest rates experienced a protracted decline over the 2000-2010 period and have hovered since then near the zero lower bound. This paper documents how holdings of money (M2) have adjusted to the low-interest rate environment. Using national statistics from several European countries, we document that aggregate holdings of M2 have increased both in nominal terms and as a fraction of GDP. Perhaps more surprisingly, the cash share, defined as the ratio of M2 to aggregate financial assets, has steadily declined since 1995. We investigate the microeconomic drivers of the cash share in a high-quality administrative data set containing the detailed holdings of every individual in Norway since 1995 and every firm since 2003. We show that the decline in the aggregate share is driven almost entirely by the portfolio rebalancing of individuals and firms in the top 10% of their respective wealth distribution.

JEL Codes: E41, G11.
Keywords: Money holdings, liquidity trap, low interest rates.

*Betermier: Desautels Faculty of Management, McGill University, 1001 Sherbrooke St West, Montreal, QC H3A 1G5, Canada; sebastien.betermier@mcgill.ca. Calvet: EDHEC Business School, 16 rue du Quatre-Septembre, 75002 Paris, France, and CEPR; laurent.calvet@edhec.edu. Kvaerner: Tilburg University, Warandelaan 2 5037 AB Tilburg, Netherlands; jkverner@gmail.com. We received helpful comments from Marie Brière, Christian Gollier, Jacques de Larosière, Grégoire Naacke, and seminar participants at Observatoire de l'Epargne Européenne. Calvet acknowledges financial support from Observatoire de l'Epargne Européenne. Kvaerner acknowledges financial support from Netspar.

1 Introduction

Global interest rates experienced a protracted decline between 2000 and 2010 and have hovered since then near the zero lower bound. Economic theory suggests that a dramatic fall in nominal interest rates should have a major impact on the portfolios of risky assets held by investors and firms. If market participants do not expect risky asset returns to fall as much as interest rates, risk premia increase and investments in stocks, mutual funds, and real estate become more attractive compared to safe assets, prompting investors to rebalance their portfolios away from safe assets (Gollier, 2001; Merton, 1971; Tobin, 1958). Even if investors expect risk premia to remain constant, lower interest rates can encourage investors to "reach for yield" and reduce their proportional holdings of safe assets (Becker and Ivashina, 2015; Campbell and Sigalov, 2020; Cox, 1967). Furthermore, interest rates close to zero may encourage investors to swap bonds for liquid cash and thereby create a liquidity trap in which monetary policy becomes ineffective (Keynes, 1936).

The sensitivity of portfolio allocations to interest rates is a central question in macroeconomics and finance, with key implications for the conduct of monetary policy and its links to the business cycle. Ideally, one would like to study the rebalancing channel at both the macro and micro levels. Macroeconomic aggregates provide useful information on the relationship between changes in interest rates and the allocation of aggregate investment and thereby future economic performance. In addition, a detailed understanding of interest-rate effects should also consider the micro-level determinants of portfolio rebalancing by households and firms, a pre-requisite for targeted policies. Until now, however, the lack of comprehensive and granular data on investor holdings has made it challenging to conduct the empirical analysis at this level of granularity.

Our study resolves this challenge by exploiting two types of data sets: (i) the national accounts of several European countries, including France and Norway, and (ii) an exceptionally detailed administrative data set from Norway containing the complete asset holdings of *every* resident between 1995 and 2017 and *every* non-financial firm between 2003 and 2017. Together, these groups account for 90% of the M2 monetary aggregate[1] in Norway. Our data set is therefore comprehensive *and* granular, which allows us to study both the macro- and micro-level effects of interest rates on the demand for cash over a long sample period during which interest rates decreased significantly.

[1]The M2 monetary aggregate includes all elements of M1 as well as "near money." M1 includes cash and checking deposits, while near money refers to savings deposits, money market securities, mutual funds, and other time deposits.

Consistent with financial theory and the household finance literature (Calvet et al., 2007; Campbell, 2018; Gollier, 2001; Gomes et al., 2020), our main variable of interest is the *cash share*, defined as the ratio of cash holdings to total financial assets, computed at various levels of investor aggregation. We compute the cash share of an individual or a non-financial firm at the micro-level, or a group of individuals and non-financial firms at the macro-level. Our definition is standard, consistent with definitions used in the household finance literature, and can be replicated across countries for international comparative macro-level analysis.

Our contributions can be summarized as follows. First, we document that the aggregate cash share in France, Norway and other OECD countries has steadily *decreased* over the last 25 years. In Norway, the aggregate cash share has decreased from 31% to 21% between 1995 and 2020. The decrease in the aggregate cash share contrasts with the behavior of other monetary measures, such the nominal level of M2 or the M2-to-GDP ratio, which significantly increased during this period. In Norway, France, and Sweden, the annual growth rate of M2 averaged between 6% and 8% from 1981 to 2020.

Second, we analyze the cash share of Norwegian individuals and firms and find that the declining aggregate cash share is driven almost entirely by the portfolio rebalancing of a small number of agents. For individuals, the decline is concentrated among the wealthiest 10%, whose cash share dropped by 12 percentage points from 1995 to 2017. By contrast, the cash share has remained constant for individuals in the bottom 90% of the wealth distribution. This finding suggests that the top 10% view M2 as an investment that responds elastically to interest rates. By contrast, individuals in the bottom 90% hold M2 primarily for cash management purposes and are therefore insensitive to interest rates.

For firms, the decline in the cash share is also concentrated among the wealthiest 10% firms ranked by their level of financial asset holdings. Although the portfolio rebalancing of these firms was relatively small (their cash share declined by about 2% from 2003 to 2017), they account for more than 95% of the firms' total financial assets. Because of their large size, these firms therefore drive the bulk of fluctuations in the corporate cash share. The predominant impact of large firms on aggregate flutuctations is consistent with the granular hypothesis (Gabaix, 2011; Hulten, 1978).

Third, we do not find evidence that individual investors swap bonds for cash as interest rates decrease. In Norway the ratio of bond fund investments to cash holdings increased from 1% in 2003 to 4% in 2019. However, we observe a "flight to liquidity" effect during financial crises such as the 2008 Great Recession and the 2020 Covid-19 crisis when investors

sold bond and equity funds and temporarily kept their capital in cash.

The paper contributes to several strands of the literature. Our work complements the extensive household finance literature analyzing the determinants of portfolio decisions by investors (Gomes et al., 2020). While much of the literature documents the determinants of participation in risky asset markets, we focus on the relation between interest rates and M2 holdings. The paper also confirms that the wealthiest households tend to hold higher yielding assets (Bach, Calvet, and Sodini, 2020; Betermier, Calvet, and Sodini, 2017). We show that the holdings of wealthier households are more sensitive to changes in investment opportunities than less wealthy households.

Our paper also contributes to the extensive literature on the relationship between interest rates and aggregate holdings. 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). We show that this phenomenon is prevalent among the top 10% of individuals, but is less of concern for firms and individuals outside the top 10%.

Finally, our paper provides new insights to the fundamental question of why long-term investment rates have decreased over the past 20 years (de Larosière, 2019). We find that households are not the root cause for reduced investments in productive capital, as the share of risky assets in their financial portfolios has gone up and net flows into bond funds and equity funds have been strongly positive on average over the past two decades. Furthermore, while the largest firms have reduced the cash share in their financial portfolios, the value of the financial assets and cash holdings held by the non-financial firms have increased steadily in nominal terms and relative to GDP over the period. It may therefore be that firms themselves choose to invest less in productive projects, for example because of confounding factors such as increased economic uncertainty, as is documented in an extensive literature (Bates et al., 2009; Bloom et al., 2007; Boyle and Guthrie, 2003; Faulkender et al., 2018; Harford et al., 2014; Martin and Santomero, 1997). The low level of interest rates may itself be a reflection of a high level of economic uncertainty. The dramatic rise in public and private debt is also a possible source of slow investment and slow growth (Reinhart and Rogoff, 2009, 2010).

The rest of the paper is organized as follows. Section 2 documents the dynamics of aggregate cash shares at the macro level based on the national statistics of several European countries. In Section 3, we investigates the micro determinants of cash holdings by focus-

ing on a high-quality Norwegian administrative data set of individual investors and firms. Section 4 concludes.

2 Macro-Level Implications of Low Interest Rates

This section measures the evolution of interest rates and the aggregate cash share in France, Norway, and other European countries. Section 2.1 presents the macroeconomic data. Section 2.2 documents the decline in the aggregate cash share, and Section 2.3 documents the respective roles of the household and corporate sectors in this decline. Section 2.4 shows that the macro data since the Great Financial Crisis does not support the Keynesian assumption of a liquidity trap.

2.1 Macroeconomic Data

We use data from a variety of National Accounts databases. Information on the financial balance sheets of the household sector and the corporate sector is obtained from 1995 onward from the European System of National and Regional Accounts (ESA 2010) compiled by Eurostat.[2] The Eurostat database allows us to reliably compare the asset holdings of individuals and firms through time and across countries. Our primary focus is Norway, but we also study two other European economies for comparison purposes: France, one of Europe's leading economies, and Sweden, Norway's neighbouring economy. Another reason for studying Sweden as a benchmark is that a large literature in household finance uses Swedish micro-data to understand the microeconomic drivers of household portfolio decisions (Betermier, Calvet, and Sodini, 2017; Calvet, Campbell, and Sodini, 2007, 2009).

For each country, we denote the household sector by h (ESA code S14) and the corporate sector by c (ESA code S11), which includes all non-financial corporations. For each sector $j \in \{h, c\}$, the *total cash holdings* in year t, $M2_{j,t}$, are calculated as the sum of currency notes and coins (ESA code F21), transferable deposits (ESA code F22), and other deposits (ESA code F29). We compute the sector's *total financial assets* in year t, $FA_{j,t}$, as the sum

[2] We use Table NASA_10_F_BS, which is available at: https://ec.europa.eu/eurostat/web/main/data/database.

of its cash holdings $M2_{j,t}$ and non-cash financial assets.[3]

The *cash share* of sector j in year t is defined by

$$CS_{j,t} = \frac{M2_{j,t}}{FA_{j,t}}. \tag{1}$$

It measures the proportion of cash holdings in the sector's total financial portfolio.

We define the *aggregate* sector a as the sum of the household sector and the corporate sector. The aggregate sector's cash holdings are $M2_{a,t} = M2_{h,t} + M2_{c,t}$, the aggregate sector's financial assets are $FA_{a,t} = FA_{h,t} + FA_{c,t}$, and the aggregate cash share is given by (1). We note that the calculation of financial assets double counts some of the firms' financial assets, since individuals partly own firms. However, we verify that the double counting is relatively small in the aggregate.[4]

We obtain from the European Central Bank the average annual interest rates on deposits with maturity up to one year in the Euro Area since 2000. Data on Norwegian interest rates since 1980 are retrieved from Statistics Norway. In addition, we obtain France's M2 from Banque de France and GDP from INSEE.[5] For Norway and Sweden, we obtain data on M2 and GDP from Global Financial Data. Finally, we collect aggregate flows in and out of bond and equity mutual funds since 2003 from the Norwegian Fund and Asset Management Association.[6]

2.2 The Evolution of Aggregate Cash Holdings and Interest Rates

We use the macro data to document the decline of interest rates and the aggregate share over the past two decades. Figure 1 illustrates the evolution of deposit rates in Norway since

[3]For the household sector, non-cash financial assets include monetary gold and special drawing rights (ESA code F1), debt securities (ESA code F3), loans (ESA code F4), listed equity shares (ESA code F511), unlisted equity shares (ESA code F512), other equity (ESA code F519), investment fund shares (ESA code F522), non-life insurance technical reserves standardised (ESA code F61), life insurance and annuity entitlements (ESA code F62), financial derivatives and employee stock options (ESA code F7), and other accounts receivable / payable (ESA code F8). We use the same definition for non-cash financial assets for firms, but omit insurance assets (ESA codes F61 and F62) as well as accounts receivable (ESA code F8), which we interpret as being part of the firms' operating assets.

[4]Firms' financial assets account for a small fraction of their total market value. Moreover, households' ownership of firms represent a limited fraction of their total market value.

[5]A country's M2 includes all sectors (S1).

[6]We thank Christian Henriksen for making the data available to us. https://www.vff.no/about-the-norwegian-fund-and-asset-management-association

1980 and in the Euro Area since 2000. The average interest rate in Norway sharply dropped over the past three decades, from 11% in 1987 to 0.5% in 2020. The Norwegian deposit rate has been highly correlated to the deposit rate in the Euro area since the inception of the common currency.

Figure 2 plots the annual growth rate in the level of M2 in France, Sweden, and Norway since 1981. The time-series are again highly correlated and indicate a clear and steady growth over the same period. The growth of M2 averages 8% in Norway over the 1981-2020 period.

In Figure 3, we plot the evolution of the M2-to-GDP ratio in Norway since 1910, in Sweden since 1960, and in France since 1980. The figure reveals a significant increase in the M2-to-GDP ratio in all three countries since 1995. In Norway, the M2-to-GDP ratio increased from approximately 50% in 2000 to 77% in 2020. Put slightly differently, M2 holdings increased from 6 months to 9 months of national income over the period. The M2-to-GDP ratio is now back to the high level it had in Norway in the early 1950's. The M2-to-GDP ratio exhibits similar patterns in France and in Sweden, reaching a low in the mid 1990's and steadily increasing since then.

The fast increase in the M2-to-GDP ratio over the past two decades may seem surprising. Indeed, innovations in financial technology might have prompted economic agents to reduce their holdings of cash relative to income. However, one must recall that the demand for M2 is tied to two major aggregates. First, M2 is useful for the cash management of daily activities, such as consumption or business expenses. For this reason, one expects M2 to be tied to income. Second, M2 is also useful for managing investments, as most asset transactions are settled in cash. For this reason, M2 is also likely to be tied to aggregate wealth. Furthermore, these findings are consistent with expansionary monetary policies that considerably increased the supply of M2 over the past 20 years.

In Figure 4, Panel A, we plot the cumulative growth of GDP, M2 and financial assets (expressed in log terms) held by Norway's individuals and firms. Even though M2 grows faster than GDP, the picture also reveals the impressively high rate of growth of financial assets during this period. The high growth rate of financial assets suggests that the overall cash share is *decreasing*, despite the high growth rate of M2. Panels B and C show that the patterns are similar in France and Sweden. Thus, the growth rate of M2 is intermediate between the growth rate of GDP and the growth rate of assets.

In Figure 5, we plot the evolution of the aggregate cash share from 1995 to 2020 for

Norway, Sweden, and France. Across all three countries, the cash share steadily decreased by 9-10 percentage points from 1995 to 2020. The decline is most pronounced in the late 1990s but persists throughout the sample period.

In summary, the evidence in this Section shows that the decline in interest rates over the past 25 years has been associated with an increase in the M2-to-GDP ratio and a decrease in the aggregate cash share.

2.3 What Roles Did Firms and Individual Investors Play?

We next study the drivers of the aggregate cash share. Let $s_{h,t} = FA_{h,t}/FA_{a,t}$ denote the share of aggregate financial assets held by the household sector in year t, and let $s_{c,t} = FA_{c,t}/FA_{a,t}$ denote the share held by the corporate sector. The aggregate cash share satisfies:

$$CS_{a,t} = s_{h,t} \times CS_{h,t} + s_{c,t} \times CS_{c,t}. \tag{2}$$

This decomposition shows that the aggregate cash share depends on the level of the cash share inside the household sector, $CS_{h,t}$, the level of the cash share inside the corporate sector, $CS_{c,t}$, and the proportion of financial assets held by each sector.

Figure 6 reports the full sector breakdown of aggregate M2. Individuals and non-financial firms consistently account for over 90% of M2 in Norway. The components of the decomposition above therefore are bound to play a predominant role in driving the aggregate cash share. The remaining 10% of M2 are accounted for by financial firms and municipalities.

We infer from equation (2) that the change of the aggregate cash share between year t and year $t+1$ can be decomposed as follows:

$$\Delta CS_{a,t+1} = s_{h,t}\,\Delta CS_{h,t+1} + s_{c,t}\,\Delta CS_{c,t+1} + (CS_{h,t+1} - CS_{c,t+1})\,\Delta s_{h,t+1}, \tag{3}$$

where $\Delta x_{t+1} = x_{t+1} - x_t$ for every variable x_t. The first term in equation (3) reflects the change in the cash share in the household sector, and the second term reflects the change in the cash share in the corporate sector. The third term reflects the incremental change in the cash share due to a change in the respective shares of financial assets held by households and firms.

Figure 7 shows that all three components of equation (3) are negative and therefore con-

tribute to the decline of the aggregate cash share over the 1995-2020 period. The household cash share (green) drops from 47% to 40%, and the corporate cash share (red) declines from 19% to 12%. The household share of total financial assets (purple) also goes down, indicating a transfer of wealth from a high cash-share sector (households) to a low cash-share sector (firms) during this period.

Figure 8 illustrates the quantitative impact of each component on the decline of the aggregate cash share, which amounts to 9.6 percentage points from 1995 to 2020. Each factor has an approximately equal impact on the aggregate cash share. The decline in the household cash share accounts for 2.8 percentage points (first term). The decline in the corporate cash share accounts for another 3.8 percentage points (second term). Finally, the fact that the corporate sector became relatively wealthier contributed to the final 2.8 percentage points (third term).

Figure 9 illustrates a cross-sectional scatter plot of the aggregate cash share $CS_{a,t}$ and the household cash share $CS_{h,t}$ (Panel A) and the corporate cash share $CS_{c,t}$ (Panel B) across European economies at the end of 2019. The scatter plot confirms that the aggregate cash share is related to both the household and corporate sectors.[7]

2.4 A Liquidity Trap?

A prediction of the liquidity trap hypothesis is that, when interest rates are low, individual investors swap bonds for cash. We empirically assess this prediction by studying the aggregate investments made by individuals in stock and bond mutual funds in Norway since 2003.

Figure 10 plots the aggregate ratio of bond funds to M2 held by individuals and the equivalent ratio of equity funds to M2. Bond fund investments are the main form of bond investments for individuals, outside of their indirectly managed pension accounts.

We draw several insights from Figure 10. First, the ratio of bond funds to cash holdings is low, ranging from 1% to 4% throughout the sample period. The demand for cash holdings is therefore significantly greater than the demand for bond funds. Second, the bond funds-to-cash ratio has increased since 2008, even as interest rates continued to decline. Similarly, the ratio of equity funds to cash holdings increased from 4% to 12% between 2003 and 2019. These patterns do not indicate a transfer of bond and stock investments to cash.

[7] We obtain similar scatter plots at different points of the sample period.

Another interesting pattern from Figure 10 is that the financial shock induced by covid-19 in February and March 2020 resulted in a significant drop in the bond funds-to-cash and equity funds-to-cash ratios. This evidence suggests a flight-to-liquidity effect during financial crises, consistent with the findings of Beber et al. (2009).

We provide further evidence of the flight-to-liquidity effect by studying the quarterly aggregate flows in and out of cash holdings and bond and equity funds in Norway from 2008 to 2020. In Figure 11, Panel A, we find that flows to M2 are stable and large over the sample period, which is consistent with the growth of M2 described in Section 2.2. However, the flows to M2 rapidly increase in the first quarter of 2020, which corresponds to the covid-19 financial crash. In contrast, the flows to bond and equity funds displayed in Panels B and C are highly negative during the first quarter of 2020. Bond funds also experienced significant outflows toward the end of 2008, at the height of the Global Financial Crisis.

Outside of the two financial crises, we find that flows to bond and equity funds are mostly positive over the 2010-2020 period. This evidence suggests that investors do not substitute bonds for cash as interest rates hit the zero-lower bound.

3 Micro Level Implications of Low Interest Rates

We next study the micro-level determinants of the aggregate dynamics based on a high-quality administrative panel of Norwegian individuals and firms. Section 3.1 investigates the cash share dynamics in the panel of Norwegian individual investors, and Section 3.2 studies the cash share dynamics in the panel of firms.

3.1 Cash Share of Individual Investors

Data on Individual Investors. We use a panel containing the demographic and financial characteristics of every Norwegian resident from 1995 to 2017, which we obtained from Statistics Norway (SSB). The financial information is collected by the Norwegian Tax Administration. It provides the comprehensive disaggregated holdings and liabilities of individuals, at the level of each asset or debt contract. Since the data are collected annually for tax purposes, banks and other third parties are legally required to provide them to the Tax Administration. Financial assets include bank deposits, shares in stock funds, bonds and money market funds, listed and unlisted stocks, listed shares and mutual fund holdings through

share savings accounts and other securities.

In Figure 12, we verify that the total *cash* holdings of individuals in our panel (black) closely match the total cash holdings of the household sector in National Accounts (dashed) over the 1995 to 2017 period.[8]

The total value of *financial assets* is also very similar in the panel and in National Accounts in the later part of the sample. Minor differences arise in the treatment of non-profit organizations, which are included in the household sector by Eurostat but are not part of the micro data. However, in the early part of the sample, the total financial assets in the micro-data are approximately NOK 200-400 billion lower than those in National Account data, a proportional difference of 20-30%. This substantial gap originates from i) non-listed stocks, which the Tax Administration and the National Accounts office used to price with different methods until the later part of the sample, and ii) foreign assets, which used to be absent from tax returns until recently. The lower financial wealth reported by the Tax Administration in the early part of the sample potentially introduces a bias in the estimation of the cash share. We develop below an imputation methodology that controls for this gap.

Empirical Findings. To understand which individuals drive the decline in the household cash share, we form two groups of individuals based on their financial wealth each year: the top 10% and the bottom 90%. For each group, we calculate the aggregate cash share as the ratio of aggregate cash holdings to aggregate financial assets.

We adjust financial assets to control for the differences in reported financial wealth between the Norwegian Tax Administration data and National Accounts data. Our adjustment procedure is based on the fact that aggregate financial assets reported by the Tax Administration rapidly converge to the National Account values from 2013 to 2017. By studying changes in the proportion of total financial assets held by the top 10% and bottom 90% during this period, we are able to estimate the proportion of unreported wealth that belongs to each group.

Formally, we denote by $RA_{h,t}^{10\%}$ the risky financial assets (i.e., non cash) held by the top 10% in year t as reported by the Tax Administration. Let $\xi_{h,t}$ denote the difference between the aggregate value of financial assets reported in National Accounts and the aggregate value compiled by the Tax Administration. The gap $\xi_{h,t}$ is mostly based on the value of non-listed stocks and foreign assets. The weight $z_{h,t}^{10\%}$ represents the proportion of this unreported

[8]We use National Accounts data downloaded from Eurostat, as Section 2.1 explains.

wealth that belongs to the top 10%.

Let $\text{Share}_{h,t}^{10\%}$ denote the share of total household financial assets held by the top 10%. In 2017, this share is the same whether one uses Norwegian Tax Administration data or National Accounts data. Therefore, $\text{Share}_{h,2017}^{10\%}$ includes all risky financial assets.[9] If we assume that the share $\text{Share}_{h,t}^{10\%}$ remains constant over the 2013-2017 period, then the following identity holds:

$$\text{Share}_{h,2017}^{10\%} = \frac{RA_{h,2013}^{10\%} + z_{h,2013}^{10\%} \cdot \xi_{h,2013}}{RA_{h,2013}^{10\%} + RA_{h,2013}^{90\%} + \xi_{h,2013}}. \tag{4}$$

The Tax Administration data allows us to observe the share of financial assets, $\text{Share}_{h,2017}^{10\%}$, and the value of risky financial assets, $RA_{h,t}^{10\%}$, held by the top 10%, while the gap $\xi_{h,2013}$ is obtained by comparing the value of total assets reported by the National Accounts and Tax Authority in 2013. We infer from equation (4) that $z_{h,2013}^{10\%}$ is equal to 92.3%, which implies that most of the additional wealth in the National Accounts data belongs to the top 10% of individuals.[10] This result is not surprising since high wealth individuals are more likely to hold non-listed and foreign stocks. For each year t, we therefore allocate 92.3% of the supplementary assets $\xi_{h,t}$ to the top 10% and the remaining 7.7% to the bottom 90%.

Figure 13 plots the aggregate cash share of the bottom 90% and the aggregate cash share of the top 10% of individuals. The aggregate cash share of the bottom 90% is approximately 75%, which implies that most individuals keep the bulk of their financial wealth in the form of cash. This finding is consistent with the findings obtained in earlier work (Calvet, Campbell, and Sodini, 2007; Fagereng, Guiso, Malacrino, and Pistaferri, 2020). More importantly, the aggregate cash share of the bottom 90% remains constant over the 1995 to 2017 period. This evidence suggests that most individuals hold M2 primarily for cash management purposes and are therefore insensitive to fluctuations in interest rates.

For the top 10% of individuals, the aggregate cash share is significantly lower, which confirms that the wealthiest households tend to hold higher yielding assets (Bach, Calvet, and Sodini, 2020; Betermier, Calvet, and Sodini, 2017). Furthermore, the aggregate cash share of the wealthy declined by 12 percentage points from 1995 to 2017, from 39% to 27%. This finding suggests that the top 10% view M2 as an investment that responds elastically to interest rates. The behavior of the wealthy individuals stands in sharp contrast with the

[9] In reality, the aggregate financial assets from the Tax Administration amount to 97% of the values from the National Accounts in 2017. So we subtract the remaining 3% (about NOK 94 Billion) from the values of $\xi_{h,t}$ in previous years).

[10] The value of $z_{h,2013}^{10\%}$ is remarkably stable if we repeat the exercise using any year outside of 2013.

behavior of the average Norwegian individual.

The decline in the cash share for the 10% wealthiest individuals is economically important because these individuals own approximately 70% of financial assets, as Figure 12 shows. To further understand the relative importance of wealthy individuals, we perform a decomposition of the household cash share similar to (3).

Figure 14 presents the breakdown of the decline in the household cash share. Almost all of the decline is driven by the drop in the cash share of individuals in the top 10%. In contrast, individuals in the bottom 90% have virtually no impact.

3.2 Cash Share of Firms

Data on Firm Balance Sheets. We obtain the balance sheet of every Norwegian firm over the 2003-2017 period from the database of accounting and company information, which is available for all Norwegian corporations.[11] The financial information is based on official annual reports and includes a complete breakdown of firms' balance sheets.

We define cash as the sum of bank deposits, cash, and cash equivalents. Non-cash financial assets can be either short-term or long-term investments. Short-term assets include listed and non-listed shares in group companies, bonds that are held for an investment horizon shorter than a year, and financial instruments such as derivatives. Long-term assets include long-term investments in shares, bonds, and all forms of long-term investments in and loans to subsidiaries, joint ventures, associated companies, and independent companies. The cash share is the total holding of cash divided by the sum of short and long-term financial assets. In Figure 15, we verify that the total cash holdings and total financial assets of firms in the micro-data closely match the equivalent aggregates published in National Accounts.

Empirical Findings. We form two groups of firms based on the value of their gross financial assets each year: the top 10% and the bottom 90%. For each group, we calculate the aggregate cash share as the ratio of aggregate cash holdings to aggregate financial assets.

Figure 16 plots the evolution of the aggregate cash share across firms from 2003 to 2017. We find that, similar to individual investors, wealthier firms have a lower cash share than less wealthy firms. All firms decrease their cash share during this period. The aggregate

[11] We thank Rasmus Holmen for making the data available to us.

cash share of the bottom 90% firms decreases from 68% to 63%, and that of the top 10% firms decreases from 12% to 10%. We note that the micro-data only starts in 2003, therefore it does not capture the full decline in corporate cash share reported in Eurostat.

One important feature of the wealth distribution of firms is that it is extremely skewed. Figure 16 shows that the top 10% firms own more than 95% of firm financial assets. For this reason, the declining firm cash share is also concentrated among the wealthiest 10% of firms. The predominant impact of large firms on aggregate flutuctations is consistent with Gabaix's "granular" hypothesis (Gabaix, 2011; Hulten, 1978).

The variance decomposition of the corporate cash share presented in Figure 17 confirms this point. Although the portfolio rebalancing of the top 10% firms is relatively small, these firms are so large that they drive the bulk of fluctuations in the corporate cash share.

4 Conclusion

Over the past two decades, interest rates have fallen sharply and the money stock M2 held by households and firms has grown steadily, at a growth rate that is intermediate between the growth rate of national income and the growth rate of total financial assets. As a result, the aggregate cash holdings represent a higher share of GDP ratio but a smaller share of financial assets than they did two decades ago. These findings are consistent with expansionary monetary policies and the different roles of money, which is both a form of working capital used to manage day-to-day expenses and a form of investment.

To better understand the drivers of the cash share, we have used a high-quality administrative panel containing the disaggregated holdings of every individual and firm in Norway. The data reveal that the cash share has remained constant over the past two decades for individuals and firms in the bottom 90% of the distribution of financial assets. This finding suggests that most firms and individuals use cash for daily financial management, so that their holdings of M2 are rather insensitive to interest rates. By contrast, the cash share has fallen by over 12 percentage points for individuals in the top 10%, consistent with the view that the wealthiest agents use cash as an investment. Moreover, we do not find evidence of a Keynesian liquidity trap.

These results have a number of implications for future research and the conduct of monetary policy. First, our findings suggest that the increase in cash holdings is driven both

by the growth rate of GDP and the growth rate of financial assets. Second, the increase in the money supply is a natural consequence of expansionary monetary policies and must therefore be apparent in the holdings of economic agents, such as individuals and firms. Third, the drop in interest rates is likely to have caused both the reduction of cash holdings relative to financial assets by individuals and firms, and the increase in the value of financial assets. It therefore remains to determine the role of active and passive decisions in portfolio rebalancing.[12]

Our findings suggest that individuals are not the cause for the decline in long-term investment rates since the late 1990's. It will be interesting to use the Norwegian panel to study whether *firms* have reduced their investments in productive projects over the past 20 years, and whether the decline in their investment rates is related to low interest rates or confounding factors such as increased economic uncertainty. We leave the exploration of these topics for future research.

[12] Calvet et al. (2009) analyze of active and passive portfolio rebalancing in response to stock returns.

References

Bach, Laurent, Laurent E. Calvet, and Paolo Sodini, 2020, Rich pickings? Risk, return, and skill in household wealth, *American Economic Review* 110, 2703–2747.

Bates, T., K. Kahle, and R. Stulz, 2009, Why do u.s. firms hold so much more cash then they used to?, *Journal of Finance* 64, 1985–2021.

Beber, Alessandro, Michael W. Brandt, and Kenneth A. Kavajecz, 2009, Flight-to-quality or flight-to-liquidity? evidence from the euro-area bond market, *Review of Financial Studies* 22, 925–957.

Becker, Bo, and Victoria Ivashina, 2015, Reaching for yield in the bond market, *Journal of Finance* 70, 1863–1902.

Betermier, Sebastien, Laurent E. Calvet, and Paolo Sodini, 2017, Who are the value and growth investors?, *Journal of Finance* 72, 5–46.

Bloom, Nick, Stephen Bond, and John Van Reenen, 2007, Uncertainty and investment dynamics, *Review of Economic Studies* 74, 391–415.

Borio, Claudio, and Haibin Zhu, 2012, Capital regulation, risk-taking, and monetary policy: A missing link in the transmission mechanism?, *Journal of Financial Stability* 8, 236–251.

Boyle, G. W., and G.A. Guthrie, 2003, Investment, uncertainty, and liquidity, *Journal of Finance* 58, 2143–2166.

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini, 2007, Down or out: Assessing the welfare costs of household investment mistakes, *Journal of Political Economy* 115, 707–747.

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini, 2009, Fight or flight? Portfolio rebalancing by individual investors, *Quarterly Journal of Economics* 124, 301–348.

Campbell, John Y., 2018, *Financial Decisions and Markets: A Course in Asset Pricing* (Princeton University Press).

Campbell, John Y., and Roman Sigalov, 2020, Portfolio choice with sustainable spending: A model of reaching for yield, Harvard University.

Cox, Albert H., 1967, Regulation of interest on deposits: An historical review, *Journal of Finance* 22, 274–296.

de Larosière, Jacques, 2019, Quel est l'effet des taux d'intérêt bas ou négatifs sur l'investissement à long terme?, *Revue des Deux Mondes* 12, 155–160.

Fagereng, Andreas, Luigi Guiso, Davide Malacrino, and Luigi Pistaferri, 2020, Heterogeneity and persistence in returns to wealth, *Econometrica* 88, 115–170.

Faulkender, Michael W., Kristine W. Hankins, and Mitchell A. Petersen, 2018, Understanding the rise in corporate cash: precautionary savings or foreign taxes, *Review of Financial Studies* 32, 3299–3334.

Gabaix, Xavier, 2011, The granular origins of aggregate fluctuations, *Econometrica* 79, 733–772.

Gollier, Christian, 2001, *The Economics of Risk and Time* (MIT Press).

Gomes, Francisco, Michael Haliassos, and Tarun Ramadorai, 2020, Household finance, IMFS Working Paper Series No. 138.

Harford, J., S. Klasa, and W. F. Maxwell, 2014, Refinancing risk and cash holdings, *Journal of Finance* 69, 975–1012.

Hulten, C., 1978, Growth accounting with intermediary inputs, *Review of Economics Studies* 45, 511–518.

Keynes, John Maynard, 1936, *The General Theory of Employment, Interest and Money* (Palgrave Macmillan).

Maggio, Marco Di, and Marcin Kacperczyk, 2017, The unintended consequences of the zero lower bound policy, *Journal of Financial Economics* 123, 59–80.

Martin, J.S., and A. M. Santomero, 1997, Investment opportunities and corporate demand for lines of credit, *Journal of Banking and Finance* 21, 1331–1350.

Merton, Robert C., 1971, Optimum consumption and portfolio rules in a continuous-time model, *Journal of Economic Theory* 3, 373–413.

Rajan, Raghuram, 2006, Has finance made the world riskier?, *European Financial Management* 12, 499–533.

Rajan, Raghuram, 2013, A step in the dark: Unconventional monetary policy after the crisis 499–533, Andrew Crockett Memorial Lecture, Bank for International Settlements. Available online at https://www.bis.org/events/agm2013/sp130623.htm.

Reinhart, Carmen, and Kenneth Rogoff, 2009, *This Time is Different: Eight Centuries of Financial Folly* (Princeton University Press).

Reinhart, Carmen, and Kenneth Rogoff, 2010, Growth in a time of debt, *American Economic Review* 100, 573–578.

Stein, Jeremy, 2013, Overheating in credit markets: Origins, measurement, and policy responses, Research Symposium, Federal Reserve Bank of St. Louis. Available online at https://www.federalreserve.gov/newsevents/speech/stein20130207a.htm.

Tobin, James, 1958, Liquidity preference as behavior towards risk, *Review of Economic Studies* 25, 65–86.

Figure 1
Deposit Rate

This figure illustrates the evolution of the annualized average deposit interest rate in Norway and the European Union (EU). The deposit rates apply to household deposits with a maturity shorter than 1 year. Data on EU rates are obtained from the European Central Bank. Data on Norwegian rates are available from Statistics Norway.

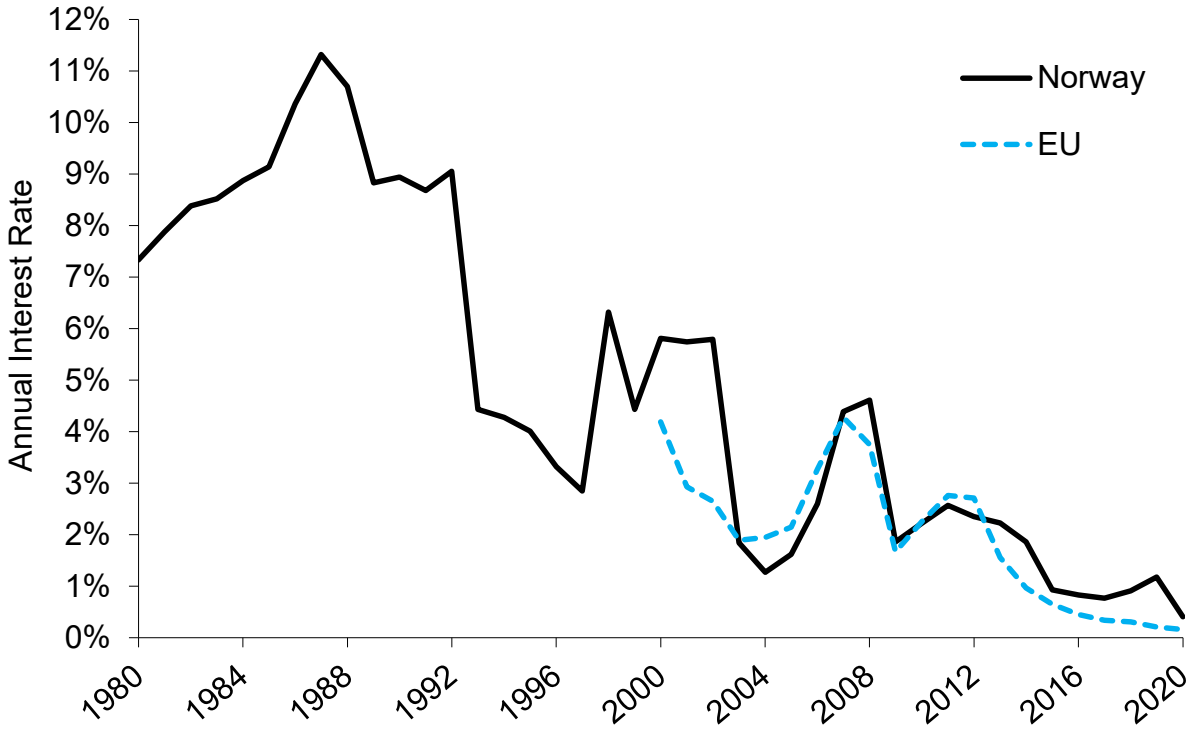


Figure 2
M2 Monetary Aggregate

This figure illustrates the annual percentage change in M2 in Norway, France, and Sweden from 1981 to 2020. Data for Norway and Sweden comes from Global Financial Data. Data for France comes from Banque de France.

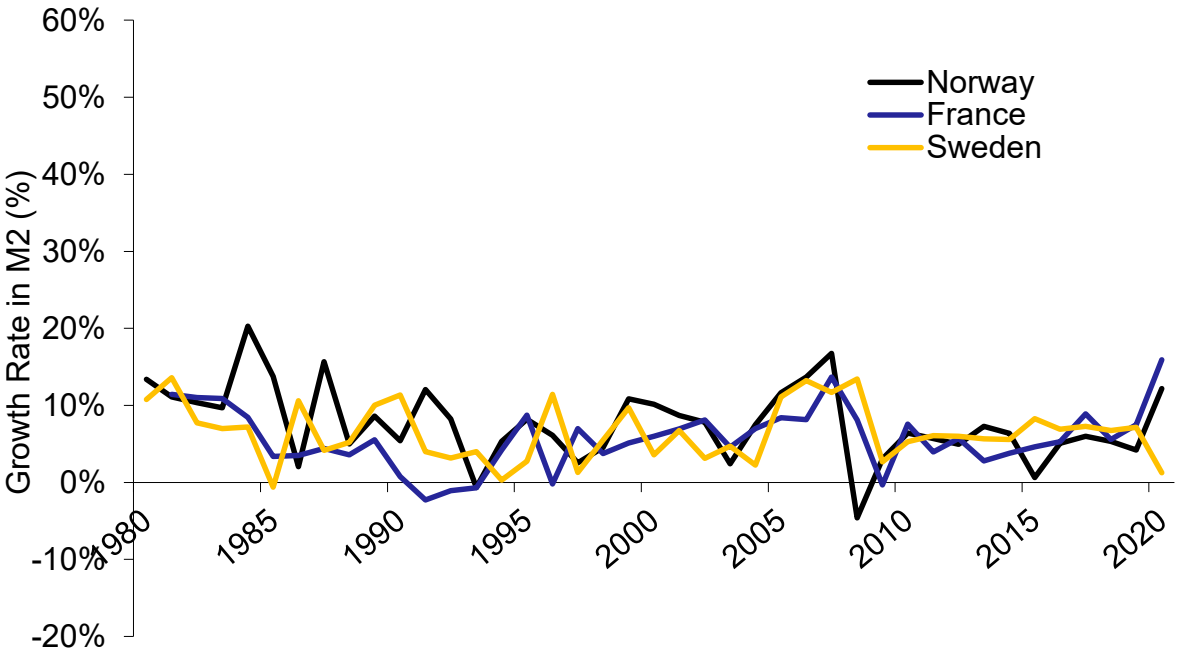


Figure 3
M2-to-GDP Ratio

This figure illustrates the evolution of the aggregate M2-to-GDP ratio in Norway, Sweden, and France. The aggregate cash share is defined as the ratio of the M2 monetary aggregate M2 to the Gross Domestic Product. Data for Norway and Sweden are retrieved from Global Financial Data. Data for France are obtained from Banque de France (M2) and INSEE (GDP).

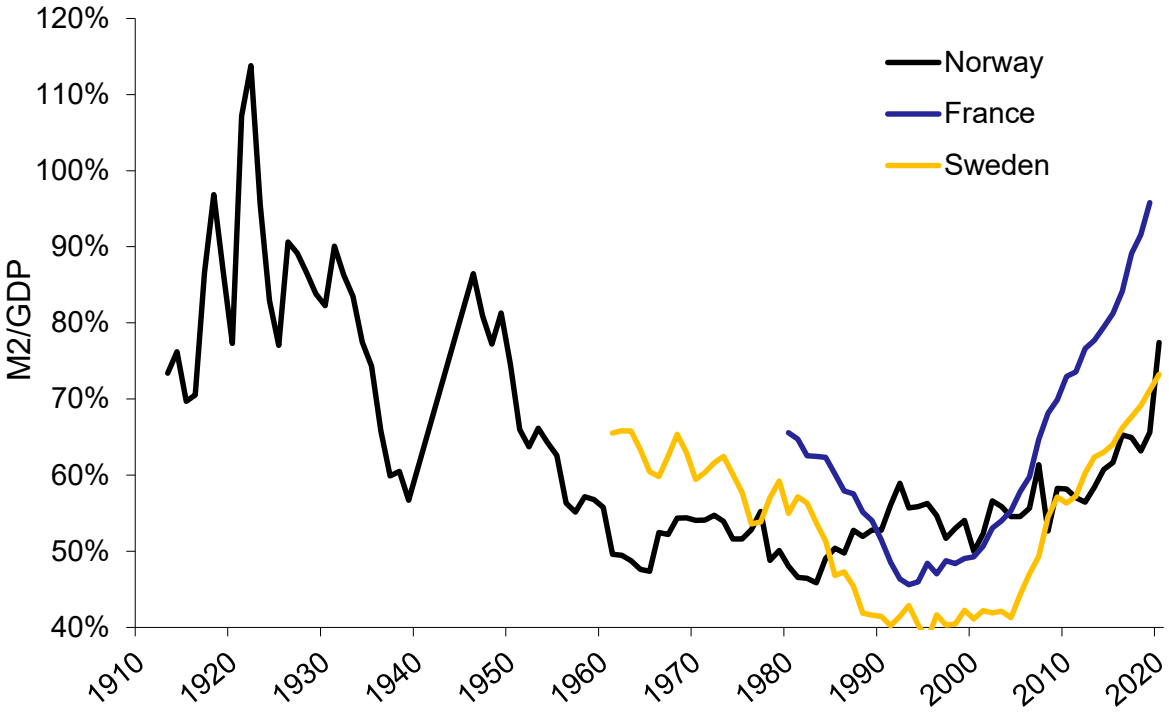
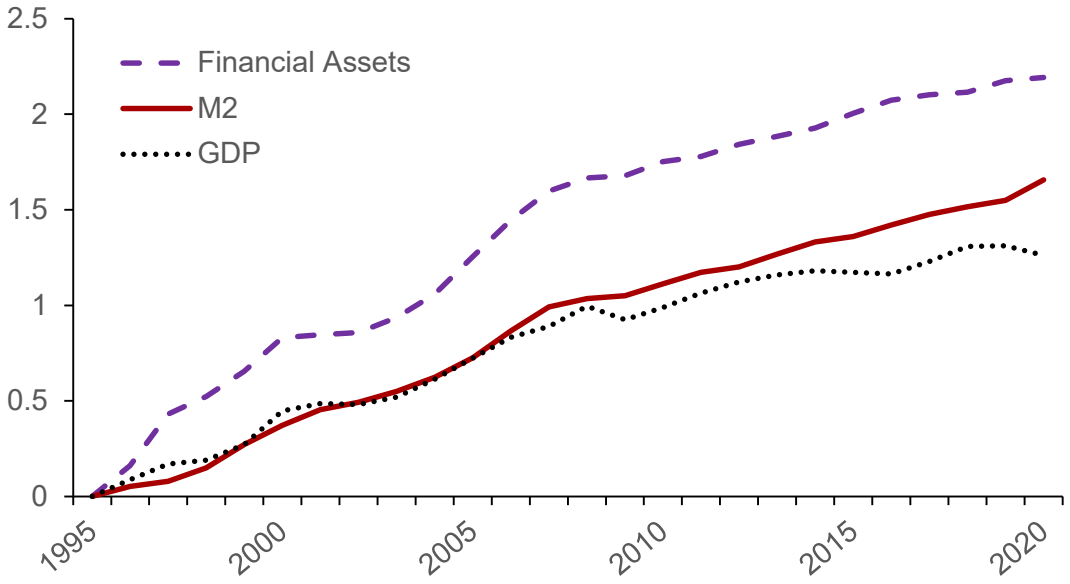


Figure 4
GDP, M2, and Financial Assets

This figure illustrates the evolution of GDP, the M2 monetary aggregate held by households and firms, and the value of financial assets held by households and firms in Norway (Panel A), France (Panel B), and Sweden (Panel C) from 1995 to 2020. All values are expressed in cumulative differences of log values. Data on M2 and financial assets are retrieved from Eurostat. Data on GDP are available from Global Financial Data (Norway and Sweden) and Banque de France and INSEE (France).

Panel A. Norway



Panel B. France

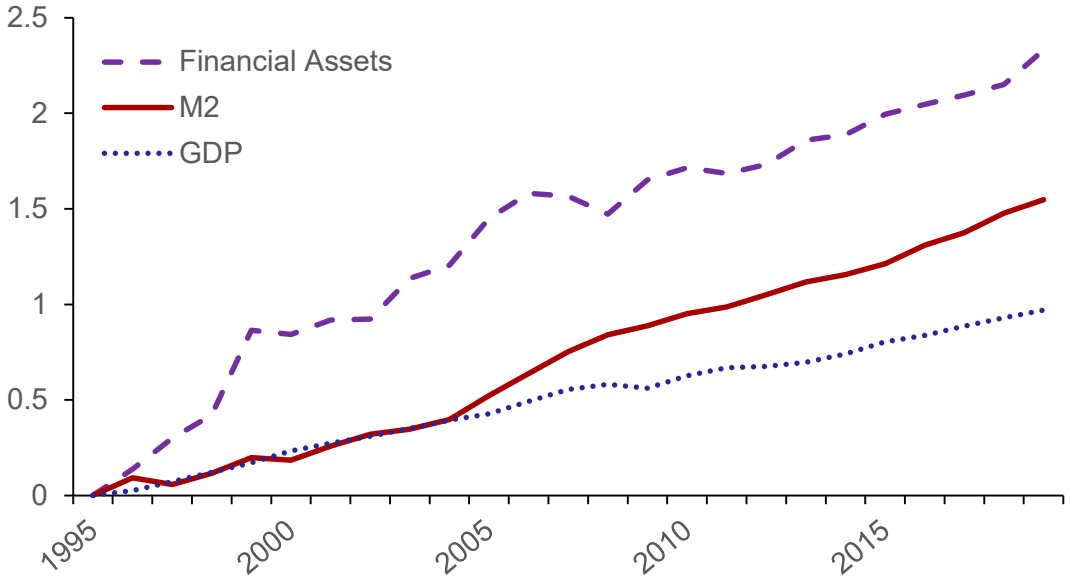


Figure 4 – *Continued*

Panel C. Sweden

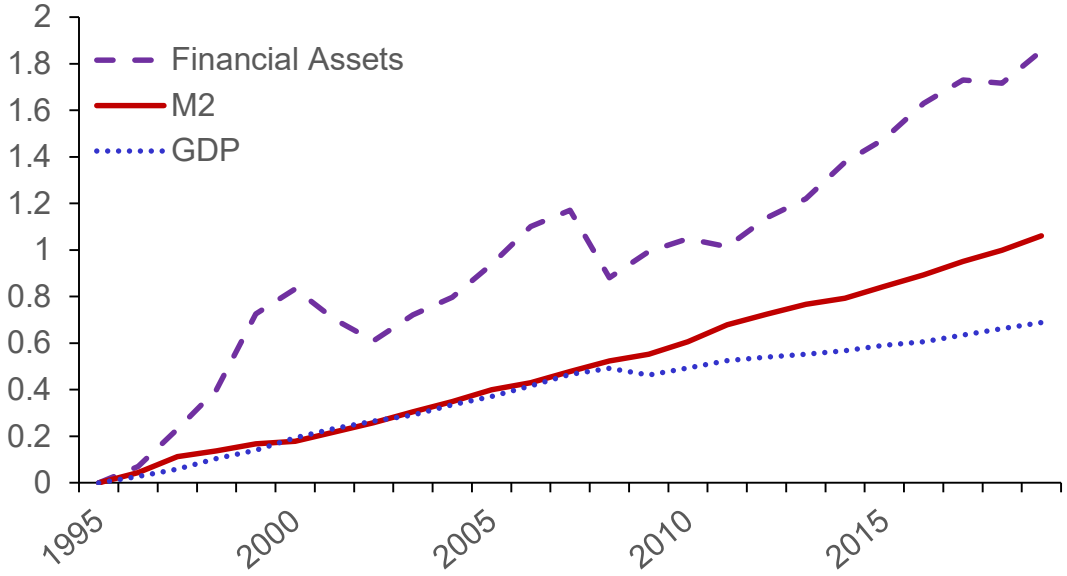


Figure 5
Aggregate Cash Share

This figure illustrates the evolution of the aggregate cash share in Norway, Sweden, and France from 1995 to 2020. The aggregate cash share is defined as the ratio of M2 held by households and non-financial corporations to their total financial assets. Data are retrieved from Eurostat.

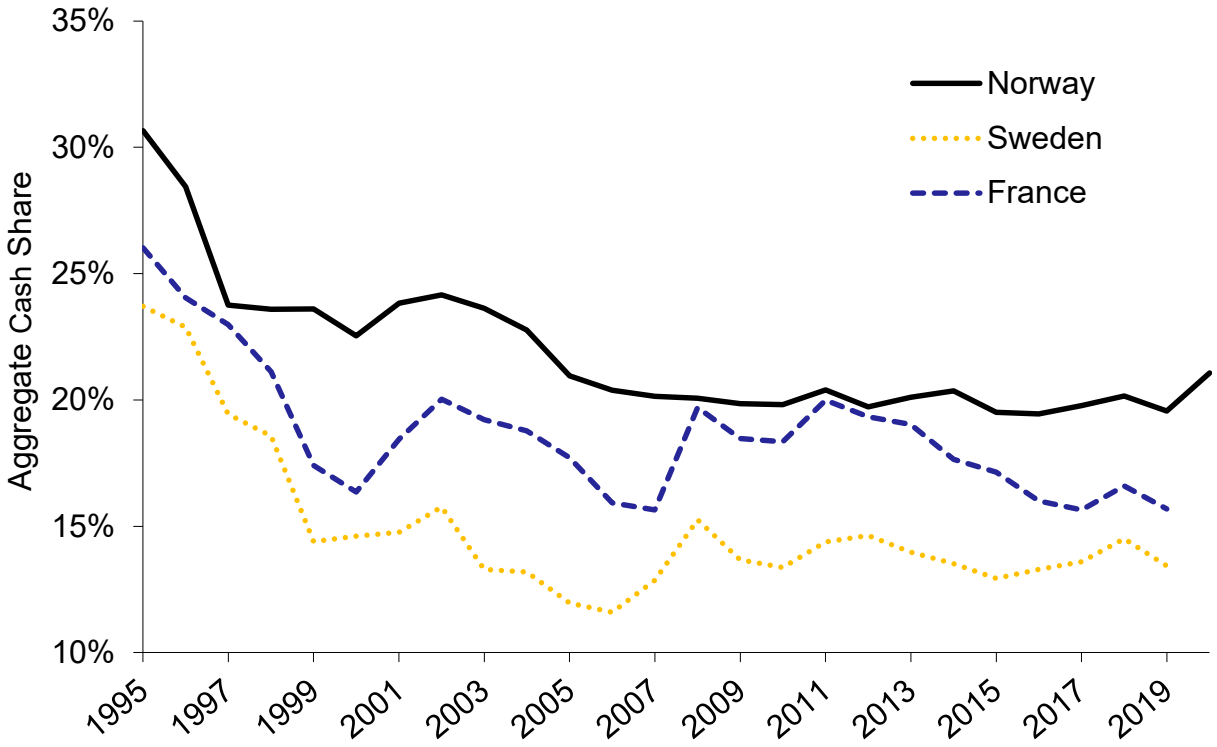


Figure 6
Sector Decomposition of Aggregate M2 in Norway

This figure illustrates the breakdown of the monetary aggregate M2 in Norway held by the household sector (green), the corporate sector consisting of non-financial firms (red), the municipal sector (light gray), and the financial sector (gray) from 2008 to 2020. Data are obtained from Statistics Norway.

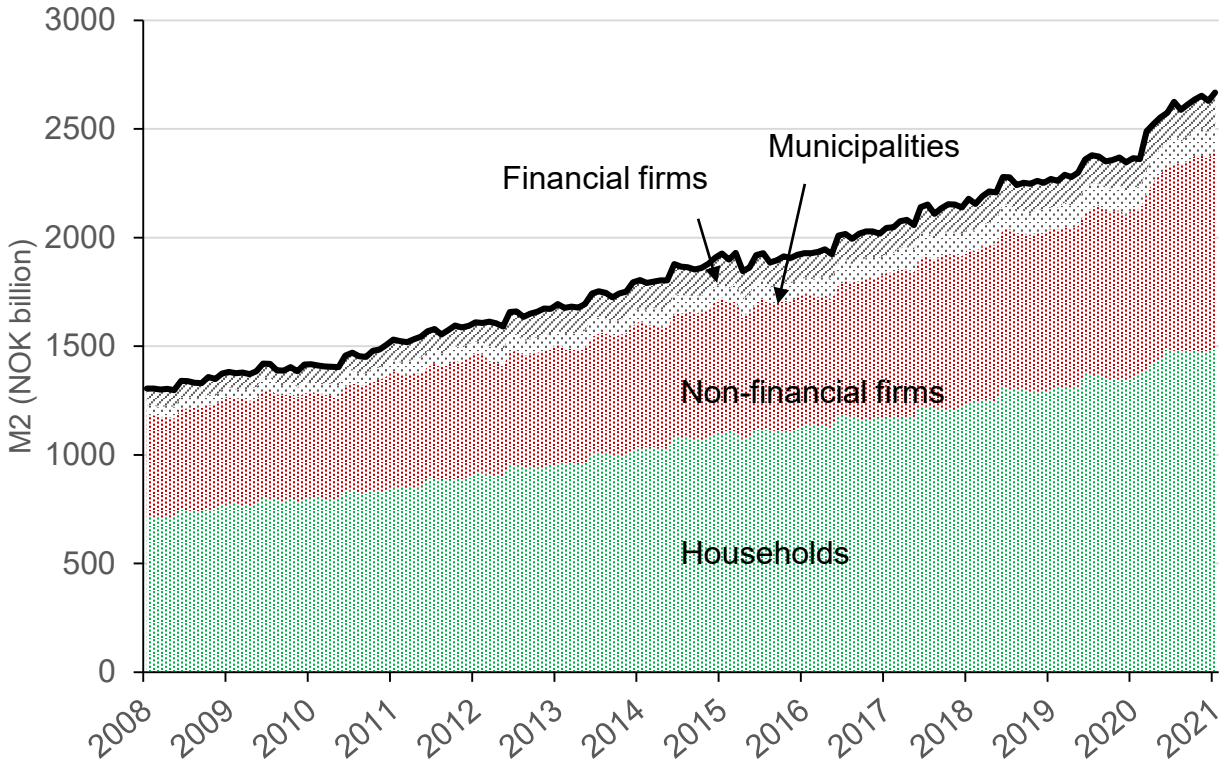


Figure 7
Cash Share of Household and Corporate Sectors

This figure illustrates the evolution of the aggregate cash share for the household and corporate sectors in Norway from 1995 to 2020. Data are retrieved from Eurostat.

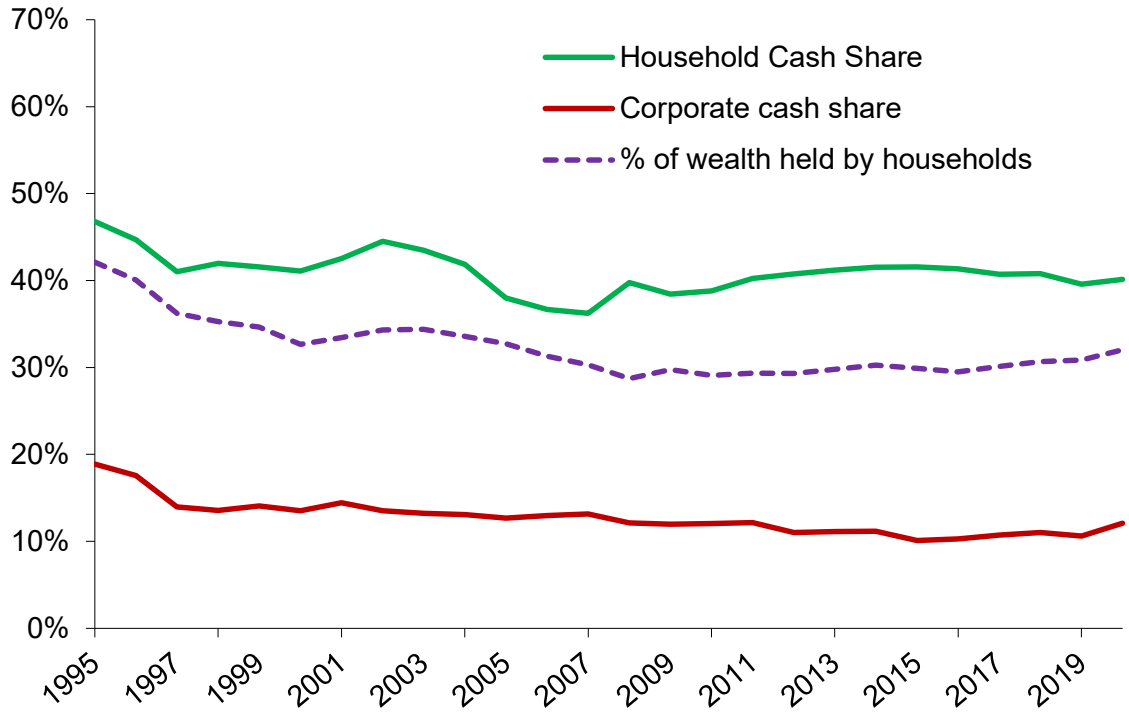


Figure 8
Decomposition of Aggregate Cash Share

This figure breaks illustrates the components of the change in the aggregate cash share in Norway between 1995 to 2020. The components include the change in the cash share from the household sector, the change in the cash share from the corporate sector, and changes in sector weights.

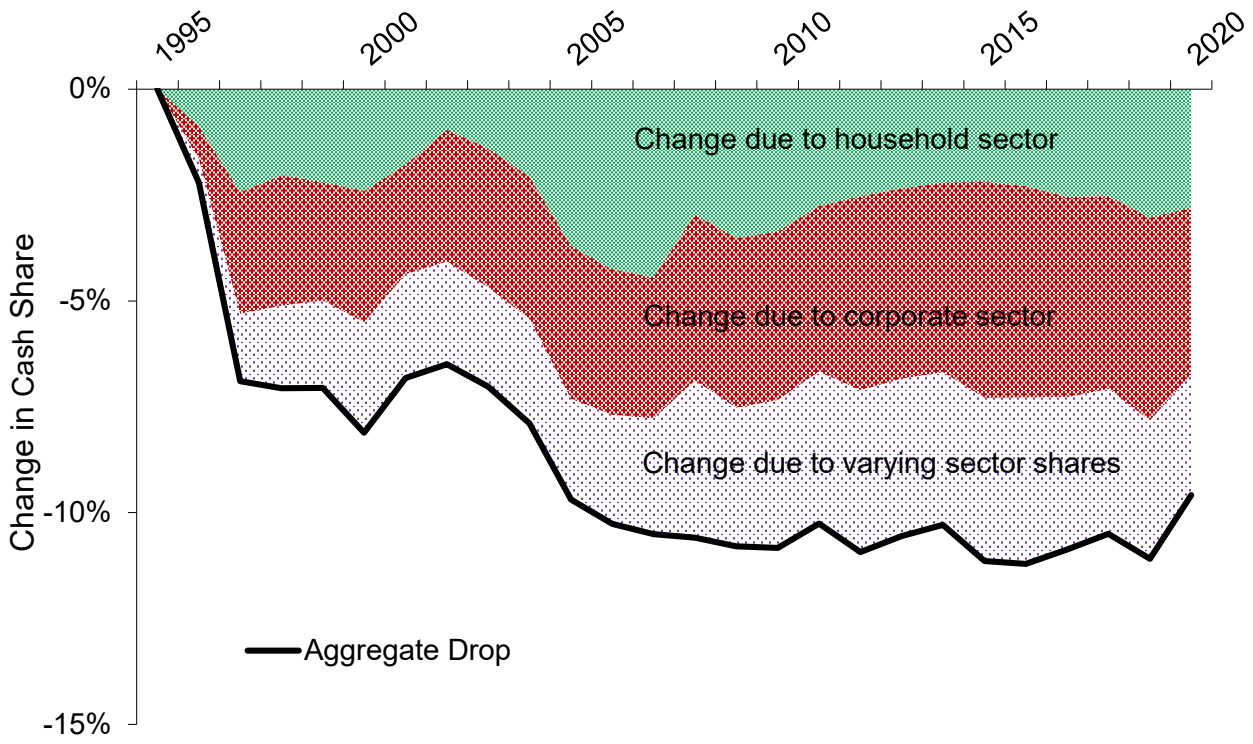
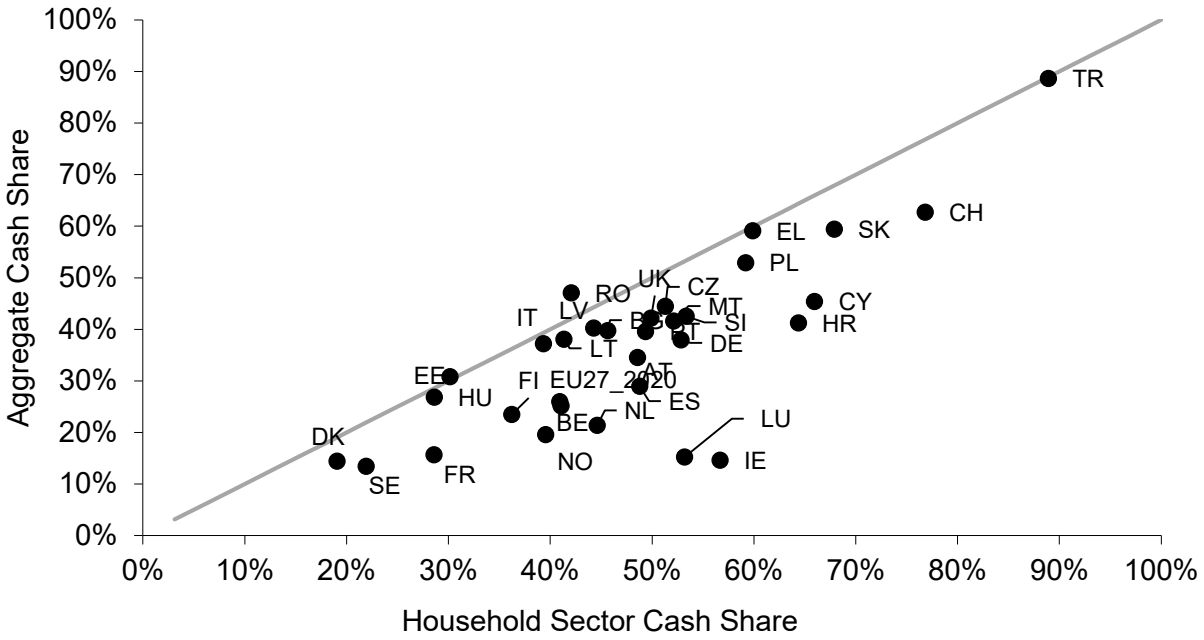


Figure 9
Aggregate Cash Share vs. Sector Cash Shares

This figure illustrates a scatter plot of the aggregate cash share and the household cash share (Panel A) and the aggregate cash share and the corporate cash share (Panel B) across European countries at the end of 2019. The solid line corresponds to the 45 degree line.

Panel A. Aggregate vs. Household



Panel B. Aggregate vs. Corporate

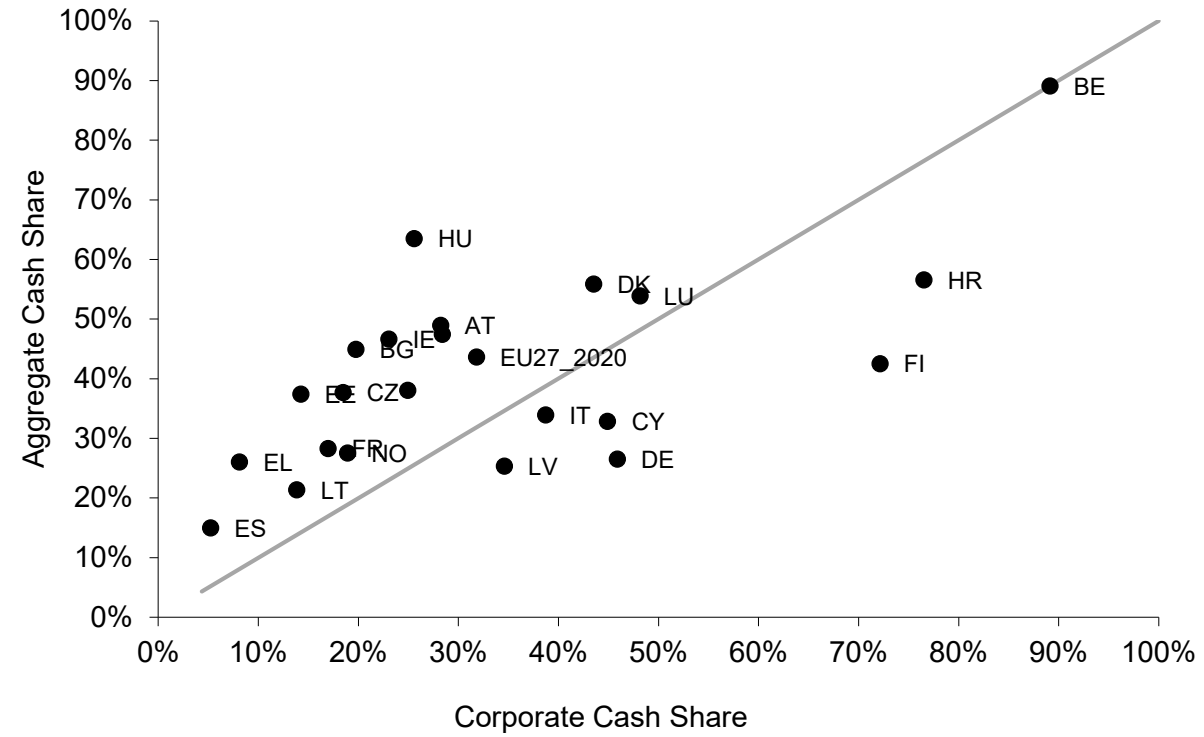


Figure 10
Holdings of Bond Funds, Equity Funds, and M2 by Individuals

This figure illustrates the evolution of the ratios of (i) bond fund holdings to M2 holdings and (ii) equity fund holdings to M2 by individuals in Norway from 2003 to 2020. Data about M2 are obtained from Statistics Norway, and data on aggregate holdings of bond and equty funds are obtained from the Norwegian Fund and Asset Management Association.

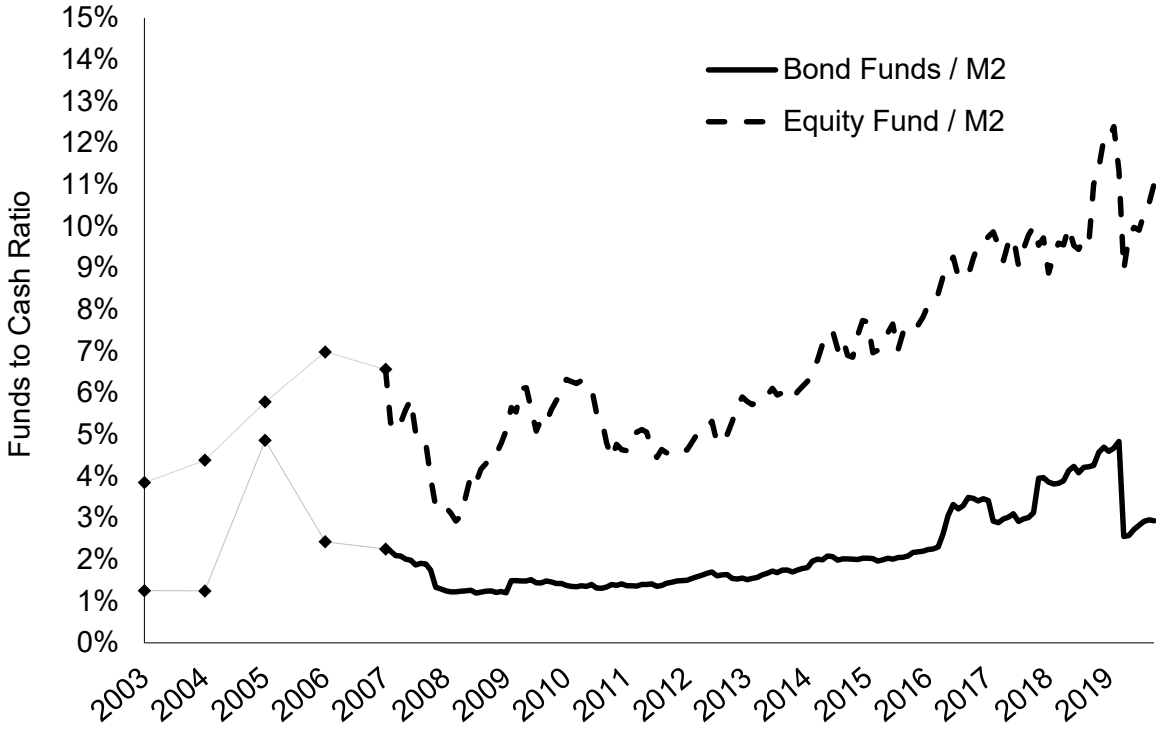
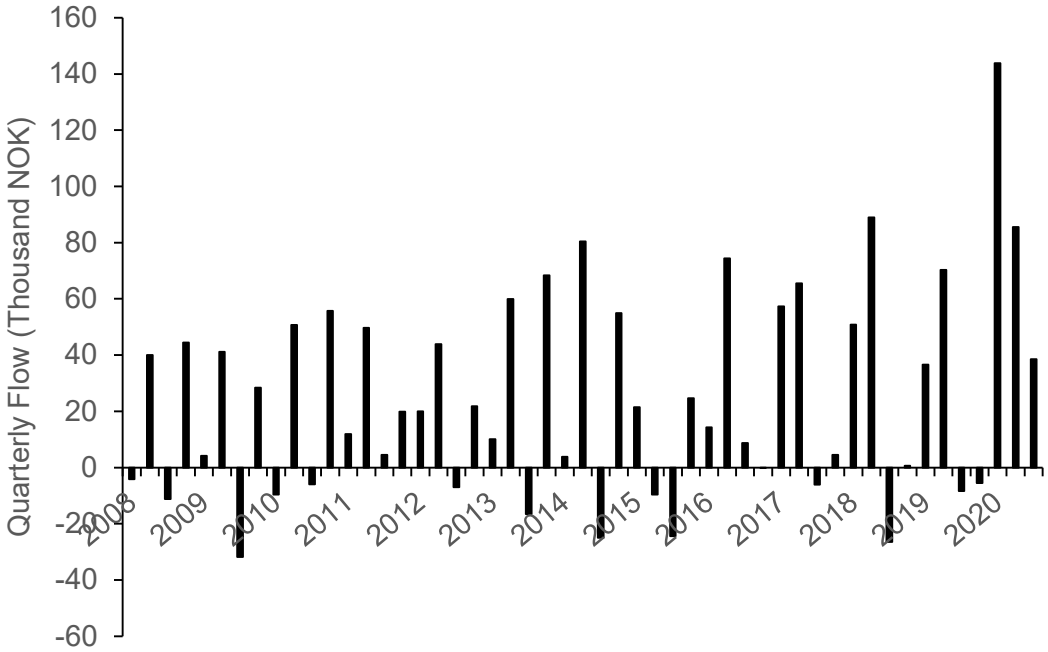


Figure 11
Flow of Funds by Individuals

This figure illustrates the quarterly flows into M2 (Panel A), bond funds (Panel B), and equity funds (Panel C) between 2008 and 2020 in Norway. Flows are expressed in NOK Thousand. Data about M2 comes from Statistics Norway, and data on aggregate holdings of bond and equty funds comes from the Norwegian Fund and Asset Management Association.

Panel A. Net Flows into M2



Panel B. Net Flows into Bond Funds

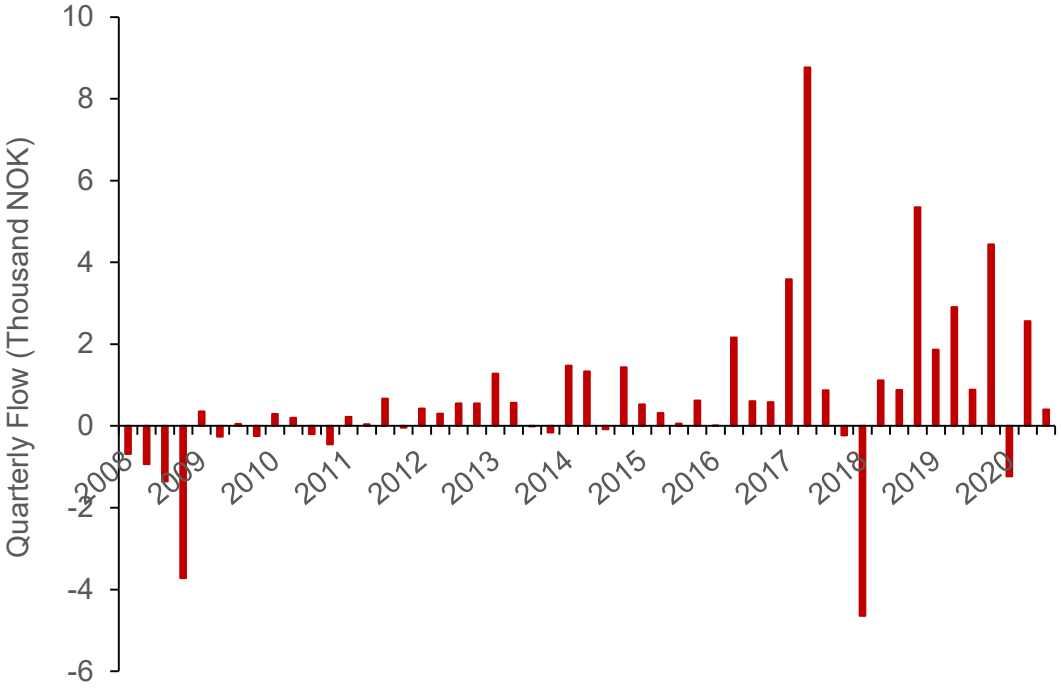


Figure 11 – *Continued*

Panel C. Net Flows Into Equity Funds

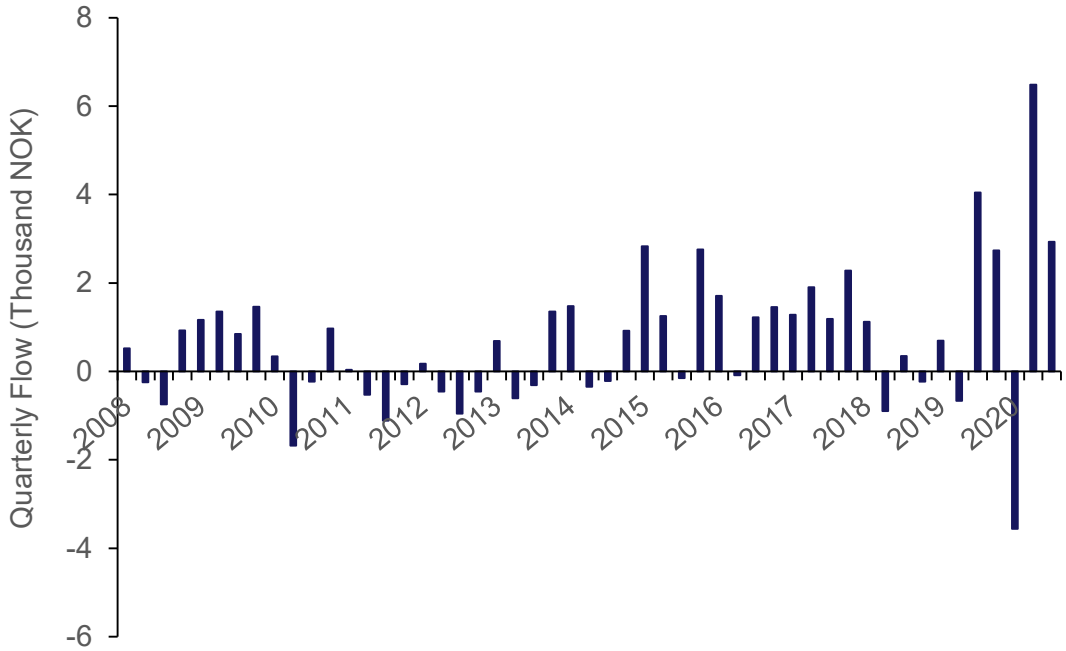
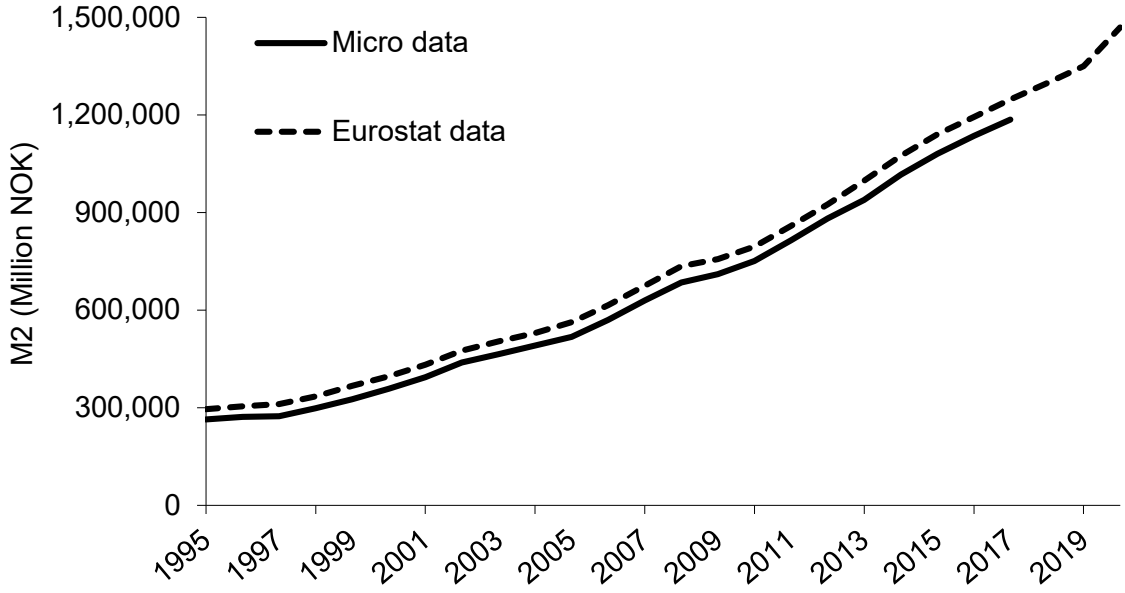


Figure 12
Aggregate Holdings of Households: Estimates from Macro and Micro Data

This figure illustrates the aggregate M2 (Panel A) and financial assets (Panel B) held by households calculated from the micro-data in Statistics Norway and the National Account data in Eurostat. The statistics are reported in NOK Million.

Panel A. Aggregate M2 Held by Individuals



Panel B. Aggregate Financial Assets Held by Individuals

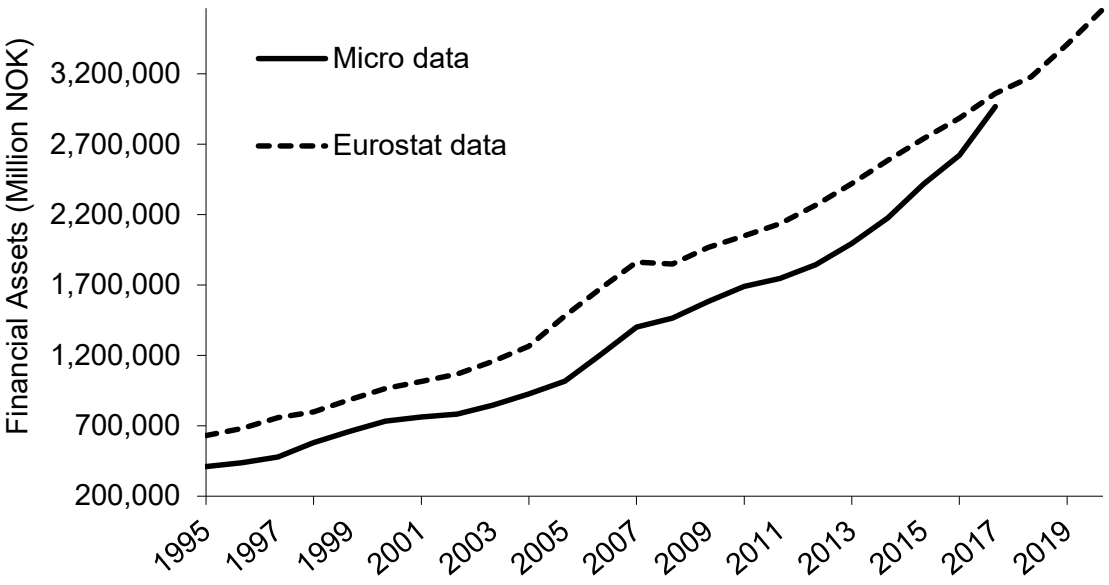


Figure 13
Cash Share of Top 10% and Bottom 90% of Individuals

This figure illustrates the evolution of the aggregate cash share for households in the bottom 90% (blue) and top 10% (red)) of the wealth distribution from 1993 to 2007 using micro-data from Statistics Norway.

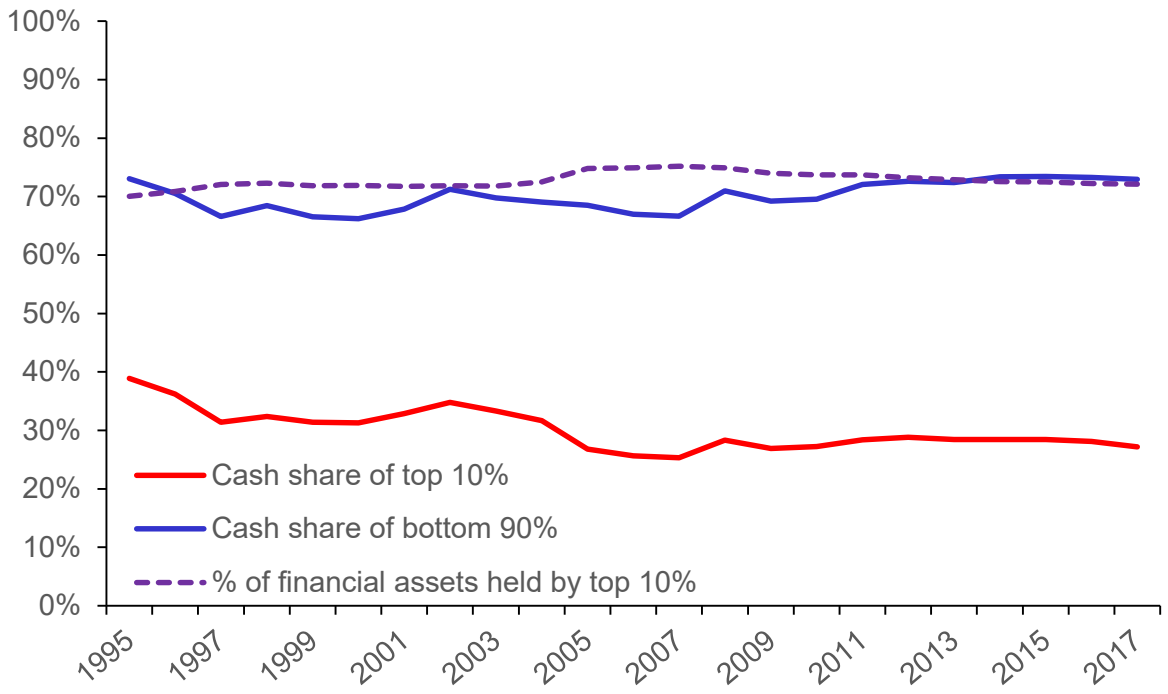


Figure 14
Decomposition of Household Cash Share

This figure illustrates the proportion of household M2 held by households in the bottom 90% and top 10% of the wealth distribution from 1993 to 2017. The analysis is based on micro data from Statistics Norway.

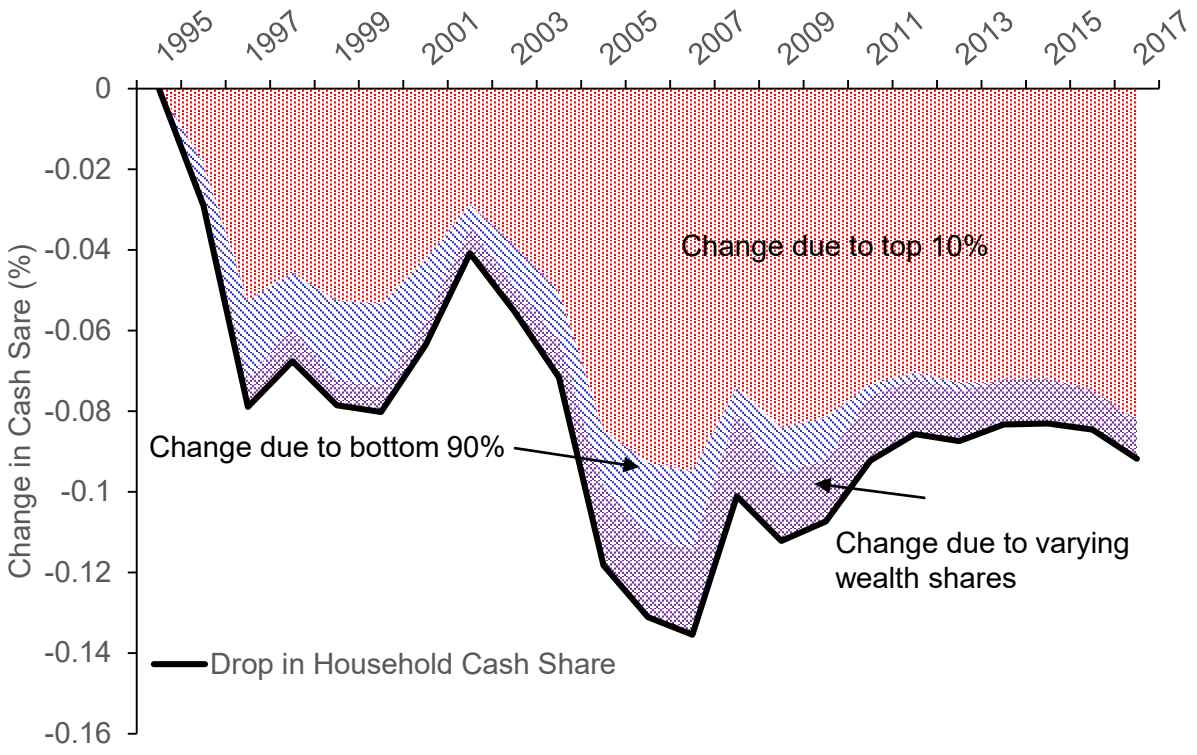
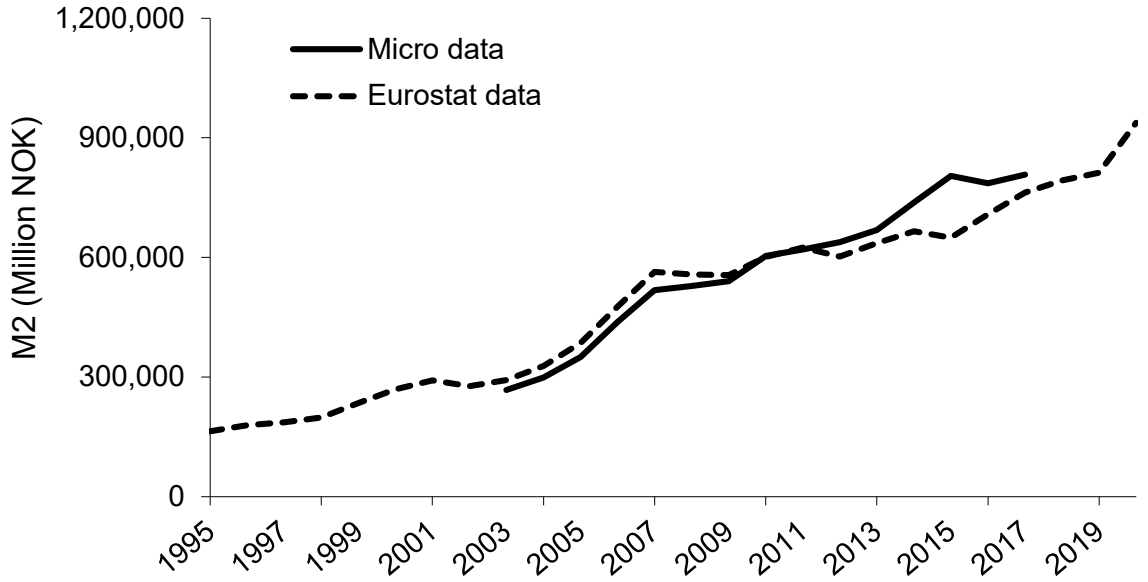


Figure 15
Aggregate Holdings of Firms: Estimates from Macro and Micro Data

This figure illustrates the aggregate M2 (Panel A) and financial assets (Panel B) held by non-financial corporations estimated from the micro-data in the Norwegian database of accounting and company information and National Account data in Eurostat

Panel A. Aggregate M2 Held by Firms



Panel B. Aggregate Financial Assets Held by Firms

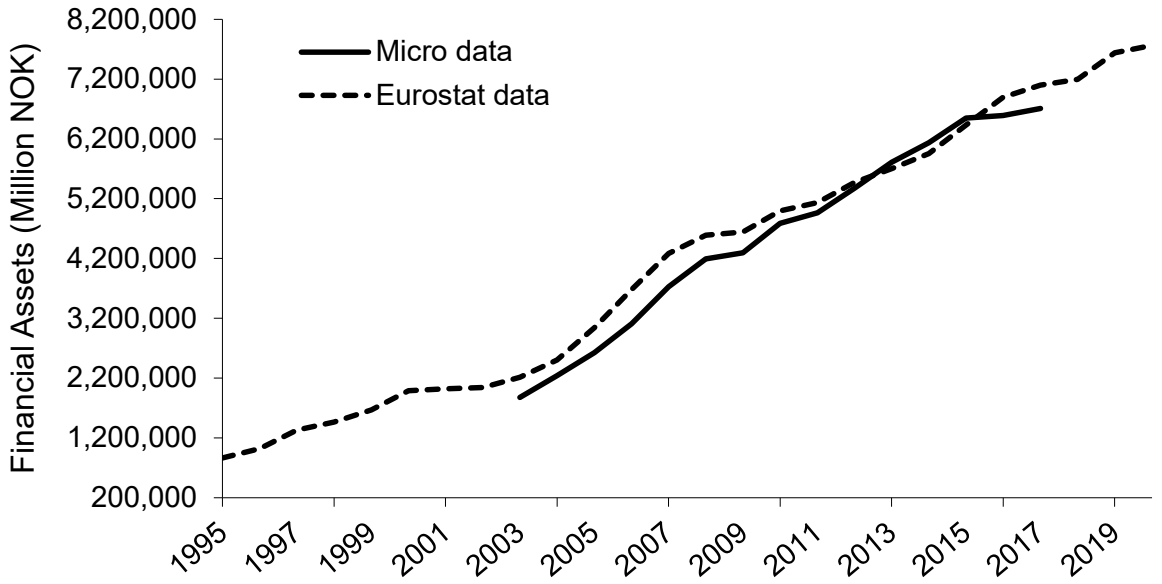


Figure 16
Cash Share of Top 10% and Bottom 90% of Firms

This figure illustrates the evolution of the aggregate cash share held by firms in the bottom 90% (blue) and top 10% (red) of the distribution of financial assets from 2003 to 2017. The calculations are based on the Norwegian database of accounting and company information.

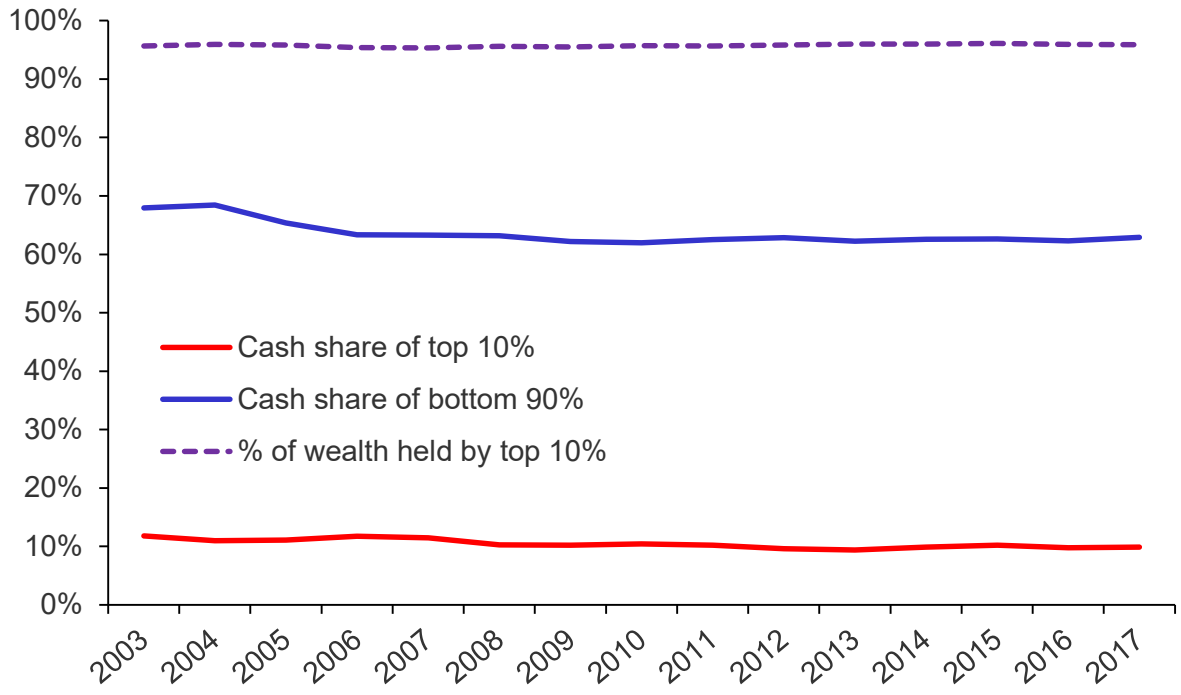
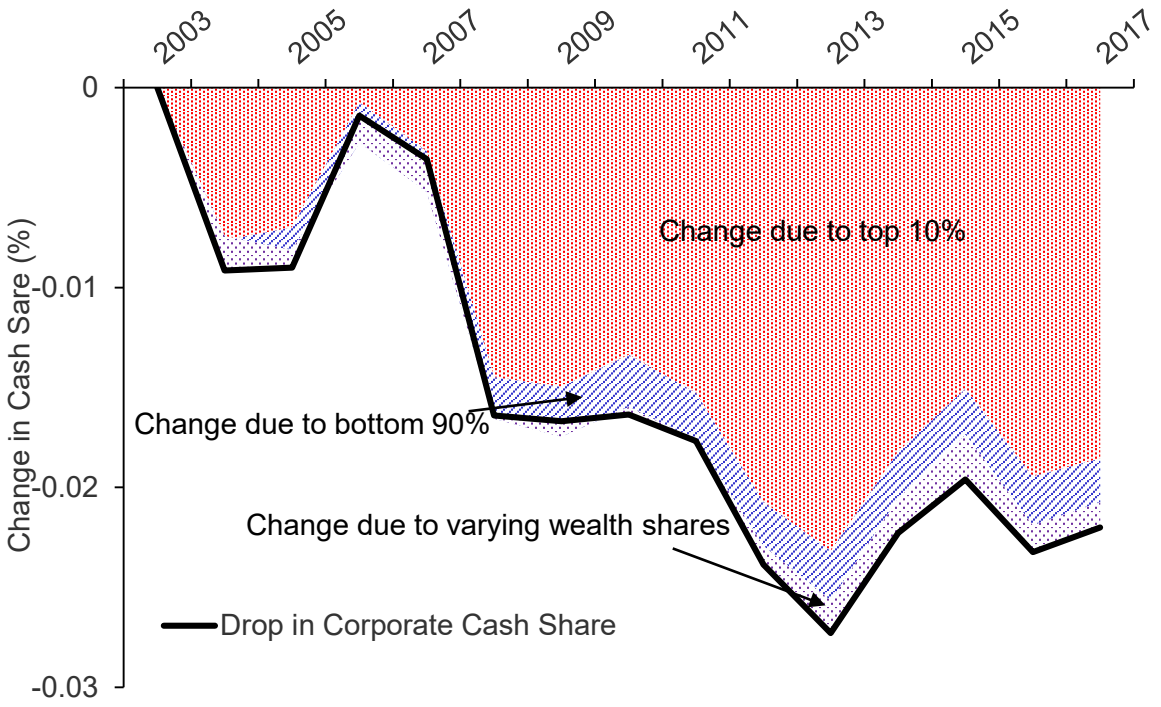


Figure 17
Decomposition of the Corporate Cash Share

This figure illustrates how the top 10% and the bottom 90% of firms contribute to the change in the aggregate cash share held by the Norwegian corporate sector from 2003 to 2017. The calculations are based on the Norwegian database of accounting and company information.