# Explaining Consumption Excess Sensitivity with Near-Rationality:

## Evidence from Large Predetermined Payments

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## Motivation:

- understanding consumption is important
  - consumption is about 2/3 of GDP in developed countries
  - effectiveness of stabilization policies depends on consumption response to often predictable cash flows
- standard model (PILCH) has two main predictions for consumption:
  1. *should* respond to news
  2. should *not* respond to timing of cash flows; i.e., predetermined income (excess sensitivity)
- previously I focused on the first prediction, now I turn to the second

## Preview:

- use new transaction data from user accounts at large personal finance website
- combine with quasi-experiments from annual Alaska Permanent Fund Dividend (PFD)
  - salient (large news coverage and own website)
  - predetermined (known 1 month before; size based on past)
  - large payments every Oct to each Alaskan ($2,072 in 2015)
- payment properties and data sample favor standard model
  - yet, I find a large response to the PFD:
    - using both non-parametric and parametric methods
    - nondurables MPC of 30%
  - the new data and the properties of the PFD rule out most previous explanations of excess sensitivity

- derive *potential* loss in wealth from fully consuming PFD instead of fully smoothing

$$Loss \propto \frac{PFD}{c_T}$$

  - $\frac{PFD}{c_T}$ is the relative size of the payment normalized by consumption (permanent income)
  - can be calculated *ex-ante* to predict excess sensitivity

- potential loss predicts heterogeneity in MPCs
  - MPCs are steeply *decreasing* across loss quintiles

- maybe surprisingly, this is consistent with high-income households having *larger* MPCs
  - indeed, MPCs are strongly *increasing* in income

- welfare losses fully explain heterogeneity in MPCs among unconstrained hh: *ex-post* losses are the same across hh and small

  $\Rightarrow$ these are near-rational deviations

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## Conclusion

1. Near-rational deviations from standard model predict heterogeneity in MPCs in the cross section
   - for higher-income households, who have sufficient liquid wealth
   - estimated using a single source of predetermined income within the same research design
2. Show borrowing constraints continue to predict high MPCs
   - for lower-income households with few liquid assets

$\Rightarrow$ this is a *new* explanation for a different population segment

## Previous explanations of excess sensitivity:

- borrowing constraints
  - majority of sample has large amounts of *liquid* assets
    $\Rightarrow$ not wealthy hand-to-mouth consumers
- precautionary saving
  - no uncertainty in the month of the dividend payments
  - low uncertainty of dividend in all other months
  - most households have lots of liquid wealth
- rational inattention, cons. commitments, optimization frictions
  - should only respond to new information since last update
  - reasonable forecast errors are positive and negative
  - news component is very small
  - instead, households respond to *entire* dividend
- non-separable preferences
  - dividend is independent of future labor income growth
  - response across all categories, including strictly nondurables

## Outline:

1. quasi-experiment and data
2. average excess sensitivity
   - nonparametric evidence
   - parametric estimate of MPC
3. near-rationality and higher-income hh MPCs
4. liquidity constraints and lower-income hh MPCs
5. external validity using the Consumer Expenditure Survey
6. robustness
   - consumption vs. spending
   - specification checks
7. extensions
   - durables and total expenditure MPCs
   - anticipation effects
   - consumption commitments

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## Alaska Permanent Fund Dividend:

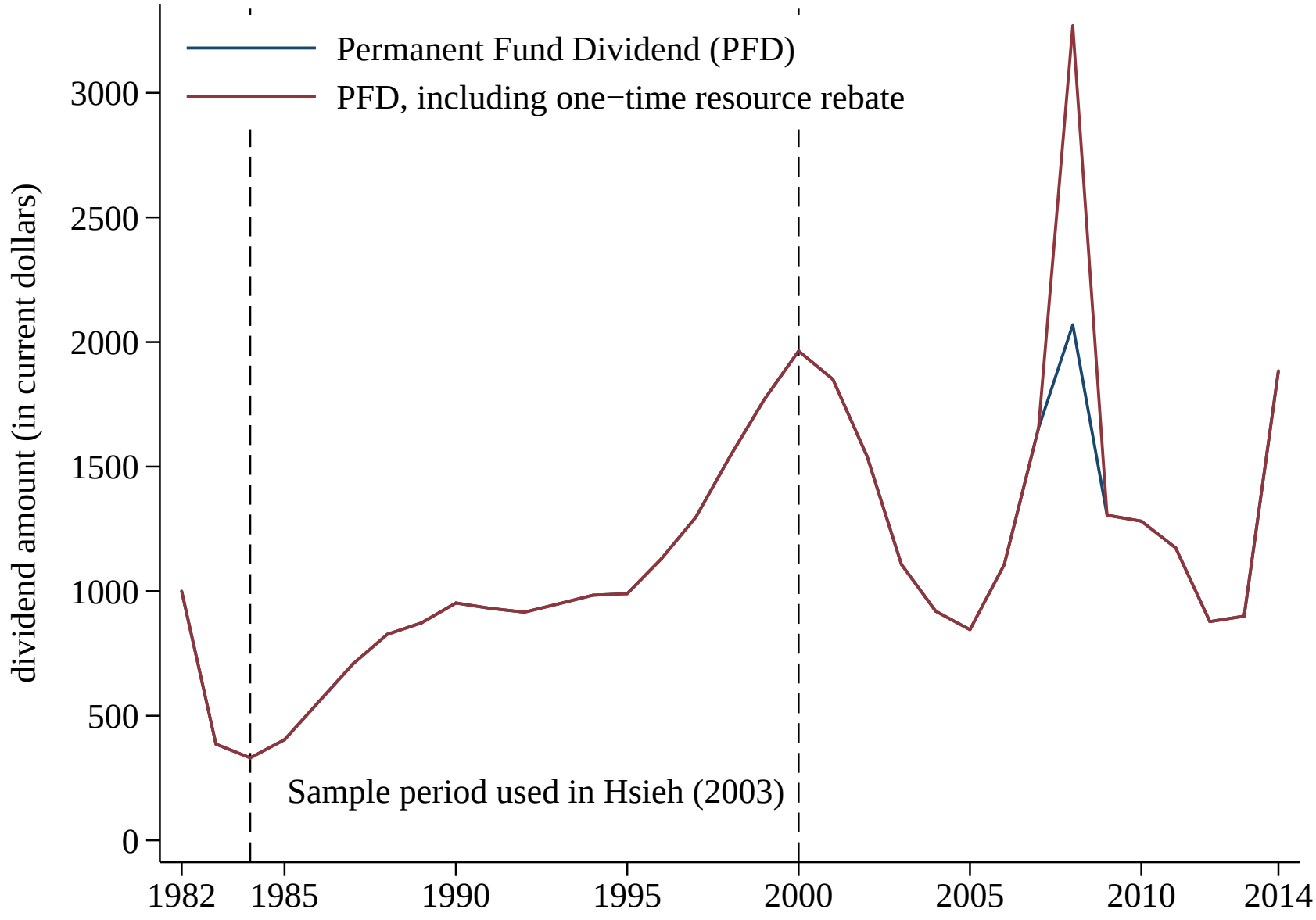
Annual payment from state's broadly-diversified wealth fund

Important characteristics of PFD for excess sensitivity tests:

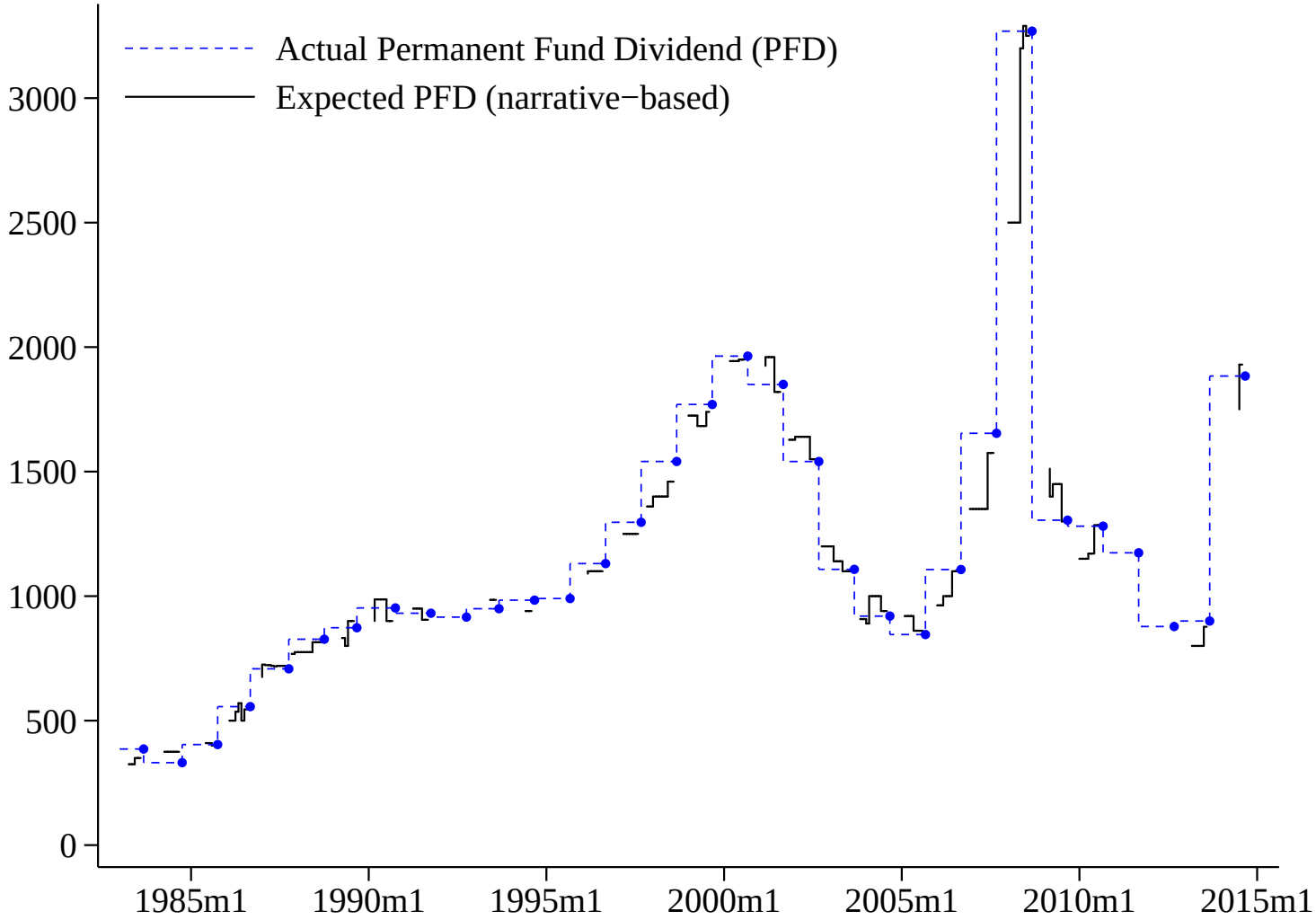
1. *salient, predetermined, and regular*
   - 5-year moving average of fund's income:
     - highly predictable
     - payment size is orthogonal to local economy
   - based on June numbers, announced in Sept., paid in October
   - well covered by local media during the year
2. *nominally large*
   - latest dividend: $2,072 in October 2015
   - for each Alaskan, including children (avg family size = 2.7)
3. *lump-sum*
   - more important for low-income households and large families

   $\Rightarrow$ cross-sectional heterogeneity in the importance of the PFD

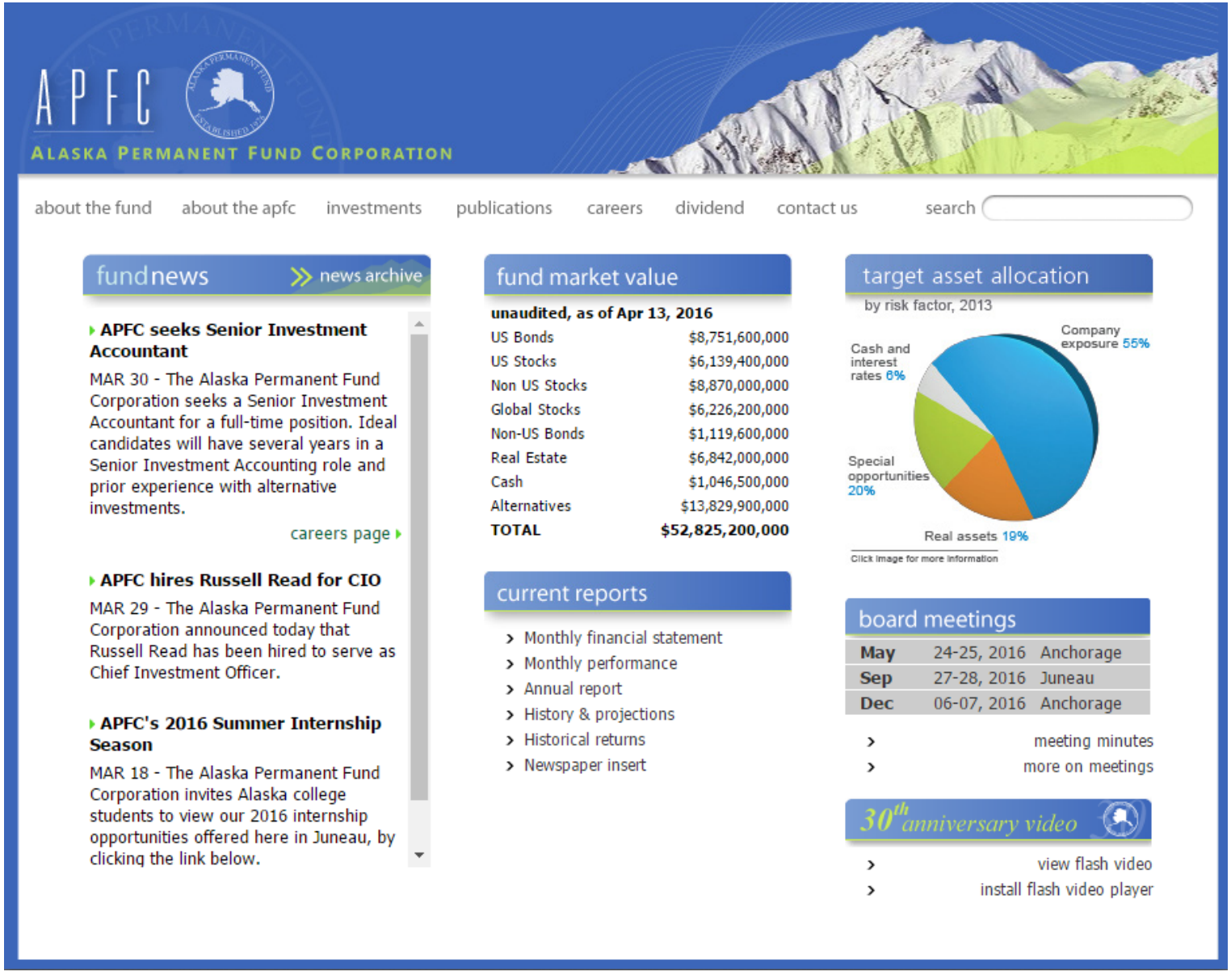
# Historical Dividend Distributions



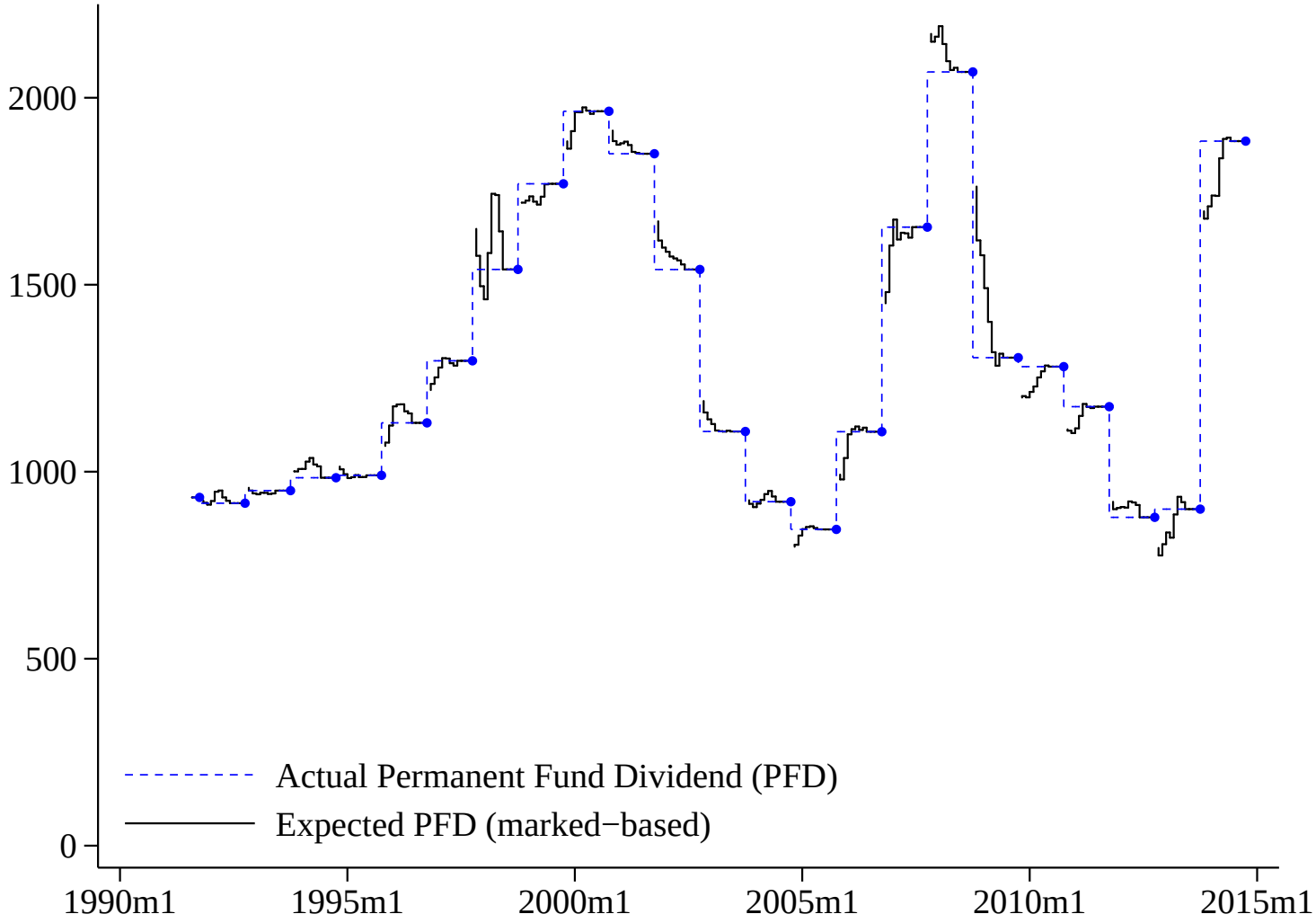
# **Salience:** **Expected divided** based on narrative analysis of local newspapers



# **Salience:** Alaska Permanent Fund's website



# **Salience:** **Expected divided** based on Permanent Fund's financial statements



## Household Spending Data:

1. New transaction data from user accounts at a large **personal finance website** (PFW) from 2010-2014
   - linked credit card and financial accounts
   - 1,400 Alaskan users that receive dividend via direct deposit (treatment group)
   - 2,200 users from state of Washington as control group
   - high-quality data on income, detailed expenditures, and financial assets

2. **Consumer Expenditure Survey** (CE) to check external validity of new data and results
   - neither dataset is representative of Alaskan population
   - PFW over-represents higher-income households
   - CE over-represents lower-income households

## Outline:

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4. liquidity constraints and lower-income hh MPCs
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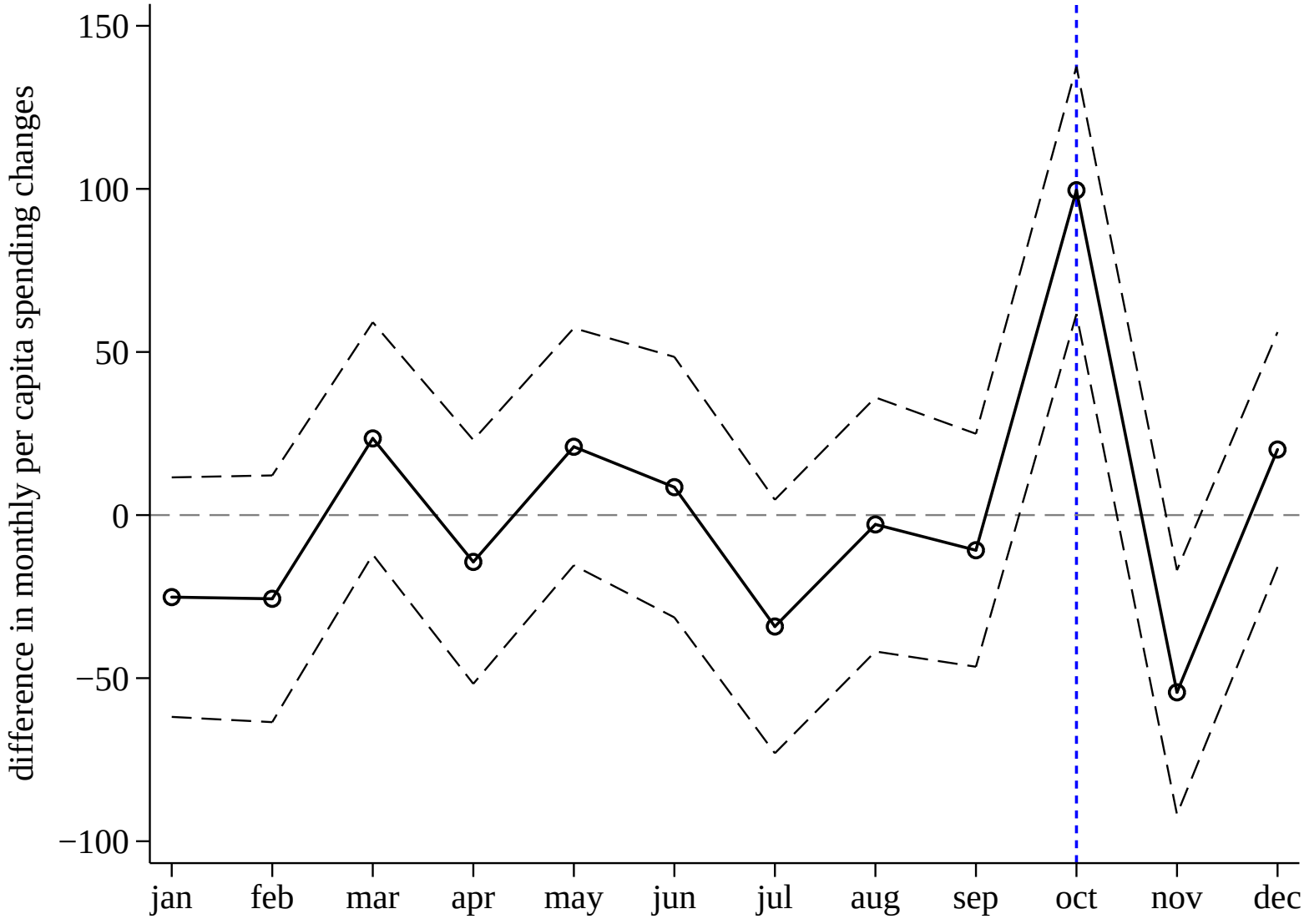
**Nonparametric Evidence:** Average nondurable spending changes per person by month in Alaska vs. Washington

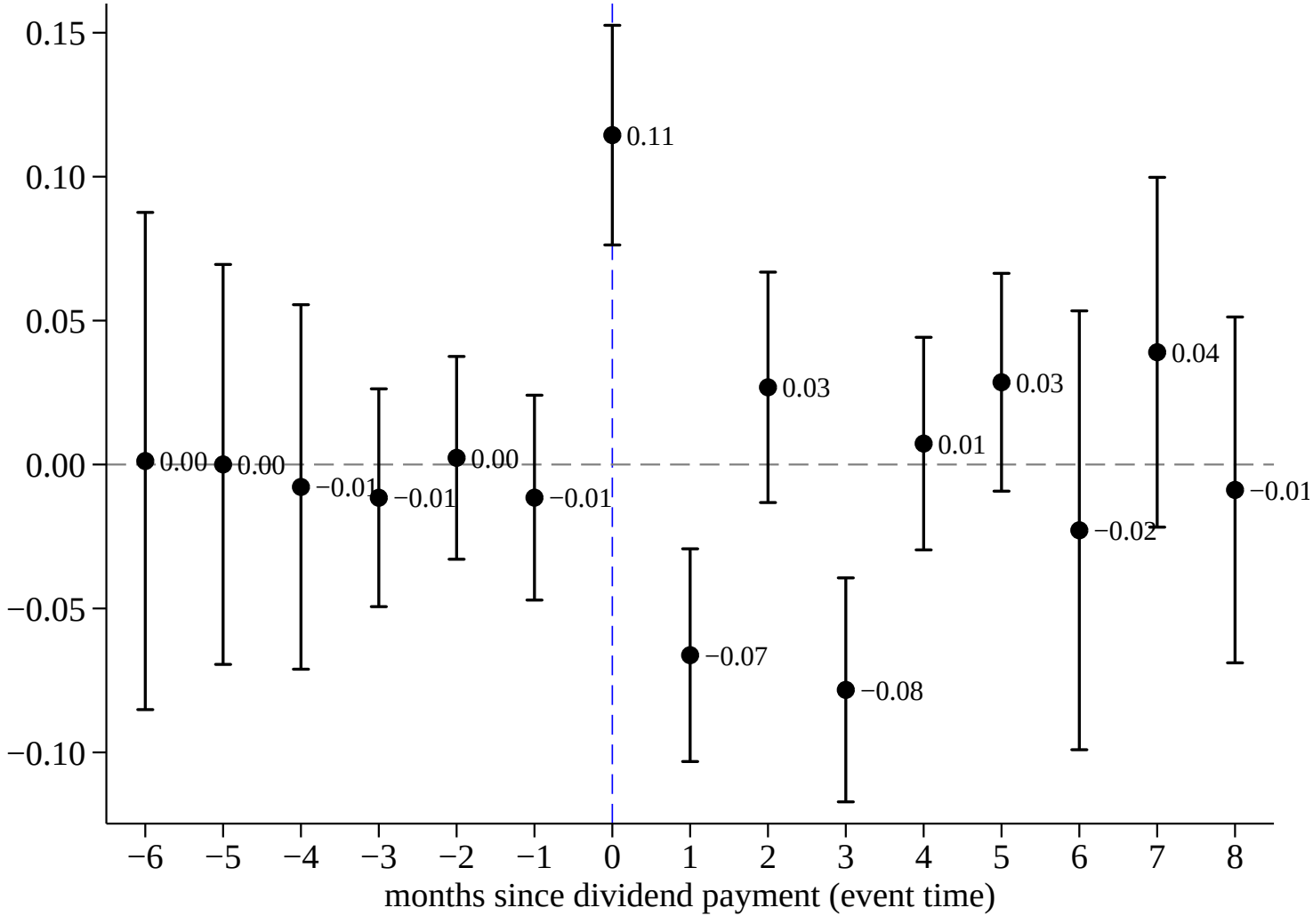


**Parametric Evidence:** Testing for anticipation effects

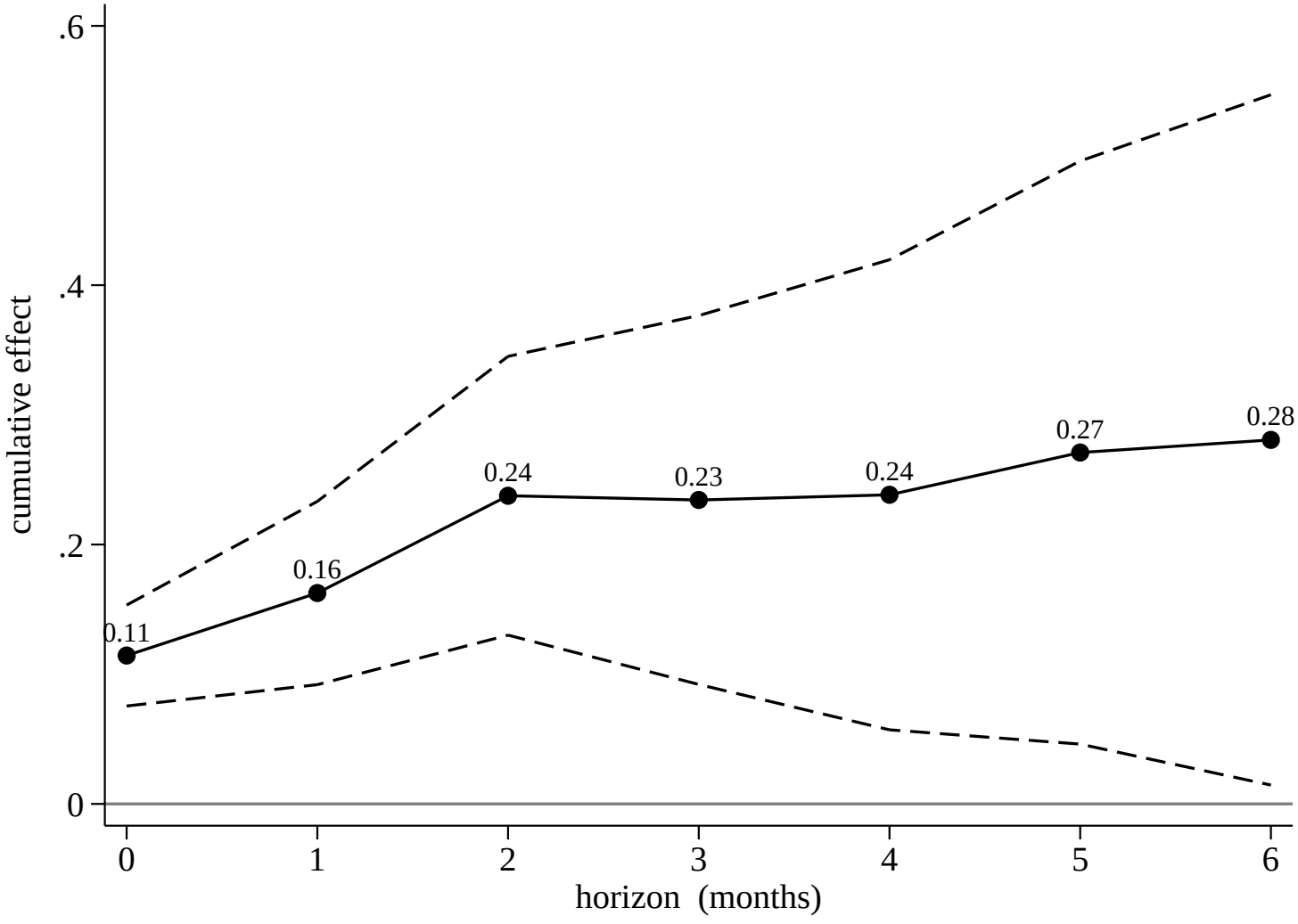
$$c_{i,t} - c_{i,t-1} = \sum_{s} \beta_s \cdot PFD_{i,t-s} + \tau_t + \text{Alaska}_i + \epsilon_{i,t}$$

# **Parametric Evidence:** Testing for anticipation effects

$$c_{i,t} - c_{i,t-1} = \sum_s \beta_s \cdot PFD_{i,t-s} + \tau_t + \text{Alaska}_i + \epsilon_{i,t}$$



# **Parametric Evidence:** Cumulative MPC $= \sum_s MPC(s)$



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## Approximate Loss from Potential Near-Rational Deviations:

Standard, frictionless life-cycle model's optimal consumption plan

$$c_w^* = \arg\max_c \left\{ U(c) = \sum_t \delta^t u(c_t) : \ p'c \leq w \right\}$$

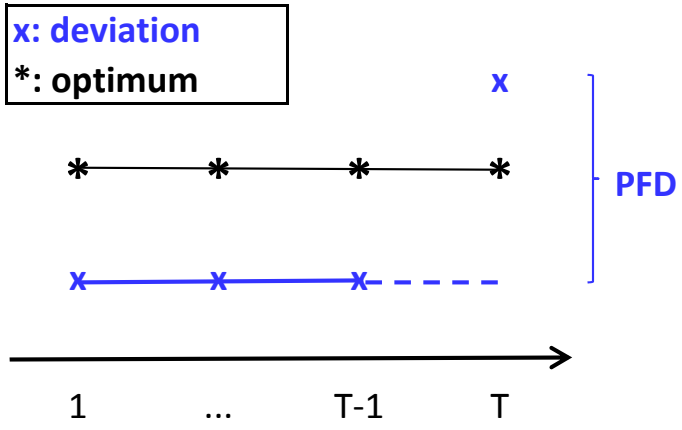
To derive money-metric proportional wealth loss

- 2nd-order approx. of utility around optimum, $U(c_w^*)$, and evaluating at deviation $\tilde{c}_w$ that satisfies budget constraint, $p'\tilde{c}_w = w$
- 1st-order approx. of $U(c_w^*)$ in wealth $\tilde{w}$, and setting $U(c_{\tilde{w}}^*) = U(\tilde{c}_w)$

$$Loss(\tilde{c}, c^*) \equiv -\frac{\tilde{w} - w}{w} \approx \frac{\gamma}{2} \sum_t \omega_t^* \left( \frac{\tilde{c}_t - c_t^*}{c_t^*} \right)^2$$

with utility annuity weights $\omega_t^* = \frac{\delta^t u(c_t^*)}{U(c^*)}$ and CES sub-utility $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$

To apply loss statistic to PFD setting, we need to specify the potential alternative consumption plan $\tilde{c}$

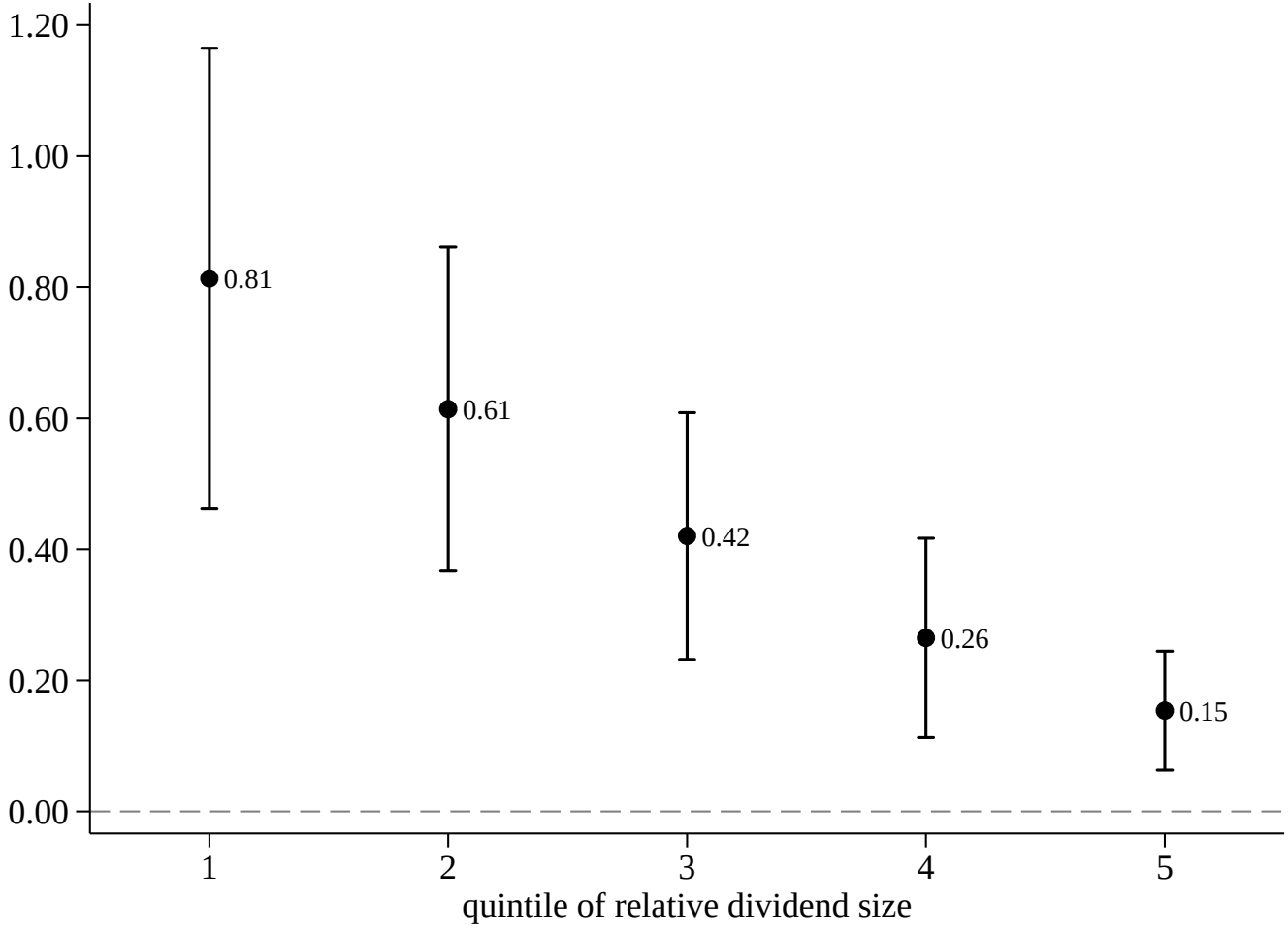



1. no discounting:
   $\delta = r = 0 \Rightarrow c_t^* = c^*$
2. spend PFD fully when paid, independent of dividend size
3. divide finite horizon in equal intervals with $T$ periods between news and payments

$$\Rightarrow \; Loss(\tilde{c}, c^*) \approx \left(\frac{PFD}{c_T}\right)^2 \cdot (T-1) \cdot \frac{\gamma}{2}$$

with $c_T = T \cdot c^*$

# **MPC heterogeneity:** by potential loss ($PFD/c_T$)




- Average rel. dividend size per quintile: $PFD/c_T$ = 1.60% , 2.7% , 3.7% , 5.4% , 10.3%
- Assuming T=4 quarters and $\gamma = 2$: Potential loss (ex-ante) = 0.08% , 0.2% , 0.4% , 0.9% , 3.2%

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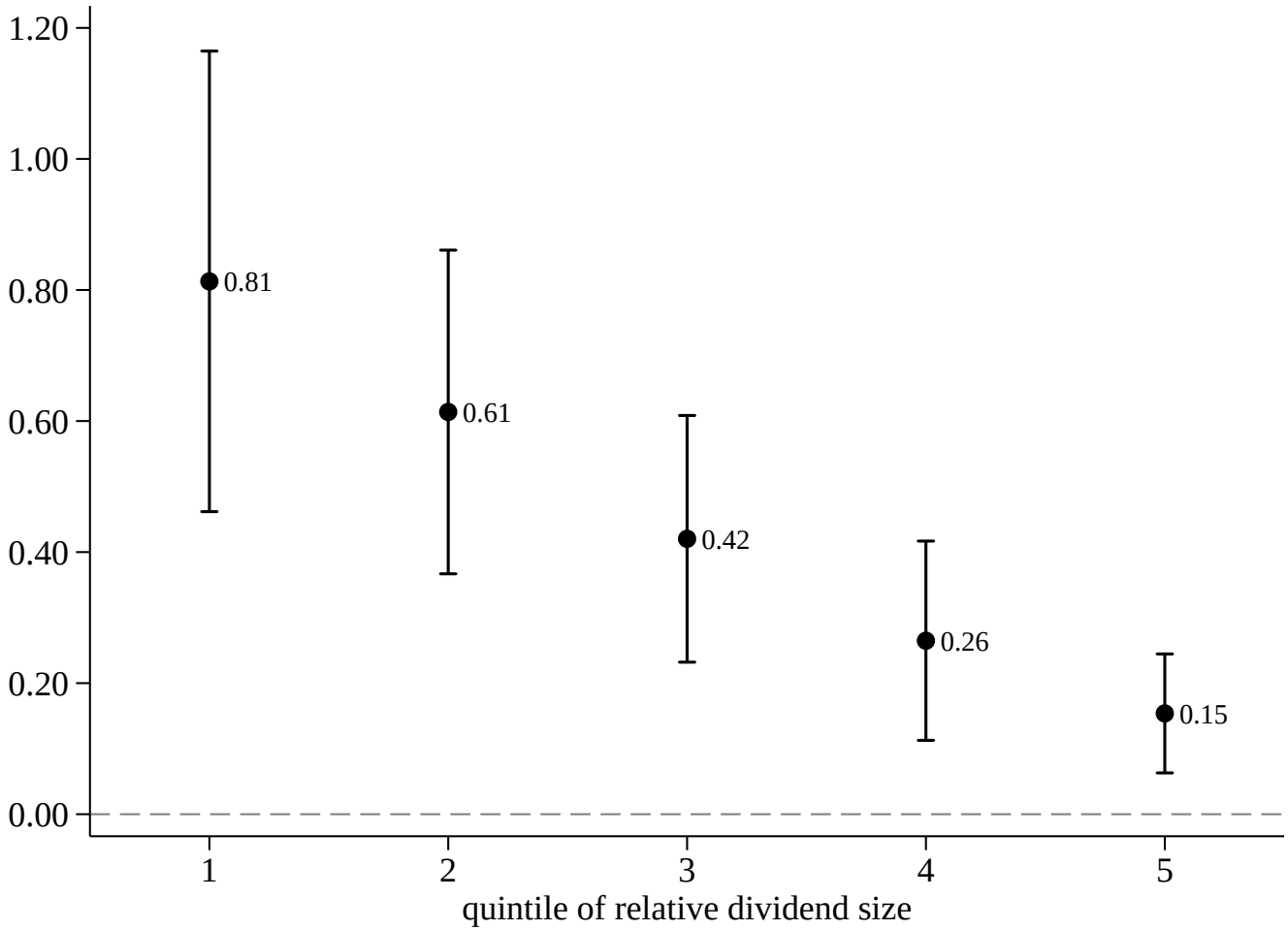
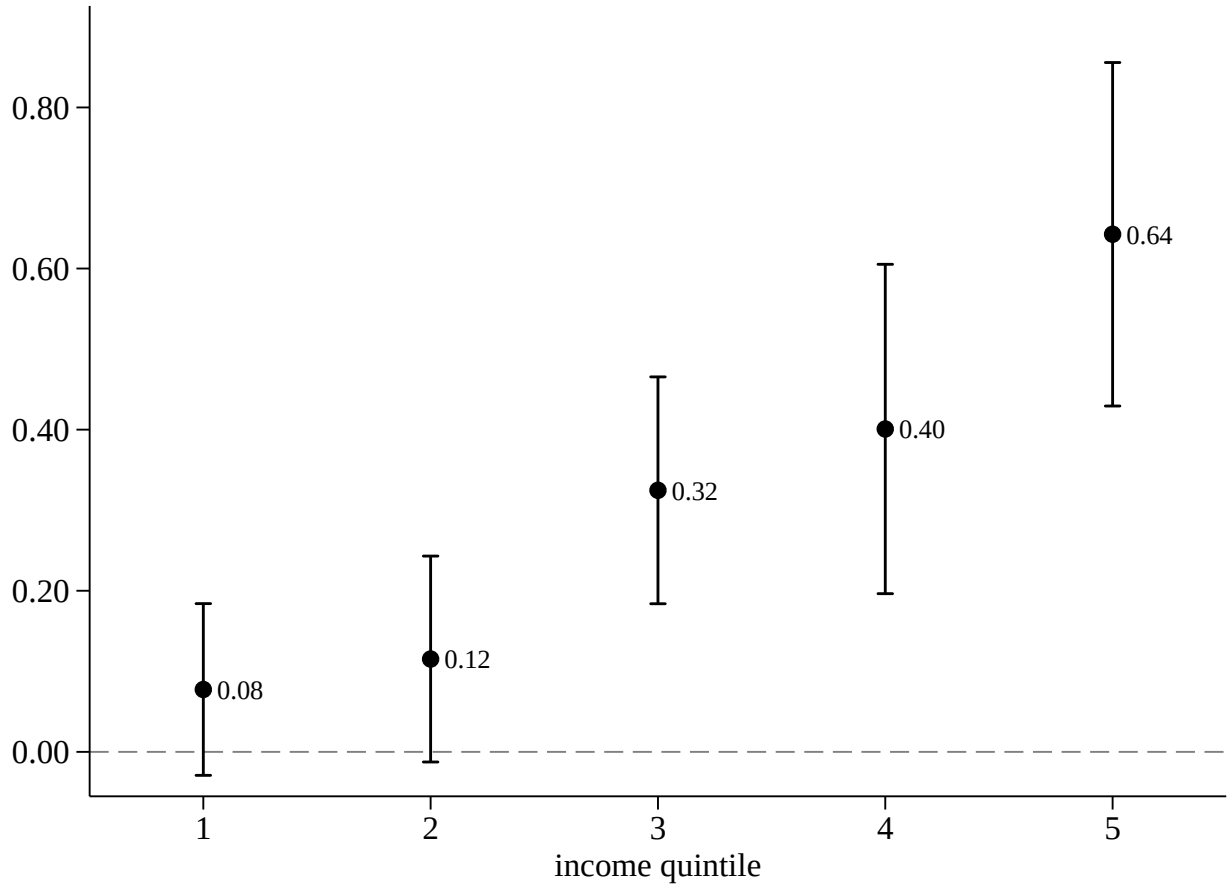



- Average rel. dividend size per quintile: $PFD/c_T$ = 1.60% , 2.7% , 3.7% , 5.4% , 10.3%
- Assuming T=4 quarters and $\gamma = 2$: Potential loss (ex-ante) = 0.08% , 0.2% , 0.4% , 0.9% , 3.2%
  Actual ex-post loss = 0.05% , 0.08% , 0.07% , 0.06% , 0.07%

# **MPC heterogeneity:** by income per person (equivalent scale)




- Average income per quintile: 16k, 30k, 42k, 58k, 104k
- Table 2 in the paper shows similar results when conditioning on shock size (and vice versa), liquid assets and hh characteristics

## Outline:

1. data and quasi-experiment ✓
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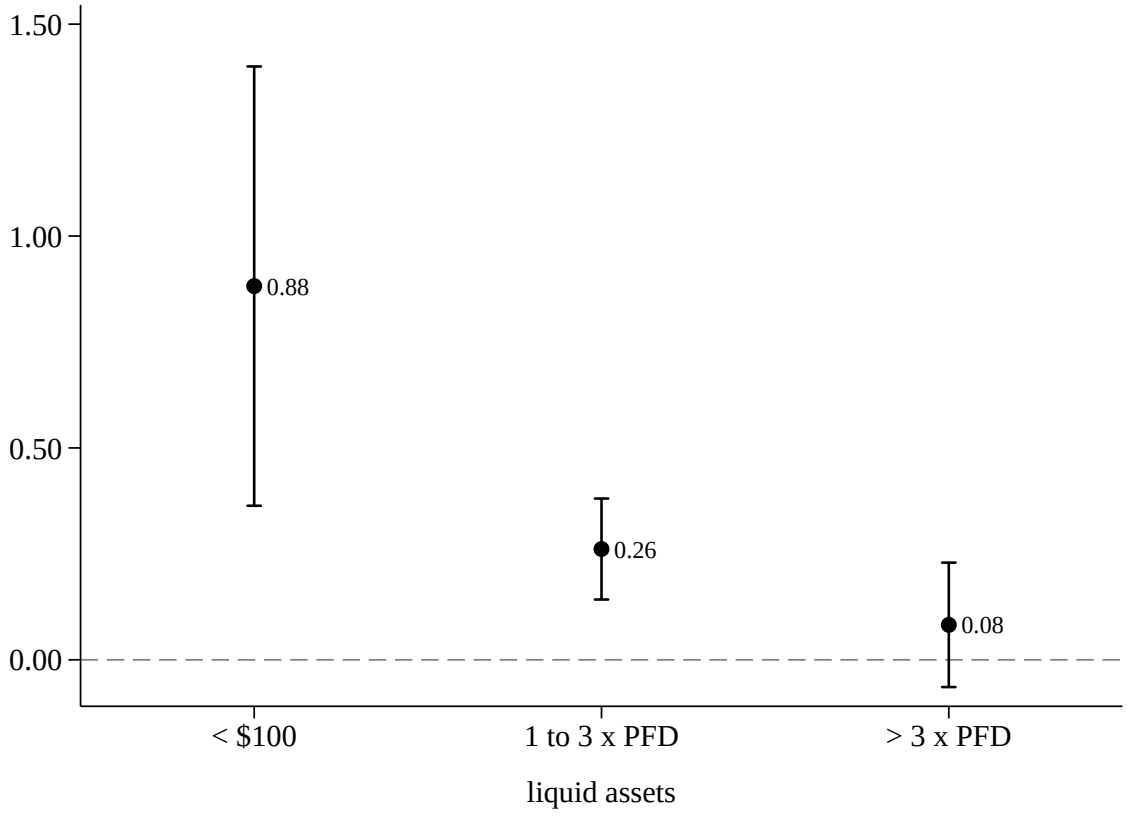
## Liquidity Constraints:

- households in top two quintiles are unconstrained (avg. bank balances of \$55k and \$84k)
- low MPCs in bottom two income quintiles might suggest that credit constraints do not explain MPCs

Hence, I focus on the sample of lower-income households (below median hh income of \$75k)

- still sizable liquid assets, but also lots of variation:
  - average bank balances of \$17k
  - standard deviation of \$7k
- form three bins:
  1. households with no or few liquidity ($<$\$100)
  2. households with 1-3$\times$PFD : potential prec. savings motives
  3. households with more than 3$\times$PFD in bank accounts

# **MPC heterogeneity:** by liquid assets (total bank balances)



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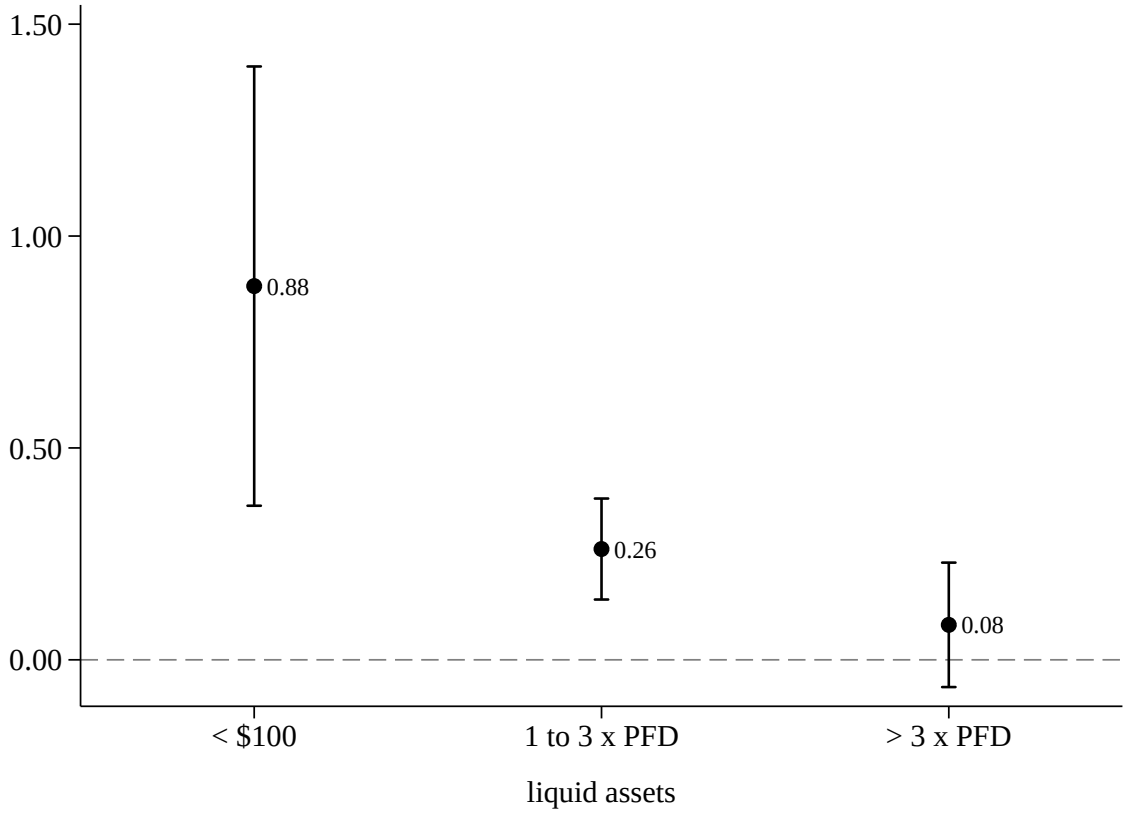


## Conclusion:

1. potential wealth losses predict MPCs for HHs with sufficient liquid assets
2. low liquid assets continue to predict high MPCs

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**External validity** implementing same analysis using the CE

Obtain similar results after taking into account

1. fraction of Alaskans that do not receive dividend
2. different sample composition
   - average Alaskan family income in CE is lower ($63k vs $94k)
   - important since MPC is increasing in income

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| | External validity | | | |
|---|---|---|---|---|
| | **CE** | PFD imputation | sample composition | IV |
| ***Panel B : Robustness and CE*** | (5) | (6) | (7) | (8) |
| imputed PFD payments in CE | **0.079**** | | | |
| | (0.036) | | | |
| PFD x family size | | 0.190*** | -0.021 | 0.264*** |
| | | (0.030) | (0.048) | (0.040) |
| PFD x family size x income/$100,000 | | | 0.187*** | |
| | | | (0.044) | |
| ***predicted MPC using average CE income*** | | | ***0.097*** | |
| - Alaska FE | YES | YES | YES | YES |
| - Period FEs | YES | YES | YES | YES |
| Observations | 385,800 | 46,807 | 46,807 | 46,807 |
| R-squared | 0.006 | 0.107 | 0.108 | 0.106 |

# Conclusion

## Main findings

- substantial response even to large payments
- near-rationality helps predict response heterogeneity, especially for higher-income hh (unconstrained)
- *actual ex-ante losses* are similar and *small*, consistent with near-rational behavior ($<$ 1 day consumption equivalent)
- low liquid assets continue to predict high responses, too

## Policy implications

# Conclusion

## Main findings

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## Policy implications

- results are important for macro policies, since most stabilizers (discretionary and automatic) have similar or lower sizes
- targeting low-income low-asset HHs might not be the only or best stimulus program
- modeling of near-rational consumption behavior is important next step, i.e., why higher-income hh spend dividend

# Appendix

# **Consumption vs Spending**: Spending across different categories

| | food and dining | | | | |
|---|---|---|---|---|---|
| | all | groceries | personal care | kids activities | gasoline |
| ***Panel A : Spending across goods*** | (1) | (2) | (3) | (4) | (5) |
| PFD payments | 0.075*** | 0.058*** | 0.007*** | 0.005*** | 0.020*** |
| | (0.014) | (0.011) | (0.002) | (0.001) | (0.005) |
| - Alaska FE | YES | YES | YES | YES | YES |
| - Period FEs | YES | YES | YES | YES | YES |
| Observations | 46,807 | 46,807 | 46,807 | 46,807 | 46,807 |
| R-squared | 0.140 | 0.109 | 0.013 | 0.011 | 0.060 |

# Specification checks

| ***Panel B : Robustness*** | Robustness: median (1) | Robustness: family size (2) | Robustness: hh charact. (3) | Robustness: Alaskans only (4) |
|---|---|---|---|---|
| PFD payments | 0.265*** | 0.282*** | 0.286*** | 0.284*** |
| | (0.032) | (0.043) | (0.044) | (0.051) |
| - Alaska FE | YES | YES | YES | -- |
| - Period FEs | YES | YES | YES | YES |
| - Family size | -- | YES | YES | -- |
| - Other household characteristics | -- | -- | YES | -- |
| Observations | 46,807 | 46,807 | 46,807 | 17,899 |
| R-squared | 0.068 | 0.107 | 0.109 | 0.117 |

# MPC Heterogeneity by relative dividend size and income

**Table 2: Heterogeneity of MPCs**

| Dep. var.: $\Delta c_{it}$, quarterly nondurables and services | average MPC | by shock size | | | by income | |
|---|---|---|---|---|---|---|
| | | linear | quintile | squared PFD | linear | quintile |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| PFD payments | 0.297*** | 0.490*** | 0.744*** | 0.288*** | 0.067 | 0.032 |
| | (0.044) | (0.078) | (0.113) | (0.095) | (0.069) | (0.052) |
| PFD x shock size | | -2.875*** | | | | |
| | | (0.775) | | | | |
| PFD x shock size quintile | | | -0.152*** | | | |
| | | | (0.032) | | | |
| squared PFD/100 | | | | -0.014 | | |
| | | | | (0.196) | | |
| PFD x income / $100,000 | | | | | 0.485*** | |
| | | | | | (0.144) | |
| PFD x income quintile | | | | | | 0.143*** |
| | | | | | | (0.027) |
| Observations | 46,807 | 46,807 | 46,807 | 46,807 | 46,807 | 46,807 |
| R-squared | 0.108 | 0.109 | 0.110 | 0.109 | 0.109 | 0.109 |
| - Alaska FE | YES | YES | YES | YES | YES | YES |
| - Period FEs | YES | YES | YES | YES | YES | YES |
| - Shock size | YES | YES | YES | -- | YES | YES |
| - Income | YES | YES | YES | YES | YES | YES |
| - Liquid assets | YES | YES | YES | YES | YES | YES |
| - Household characteristics | YES | YES | YES | YES | YES | YES |

# **MPC Heterogeneity**: relative dividend explains heterogeneity, not the squared dividend

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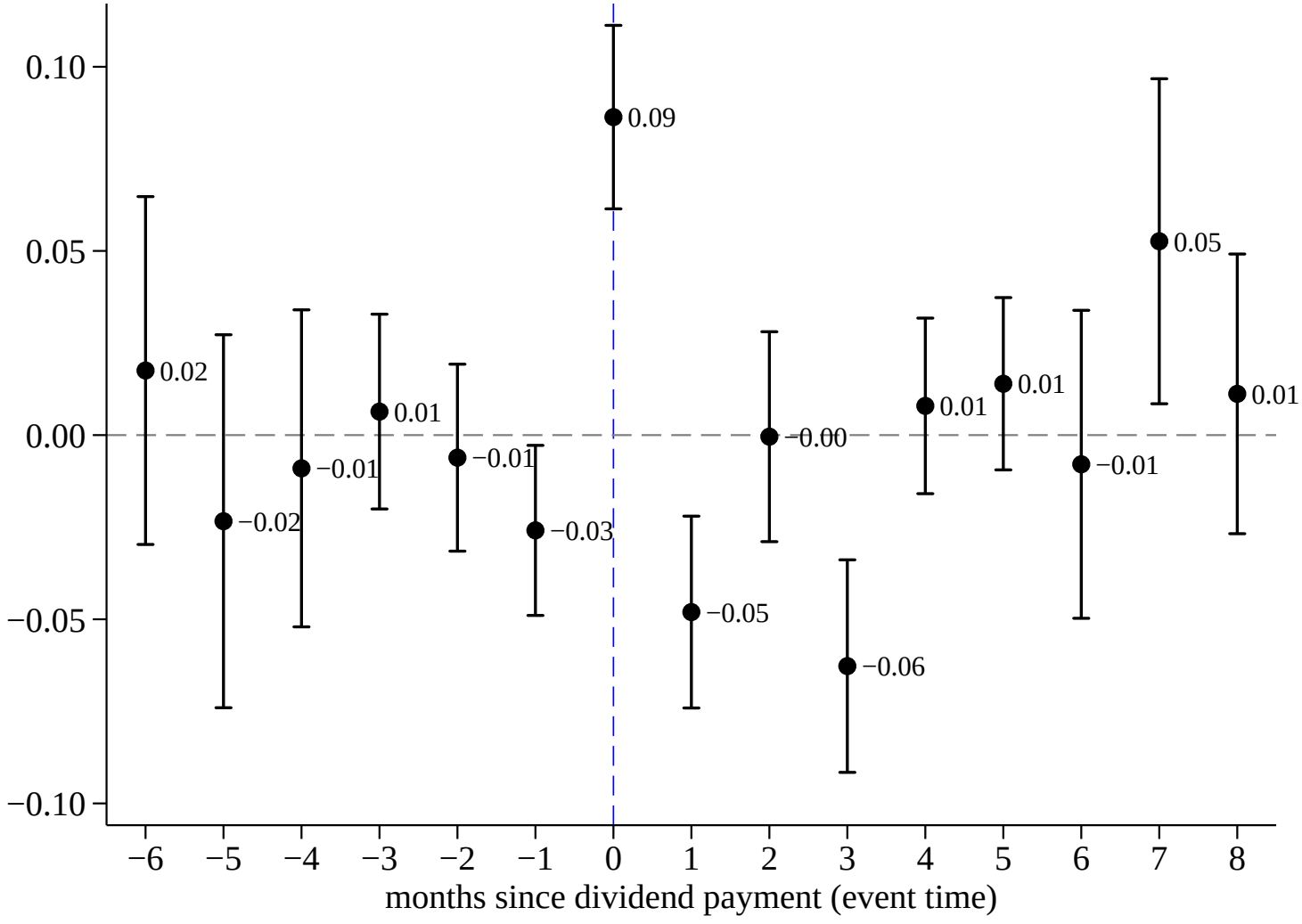
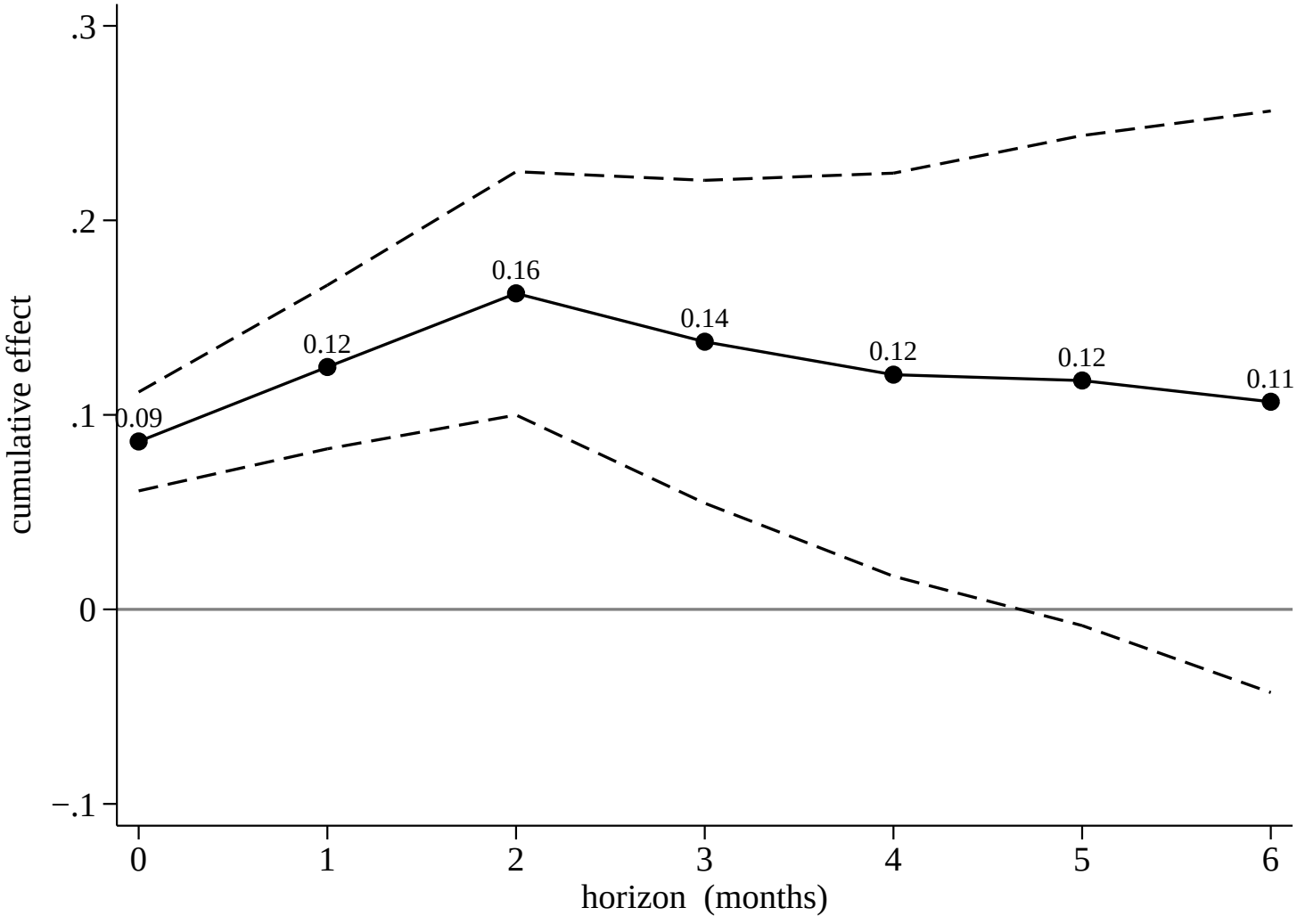
| R-squared | 0.108 | 0.109 | 0.110 | 0.109 | 0.109 | 0.109 |
| - Alaska FE | YES | YES | YES | YES | YES | YES |
| - Period FEs | YES | YES | YES | YES | YES | YES |
| - Shock size | YES | YES | YES | -- | YES | YES |
| - Income | YES | YES | YES | YES | YES | YES |
| - Liquid assets | YES | YES | YES | YES | YES | YES |
| - Household characteristics | YES | YES | YES | YES | YES | YES |

# **Smaller Durables.** Testing for anticipation effects

$$c_{i,t} - c_{i,t-1} = \sum_s \beta_s \cdot PFD_{i,t-s} + \tau_t + \text{Alaska}_i + \epsilon_{i,t}$$



# **Smaller Durables.** Cumulative MPC $= \sum_s MPC(s)$



# Smaller Durables and Total Expenditures

| | smaller durables | | |
|---|---|---|---|
| | cc txns | incl. withdrawals | total exp |
| ***Panel A : Spending across goods*** | (6) | (7) | (8) |
| PFD payments | 0.123*** | 0.185*** | 0.714*** |
| | (0.028) | (0.040) | (0.151) |
| - Alaska FE | YES | YES | YES |
| - Period FEs | YES | YES | YES |
| Observations | 46,807 | 46,807 | 46,807 |
| R-squared | 0.060 | 0.042 | 0.062 |

# **Hsieh's specification:** Normalization of dividend by family income (current income) vs total expenditures (permanent income) in the CE matters.

| | *Alaskans only* | | | *All households* | | |
|---|---|---|---|---|---|---|
| | Hsieh's specification | | | | | |
| Dep. var.: $\Delta \ln(c_{it})$, nondurables and services | Hsieh (2003) | replication and extension | normalize w/ total expend. | using rest of U.S. as contol | attenuation factor | IV curr inc w/ perm inc |
| | (1) | (2) | (3) | (6) | (8) | (9) |
| A: Sample 1980-2001 | | | | | | |
| PFD x family size x Alaska / before-tax income | -0.003 | -0.003 | | | | 0.052** |
| | (0.033) | (0.005) | | | | (0.025) |
| PFD x family size x Alaska / total expenditures | | | 0.123 | 0.090** | **0.107**** | |
| | | | (0.086) | (0.036) | (0.043) | |
| - Other household characteristics | YES | YES | YES | YES | YES | YES |
| - Family size | YES | YES | YES | YES | YES | YES |
| - Period FEs | | | | YES | YES | YES |
| - Alaska FE | | | | YES | YES | YES |
| - Inverse total expenditures | | | | | YES | YES |
| Number of observations (rounded) | 806 | 800 | 800 | 315200 | 315200 | 281500 |
| Number of Alaskan CUs (rounded) | 806 | 800 | 800 | 1700 | 1700 | 1500 |
| R-squared | N/A | 0.009 | 0.013 | 0.009 | 0.009 | 0.010 |

# **Hsieh's specification:** Extending CE sample to 2013.

| | *Alaskans only* | | | *All households* | | |
|---|---|---|---|---|---|---|
| | Hsieh's specification | | | | | |
| Dep. var.: $\Delta \ln(c_{it})$, nondurables and services | Hsieh (2003) | replication and extension | normalize w/ total expend. | using rest of U.S. as contol | attenuation factor | IV curr inc w/ perm inc |
| | (1) | (2) | (3) | (6) | (8) | (9) |
| B: Sample 1980-2013 | | | | | | |
| PFD x family size x Alaska / before-tax income | -- | -0.001 | | | | 0.076*** |
| | | (0.004) | | | | (0.023) |
| PFD x family size x Alaska / total expenditures | -- | | 0.116* | 0.113*** | **0.136*** ** | |
| | | | (0.060) | (0.027) | (0.032) | |
| - Other household characteristics | | YES | YES | YES | YES | YES |
| - Family size | | YES | YES | YES | YES | YES |
| - Period FEs | | | | YES | YES | YES |
| - Alaska FE | | | | YES | YES | YES |
| - Inverse total expenditures | | | | | YES | YES |
| Number of observations (rounded) | | 1400 | 1400 | 559400 | 559400 | 458000 |
| Number of Alaskan CUs (rounded) | | 1400 | 1400 | 2800 | 2800 | 2300 |
| R-squared | | 0.004 | 0.007 | 0.007 | 0.007 | 0.009 |

**Hsieh's specification:** Measurement error in current income, and comparison to permanent income (total expenditures).