

Group-Specific Inflation and Households' Choices

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How does inflation affect households' consumption and financial decisions?

Recent increase in inflation rates in developed countries:

- Long period of expansionary monetary policies;
- Disruptions in global supply chains due to COVID;
- Inflationary pressure from the transition to green economy;
- Shortage of raw materials and agricultural products due to the war;
- ...

Purpose: to investigate how households react to inflation they are exposed to ← observed contemporaneous price changes rather than long-term experiences.

Group-specific inflation

- Inflation heterogeneity across households.
- "Representative" CPI inflation vs. group-specific inflation.

Different groups of households experience different inflation rates based on consumption habits, consumption baskets and life-cycle positions:

- Kaplan & Schulhofer-Wohl (2017) → most variability in a household's inflation rate comes from changes in household-level prices, not from aggregate inflation.
- Hobijn & Lagakos (2005), Jaravel (2021) → Inflation inequality - elderly and low income households are more exposed to price increases.

Inflation inequality matters for monetary policy.

Why would contemporaneous observed inflation affect consumption decisions?

Expectations channel

- Adaptive expectations → Malmendier & Nagel (2016) show that households form their inflation expectations from previous experiences in inflation.
- D'Acunto et al. (2019) find that households overweight frequently observed prices (e.g. food prices) when forming inflation expectations.

⇒ Expect **positive** relationship between inflation and consumption due to intertemporal substitution mechanism.

Why would contemporaneous observed inflation affect consumption decisions?

Money illusion channel

- Consumers misinterpret real and nominal prices growth. E.g. Deaton (1977) → Predicts **negative** relationship between inflation and consumption (unexpected inflation).
- Can also think of illusion about income (Branson & Klevorick 1969) which would imply an opposite effect.

Challenging to distinguish different mechanisms empirically, we estimate the **net effect** of possible channels.

General idea:

- Use standard consumption function where real consumption responds to the changes in income and wealth (Attanasio and Weber 2010; Jappelli and Pistaferri 2010).
- Add inflation into the model:

$$\Delta \log C_{it} = \Delta \log Inc_{it} + \Delta \log Fin_{it-1} + Infl_{it} + \dots \quad (1)$$

How does consumption responds to change in group-specific inflation after controlling for changes in real income and real wealth?

Group-specific inflation calculation

Heterogeneity in experienced inflation due to different consumption baskets:

$$\text{IndCPI}_h = \sum_{i=1}^N w_{i,h} \text{CPI}_{i,h} \quad (2)$$

where $w_{i,h}$ is expenditure share of product or product category i in the total consumption basket of a household.

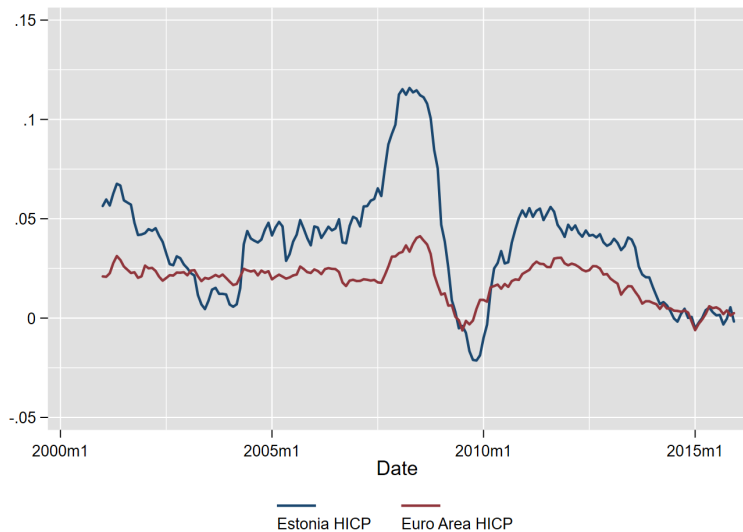
Difficulties - granular data only available recently, most countries have not experienced high inflation in recent years. Data from the current inflation episode mostly not there yet.

Additional empirical challenges: need enough variation in inflation, the presence of reverse causality and omitted time-varying variables.

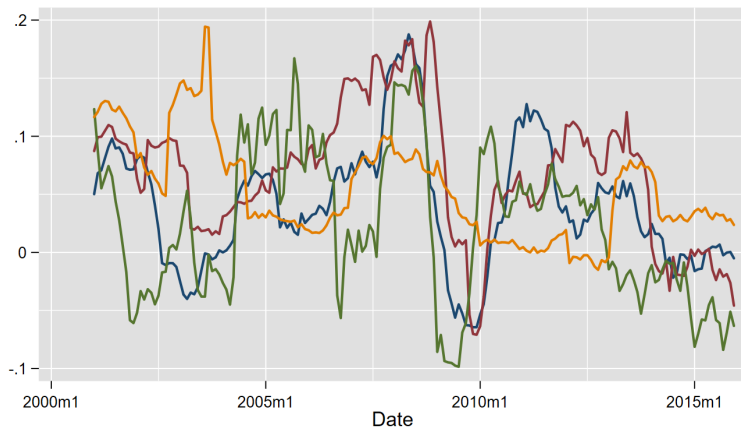
⇒ We use micro-data from a commercial bank in Estonia.

- High and volatile inflation in the 2005-2011 period.
- Small open economy - inflation plausibly driven mostly by external factors: Maćkowiak (2007), Aastveit et al. (2016), Jovičić et al. (2017).
- Panel data → control for time and individual effects.
- Robustness checks: extensions to baseline model to control for omitted time-varying variables.

Inflation in Estonia - graph



Inflation in Estonia - sub-indices



— Food and non-alcoholic beverages	— Housing
— Transport	— Health

1) Account dataset - quarterly account-level data from a large commercial bank, covering around 12% of entire population from 2005 to 2011.

- Outflows and inflows on checking accounts → proxies for income and spending.
 - Cleaned from transactions between saving and investment accounts, debt repayments, house purchases etc.
- Balance on checking accounts, term deposits and investment accounts → holding of financial assets.
- Balance on housing and consumer loans.
- Socio-economic characteristics: age, gender, region, education.

No consumption shares in account data set to calculate groups-specific inflation → We impute the weights of consumption categories based on households' characteristics.

2) Household Budget Survey (HBS)

- Household level data containing detailed data on consumed goods and services.
- We use data on households' consumption expenditures - 12 consumption categories (e.g. food, transport, accommodation ...).
- Rich set of socio-economic characteristics.

Consumption shares imputation

Imputation strategy takes into account characteristics of the weights of consumption categories:

- Weights need to be non-negative, between 0 and 1, and add up to 1.
- → Multinomial Fractional Logit (MFL); non-linear simultaneous estimation of the vector of weights.

$$E[w_{i,h}|X_h] = \frac{e^{\beta_i X_h}}{\sum_{k=1}^N e^{\beta_k X_h}}, \quad (3)$$

where X_h is a vector of explanatory variables and $w_{i,h}$ is a vector of consumption weights.

Empirical approach

Step 1 - estimate the MFL model of consumption shares on HBS data using characteristics X_h and obtain the vector of parameters $\hat{\beta}$.

Step 2 - using estimated $\hat{\beta}$ to calculate consumption shares $\hat{w}_{i,h}$ using account level data.

Step 3 Calculate household-specific price index:

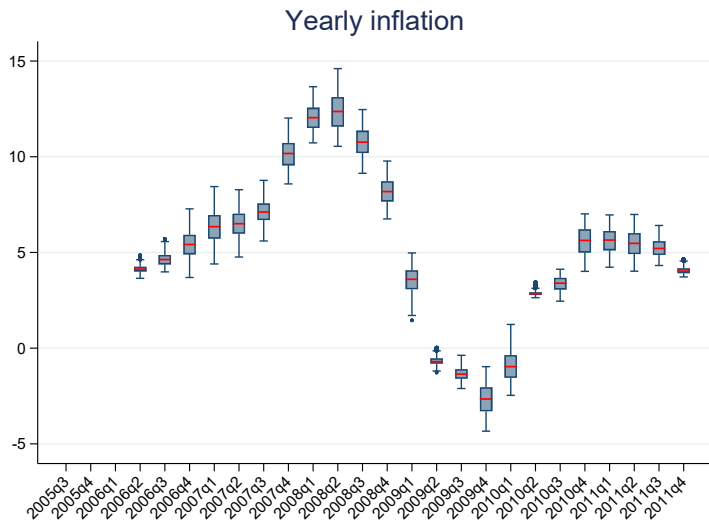
$$\text{IndCPI}_{it} = \sum_{cat=1}^{12} \hat{w}_{cat,i,t-1} \text{CPI}_{cat,t}. \quad (4)$$

NB! The weights are one period lagged.

Step 4 Calculate quarterly inflation from individual CPI.

Due to imputation we obtain a proxy for personally experienced inflation
→ group-specific inflation.

Group-specific experienced inflation - distribution



Estimate empirical model from account-level data:

$$\Delta \ln C_{it} = \beta_1 \Delta \ln Inc_{it} + \beta_2 \Delta \ln Fin_{it-1} + \beta_3 IndInfl_{it} + \lambda_i + \gamma_t + \epsilon_{it} \quad (5)$$

- Quarterly panel data \rightarrow Individual and time FE included.
- The estimated coefficient β_3 captures the response of consumption to the group-specific experienced inflation **conditional on the value of headline inflation**.
- Interpretation: redistribution of consumption between more and less inflation-exposed households' groups.

Results 1) - Main model

Table: Individual experienced inflation and consumption growth

	Dependent variable: $\Delta \log C_{it}$	
	(1)	(2)
$IndInf_{it}$	0.057*** (0.004)	0.026*** (0.002)
$IndInf_{it}^2$		0.025*** (0.001)
$\Delta \log Inc_{it}$	0.480*** (0.006)	0.480*** (0.006)
$\Delta \log Fin_{i,t-1}$	0.108*** (0.002)	0.108*** (0.002)
Constant	-0.035*** (0.003)	-0.025*** (0.003)
Household FE	Yes	Yes
Time FE	Yes	Yes
Observations	2,179,552	2,179,552
Within R^2	0.207	0.208
Groups	89,507	89,507

Positive relationship between experienced inflation and consumption \rightarrow expectations channel?

Results 2) - Large purchases

$$\text{Logit}(\text{LargePurchase}_{it}) = \beta_1 \text{IndInf}_{it} + \beta_2 X_{it} + \lambda_i + \gamma_t + \epsilon_{it} \quad (6)$$

Table: Large purchases - odds ratios from panel logit model

	Dependent variable: <i>DurablePurchase</i>		
	(1) > 50%	(2) > 75%	(3) > 100%
<i>IndInf_{it}</i>	1.227*** (0.015)	1.302*** (0.020)	1.371*** (0.028)
$\Delta \log \text{Inc}_{it}$	2.717*** (0.014)	3.125*** (0.020)	3.388*** (0.027)
$\Delta \log \text{Fin}_{it-1}$	1.313*** (0.003)	1.358*** (0.005)	1.385*** (0.006)
Household FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	1,611,387	1,147,872	785,039
Groups	66,218	47,218	32,324

⇒ "Durable" consumption positively affected by experienced inflation.

Results 3) - How do households finance consumption?

$$\text{Logit}(\text{NewLoan}_{it}) = \beta_1 \text{IndInf}_{it} + \beta_2 X_{it} + \lambda_i + \gamma_t + \epsilon_{it} \quad (7)$$

Table: Taking out new or additional loans - odds ratios from panel logit model

	Housing Loan	Consumer Loan
<i>IndInf_{it}</i>	0.985 (0.040)	1.069*** (0.031)
$\Delta \log \text{Inc}_{it}$	1.246*** (0.020)	1.000 (0.013)
$\Delta \log \text{Fin}_{it-1}$	1.017*** (0.006)	0.995 (0.005)
Household FE	Yes	Yes
Time FE	Yes	Yes
Observations	260,030	433,375
Groups	10,950	17,748

⇒ Experienced inflation increases the odds ratio of taking out a consumer loan but not a housing loan.

Results 4) - How do households finance consumption?

Table: Experienced inflation and the balance of savings products

	Checking account	Term deposit	Securities
$IndInf_{it}$	0.000 (0.006)	-0.045*** (0.013)	0.023* (0.013)
$\Delta \log Inc_{it}$	0.944*** (0.013)	0.195*** (0.006)	-0.027** (0.009)
$\Delta \log Term_{i,t-1}$	0.048*** (0.001)		0.007** (0.003)
$\Delta \log Curr_{i,t-1}$		0.074*** (0.004)	0.023*** (0.003)
$\Delta \log Sec_{i,t-1}$	0.023*** (0.003)	0.005 (0.005)	
Household FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	2,178,027	539,668	161,859
Groups	89,454	22,484	7,063

⇒ Households reduce their savings on term deposits in response to high observed inflation.

Results 5) - Heterogeneity by debt status

Table: Debt and consumption

	Total debt	Housing debt	Consumer debt
$IndInf_{it}$	0.057*** (0.004)	0.058*** (0.004)	0.057*** (0.004)
$\Delta \log Inc_{i,t}$	0.476*** (0.006)	0.477*** (0.006)	0.477*** (0.006)
$\Delta \log Inc_{i,t} \times IndInf_{it}$	0.003*** (0.001)	0.003*** (0.001)	0.003*** (0.001)
$\Delta \log Fin_{it-1}$	0.109*** (0.002)	0.109*** (0.002)	0.109*** (0.002)
$\Delta \log Fin_{it-1} \times IndInf_{it}$	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
$Debt_{it}$	-0.020*** (0.002)	-0.027*** (0.002)	-0.026*** (0.002)
$Debt_{it} \times IndInf_{it}$	0.007*** (0.001)	0.007*** (0.001)	0.004*** (0.001)
Household FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes
Observations	2,179,552	2,179,552	2,179,552
R2	0.198	0.198	0.198

Inflation and debtor interaction is positive \Rightarrow Households increase consumption in response to higher inflation more when they are indebted.

Main identification problem for causal interpretation: endogeneity of consumption weights.

- Groups with different consumption bundles might have different consumption dynamics.
- Robustness 1: include group specific dynamics in the consumption.
- Robustness 2: time varying individual effects → interactive fixed effects (Bai 2009).

Other robustness checks:

- Additional robustness estimations with different set of regressors in the imputation model.

Conclusion

- **Main message:** inflation heterogeneity matters for consumption dynamics.
- Groups experiencing higher inflation increase their consumption → 1% increase in quarterly experienced inflation corresponds to almost 6% increase in real consumption.
- Increased consumption is financed by combination of borrowing and drawing on savings.
- Results consistent with inter-temporal substitution and experienced inflation affecting expectations (additional exercise using group-level expectations from ECB's business and consumer surveys series).
- Heterogeneity across age and income groups → policy implications.

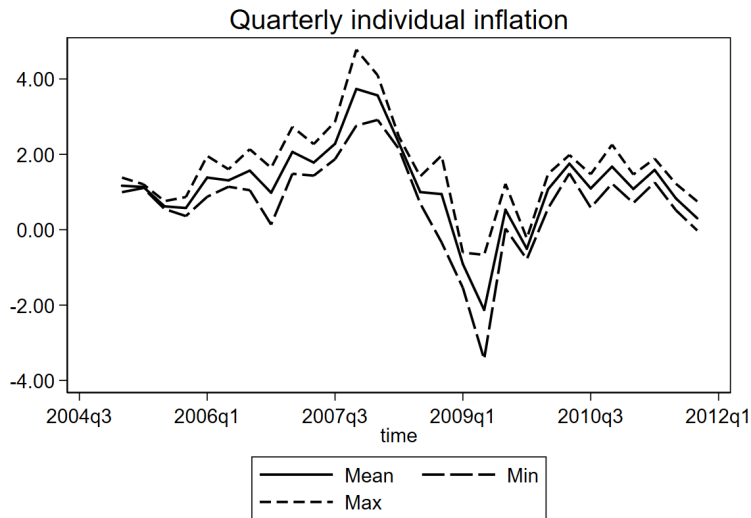
THANK YOU! QUESTIONS?

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Experienced inflation



Results 1) - by income groups

Table: Individual experienced inflation and consumption by income group

	Dependent variable: $\Delta \log C_{it}$ by income group (quantile)				
	Q1	Q2	Q3	Q4	Q5
$IndInf_{it}$	0.104*** (0.012)	0.114*** (0.009)	0.108*** (0.008)	0.098*** (0.008)	0.056*** (0.005)
$\Delta \log Inc_{it}$	0.572*** (0.011)	0.497*** (0.007)	0.451*** (0.006)	0.432*** (0.008)	0.463*** (0.008)
$\Delta \log Fin_{it}$	0.119*** (0.003)	0.103*** (0.002)	0.101*** (0.002)	0.104*** (0.002)	0.113*** (0.003)
Household FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	441,136	439,780	438,166	435,508	424,962
R^2	0.237	0.210	0.194	0.190	0.209
Groups	17,830	18,049	18,241	18,370	18,485

⇒ The highest income group responds to the individual inflation the least. The results with lagged coefficients provide evidence for intertemporal substitution in this group.

Results 1) - by age groups

Table: Individual experienced inflation and consumption by age group

	Dependent variable: $\Delta \log c_{it}$ by age group (years of age)				
	(20-29)	(30-39)	(40-49)	(50-59)	(60-70)
$IndInf_{it}$	0.074*** (0.007)	0.083*** (0.008)	0.076*** (0.007)	0.107*** (0.009)	0.147*** (0.017)
$\Delta \log Inc_{it}$	0.561*** (0.012)	0.506*** (0.009)	0.450*** (0.008)	0.424*** (0.007)	0.392*** (0.011)
$\Delta \log Fin_{it}$	0.112*** (0.003)	0.105*** (0.003)	0.101*** (0.003)	0.105*** (0.003)	0.132*** (0.006)
Household FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Observations	374128	517658	537281	526338	224147
R^2	0.313	0.256	0.207	0.157	0.107
Groups	15474	21443	22040	21429	9121

⇒ The oldest age group responds the strongest to the current inflation while they have also experienced hyperinflation in the beginning of 90s.

Results robustness - group specific consumption dynamics

Table: Robustness - group specific trends

	Dependent variable: $\Delta \log C_{it}$			
	(1)	(2)	(3)	(4)
<i>IndInf_{it}</i>	0.060*** (0.004)	0.090*** (0.004)	0.094*** (0.004)	0.151*** (0.005)
Controls	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Gender#Time FE	Yes	No	Yes	No
Age#Time FE	No	Yes	No	No
Income#Time FE	No	No	Yes	No
Income#Age#Time FE	No	No	No	Yes
Observations	2179552	2179552	2179552	2179552

⇒ Results robust to exploiting only within-group variation in experienced inflation along most "suspicious" dimensions.

Results robustness - interactive fixed effects

Table: Interactive fixed effects regressions

	Dependent variable: $\Delta \log C_{it}$			
	FE	IFE	IFE	IFE
$IndInf_{it}$	0.058*** (0.004)	0.060*** (0.004)	0.053*** (0.004)	0.051*** (0.004)
$\Delta \log Inc_{it}$	0.479*** (0.006)	0.501*** (0.006)	0.504*** (0.006)	0.511*** (0.006)
$\Delta \log Fin_{i,t-1}$	0.108*** (0.002)	0.108*** (0.002)	0.106*** (0.002)	0.106*** (0.002)
Constant	-0.071*** (0.005)	-0.074*** (0.004)	-0.066*** (0.004)	-0.063*** (0.004)
Household FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
IFE	No	Yes	Yes	Yes
Factors	x	1	2	3
Observations	1089965	1089965	1089965	1089965

⇒ Results are robust to controlling for unobserved time-varying individual factors.

Table: Inflation perceptions and expectations

	Dependent variable: 12 month ahead expectations			
	Age	Income	Gender	Education
12 month perception	0.437*** (0.115)	0.604*** (0.075)	0.385*** (0.075)	0.156 (0.106)
Time FE	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes
Observations	104	104	104	104

Source: ECB business and consumer survey series. Inflation perceptions strongly correlate cross-sectionally with expectations.