Motivation

- Consumption is a central part of macro models.

- Real interest rates are important determinants of consumption expenditure.
  - However, results from empirical studies are not conclusive.

- In the last decade, the response of private consumption to inflation expectations came to the forefront in modern macro due to the zero-lower-bound on nominal interest rates.
Consumption function in the cross-sectional data:

\[ C_{j,t} = C(r_{j,t}, Y_{j,t}^{d}, R_{j}, V_{j}) \]  

(1)

where \( j \) denotes \( j \)-th household.

- It is crucial to control for the effect of \( i_{j,t} \) on \( C_{j,t} \).
  - In normal times: Taylor principle: \( i_{t} = \phi_{\pi} \mathbb{E}_{t} \pi_{t+1} \) with \( \phi_{\pi} > 1 \)
    \[ \mathbb{E}_{t} \pi_{t+1} \uparrow \Rightarrow i_{j,t} \uparrow \Rightarrow r_{j,t} \uparrow \Rightarrow C_{j,t} \downarrow \]
  - In ZLB: \( i_{t} = \bar{i} \approx 0 \)
    \[ \text{If } i_{j,t} = \bar{i}, \text{ then } \mathbb{E}_{t} \pi_{t+1} \uparrow \Rightarrow r_{j,t} \downarrow \Rightarrow C_{j,t} \uparrow \]

- Focusing only on ZLB period is problematic.
  - Short sample
  - What if \( \mathbb{E}_{t} \pi_{t+1} \uparrow \) implies an exit of ZLB \( \Rightarrow i_{j,t} \uparrow \)?
What We Do

- Test consumption theory using micro-level household data with **detailed decomposition of inflation expectations and nominal interest rate expectations** (annual BoE/TNS Inflation Attitude Survey, February 2011 - February 2020).
  - Isolate the effect of inflation expectations on consumption behavior controlling for **quantitative** individual interest rate expectations (which allows to test consumption theory regardless of ZLB period).
  - Consider both durable and nondurable consumption.
  - Link the empirical findings to a macro model.

- Investigate heterogeneity in intertemporal substitution of consumption due to differences in economic knowledge.

- Test discounting in the Euler equation (micro level data test of Gabaix (2020) model).
Main Findings

- Higher inflation expectations:
  - stimulates current durable consumption,
  - decreases nondurable consumption.

- This is consistent with a model:
  - Durables are more sensitive to real interest rates and go up.
  - Nondurables react but are less sensitive to real interest rate, and go down due to an eroding effect of inflation on nominal income.
  - Extensive tests based on a macro model and find that the model and the data are consistent.
  - Nominal income erosion and wage growth expectations are key.

- Other findings:
  - Economically informed households are more responsive in intertemporal substitution of durable goods to real interest rates than less informed households.
  - The consumption Euler equation has discounting.
**Empirical Results: Baseline**

**Table: Baseline: Cut Back Spending**

<table>
<thead>
<tr>
<th></th>
<th>(1) Avg. marginal effects</th>
<th>(2) Avg. marginal effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_t \pi_{t,t+1}$</td>
<td>0.015*** (–) (0.002)</td>
<td>0.016*** (–) (0.004)</td>
</tr>
<tr>
<td>$E_t i_{t,t+1}$</td>
<td>0.024** (+) (0.012)</td>
<td>0.041** (+) (0.020)</td>
</tr>
<tr>
<td>$E_t (w_{t+1} - w_t)/w_t$</td>
<td>-0.012** (–) (0.006)</td>
<td></td>
</tr>
<tr>
<td>Control variables</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>6327</td>
<td>2680</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>0.052</td>
<td>0.033</td>
</tr>
</tbody>
</table>

**Table: Baseline: Durables**

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</thead>
<tbody>
<tr>
<td>$E_t \pi_{t,t+1}$</td>
<td>0.003*** (+) (0.001)</td>
<td>0.004*** (+) (0.002)</td>
</tr>
<tr>
<td>$E_t i_{t,t+1}$</td>
<td>0.008 (–) (0.005)</td>
<td>0.003 (–) (0.009)</td>
</tr>
<tr>
<td>$E_t (w_{t+1} - w_t)/w_t$</td>
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Explaining Baseline Empirical Results

- Higher inflation expectations:
  - increase the willingness to bring forward durable goods
  - increase the willingness to cut back spending

- This sounds counterintuitive, but it is not contradictory to the theory.
  - One can increase current durable consumption and cut back nondurable consumption.

1. \[
\frac{u_C(C_t, X_t)}{u_C(C_{t+1}, X_{t+1})} = \beta \frac{1 + i_t}{\Pi_{t+1}}: \text{higher } \Pi_{t+1} \text{ increases the ratio of current nondurable consumption to future nondurable consumption.}
\]

2. Current nondurable consumption **level** can decrease because higher \( \Pi_{t+1} \) could erode the values of nominal assets and/or future nominal income.

3. \[
\frac{u_X(C_t, X_t)}{u_C(C_t, X_t)} = 1 - (1 - \delta) \frac{\Pi_{t+1}}{1 + i_t}: \text{higher } \Pi_{t+1} \text{ increases the ratio of current durable consumption to nondurable consumption.}
\]

- This is often missed when we just look at consumption Euler equation,
  \[
c_t = \mathbb{E}_t c_{t+1} - \sigma(i_t - \mathbb{E}_t \pi_{t+1} - r^n_t),
\]
  without considering changes in income and two types of goods.
Infinite-horizon Model

- Household’s lifetime utility function

\[
U = E_0 \left[ \sum_{t=0}^{\infty} \beta^t u(C_t, X_t, L_t) \right]
\]  

\text{(2)}

with period utility function:

\[
u(C_t, X_t, L_t) = \frac{1}{1 - \frac{1}{\sigma}} \left[ \left( \psi(C_t - \lambda_c C_{t-1}) \frac{\eta-1}{\eta} + (1 - \psi)(X_t - \lambda_x X_{t-1}) \frac{\eta-1}{\eta} \right) \frac{\eta}{\eta-1} \right]^{1 - \frac{1}{\sigma}} \exp \left( \frac{1}{\sigma} - 1 \frac{L_t^{1+\nu_l}}{1 + \nu_l} \right)
\]  

\text{(3)}

subject to the flow budget constraint

\[
P_t C_t + P_t \{X_t - (1 - \delta)X_{t-1}\} + B_t \leq P_t Y_t^R + W_t L_t + (1 + i_{t-1})B_{t-1}
\]  

\text{(4)}

- Household’s expectations:

\[
\log(\Pi_t) = (1 - \rho_{\Pi}) \log(\Pi_{ss}) + \rho_{\Pi} \log(\Pi_{t-1}) + \epsilon_{\Pi, t-1}
\]  

\text{(5)}

\[
\log(1 + i_t) = (1 - \rho_i) \log(1 + i_{ss}) + \rho_i \log(1 + i_{t-1}) + \epsilon_{i, t-1}
\]  

\text{(6)}

\[
\log(\tilde{w}_t^R) - \log(\tilde{w}_{t-1}^R) = (1 - w_{index})(\Pi_{ss} - \Pi_t) + \epsilon_{w, t-1}
\]  

\text{(7)}

\[
\log(\tilde{y}_t^R) - \log(\tilde{y}_{t-1}^R) = \epsilon_{y, t-1}
\]  

\text{(8)}

where \( W_t^R = \frac{W_t}{P_t} \) and \( \tilde{a}_t = \frac{A_t}{\gamma^t} \) (detrended variable)
Simulation: IRFs to Inflation Expectations Shock

Figure: Wage Expectations set to 0.034 ($w_{index} = 0.034$) of Inflation Expectations

Figure: Wage Expectations set to 0.95 ($w_{index} = 0.95$) of Inflation Expectations