The Transmission of Monetary Policy under the Microscope

Martin B. Holm
Pascal Paul
Andreas Tischbirek

NBER Summer Institute, 9 July 2020
Motivation

• How does monetary policy affect household consumption?

• Recent advances in monetary economics

RANK → HANK
Motivation

• How does monetary policy affect household consumption?

• Recent advances in monetary economics

  RANK → HANK

• Appealing features of HANK models
  • Large consumption response of HHs with few liquid assets
  • MP works through general equilibrium ("indirect") effects

• But: Limited empirical evidence for these predictions
Motivation

• How does monetary policy affect household consumption?

• Recent advances in monetary economics

  RANK → HANK

• Appealing features of HANK models
  - Large consumption response of HHs with few liquid assets
  - MP works through general equilibrium (“indirect”) effects

• But: Limited empirical evidence for these predictions

• This paper: provide detailed analysis of monetary transmission at the household level using Norwegian administrative data
Our findings

1. Responses across the liquid asset distribution
   - Low- but also high-liquidity HHs respond strongly
   - $r \uparrow \Rightarrow c_{\text{low liq.}} \downarrow$ and $c_{\text{high liq.}} \uparrow$
   - Most surprising: $\Delta c_{\text{high liq.}}$ is large
     $\rightarrow$ Sizable MPCs for high-liquidity HHs
     $\rightarrow$ Cash flow effects are important
Our findings

1. Responses across the liquid asset distribution
   - Low- but also high-liquidity HHs respond strongly
   - $r \uparrow \Rightarrow c_{\text{low liq.}} \downarrow \text{ and } c_{\text{high liq.}} \uparrow$
   - Most surprising: $\Delta c_{\text{high liq.}}$ is large
     → Sizable MPCs for high-liquidity HHs
     → Cash flow effects are important

2. Empirical decomposition into direct and indirect effects
   - Years 0-2: almost all direct
   - Years 3-5: about half indirect
     → Indirect effects of MP are large, albeit with a lag
Literature

• **HANK models**

• **Monetary transmission using micro data**
Roadmap

1. Monetary Policy Identification
2. Administrative Data
3. Monetary Transmission at the Household Level
4. Direct and Indirect Effects of Monetary Policy
5. Conclusion
Monetary Policy Identification
Monetary policy identification

• Identification follows Romer-Romer (2004)

\[ \Delta i_m = \alpha_1 + \alpha_2 i_{m,-1} + \sum_{k=0}^{1} \beta_k^\pi \pi_{m,t+k} + \sum_{k=0}^{1} \beta_k^{\Delta \pi} \Delta \pi_{m,t+k} \]

\[ + \sum_{k=0}^{1} \beta_k^y y_{m,t+k} + \sum_{k=0}^{1} \beta_k^{\Delta y} \Delta y_{m,t+k} \]

\[ + \gamma_1 e_{x,m,-1} + \gamma_2 I^{IT}_m \cdot e_{x,m,-1} + \epsilon_{MP}^m \]

• $i$ policy rate, $y$ GDP growth forecast (mainland), $\pi$ inflation forecast, $e_x$ exchange rate, and $I$ indicator for pre-inflation targeting
Monetary policy identification

<table>
<thead>
<tr>
<th>Variable</th>
<th>Constant</th>
<th>$i_{m,-1}$</th>
<th>$\pi_m$</th>
<th>$y_m$</th>
<th>$e_{x_{m,-1}}$</th>
<th>$I_{m}^{1T} \cdot e_{x_{m,-1}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Year</td>
<td>-0.50</td>
<td>0.02</td>
<td>0.02**</td>
<td>0.05</td>
<td>(0.06)</td>
<td>(0.05)</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.09)</td>
<td>(0.95)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Next Year</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
<td></td>
<td>(0.44)</td>
<td>(0.37)</td>
</tr>
<tr>
<td></td>
<td>(0.44)</td>
<td>(0.62)</td>
<td>(0.62)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta$Current Year</td>
<td>0.02</td>
<td>0.27***</td>
<td>0.27***</td>
<td></td>
<td>(0.28)</td>
<td>(0.00)</td>
</tr>
<tr>
<td></td>
<td>(0.28)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\Delta$Next Year</td>
<td>0.11**</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
<td>(0.02)</td>
<td>(0.58)</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.58)</td>
<td>(0.58)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$N = 162$  


$R^2 = 0.30$
Monetary policy identification

<table>
<thead>
<tr>
<th>Variable</th>
<th>Constant</th>
<th>$i_{m,-1}$</th>
<th>$\pi_m$</th>
<th>$y_m$</th>
<th>$ex_{m,-1}$</th>
<th>$I_{m}^{IT} \cdot ex_{m,-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Year</td>
<td>-0.50</td>
<td>-0.02*</td>
<td></td>
<td></td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.09)</td>
<td></td>
<td></td>
<td>(0.95)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>Next Year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.06**</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.04)</td>
<td>(0.37)</td>
</tr>
<tr>
<td>ΔCurrent Year</td>
<td>0.04</td>
<td></td>
<td></td>
<td></td>
<td>0.04</td>
<td>0.27***</td>
</tr>
<tr>
<td></td>
<td>(0.44)</td>
<td></td>
<td></td>
<td></td>
<td>(0.62)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>ΔNext Year</td>
<td>0.02</td>
<td>0.11**</td>
<td></td>
<td></td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.28)</td>
<td>(0.02)</td>
<td></td>
<td></td>
<td>(0.58)</td>
<td></td>
</tr>
</tbody>
</table>


$R^2 = 0.30$
Local projections

Based on shock series $\epsilon_{t}^{MP}$, estimate local projections

$$y_{t+h} - y_{t-1} = \alpha^{h} + \beta^{h} \cdot \epsilon_{t}^{MP} + \gamma^{h} X_{t-1} + u_{t}^{h}$$

for outcome variable of interest $y_{t}$

- Impulse response horizons
  - $h=0,1,...,20$ for quarterly data
  - $h=0,1,...,5$ for annual data
- Newey-West standard errors
- $X_{t-1}$: controls (three lags of $\epsilon^{MP}$)
Macro responses

- Time aggregation
- Additional evidence & robustness

68% & 95% confidence bands
Macro responses

- Time aggregation
- Additional evidence & robustness

68% & 95% confidence bands
Administrative Data
Sources

- Tax registry (income and wealth tax)
- Housing ownership and transactions
- Shareholder registry
- Longitudinal socio-economic database

Characteristics

- Third-party reported (employers, financial institutions)
- We aggregate information to household level
- Includes population of households in Norway (∼ 1.9 million)
- Annual panel for 1996 to 2015 (20 years)
• **Consumption expenditures** imputed from budget identity

\[
\text{Consumption } (C_t) = \text{Disposable Income } (Inc_t) - \text{Saving } (S_t)
\]
\[
Inc_t = \text{Labor inc}_t + \text{Net capital inc}_t + \text{Transfers}_t - \text{Taxes}_t + \text{Misc}_t
\]
\[
S_t = \Delta \text{Wealth}_t - \text{Capital gains}_t
\]
• **Consumption expenditures** imputed from budget identity

\[
\text{Consumption} \ (C_t) = \text{Disposable Income} \ (Inc_t) - \text{Saving} \ (S_t)
\]

\[
Inc_t = \text{Labor inc}_t + \text{Net capital inc}_t + \text{Transfers}_t - \text{Taxes}_t + \text{Misc}_t
\]

\[
S_t = \Delta\text{Wealth}_t - \text{Capital gains}_t
\]

• **Capital gains**

  • Based on household-level housing & stock transaction data
  • All results robust to “no risky asset” sample
Interest rate pass-through

- Red line: Average Loan Rate
- Blue line: Average Policy Rate
- Green line: Average Deposit Rate
Monetary Transmission at the Household Level
Monetary Policy and Liquid Assets

Predictions from HANK models

• High-liquidity HHs: MPC small, intertemp. subs. dominate
• Low-liquidity HHs: MPC large, intertemp. subs. small
Monetary Policy and Liquid Assets

Predictions from HANK models

- High-liquidity HHs: MPC small, intertemp. subs. dominate
- Low-liquidity HHs: MPC large, intertemp. subs. small

Estimate impulse responses by liquid asset holdings

- Liquid assets = deposits + bonds + stocks + stock funds
- Divide HHs into groups $g = 1, 2, \ldots, 10$ by liquid assets in $t - 1$

$$
\frac{y_{i,t+h} - y_{i,t-1}}{inc_{i,t-1}} = \alpha^h_i + \beta^h_g \cdot \epsilon^M_{t} + \gamma^h_g X_{i,t-1} + u^h_{i,t} \quad \forall i \in g
$$

- $X_{i,t-1}$: Controls
  - Three lags of $\epsilon^M_{t}$
  - Two lags of dependent variable (h=0)
- Driscoll-Kraay standard errors
Responses by liquid assets

- Confidence bands
- Distributions

- Disposable Income
- Saving
- Consumption

- Financial Income (Net)
- Nonfinancial Income
- Net Interest Income

Percent

0 20 40 60 80 100

Percent

0 20 40 60 80 100

Percent

0 20 40 60 80 100
Responses by **liquid assets**

- **Confidence bands**
- **Distributions**
Responses by **liquid assets**

- **Disposable Income**
  - Percentiles: 0 to 100
  - Financial Income (Net)
  - Distribution pattern

- **Saving**
  - Percentiles: 0 to 100
  - Nonfinancial Income
  - Distribution pattern

- **Consumption**
  - Percentiles: 0 to 100
  - Net Interest Income
  - Distribution pattern

- **Confidence bands**
- **Distributions**
Responses by liquid assets

- Confidence bands
- Distributions

- Disposable Income
- Saving
- Consumption

- Financial Income (Net)
- Nonfinancial Income
- Net Interest Income

Percent vs. Percentile graphs showing distributions and confidence bands.
Responses by liquid assets

- Confidence bands
- Distributions

Disposal Income

Saving

Consumption

Disposable Income

Saving

Consumption

Financial Income (Net)

Nonfinancial Income

Net Interest Income

Percent

Percent

Percent

Percent

Percent

Percent

Percent
Responses by liquid assets

- **Disposable Income**
  - 0-1 years
  - 2-3 years
  - 4-5 years

- **Saving**

- **Consumption**

- **Financial Income (Net)**

- **Nonfinancial Income**

- **Net Interest Income**
Additional Evidence & Robustness

• Wealth effects ▶ Details

• Planned durable purchases ▶ Persistence

• Correlation with age ▶ Details

• Correlation with income ▶ Details

• Which HHs drive aggregate response? ▶ Details ▶ Within top 10%

• Liquidity/Income distribution ▶ Details

• Consumption imputation ▶ Non-stockholders

• Additional evidence on MPCs ▶ Details
Responses by net interest rate exposure

- Net interest rate exposure = deposits - debt
Responses by net interest rate exposure

- Net interest rate exposure = deposits - debt
Responses by net interest rate exposure

• Net interest rate exposure = deposits - debt

Disposable Income

Saving

Consumption

Financial Income (Net)

Nonfinancial Income

Net Interest Income
• Net interest rate exposure = deposits - debt

Responses by net interest rate exposure

Disposable Income

Saving

Consumption

Nonfinancial Income

Net Interest Income
Direct and Indirect Effects of Monetary Policy
Direct and indirect effects

• Kaplan-Moll-Violante (2018) decomposition

\[
dC_0 = \int_0^\infty \frac{\partial C_0}{\partial r_t} dr_t dt + \int_0^\infty \frac{\partial C_0}{\partial Y_t} dY_t dt
\]

\(\{\text{direct}\}\) + \(\{\text{indirect}\}\)

• Empirical analogue (simplified notation)

\[
\Delta^h C_{i,t-1} = \alpha_i^h + \beta^h \epsilon_{t}^{MP} + u_{i,t}^h
\]

\[
\Delta^h C_{i,t-1} = \tilde{\alpha}_i^h + \tilde{\beta}^h \epsilon_{t}^{MP} + \tilde{\gamma}^h \Delta^h Y_{i,t-1} + \nu_{i,t}^h
\]

where

\[
\beta^h = \underbrace{\tilde{\beta}^h}_{\text{direct}} + \underbrace{\tilde{\gamma}^h \times \delta^h}_{\text{indirect}}
\]

\(\delta^h\) is coefficient in projection of \(\Delta^h Y_{i,t-1}\) on \(\epsilon_{t}^{MP}\)
Empirical model:

\[
\frac{c_{i,t+h} - c_{i,t-1}}{\bar{c}_{t-1}} = \delta^h_i + \sum_{k=1}^{K} \sum_{m=0}^{h} \gamma^h_{m,k} \tilde{y}^k_{i,t+m} + \mu^h X_{i,t-1} + u^h_{it}
\]

where \(\tilde{y}^k_{i,t+m}\) is change in income \(k\) since \(t - 1\) relative to \(\bar{c}_{t-1}\).

- In \(k\): labor income, transfers, taxes, other income, dividends
- Not in \(k\): interest income & expenses (direct + reverse causality)
- Not in \(k\): future expected changes (included in theory)
- Not in \(k\): capital gains and losses (robustness)
Direct and indirect effects

- MPCs
- Capital Gains
- By liquid assets

Consumption Expenditures

- Unconditional (direct + indirect)
- Conditioned on income (direct)
Direct and indirect effects - IV

Potential concerns

• Other shocks move consumption directly & through income
• Too high MPC: inc. variation is more persistent than MP shock

Solution

• Use lottery prizes to instrument for non-financial income
• 30,000 unique lottery winners (Fagereng, Holm, Natvik, 2020)

1st-stage

\[
\tilde{y}_{i,t+h} = \delta_i^h + \delta_1^h \text{lottery}_{i,t+h} + \delta_2^h \epsilon_{t}^{MP} + \delta_3^h X_{i,t-1} + \tilde{u}_{i,t}^h
\]

2nd-stage

\[
\frac{c_{i,t+h} - c_{i,t-1}}{\bar{c}_{t-1}} = \delta_i^h + \beta^h \epsilon_{t}^{MP} + \sum_{m=0}^{h} \gamma_m^h \tilde{y}_{i,t+m} + \mu^h X_{i,t-1} + u_{i,t}^h
\]
Direct and indirect effects - IV

Consumption Expenditures

- Unconditional (direct + indirect)
- Conditioned on income (direct)
- IV-Estimation (direct)
Conclusion
Conclusion

1. We identify monetary policy shocks for Norway and find “text-book” aggregate responses
   • ... based on macro aggregates
   • ... based on micro data

2. Monetary policy affects consumption through income
   • Cash-flow effects are important
   • Deposit-rich households are ‘large’ and increase consumption with higher interest rates $\rightarrow$ dampened initial aggregate impact of monetary policy

3. Indirect effects of MP are large, albeit with a lag
   • Year 0-2: mostly direct
   • Year 3-5: about half indirect
APPENDIX
Collected data on:

1. Historical Monetary Policy Meetings

2. Norges Bank Forecasts (≈4 per year)
   - until 2006: “Inflation Reports”
   - since 2007: “Monetary Policy Reports”

3. Consensus Forecasts (monthly)


<table>
<thead>
<tr>
<th>Correlations</th>
<th>$y_t$</th>
<th>$y_{t+1}$</th>
<th>$\pi_t$</th>
<th>$\pi_{t+1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlations</td>
<td>0.95</td>
<td>0.80</td>
<td>0.93</td>
<td>0.69</td>
</tr>
</tbody>
</table>
To assign forecasts to the policy meetings (162 in total), we use the following rule:

1. If available, use Norges Bank forecasts that are either
   - directly prepared for a policy meeting (51)
   - the same month before the meeting (5)
   - or in the month before the meeting (32)

2. For any remaining meetings, we use the Consensus forecasts that are
   - conducted in the same month before the meeting (4)
   - or in the month before the meeting (70)

Hence, for 88 meetings we use the Norges Bank forecasts, and the Consensus forecasts for the remaining 74 meetings.
Historical policy rate (sight deposit rate)
MP shocks monthly

![Line plot showing MP shocks monthly from 1995 to 2015. The y-axis represents Basis Points ranging from -100 to 80, and the x-axis represents years from 1995 to 2015. The plot displays fluctuations in the shocks over time.]
Rate changes vs. MP shocks

Monetary Policy Shocks
Policy Rate Changes

Basis Points

Predictability of MP shocks

Table 3: Predictability of Monthly Monetary Policy Shocks.

<table>
<thead>
<tr>
<th>Variables</th>
<th>3 Lags</th>
<th>6 Lags</th>
<th>9 Lags</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F-statistic</td>
<td>P-value</td>
<td>F-statistic</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>0.90</td>
<td>0.44</td>
<td>0.83</td>
</tr>
<tr>
<td>CPI-AEL Inflation</td>
<td>1.15</td>
<td>0.33</td>
<td>1.42</td>
</tr>
<tr>
<td>Industrial Production</td>
<td>0.25</td>
<td>0.86</td>
<td>0.25</td>
</tr>
<tr>
<td>All of the above</td>
<td>0.84</td>
<td>0.58</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Notes: The dependent variable is the monthly series of monetary policy shocks. The regressors are three, six, or nine lagged values of the change in the unemployment rate, monthly CPI-AEL inflation, the monthly growth rate of industrial production, or a joint regression with all three variables. The table reports F-statistics and the associated p-values given the null hypothesis that all coefficients are zero.
Additional evidence & robustness

- Additional responses
- Monetary tightenings & easings
- Comparison with U.S. data
- Only Consensus forecasts
- Only rate changes
- Lag length
- Timing of shocks
- Alternative samples
Additional Responses - Monthly

**Manuf. Production**

**Producer Prices Manuf.**

**Exchange Rate Kroner/$**

**Stock Prices**
Monetary tightenings & easings

All Meetings

Monetary Tightenings

Monetary Easings
Comparison with U.S. data
Only Consensus forecasts
Timing of shocks

Policy Rate

Unemployment Rate

Consumer Price Index

Industrial Production
Details on (unrealized) capital gains

1. Housing
   • Transactions observed
   • Capital gains = $\Delta$ housing wealth not due to transactions

2. Stocks
   • After 2006: individuals stock holdings observed
   • Before 2006: average capital gains for stocks

3. Stock funds
   • Average capital gains for stock funds from national accounts

4. Private business
   • Capital gains zero for the company
   • Attribute capital gains on stock holdings in firm to owner if observer
Sample restrictions

1. Adult population ($> 20$)

2. No change in marital status between couple and single

3. Income and consumption $> \text{the minimum level in the Norwegian social security scheme}$

4. Growth rate in consumption $< 50\% \text{ in absolute value}$
<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>P10</th>
<th>Median</th>
<th>P90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>51.63</td>
<td>17.85</td>
<td>28.00</td>
<td>50.00</td>
<td>77.00</td>
</tr>
<tr>
<td>Consumption</td>
<td>43,091</td>
<td>159,368</td>
<td>22,099</td>
<td>37,714</td>
<td>65,424</td>
</tr>
<tr>
<td>Disposable income</td>
<td>43,437</td>
<td>81,284</td>
<td>23,616</td>
<td>39,833</td>
<td>63,817</td>
</tr>
<tr>
<td>Income before tax</td>
<td>58,827</td>
<td>89,245</td>
<td>26,940</td>
<td>52,875</td>
<td>93,096</td>
</tr>
<tr>
<td>Labor income</td>
<td>44,210</td>
<td>42,362</td>
<td>0</td>
<td>43,977</td>
<td>92,636</td>
</tr>
<tr>
<td>Net capital income</td>
<td>-1,692</td>
<td>21,031</td>
<td>-8,263</td>
<td>-892</td>
<td>2,355</td>
</tr>
<tr>
<td>Dividend income</td>
<td>429</td>
<td>19,841</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Interest income</td>
<td>873</td>
<td>3,150</td>
<td>5</td>
<td>198</td>
<td>2,207</td>
</tr>
<tr>
<td>Interest expenses</td>
<td>3,316</td>
<td>5,072</td>
<td>0</td>
<td>1,631</td>
<td>8,970</td>
</tr>
<tr>
<td>Total assets</td>
<td>371,601</td>
<td>1,292,982</td>
<td>5,588</td>
<td>281,798</td>
<td>782,215</td>
</tr>
<tr>
<td>Liquid assets</td>
<td>31,337</td>
<td>75,379</td>
<td>565</td>
<td>11,262</td>
<td>78,912</td>
</tr>
<tr>
<td>Deposits</td>
<td>26,569</td>
<td>59,632</td>
<td>465</td>
<td>9,065</td>
<td>67,554</td>
</tr>
<tr>
<td>Bonds</td>
<td>1,015</td>
<td>13,660</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Risky assets</td>
<td>4,261</td>
<td>293,320</td>
<td>0</td>
<td>0</td>
<td>8,038</td>
</tr>
<tr>
<td>Stocks</td>
<td>1,945</td>
<td>292,750</td>
<td>0</td>
<td>0</td>
<td>660</td>
</tr>
<tr>
<td>Stock funds</td>
<td>2,316</td>
<td>12,507</td>
<td>0</td>
<td>0</td>
<td>5,339</td>
</tr>
<tr>
<td>Housing</td>
<td>321,580</td>
<td>371,837</td>
<td>0</td>
<td>248,128</td>
<td>703,170</td>
</tr>
<tr>
<td>Total debt</td>
<td>73,658</td>
<td>885,968</td>
<td>0</td>
<td>33,954</td>
<td>186,687</td>
</tr>
<tr>
<td>Observations per year</td>
<td>1,909,603</td>
<td>83,648</td>
<td>1,821,377</td>
<td>1,864,722</td>
<td>2,032,543</td>
</tr>
</tbody>
</table>

Notes: The table shows summary statistics for the estimation sample. Disposable income is the sum of labor income, capital income, and transfers, net of taxes. Liquid assets is the sum of deposits, bonds, stocks held directly, and stock funds. Risky assets consist of stocks and stock funds. Stocks also includes stocks held indirectly by holding companies. Total debt includes mortgages, consumer debt, and student debt. All values except age are in U.S. dollars, 2011 prices.
Consumption comparison

![Graph showing consumption comparison over years (1997-2015)]

- Consumption in national accounts
- Imputed consumption expenditures
Micro-macro responses

• Estimate local projections

\[
\frac{y_{i,t+h} - y_{i,t-1}}{\bar{y}_{t-1}} = \delta_i^h + \beta^h \cdot \epsilon_{t}^{MP} + \gamma^h X_{i,t-1} + u_{i,t}^h
\]

• \(\bar{y}_{t-1} = \frac{1}{N} \sum_{i=1}^{N} y_{i,t-1}\)

• Controls:
  
  • 3 years of lags of \(\epsilon_{t}^{MP}\)
  
  • 2 years of lags dependent variable (\(h=0\))

• Driscoll-Kraay standard errors
Micro-macro responses
Inequality responses

Income Inequality

Consumption Inequality

Wealth Inequality
Monetary transmission by liquid assets in models

Monetary transmission by liquid assets in models

Figure 6. Consumption responses by liquid wealth position

Monetary transmission channels \((r \uparrow)\)

- **Substitution effect** \((c \downarrow)\)
- **Standard income effect**  
  \((c \uparrow \text{ if rate exposure } > 0, \ c \downarrow \text{ if rate exposure } < 0)\)
- **Cash-flow effect**  
  (same as standard income + front-load \(c\) response)
- **Indirect income effects**  
  (same sign as movement of non-financial income)
Monetary transmission channels \((r \uparrow)\)

- **Substitution effect** \((c \downarrow)\)
- **Standard income effect**
  \((c \uparrow \text{ if rate exposure } > 0, \ c \downarrow \text{ if rate exposure } < 0)\)
- **Cash-flow effect**
  (same as standard income + front-load \(c\) response)
- **Indirect income effects**
  (same sign as movement of non-financial income)

Predictions from models: channels depend on **liquidity**

1. **High-liquid**: ‘all’ substitution & standard income effects
2. **Illiquid**: mostly cash-flow, substitution & indirect income effects
Liquid assets distribution

![Graphs showing the distribution of liquid assets and income over percentiles.

- Left graph: Share of Total Assets vs. Percentile.
  - Financial assets
  - Housing
  - Debt (all)

- Right graph: Share of Disposable Income vs. Percentile.
  - Financial income (net)
  - Nonfinancial income]
Responses by liquid asset; selected groups

- $g = 1$ (0% – 10%)
- $g = 5$ (40% – 50%)
- $g = 10$ (90% – 100%)
Responses by liquid asset; selected groups

$g = 1$ (0% – 10%)

$g = 5$ (40% – 50%)

$g = 10$ (90% – 100%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Saving Percent

Financial Inc. Percent

Nonfin. Inc. Percent
Responses by liquid asset; selected groups

$g = 1 \ (0\% - 10\%)$

$g = 5 \ (40\% - 50\%)$

$g = 10 \ (90\% - 100\%)$

- Cap. Rev. Percent
- Cap. Expend. Percent
- Interest Inc. Percent

Year
Responses by liquid asset; group comparisons

$g = 1$ (0% - 10%)

$g = 10$ (90% - 100%)
Responses by liquid asset; group comparisons

\[ g = 1 \ (0\% - 10\%) \]

\[ g = 10 \ (90\% - 100\%) \]

- **Saving Percent**
  - Year 0 to Year 5

- **Financial Inc. Percent**
  - Year 0 to Year 5

- **Nonfin. Inc. Percent**
  - Year 0 to Year 5
Responses by liquid asset; group comparisons
IRFs by Liquid Assets – Wealth Effects

**Capital Gains (Housing)**

- **Percent**
  - 0
  - 20
  - -20

- **Percentile**
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100

**Capital Gains (Risky Assets)**

- **Percent**
  - 0
  - 2
  - -2

- **Percentile**
  - 0
  - 20
  - 40
  - 60
  - 80
  - 100

Legend:
- **0-1 years**
- **2-3 years**
- **4-5 years**
• Threshold high (>\$120,000 in several years)

• Persistence
  • 90% in top 10% prior year
  • 67% in top 10% for past five years

• Consumption response robust at top when only considering households that are persistently in top 10% (3 past years)
Consumption Responses by Age

0-1 Years

2-3 Years

4-5 Years

Percent

Percent

Percent

0 20 40 60 80 100

0 20 40 60 80 100

0 20 40 60 80 100

-2

-1

0

1

1

0

0

0

1

1

0

0

0

1

1

0

-2

-1

0

1

1

0

0

0

1

1

0
Consumption Responses by Lagged Income
Responses relative to average income

- Estimate local projections

\[
\frac{y_{i,t+h} - y_{i,t-1}}{inc_{i,t-1}} = \delta_i^h + \beta_g^h \cdot \epsilon_t^{MP} + \gamma_g X_{i,t-1} + u_{i,t}^h
\]

for deciles across liquid asset distribution

- \[inc_{t-1} = \frac{1}{N} \sum_{i=1}^{N} inc_{i,t-1}\]

- Controls:
  - 3 years of lags of \(\epsilon_t^{MP}\)
  - 2 years of lags dependent variable (\(h=0\))

- Driscoll-Kraay standard errors
Responses relative to average income
Responses relative to average income

- Disposable Income
- Saving
- Consumption

- Financial Income (Net)
- Nonfinancial Income
- Net Interest Income

- Percent
- Percent
- Percent

- 0-1 years
- 2-3 years

- Percentile
- Percentile
- Percentile

- 0 20 40 60 80 100
- 0 20 40 60 80 100
- 0 20 40 60 80 100

- -2 -1 0 1 2
- -2 -1 0 1 2
- -2 -1 0 1 2
Responses relative to average income

- Disposable Income
- Saving
- Consumption

Graphs showing the percentiles of financial income (Net), nonfinancial income, and net interest income relative to average income.
IRFs by Liquid Assets – Top 10%
IRFs by Liquid Assets per Income Unit

Consumption

Disposable Income

Saving

- Percent

- Percent

- Percent

0 20 40 60 80 100

0 20 40 60 80 100

0 20 40 60 80 100

0-1 years
2-3 years
4-5 years
IRFs by Liquid Assets – Non-stockholders

- Consumption
- Disposable Income
- Saving

Percent vs. Percentile for different time periods:
- 0-1 years
- 2-3 years
- 4-5 years
MPCs by Liquid Assets

Marginal Propensities to Consume

- Implied "MPCs" from Decomposition
- MPC Estimates from Fagereng, Holm, and Natvik (2019)
Responses by rate exposure; selected groups
Responses by rate exposure; group comparison

- For $g = 1$ (0% - 10%), consumption and disposable income show increases over the years, with saving rates slightly lower.
- For $g = 10$ (90% - 100%), the trends are similar but with more pronounced variations, indicating higher exposure to rate changes.

The graphs illustrate the percentage changes over five years, highlighting the impact of rate exposure on consumption, disposable income, and saving rates.
Responses by rate exposure; group comparison
Direct vs. indirect by liquid assets

0-1 Year Responses

2-3 Year Responses

4-5 Year Responses

Percent

Percent

Percent

Cons. uncond.
Cons. cond. on income

Cons. uncond.
Cons. cond. on income

Cons. uncond.
Cons. cond. on income
MPC Estimates

![Graph of Consumption Expenditures](image)

- **Graph 1:**
  - X-axis: Years
  - Y-axis: Percent
  - Legend:
    - Blue line: Unconditional (direct + indirect)
    - Red dashed line: Indirect Effect based on MPCs

- **Graph 2:**
  - X-axis: Years
  - Y-axis: Percent
  - Legend:
    - Blue line: Unconditional (direct + indirect)
    - Red dashed line: Implied Direct Effect