# Debt and Response to Household Income Shocks

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# Motivation

- We want to know how idiosyncratic income shocks transmit to household consumption.
- Survey data and administrative data cannot capture high-frequency income shocks and consumption behavior.
- Big data on linked financial accounts brings opportunity.
  - Personal finance service companies manage data from users' multiple financial accounts.
  - Rich high-frequency data: transaction (consumption) and balance sheet (income, asset, credit).
  - This paper: 4 million users, 5 billion transactions and daily balance sheets in 2008-2013.

# Research Question and Contribution

- Research question:
  - How does consumption elasticity vary among households?
  - What are the channels of transmission?
- This paper:
  - Validate and use a comprehensive household financial data from 2008-2013.
  - Find that elasticity of consumption is significantly higher in households with more debt, fewer assets, more tightening borrowing constraints.
  - The heterogeneity can be explained (almost) entirely by credit and liquidity constraints.

# Data

- A large online personal finance website connecting 4 million users' financial accounts.
  - Transaction data: time-stamped spending and income records with detailed information (source, category, instrument, etc.)
  - Balance sheet data: daily updated in investment, equity, retirement, real estate, and loan accounts.
- Demographic data of households are available:
  - can map account level data to households.
  - can adjust the sample to CPS weight (on age, sex, income range, and state of residence).
- Other data sources:
  - Compustat data on firms, news data on firm layoffs (IV).
  - Geographic characteristics of metro areas (IV).

# Data: Potential Problems

- Userbase Representativeness: Validate with Survey Data.
  - Census Retail Sales (CRS) and CEX on spending category.
  - SCF for wealth and income distribution.
  - Zillow for wealth and house price.

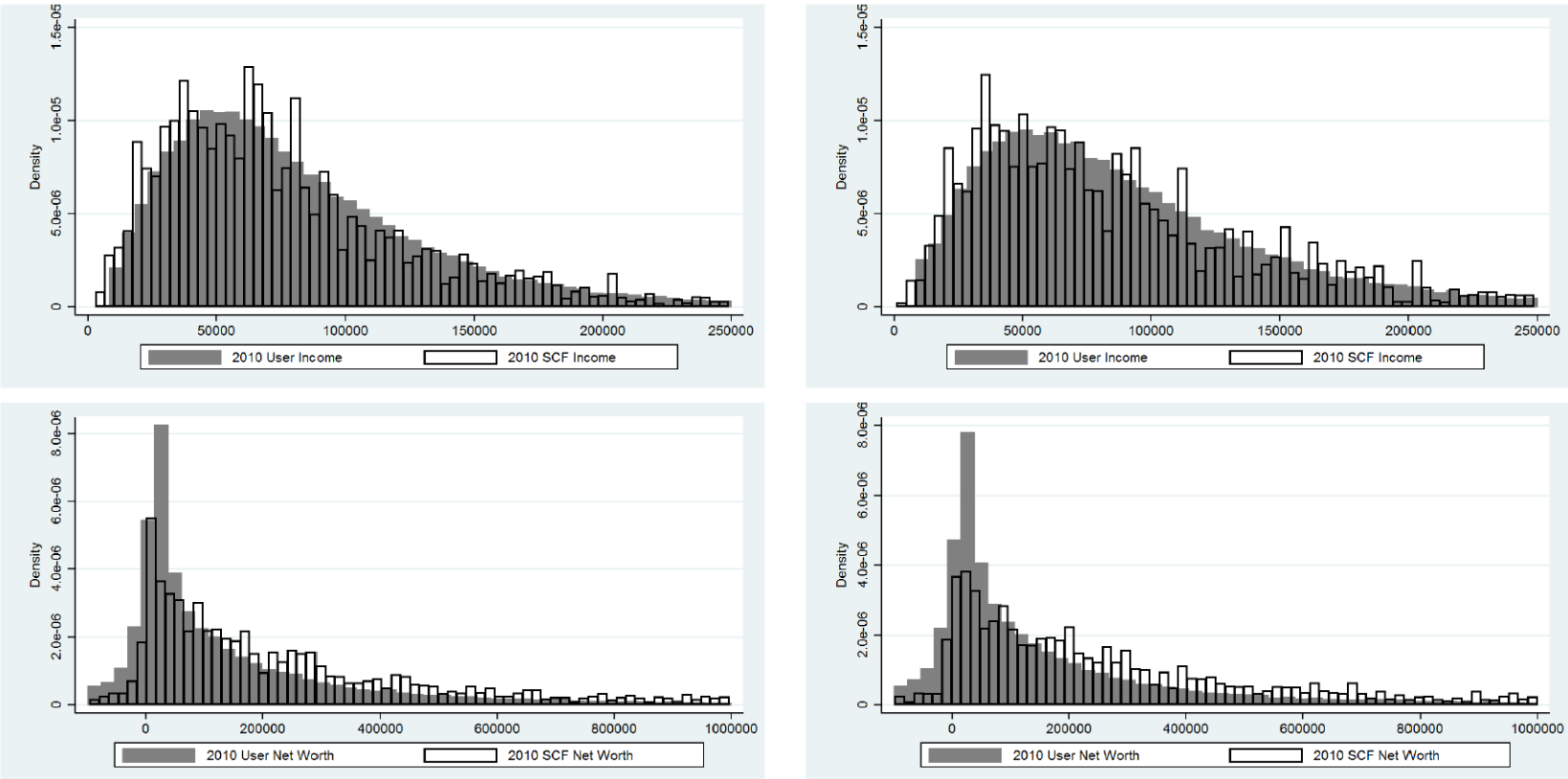



Figure: Wealth and Income: Adjusted Linked Account vs SCF

# Data: Potential Problems

- Userbase Representativeness: Validate with Survey Data
  - Census Retail Sales (CRS) and CEX on spending category.
  - SCF for wealth and income distribution.
  - Zillow for wealth and house price.
- Account Completeness
  - Not a problem according to internal survey.
- Cash, Check and Tax Observability
- Platform-Driven Changes in Financial Behavior

# Empirical Specification

## Model Setup

- Dependent Variable: $\Delta log(Spending_{it})$
- Explanatory Variables:
  1. $\Delta log(Income_{it})$
  2. $\Delta log(Income_{it}) \times$ Leverage Measures
  3. $\Delta log(Income_{it}) \times$ Asset Measures
  4. $\Delta log(Income_{it}) \times$ Credit Measures
- Instrument Variables:
  1. Income shock: 3 types of (unanticipated) firm shocks.
  2. Leverage variation: geographic characteristics of metro areas (Albert Saiz, 2010).
- Regression sample: employees of publicly listed firms satisfying some other proper requirements - 156,604 households.

# Empirical Results

## Impact of Debt and Asset on $\Delta log(Spending)$

Table 7: **Impact of Debt on ΔLog(Spending) Following Income Shocks**

| | (1) OLS ΔLog(Spd) | (2) OLS ΔLog(Spd) | (3) OLS ΔLog(Spd) | (4) IV ΔLog(Spd) | (5) IV ΔLog(Spd) | (6) IV ΔLog(Spd) | (7) IV ΔLog(Spd) | (8) IV ΔLog(Spd) |
|---|---|---|---|---|---|---|---|---|
| ΔLog(Inc) | 0.295*** | 0.258*** | 0.264*** | 0.377*** | 0.365*** | 0.336*** | 0.451*** | 0.287* |
| | (0.004) | (0.003) | (0.005) | (0.033) | (0.062) | (0.073) | (0.055) | (0.154) |
| ΔLog(Inc)*D/(D+A) | | 0.078*** | | | 0.084*** | | | 0.055* |
| | | (0.004) | | | (0.026) | | | (0.030) |
| ΔLog(Inc)*D/I | | | 0.060*** | | | 0.072*** | | |
| | | | (0.005) | | | (0.024) | | |
| ΔLog(Inc)*Assets | | | | | | | -0.134*** | |
| | | | | | | | (0.011) | |
| Observations | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 |
| Period FE | YES | YES | YES | YES | YES | YES | YES | YES |
| Household FE | YES | YES | YES | YES | YES | YES | YES | YES |
| Instrumented Variables | None | None | None | Inc | Inc,Lev | Inc,Lev | Inc | Inc,Lev |
| F-Tests (Inc) | - | - | - | 45.9 | 36.1 | 42.6 | 45.9 | 13.9 |
| F-Tests (Lev) | - | - | - | - | 17.4 | 28.4 | - | 17.4 |
| Sargan P-Value | - | - | - | 0.363 | 0.547 | 0.471 | 0.318 | - |

*** p<0.01, ** p<0.05, * p<0.1

- Elasticity of consumption is significantly higher in households with more debt and fewer assets.
- IV estimates is larger than panel OLS.

# Empirical Results

## Liquid vs. Illiquid Assets, Durable vs. Nondurable Spending

**Effects of Balance Sheet Holdings on ΔLog(Spending) Following Income Shocks**

| | (1) IV | (2) IV | (3) IV | (4) IV | (5) IV |
|---|---|---|---|---|---|
| Sample: | All | All | All | Non-Durables | Durables |
| ΔLog(Inc) | 0.315*** | 0.343*** | 0.346*** | 0.319*** | 0.414*** |
| | (0.031) | (0.026) | (0.023) | (0.022) | (0.021) |
| ΔLog(Inc)*(Debt/Inc) | 0.076*** | 0.071*** | 0.051*** | 0.049*** | 0.063*** |
| | (0.024) | (0.023) | (0.016) | (0.015) | (0.021) |
| ΔLog(Inc)*(Total Assets/Inc) | | -0.049*** | | | |
| | | (0.014) | | | |
| ΔLog(Inc)*(Liq Assets/Inc) | | | -0.074*** | -0.069*** | -0.101*** |
| | | | (0.014) | (0.016) | (0.018) |
| ΔLog(Inc)*(Non-Liq Assets/Inc) | | | -0.028*** | -0.024** | -0.037*** |
| | | | (0.010) | (0.011) | (0.015) |
| Observations | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 |
| Period FE | YES | YES | YES | YES | YES |
| Household FE | YES | YES | YES | YES | YES |
| Instrumented Variables | Inc | Inc | Inc | Inc | Inc |

*** p<0.01, ** p<0.05, * p<0.1

- Illiquid assets have less effect.
- Nondurable consumption elasticity is higher than durable.

# Empirical Results

## Credit Constraints

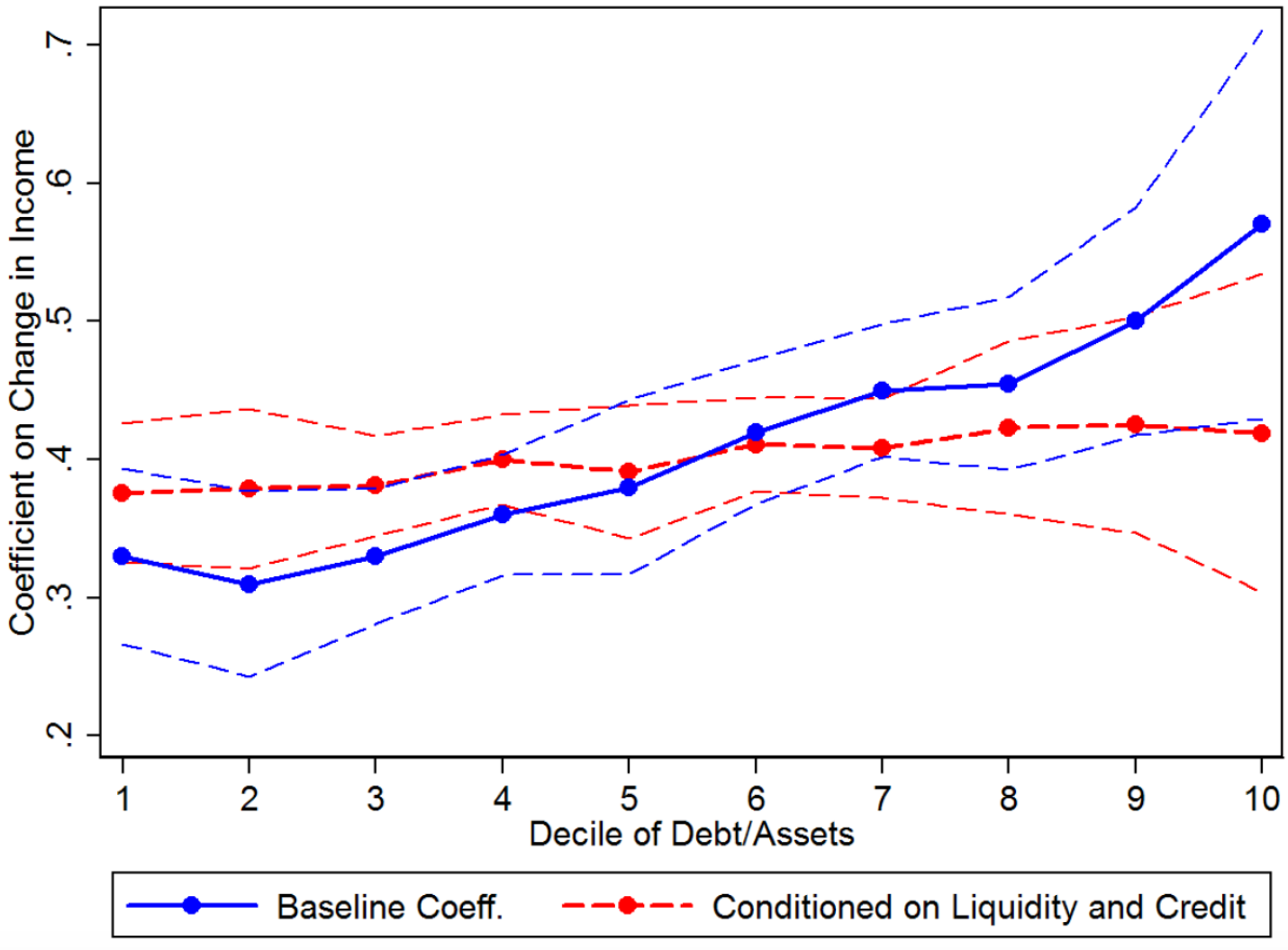
Table 9: **Impact of Debt and Credit on ΔLog(Spending) Following Income Shocks**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | IV | IV | IV | IV | IV | IV |
| Sample: | All | All | All | All | All | All |
| ΔLog(Inc) | 0.321*** | 0.343*** | 0.346*** | 0.329*** | 0.334*** | 0.324*** |
| | (0.032) | (0.026) | (0.023) | (0.022) | (0.021) | (0.023) |
| ΔLog(Inc)*(Debt/(Debt+Assets)) | 0.087*** | 0.073*** | 0.052*** | 0.031** | 0.024* | 0.016 |
| | (0.026) | (0.024) | (0.016) | (0.015) | (0.014) | (0.016) |
| ΔLog(Inc)*(Credit Score) | | -0.037*** | -0.030** | -0.026** | -0.019* | -0.026** |
| | | (0.014) | (0.011) | (0.012) | (0.011) | (0.012) |
| ΔLog(Inc)*(Unused Credit) | | | -0.062*** | -0.059*** | -0.051*** | -0.043*** |
| | | | (0.012) | (0.011) | (0.012) | (0.011) |
| ΔLog(Inc)*(Liq Assets) | | | | -0.073*** | -0.071*** | -0.068*** |
| | | | | (0.015) | (0.016) | (0.019) |
| ΔLog(Inc)*(Credit Limit Decline) | | | | | 0.063* | 0.069* |
| | | | | | (0.034) | (0.036) |
| ΔLog(Inc)*(Marginal Int Rate) | | | | | | 0.094** |
| | | | | | | (0.046) |
| Observations | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 | 3,014,721 |
| Period FE | YES | YES | YES | YES | YES | YES |
| Household FE | YES | YES | YES | YES | YES | YES |
| Sargan P-Value | 0.290 | 0.344 | 0.389 | 0.410 | 0.376 | 0.338 |
| Instrumented Variables | Inc | Inc | Inc | Inc | Inc | Inc |

- Credit Constraints increase consumption elasticity.
- Debt is not significant after controlling credit and liquidity constraints.

# Empirical Results

Figure 11: **Consumption Elasticity with Respect to Income Across Debt/Asset Deciles**



# Takeaways and Contributions

- Big Data (high-frequency, rich information, large sample) help us test and revisit classical theories but require extra work.
- Credit and liquidity constraints play a major role in the transmission of income shock to consumption.
- Too much illiquid asset holding (e.g. housing) triggers the sharp consumption decline in the crisis.

# Discussion

- Lots of work can be done with this big data
  1. Source of wealth inequality
  2. Impact of various shocks of interest (e.g. policy shocks, trade shocks, etc.)
  3. Further work by Scott Baker, Lorenz Kueng (another PFW) and Michaela Pagel (Iceland data)
- More evidence is needed for the "explained entirely by credit and liquidity" claim.
- Not addressed issue: selection bias via data cleaning.
- The elasticity might be overestimated.