

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 affects the MPC differently

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► Objectives:

- Examine the consumption dynamics out of anticipated income changes
- Exploit **the MPC heterogeneity** along **different magnitudes**
- Provide mechanisms behind the size-dependent MPC

► What we do:

- Quasi-natural experiment: Quarter following the final car loan payment
- Using a newly constructed rich dataset and nonparametric regression analysis, we empirically estimate
 - the consumption path over time
 - the MPC heterogeneity out of different magnitudes
- Provide theoretical explanations behind the magnitude effect
 - Revisit the standard models of consumption
 - Compute the welfare cost using a sufficient statistic approach
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Key Findings

1. Does household consumption respond to anticipated income changes?

2. If so, how does the response depend on the magnitude of income changes? and which households respond the most?

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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 improves the aggregate consumption growth

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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
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Consumption, anticipated income changes, and magnitudes

Data and Identification Strategy

▶ 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

▶ Quasi-natural experiment approach

▶ Distribution of sample

- ▶ **Income changes:** Quarter following the final car loan payment
- ▶ **Consumption:** Financial transactions (debit/credit card expenditure)
- ▶ **Sample selection:** Consider car buyers with fixed payments
- ▶ Number of observations in the analysis: 77,148

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, region, individual 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
-
- **Magnitude effects** along different dimensions
 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)

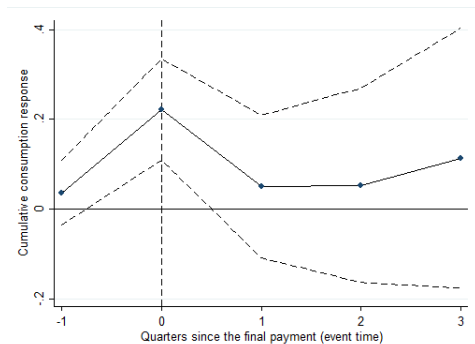
Finding 1: Consumption responds to anticipated income changes

► Main effects: ► Results

- **MPC $\approx 18\%$** in the quarter following the final payment 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

- $\Delta c_{it} = \alpha_t + \gamma_i + \text{Region}_i + \sum_D \beta_D \cdot \text{FP}_{it} \times \mathbb{1}(y_{it} \in D) + \lambda' x_{it} + \epsilon_{it}$
- 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*** (0.156)	0.712*** (0.158)	0.321*** (0.066)	0.863*** (0.169)	0.761*** (0.156)	0.712*** (0.158)
FP * $\mathbb{1}$ (FP=Middle)	-0.558*** (0.164)			-0.308 (0.218)	-0.502*** (0.170)	
FP * $\mathbb{1}$ (FP=High)	-0.614*** (0.160)			-0.343 (0.229)	-0.492*** (0.182)	
FP * $\mathbb{1}$ (FP to Income=Middle)		-0.540*** (0.165)		-0.378* (0.217)		-0.474*** (0.173)
FP * $\mathbb{1}$ (FP to Income=High)		-0.565*** (0.163)		-0.378* (0.228)		-0.417** (0.192)
FP* $\mathbb{1}$ (FP to CCE=Middle)			-0.184** (0.075)		-0.129 (0.092)	-0.144 (0.100)
FP* $\mathbb{1}$ (FP to CCE=High)			-0.225 (0.153)		-0.172 (0.169)	-0.199 (0.177)
Constant	0.390* (0.218)	0.396* (0.218)	0.393* (0.218)	0.393* (0.218)	0.392* (0.218)	0.396* (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:

$$\Delta c_{it} = \alpha_t + \gamma_i + \text{Region}_i + \sum_{D_z} \beta_{D_z} \cdot FP_{it} \times \mathbb{1}(z_{it} \in D_z) + \sum \delta_{D_z} \times \mathbb{1}(z_{it} \in D_z) + \lambda' x_{it} + \epsilon_{it} \quad (2)$$

where $z_{it} \in \{\text{Age}, \text{Income}, \text{Liquidity}\}$ 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

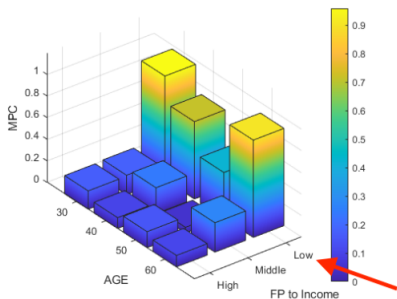
► Intuition

► Income and relative size

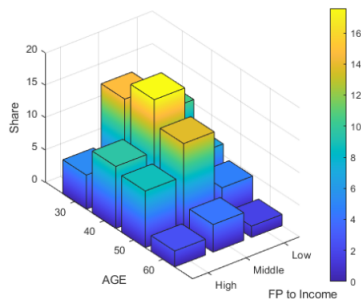
Joint Distribution:

MPC, Age, and the Relative Size

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



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



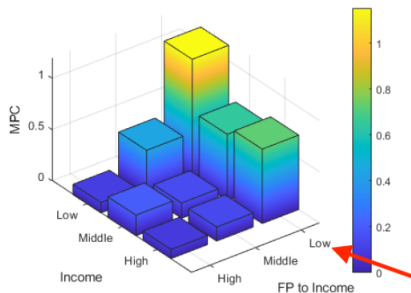
► **Strong size effects** (i.e., Larger MPC when the size is small) regardless of age

► Absolute Size

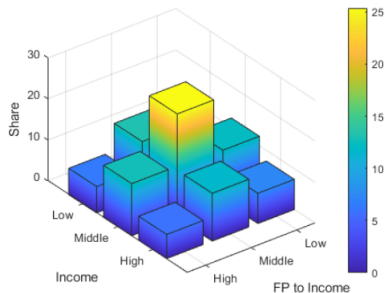
Joint Distribution:

MPC, Income, and the Relative Size

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



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



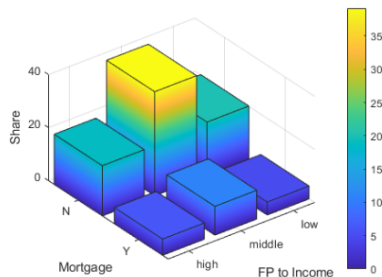
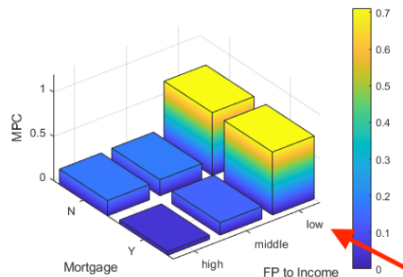
► **Strong size effects** (i.e., Larger MPC when the size is small) regardless of income

► Absolute Size

Joint Distribution:

MPC, Liquidity, 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

► Proxy var: income

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
- ▶ Standard models fail to generate the one-time sharp increase upon the arrival of predictable income changes

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:

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

where FP_i : final payment for individual i

- ▶ δ captures the curvature of the utility function
- ▶ ζ_t is the utility weight function

$$\text{where } \zeta_t = \gamma^t \frac{\partial u(c_t^{\text{pih}})}{\partial c} c_t^{\text{pih}} / \sum_i \gamma^n \frac{\partial u(c_n^{\text{pih}})}{\partial c} c_n^{\text{pih}} = \frac{\gamma^t u(c_t^{\text{pih}})}{U(c^{\text{pih}})}$$

- ▶ 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

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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:	MPC = $\Delta C / \Delta Y$	Agg. cons. growth
Transfer equivalent to 1% of GDP		
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

◀ Go Back

Appendix A.1

Data

- ▶ Event of anticipated changes in discretionary income
 - ▶ Natural experiments: Income \uparrow 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

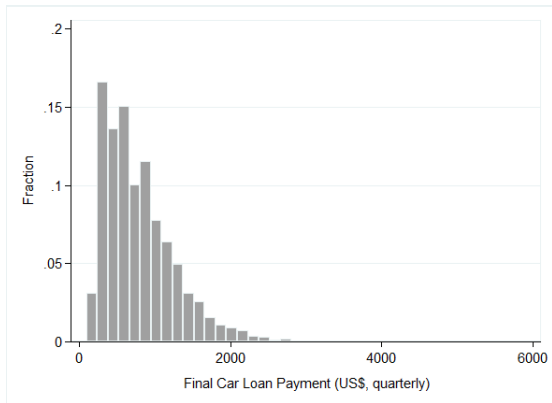
Appendix A.1

1. Advantages

2. Disadvantages

Appendix A.2

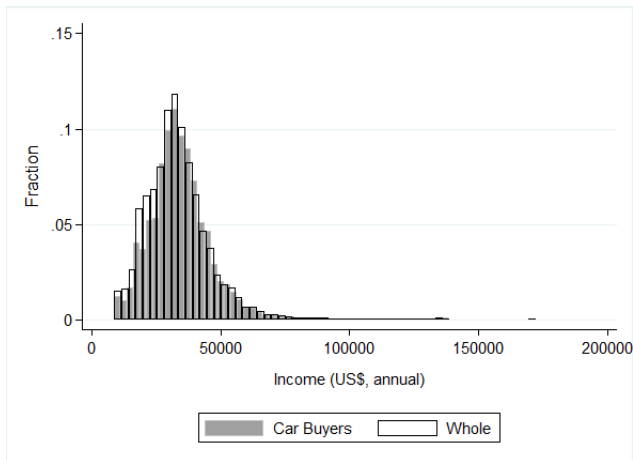
Distribution of sample: Final payment (US\$, quarterly)



[◀ Go Back](#)

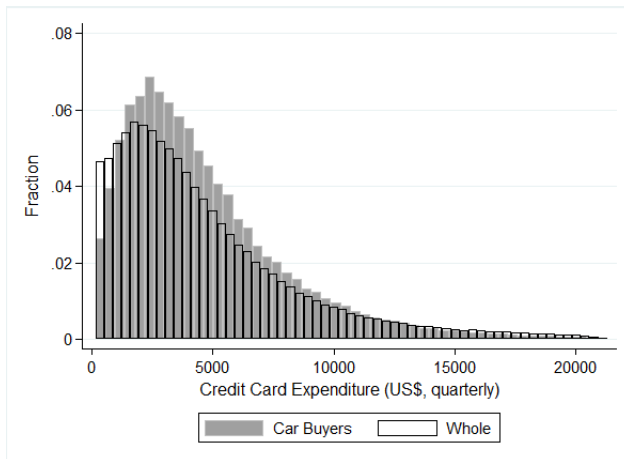
Appendix A.2

Distribution of sample: Income (US\$, annual)



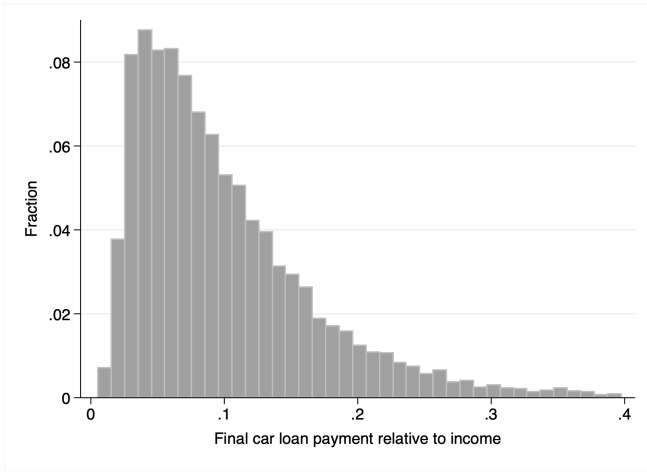
Appendix A.2

Distribution of sample: Consumption (US\$, quarterly)



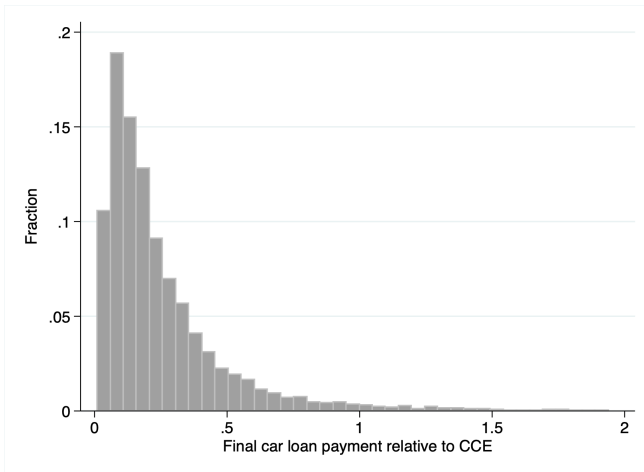
Appendix A.2

Distribution of sample: Predictable income change relative to income



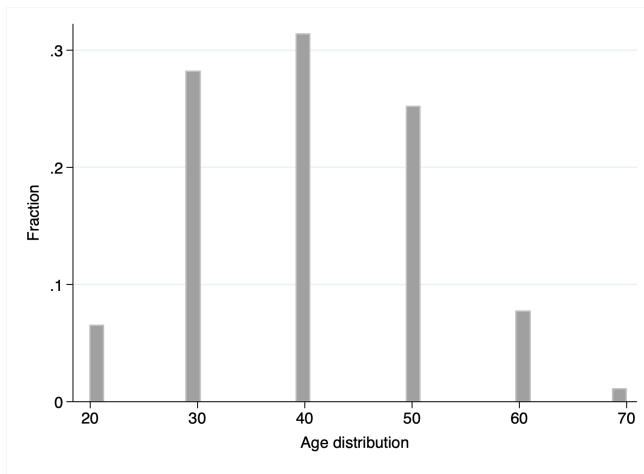
Appendix A.2

Distribution of sample: Predictable income change relative to consumption



Appendix A.2

Distribution of sample: Age



◀ Go Back

Appendix A.3.a

Main estimation results:

Consumption response to anticipated income changes

Dep. Var: Δc_{it}	(1)	(2)	(3)	(4)
FP	0.190*** (0.032)	0.178*** (0.032)	0.196*** (0.034)	0.177*** (0.033)
Constant	0.237 (0.152)	0.219 (0.156)	0.266 (0.167)	0.393* (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.

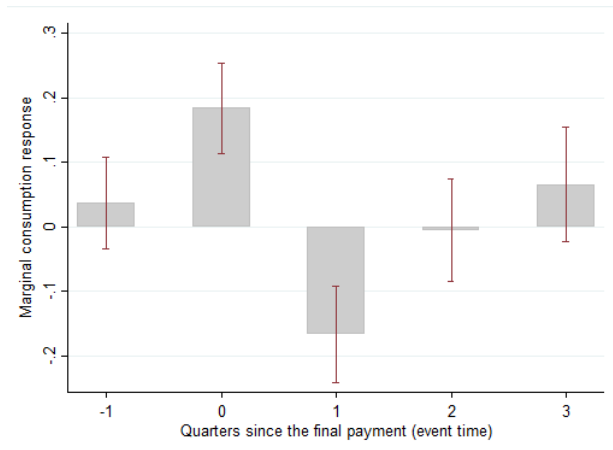
◀ Go Back

Appendix A.3.b

Marginal effects by time

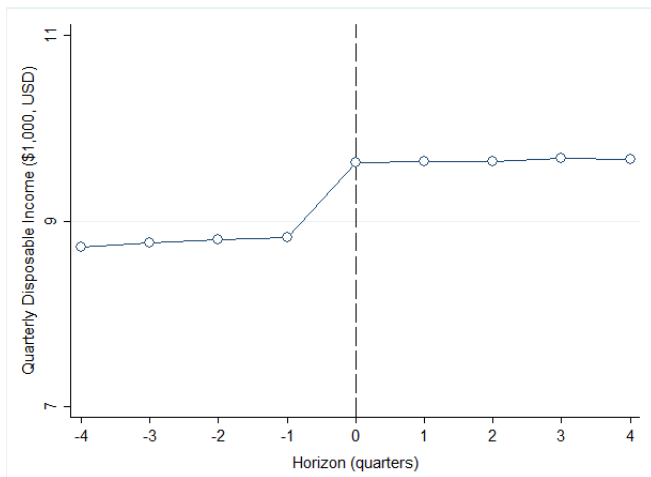
- Consumption response (i.e., Marginal effects) by time

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



Appendix A.3.c

Income process



◀ Go Back

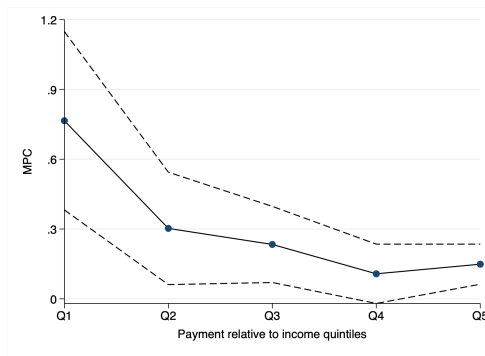
Appendix A.4.a

Robustness: MPC heterogeneity by income quintiles

► Exploring the MPC heterogeneity

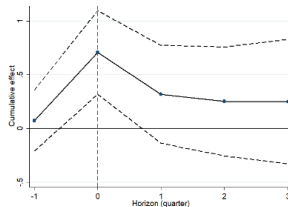
$$\Delta c_{it} = \alpha_t + \gamma_i + Region_i + \sum_{q_y} \beta_{q_y} FP_{it} * \mathbb{1}(y_{it} \in q_y) + \sum_{q_y} \eta_{q_y} \mathbb{1}(y_{it} \in q_y) + \lambda' x_{it} + \epsilon_{it}$$

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

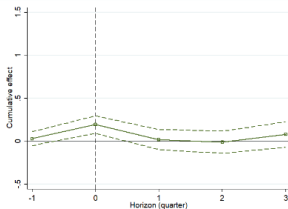


Robustness: Consumption dynamics by relative magnitudes

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



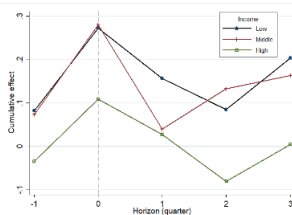
(d) Consumption dynamics (FP to Income = High)



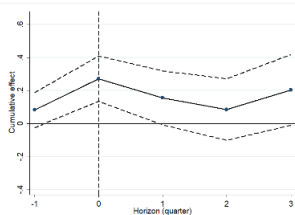
Appendix A.4.c

Robustness: Consumption dynamics by income

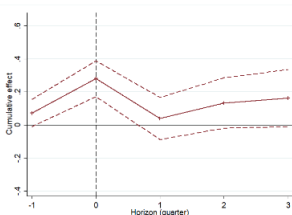
(a) Cumulative consumption responses by Income



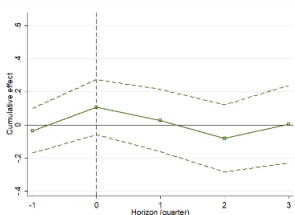
(b) Consumption dynamics (Income = Low)



(c) Consumption dynamics (Income = Middle)



(d) Consumption dynamics (Income = High)



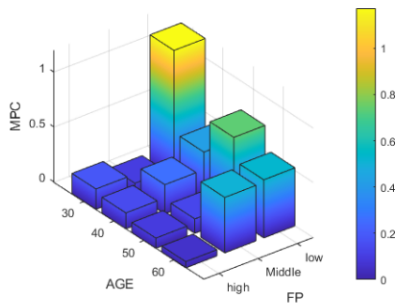
Appendix A.4.d

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta C_{i,t}$	$\Delta C_{i,t}$	$\Delta \ln C_{i,t}$	$\Delta C_{i,t}$	$\Delta C_{i,t}$	$\Delta \ln C_{i,t}$
FP	0.196*** (0.028)	0.179*** (0.028)		0.203*** (0.029)	0.177*** (0.028)	
FP to Income			0.350*** (0.044)			0.357*** (0.045)
Constant	0.232 (0.429)	0.809 (0.530)	0.022* (0.011)	0.104 (0.489)	2.461** (1.198)	0.049** (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

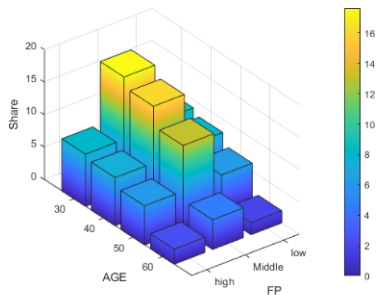
Appendix B.1

Distribution of MPC, Age, and Absolute Size

(a) MPC distribution, age, size



(b) Population share, age, size

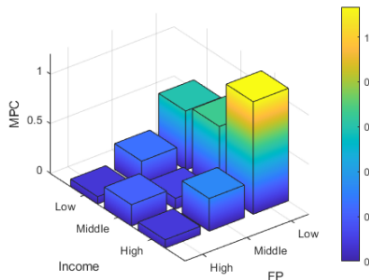


◀ Go Back

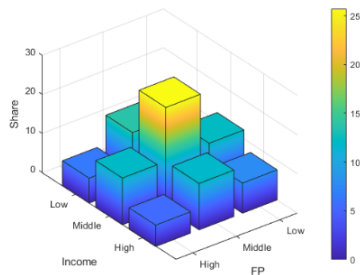
Appendix B.2

Distribution of MPC, Income, and Absolute Size

(c) MPC distribution, income, size



(d) Population share, income, size

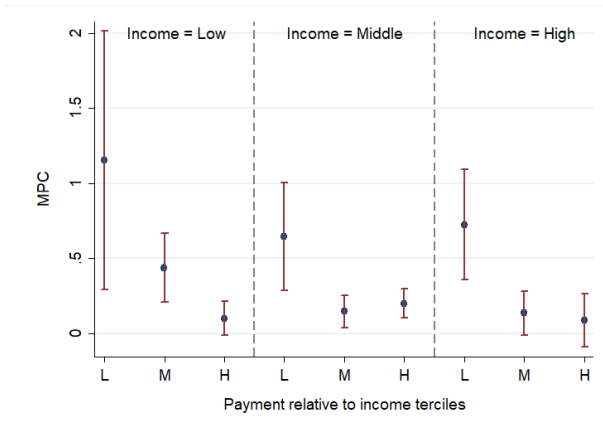


◀ Go Back

Appendix B.3.a

Conditional MPC heterogeneity by relative size groups

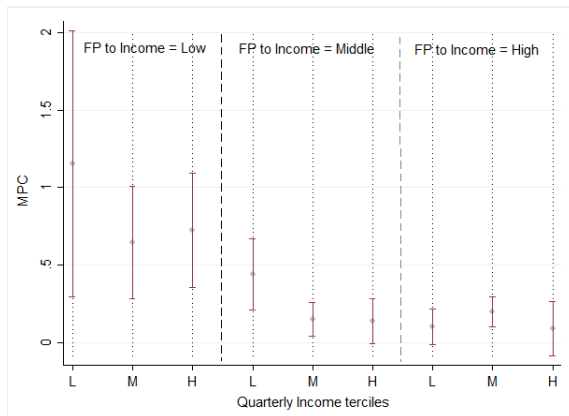
- ▶ **Role of liquidity constraints** by income as a proxy
 - ▶ Larger MPC when the size is **small** across all income groups



Appendix B.3.b

Conditional MPC heterogeneity by relative size groups

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



Appendix B.4

MPC heterogeneity: payment size relative to income

► Consumption monotonically decreases by size relative to income

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

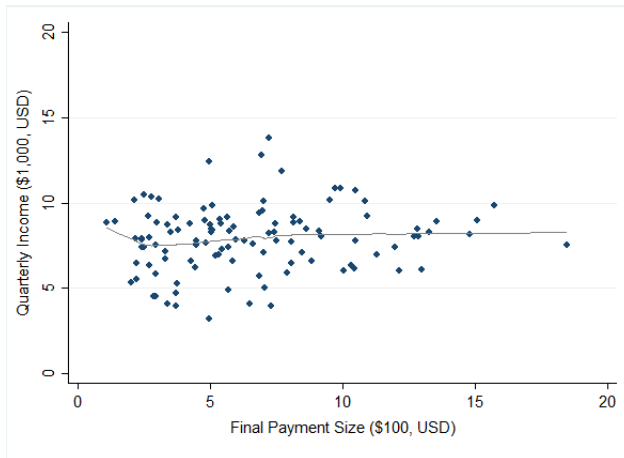
- $\Delta c_{it}^{FP \text{ to income} = Low} > \Delta c_{it}^{FP \text{ to income} = High}$
- When final payment size relative to quarterly income is small, most of them are spent on consumption
(i.e. Deviate from optimal consumption decision; $\Delta c_{it} = 0$)

◀ Go Back

Appendix B.5.a

Income and final car loan payment, Sample

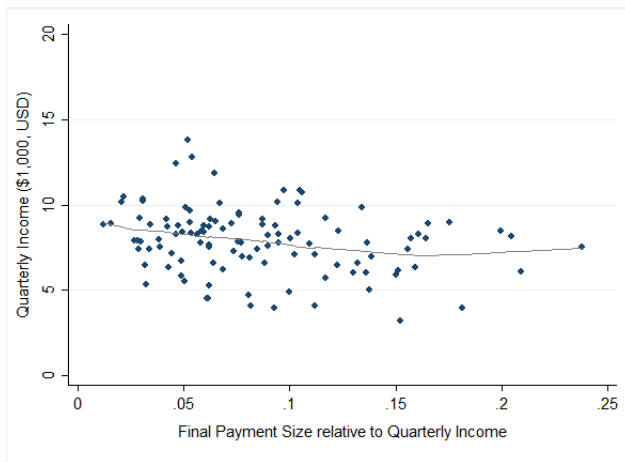
- No strong correlation between income & payment size



Appendix B.5.b

Income and payment size relative to income, Sample

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



Appendix B.5.c

Income and payment size relative to income, Full data

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



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

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

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

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

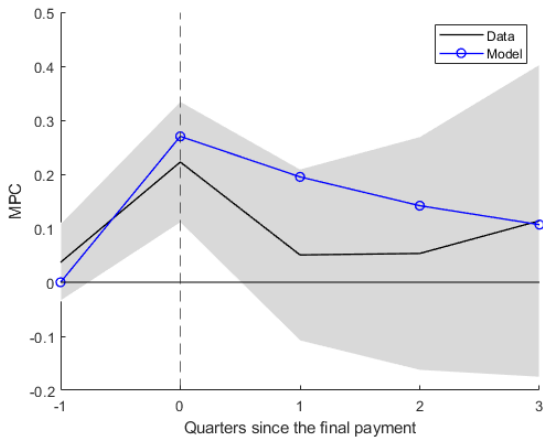
$$p_t = \rho p_{t-1} + \epsilon_t^P$$

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

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



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

◀ Go Back

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

◀ Go Back

Policy experiment, details

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

$\tau_i(j)$: transfer received by individual i for policy experiment j

y_i : individual income

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

c_i : individual consumption

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

◀ Go Back