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Revisiting imputed consumption expenditure during the recent tightening cycle in Norway*

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Abstract

We impute household-level consumption expenditure in Norway (2009-2023) using administrative register data. Employing established methodologies, we decompose income and net wealth changes into active savings and consumption expenditure. After excluding households with measurement challenges, we retain 86% of households. The contributions are twofold. First, we describe and implement a transparent framework for imputing consumption expenditure which can be updated as new register data becomes available. Our measure of consumption expenditure shows strong comovement with the National Accounts (correlation 0.9). Second, we illustrate how imputed consumption expenditure can be used to examine household heterogeneity across households and time. We document that consumption declined most among highly indebted households in 2023, reflecting higher interest expenses and weaker disposable income growth relative to other households. These results demonstrate how imputed consumption expenditure can be used to examine heterogeneity in household responses to changes in economic conditions.

JEL Classification: C81, D12, D14, E21
Keywords: consumption, administrative data

*This paper should not be reported as representing the views of Norges Bank. The views expressed are those of the author and do not necessarily reflect those of Norges Bank. Contact: magnus.gulbrandsen@norges-bank.no, erlend-salvesen.njolstad@norges-bank.no, sjur.lone.nilsen@norges-bank.no. Thanks to Leif Brubakk, Andreas Fagereng, Sigurd Mølster Galaasen, Per Espen Lilleås, Magdalena D. Riiser and Ørjan Robstad for useful comments and suggestions.

1 Introduction

Household consumption accounts for roughly half of Norwegian GDP and is therefore central to understanding business cycle dynamics and the transmission of monetary policy. In recent decades, household heterogeneity has taken center stage in macroeconomic research—both theoretical and empirical—and, more recently, in policy analysis (see, for example, Kaplan, Moll, and Violante (2018); Holm, Paul, and Tischbirek (2021); Kaplan and Violante (2018); Norges Bank (2022); Norges Bank (2023)). While this represents an important step forward, an important limitation persist: the lack of up-to-date, micro-level data on household consumption. This limits the use of micro data for policy analysis. This Staff Memo takes a step toward addressing this limitation by utilizing Norwegian administrative data.

We use the most recently updated Norwegian administrative tax records covering the period 2009–2023 to impute household-level consumption expenditure. Following established literature—notably Fagereng and Halvorsen (2017) and Eika, Mogstad, and Vestad (2020)—we derive consumption as the residual between disposable income and active saving, where active saving is defined as changes in wealth adjusted for estimated capital gains (i.e., passive saving).[1] The resulting dataset provides an updated, well-documented, and internally consistent micro-level measure of household consumption for the period 2009–2023, available for analysis within Norges Bank.

Data on imputed consumption expenditure have been increasingly used over the past decade to provide micro-level evidence on household consumption patterns and to inform macroeconomic models with household heterogeneity. Examples include studies of heterogeneous marginal propensities to consume, the micro-level transmission of monetary policy, and consumption responses to unemployment (Fagereng, Holm, and Natvik (2021); Holm et al. (2021); Fagereng, Onshuus, and Torstensen (2024)). The contribution of this memo, relative to the existing research, is twofold. First, we apply the established method to data available within Norges Bank, thereby enabling more up-to-date policy analyses. Whereas

[1] Fagereng and Halvorsen (2017) and Eika et al. (2020) use the same Norwegian data source. Early contributions to this literature include Browning and Leth-Petersen (2003) and Koijen, Van Nieuwerburgh, and Vestman (2014).

published research typically relies on data that are five to ten years old (or older), we impute consumption expenditure using the most recently updated Norwegian administrative data (2023).[2] We present a transparent framework that facilitates straightforward and regular updating as new data become available each year. By doing so, we prepare the ground for both more timely and policy-relevant research and for using imputed consumption data to inform policy discussions on a more regular basis. Our second contribution is to demonstrate how this can be implemented in practice. We use our constructed dataset to shed light on how household consumption expenditure has adjusted to rising inflation and the subsequent increase in the policy rate.

To construct our measure of household consumption, we leverage Norway's dual-reporting tax system, in which employers and financial institutions report income and wealth directly to the tax authorities. This institutional feature minimizes measurement error and ensures near-complete population coverage. We distinguish active saving (actual portfolio changes) from passive saving (capital gains) by utilizing asset-class decomposition of wealth, building on the work of Lindquist and Riiser (2023), and constructing return indices.

Naturally, there are both advantages and drawbacks to imputing consumption expenditure based on annual administrative data. Most obviously, we produce only a single measure of total expenditure which, because our data are annual, is measured only at an annual frequency. To arrive at a household-level consumption, we also make assumptions about portfolio holdings and the absence of intra-year trading. These assumptions might be unrealistic, particularly for the wealthiest households.

On the other hand, a key strength of our data is that we have access to the entire Norwegian population. This comprehensive coverage facilitates comparisons with aggregate data and, crucially, allows us to identify and exclude outliers and potentially large-error observations. Consistent with findings in previous studies (e.g., Baker, Kueng, Meyer, and Pagel (2021)), we show that by excluding a small subset of households—amounting to roughly 10 percent of all observations—our measure of consumption performs remarkably well when

[2]These data—routinely obtained from Statistics Norway—have been used extensively for research and policy work at Norges Bank for more than two decades, but only sporadically to evaluate household-level consumption, see e.g., Fagereng and Halvorsen (2016).

compared with the National Accounts, survey-based estimates, and other benchmarks. Our imputed consumption measure tracks National Accounts per capita consumption with a correlation of 0.91 over the period 2010–2023. Moreover, we find that as data quality improve over time, the fit with National Accounts also improves, which is promising for future updates. Thus, we argue that for the vast majority of households, imputed consumption provides a reliable measure of actual consumption and can therefore be used to inform policy decisions—analogously to how other observable variables, such as debt, income, or bank deposits, have been used over the past two decades.

Our descriptive analysis of households' income, saving, and consumption over the past few years yields four key insights. First and perhaps unsurprisingly, the cash-flow channel explains the consumption tightening observed among highly indebted households in 2023 (Ahn, Galaasen, and Mæhlum (2024)). Second, nominal wages increased somewhat more for this same group, partially cushioning the decline in consumption relative to other households. Third, high-debt households appear unable or unwilling to smooth consumption through additional borrowing or by adjusting their annuity payments. Finally, accumulated savings from the pandemic (2020) acted only marginally as a buffer during the period of rising costs—partly because these savings were largely depleted by the time interest rates and inflation began to rise, and partly because the accumulated stock of savings was small relative to the sharp increase in interest expenses in 2023.

The memo is structured as follows. Section 2 describes our data sources. Section 3 documents our method for imputing consumption expenditure and how our resulting measure of consumption compares with the National Accounts and the Norwegian Consumption Expenditure Survey. In Section 4 we provide our set of descriptive facts about consumption in Norway over the past 13 years with a focus on the past five years. Section 5 concludes the paper and outlines possible directions for future research.

2 Data

Our study relies on comprehensive Norwegian register data. The Administrative Tax Records serve as our primary data source, providing annual, individual-level information on income, wealth, and taxation. The tax records refer to the balance as of 31 December each year and are third-party reported by employers, financial institutions, and other intermediaries, ensuring a high degree of accuracy and reliability. A key strength of the Norwegian register data is that, because Norway levies a wealth tax, and thus detailed information on wealth and its components is available. The tax data are collected and cross-checked with other administrative sources by Statistics Norway. Norges Bank routinely obtains pseudonomized data for research and policy analysis. The latest available year is 2023, and our dataset covers all Norwegian residents from 2009 to 2023.

In addition, we link the tax records to information from the Population Register, which includes demographic and family characteristics such as age, education, and household composition. This linkage enables us to aggregate the data to the household level. We also complement the dataset with housing transaction records from the Norwegian Mapping Authority, which provide detailed information on property values and the parties involved in each transaction. These data allow us to identify housing transactions and control for changes in wealth related to real estate.

3 Imputing consumption expenditure

The starting point for imputing consumption expenditure from household balance sheets is the basic household flow budget constraint:

$$c_{i,t} = y_{i,t} - s_{i,t} \tag{1}$$

That is, consumption ($c_{i,t}$) equals disposable income ($y_{i,t}$) minus active saving ($s_{i,t}$), defined as the portion of income set aside for investment rather than consumption. The accounting identity in Equation 1 would accurately measure imputed consumption if complete

information on both income and savings were available. In our data, we observe $y_{i,t}$ directly. Moreover, due to the existence of a wealth tax, we also observe the end-of-year stock of wealth and its broad components (i.e., asset classes).

However, we cannot directly distinguish between changes in wealth arising from active saving and those stemming from capital gains (i.e., passive saving). A naive approach that ignores capital gains and losses would incorrectly attribute price-induced changes in wealth to saving, thereby overstating (understating) saving and understating (overstating) consumption. The difference between this naive approach and our adjusted measure—after accounting for capital gains—is illustrated in Figure 1. On average, the figure shows a sizable gap between the two measures, indicating that in most (though not all) years, the naive approach would overestimate saving and thus underestimate consumption.

The central challenge in imputing consumption expenditure is therefore to separate the active saving component from the passive saving component of wealth changes. In the following, we outline our procedure, which closely follows Fagereng and Halvorsen (2017) and Eika et al. (2020).

3.1 Approximating active saving

Our procedure for imputing capital gains rests on two assumptions regarding household asset holdings and trading behavior. First, we observe each asset class, rather than individual assets. We therefore assume that, within each asset class, households hold identical portfolios of underlying assets. Consequently, households that achieve returns above the benchmark portfolio are interpreted as actively saving more (and consuming less), whereas households with returns below the benchmark are interpreted as saving less (and consuming more). Second, following Fagereng and Halvorsen (2017), we assume that there is no intra-year trading that generates gains or losses available for consumption, since our data record only end-of-year values. Eika et al. (2020) use transaction-level data and find that such trading can matter for wealthy investors. However, for the vast majority of households, this is a minor concern. This assumption motivates our sample restriction excluding wealthy households

with large stock portfolios (see Section 4.1).

Under these assumptions, let $p_{k,t}$ denote the price and $A_{i,k,t}$ the volume holdings of asset class k for household i at time t. In our data, we observe the product $p_{k,t}A_{i,k,t}$, allowing us to compute total saving, $S_{i,t}$, as:

$$S_{i,t} = \sum_k [p_{k,t}A_{i,k,t} - p_{k,t-1}A_{i,k,t-1}] + (D_{i,t} - D_{i,t-1}) \tag{2}$$

where $D_{i,t}$ denotes total debt, which is also observed in our data. When imputing consumption expenditure, we aim to remove the component of total saving attributable to price changes (i.e., $p_{k,t} - p_{k,t-1}$) and focus instead on the active transactions (i.e., $A_{i,k,t} - A_{i,k,t-1}$) which are assumed to be at the end of year. The return between $t-1$ and t is defined as $r_{k,t} = \frac{p_{k,t}}{p_{k,t-1}} - 1$, and active saving, $s_{i,t}$, for each household can therefore be expressed as:

$$s_{i,t} = \sum_k [p_{k,t}A_{i,k,t} - (1 + r_{k,t})p_{k,t-1}A_{i,k,t-1}] + (D_{i,t} - D_{i,t-1}) \tag{3}$$

The Norwegian tax data provide individual-level information on several financial asset classes: bonds, listed and unlisted stocks, and mutual funds. Since we do not observe each household's specific assets or their corresponding prices, but only the total value within each asset class, we must make assumptions about the returns component, $r_{k,t}p_{k,t-1}A_{i,k,t-1}$, to derive each household's active saving, $s_{i,t}$. We do so by constructing asset-class-specific return indices, $r_{k,t}$, using aggregate registry data for each asset class k. We assume that within each asset class, households hold portfolios that mirror the aggregate (mean) portfolio. This allows us to compute household- and asset-class-specific returns based on their holdings at $t-1$. Table 1 summarizes the data sources used to construct the asset-class-specific returns. As households over the last decade have increased their share of assets held abroad, we include a time-varying ω_t calculated using data from the Norwegian Fund and Asset Management Association. Appendix A.1 describes the different asset types and the construction of the

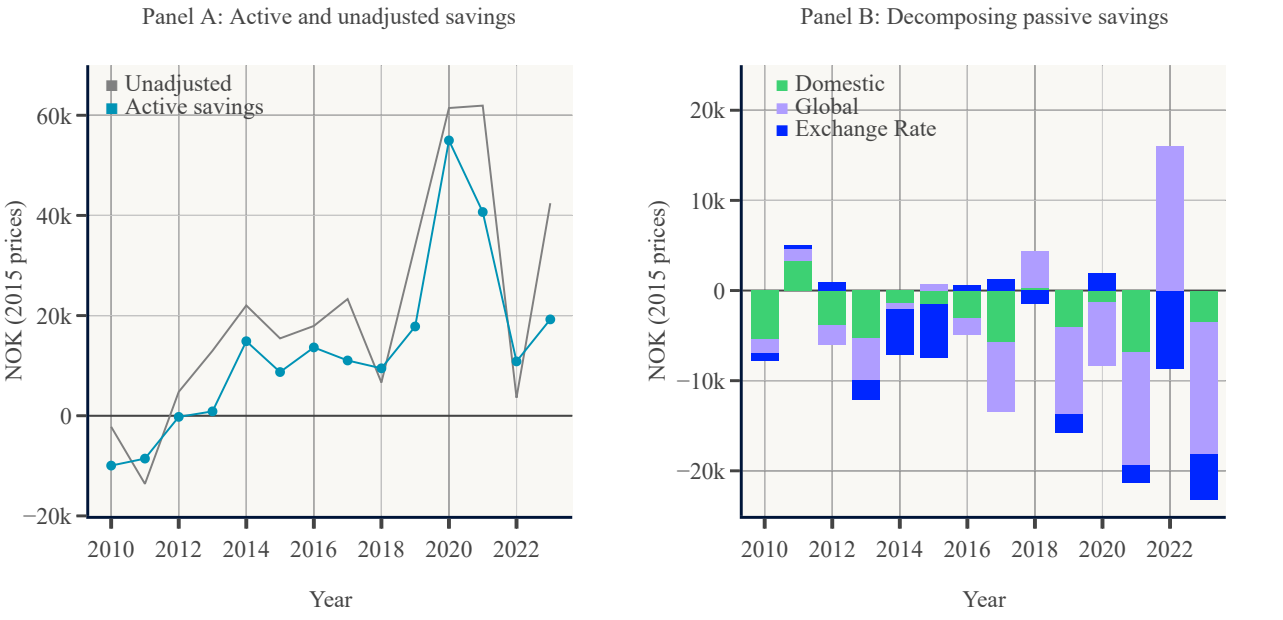
corresponding return indices.

Table 1: Asset-class specific returns

Asset Category	**Return Index** ($r_{k,t}$)
Bonds and money market funds	5 year government bonds yield
Stocks fund and ASK	ω_t × OSEBX + (1 - ω_t) × MSCI + (1 - ω_t) × USDNOK
Stocks (Listed)	OSEBX
Foreign taxable wealth	USDNOK

Figure 1A compares our adjusted measure of active saving (blue line) with the unadjusted, or naive, measure of total saving that includes capital gains (grey line). As expected, active saving is generally lower than total financial saving due to positive capital gains over the period. Figure 1B decomposes passive saving into domestic returns, global returns, and exchange rate effects (arising from the depreciation of the Norwegian krone), as imputed from

Figure 1: Adjusting savings for capital gains



Source: SSB National Accounts.

our asset-class assumptions. The values are typically negative, reflecting that average returns were positive over the period. This decomposition illustrates that, without adjustment for capital gains, passive returns can significantly distort measured saving and, by extension, imputed consumption expenditure.

As an alternative, one could employ the Norwegian Tax Administration's Register of Shareholders (Aksjonærregisteret) and transaction-level data, as in Eika et al. (2020). This would allow for precise construction of household-specific stock portfolios and corresponding adjustments for intra-year trading gains and losses. While this would improve accuracy for equity holdings, it would not fully resolve the challenge for other asset types such as bonds and mutual funds. Ultimately, there is a trade-off between precision and practicality. An important goal of this memo is to provide a simple and easily updated framework that allows Norges Bank to refresh household consumption estimates annually as new data become available. Incorporating detailed portfolio or transaction-level corrections would yield more accurate estimates of net saving under weaker behavioral assumptions, but at the cost of significantly greater complexity. Our chosen approach, while relying on stronger sample restrictions, remains transparent, replicable, and provides reliable measures of consumption for the vast majority of households (see Section 4).

3.2 Real estate

Real estate introduces potential measurement error at the transaction year, and a measurement bias between owners and renters of real estate in subsequent years. To address the measurement bias, real estate owners' income (and thus consumption) has been augmented with imputed rent. We use aggregate imputed rents from the National Accounts which is distributed among households based on the value of their primary residence. This ensures there is heterogeneity in the cross-section, depending on the value of their primary residence, while variation in the aggregate across years is consistent with the evolution of imputed rent in the National Accounts.

To accurately measure consumption during transaction years, we would need to add ac-

tive savings in real assets. An illustration of how consumption and savings changes when accounting for active savings in real assets is available in appendix A.2. Even when accounting for the increase in real savings (transaction price), there is possibly some measurement error in savings, and thus consumption[3].

3.3 Sample selection

As outlined above, several potential sources of error may arise when using register data to impute consumption. To mitigate their impact, we apply a set of sample restrictions designed to minimize both the likelihood and influence of such errors. The applied restrictions are summarized in Table 2.

Table 2: Summary of conditions

Conditions	**Description**	**Observations** *(per year)*
0 - Sampling	Years: 2009–2023	35,120,510 *(2,341,367)*
1 - Baseline	Stable households Age: 18–90	28,024,233 *(2,001,731)*
2 - Real estate	Exclude years with real estate purchases or sales	26,709,646 *(1,907,832)*
3 - Business owners	Exclude business owners with above 1G business income	25,273,770 *(1,805,269)*
4 - High dividends	Exclude households with dividends above 1G	24,755,944 *(1,768,282)*
5 - Extreme returns	Exclude extreme returns (1st and 99th percentile)	24,492,343 *(1,749,543)*
6 - Trimming	Trim on imputed consumption expenditure (1st and 99th percentile per year)	24,002,485 *(1,714,463)*

Conditions 0 and 1 in Table 2 define our baseline sample, which includes approximately two million household observations per year. We focus on the period 2009–2023 to ensure

[3]Factors contributing to the measurement error may be discrepancies between the transaction date in data from the Norwegian Mapping Authority and the Administrative Tax Records, correctly accounting for Stamp duty (dokumentavgift), and gifts/inheritance which may be unreported.

consistency in data quality and coverage. Additionally, after 2010, housing wealth is estimated more accurately using hedonic regressions. We also restrict attention to households with heads aged 18 to 90. We further require a stable adult composition within each household. If the household composition changes, the household is dissolved, and new household identifiers are assigned to its former members. Finally, because our saving measure is derived from annual snapshots of wealth, at least two consecutive yearly observations are required to impute consumption expenditure.

Below the dashed line in Table 2, we list the conditions we apply because our imputed consumption expenditure is likely a bad, or noisy, proxy of actual consumption. Furthermore, they are likely to introduce excess volatility in imputed consumption, potentially distorting both the level and trend of our data when compared with the aggregate figures from the National Accounts.

We follow the previous literature and exclude years with housing transactions due to large wealth and debt fluctuations. We also exclude business owners and traders for volatile incomes, and households with extreme changes in financial assets. These sample restrictions are all applied because our estimated real returns of these households' financial portfolios are more likely imprecise. That is, these households are less likely to hold the average portfolio and/or more likely to do intra-year trading. Finally, the dataset is trimmed at the 1st and 99th percentile of the consumption distribution each year. This last step removes noise from extreme outliers[4]. After applying the conditions 2–6, we retain 86% of our baseline sample.

Our conditions effectively remove extreme volatility. Table 3 compares financial variables between excluded groups and our final sample. The excluded households show distinct financial profiles. For example, households participating in real estate transactions or exhibiting extreme returns have a lower average age, while high-dividend households show a slightly higher mean age. The most clear feature of excluded households however is their significant net wealth and savings. As these are regarded as relatively more volatile and hence harder subjects for which to impute consumption expenditures, our final sample shows signifi-

[4]How to deal with non-generalizable outliers is a common puzzle in the literature. Since our imputed measure is a residual, we avoid imposing a threshold for "wrong" imputed consumption (e.g. 0) and trim instead. In our final sample around 2% have negative imputed consumption.

Table 3: Households mean and standard deviation of variables by condition (1 000)

Condition	Disposable Income	Savings	Consumption	Debt	Net Wealth	Head age	Size
2 - Real estate	779	-287	1,066	2,610	3,132	46.4	2.3
	(4,640)	*(17,150)*	*(17,682)*	*(3,448)*	*(49,413)*	*(17.0)*	*(1.3)*
3 - Business owners	871	65	806	2,422	3,659	51.1	2.8
	(1,970)	*(12,119)*	*(12,148)*	*(3,838)*	*(36,151)*	*(13.5)*	*(1.4)*
4 - High dividends	1,754	1,030	724	3,261	19,212	54.8	2.8
	(4,178)	*(50,550)*	*(50,408)*	*(7,107)*	*(128,835)*	*(13.0)*	*(1.3)*
5 - Extreme returns	688	149	539	1,537	3,961	44.5	2.3
	(2,582)	*(18,381)*	*(18,399)*	*(3,520)*	*(53,445)*	*(17.4)*	*(1.4)*
Our final sample	532	14	518	1,030	1,914	52.8	2.0
	(334)	*(314)*	*(418)*	*(1,340)*	*(2,736)*	*(18.2)*	*(1.2)*

This table display the mean and standard deviation (in parantheses) of key variables measured in 2015-prices. See table 4 for extended descriptive statistics of the sample (in 2022) per household. Head age and size are actual values.

cantly reduced variation. Appendix A.3 graphs how mean imputed consumption expenditure changes as we sequentially introduce each sample condition. Our flagging stabilize the mean and standard deviation but create a cost: we flag high-income and wealthy households since real estate traders, business owners, and those with extreme returns all have higher mean incomes and net wealth than our final sample.

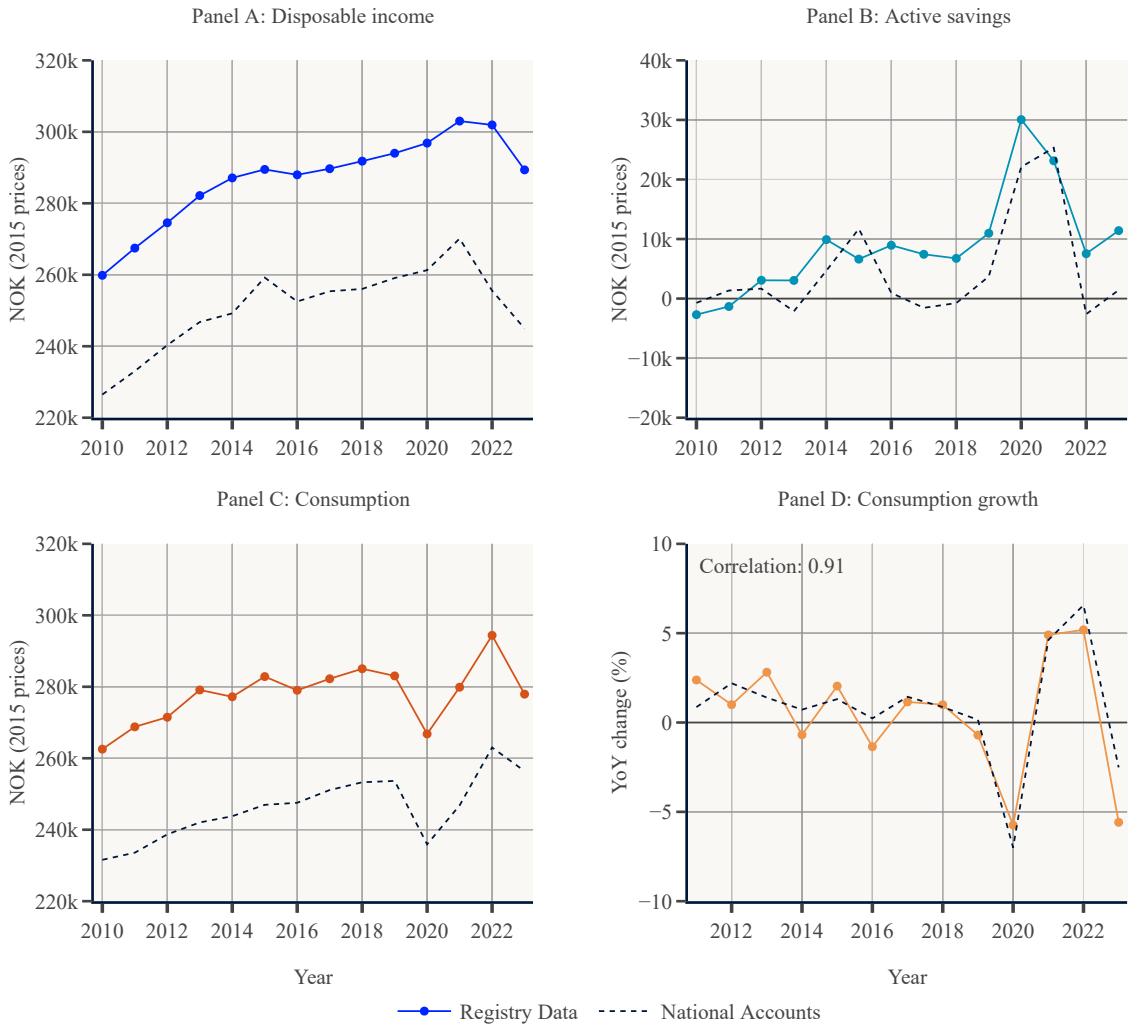
4 Comparing Registry Data with the National Accounts

Figure 2 compares our data, within our sample, on income, estimated active savings, imputed consumption levels and growth with the aggregate National Accounts on the same variables. The National Accounts provide the closest available benchmark to validate our imputation methodology. In this section the variables in the figure are NOK per capita to make the two measures comparable.

Figure 2A shows that disposable income per capita rises over time and that our register data track the National Accounts closely. There is a sizable gap in the level of disposable income across all years, and disposable income from the register data exceeds the National Accounts. This is partly due to different definitions of disposable income[5], and also due to our

[5]Disposable income and savings in the National Accounts includes some income components that are

Figure 2: Registry Data vs National Accounts (per capita)



Source: SSB, SSB National Accounts.

sample restrictions. Our sample does not include very young or old households, who typically have low income. Furthermore, by requiring stable households and two consecutive years to impute consumption, we are more likely to exclude younger households with lower average income, as they change composition and move more frequently. The deviation in income is largest in 2015 and 2021. This is due to a sharp increase in dividends prior to changes in the taxation of capital gains in 2016 and 2022 (Antonsen (2025); Finansdepartementet (2022)). In our sample we see only muted effects because we exclude large dividend recipients.

not accounted for in the register data. This includes production within the household sector, depreciation, pension savings and financial intermediation services indirectly measured (FISIM).

Figure 2B shows average active savings per capita in the register data compared to net financial investments from the National Accounts. Our measure of active savings resembles the variation in the National Accounts over time, but comparisons of different savings measures can be challenging as differences in definition, sample restrictions and measurement error become amplified. The deviations are larger in 2015 and 2021, related to the aforementioned changes in taxation of capital gains. We clearly see the savings shock during the pandemic in our savings measure, and active savings surged to record highs in 2020 and 2021. Similar to the National Accounts, savings has decreased significantly the last two years.

Figure 2C and 2D compares National Accounts household consumption with our imputed consumption expenditure in levels and growth rates. Similar to disposable income, the consumption level is higher in the register data compared to the National Accounts. The correlation between growth rates is high (0.91) over the sample period 2010 to 2023, and indicates that our measure of consumption expenditure from register data closely matches the variation in aggregate consumption. Imputed consumption indicates a strong decline in consumption in 2023, but somewhat stronger than the National Accounts.

4.1 Comparing the Registry Data the Consumption Expenditure Survey

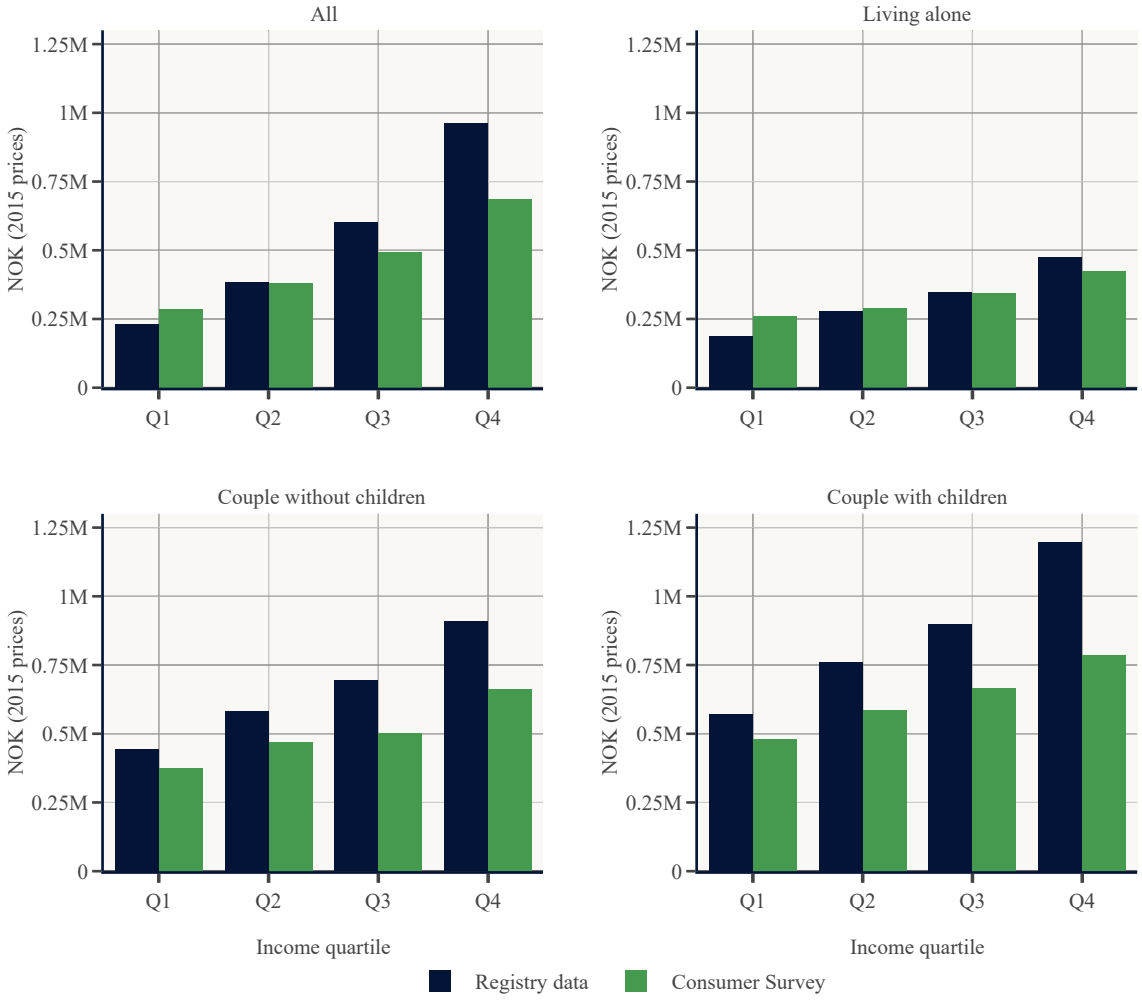
We compare our imputed consumption expenditure with Statistics Norway's 2022 Survey of Consumer Expenditure (CEX) to assess how closely our imputed measures track self-reported spending across income deciles (Holmøy, Egge-Hoveid, Lillegård, and Seferi (2024)).[6]

Such surveys, similar to the US Consumer Expenditure Survey (CES), are commonly used for heterogeneity in income and consumption in countries lacking registry data. Previous research has highlighted systematic differences between survey-based and registry-based consumption measures (Bee, Meyer, and Sullivan, 2012; Eika et al., 2020; Koijen et al., 2014; Kolsrud, Landais, and Spinnewijn, 2017).

Figure 3 compares mean imputed consumption expenditure (black bars) and survey-

[6]The consumer survey conducted in Norway in 2022 is based on 3,507 respondents (out of a total 12,000 invited responses).

Figure 3: Mean consumption expenditure across income quartiles (2022)



Source: SSB Survey of consumer expenditure, 18 Dec 2023.

reported expenditure (green bars) across income quartiles and household compositions for the latest available CEX. Consistent with earlier findings, imputed consumption is systematically higher than survey-reported expenditure across all sub-groups (Eika et al., 2020; Koijen et al., 2014; Kolsrud et al., 2017). As noted by Koijen et al. (2014), durables such as cars are often under-reported in surveys but captured immediately in registry data. Both sources are affected by measurement challenges—surveys by recall and sampling bias, and registry imputations by assumptions and potential omissions of informal transactions. Interestingly, alignment between the two measures is strongest for single-person households, suggesting that household complexity amplifies reporting and measurement errors.

5 Consumption expenditure in Norway

With imputed household-level consumption expenditure, we are able to examine both the cross-sectional and time-series dynamics of consumption within the aggregate household sector and across different subgroups. Table 4 presents summary statistics on Norwegian households' income and wealth in 2022. The data reveal substantial heterogeneity across households. For most households, wage income constitutes the primary source of earnings, while capital income remains relatively minor.

Household balance sheets are dominated by real assets, primarily housing. Approximately 80 percent of Norwegian households are homeowners, and roughly 80 percent of total household debt consists of mortgage loans, reflecting that home purchases are typically financed through borrowing early in life.

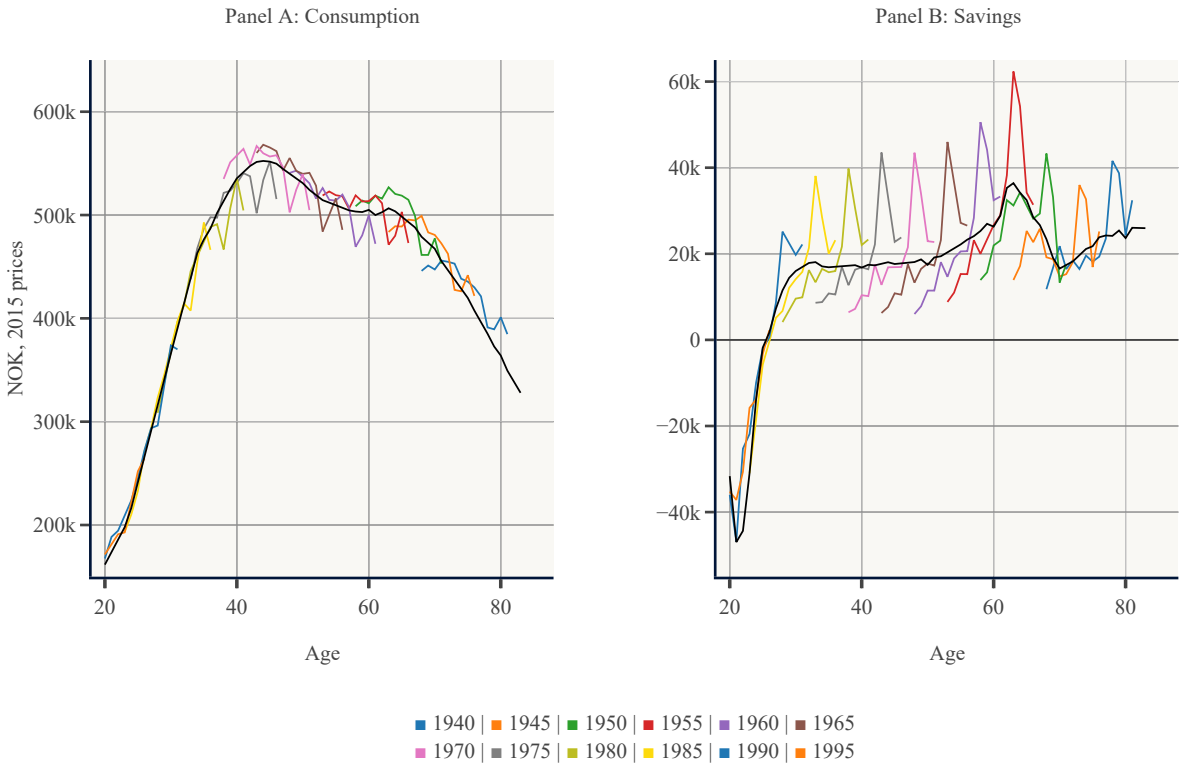
Table 4: Summary statistics for 2022. 2015-NOK (1 000)

Income	p5	p50	p95	mean	st.dev
Total income	163	567	1549	685	476
Wage income	0	387	1439	479	525
Capital income	0	2	55	11	76
Transfers	0	96	634	194	223
Disposable income	152	486	1167	555	346
Consumption	106	443	1301	544	457
Savings	-418	19	407	11	354
Balance sheet					
Financial assets	3	242	2714	688	1676
Deposits	2	160	1785	432	789
Other financial assets	0	12	1128	257	1359
Real assets	0	2532	7450	2766	2692
Primary housing	0	2318	6378	2408	2290
Secondary housing	0	0	1421	188	884
Other real assets	0	46	737	170	365
Debt	0	537	3935	1138	1451
Net wealth	-403	1542	7778	2317	3229
Household characteristics					
Household size	1	2	4	2.0	1.2
Age (head of household)	25	53	82	53.2	18.0

Figure 4 illustrates the evolution of consumption and savings over the life cycle. The black line represents the cross-sectional median across all years, while the colored lines trace the trajectories of different cohorts over time. The overall consumption profile (Panel A) follows a smooth and age-dependent pattern. Consumption rises sharply during early and middle adulthood (approximately ages 25–45), coinciding with increases in earnings and family-related expenditures, before entering a gradual decline between ages 45 and 65. After age 65, as many households transition into retirement, average consumption declines markedly. This decline may be attributed to reduced disposable income, but may also be driven by reduced purchases of work-related expenses, increased home production, and involuntary retirement due to deteriorating health (Banks, Blundell, and Tanner, 1998; Battistin, Brugiavini, Rettore, and Weber, 2009; Bernheim, Skinner, and Weinberg, 2001; Li, Shi, and Wu, 2015).

On average, households exhibit negative savings early in the life cycle, which gradually turn positive at later stages (Panel B). Negative savings among young households are

Figure 4: Median consumption and savings over the life cycle



likely attributable to the prevalence of students who rely on grants and loans from public institutions, such as the Norwegian State Educational Loan Fund. In their late twenties, most individuals transition from student to employment status, accompanied by pronounced increases in both consumption and savings. Thereafter, the sharp increase in savings disappears reflecting major life expenditures such as housing and child-bearing, before rising again after the age of 50. At retirement age (approximately 60–70), a distinct hump emerges in the savings trajectory. The subsequent decline in disposable income associated with retirement leads households to reduce their savings to smooth consumption during this transition, though savings decline less than consumption, supporting the aforementioned observation that retirement is associated with changes in consumption patterns beyond income effects.

Figure 4 also illustrates how the COVID-19 pandemic affected consumption patterns differently across age groups. Younger households experienced a pronounced spike in consumption in 2020, followed by a substantial rebound in 2021 and a return to trend levels by 2022. In contrast, the oldest households exhibited a weaker recovery in 2021, a more pronounced rebound in 2022, and a normalization by 2023. This pattern likely reflects greater caution among older households, owing to elevated health risks and slower behavioral adjustments. Finally, households aged 30–50, who typically hold larger mortgage balances, display a sharp decline in consumption in 2023—likely driven by higher interest payments that reduced disposable income and, consequently, imputed consumption. In the following sections, we provide a more detailed analysis of how households adjusted during the recent period of rising interest rates.

5.1 Drivers of consumption growth over the last decade

To explore the drivers of changes in consumption over time, we decompose the imputed consumption expenditure growth into its observable income and saving components. Because we observe household-level data on all relevant items, we can carry out this purely accounting-based decomposition at the household level, enabling an analysis of heterogeneity. While this exercise does not provide a causal interpretation of household behavior, it accounts for

changes in consumption by tracing how income and saving evolve over time. Equation (1) can be rearranged to emphasize changes in income, $\Delta y_{i,t}$, and changes in savings, $\Delta s_{i,t}$:

$$\Delta c_{i,t} = \overbrace{\Delta l_{i,t} + \Delta b_{i,t} - \Delta \tau_{i,t} - \Delta \nu_{i,t} + \Delta \epsilon_{i,t}}^{\Delta y_{i,t}} - \Delta s_{i,t} \tag{4}$$

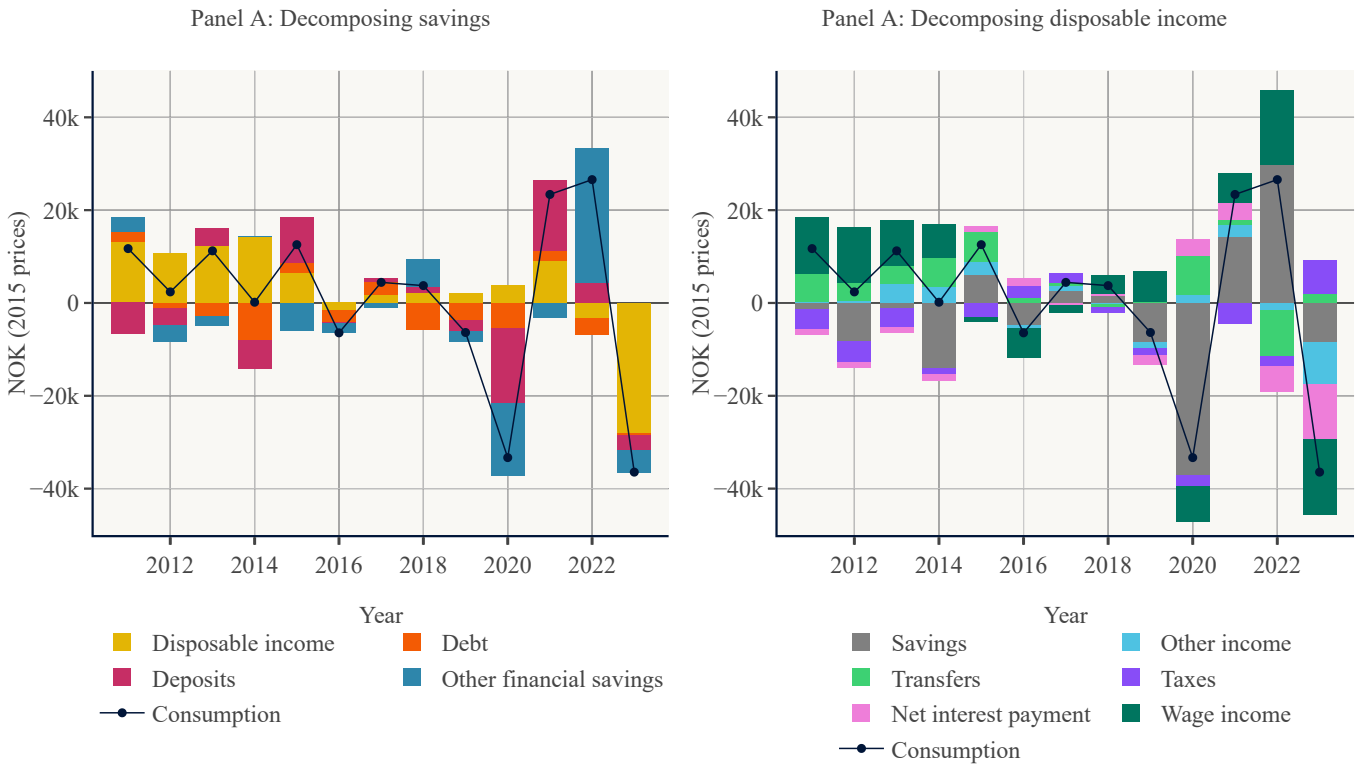
$$\Delta c_{i,t} = \Delta y_{i,t} - \overbrace{(\Delta B_{i,t} + \Delta O_{i,t} - \Delta D_{i,t})}^{\Delta s_{i,t}} \tag{5}$$

Where l is labor income, b is benefits/transfers from the government, τ is taxes paid to the government, ν is net interest payment and ϵ is other income. On the asset side we decompose savings into changes in deposits B, debt D and other financial assets O.[7] The two decompositions of changes in consumption the last decade is illustrated in figure 5.

Figure 5 shows the decomposition of consumption growth (black line) at the mean household level. Note that negative values for the savings components correspond to increases in savings, and vice versa. Compared with the preceding decade, the volatility in consumption in recent years has been extraordinary. The decomposition highlights that the drivers of this volatility have been markedly different across periods. Panel A shows that the sharp decline in consumption in 2020 was not primarily driven by lower income, but by a surge in household saving, mainly through increased bank deposits (red bars) and other financial assets (blue bars). Panel B shows that while wage income on average declined (dark green bars), mainly due to higher unemployment, increased transfers (light green bars) and lower net interest payments (pink bars) more than offset the fall. As a result, disposable income actually increased. The subsequent rebound in 2021 and 2022 was largely driven by a reversal of this saving behavior, with households drawing down financial buffers to support higher consumption. In contrast, the sharp reduction in consumption in 2023 was mainly due to a decline in disposable income, reflecting higher interest payments and lower real wage income due to high inflation. Interestingly, households' use of debt to smooth consumption during this period appears to have been limited, even in the face of rising living costs.

[7] As the asset side consists of stock variables, B, D and O denote the *change* between $t-1$ and t.

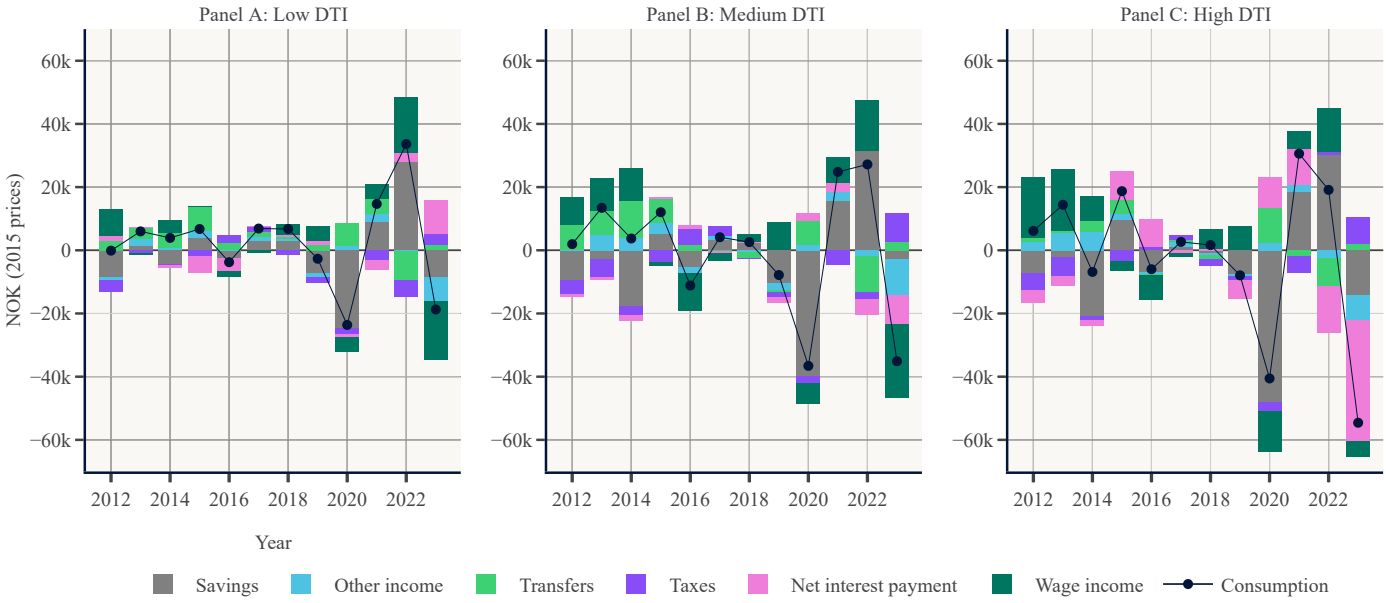
Figure 5: Decomposition of changes in consumption



5.2 Heterogeneity during the recent monetary policy cycle

Compared with the previous decade, the period from 2020 to 2023 was characterized by unusually large swings in economic conditions and heightened uncertainty. As a consequence, the stance of monetary policy in Norway has changed substantially since the COVID-19 pandemic. Following the introduction of a historically low policy rate of 0 percent in 2020, Norges Bank initiated a rapid tightening of monetary policy in response to the subsequent increase in inflation and the policy rate was 4.5 percent by the end of 2023. Because most Norwegian households have floating-rate mortgages, changes in monetary policy directly affect households' disposable income through changes in net interest payments (the so-called cash-flow channel). A key advantage of our household-level data is that it allows us to replicate the decompositions shown in Figure 5 at the household level, thereby enabling us to explore heterogeneous responses in recent years. Given the prominent role of household debt and liquidity in policy discussions, we focus on these factors when examining the

Figure 6: Change in consumption and contribution from different income components across DTI groups



heterogeneous responses during this period.

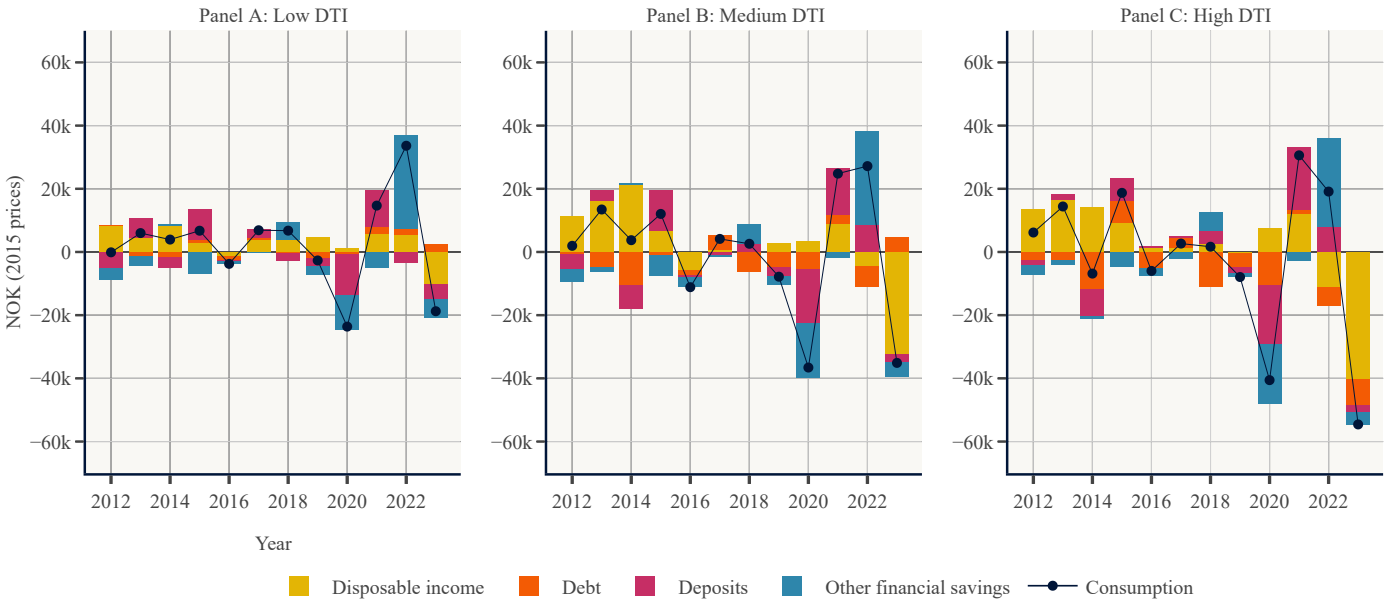
To examine the role of debt and liquidity, we divide households into groups based on their debt-to-income (DTI) ratio. Figure 6 shows the decomposition of income across three equally sized groups, classified by their DTI in the previous year. There is considerable heterogeneity both in the magnitude of changes in consumption and in the factors driving those changes across the three groups. Households with low DTI (typically older households or renters, Panel A) experienced small changes in income arising from changes in net interest payments. For households with high DTI (Panel C), changes in net interest payments have been the main contributor to lower disposable income in 2023. While highly leveraged households experienced somewhat higher wage growth than others in 2023, these differences were not large enough to offset the much larger increase in net interest payments.

Next, we disentangle the drivers of savings across DTI groups to see if the groups have adjusted their balance sheet differently during the recent interest rate hike. The results are shown in Figure 7. The figure shows that the surge in savings during the pandemic was broadly based across the different groups. However, the magnitude of the savings shock was

bigger for households with high DTI. On average, these households increased their down-payment of debt in 2020, but the main source of savings in 2020 was deposits and other financial savings. Conversely, reduced savings was a key contributor to consumption growth in 2021 and 2022 for all groups. In 2023, there are small changes to savings compared to disposable income, and there are no notable differences in the composition of savings to offset the reduced disposable income across groups. Perhaps surprisingly, the most highly leveraged households tended to reduce their debt more than medium-leveraged households, even though they faced a significantly sharper increase in interest payments.

Figure 6 and 7 show that there is significant heterogeneity in consumption behavior across DTI groups over time, and that a simple decomposition helps shed light on the accompanying income and saving behavior. However, many other factors also influence consumption behavior across households. To further investigate the relationship between DTI and changes in consumption, we run a set of cross-sectional regressions at the household level to estimate the correlation between DTI and changes in consumption in 2023, while controlling for other factors. In addition to exploring the relationship between DTI and

Figure 7: Change in consumption and contribution from different savings components across DTI groups



consumption, we examine whether the excess savings accumulated during the pandemic, ΔS_{2020}, contributed to mitigating the consumption drop in 2023. Finally, to investigate the role of liquid buffers more generally, we split the sample based on households' liquidity buffer (that is, hand-to-mouth status) and run separate regressions for the two groups.[8] Our dependent variable in all regressions, ΔC_{2023}, is the NOK change in consumption from 2022 to 2023:

$$\Delta C_{t,h} = \alpha_h + \beta_1 DTI_{t-1,h} + \beta_2 \Delta S_{t-3,h} + X_{t,h} + \varepsilon_{t,h} \tag{6}$$

The results are presented in Table 5. As expected, the coefficient for DTI_{t-1} is negative in all regressions and remarkably stable across specifications and controls. Thus, households with higher debt relative to income reduced their consumption more than others when net interest payments increased in 2023. This finding is consistent with the cash-flow channel of monetary policy (Ahn et al. (2024)).

Regressions (4) and (5) indicate that households with low liquidity buffers reduced their consumption significantly more for the same level of DTI, in line with the findings of Flodén, Kilström, Sigurdsson, and Vestman (2021). Finally, regression (3) indicates that savings accumulated during the pandemic contributed to higher consumption in 2023, although the effect is very small. The mean of ΔS_{2020} is 35,457 NOK. Taken at face value, the coefficient implies that, on average, pandemic-related savings contributed to an increase in consumption of only about 116 NOK in 2023. The small effect is consistent with the evidence in Figure 7, which suggests that excess savings from 2020 had largely been drawn down by 2021 and 2022. Hence, this effect was likely more important in earlier years and may vary across asset classes. As expected, we find that this effect is present only among households that were not liquidity constrained in 2022 (i.e., $HTM = 0$).[9]

[8] Households are characterized as hand-to-mouth (HTM) if their deposits are less than half a month's disposable income.

[9] Appendix Table A.1 presents results from a specification using changes in log consumption as the dependent variable. The results are consistent with those presented here.

Table 5: Determinants of ΔC in 2023

	(1) ΔC_{2023}	(2) ΔC_{2023}	(3) ΔC_{2023}	(4) ΔC_{2023}	(5) ΔC_{2023}
Sample	All	All	All	$HTM = 0$	$HTM = 1$
DTI_{2022}	-1206.3***	-3251.6***	-3259.8***	-2768.9***	-7006.0***
	(208.2)	(187.0)	(187.0)	(219.1)	(379.9)
ΔS_{2020}			0.00328**	0.00392***	-0.00282
			(0.00128)	(0.00135)	(0.00415)
R^2	0.299	0.475	0.475	0.476	0.473
Observations	899 426	899 426	899 426	774 370	125 056
Controls	No	Yes	Yes	Yes	Yes

Robust standard errors in parentheses.
Controls: change in income after tax, income after tax $t-1$, net wealth $t-1$, age-fixed effects and household size.
All regressions include consumption $t-1$ as a control.
Variables DTI, ΔC and ΔS are winsorized p(1) and p(99) per year.
Households without positive income after tax or DTI above 20 are excluded.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.001$

6 Conclusion

In this we memo revisit the imputation of household consumption expenditure using Norwegian administrative data for the period 2009–2023. Following established approaches in the literature, we derive consumption expenditure as disposable income net of active saving, where active saving is adjusted for capital gains across major asset classes. We describe the data sources, adjustments, and sample restrictions applied to ensure internal consistency and comparability with aggregate benchmarks.

The contribution of the memo is twofold. In the first part of the memo, we describe and implement a framework within Norges Bank that enables regular and transparent updating of household consumption data as new administrative records become available. Our benchmarking exercises suggest that, after excluding a small share of volatile observations, the imputed data capture aggregate trends and cross-sectional patterns in household consumption with reasonable accuracy. We obtain a final dataset spanning 13 years, retaining 86% of our sample. In the second part of the paper, we illustrate how the resulting dataset

can be used to examine recent developments in household consumption, income, and saving, including during the recent monetary tightening cycle.

We document that the recent tightening cycle has led to clear differences in household adjustment across the debt distribution. Consumption declined most among highly indebted households, reflecting higher interest expenses and weaker disposable income growth relative to others. Wage growth provided some offset but was insufficient to fully cushion the effect of increased debt service costs. Households with low liquidity buffers reduced consumption more strongly, while savings accumulated during the pandemic played only a limited role in smoothing expenditure. These results demonstrate how the imputed consumption data can be used to monitor heterogeneity in household responses to changes in economic conditions.

Our measure of consumption expenditure is not perfect, and may be improved in the future as data availability and quality improves. Therefore, the framework is designed to be replicable and extendable, facilitating continuous refinement. In this way, we hope that the work establishes a basis for ongoing research and policy analysis grounded in up-to-date, micro-level evidence on Norwegian households. Possible uses going forward may be examining the transmission of fiscal and monetary policy, and how households adapt to important life events.

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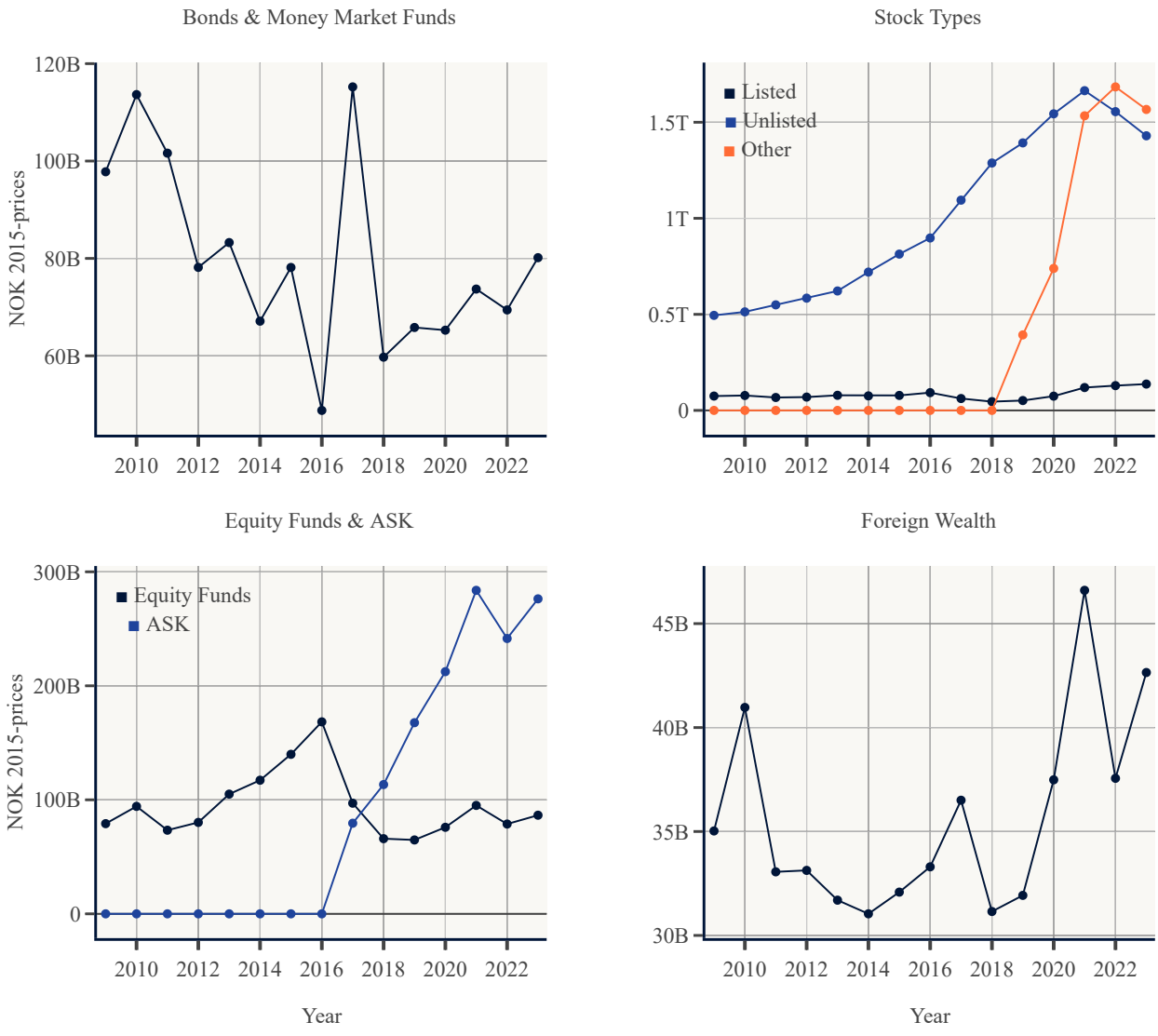
A Appendix

A.1 Granularity of wealth portfolio

Capturing wealth portfolio components is essential for accurate realized return estimation. This appendix documents asset reporting variations across years, our methodological assumptions, and solutions to data inconsistencies. Figure A.1 plots raw asset class data, showing summed values across the dataset with no selection. Variables are unadjusted except for stock types, for which "Other" (orange) is distributed to listed and unlisted stocks

Figure A.1: Evolution of wealth accounts in raw data

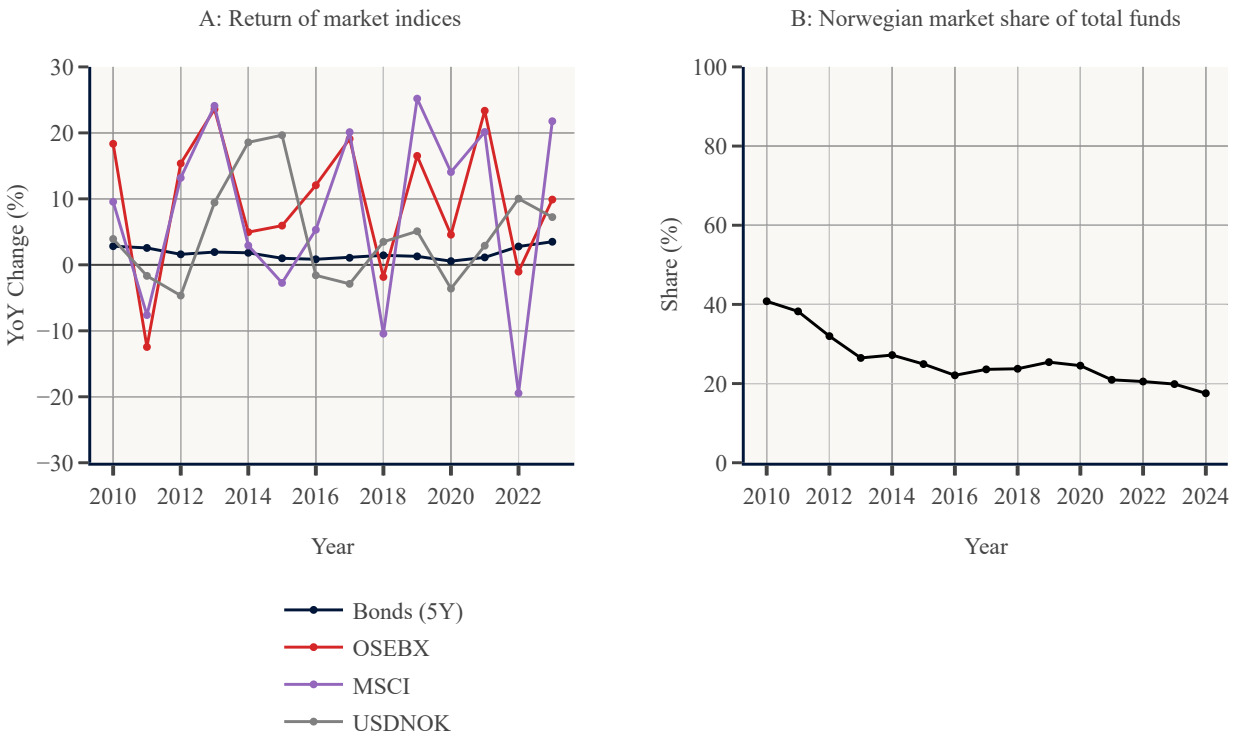


based on the household's history.

Bonds and money market funds illustrate how the raw data can contain large changes, like those in 2016-2017. Otherwise, bonds and money market funds behave reasonably. For stocks, the picture differs. Unlisted stocks, the largest component, grow consistently. The challenge is a new "other stocks" category introduced in 2019. We allocate this forward based on the 2017 listed-to-unlisted ratio for each household. We observe that "other stocks" appears predominantly unlisted. If no history is available for the household, we distribute it according to the cross-sectional listed-to-unlisted ratio in 2017. It is reasonable to believe that most of "other stocks" is indeed unlisted stocks, as the introduction of ASK is also expected to capture listed stocks. In final calculations, we use only listed and unlisted categories after redistributing "other stocks" between them.

We treat equity funds and ASK (Aksjesparekonto) identically, summing them as total equity fund holdings. ASK was introduced in 2017 and the rapid increase in volume from there on is striking. Additionally, we observe that some equity funds before 2017 show up

Figure A.2: Evolution of wealth accounts in raw data



in ASK the year it is introduced. Treating ASK as an equity fund might be our strongest assumption: "equity funds" is a more specific concept than ASK, as ASK can include individual stocks and balanced funds (with at least 80% equities) as well. However, given ASK's design, wide menu of options, and accessibility, we assume households hold portfolios targeting average market returns.

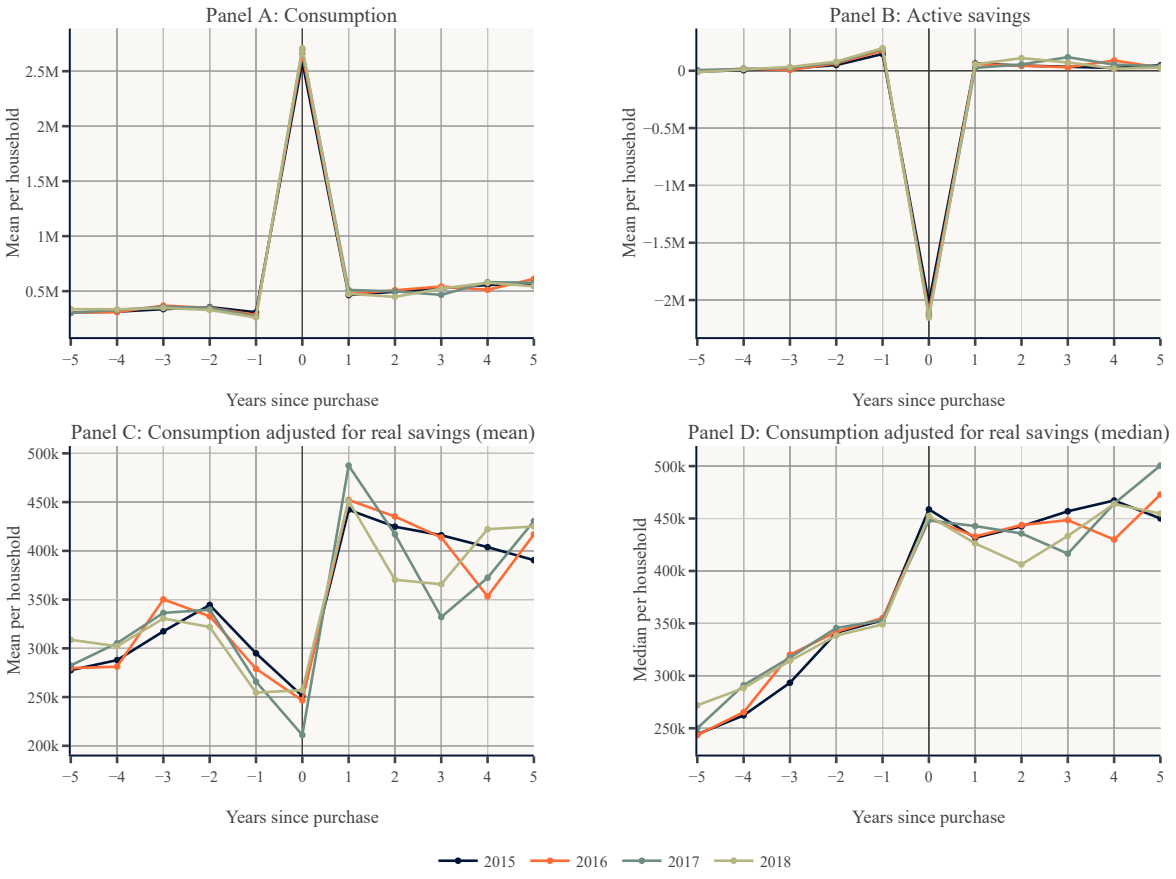
Finally, we treat foreign wealth as assets held in foreign currency, adjusted only for USDNOK exchange rate changes. While many hold Euro assets, we use USD consistently since we use USD-based MSCI returns and NOK behaves similarly against both major currencies.

Figure A.2 shows the indices used for calculated estimated realized returns, on our four asset classes bonds and money market funds, stocks, equity funds and ASK, and foreign taxable wealth. To create a return index for equity funds, we use a weight ω of domestic and foreign $(1 - \omega)$ returns based on Verdipapirforeningens data. For stocks we disregard adjusting the unlisted stocks, and only adjust listed stocks for market returns.

A.2 Consumption and savings during real estate transactions

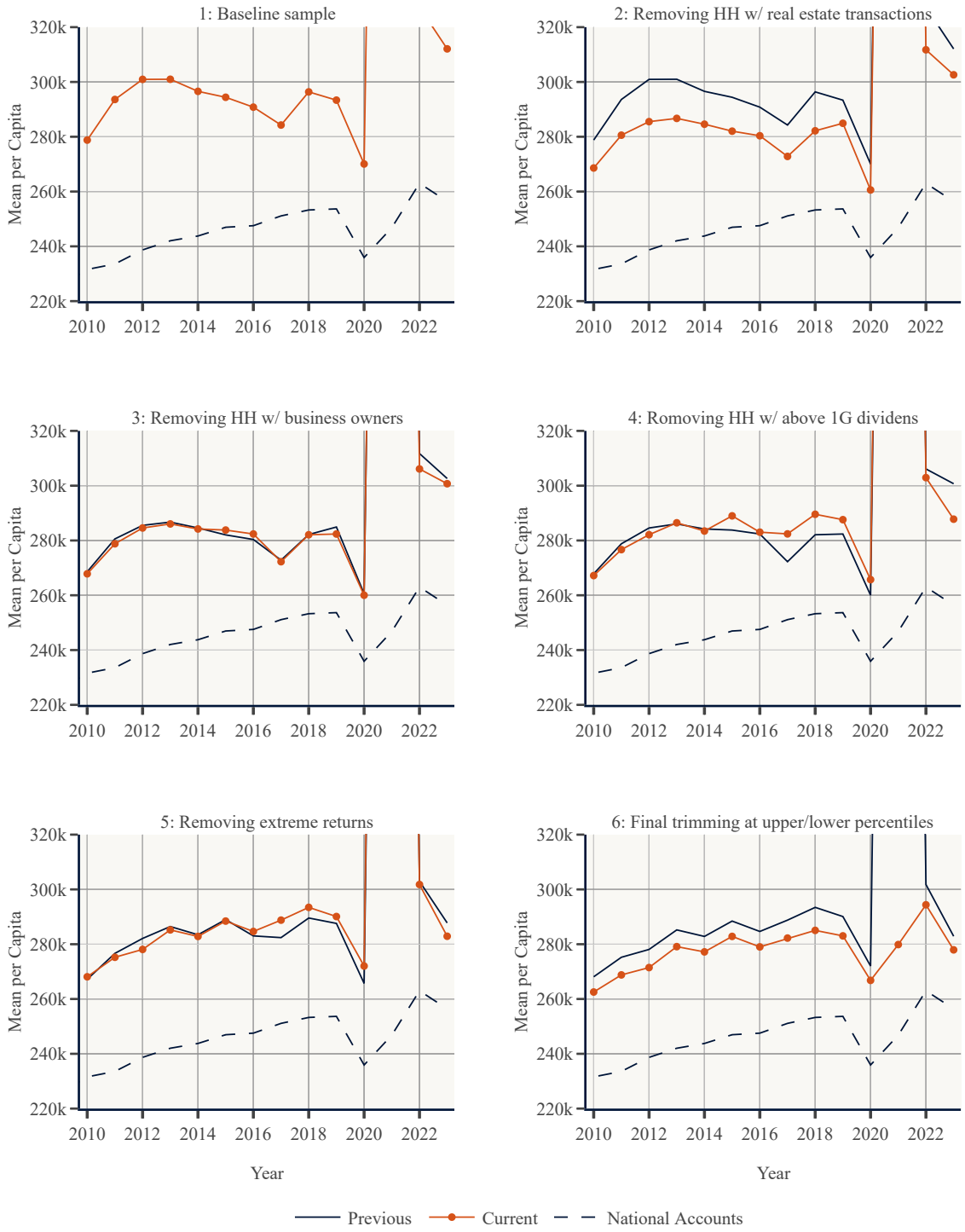
The panels in figure A.3 illustrates consumption and savings for households who purchase their first primary residence at $t = 0$. The sample is limited to households with only one transaction during the sample period. Consumption adjusted for real savings is imputed consumption minus the purchase price.

Figure A.3: Consumption and savings for households for different transaction years



A.3 Exclusion of households

Figure A.4: Progressive sample restrictions



A.4 Regression results

Regression result for a specification similar to equation 6, but relevant variables (consumption, income, wealth) are log-transformed.

Table A.1: Determinants of Δc in 2023 (difference in log consumption)

	(1) Δc_{2023}	(2) Δc_{2023}	(3) Δc_{2023}	(4) Δc_{2023}	(5) Δc_{2023}
Sample	All	All	All	$HTM = 0$	$HTM = 1$
DTI_{2022}	0.0000233	0.000397***	0.000396***	0.000382***	0.000950***
	(0.0000238)	(0.0000432)	(0.0000432)	(0.0000385)	(0.000103)
Δs_{2020}			7.23e-09***	6.77e-09***	1.00e-08
			(1.67e-09)	(1.73e-09)	(6.14e-09)
R^2	0.159	0.372	0.372	0.372	0.390
Observations	752 581	752 581	752 581	682 565	70 016
Controls	No	Yes	Yes	Yes	Yes

Robust standard errors in parentheses.

Controls: Same as in table 5

Log consumption level is always included as a dependent variable.

Variables DTI, Δc and Δs are winsorized p(1) and p(99) per year.

Households without positive income after tax or DTI above 20 are excluded.

* < 0.10, ** < 0.05, *** < 0.001