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Drivers of Post-COVID Private Consumption in the U.S.

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ABSTRACT: Private consumption in the U.S. has recovered swiftly from the pandemic trough and has been running above the pre-pandemic trend even as interest rates rose sharply. This paper examines the underlying drivers for this strong growth in consumption. Using both state- and household-level data, we find that excess savings from the pandemic, large increases in household wealth (especially housing), along with solid real income gains contributed to strengthening post-pandemic consumption. Compared with pre-COVID estimates, the marginal propensity to consume out of housing wealth is substantially higher, which, together with large gains in housing prices, made the wealth effect a key driver for post-pandemic consumption growth.

JEL Classification Numbers:	D12; D14; E21; E24; G51; R39
Keywords:	private consumption; marginal propensity to consume; income; saving; wealth; post-COVID recovery.

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1 Introduction

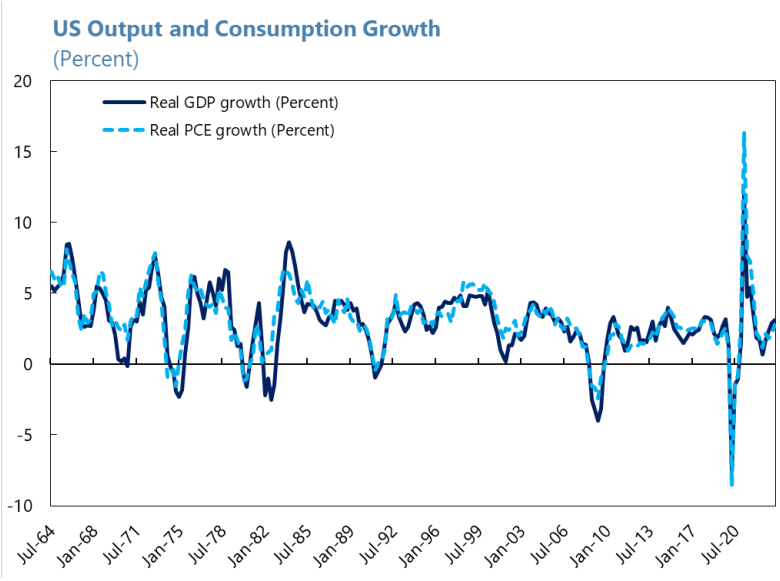
The U.S. economy has shown impressive resilience throughout the recovery from the pandemic and the monetary tightening cycle since early 2022. The strong GDP growth has been primarily driven by private consumption, which has consistently over-performed relative to expectations, notwithstanding a sharp increase in interest rates and high inflation, and is now running above the pre-pandemic trend path.

Looking at quarterly GDP and consumption growth, the latter measured by the growth in real personal consumption expenditures, the two lines virtually lie on top of each other (Figure 1). Understanding U.S. GDP growth means understanding U.S. consumption growth. The U.S. is a large, relatively closed economy, where private consumption has, in the post-war period, been the main engine of economic growth. Understanding the drivers of private consumption at the current juncture is particularly important as it can help us understand what factors underpin the exceptionally strong U.S. economy amid the monetary policy tightening cycle.

In this paper, we leverage data at different levels of disaggregation to shed light on the determinants of household consumption since the pandemic. Using both state-level as well as household-level data, we establish the following key results: First, solid labor income growth has been supporting consumption across all segments of the income distribution, with the post-pandemic period registering a somewhat higher marginal propensity to consume out of that income. Second, relative to the past, housing wealth has been playing a much more important role in driving consumption growth among better-off homeowners. We also find an important role for excess savings built up during the pandemic which has supported consumption long into the current juncture, as well as the impact of government transfers. However, in terms of overall economic magnitudes, the contribution of housing and possibly other types of wealth has been by far the most dominant force underpinning aggregate consumption growth.

The paper is organized as follows. Section 2 presents some stylized facts on aggregate consumption and its composition among broad types of goods and services, along with the breakdown into contributions from different household income groups. Section 3 provides an overview of the potential drivers of consumption, drawing from the relevant literature and recent macroeconomic context. Section 4 details the various datasets used, their complementary strengths and caveats, and the empirical strategy we employ to estimate drivers of consumption. Results for state-level analysis is presented in section 5, and household-level results in section 6. In section 7, we circle back to the macro perspective by computing the contribution of each main driver to aggregate consumption growth since the pandemic, combining our micro-level estimates with macro data out-turns. We conclude with some discussion of the outlook for consumption in section 8.

Figure 1: Real GDP and Real Consumption Growth



Sources: Federal Reserve Bank St. Louis.

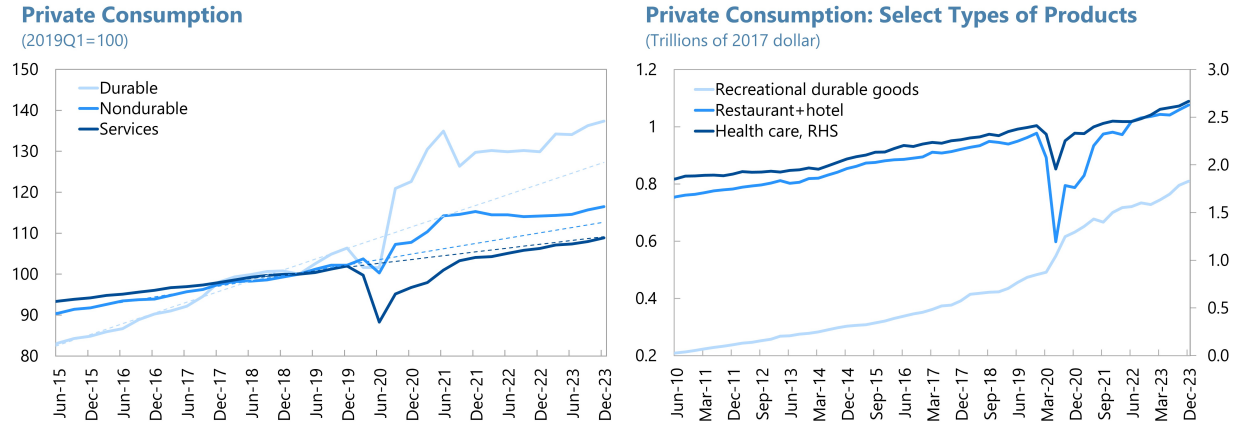
2 Stylized Facts

The post-COVID recovery of consumption differs widely across different consumption categories. As shown in the left chart of Figure 2, services experienced the most severe decline during the lockdown—due to restrictions on mobility (e.g., travel) and in-person contact (e.g., dining and recreation services), but since the economy re-opened, services consumption has staged a solid recovery back to the pre-COVID trend. At the same time, goods consumption dropped briefly during COVID, but rebounded swiftly and surpassed the pre-COVID trend. At their highest cyclical levels in 2021Q2, durable goods and nondurable goods consumption exceeded about 20 and 10 percent their pre-COVID trend levels, respectively. The elevated durable goods consumption could be due to the fact that people postponed durables consumption during the lockdown, creating momentum for subsequent pent-up demand. However, for nondurable goods and services, the recovery should be more moderate, as the lost spending on services like haircuts or nondurables like gasoline may simply be foregone (Beraja and Wolf (2021)). Although goods consumption growth moderated since the second half of 2021, its level remains above the pre-COVID trend.

Some subcategories of consumption experienced a faster recovery than others. As shown in the right chart of Figure 2, recreational durable goods hardly experienced any setback during the lockdown and stepped on to an elevated trend instead, as they are the immediate substitution for services (e.g., treadmill can be a substitute for working out in gym). Spending on health care, restaurant,

and hotel rebounded fast alongside reopening, when people started to resume the pre-COVID consumption patterns and to catch up with pent-up services demand.

Figure 2: Consumption by Categories



Sources: BEA.

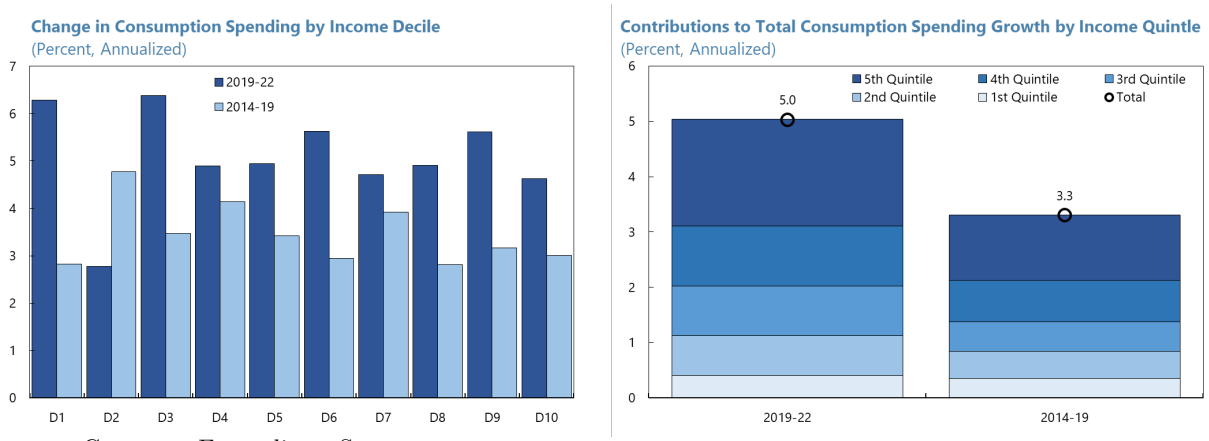
Looking at the consumption breakdown along the income distribution, we observe the following important facts. Low-income households had larger gain in consumption, while high-income households contributed more to the overall consumption growth. As shown in the left chart of Figure 3, the bottom decile saw an averaged annualized consumption growth of 6 percent between 2019 and 2022, more than doubling the rate during 2014 - 2019. High-income households increased their consumption as well, though at a lower rate. That said, given the higher share of high-income households in overall consumption, they were the main contributor to the aggregate increase in consumption (the right chart of Figure 3): The top two quintiles accounting for almost half of the average 5 percent consumption growth between 2019 and 2022. The U.S. consumer economy is primarily powered by the relatively well-off, even more so in recent post-pandemic years.

3 Potential Drivers

Resilient private consumption in the U.S. since the pandemic has been underpinned by a confluence of pivotal factors, each playing a significant role in supporting economic activities. The robust labor market stands out as the fundamental driver, characterized by employment and wage growth, which have contributed to higher disposable incomes and job security for households, thereby supporting consumer spending.[1] Despite a slowdown in job growth from its peak in 2021, employment rates have continued to exceed historical averages and market expectations. Moreover, the sustained

[1]Although life-cycle and permanent income models propose that individuals utilize savings to mitigate income fluctuations and exhibit minimal responsiveness to anticipated changes in income, numerous studies, as outlined by Jappelli and Pistaferri (2010), find that consumption is sensitive to income changes.

Figure 3: Consumption by Income



Sources: Consumer Expenditure Survey.

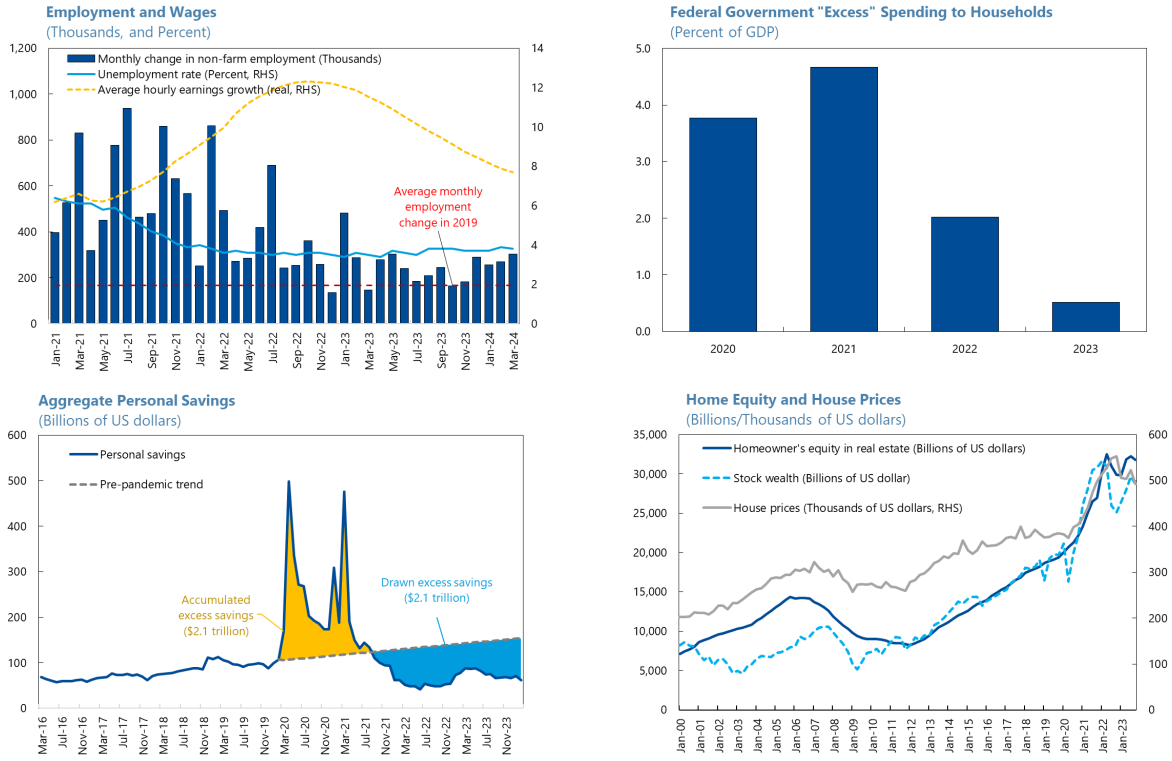
low unemployment rate, persistently below 4 percent for an extended period, along with workers' earnings outpacing U.S. inflation rates in most recent quarters, could further support consumer confidence and spending.

The fiscal stimulus package has also been instrumental in supporting private consumption by injecting direct financial assistance to individuals. Government interventions, including stimulus checks and enhanced unemployment benefits, amounted to approximately 4-5 percent of GDP per year during 2020-21. This substantial infusion of funds served as a lifeline for individuals navigating economic uncertainty caused by the pandemic's fallout. While some used this financial aid to cover essential expenses, others seized the opportunity to bolster their savings and/or to repay high-cost debt, creating a financial buffer to weather uncertainties and prepare for the recovery period (see for example, Casado et al. (2020); Parker et al. (2022); R. Baker et al. (2023)). Consequently, by the time the economy recuperated, much of the expired pandemic stimulus was still effective in the form of improved household balance sheets, potentially helping to bolster consumer confidence and sustain purchasing power throughout the post-pandemic recovery.

Furthermore, the accumulation of savings from fiscal transfers and incomes held up during the pandemic emerged as a critical buffer for private consumption in the post-pandemic period. Fiscal support during economic closures prompted an unprecedented surge in personal savings, surpassing pre-pandemic trends and levels seen in prior recessions. As economic conditions improved and confidence rebounded, this amassed savings pool served as a reservoir from which consumers drew, bolstering sustained consumption levels. Empirical evidence indicates a drawdown of pandemic-related "excess" savings since mid-2021 of about 2.1 trillion dollars cumulatively (Abdelrahman and Oliveira (2023*a*)), underscoring the role of saving decumulation as a fuel for post-pandemic private consumption.

Lastly, the appreciation of housing and stock market wealth represents a significant potential driver of resilient private consumption post-pandemic. Since the pandemic, housing and stock market wealth have increased by around 50 and 25 percent, respectively, in aggregate terms. The strong upward trend in house prices has bolstered homeowners' home equity and increased financial security. This enhanced financial confidence can translate into increased consumer spending (Case, Quigley and Shiller (2005); Caceres (2019)). In addition, the appreciation of home values can enable homeowners to access additional funds through home equity loans or lines of credit, providing them with the means to finance further consumption. Similarly, the surge in stock market wealth contributes in tandem to reinforcing resilient private consumption. As stock market values increase, investors experience a corresponding increase in their investment portfolios' value, potentially prompting them to feel more financially secure and inclined to spend and thereby supporting economic recovery efforts.

Figure 4: Potential Drivers of Private Consumption



Sources: Abdelrahman and Oliveira (2023*a*); Federal Reserve Bank Atlanta; Federal Reserve Bank St. Louis; U.S. Treasury; U.S. Bureau of Labor Statistics; Consumer Expenditure Survey.

4 Data and Methodology

State-level Analysis

The state-level dataset spans the period from 1990Q1 to 2023Q4 and is assembled from multiple sources. Income and income components are taken from the Regional Economic Accounts of BEA, where total income, wage, dividend/interest/rent income (i.e., asset-based income), and other types of income are collected. Housing wealth is constructed by multiplying the home ownership rate (from the Housing Vacancies and Home-ownership dataset of Census), number of households (from State and County Intercensal Tables of Census for years prior to 2010 and American Community Survey for years starting from 2010), and Freddie Mac House Price Index for each state. Both income variables and housing wealth are converted to real values by deflating by personal consumption expenditure (PCE) price index.

State-level real consumption is proxied by retail employment. As quarterly real consumption is not available at state-level, following the literature (e.g., Guren et al. (2021)), retail employment is used as the proxy for real consumption. As e-commerce becoming more prominent post-COVID, it could affect how well retail employment is able to represent the dynamics in real consumption. To check this, we use the annual state-level real consumption from BEA and regress it on retail employment along with state and year fixed effects. The result show that the relationship between real consumption and retail employment doesn't significantly differ between pre- and post-COVID periods (see Figure A1). Therefore, similar to Guren et al. (2021), we assume this elasticity between real consumption and retail employment is one when we interpret our empirical results as a consumption response. Other control variables include mobility index during COVID (from Google Mobility), Federal Funds Rate, and global supply chain pressure index (from Federal Reserve Bank New York).

The state-level baseline regression is specified as in Equation 1. Consumption is assumed to be a function of income (asset-based and non-asset-based) and housing wealth, where c is proxied with retail employment, y is income (excluding income from assets: dividend, interest, and rent income), a is asset-based income, and h is housing wealth. The subscript s denotes state and t for quarter. α_s and q_t represents state fixed effects and quarter fixed effects, respectively. The quarter fixed effects take out any national-level factors (e.g., monetary policy) that could affect consumption uniformly across states, and also absorb any deterministic trend in the variables.[2] The coefficients of interest here are β_1 and β_2, which measure the elasticity of consumption to non-asset income and housing wealth. Although β_3 could represent the elasticity regarding asset-based income, without a good measure on financial wealth in the regression, it could capture a combination of both the

[2]We also check whether there is stochastic trend of the variables, and the unit root test results (Table A1) reject nonstationarity.

income and wealth effects from assets. Therefore, we focus more on β_1 and β_2.

$$\ln c_{st} = \beta_1 \ln y_{st} + \beta_2 \ln h_{st} + \beta_3 \ln a_{st} + \alpha_s + q_t + \epsilon_{st} \tag{1}$$

Household-level Analysis

To enhance the analysis conducted at the state level, this study broadens its perspective by integrating household-level data sourced from the U.S. Consumer Expenditure Survey (CE), conducted by the Bureau of Labor Statistics (BLS), available from 2013 to 2022. It is a comprehensive survey that collects data on spending patterns, income, assets and liabilities and demographic characteristics, covering approximately 7,000 to 8,000 households across all the U.S. states.

Understanding household spending, income, and wealth data obtained from the CE is key to the analysis. Concerning *spending* patterns, total consumption expenditure encompasses various elements: food expenditure (both home and away); housing-related expenditure (including mortgage payments/rent, property tax and insurance, utility charges, home repairs and home furnishing); transportation expenditure (both personal and public transportation; and maintenance expenses); healthcare expenditure; entertainment expenditure (including sport and other entertainment equipment, and entertainment services); and others (such as clothing, personal care and education, miscellaneous). Further analysis involves categorizing expenditure into distinct groups, namely (i) recreational expenditure (including vacation transportation and accommodation, entertainment, and personal care); (ii) automobile purchases; (iii) healthcare expenditure; (iv) home food expenditure; and (v) other expenditures (covering remaining categories). Regarding *income*, the analysis utilizes information on total income after tax; as well as income after tax—excluding transfers and income derived from assets such as dividend, interest, and rent. On *wealth*, variables of interest are housing value; saving; and other financial assets (such as stocks, mutual funds, bonds; retirement accounts, insurances). Other financial assets are examined both in gross and net terms (after deducting liabilities), with liabilities including credit card debt, student loans, and other loans excluding mortgage and lease. All nominal values are converted to 2017 real dollars using the PCE price index.

The baseline regression at the household level is specified as follows (Equation 2).

$$\ln C_{jt} = \alpha_j + \beta_1 \ln Y_{jt} + \beta_2 \ln H_{jt} + \boldsymbol{\beta_3} \ln \mathbf{I_{jt}} + \boldsymbol{\beta_4} \ln \mathbf{A_{jt}} + q_t + \epsilon_{jt} \tag{2}$$

where C represents consumption; Y is income after tax (excluding transfers and income from dividend, interest, and rent in some specifications); H denotes housing wealth; $\mathbf{I}$ represents a matrix of other income types excluded from Y in some specifications such as transfers and income from

dividend, (gross) interest, and rent; and $\mathbf{A}$ is a matrix of asset variables such as saving and other non-housing assets. Time fixed effects are also included.

Potential correlations between the explanatory variables and unobserved household factors may introduce bias into estimates of the relationship under investigation. Within a panel structure, this issue can be mitigated by employing within-household fixed effects to control for household-specific time-invariant heterogeneity. In the context of repeated cross-sectional data, such as the CE, constructing a cohort-based panel can be an effective strategy (Browning, Deaton and Irish (1985); Deaton (1985)). This involves grouping households into cohorts based on common characteristics that are likely to remain stable over time (or characteristics from which heterogeneous effects could arise) and transforming the pooled cross-sectional data into pseudo panel data comprising cohort means.[3] In this household-level analysis, households are assigned to a specific cohort based on year of birth, gender, and education of the reference person, as well as home-ownership status. In Equation 2, denoting j as the cohort, all variables represent the average values among households in cohort j.

In addition, consumption responses tend to differ across income and wealth distribution owing to different consumption behavior influenced by liquidity constraints. Many studies accommodate such heterogeneity by estimating elasticity across wealth quantiles (as demonstrated, for instance, by Johnson, Parker and Souleles (2006), Kaplan, Violante and Weidner (2014), Carroll et al. (2017), and Fisher et al. (2020)).[4] In our analysis, recognizing the likely incomplete information on household wealth from the CE, we account for the heterogeneity arising from diverse budget constraints among households by allowing the elasticity of consumption with respect to income and housing wealth to vary across households with different home-ownership statuses, as outlined in the following specification.

$$\ln C_{jt} = \alpha_j + \beta_{1d}\mathbf{D}\ln Y_{jt} + \beta_{2d}\mathbf{D}\ln H_{jt} + \beta_{\mathbf{3}}\ln \mathbf{I_{jt}} + \beta_{\mathbf{4}}\ln \mathbf{A_{jt}} + q_t + \epsilon_{jt} \tag{3}$$

where $\mathbf{D}$ denotes household groups by home-ownership status.

Similar to the state-level analysis, β_1 and β_2 in Equation 2 and 3 measure the elasticity of consumption with respect to income and housing wealth, and are the main focus of our analysis.

[3] In pseudo panel data, fixed effect estimates can then be used to control for both observed and unobserved time invariant characteristics that may be correlated with the outcome and explanatory variables.

[4] While wealth and income typically exhibit a strong correlation (controlling for age), wealth reflects permanent income and demonstrates less volatility than income, rendering it a preferred variable.

Complementarity between State- and Household-level Analyses

Utilizing both state- and household-level data provides complementary insights into understanding consumption in the U.S. during the recovery from the pandemic. State-level data—thanks to the timeliness in the data release—gives us the latest observations on consumption, income, and wealth. Moreover, the state-level variables are not self-reported, hence, they are less prone to measurement errors that are inherently present in survey data. On the other hand, household-level data provides detailed information about individual households, allowing a more granular and differentiated analysis of consumption behavior. For example, it enables the examination of variations in consumption responses within and across household groups based on their budget constraints and other demographic characteristics. This approach also captures the heterogeneity in consumption behavior across households that exists within states and allows for the control of individual-level factors that may influence consumption responses. Nonetheless, household-level data is likely subject to measurement errors including recall bias in reporting expenditures as well as under-reporting and non-response bias particularly in reporting of income, assets, and liabilities.[5] It is crucial also to highlight that our estimated elasticities, derived from both state- and household-level data, represent conditional correlations (contingent upon wealth and transfers) rather than causal effects of income shocks on consumption. Furthermore, we illustrate how these conditional correlations have shifted before and after the COVID-19 pandemic.

5 State-Level Results

We present two sets of results on the elasticities of consumption to income and housing wealth at state-level in this section. The first part shows the baseline regression as in Equation 1 and variations of it with different samples, income components breakdowns, and additional control variables. The second part presents time-varying estimates based on the post-COVID period to explore whether the elasticities differ in the recent quarters relative to the past.

Table 1 presents the regression results in Equation 1 for different samples and variations of specifications. The first column reports the estimates for the pre-COVID sample 1990Q1–2019Q4. The panel regression with state and quarter fixed effects yields an estimate of 0.5 elasticity of consumption for non-asset income and 0.06 for housing wealth (although it is not significant). To put the magnitude in the context of marginal propensity to consume (MPC), this is equivalent to an MPC of 50 cents on one dollar increase in non-asset income and 3 cents on one dollar increase in housing wealth. The MPCs are broadly in line with the literature, for instance, Mian, Rao and Sufi (2013) and Guren et al. (2021) on housing MPC, Broda and Parker (2014) on government transfer MPC, Caceres

[5]The BLS explicitly indicates that, within the CE, the reliability of data pertaining to income, assets, and liabilities is not as robust as that of expenditure data.

Table 1: State-level Results

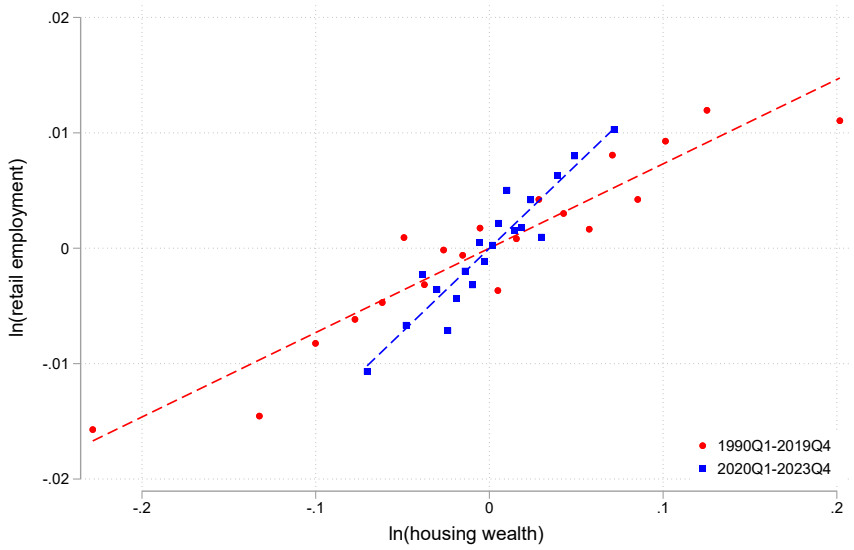
	(1)	(2)	(3)	(4)	(5)
Income (non-asset)	0.5094***	0.0047	-0.0326		
	(0.111)	(0.052)	(0.057)		
Wage				0.2731***	0.5529***
				(0.074)	(0.086)
Asset-based income (dividend/interest/rent)	0.1688**	0.0933*	0.0369	0.0493	0.1571**
	(0.068)	(0.052)	(0.057)	(0.056)	(0.067)
Income other than wage and dividend/interest/rent				-0.0599**	-0.0657***
				(0.023)	(0.011)
Cumulative income since COVID, 1-quarter lag			0.2930**	0.0999	0.0948
			(0.129)	(0.139)	(0.069)
Housing wealth	0.0588	0.1463***	0.1352***	0.0887***	0.0861***
	(0.041)	(0.019)	(0.018)	(0.018)	(0.017)
Mobility, retail/transit/work		0.0006***	0.0007***	0.0006***	0.0014***
		(0.000)	(0.000)	(0.000)	(0.000)
Federal Funds Rate					-0.0076***
					(0.002)
Global supply chain pressure index					-0.0072***
					(0.001)
Observations	6,120	816	816	816	816
Quarter FE	Y	Y	Y	Y	N but detrended
State FE	Y	Y	Y	Y	Y
Sample	90Q1-19Q4	20Q1-23Q4	20Q1-23Q4	20Q1-23Q4	20Q1-23Q4
Within R-squared	0.663	0.176	0.189	0.270	0.654

Note: This table reports the state-level panel regressions of retail employment (in logarithm) on income variables and housing wealth (in logarithm) and other control variables. Column (1) is the sample from 1990Q1 to 2019Q4, column (2) is the sample from 2020Q1 to 2023Q4, column (3) adds lagged cumulative income since COVID, column (4) separates wage out from other income, and column (5) drops quarter fixed effects but explicitly controls for Federal Funds Rate and supply disruptions. Standard errors are clustered at state level. *, ** and *** represent significance level at 10, 5 and 1%, respectively.

(2019) on income and wealth MPCs.

The second column of Table 1 shows the baseline regression on the 2020Q1–2023Q4 sample. Given that lockdowns during the pandemic exogenously constrained consumption, we control for this effect by adding the state-level Google mobility index. Limiting the sample to 2020Q1 onwards yields a larger elasticity of housing wealth, which almost doubles that in pre-COVID period. The difference in elasticity can be visualized in Figure 5, where the binscatter plots the relationship between housing wealth and consumption (proxied by retail employment). The slope steepens since COVID, and the dots lie close to the fitted line indicating small standard errors in the estimation. This increase in elasticity from housing wealth occurred at the same time as housing prices surged, partly due to the shift to working from home (e.g., Gamber, Graham and Yadav (2023)). If consumption response to housing wealth is nonlinear—for instance, if households face borrowing constraints (Carroll (2001))—then the housing wealth MPC can rise discretely when housing wealth surpasses certain threshold.

Figure 5: Elasticity of Consumption to Housing Wealth



Note: This chart shows the binscatter plot of retail employment and housing wealth, both in logarithm and residualized by regressing on the logarithm of asset-based income and non-asset income, state and quarter fixed effects. The red dots are based on pre-COVID sample (1990Q1 to 2019Q4), and the blue squares are based on the period since COVID (2020Q1 to 2023Q4).

As the second column shows a non-significant elasticity for non-asset income, we try to explore it more in the third and fourth columns. During the early phase of the pandemic, households accumulated large amount of excess savings (e.g., Abdelrahman and Oliveira (2023*b*)) as a result of fiscal stimulus programs and the lack of spending opportunities due to lockdowns. In the reopening

period, these unspent money can lead to pent-up demand. In the absence of timely household savings measure at state-level, we use the cumulative income since 2020Q1 as a proxy—not a perfect measure of savings which requires subtracting consumption from income—for savings. The third column shows that the elasticity from savings is significant, and the magnitude is of economic significance, even higher than that of the non-asset during pre-COVID period.

To unpack income, we separate one of the most important income source—wage income—to see if it shows significant elasticity. The fourth column presents that the elasticity from wage is about 0.3, which translate to an MPC of about 40 cents on one dollar wage increase. In contrast, the elasticity of other non-asset income is negative, possibly due to reverse causality from government transfers, which lead lower-income households who can't spend more to receive more government support.

The last column explicitly examines the role of national-level factors—i.e., monetary policy and supply disruptions—on consumption. To do so, we drop the quarter fixed effects and include Federal Funds Rate and the global supply chain pressure index. As expected, the hiking of Federal Funds Rate discourages consumption, and the supply disruptions constrains consumption. Although the coefficient of Federal Funds Rate is not large, it doesn't mean the impact from monetary tightening is negligible as its impact could have been captured by other channels such as income.

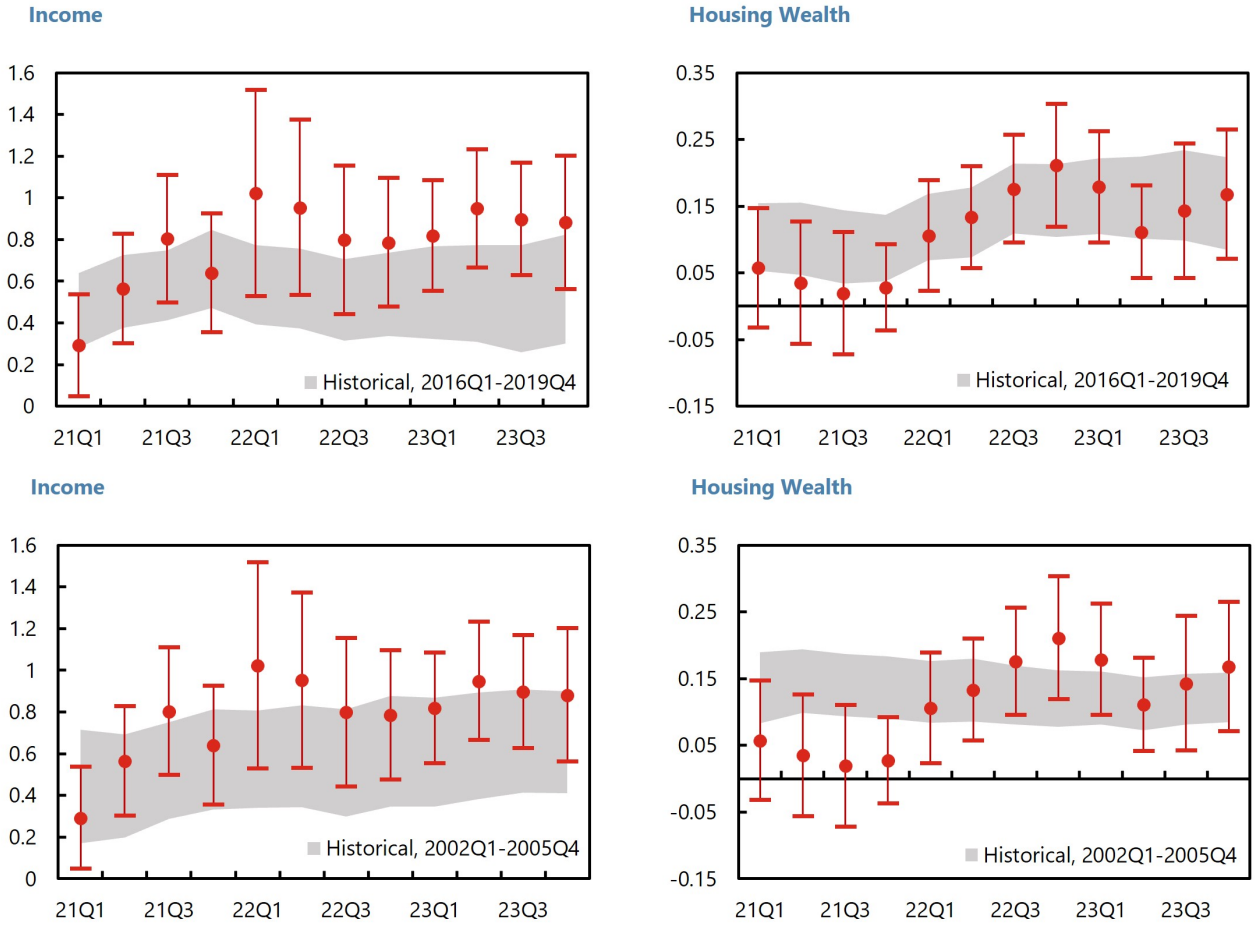
As a robustness check to the approach of combining the elasticity of retail employment to income and wealth with the elasticity of real consumption to retail employment, we also impute real consumption and use the imputed values directly in the regressions. The imputation is based on the relationship between real consumption and retail employment from 2008 to 2022, when real consumption at state-level is available (annually). Time trend T_t is used instead of yearly dummy, because we need to do out-of-sample imputation for 2023. The elasticities using imputed real consumption are similar to the baseline.

$$\ln(\textit{real consumption})_{st} = \gamma \ln(\textit{retail employment})_{st} + \lambda T_t + \alpha_s + \epsilon_{st} \tag{4}$$

We summarize the baseline state-level regression results using this alternative construction of imputed consumption in Table A2 in the Appendix. The results are robust and similar to the baseline ones.

To fully utilize the timeliness of the state-level data, we estimate the elasticity quarter-by-quarter. For each quarter t and each variable, we take the log difference of the cumulative value up to t relative to 2019Q4, and regress the log difference of retail employment $\Delta \ln c_{st}^{19Q4}$ on that of income $\Delta \ln y_{st}^{19Q4}$ and housing wealth $\Delta \ln h_{st}^{19Q4}$ (Equation 5). This specification explores the across-state variation of the cumulative change up to quarter t relative to pre-COVID level. As shown in Table 1, excess saving during COVID plays an important role in supporting consumption, by using cumulative changes, we can implicitly take account of the impact from excess saving (which is essentially part of

Figure 6: Elasticity of Real Consumption to Income and Wealth



Note: The whiskers plot the coefficients (with 90% confidence band) of income and housing wealth when regressing retail employment on income and housing wealth (all in logarithm and as deviation to 2019Q4) quarter-by-quarter using state-level data. The coefficients can be interpreted as the percent increase in retail employment associated with 1 percentage point increase in income or wealth. The shaded area represents the 90% confidence band of the coefficients of income and housing wealth when running the same regression on the pre-COVID sample (2016Q1 to 2019Q4 as deviation from 2015Q4) and the recovery periods after the 2001 recession (2002Q1 to 2005Q4 as deviation from 2001Q1).

the income in quarters prior to t). For comparison, we also run a similar regression for pre-COVID sample (2016Q1 to 2019Q4, as deviation from 2015Q4) and the recovery periods from the 2001 recession (2002Q1 to 2005Q4, as deviation from 2001Q1). We didn't choose GFC recovery as it is known more as a demand-driven recession which is different from the COVID recession.

$$\Delta \ln c_{st}^{19Q4} = \gamma_1 \Delta \ln y_{st}^{19Q4} + \gamma_2 \Delta \ln h_{st}^{19Q4} + \alpha + \epsilon_{st}^{19Q4}, \quad \text{for each quarter } t \text{ starting from 21Q1} \quad (5)$$

Figure 6 presents the time-varying estimates of the elasticities from income and housing wealth. For income, at the beginning of the reopening (2021Q1), the elasticity is relatively lower, partly due to the lingering caution in outdoor activities. As pandemic situation improved, the elasticity recovered. For housing wealth, prior to 2022Q2, the elasticity is about at par with pre-COVID level. However, since the second half of 2022, there are several quarters where the elasticity remains notably higher than pre-COVID level and post-2001-recession level. This aligns with Table 1 and indicates that the elasticity of housing wealth turns higher after COVID relative than before.

6 Household-Level Results

In the household-level analysis, three sets of results on the elasticities of consumption with respect to income and housing wealth are presented. The first set comprises the baseline regression as in Equation 2, along with its variations with different samples spanning various time periods and different income breakdowns. The second set of results originates from the regression accommodating different elasticities across household groups as illustrated in Equation 3. The final set of results delineates estimated consumption responses across various categories of consumption expenditure.

Baseline Results

Regression results of Equation 2 are presented in Table 2. The first four columns display estimations where all income types are grouped into one category termed total income after tax, and the time coverage encompassing the total duration as well as being divided into pre-, during- and post-COVID periods. The estimated consumption elasticity is approximately 0.3 for income after tax and ranges from 0.1 to 0.15 for housing wealth, with the latter being higher for the post-COVID period. Meanwhile, the estimated elasticities concerning savings and stock holdings is relatively modest and not consistently statistically significant. The estimated elasticities with respect to income align closely with findings from existing studies on the U.S. using micro-level data (for instance, Carroll et al. (2017); Caceres (2019); Fisher et al. (2020); Cho, Morley and Singh (2024)). However, the estimated housing wealth MPCs are significantly higher than the literature (for instance, Caceres (2019)) particularly for the COVID and post-COVID period.

The final three columns of Table 2 present baseline regression results when income is divided into non-asset income after tax (excluding transfers, dividend, rent, and interest), current transfers, and income from assets. To capture the role of excess saving during the pandemic on consumption, cumulative saving since 2020Q1 is introduced into the regression.[6] Elasticities with respect to non-asset income exhibit a slight decrease compared to those of total income, whereas those with respect

[6]For the pre-COVID period, this variable is proxied by the cumulative savings over the preceding 8 quarters up to the current period.

to housing wealth increase slightly further for the post-COVID period. Current transfers appear to be positively correlated with consumption, except during the COVID period when households received more transfers but significantly curtailed consumption due to restricted mobility measures. The elasticity derived from cumulative saving is small and not statistically significant during the pre-COVID period, but becomes more substantial and statistically significant since the onset of the COVID period.

Table 2: Household-level Results: Baseline

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Consumption expenditure; log						
Income after tax; log	0.345***	0.339***	0.340***	0.352***			
	(0.009)	(0.012)	(0.025)	(0.013)			
Income after tax excl. transfers/ dividend/ interest/rent; log					0.300***	0.351***	0.335***
					(0.016)	(0.037)	(0.021)
Home value; log	0.100***	0.096***	0.129***	0.153***	0.094***	0.135***	0.180***
	(0.006)	(0.006)	(0.020)	(0.018)	(0.009)	(0.024)	(0.013)
Savings; log	0.003***	0.004***	0.002	0.002***	0.003***	0.001	0.002**
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Stocks; log	0.003***	0.003***	0.002	0.002	0.002***	0.002	0.002
	(0.000)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
1{Zero current transfers}					0.030***	-0.008	0.026
					(0.009)	(0.029)	(0.018)
Current transfer; log					0.006***	-0.001	0.005*
					(0.002)	(0.005)	(0.003)
Dividend/interest/rent; log					0.018***	0.013***	0.012***
					(0.001)	(0.003)	(0.002)
L.Cumulative saving since Covid; log					0.004	0.024**	0.052***
					(0.003)	(0.009)	(0.011)
Cohort and time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	Pre-COVID	COVID	Post-COVID	Pre-COVID	COVID	Post-COVID
Observations	45788	32819	4304	8665	17094	2423	4995
R2	0.757	0.767	0.847	0.816	0.805	0.871	0.839

Note: 1/ * p<0.1; ** p<0.05; and *** p<0.01.
2/ Household characteristics included.
3/ Pre-COVID sample: 2013Q1-2019Q4; COVID sample: 2020Q1-2021Q1; Post-COVID sample: 2021Q2-2022Q4.
4/ Robust standard errors in parentheses.

Heterogeneity across Household Groups

Table 3 presents the regression results from Equation 3 where elasticities are allowed to vary across different household groups identified by their home-ownership status, namely homeowners with and without mortgage, renters, and occupants without rental payment. These homeowner statuses are proxies for wealth and/or budget constraints that could influence consumption behavior.

The first three columns of Table 3 display the results of heterogeneous elasticities when all income types are aggregated into a single group. Income elasticities become higher for homeowners and renters hovering around 0.4 (with a marginal increase in the post-COVID period), whereas for occupants without rental payments, their income elasticities decline significantly and are the lowest

and statistically insignificant. Meanwhile, housing wealth elasticities are found to be higher for homeowners with mortgage at about 0.2, but the post-COVID increases in these elasticities are more pronounced for homeowners without mortgage, nearly doubling from 0.07 to 0.13, suggesting a larger role of housing wealth among the less constrained households. Results remain robust to using non-asset income as the main income measure (as presented in the last three columns of Table 3. This evidence suggests that, as more income and housing wealth accumulated among the better-off households (those less constrained by budget limitations) and their elasticities tend to increase post-COVID, their contributions to overall consumption growth is potentially large. Furthermore, elasticities with respect to cumulative savings also experience a rise post-COVID especially for homeowners followed by renters.

Table 3: Household-level Results: Household Groups

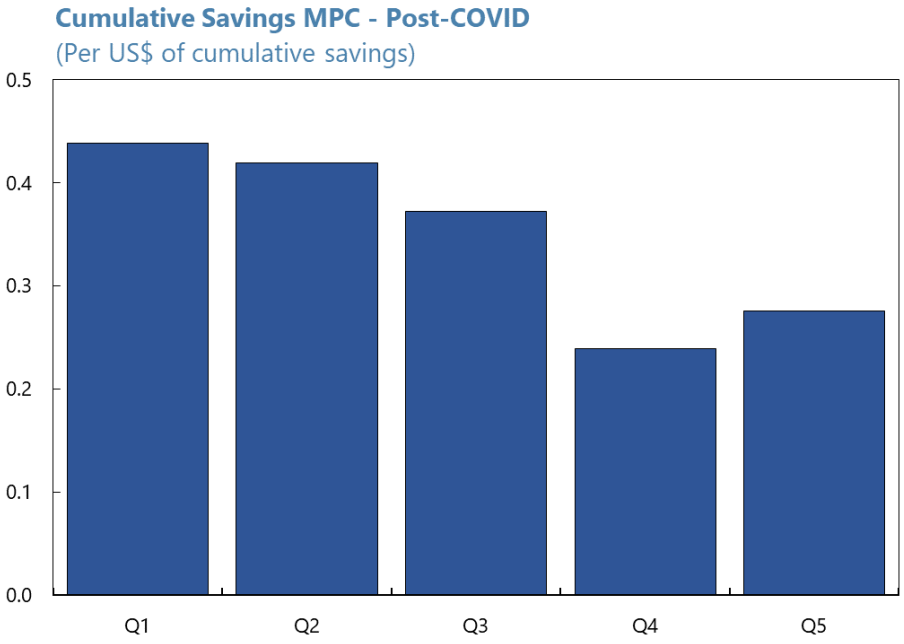
	(1)	(2)	(3)	(4)	(5)	(6)
	Consumption expenditure; log					
Income after tax; log #						
Homeowner w/ mortgage	0.392***	0.450***	0.393***			
	(0.020)	(0.041)	(0.022)			
Homeowner w/o mortgage	0.424***	0.382***	0.441***			
	(0.017)	(0.057)	(0.024)			
Renter	0.429***	0.443***	0.443***			
	(0.039)	(0.048)	(0.023)			
Occupant w/o rent payment	0.363***	0.574***	0.069			
	(0.077)	(0.098)	(0.055)			
Income after tax excl. transfers and dividend/interest/rent; log #						
Homeowner w/ mortgage				0.325***	0.409***	0.358***
				(0.024)	(0.039)	(0.022)
Homeowner w/o mortgage				0.286***	0.335***	0.317***
				(0.023)	(0.057)	(0.037)
Renter				0.348***	0.340***	0.367***
				(0.034)	(0.062)	(0.025)
Occupant w/o rent payment				0.172***	0.333***	0.089
				(0.024)	(0.071)	(0.063)
Home value; log #						
Homeowner w/ mortgage	0.166***	0.176***	0.214***	0.160***	0.173***	0.209***
	(0.011)	(0.031)	(0.019)	(0.011)	(0.031)	(0.020)
Homeowner w/o mortgage	0.072***	0.114***	0.149***	0.076***	0.117***	0.161***
	(0.008)	(0.028)	(0.018)	(0.009)	(0.029)	(0.018)
L.Cumulative implied saving since COVID; log #						
Homeowner w/ mortgage	0.011***	0.035***	0.056***	0.012***	0.029***	0.052***
	(0.004)	(0.010)	(0.015)	(0.004)	(0.009)	(0.015)
Homeowner w/o mortgage	0.006	0.039***	0.107***	0.008	0.033***	0.095***
	(0.005)	(0.010)	(0.018)	(0.005)	(0.010)	(0.018)
Renter	-0.006	0.042***	0.039***	-0.005	0.035***	0.034**
	(0.006)	(0.010)	(0.014)	(0.006)	(0.010)	(0.014)
Occupant w/o rent payment	-0.020	0.045*	0.119*	-0.010	0.031	0.112
	(0.043)	(0.025)	(0.070)	(0.041)	(0.023)	(0.071)
Cohort and time FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Pre-COVID	COVID	Post-COVID	Pre-COVID	COVID	Post-COVID
Observations	17094	2423	4995	17094	2423	4995
R2	0.817	0.876	0.847	0.808	0.872	0.841

Note: 1/ * p<0.1; ** p<0.05; and *** p<0.01.
2/ Household characteristics included.
3/ Pre-COVID sample: 2013Q1-2019Q4; COVID sample: 2020Q1-2021Q1; Post-COVID sample: 2021Q2-2022Q4.
4/ Robust standard errors in parentheses.

Taking a closer look at the cumulative savings since COVID, we conduct separate estimations of the baseline regression (Equation 2) for households across five different income quintiles. MPCs

are then derived by multiplying the estimated elasticities with the consumption to savings ratio of each household quintile. Notably, the saving MPCs are highest among households at the lower end of the income distribution, suggesting a faster depletion of excess savings amassed since COVID (Figure 7). On average, low-income households spend approximately 40-45 cents for every dollar increase in cumulative savings, in contrast to a response of about 20-25 cents for the top 40 percent of households by income.

Figure 7: Saving MPCs by Income Quintiles



Heterogeneous Consumption Responses across Expenditure Categories

Examining consumption responses by spending categories alongside total consumption is crucial, especially for the post-COVID period, given the substantial shifts in consumer behavior, including changes in spending priorities and preferences. In this analysis, consumption expenditures are divided into five non-overlapping groups: recreational expenditure; automobile purchase; healthcare; home food; and others. Regression results for these spending categories are presented in Table 4, covering pre- and post-COVID periods.

There are considerable variations in income elasticities across different spending categories. Higher elasticities are evident for recreation, automobile, and healthcare spending, while home food exhibits relatively lower elasticities. The income elasticities for other spending categories closely align with

the pooled estimates. The pattern of higher income elasticities among homeowners and renters persists across all spending categories, except for home food, where occupants without rental payment exhibit the highest elasticities. This discrepancy is likely due to lower-income and budget constrained households allocating a larger proportion of their income to essential goods like food. Given the necessity of these items, any additional income received will likely be immediately spent on essential needs, leading to slightly higher elasticities among budget constrained households. Conversely, greater income enables wealthier households to dedicate a larger share of their earnings to discretionary spending on recreational items, resulting in higher income elasticities. Furthermore, the rise in income elasticities post-COVID is particularly pronounced for recreation expenditures, with noticeable increases observed across all household groups.

Housing wealth and excess saving elasticities are also particularly high for recreational spending. These significant elasticities primarily stem from homeowners without mortgage. For example, post-COVID elasticities for recreational spending among homeowners without mortgage are estimated at 0.3 with respect to housing wealth and approximately 0.2 with respect to excess saving. This finding indicates that affluent households allocate a greater portion of their resources to recreational spending, driven by their growing income as well as housing value and past excess saving.

Table 4: Household-level Results: Spending Categories

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Recreation; log		Auto purchase; log		Health; log		Home food; log		Others; log	
Income after tax excl. transfers and dividend/interest/rent; log #										
Homeowner w/ mortgage	0.534***	0.655***	0.690***	0.518**	0.482***	0.368***	0.130***	0.094***	0.340***	0.387***
	(0.050)	(0.073)	(0.108)	(0.206)	(0.062)	(0.102)	(0.016)	(0.029)	(0.025)	(0.023)
Homeowner w/o mortgage	0.453***	0.653***	0.699***	0.834***	0.407***	0.547***	0.079***	0.085***	0.314***	0.358***
	(0.041)	(0.080)	(0.086)	(0.171)	(0.047)	(0.067)	(0.019)	(0.020)	(0.025)	(0.046)
Renter	0.561***	0.762***	0.698***	0.673***	0.497***	0.685***	0.194***	0.140***	0.376***	0.393***
	(0.052)	(0.104)	(0.088)	(0.187)	(0.063)	(0.117)	(0.034)	(0.026)	(0.034)	(0.026)
Occupant w/o rent payment	0.221***	0.423***	0.430***	0.173	0.286***	0.235	0.156***	0.248*	0.191***	0.065
	(0.059)	(0.157)	(0.059)	(0.154)	(0.058)	(0.183)	(0.046)	(0.129)	(0.031)	(0.094)
Home value; log #										
Homeowner w/ mortgage	0.208***	0.214***	-0.191*	-0.098	-0.103**	0.159**	0.078***	0.087***	0.198***	0.245***
	(0.051)	(0.074)	(0.098)	(0.169)	(0.050)	(0.077)	(0.013)	(0.024)	(0.013)	(0.021)
Homeowner w/o mortgage	0.177***	0.328***	0.032	-0.271*	0.147***	0.076	0.072***	0.100***	0.086***	0.184***
	(0.029)	(0.078)	(0.051)	(0.159)	(0.033)	(0.092)	(0.021)	(0.023)	(0.010)	(0.020)
L.Cumulative implied saving since COVID; log #										
Homeowner w/ mortgage	0.019	0.151***	0.023	0.327**	0.006	0.057	0.010**	0.000	0.012**	0.039**
	(0.014)	(0.048)	(0.034)	(0.150)	(0.018)	(0.045)	(0.005)	(0.017)	(0.005)	(0.015)
Homeowner w/o mortgage	-0.002	0.175***	-0.064	0.138	0.019	0.116***	0.003	0.043***	0.012**	0.076***
	(0.014)	(0.049)	(0.046)	(0.142)	(0.014)	(0.040)	(0.005)	(0.015)	(0.006)	(0.020)
Renter	-0.019	0.062	-0.048	0.171	-0.035**	0.104	-0.003	0.016	-0.003	0.039***
	(0.012)	(0.047)	(0.031)	(0.121)	(0.017)	(0.067)	(0.007)	(0.016)	(0.006)	(0.011)
Occupant w/o rent payment	0.194	0.051	0.043	-0.258	0.157	-0.023	-0.042	0.540***	-0.018	0.051
	(0.159)	(0.218)	(0.198)	(0.277)	(0.177)	(0.226)	(0.077)	(0.177)	(0.051)	(0.090)
Cohort and time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Pre-COVID	Post-COVID	Pre-COVID	Post-COVID	Pre-COVID	Post-COVID	Pre-COVID	Post-COVID	Pre-COVID	Post-COVID
Observations	17094	4995	17094	4995	17094	4995	17094	4995	17094	4995
R2	0.586	0.605	0.447	0.485	0.551	0.616	0.538	0.624	0.814	0.844

Note: 1/ * p<0.1; ** p<0.05; and *** p<0.01.
2/ Household characteristics included.
3/ Pre-COVID sample: 2013Q1-2019Q4; COVID sample: 2020Q1-2021Q1; Post-COVID sample: 2021Q2-2022Q4.
4/ Robust standard errors in parentheses.

Other Robustness Checks

These results are consistent when additional variables beyond income, housing wealth, and saving are incorporated into the regressions.

First, controlling for other financial assets, both gross and net of liabilities, helps ensure that the estimated housing wealth elasticities are not confounded by factors associated with non-housing wealth, as these variables often exhibit high correlation. These results are presented in Table A3 in the Appendix. The inclusion of other financial assets does not change the housing wealth elasticities, and the elasticities with respect to other financial assets are notably small. Two possible interpretations arise from these results: firstly, the observed housing wealth elasticities represent the genuine effect; or secondly, they still reflect a blend of housing and non-housing wealth effects (particularly if non-housing wealth is subject to notable measurement or reporting errors). Upon scrutinizing the data, it becomes evident that the correlations between housing and financial assets are weaker compared to those observed in the Survey of Consumer Finance, likely attributed to potential under-reported financial assets in the CE. While the latter possibility cannot be entirely ruled out, this adjustment represents the most comprehensive control possible within the household-level framework.

Second, we control for other variables that could affect consumption and wealth simultaneously such as fixed rate mortgage and student loans. The results remain robust, with households with fixed rate mortgage consuming slightly more (Table A4 in the Appendix). However, the coefficients become insignificant during the post-COVID period and in the specifications with controls on cumulative saving. Additionally, there was no statistically significant relationship between consumption and households with student loans. While this could potentially imply a very small impact of student loan debt relief on consumption, such results should be interpreted with cautions owing to underreporting of student loan status in the CE and/or nonlinear effects stemming from the amount of student loan debt held by individuals.

7 Putting It All Together

Using the estimated elasticities of consumption with respect to the main drivers we obtained from the household-level regressions, we now ask the question of how much of the aggregate consumption growth can be explained by underlying drivers identified in the micro analysis. In the following, we apply the estimated coefficients from our baseline household-level regressions in the last three columns of Table 2 to the corresponding change in the respective macro-level variables: after-tax wages and salary income, current transfers, dividend/interest and rental income, and excess pandemic saving drawdowns. Macro data are mainly taken from the BEA and Federal Reserve Board, and deflated with the PCE price index. We compare the predicted contribution of each driver using the pre-COVID estimates of consumption elasticities and compare them to those using post-COVID estimates, so as to gauge the magnitude of the change in household behavior.

Figure 8 plots the estimated contributions of each driver to aggregate consumption growth, using

the pre-COVID estimates of consumption elasticities (upper panel chart in Figure 8), compared to those using post-COVID estimated elasticities (lower panel chart in Figure 8). The actual and predicted change in real consumption is expressed in terms of percent deviation from 2019Q4 level. At the trough during the COVID lockdown in 2020Q2, consumption was 10 percent below the 2019Q4 level, with the loss in real incomes explaining only a small share of the contraction. The bulk of the consumption decline is, as expected, accounted for by the residual, as mobility restrictions, lockdowns and pandemic-induced supply shocks severely constrained consumption and economic activity far beyond the loss in income.

As the economy re-opened and supply restrictions eased, we see the residual narrowing and disappearing by the second half of 2022 (in the lower panel). At the same time, consumption sharply recovered and continued growing at an accelerated pace in recent quarters. By the end of 2022, aggregate consumption was already around 7 percent above the pre-pandemic level, of which 4.6 percent can be explained by the rise in housing wealth as estimated using the post-COVID household-level data (blue bar of the lower panel). A smaller portion of about 1.6 percent increase in consumption can be explained by higher real household incomes (red bar). The remaining 1.1 percent of consumption increase in 2022Q4 can be explained by the drawdown of excess savings from the pandemic (yellow bar). Throughout 2023, consumption continued to grow, even picking up in pace. By the end of 2023, the additional increase in consumption relative to the year prior can be partly explained by higher real incomes (by $2.7 - 1.6 = 1.1$ percent) as wage growth outstripped inflation, and by a lesser increment in housing wealth (contributing an additional $5.2 - 4.6 = 0.6$ percent growth). Excess saving drawdown, on the other hand, slowed down quite notably, as more households exhaust their pandemic savings, contributing only 0.5 percent of consumption growth relative to end-2019, almost a percentage point less than the peak contribution of saving draw-down in 2022Q2. One fifth of the consumption growth in 2023Q4 relative to 2019Q4 remains unexplained (grey bar).

Compared with the decomposition using pre-COVID elasticities (upper panel of Figure 8), the contribution of housing wealth is roughly double as strong when we apply post-COVID elasticities. This differential highlights the increased role that household wealth has been playing during this cycle. Not only has wealth, in particular housing wealth, risen strongly and fueled wealthy households' consumption, but the propensity to consume out of a given increase in wealth has almost doubled, reinforcing the contribution of wealth to consumption growth. The strong wealth effect on consumption is also consistent with a persistently low personal savings (which fell in 2023 as the stock market and housing valuation rose), as households consume more of their income when their net wealth is higher.

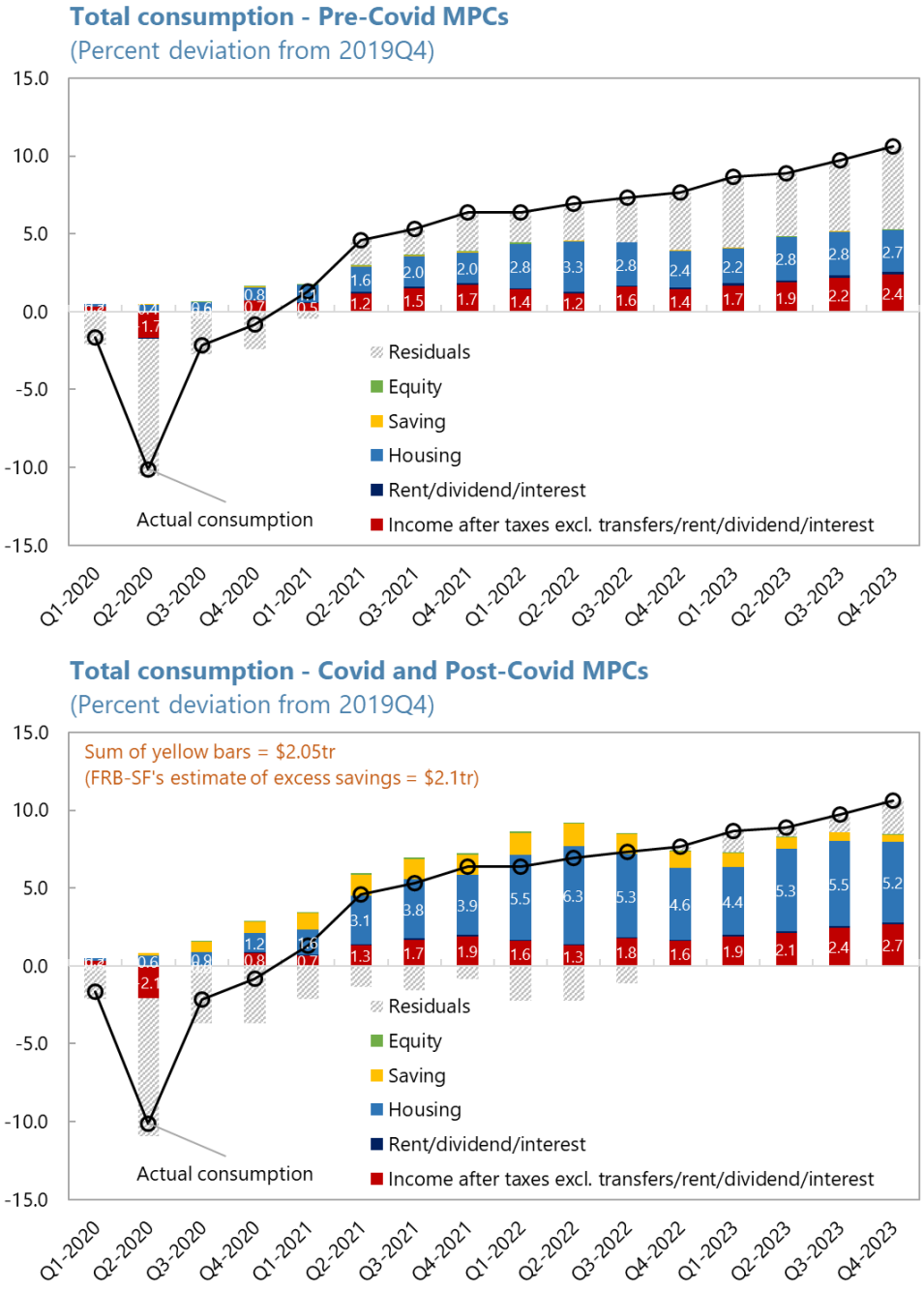
How do we assess the plausibility of our estimates and what are the main takeaways from the decomposition exercise? Applying our micro estimates of elasticities to macro data allows us to check

for some external validity. First, the contribution of excess saving to post-pandemic consumption, how do they compare with independent estimates of excess saving dynamics? We can compare the cumulative draw-down of excess saving implied by our estimates by summing the yellow bars over the sample period. This sum is equivalent to about 2 Trn Dollar (in nominal terms), very close to Abdelrahman and Oliveira (2023*a*)'s estimate of 2.1 Trn Dollar over roughly the same period. Second, an analysis of residuals also allows for some external validity check: the implied residuals from the macro decomposition are by design not constrained to average to zero as the regression was run on separate micro data. However, the fact that residuals were largest and negative during the lockdown period, close to zero when consumption had staged a complete recovery, and positive but small in the latest quarter (2023Q4) when consumption was unusually strong (relative to market expectations) on balance convey that the resulting estimates are plausible. Note also that the consumption decomposition for 2023 is an out-of-sample prediction using micro-level estimates from 2021Q2-2022Q4, but is still able to statistically explain around 80 percent of observed aggregate consumption growth in 2023. This is yet another piece of external validity support for our exercise.

What is the main takeaway from the decomposition exercise? The most striking finding is the magnitude of the wealth effect. While media and policy commentary mainly focused on the vast pool of pandemic excess saving as the key factor fueling consumption, our results show that this source of consumption strength was most important in earlier quarters following the re-opening, while its relative contribution diminishes in 2022-2023, when housing wealth emerges as the main driver for consumption growth. Around half of the consumption increase in 2023Q4 relative to 2019Q4 can be explained by the rise in housing wealth and the higher propensity of home owners to consume out of this wealth.

Given the estimated housing consumption elasticity, a big part of the housing contribution is accounted for by the large rise in housing prices since the pandemic. But what lies behind the larger propensity to consume out of housing wealth in the post-pandemic period, a finding consistently uncovered in both the state-level and household-level analysis (and which accounts for the differences in blue bars in the upper and lower panels of Figure 8)? While a thorough study if this interesting question is left for future research, we can point to some possible factors supported by other studies. For one, housing wealth in recent years is found to be more wide-spread across different segments of the population thanks to larger shares of home ownership among the young, as documented by Kent and Ricketts (2024), likely raising consumption relative to an environment where housing wealth is more concentrated. Another reason could be that the estimated effect of housing wealth also reflect the impact of other non-housing wealth that is under-reported in survey data. It is well-known that financial wealth is heavily under-reported in survey data, more so than non-financial wealth such as housing. To the extent that non-housing financial wealth is correlated with housing wealth, the effect we are estimating could be capturing the impact of broader measures of wealth (from financial investment, business wealth etc). Data from the latest Survey of Consumer Finances show that

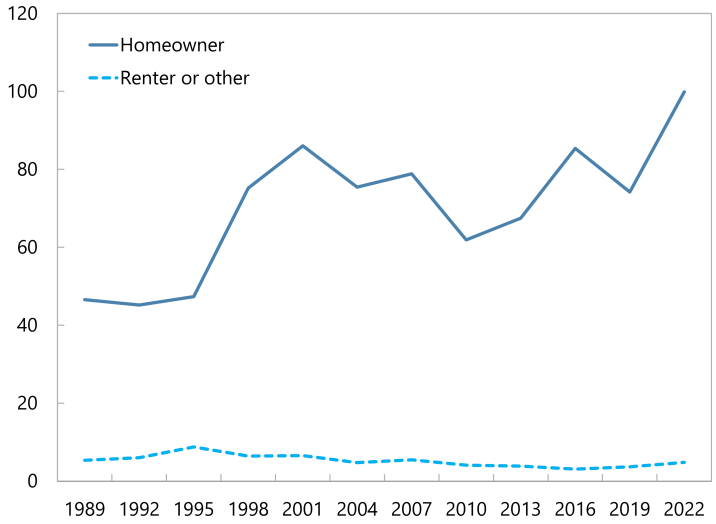
Figure 8: Consumption Decomposition: Contribution of Drivers



Sources: BEA; Federal Reserve Board; IMF staff calculations.

homeowners also own much larger levels of non-housing financial wealth, and that this wealth has been appreciating more strongly for homeowners, along with their rising housing wealth in recent years (Figure 9). Related to this distributional pattern, recent work by Aiello et al. (2023) show that cryptocurrency wealth is correlated with housing wealth at the individual- and county-level, and is associated with an MPC that is multiple times larger than historical MPC out of housing.

Figure 9: Financial Assets by Homeownership Status (Median, thousands of 2022 dollars)



Source: U.S. Survey of Consumer Finances.

8 Conclusion

In this paper, we use state-level and household-level data to quantify the most macro-relevant drivers of household consumption during the post-pandemic years. The common finding that emerged from the different levels of disaggregation is that housing wealth has become the most important driver of private consumption in recent years. This finding dovetails with the fact that it is households in the upper part of the income distribution that have been disproportionately contributing to the growth in overall consumption (Figure 3).

Going forward, what are the prospects for consumption to continue driving the U.S. GDP growth? Under the baseline assumption that disinflation continues, the labor market remains resilient and wage growth robust, growth in real incomes should continue supporting consumption. In addition, a lot depends on how household wealth evolves going forward. With household consumption now being more responsive to wealth changes, a continued housing price appreciation, as interest rates come down and more housing demand enters the market, can provide a continued tailwind to U.S.

consumption and growth. However, by the same token, any repricing of housing and other financial assets could also pose risks to a sharp retrenchment in household consumption.

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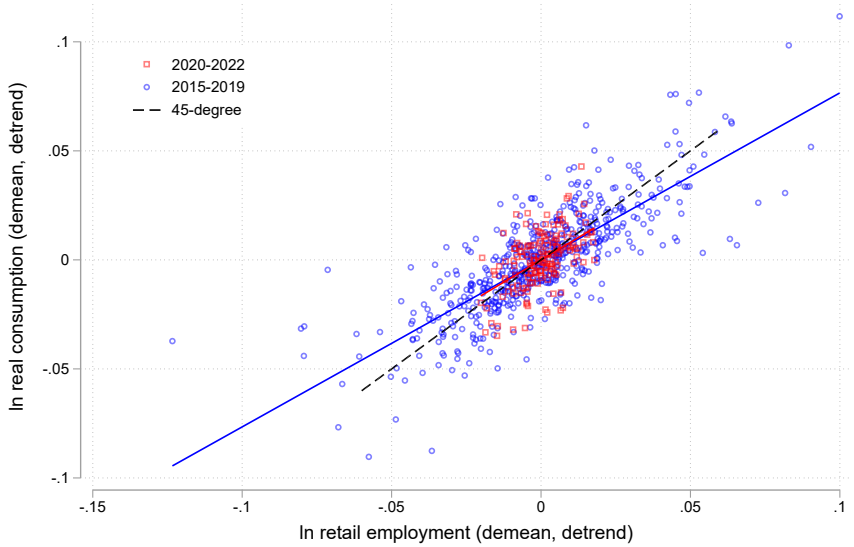
Appendix

Figure A1: Real Consumption and Retail Employment, pre- vs. post-COVID



Note: This chart shows the relationship between real consumption and retail employment for pre-COVID (blue squares) and post-COVID (red dots). Both variables are in logarithm, residualized by regressing on state and year fixed effects. The with-in R^2 for both regressions are around 0.95.

Table A1: Panel unit root test (H_0: panels contain unit roots; H_a: panels are stationary)

p-value	Pre-COVID	Post-COVID
Retail employment	0.0	0.0
Income	0.1	0.0
Wage	0.0	0.0
Dividend/interest/rent	0.0	0.0
Non-wage income	0.1	0.0
Housing wealth	0.0	0.0

Note: This table shows the panel unit root test (Levin–Lin–Chu) of the state-level variables (in logarithm and demeaned). P-value is reported.

Table A2: State-level Results Using Imputed Real Consumption

	(1)	(2)	(3)	(4)
Wage				0.1762***
				(0.048)
Asset-based income (dividend/interest/rent)	0.1089**	0.0602*	0.0238	0.0318
	(0.044)	(0.033)	(0.037)	(0.036)
Income other than dividend/interest/rent	0.3286***	0.0031	-0.0210	
	(0.072)	(0.034)	(0.037)	
Income other than wage and dividend/interest/rent				-0.0386**
				(0.015)
Housing wealth	0.0379	0.0944***	0.0872***	0.0572***
	(0.026)	(0.012)	(0.012)	(0.012)
Cumulative income since COVID, 1-quarter lag			0.1891**	0.0644
			(0.083)	(0.090)
Mobility, retail/transit/work		0.0004***	0.0005***	0.0004***
		(0.000)	(0.000)	(0.000)
Observations	6,120	816	816	816
Quarter FE	Y	Y	Y	Y
State FE	Y	Y	Y	Y
Sample	90Q1-19Q4	20Q1-23Q4	20Q1-23Q4	20Q1-23Q4
Within R-squared	0.663	0.176	0.189	0.270

Note: This table reports the state-level panel regression of real consumption (in logarithm, imputed by the historical relationship between real consumption and retail employment) on income variables and housing wealth (in logarithm) and other control variables. Column (1) is the sample from 1990Q1 to 2019Q4, column (2) is the sample from 2020Q1 to 2023Q4, column (3) adds lagged cumulative income since COVID, and column (4) separates wage out from other income. Standard errors are clustered at state level. *, ** and *** represent significance level at 10, 5 and 1%, respectively.

Table A3: Household-level Results: Robustness Checks - Other Financial Assets

	(1)	(2)	(3)	(4)	(5)	(6)
	Consumption expenditure; log					
Income after tax excl. transfers/ dividend/ interest/rent; log	0.299***	0.348***	0.335***	0.299***	0.350***	0.335***
	(0.016)	(0.037)	(0.021)	(0.016)	(0.037)	(0.021)
Home value; log	0.094***	0.136***	0.181***	0.094***	0.136***	0.180***
	(0.009)	(0.024)	(0.013)	(0.009)	(0.024)	(0.013)
Savings; log	0.002**	-0.002	0.002*	0.002***	-0.001	0.002*
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
1{Zero current transfers}	0.030***	-0.005	0.026	0.030***	-0.008	0.026
	(0.009)	(0.029)	(0.018)	(0.009)	(0.029)	(0.018)
Current transfer; log	0.006***	-0.000	0.005*	0.006***	-0.001	0.005*
	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)	(0.003)
Dividend/interest/rent; log	0.018***	0.012***	0.012***	0.018***	0.013***	0.012***
	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)
L.Cumulative saving since COVID; log	0.004	0.024**	0.052***	0.004	0.024**	0.052***
	(0.003)	(0.009)	(0.011)	(0.003)	(0.009)	(0.011)
Financial assets (excl. savings); log	0.002***	0.004***	0.001			
	(0.001)	(0.002)	(0.001)			
Net financial assets (excl. savings); log				0.002***	0.003**	0.001
				(0.001)	(0.001)	(0.001)
Cohort and time FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Pre-COVID	COVID	Post-COVID	Pre-COVID	COVID	Post-COVID
Observations	17094	2423	4995	17094	2423	4995
R2	0.805	0.872	0.839	0.805	0.871	0.839

Note: 1/ * p<0.1; ** p<0.05; and *** p<0.01.

2/ Household characteristics included.

3/ Pre-COVID sample: 2013Q1-2019Q4; COVID sample: 2020Q1-2021Q1; Post-COVID sample: 2021Q2-2022Q4.

4/ Robust standard errors in parentheses.

Table A4: Household-level Results: Robustness Checks - Fixed Rate Mortgage and Student Loans

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Consumption expenditure; log								
Income after tax excl. transfers/ dividend/interest/rent; log	0.300***	0.352***	0.335***	0.299***	0.349***	0.335***	0.299***	0.350***	0.335***
	(0.016)	(0.037)	(0.021)	(0.016)	(0.037)	(0.021)	(0.016)	(0.037)	(0.021)
Home value; log	0.094***	0.135***	0.180***	0.094***	0.136***	0.181***	0.094***	0.136***	0.181***
	(0.009)	(0.024)	(0.013)	(0.009)	(0.024)	(0.014)	(0.009)	(0.024)	(0.013)
Savings; log	0.003***	0.000	0.002**	0.002**	-0.002	0.002	0.002**	-0.001	0.002
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Stocks; log	0.002***	0.002	0.002						
	(0.001)	(0.002)	(0.001)						
1{Zero current transfers}	0.030***	-0.007	0.026	0.030***	-0.004	0.026	0.030***	-0.007	0.026
	(0.009)	(0.029)	(0.018)	(0.009)	(0.029)	(0.018)	(0.009)	(0.029)	(0.018)
Current transfer; log	0.006***	-0.000	0.005*	0.005***	-0.000	0.005*	0.006***	-0.000	0.005*
	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)	(0.003)
Dividend/interest/rent; log	0.018***	0.013***	0.012***	0.018***	0.012***	0.012***	0.018***	0.013***	0.012***
	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)
L.Cumulative saving since COVID; log	0.004	0.024***	0.052***	0.004	0.024***	0.052***	0.004	0.025***	0.052***
	(0.003)	(0.009)	(0.011)	(0.003)	(0.009)	(0.011)	(0.003)	(0.009)	(0.011)
Financial assets (excl. savings); log				0.002***	0.004***	0.001			
				(0.001)	(0.002)	(0.001)			
Net financial assets (excl. savings); log							0.002***	0.003**	0.001
							(0.001)	(0.001)	(0.001)
1{Fixed rate mortgage}	0.028	0.124*	-0.049	0.027	0.129*	-0.049	0.027	0.129*	-0.049
	(0.024)	(0.075)	(0.050)	(0.024)	(0.076)	(0.050)	(0.024)	(0.076)	(0.050)
1{Student loans}	0.038	0.064	-0.006	0.031	0.057	-0.007	0.046*	0.081	-0.001
	(0.026)	(0.055)	(0.042)	(0.026)	(0.054)	(0.042)	(0.026)	(0.055)	(0.042)
Cohort and time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Pre-COVID	COVID	Post-COVID	Pre-COVID	COVID	Post-COVID	Pre-COVID	COVID	Post-COVID
Observations	17094	2423	4995	17094	2423	4995	17094	2423	4995
R2	0.805	0.871	0.839	0.805	0.872	0.839	0.805	0.872	0.839

Note: 1/ * p<0.1; ** p<0.05; and *** p<0.01.

2/ Household characteristics included.

3/ Pre-COVID sample: 2013Q1-2019Q4; COVID sample: 2020Q1-2021Q1; Post-COVID sample: 2021Q2-2022Q4.

4/ Robust standard errors in parentheses.

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