Consumption Response to Anticipated Income Changes: Evidence from the Magnitude Effect

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Introduction

- Marginal propensity to consume (MPC) out of **anticipated income changes** is of interest to both policymakers and academics
- Previous evidence on the *Excess Sensitivity* based on the liquidity channel
  - Liquidity constrained $\Rightarrow$ Lack of liquid income sources $\Rightarrow$ Any (anticipated) changes in income $\Rightarrow$ Consumption
- How does it depend on the magnitude of anticipated income changes?
  - Only a few studies with very limited data studying **how the magnitude of income changes** affects the MPC differently

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This paper

- **Objectives**:
  - Examine the consumption dynamics out of anticipated income changes
  - Exploit **the MPC heterogeneity** along **different magnitudes**
  - Provide potential mechanisms behind the size-dependent MPC
- **What we do**:
  - Natural experiment: Quarter following the final car loan payment
  - Using a newly constructed rich dataset (at an individual level) and parametric regression analysis, **we empirically estimate**
    - the consumption path over time
    - the MPC heterogeneity out of different magnitudes
  - **Provide theoretical explanations** behind the magnitude effect
    - Compute the welfare cost using a sufficient statistic approach
  - **Conduct policy experiment** with a consideration of the size-effect

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Key Findings

1. **Does household consumption respond to anticipated income changes?**
   - **Yes, MPC** $\sim 18\%$
   - Consumption peaks upon the arrival of income changes
2. **If so, how does the response depend on the magnitude of income changes? and which households respond the most?**
   - **MPC monotonically decreases with the size of income changes**
3. **What is behind the MPC heterogeneity?**
   - Strong size effects regardless of liquidity constraints
   - Theoretical discussion:
     - Bounded rationality
       - Welfare cost from deviation is lower for smaller income changes
   - Policy implications: Considering the size effect helps us find the right consumption growth by more

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Contribution

- One of a few studies that examine how the size affects consumption responses
- Address the econometric challenges (clearly identified income and consumption)
- Newly constructed data with detailed information at an individual level
  - More than 70,000 observations
  - Able to exploit the MPC heterogeneity along a different dimension
- Provide theoretical discussion and policy implications with the magnitude effect

Related literature More

- Empirical evidence on excess sensitivity
  - Running out of mortgage payments, Alaska permanent dividends, and tax rebates (Agarwal, Liu, and Souleles, 2007; Hsieh, 2003; Scholnick, 2013)
- Theoretical model
  - Liquidity constraints (Baker et al., 2020; Campbell and Hercowitz, 2019)
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Consumption, anticipated income changes, and magnitudes

Data

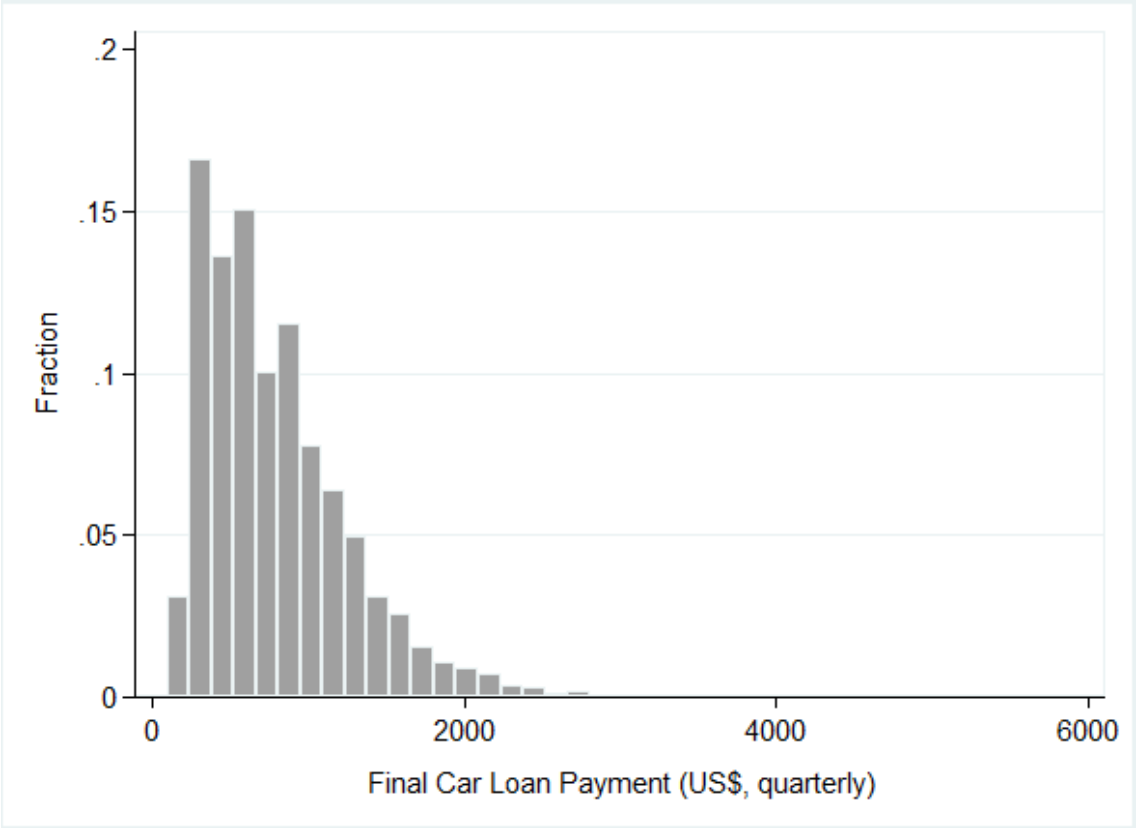
- **Newly constructed data based on BOK household debt Database**
  - Data description, Pros and Cons
    - Bank of Korea (BOK) Household debt database
      - De-identified individual level data
      - Longitudinal panel from credit bureau at a quarterly frequency
      - Sample period: Dec 2012 to Dec 2016
    - Include income, actual credit and debit card expenditure, debt structure, and demographic characteristics
    - Highly representative
      - Stratified random sample (2.4% of total population, 1mil)
    - Highly reliable source without recall bias or measurement error
      - Easy to identify anticipated income changes
      - **Actual financial transaction data** across *all* issuing banks
      - Credit card expenditure constitutes 75% of total consumption
    - Allows us to conduct various micro-level analyses

Identifying Predictable Income Changes

- Natural experiment approach
  - **Anticipated Income changes**:
    - Debt structure data: payment size, beginning and end date
    - Quarter following the final car loan payment (i.e., $t-1$ to $t+3$)
    - Get multiple notification letters before the expiration date
  - **Sample selection**: Consider first-time car buyers with a fixed rate
    - Final sample (i.e., Car buyers) vs. General population
    - No strong correlation between income and the loan payment size
- Identification strategy
  - **Treatment**: Consumers making the final loan payment
  - **Control**: Consumers with remaining car loans
  - **Identifying Assumption**:
    the end date of loan payment is independent of other individual's end date

Distribution of Anticipated Income Changes

- Car loan payments ▸ Distribution of sample on other variables
  - Average duration: 3 to 5 years
  - Quarterly payment: \$788 US dollars (or \$262 each month)
  - Approximately 10% of total income, 25% of total consumption



Summary Statistics

	Mean	Median	St.Dev.
Car Loans			
Quarterly payments	**788**	682	475
per quarterly before-tax income	9.91%	8.21%	6.61%
per quarterly total expenditures	25.27%	17.66%	24.40%
Quarterly expenditures			
Credit card expenditure (CCE)	**4,802**	4,091	3,247
Card utilization rate	27.39%	16.84%	58.80%
Quarterly before-tax Income	**8,841**	8,487	3,231
Card Holders' Characteristics			
Credit grade (scale 1 to 10)	3.30	3.00	2.06
Age between 40 and 59 (%)		56.51%	
Number of observations	77,148		

Note: The unit is real US$ with the base year 2020. The credit card limit is based on 40 days of credit period. Credit grade is on a scale of 1 to 10, 1 being the highest (great), 10 being the lowest (poor).

- Monthly income: $\$2,950$, Consumption: $\$1,600$, Predictable income changes: \$263
- 2016 Real GDP per capita (chained 2012 dollars): $\$29,288$ (Korea), $\$58,021$ (US)

Empirical Specification

- Consumption response to anticipated income changes

$$\Delta c_{it} = \alpha_t + \gamma_i + Region_i + \sum_{s=n}^{m} \beta_s \cdot FP_{i,t-s} + \lambda' x_{it} + \epsilon_{it} \quad (1)$$

  - Time, individual, region fixed effects
  - Δc_{it}: credit card expenditure during period t by individual i
  - $FP_{i,t-s}$: the amount of the final car loan payment made at time t in the event window (n, m)
  - Control variables: changes in income, annual income level, changes in credit card limits, utilization rates, credit grades, debt to income ratios, age dummies

Empirical Specification, cont

- **Magnitude effects** along different dimensions

$$\Delta c_{it} = \alpha_t + \gamma_i + Region_i + \sum_D \beta_D \cdot FP_{it} \times \mathbb{1}(y_{it} \in D) + \lambda' x_{it} + \epsilon_{it} \qquad (2)$$

  - y_{it} is types of sizes and $D \in \{Low, Middle, High\}$

- Types of sizes of anticipated income changes
  1. **Absolute size** of final payment (i.e., *FP*)
  2. Final payment **relative to income** (i.e., *FP to income*)
  3. Final payment **relative to consumption** (i.e., *FP to CCE*)

- Cutoff points (per quarter) for three subgroups

	25%	mean	75%
FP	\$400	\$788	\$1,000
FP to Income	5%	10%	13%
FP to CCE	10%	25%	31%

Empirical Specification, cont

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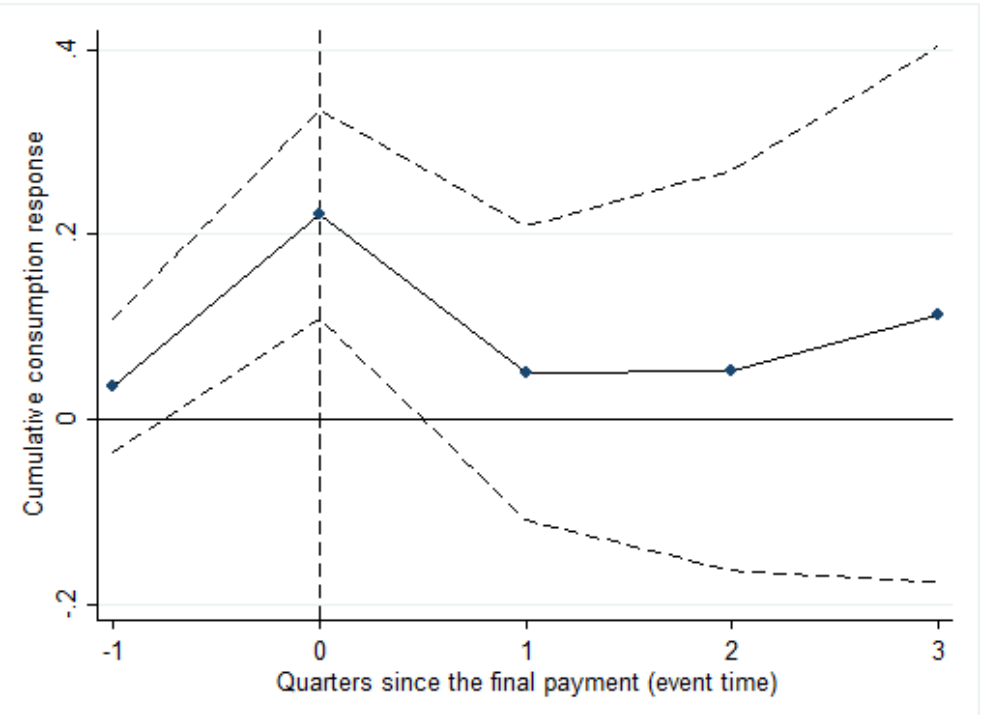
Finding 1: Consumption responds to anticipated income changes

- **Main effects:** ▸ Results
  - **MPC $\approx$ 18%** on average
    with the inclusion of control variables, time, region, and individual FE
- **Effects by time:** ▸ Marginal effects ▸ Income process
  - Expand the regression with a time lag
  - **No effects before** $t = 0$ with 95% confidence interval
  - **Large spending response** in the quarter with predictable income changes



Finding 2: Monotonically decreasing MPC in the size

- **Consumption response depends on the payment size**
  - When the payment size is **small** (i.e., reference group, first row), consumption ↑↑ for all three types of sizes (absolute, relative to income and consumption)
  - Large heterogeneity across groups (e.g., Column (2) 0.712 low, 0.172 middle, 0.147 high)

Dep. Var: Δc_{it}	(1)	(2)	(3)	(4)	(5)	(6)
FP (reference group)	**0.758*** **	**0.712*** **	**0.321*** **	0.863***	0.761***	0.712***
	(0.156)	(0.158)	(0.066)	(0.169)	(0.156)	(0.158)
FP * 𝟙 (FP=Middle)	-0.558***			-0.308	-0.502***	
	(0.164)			(0.218)	(0.170)	
FP * 𝟙 (FP=High)	-0.614***			-0.343	-0.492***	
	(0.160)			(0.229)	(0.182)	
FP * 𝟙 (FP to Income=Middle)		-0.540***		-0.378*		-0.474***
		(0.165)		(0.217)		(0.173)
FP * 𝟙 (FP to Income=High)		-0.565***		-0.378*		-0.417**
		(0.163)		(0.228)		(0.192)
FP* 𝟙 (FP to CCE=Middle)			-0.184**		-0.129	-0.144
			(0.075)		(0.092)	(0.100)
FP* 𝟙 (FP to CCE=High)			-0.225		-0.172	-0.199
			(0.153)		(0.169)	(0.177)
Constant	0.390*	0.396*	0.393*	0.393*	0.392*	0.396*
	(0.218)	(0.218)	(0.218)	(0.218)	(0.218)	(0.218)
R-squared	0.059	0.059	0.059	0.059	0.059	0.059
N	77,148	77,148	77,148	77,148	77,148	77,148

Finding 3: Size relative to income matters the most

- **Relative importance**:
  Size relative to Income > Absolute size > Size relative to consumption

  (Column(4): FP to Income>FP, Column(5): FP>FP to CCE, Column(6): FP to Income>FP to CCE)

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Summary of Empirical Findings

- **Key findings**
  - **Finding 1**: Consumption responds to anticipated income changes
  - **Finding 2**: Monotonically decreasing MPC in the size of income changes
  - **Finding 3**: Size relative to income matters the most
- **Robustness checks**
  - Decomposition further into five quintiles
  - Consumption dynamics by different size groups
  - Consumption dynamics by different income groups
  - Empirical analysis based on Korean currency

Focusing on the payment size relative to income,

- **Question**: **What is behind the MPC heterogeneity?**

Conditional MPC: Age, Income, and Liquidity

- Joint distribution of key variables and relative size:

$$\begin{aligned}\Delta c_{it} = \alpha_t + \gamma_i + Region_i + \sum_{D_z} \beta_{D_z} \cdot FP_{it} \times \mathbb{1}(z_{it} \in D_z) \\ + \sum \delta_{D_z} \times \mathbb{1}(z_{it} \in D_z) + \lambda' x_{it} + \epsilon_{it}\end{aligned} \tag{3}$$

where $z_{it} \in \{Age,\ Income,\ Liquidity\}$ for each tercile D_z

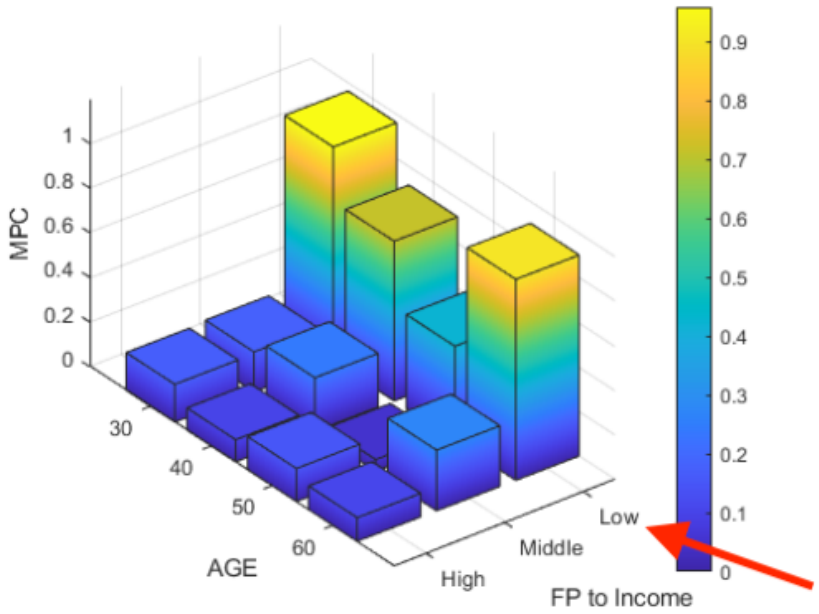
- **Strong size effects** regardless of ages, income, and liquidity constraints
  (i.e., Larger MPC when the size of income change is small)
  - Role of liquidity constraints: income level, extra debt constraint
  - Other variables: Cash consolidation loans, Late payment

▸ Intuition ▸ Income and the Payment Size

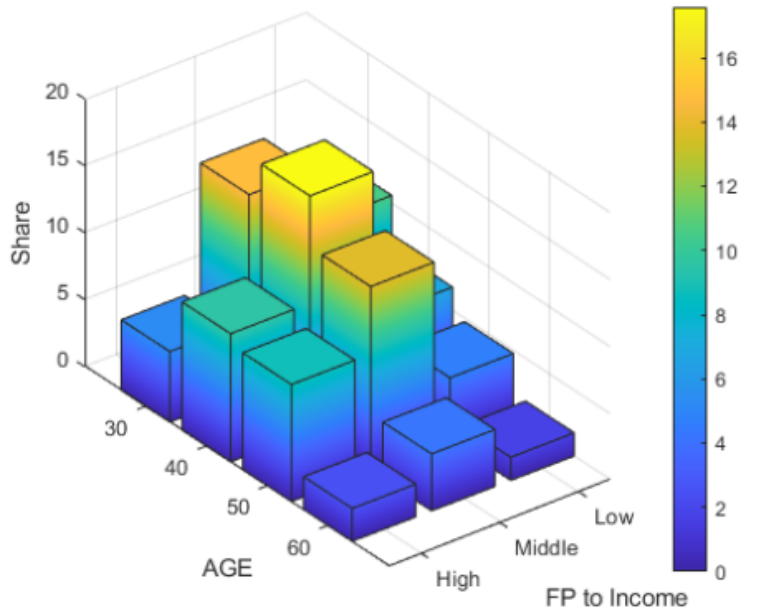
Joint Distribution:

MPC, Age, and the Relative Size

(a) MPC distribution, age, size relative to income



(b) Population share, age, size relative to income



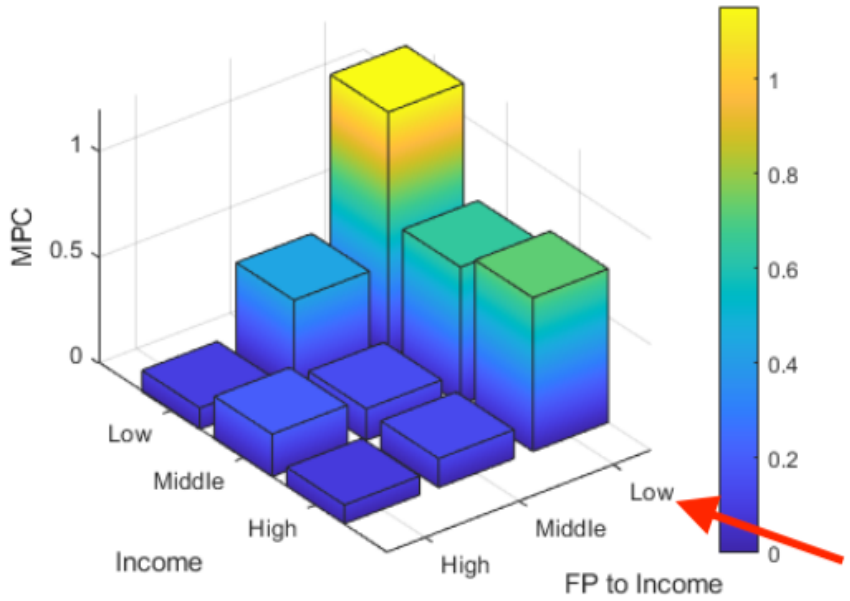
- Strong size effects (i.e., Larger MPC when the size is small) regardless of age

▸ Absolute Size

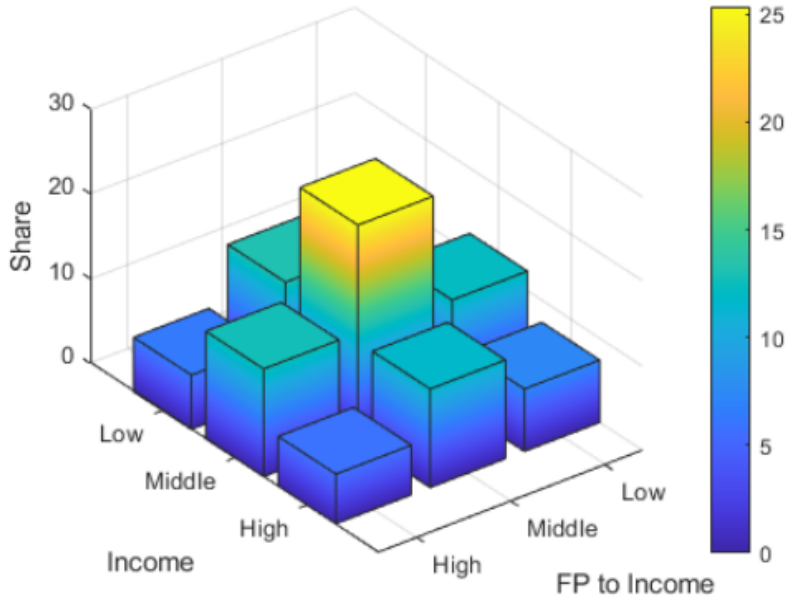
Joint Distribution:

MPC, Income, and the Relative Size

(c) MPC distribution, income, size relative to income



(d) Population share, income, size relative to income



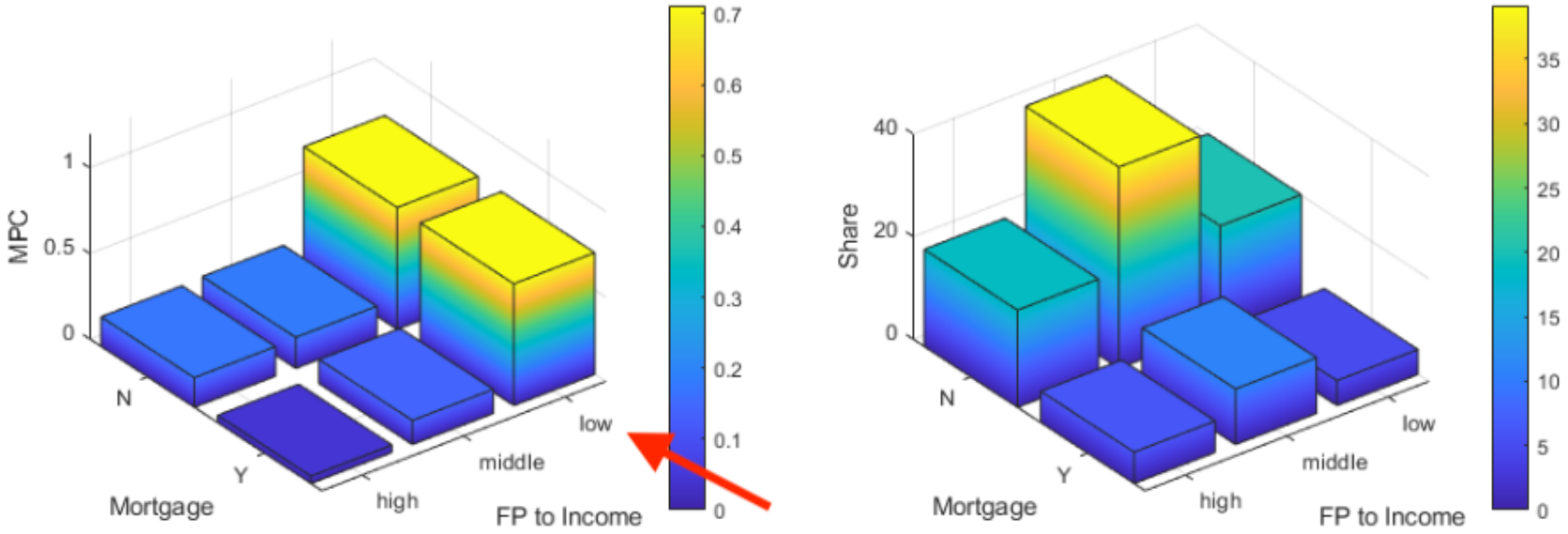
- Strong size effects (i.e., Larger MPC when the size is small) regardless of income

▸ Absolute Size

Joint Distribution:

MPC, Liquidity (extra debt, mortgage status), and the Relative Size

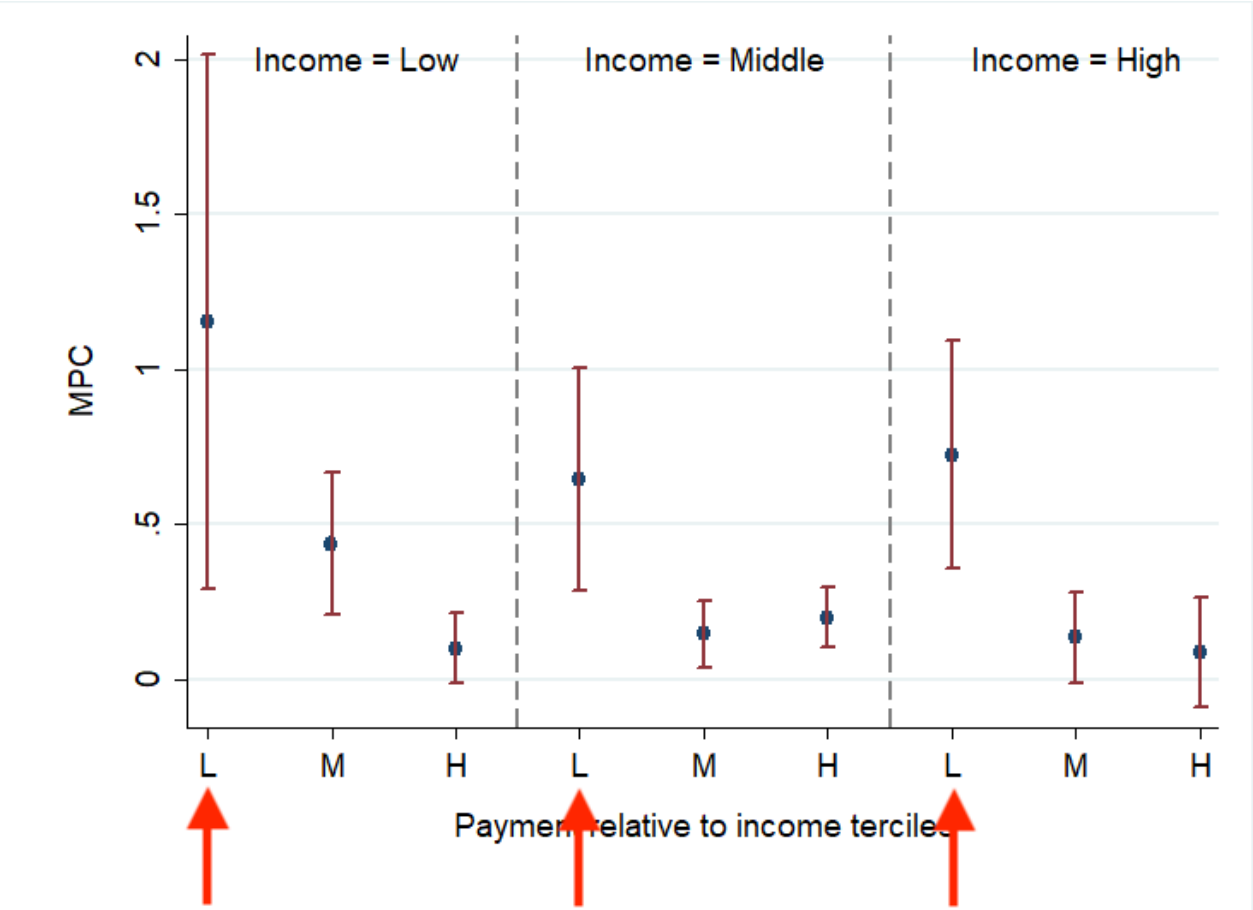
(a) MPC distribution, mortgage, size relative to income (b) Population share, mortgage, size relative to income



- Strong size effects (i.e., Larger MPC when the size is small) regardless of extra debt status

Joint Distribution:

MPC, Liquidity (income), and the Relative Size



- Statistically significant consumption response when the size is **small** regardless of income

▸ Conditional MPC, Relative to Income terciles

Summary of Empirical Findings, cont

So far,

- **Finding 1**: Consumption responds to anticipated income changes
- **Finding 2**: Monotonically decreasing MPC in the size of income changes (i.e., MPC heterogeneity in sizes)
- **Finding 3**: Payment size relative to income matters the most
- **Finding 4**: Strong size effects exist regardless of age, income, and liquidity

Discussion on theory and policy implications

Theoretical Explanations

1. **Standard models of intertemporal consumption** More
   - $MPC^{LCPIH} \approx 0$ in response to anticipated income changes
   - $MPC^{Empirical} > 0$ peaks at $t = 0$ then sharply decreases
   - Revisiting the standard models of consumption
     - Fails to generate the one-time sharp increase upon the arrival of predictable income changes
     - As permanent income increases, consumption increases proportionally
   - Behavioral trait from households
     - Average duration of car loan payments: 3-5 years
     - Perceiving income shock not as persistent

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Theoretical Explanations, cont

2. **Bounded rationality and welfare cost**
   - Higher $MPC^{Empirical}$ for smaller income changes
   - Consumers deviate by more from consumption smoothing behavior in response to smaller income shocks
   - **Bounded rationality**: Individuals smooth consumption *only if* there are large and predictable income changes
   - **Welfare costs**: Deviation of consumption smoothing behavior is *less* costly for smaller anticipated income changes

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Welfare Loss Analysis

- Following Fuchs-Schundelen and Hassan (2016) and Keung (2018), we compute the welfare loss from not fully smoothing consumption by:

$$\textit{Welfare loss}\ (c_i^{deviate}, c_i^{pih}) \approx \frac{\delta}{2} \cdot \sum_t \zeta_t \left(\frac{c_t^{deviate} - c_t^{pih}}{c_t^{pih}} \right)^2$$

  where FP_i: final payment for individual i
  - δ captures the curvature of the utility function
  - ζ_t is the utility weight function
    where $\zeta_t = \gamma^t \frac{\partial u(c_t^{pih})}{\partial c} c_t^{pih} / \sum_i \gamma^n \frac{\partial u(c_n^{pih})}{\partial c} c_n^{pih} = \frac{\gamma^t u(c_t^{pih})}{U(c^{pih})}$
  - Utility function $u(c) = c^{1-\delta}/(1-\delta)$

- **Monotonically increasing welfare cost** associated with the payment size relative to income tercile: 0.13, 0.61, 2.4 percent

Discussion on Policy Implications

- Anticipated income changes, even with an announcement in advance, would boost consumption in the short-term
- **Conduct two transfer policies** to exemplify the qualitative direction of existing policies with the magnitude effect

  Give transfer (1% of national disposable income) as follows:
  - **Policy 1**: target 1st bottom income tercile equally
  - **Policy 2**: target 1st and 2nd income tercile equally

- **Intuition**: As **Policy 2** targets a larger fraction in the total population, the absolute and relative payment size becomes *smaller*, implying a higher MPC
- Alternative policy with different levels of income shocks may improve the aggregate consumption growth

Policy experiment, details | Previous policies

Discussion on Policy Implications

- Anticipated income changes, even with an announcement in advance, would boost consumption in the short-term
- **Conduct two transfer policies** to exemplify the qualitative direction of existing policies with the magnitude effect

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- Alternative policy with different levels of income shocks may improve the aggregate consumption growth

▸ Policy experiment, details ▸ Previous policies

Computing MPC and Aggregate Consumption Growth

- Aggregate marginal propensity to consume (MPC)

$$MPC_j = \sum_i \frac{\overbrace{\beta_i \tau_i(j)}^{MPC_i \times \text{Anticipated income increase}_i(j)}}{\underbrace{G}_{\text{Total transfers}}}$$

where β_i: individual MPC computed using sample data
$\tau_i(j)$: transfer received by individual i for policy experiment j
G: total government revenues where $G = 0.01 \times \sum_i y_i$
y_i: individual income

- Aggregate consumption growth

$$g(C)_j = \frac{\sum_i \beta_i \tau_i(j)}{\sum_i c_i}$$

where $g(C)_j$: aggregate consumption growth for policy experiment j
c_i: individual consumption

Policy Experiment, Results

- Considering an alternative policy that captures the size effect and heterogeneous MPC,
  - Aggregate consumption growth: 0.47% to 1.38% (i.e., **0.91% increase**)

Policy: Transfer equivalent to 1% of GDP	MPC $= \Delta C/\Delta Y$	Agg. cons. growth
Homogeneous MPC		
Policy 1: Transfer to 1st income tercile	0.24	0.45%
Heterogeneous MPC		
Policy 1: Transfer to 1st income tercile	0.25	0.47%
Policy 2: Transfer to 1st and 2nd income terciles	0.73	**1.38%**

Concluding Remarks

- Examine how consumption respond to anticipated income changes using newly constructed individual-level rich data set
- We find that
  - On average, consumption responds to anticipated income changes by 18%
  - Consumption response varies by the size of income changes and size relative to income matters the most
  - With a strong size effect regardless of liquidity constraints, considering an alternative policy with size improves the aggregate consumption growth

Appendix A

Literature review on MPC

Study	Experiment (USD)	Data	MPC (out of 1)	Liquidity constraint	Size
Agarwal et al. (2007)	2001 Federal income tax rebates ($500)	Credit card accounts; 2000 - 2002	0.40	Based on credit limit, utilization rate, and age	x
Johnson et al. (2006)	2001 Federal income tax rebates ($500)	CEX interview survey; 2000 - 2002	0.20 - 0.40	Based on age, income, and liquid assets	x
Misra and Surico (2014)	2001 Federal income tax rebates ($500) & 2008 Economic stimulus payments ($900)	CEX interview survey; 2000 - 2002 & 2007 - 2008	0.43 (2001) & 0.16 (2008)	Based on high income and high mortgage debt	x
Broda and Parker (2014)	2008 Economic stimulus payments ($900)	Scanner data; 2007 - 2009	0.10	Availability of easily accessible funds	x
Parker et al. (2013)	2008 Economic stimulus payments ($900)	CEX interview survey; 2007 - 2008	0.12 - 0.30	Based on age, income, and liquid assets	x
Scholnick (2013)	Last mortgage payment ($627)	Credit card accounts; 2004 - 2006	0.40	Based on liquid assets	o
Kueng (2018)	Alaska permanent fund ($1650)	Credit card accounts; 2010 - 2014	0.25	Based on income and liquid assets	o
Baker et al. (2020)	2020 Economic stimulus payments ($1200)	Transaction level data; 2016-2020	0.25 - 0.40	Based on income and liquid assets	x
Coibion et al. (2020)	2021 Economic stimulus payments ($1200)	Scanner data; 2018 - 2020	0.40	Based on income and liquid assets	x

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Appendix A.1

Data

- Event of anticipated changes in discretionary income
  - Natural experiments: Income ↑ following final car loan payment
  - Representing almost 9% of population in total sample
  - Car loan repayments
    - Average duration: 3-5 years
    - Quarterly payment: $788 US dollars (or $262 each month)
    - Approximately 10% of total income, 25% of total consumption
- Spending, Income, and demographic characteristics
  - Credit/Debit card expenditures across all issuing banks
  - Annual income (before tax) based on proof of income
  - Others: Age (i.e. 20s, 30s, ...), region, credit card limit, credit grade, card utilization rates, other debts
- Consumption and card expenditure

Year	2012	2013	2014	2015	2016
	0.72	0.71	0.73	0.77	0.84

Source: The credit finance association

Appendix A.1

Pros and Cons of BOK household debt DB

1. **Advantages**
   - Highly reliable source (i.e. automatic data collection from actual financial transactions)
   - No recall bias or other measurement error from survey data
   - Easy to identify anticipated income changes (i.e. final loan payment)
   - Long panel of expenditures and income
   - Allows us to make various micro-level analyses (that couldn't be performed based on existing macro-data)

2. **Disadvantages**
   - Hard to trace cash transactions
     $\rightarrow$ *card transactions constitute approximately* 80% *of total consumption; card expenditure* $\uparrow \propto$ *Total spending* $\uparrow$
   - Missing information about proof of income
     $\rightarrow$ *only* 2.4% *of total sample, estimates based on past income*
   - Unlinked accounts

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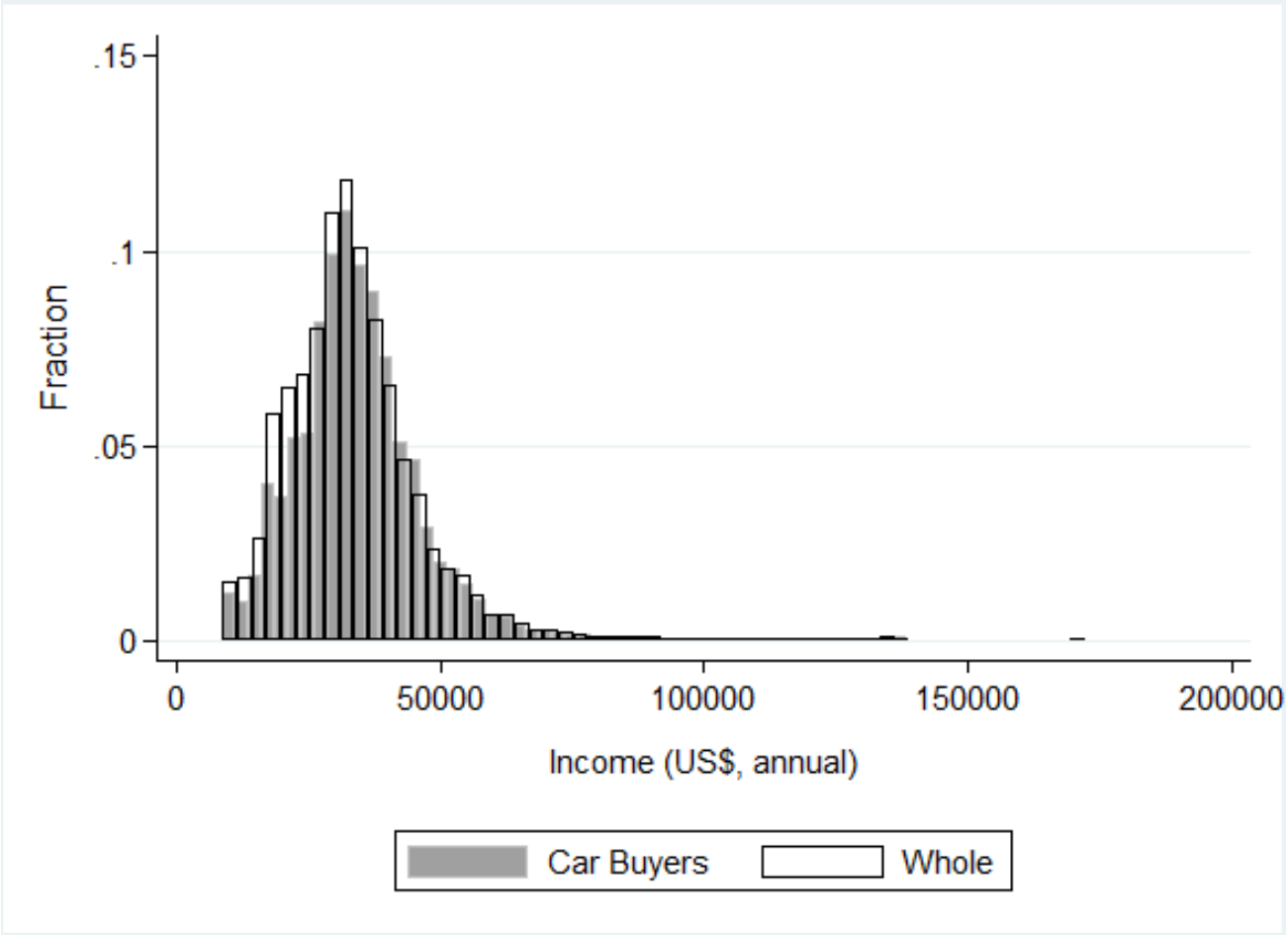
Appendix A.2

Distribution of sample: Income (US$, annual)



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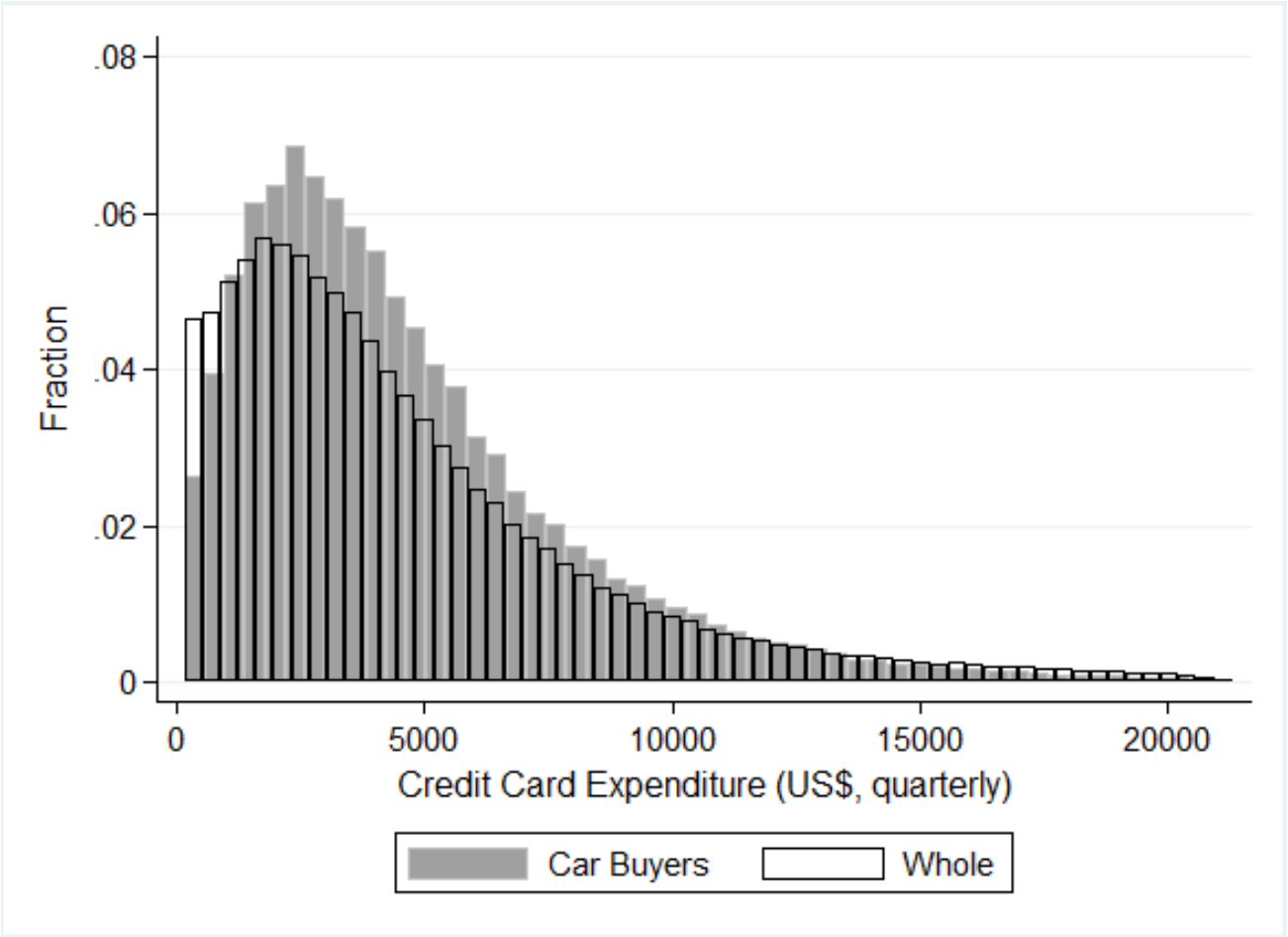
Appendix A.2

Distribution of sample: Consumption (US$, quarterly)



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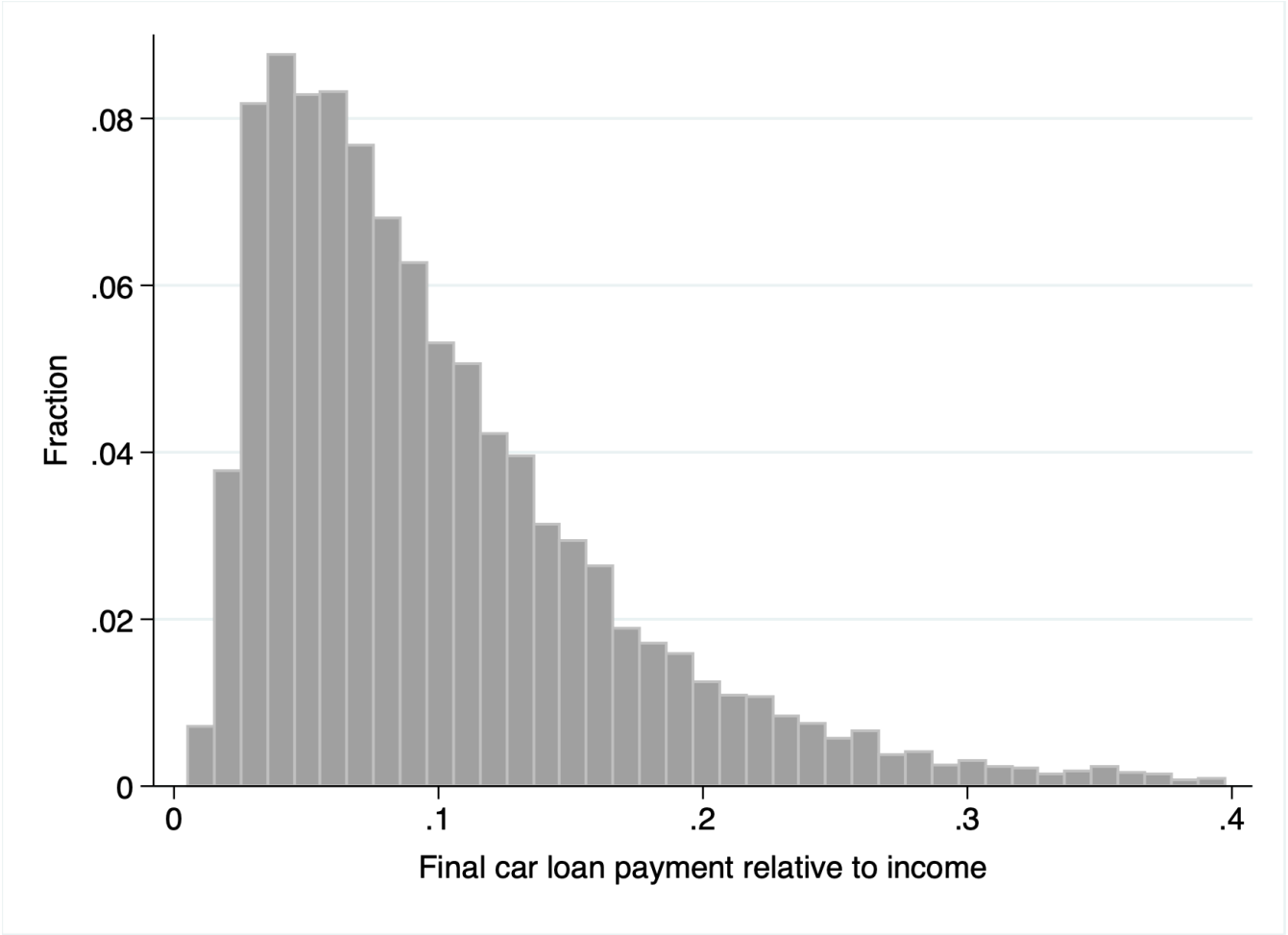
Appendix A.2

Distribution of sample: Predictable income change relative to income



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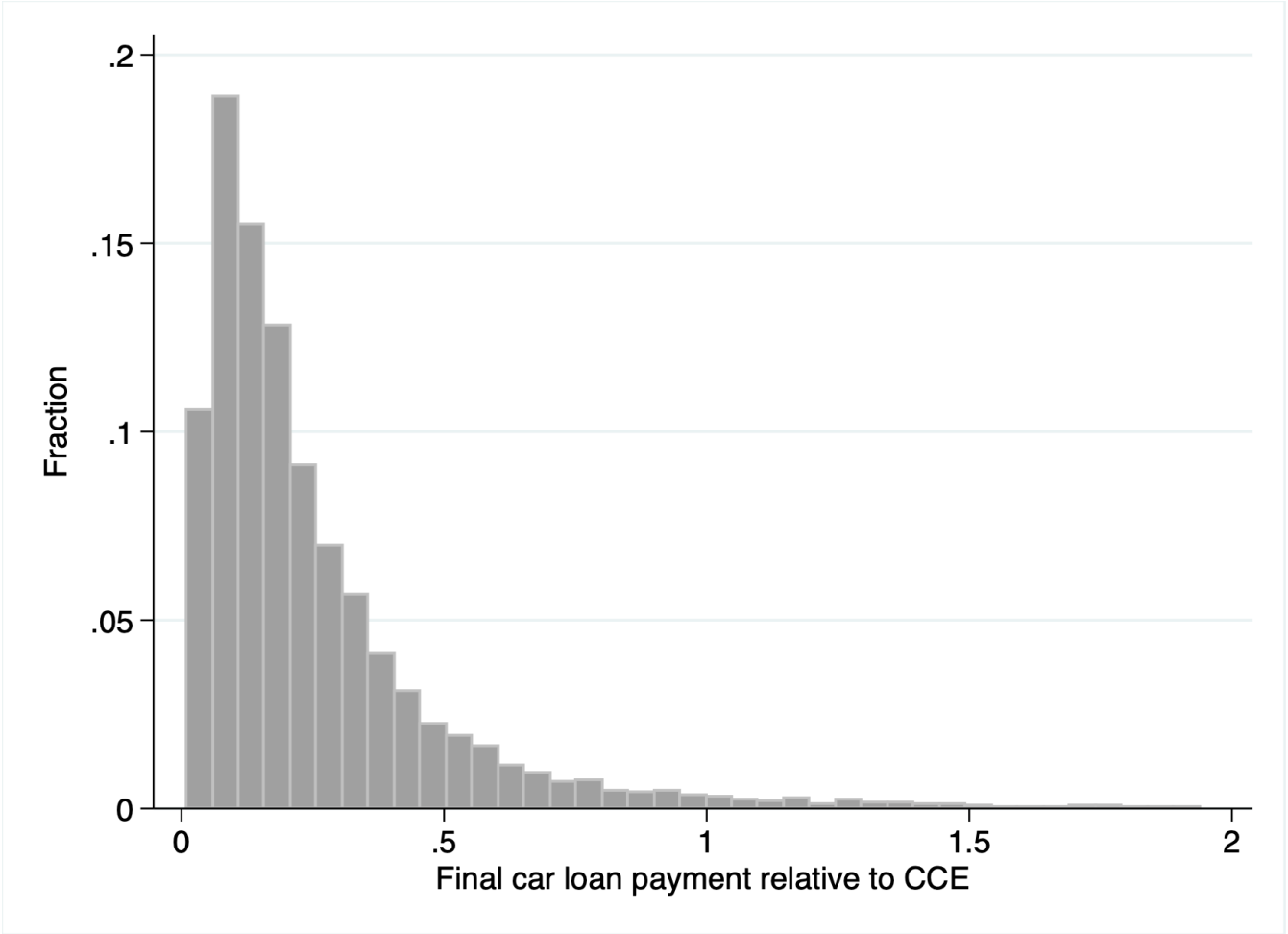
Appendix A.2

Distribution of sample: Predictable income change relative to consumption



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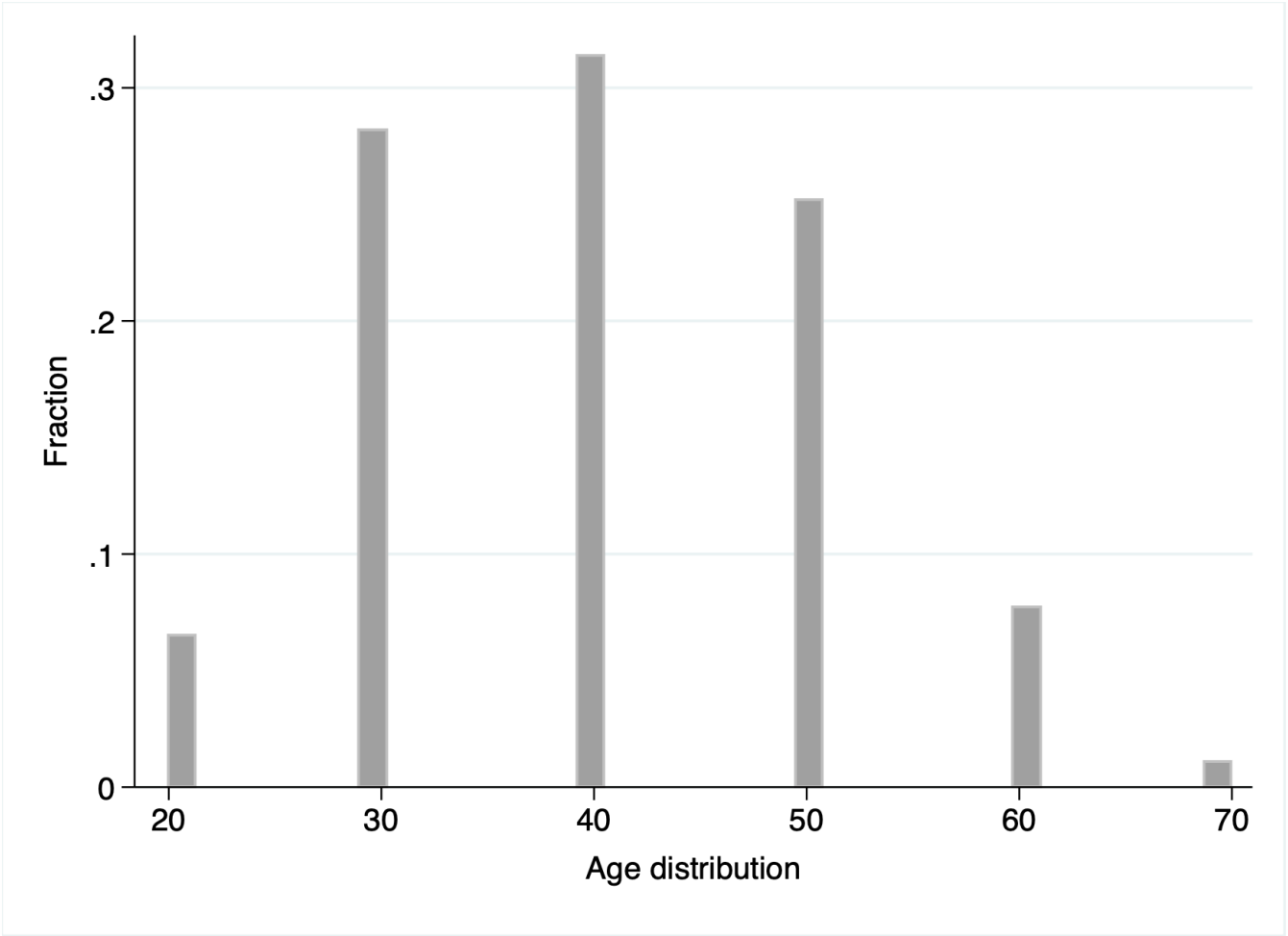
Appendix A.2

Distribution of sample: Age



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Appendix A.3.a

Main estimation results:

Consumption response to anticipated income changes

Dep. Var: Δc_{it}	(1)	(2)	(3)	**(4)**
FP	0.190***	0.178***	0.196***	**0.177*** **
	(0.032)	(0.032)	(0.034)	(0.033)
Constant	0.237	0.219	0.266	0.393*
	(0.152)	(0.156)	(0.167)	(0.218)
Control Variables	No	Yes	No	**Yes**
Time and Region FE	Yes	Yes	Yes	**Yes**
Individual FE	No	No	Yes	**Yes**
R-squared	0.003	0.028	0.003	0.059
Observations	77,148	77,148	77,148	77,148

Note: *, **, and *** represent significance at 10%, 5%, and 1%, respectively.

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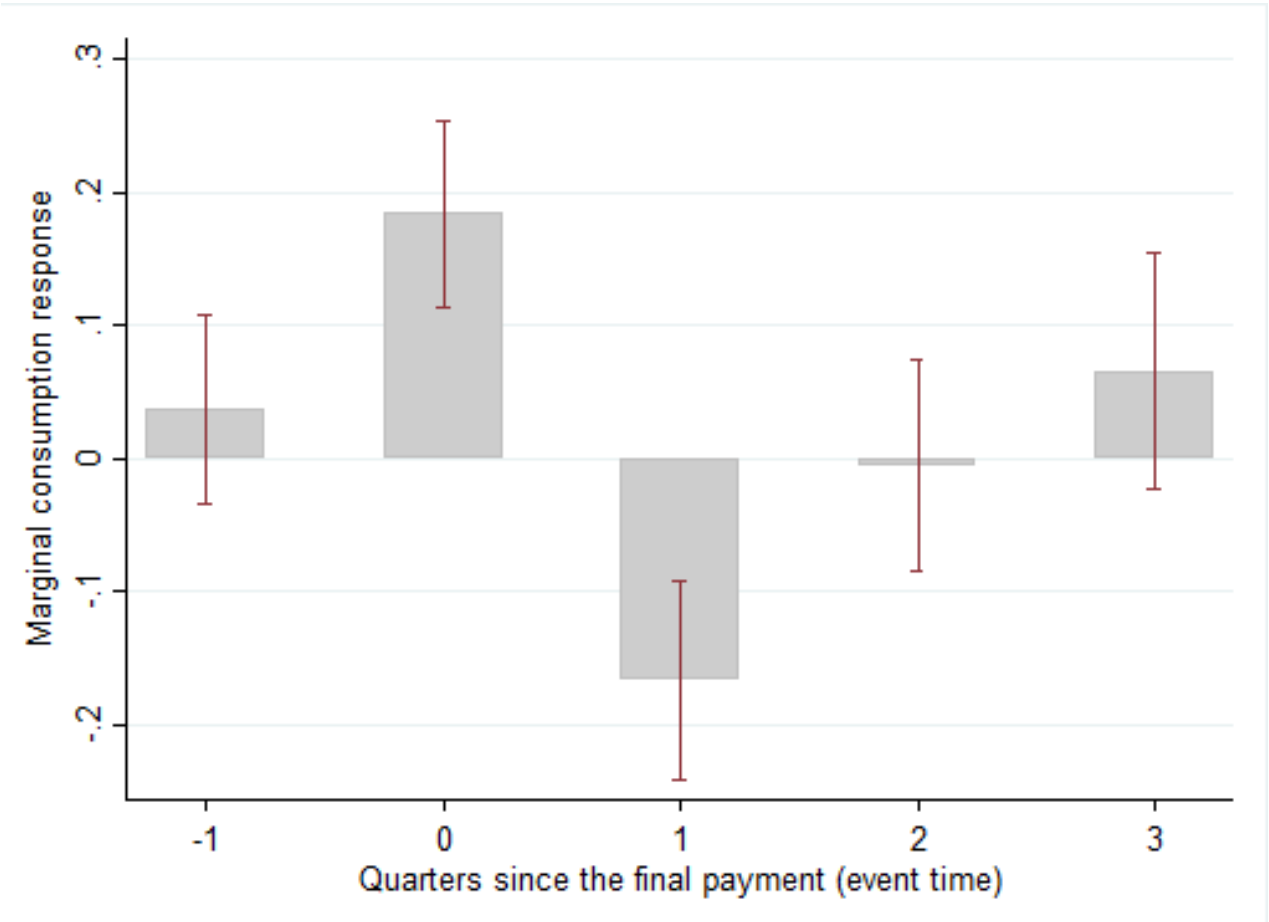
Appendix A.3.b

Marginal effects by time

- Consumption response (i.e., Marginal effects) by time

$$\Delta c_{it} = \alpha_t + \gamma_i + Region_i + \sum_{s=n}^{m} \beta_s FP_{i,t-s} + \lambda' x_{it} + \epsilon_{it}$$



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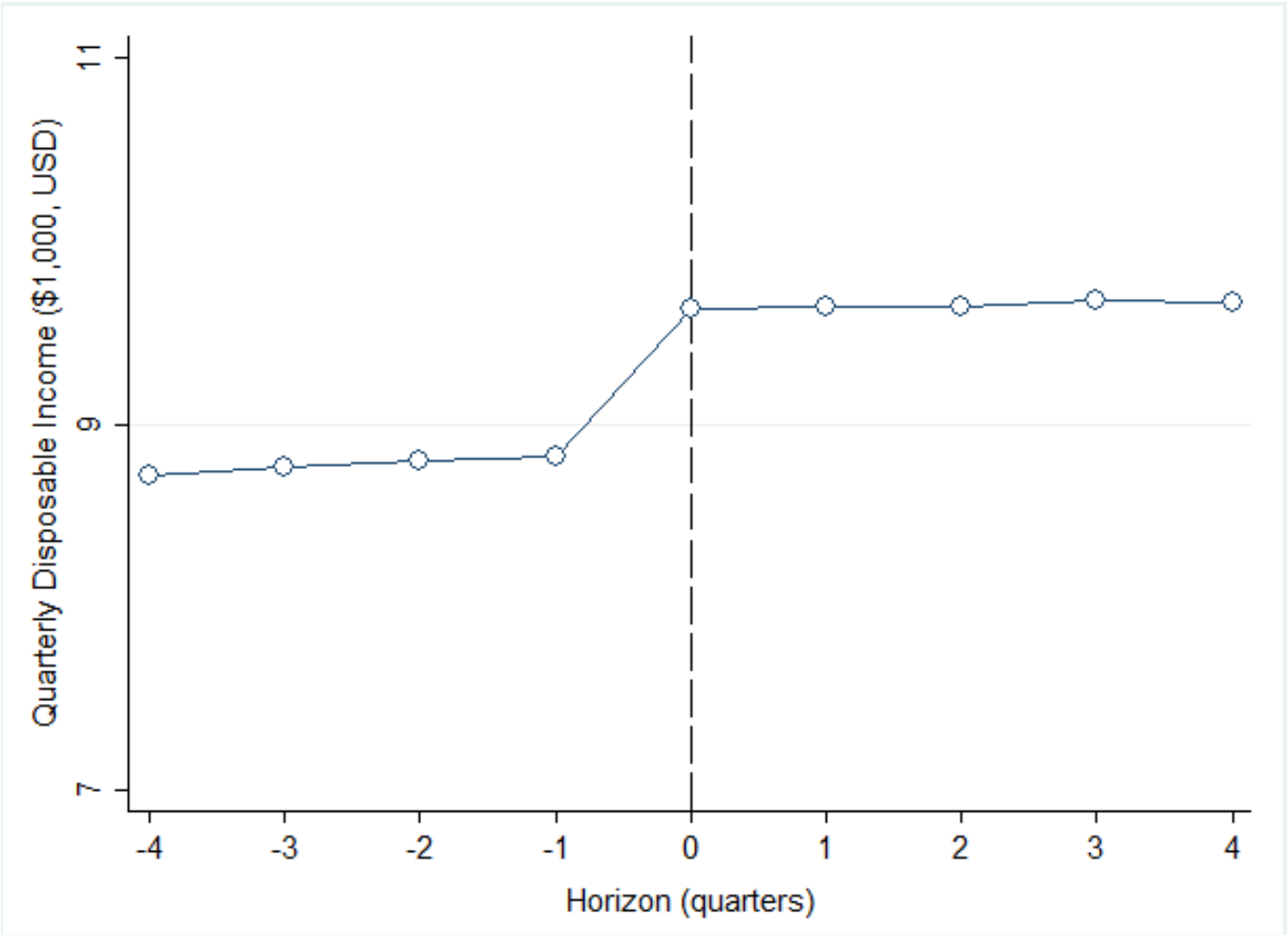
Appendix A.3.c

Income process



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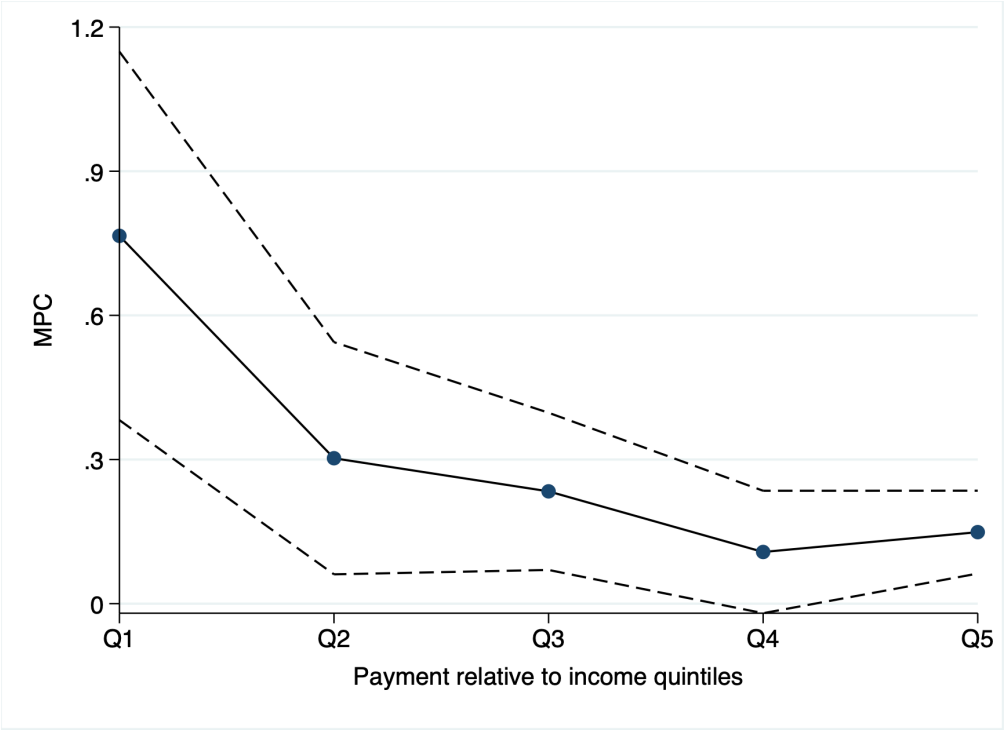
Appendix A.4.a

Robustness: MPC heterogeneity by income quintiles

- **Exploring the MPC heterogeneity**

$$\Delta c_{it} = \alpha_t + \gamma_i + Region_i + \sum_{q_y} \beta_{q_y} FP_{it} * \mathbb{1}(y_{it} \in q_y) + \sum_{q_y} \eta_{q_y} \mathbb{1}(y_{it} \in q_y) + \lambda' x_{it} + \epsilon_{it}$$

  - Divide FP to income into five quintiles (i.e. quintiles q_y)
  - The bottom quintile Q1 has the largest spending response



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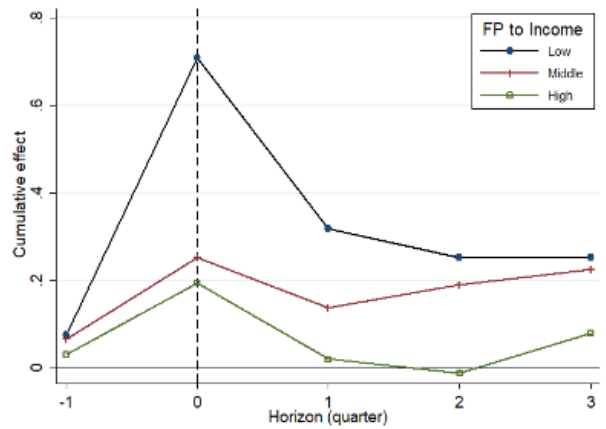
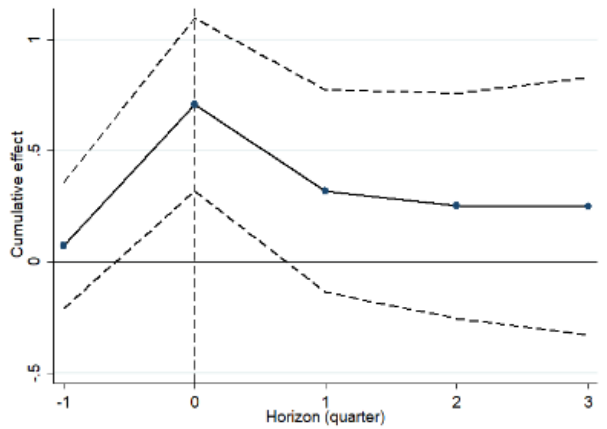
Appendix A.4.b

Robustness: Consumption dynamics by relative magnitudes

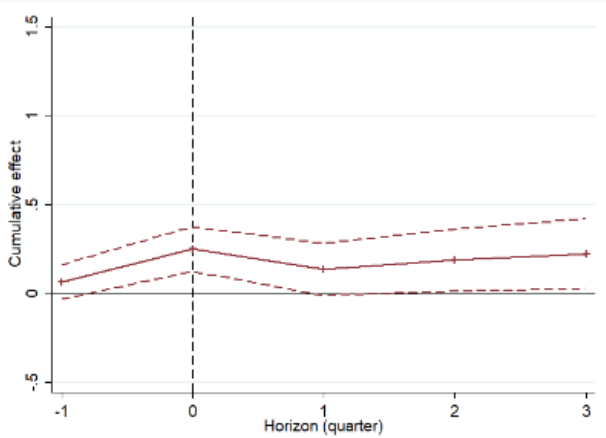
(a) Cumulative consumption responses by FP to Income



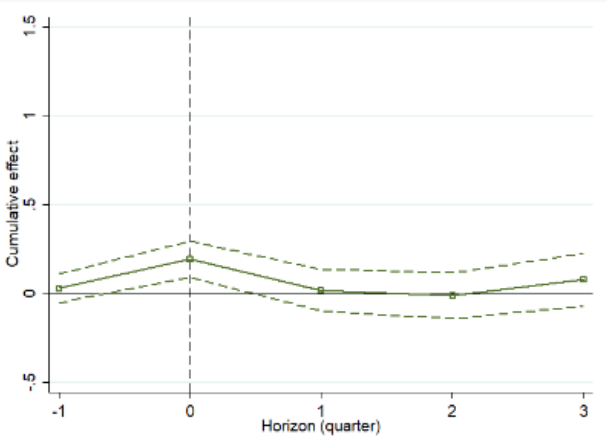
(b) Consumption dynamics (FP to Income = Low)



(c) Consumption dynamics (FP to Income = Middle)



(d) Consumption dynamics (FP to Income = High)



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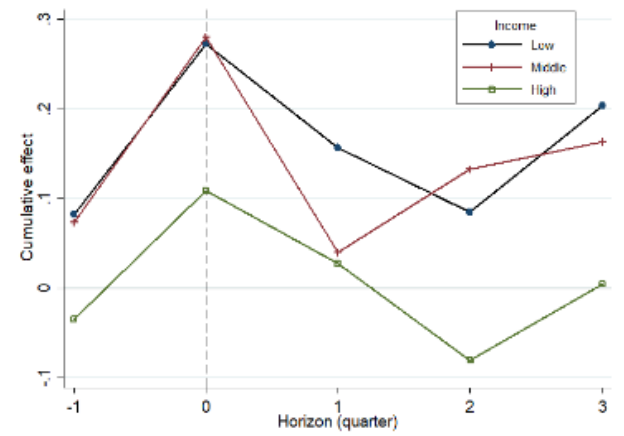
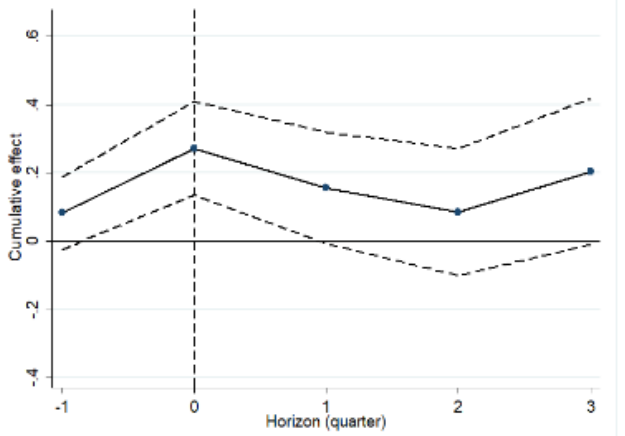
Appendix A.4.c

Robustness: Consumption dynamics by income

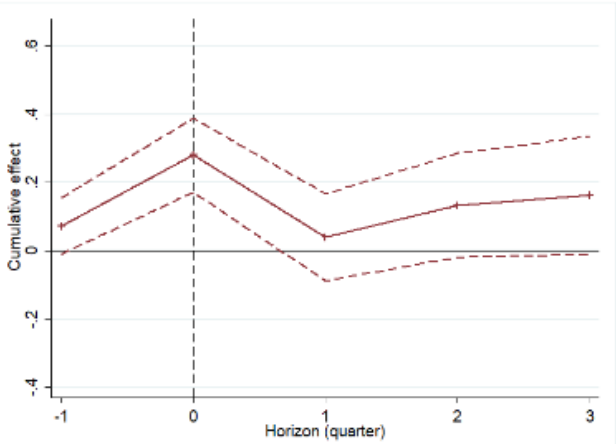
(a) Cumulative consumption responses by Income



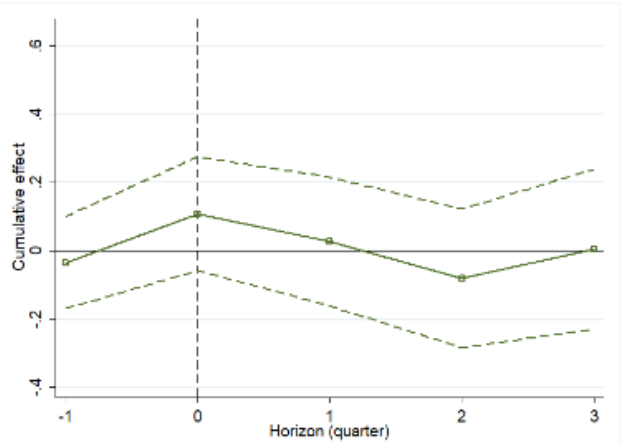
(b) Consumption dynamics (Income = Low)



(c) Consumption dynamics (Income = Middle)



(d) Consumption dynamics (Income = High)



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Appendix A.4.d

Robustness: Excess sensitivity in original currency

	(1)	(2)	(3)	(4)	(5)	(6)
	$\triangle C_{i,t}$	$\triangle C_{i,t}$	$\triangle lnC_{i,t}$	$\triangle C_{i,t}$	$\triangle C_{i,t}$	$\triangle lnC_{i,t}$
FP	0.196***	0.179***		0.203***	0.177***	
	(0.028)	(0.028)		(0.029)	(0.028)	
FP to Income			0.350***			0.357***
			(0.044)			(0.045)
Constant	0.232	0.809	0.022*	0.104	2.461**	0.049**
	(0.429)	(0.530)	(0.011)	(0.489)	(1.198)	(0.025)
Control Variables	×	○	○	×	○	○
Time and Region FE	○	○	○	○	○	○
Individual FE	×	×	×	○	○	○
R^2	0.000	0.023	0.024	0.002	0.02	0.021
Observations	141,933	141,933	141,933	141,933	141,933	141,933

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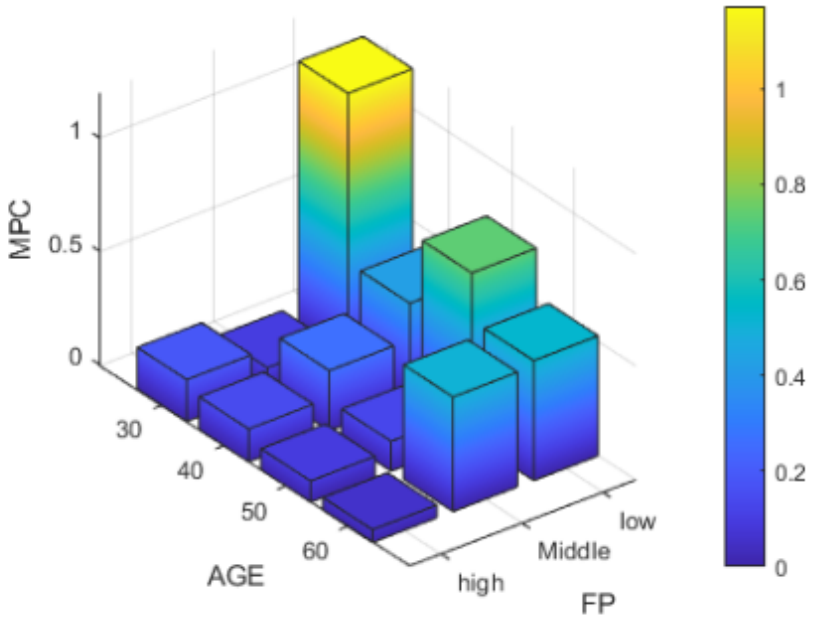
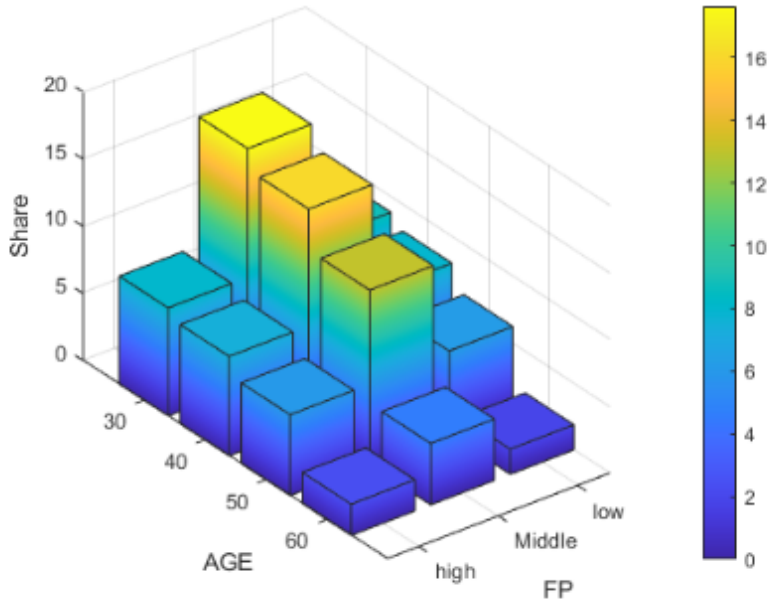
Appendix B.1

Distribution of MPC, Age, and Absolute Size

(a) MPC distribution, age, size



(b) Population share, age, size



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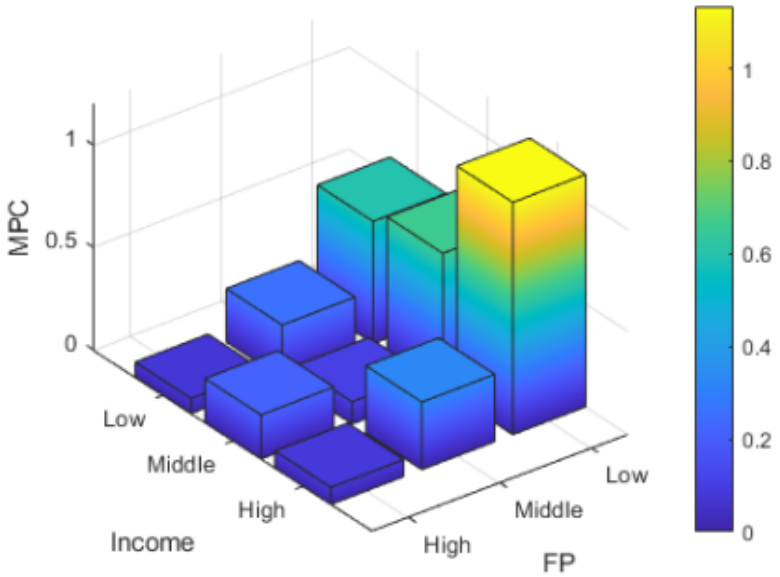
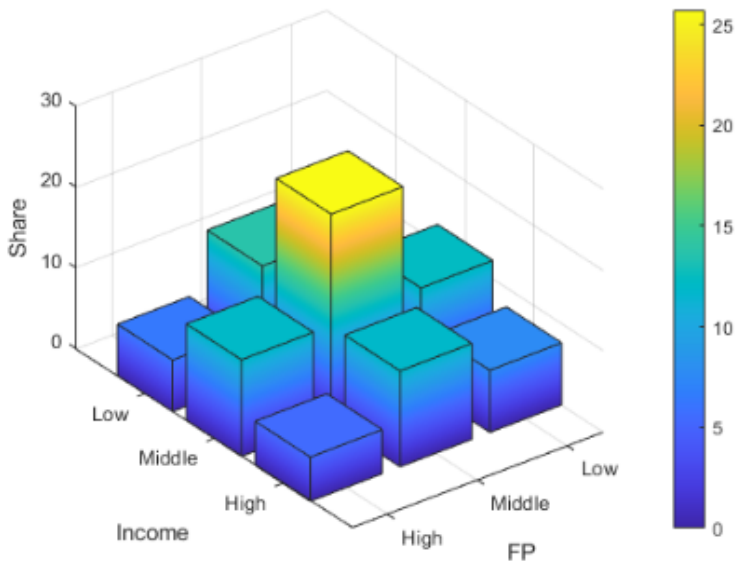
Appendix B.2

Distribution of MPC, Income, and Absolute Size

(c) MPC distribution, income, size



(d) Population share, income, size



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Appendix B.3

Conditional MPC heterogeneity by relative size groups

- Size effects dominate the liquidity effect
  - $MPC(\textit{High income}|\textbf{size = Low}) > MPC(\textit{Low income}|\textbf{size = High})$
  - Difference is statistically significant at 1% level, (F = 7.11)

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Appendix B.4

MPC heterogeneity: payment size relative to income

- **Consumption monotonically decreases by size relative to income**

$$FP\ to\ income = \underbrace{\frac{Final\ payment^{\textbf{small}}}{Total\ income_{fixed}}}_{\text{FP to income = Low}} < \underbrace{\frac{Final\ payment^{\textbf{large}}}{Total\ income_{fixed}}}_{\text{FP to income = High}}$$

  - $\Delta c_{it}^{\text{FP to income = Low}} > \Delta c_{it}^{\text{FP to income = High}}$
  - When final payment size relative to quarterly income is small, most of them are spent on consumption
    (i.e. Deviate from optimal consumption decision; $\Delta c_{it} = 0$)

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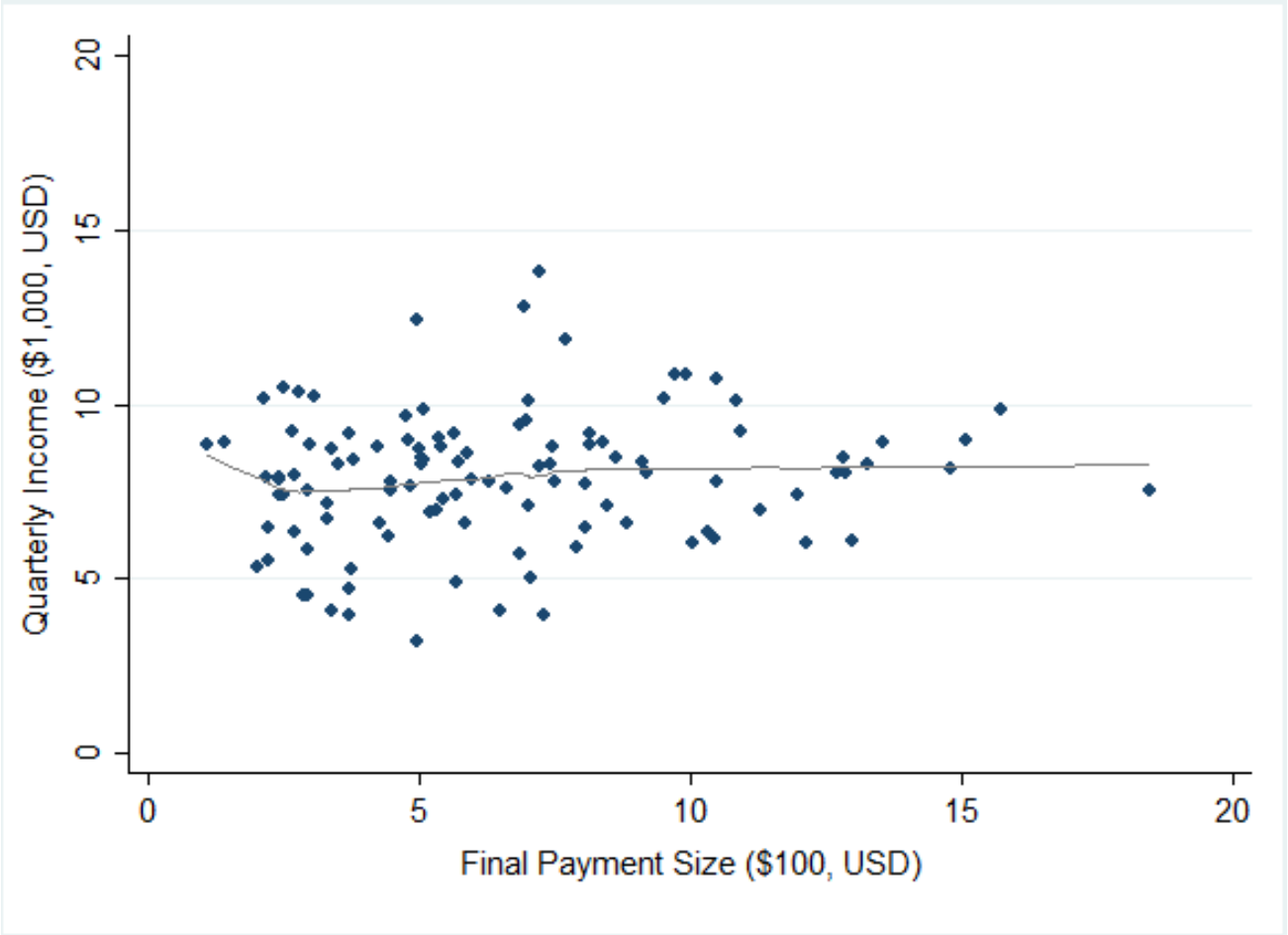
Appendix B.5.a

Income and final car loan payment, Sample

- No strong correlation between income & payment size



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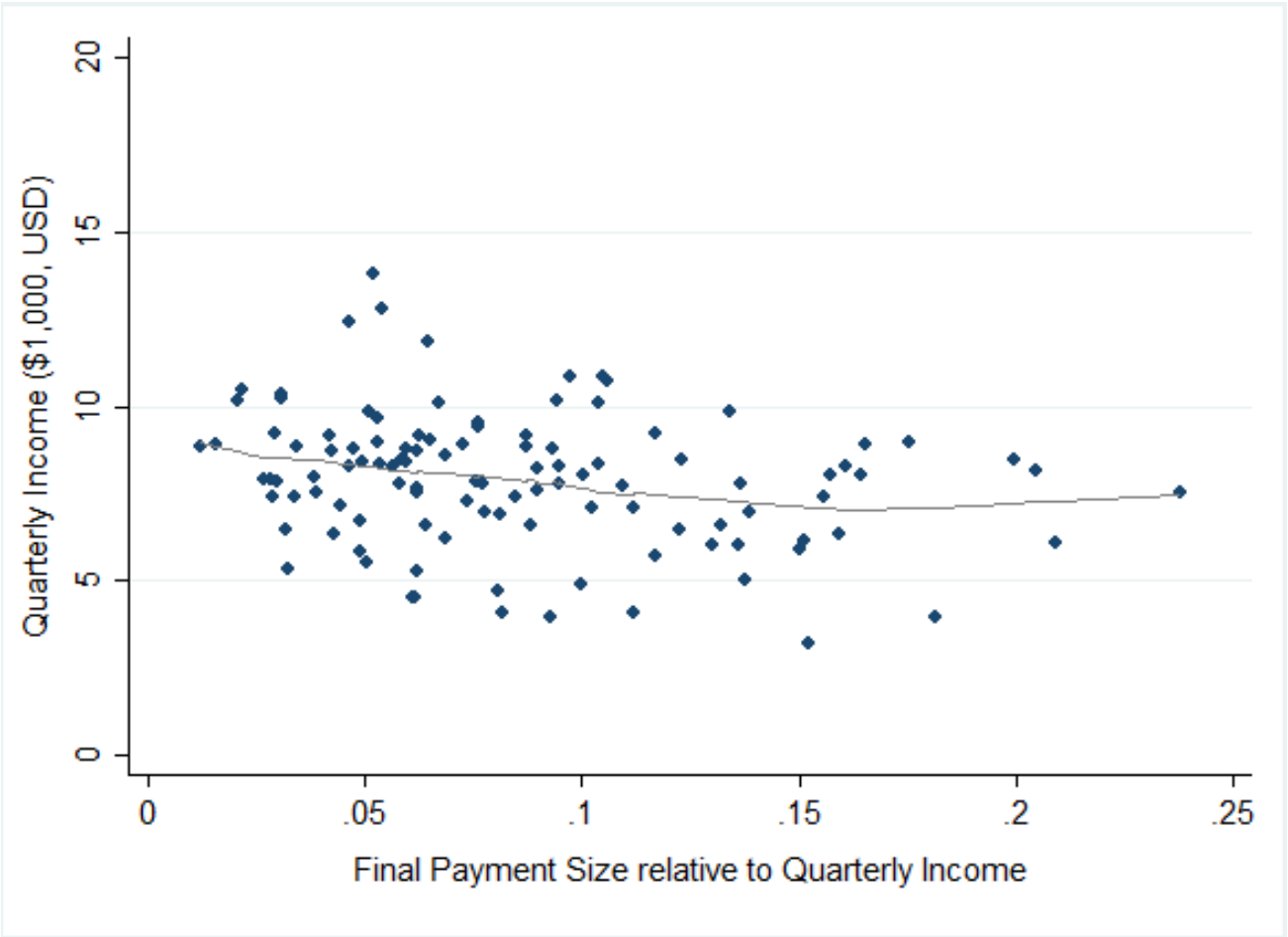
Appendix B.5.b

Income and payment size relative to income, Sample

- No strong correlation between income & size relative to income ratio



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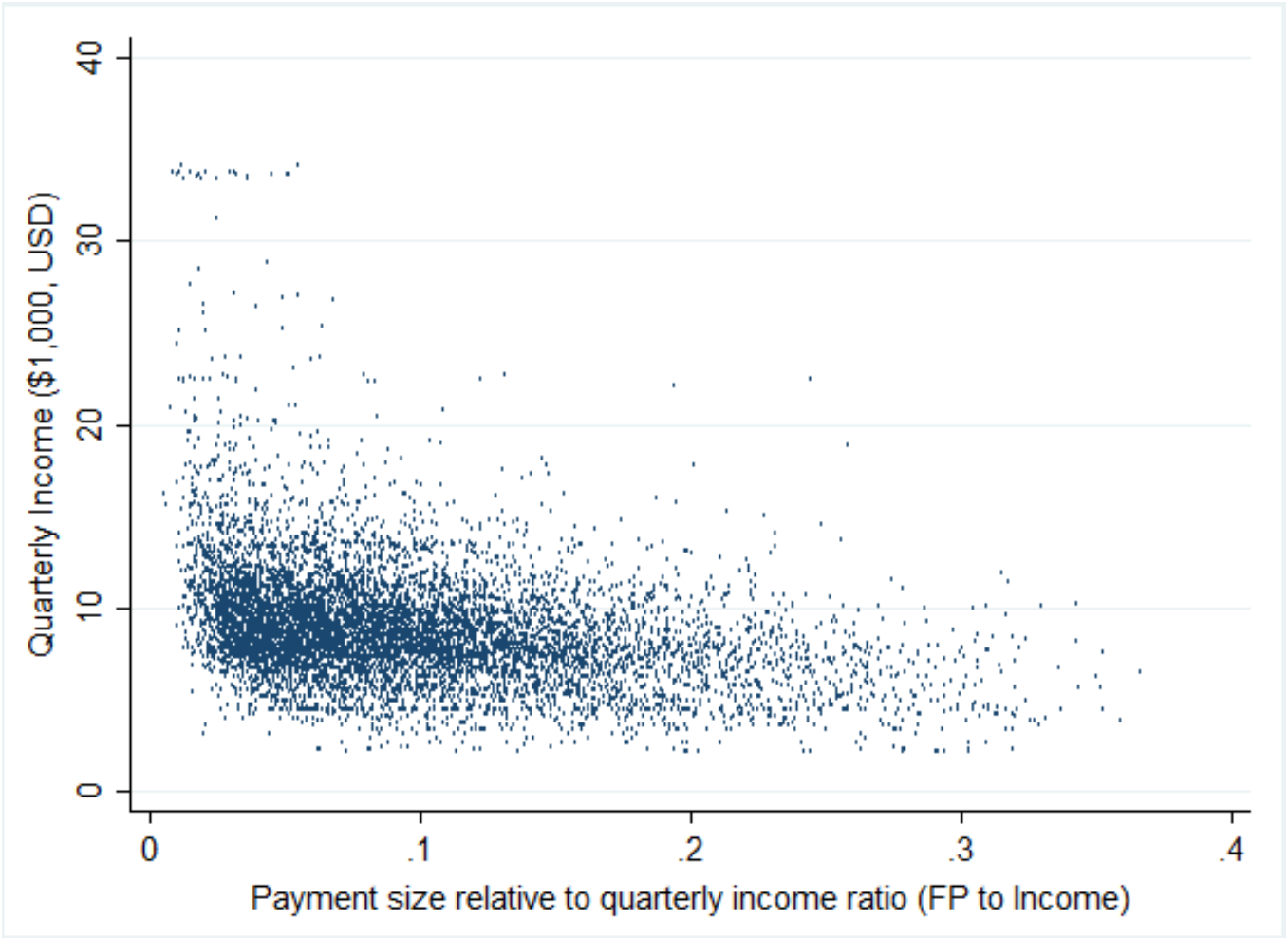
Appendix B.5.c

Income and payment size relative to income, Full data

- No strong correlation between income & size relative to income ratio



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Appendix C.1

Consumption-saving model

- Households maximize the sum of discounted utility

$$\max_{\{c_t\}_{t=\tau}^{T}} E_t \sum_{t=\tau}^{T} \beta^t u(c_t)$$

subject to

$$m_t = m_{t-1} + r a_{t-1} + e^{y_t} - d_t - c_t$$

$$a_t = a_{t-1} + d_t$$

$$y_t = p_t + \tau_t + \epsilon_t^T$$

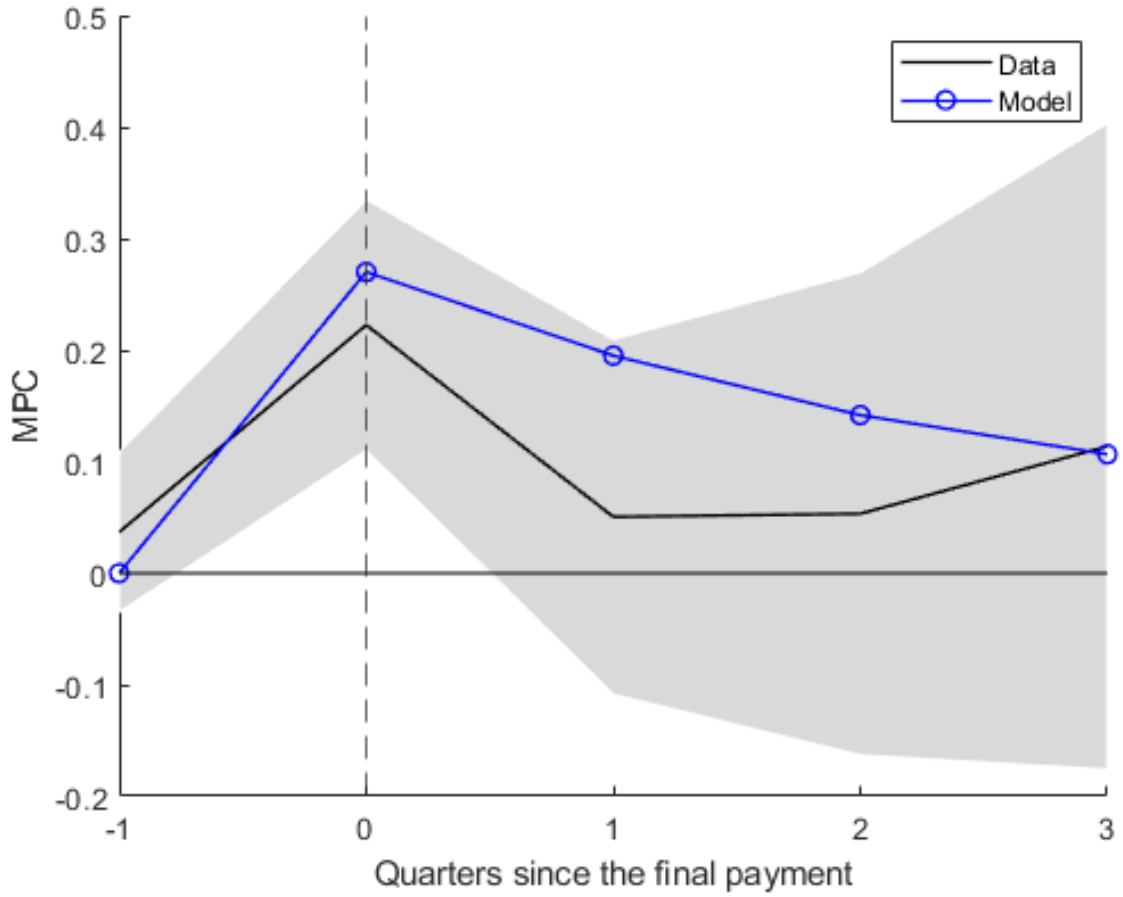
$$p_t = \rho p_{t-1} + \epsilon_t^P$$

$$m_t \geq 0 \quad \forall t = \tau, ..., T$$

where $u(c_t) = c_t^{1-\gamma}/(1-\gamma)$, β: discount factor, c_t: consumption, y_t: labor income, τ_t: deterministic income component at age t, a_t and m_t: illiquid and liquid assets, d_t: deposits, ϵ_t^T: transitory income shock, ϵ_t^P: permanent income shocks

Appendix C.2

Consumption-saving model, Results



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Appendix C.3

Policy experiment, details

- For simplicity, use the MPC sample distribution in the data
- Based on the sample data,
  - GDP per capita: \$35,360 per year
  - Aggregate GDP_{sample}: \$300 million
  - $Consumption_{sample}$: \$160 million (53% of GDP)
  - $Transfer_{sample}$: \$3 million (1% of GDP)
- Following Jappelli and Pistaferri (2014), conduct a policy experiment
  - Policy 1: transfers to the bottom 25% of income distribution equally
  - Policy 2: transfers to the bottom 75% of income distribution equally

Appendix C.3

Policy experiment, details

- Objective: to stimulate aggregate consumption growth
- Give transfer (1% of national disposable income, $3 million)
  - **Policy 1** (income-based):
    - Payment per individual: $1,420
    - Income cut-off: $28,150
  - **Policy 2** (size-based):
    - Payment per individual: $470
    - Income cut-off: $40,800
    - Overall, the absolute size becomes smaller & the relative size to income becomes smaller for 2nd group, implying a higher MPC

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Appendix C.4

Previous policies

Policy	Payment per ind.	Total	% of GDP	Target income
2001 Income tax rebates	\$500	\$38 billion	0.4%	>\$6,000
2008 Economic stimulus payments	\$900	\$96 billion	0.7%	<\$75,000
2020 Economic stimulus payments	\$1,200	\$803 billion	4%	<\$75,000

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