Inflation Expectations and Consumption Expenditure

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Motivation

*In the current situation, where nominal interest rates are constrained because they can’t go below zero, a small increase in expected inflation could be helpful. It would lower real borrowing costs, and encourage spending on big-ticket items like cars, homes and business equipment.*

Christina Romer (2013)
Research Question

- Do higher inflation expectations lead to higher consumption?
- Monetary policy constrained when zero lower bound (ZLB) binds
- Higher inflation expectations lower real interest rates with binding ZLB
- Fiscal multipliers increase with higher inflation when ZLB binds
- **But**: precautionary savings channel, preference assumptions, inflation tax on liquid asset, income effects, etc.

⇒ Relationship inflation expectations ⇔ consumption empirical question
This Paper

- Relationship btw inflation expectations & willingness to purchase
- Use novel German household data for sample Jan 2000 to Dec 2013
- Unexpected rise in value-added tax as shock to inflation expectations
- Match German & foreign HHs in DiD research design for identification

Main finding: Households which expect inflation to increase 9% more likely to purchase durables

Effect stronger for more educated, high-income, urban households
Overview of Results: Time-Series Evidence

- HH with positive inflation expectations 9% more likely to purchase durables in XS
- 19% after announcement and before taking effect of VAT (11/05 – 12/06): blue dots
Related Literature

- Theoretical literature on stabilization role of inflation
  - **Historical perspective**: Romer, Romer (2013), Eggertsson (2008)

- Household survey data on inflation expectations
Household’s Problem

- Representative household derives flow utility from nondurable consumption, $C_t$, and stock of durable consumption, $D_t$ and maximes:

$$
\beta^s \sum_{s=0}^{\infty} \left( \frac{C_{t+s}^{1-\gamma}}{1-\gamma} + \frac{D_{t+s}^{1-\gamma}}{1-\gamma} \right)
$$

s.t.  \[ P_t C_t + P_t [D_t - (1 - \theta)D_{t-1}] + B_{t+1} = Y_t + R_t B_t. \]

$\beta$: time discount
$\gamma$: coefficient of relative risk aversion
$\theta$: depreciation rate
$P_t$: price index
$R_t$: gross nominal interest rate
$B_t$: nominal bond holdings
$Y_t$: nominal endowment
NB: WLOG flow of durable consumption proportional to stock with factor of 1
First-Order Conditions

- Intertemporal Euler equation:

\[
\left( \frac{C_{t+1}}{C_t} \right)^\gamma = \beta \frac{R_{t+1}}{\pi_{t+1}}
\]

Higher inflation $\Rightarrow$ drop in consumption growth with fixed $R_{t+1}$, and $\gamma > 0$

- Intratemporal Euler equation:

\[
\left( \frac{C_t}{D_t} \right)^\gamma = \left[ 1 - \frac{\pi_{t+1}}{R_{t+1}}(1 - \theta) \right].
\]

Higher inflation $\Rightarrow$ intratemporal substitution from nondurables to durables
Potential Caveats

- Fisher equation *accounting identity*; no direction of adjustment

- Nominal rates do not move sufficiently to offset changes in inflation

- Future marginal utility not affected by shock to inflation

- Fix future nominal endowment

- No uncertainty

- No household heterogeneity

⇒ Sign of relationship empirical question!
Data Sources

- European Union harmonized survey on consumption climate
- Administered in Germany by GfK (market research company)
- Representative sample of 2,000 German households every months
- Questions about aggregate and personal economic expectations
- Repeated cross section of households
- Sample period from January 2000 to December 2013
- Rich demographics (age, income, marital status, city size, kids, job)
- Macro aggregates (unemployment, uncertainty, Dax, interest rates)
Pros and Cons of Data

■ Pros
  ■ Unique natural experiment for causal identification
  ■ Micro data allows study at level of actual decision maker
  ■ Study household heterogeneity and control for wealth effects
  ■ Examine effect over time
  ■ Expectations do not affect aggregate consumption

■ Cons
  ■ No panel, but rich set of demographics and individual expectations
  ■ Only qualitative question, but Binder (2015): households have no clue
  ■ Only willingness to purchase, but tracks actual spending closely
Survey Questions I

Question 8

*Given the current economic situation, do you think it’s a good time for your households to buy larger items such as furniture, electronic items, etc.?*

Answer choices: “it’s neither good nor bad time,” “it’s bad time,” or “it’s a good time.”
Question 3

*How will consumer prices evolve during the next twelve months compared to the previous twelve months?*

Answer choices: “prices will increase more,” “prices will increase by the same,” “prices will increase less,” “prices will stay the same,” or “prices will decrease.”

Create a dummy that equals 1 when households answer “prices will increase more.”
Inflation Expectations over time

- Inflation expectation start building up beginning of 2006
- Spike in December of 2006
Durable Inflation and lagged Inflation Expectations

- Increase in CPI inflation in 2007 driven by durable goods inflation subject to VAT increase
- Lagged inflation expectations and standardized durable inflation highly correlated
Readiness to Spend and Real Durable Consumption

- Positive correlation between purchasing propensity and actual purchases
- Most positive observation in last quarter before VAT increase
- Large negative observation in quarter of increase
Baseline Specification: Multinomial Logit

- Assume survey answer is random variable $y$
- Define the response probabilities as $P(y = t|X)$
- $X$ contains unit vector, and a rich set of household-level observables
- Assume the distribution of the response probabilities is

$$P(y = t|X) = \frac{e^{X\beta_t}}{1 + \sum_{z=1,2} e^{X\beta_z}},$$

- Estimate $\beta_t$ via maximum likelihood
- Marginal effect: derivative of $P(y = t|x)$ with respect to $x$
- Empirically: define “it’s neither good nor bad time” as baseline
Baseline Specification

Marginal Effects: \[
\frac{\partial P(y = t|x)}{\partial x} = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x) \beta_{zx} \right]
\]

<table>
<thead>
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<td>Inflation Increase</td>
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<td>Nobs</td>
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</table>

Households which expect inflation to increase

- 7% more likely to answer “good time to purchase durables”
- BUT also 2% to 4.5% more likely to reply “bad time to purchase durables”
Empirical Results

Demographics, Expectations, and Macro Aggregates

- HH characteristics shape purchasing propensities (age, income, ...)
  - Characteristics might be systematically related to inflation expectations

- Economic outlook can affect cross-sectional relationship
  - Optimistic households might expect high growth and low inflation

- Household might be bullish or bearish about the economy
  - w/ Philips curve in mind: answer high growth and high inflation
### Empirical Results

**Control for Demographics, Outlook, and Macro-aggregates**

Marginal Effects:  
\[
\frac{\partial P(y = t|x)}{\partial x} = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x)\beta_{z}\right]
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<td>(1.60)</td>
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<td>(1.16)</td>
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<tr>
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<td>5.70***</td>
<td>-3.00***</td>
<td>3.76***</td>
<td>-2.00***</td>
<td>3.31***</td>
<td>-1.14***</td>
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<td>(0.45)</td>
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</tr>
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</table>

|                                | X        | X         | X        | X         | X        | X         |
| Demographics                   |          |           |          |           |          |           |
| Individual expectations        | X        | X         | X        | X         | X        | X         |
| Macro Aggregates               | X        | X         |          |           | X        | X         |
| Pseudo R²                      | 0.0292   | 0.0654    | 0.0762   |
| Nobs                           | 244,497  | 219,799   | 219,799  |

- HH which expect inflation to increase 8% more likely to answer “good time to purchase”
- Positive effect on “bad time to purchase durables” disappears
Empirical Results

Control for **Demographics, Outlook, and Macro-aggregates**

Marginal Effects: 

\[
\left( \frac{\partial P(y = t|x)}{\partial x} \right) = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x) \beta_{zx} \right]
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Empirical Results

Control for Demographics, Outlook, and Macro-aggregates

Marginal Effects:
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<td>(0.23)</td>
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</table>

Demographics | X | X | X | X | X | X | X |
Individual expectations | X | X | X | X | X |
Macro Aggregates | X | X |
Pseudo R² | 0.0292 | 0.0654 | 0.0762 |
Nobs | 244,497 | 219,799 | 219,799 |

- HH which expect inflation to increase 8% more likely to answer “good time to purchase”
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## Individual Economic Outlook

**Marginal Effects:**

\[
\frac{\partial P(y = t|x)}{\partial x} = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x) \beta_{zx} \right]
\]

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<td>-3.55***</td>
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<td>(0.49)</td>
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<td>Past Inflation (3)</td>
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<td>-3.20***</td>
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<tr>
<td></td>
<td>(0.47)</td>
<td>(0.28)</td>
</tr>
</tbody>
</table>

- HH which expect inflation to increase 8% more likely to answer “good time to purchase”
- **Positive effect** on “bad time to purchase” contained among HH with negative outlook
Exogenous Shock to Inflation Expectations

- Richness of micro data many desirable features
- BUT: cannot rule out movements along the supply curve
- Here: *expected* inflation and propensity to buy mitigates concern
- Ideal experiment: shock to inflation expectations that does not affect households’ willingness to purchase durables through channels different from expectations of rising prices
- Follow narrative approach of Romer and Romer (2010)

⇒ Unexpected increase in value-added tax (VAT)
VAT Experiment of 2007 I

- Nov 2005: new government announces increase in VAT by 3%
- Jan 2007: entry into force of VAT increase
- Pre-election: promise not to increase VAT
- VAT increase legislated to consolidate budget
- Not related to prospective economic conditions
- Exogenous tax change acc to Romer and Romer nomenclature
VAT Experiment of 2007 II

- Inflation expectations build up during 2006
- Germany part of Euro zone and no independent monetary policy
- Nominal rate did not increase to offset inflation expectations
- Experiment resembles unconventional fiscal policy described in Correia, Fahri, Nicolini, Teles (2013)
- Feldstein (2002) proposition for Japan: Pre-announced VAT increases
- Stimulate inflation expectations & private spending
VAT as Shock to Inflation Expectations

- Inflation expectation start building up beginning of 2006
- Spike in December of 2006
Difference-in-Differences Matching Estimator

- All Germans treated by VAT shocks
- Micro data for France, UK, Sweden from EU harmonized survey
- National statistical offices and GfK subsidiaries
- Match German & foreign households with nearest-neighbor algorithm
- Matching categories: gender, age, education, income, social status
- Estimate Average Treatment Effect of VAT shock:

  \[
  (\overline{Dur}_{\text{German}, \text{post}} - \overline{Dur}_{\text{German}, \text{pre}}) - (\overline{Dur}_{\text{foreign}, \text{post}} - \overline{Dur}_{\text{foreign}, \text{pre}})
  \]
Parallel-Trends Identification Assumption 1

- Control group behaves similarly to Germans before VAT shock
- Behavior of control group after shock how Germans behaved absent of it
Parallel-Trends Identification Assumption II

Parallel trends in inflation expectations *before* the announcement of the VAT increase
Parallel-Trends Identification Assumption III

Parallel trends in durable propensity *before* the announcement of the VAT increase
Further Identification Assumption

- Balanced households’ characteristics after matching ( )
- Treated and control households distributed across full distribution ( )
- Positive effect of inflation expectations on consumption expenditure at micro level for all countries ( )
Further Identification Assumption

- Balanced households’ characteristics after matching (√)

- Treated and control households distributed across full distribution ( )

- Positive effect of inflation expectations on consumption expenditure at micro level for all countries ( )
Empirical Results

Further Identification Assumption

- Balanced households’ characteristics after matching (√)
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- Positive effect of inflation expectations on consumption expenditure at micro level for all countries ( )
Further Identification Assumption

- Balanced households’ characteristics after matching (√)
- Treated and control households distributed across full distribution (√)
- Positive effect of inflation expectations on consumption expenditure at micro level for all countries (√)
Empirical Results

Average Treatment Effect of VAT shock

- German and foreign households behave similarly before shock
- Immediate increase of purchasing behavior of Germans after shock
- Effect builds up during 2006
- Reversion to normal after actual VAT increase
Household Heterogeneity

Positive effect of inflation expectations on willingness to spend stronger for

- More educated households  by Education
- High income households  by Income
- Urban households  by City Size
- Unconstrained households  by Financial Constraints
Robustness

- Different left-hand side variables: cars, furniture, etc.
- Households expecting higher inflation less likely to save
- Households expecting deflation less likely to consume
- Split by individual economic outlook
- Inflation dummies for all categories
- OLS and ordered probit specification
- Year and month dummies
Durable Consumption versus Aggregate Demand

- HH with higher inflation expectations more willing to purchase durables
- We do not observe other components of consumption or investment
- Real GDP growth increased from 1.6% in 2005Q4 to 4.4% in 2006Q4
Permanent vs temporary Increases in Inflation Expectations

- Suggestion to unexpectedly increase inflation to inflate away debt
  - Hilscher, Raviv, Reis (2014): unlikely to substantially lower real debt

- Suggestion to permanently increase inflation targets
  - Mishkin (2011): occurrence of zero-lower bound periods too rare
  - Coibion, Gorodnichenko, Wieland (2012): optimal inflation rate < 2%
  - Gorodnichenko and Weber (2015): large costs of price adjustments
Permanent vs temporary Increases in Aggregate Demand

- Higher inflation expectations $\Rightarrow$ higher purchasing propensity
- No evidence on persistence of increase in spending
- Effect in 2006 could be pull forward effects
- Consistent with intertemporal substitution channel
- Durable consumption growth & propensities decrease in 2007Q1
- BUT: no stark drop in GDP growth!
- German & foreign HHs behave similarly after VAT rise: back to normal
Fiscal vs Monetary Policy

- Models often rely on monetary policy to engineer higher inflation
- Cannot identify source of heterogeneity in survey expectations
- VAT experiment: fiscal policy as source of increases in expectations
- NK fiscal multiplier: substitution rather than income channel
- Unconventional discretionary fiscal policy in severe recessions
- Increase private incentives to spend while keeping budget balanced
Inflation Expectations: Good vs Bad Times

- Higher inflation to stimulate demand often prescribed in liquidity trap
- Key mechanism relies on nominal rates not moving sufficiently
- In XS: HH with higher inflation expectations should consume more
- Conjecture larger marginal effects during liquidity trap
- Preferred policy tool might differ but Feldstein (2002)
Identification vs Policy Implications

- HH characteristics shape purchasing propensities
- Control for those to interpret effect of inflation expectations causally
- Policy makers cannot condition on characteristics
  (conventional monetary policy or VAT increase studied here)
- Findings hold in aggregate and without controlling for characteristics
- Heterogeneous effects call for increased policy transparency
Follow-up Work

- What determines heterogeneity in inflation expectations?
- Hypothesis: Consumption bundle and frequency of purchase
- Test: AC Nielsen homescan data and own survey on household panel
Conclusion

- We document a positive cross-sectional relationship between households’ inflation expectation and their willingness to purchase durable goods.

- The positive effect is stronger for more educated, urban, working-age, and higher income households.

- Our findings provide support for conventional wisdom that temporarily higher inflation expectations can stir consumption expenditure.

- The heterogeneity across households and the delayed response in 2006 suggest scope for increased economic literacy and policy transparency.

- Discretionary fiscal policy in recessions: series of pre-announced VAT increases and a simultaneous Reduction in income tax rates.
## Balancing of Variables: German and Foreign Households

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<th>Variable</th>
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<td>2.61</td>
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Obs in common support: 5,108 | 1,431
Balancing of Variables: German and Foreign Households
# Baseline Specification Foreign Households

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Standard errors in parentheses

*$p < 0.10$, $**p < 0.05$, $***p < 0.01$
Baseline Specification by Education

Marginal Effects: \[ \frac{\partial P(y = t|x)}{\partial x} = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x)\beta_{zx} \right] \]

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<tr>
<td>Hauptschule</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Realschule</td>
<td>(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gymnasium</td>
<td>(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Baseline Specification by Income

Marginal Effects: 
\[
\frac{\partial P(y = t|x)}{\partial x} = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x) \beta_{zx} \right]
\]

<table>
<thead>
<tr>
<th>Income</th>
<th>Bad time (1)</th>
<th>Good time (2)</th>
<th>Bad time (3)</th>
<th>Good time (4)</th>
<th>Bad time (5)</th>
<th>Good time (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income ≤ 1,000</td>
<td>-0.99 (1.05)</td>
<td>8.98*** (1.68)</td>
<td>-0.55 (0.78)</td>
<td>8.51*** (1.51)</td>
<td>-1.09 (0.77)</td>
<td>10.48*** (2.03)</td>
</tr>
<tr>
<td>1,000 &lt; Income ≤ 2,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2,500 &lt; Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Inflation increase
- Past Inflation

Demographics: X X X X X X

Individual expectations: X X X X X X

Pseudo R²: 0.0655 0.0596 0.0504

Nobs: 96,555 112,710 16,477
Baseline Specification by City Size

\[
\text{Marginal Effects: } \frac{\partial P(y = t|x)}{\partial x} = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x) \beta_{zx} \right]
\]

<table>
<thead>
<tr>
<th>City $\leq$ 2T</th>
<th>2T $&lt;$ City $\leq$ 20T</th>
<th>20T $&lt;$ City $\leq$ 100T</th>
<th>100T $&lt;$ City</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inflation increase</strong></td>
<td><strong>Past Inflation</strong></td>
<td><strong>Demographics</strong></td>
<td><strong>Individual expectations</strong></td>
</tr>
<tr>
<td>Bad time</td>
<td>Good time</td>
<td>Bad time</td>
<td>Good time</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Inflation increase</td>
<td>$-1.23$</td>
<td>$5.81^{***}$</td>
<td>$0.18$</td>
</tr>
<tr>
<td>(1.32)</td>
<td>(1.99)</td>
<td>(0.86)</td>
<td>(1.51)</td>
</tr>
<tr>
<td>Past Inflation</td>
<td>$4.14^{***}$</td>
<td>$-1.96^{***}$</td>
<td>$2.98^{***}$</td>
</tr>
<tr>
<td>(0.52)</td>
<td>(0.55)</td>
<td>(0.36)</td>
<td>(0.34)</td>
</tr>
<tr>
<td>Demographics</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Individual expectations</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>0.0738</td>
<td>0.0632</td>
<td>0.0721</td>
</tr>
<tr>
<td>Nobs</td>
<td>17,833</td>
<td>74,937</td>
<td>59,674</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

\( *p < 0.10, \; **p < 0.05, \; ***p < 0.01 \)
Baseline Specification by Financial Constraints

Marginal Effects: \[
\frac{\partial P(y = t|x)}{\partial x} = P(y = t|x) \left[ \beta_{tx} - \sum_{z=0,1,2} P(y = z|x) \beta_{zx} \right]
\]

<table>
<thead>
<tr>
<th>Inflation Increase</th>
<th>Unconstrained</th>
<th>Constrained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bad time (1)</td>
<td>Good time (2)</td>
</tr>
<tr>
<td>Inflation Increase</td>
<td>-0.57 (0.66)</td>
<td>10.42*** (1.80)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Past Inflation</th>
<th>Unconstrained</th>
<th>Constrained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past Inflation</td>
<td>3.45*** (0.27)</td>
<td>-2.50*** (0.38)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pseudo R²</th>
<th>Unconstrained</th>
<th>Constrained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudo R²</td>
<td>0.0615</td>
<td>0.0608</td>
</tr>
</tbody>
</table>

Nobs | 98,344 | 121,455 |