Measuring and comparing consumption inequality in France and the United States

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December 2, 2022

**Views are my own and do not represent the position of the Banque de France or the Eurosystem.*

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- Most research has focused on **income and wealth** inequality, partly because of highly granular data (from administrative sources), and of the scarcity of micro data on consumption
- But **consumption is what matters** in micro-founded models (e.g., Krueger et al. 2016) for measuring welfare

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$\Rightarrow$ This paper is a first step within a broader agenda of evaluating the **impact of monetary policy on inequality**

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- We **validate the technique by doing counterfactuals** with the US data
  - Outperforms linear interpolation

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3. **Higher inequality in the US than in France** with different dynamics
   - **Ratio Q5/Q1 for consumption** is **1.5 times bigger**, and **3.5 for income**
4. **No evidence of inflation inequality** (with our level of disaggregation)
   - More visible with higher level of disaggregation (US)

Related literature

1. **Long-run inequality analyses**
   - Most focus on income (Boiron 2016, Heathcote 2010) or wealth (Piketty and Zucman 2014)
   - Studies contrasting consumption and income in the US do not reach a consensus: Amin-Smith and Attanasio (2020), Attanasio and Davis (1996), Slesnick (2001), Krueger and Perri (2006), Attanasio et al. (2007, 2012)
   - Consumption inequality in France: Accardo et al. (2009, 2017), Chevalier et al. (2018) focus on few survey waves
2. **Measurement issues in surveys, dissensus caused by difference in data sources or definitions**:
   - Measurement errors (Aguiar and Bills (2015)), gap with national accounts (Garner et al. 2006)
   - Subset of consumption (Meyer and Sullivan 2017)
   - Our measure consistent with national accounts partly corrects for these measurement errors

Data

Survey Budget de Famille - France

- Cross-section of households (sample $S \approx 25000$, respondents $S \approx 15000$)
- Every 5 years since 1979 in its current format (but available since 1972), our sample starts in 1995
- Questionnaires for durables over a year, and two booklets about non-durables over 2 weeks
- Nomenclature of items in the BdF survey (around 900 items) following Eurostat norms (COICOP) since 2001
- Information about income (labor income, rents, etc)

Product nomenclature of French national accounts

	COICOP
Food	011
Non-alcoholic beverages	012
Alcoholic beverages	021
Tobacco	022
Clothing	031
footwear	032
Actual rentals for housing	041
Imputed rents	042
Regular maintenance and repair of the dwelling	043
Other services related to the dwellings	044
Electricity, gas and other fuels	045
Furniture, furnishings and decorations, carpets and other floor coverings and repairs	051
Household textiles	052
Household appliances	053
Glassware, tableware and household utensils	054
Tools and equipment for house and garden	055
Goods and services for routine household maintenance	056
Medical products, appliances and equipment	061
Outpatient services	062
Hosptical services	063
Purchase of vehicle	071
Sale of vehicle	071bis
Operation of personal transport equipment	072
Transport services	073

Product nomenclature of French national accounts

Communications	081
Audio-visual, photographic and information processing equipment	091
Other major durables for recreation and culture	092
Other recreational items and equipment, gardens and pets	093
Recreational and cultural services	094
Newspapers, books and stationery	095
Package holidays	096
Education	10
Catering services	111
Accomodation services	112
Personal care	121
Personal effects n.e.c	123
Social protection	124
Insurance	125
Financial services n.e.c	126
Other services	127

Consumer Expenditure Surveys - United States

- Available at yearly frequency, from 1984 to 2019
- Sample of 14 000 per year
- Based on two surveys: the quarterly Interview Survey for major and/or recurring items and the Diary Survey for more minor or frequently purchased items
- Provides data on income, expenditures and demographic characteristics of consumers

Constructing survey consumption consistent with NA

Building on Accardo et al. (2009, 2017):

1. **Identification in the consumption entry** of the survey, the corresponding COICOP category in the national accounts
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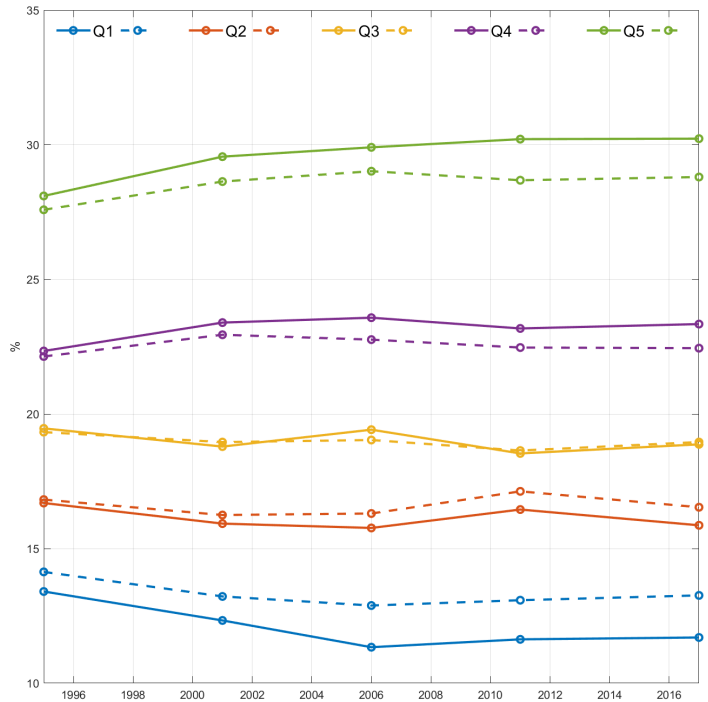
4. We proceed **similarly for income**
   - Ranking households by income to get consumption by quintiles

Consumption: survey vs national accounts

Consumption (in billions)	Matched with National Accounts	Original Survey	Difference without matching
2017	1178,80	732,85	37.8%
1	137,89	97,19	
2	187,02	121,18	
3	222,46	138,93	
4	275,13	164,49	
5	356,31	211,07	
2011	1079,14	710,38	34.1%
1	125,49	92,93	
2	177,52	121,66	
3	200,02	132,43	
4	250,11	159,61	
5	326,00	203,75	
2006	964,48	729,71	24.3%
1	109,34	94,02	
2	152,06	118,96	
3	187,27	138,88	
4	227,39	166,09	
5	288,43	211,75	
2001	799,70	617,05	22.8%
1	98,61	81,59	
2	127,37	100,25	
3	150,25	116,96	
4	187,09	141,57	
5	236,38	176,69	

- Like with CEX (Garner et al. 2006), increasing gap between survey and national account without pairing and rescaling

Consumption: survey vs national accounts



Note: Consumption in BdF survey matched with national accounts (full line), and consumption from BdF survey only (dotted line)

- Without this matching: under estimate the consumption of the top 3 quintiles, and over estimate that of the bottom quintiles $\rightarrow$ **under-estimating inequality**
- Different readjustment across quintiles and years $\rightarrow$ a biased estimate of the evolution of consumption inequality

Bridging missing years - Kalman filter

Kalman filter

- Multivariate Kalman filter with a linear constraint and a regression component
- State equation:

$$\begin{bmatrix} X_{1,t} \\ X_{2,t} \\ X_{3,t} \\ X_{4,t} \\ X_{5,t} \end{bmatrix} = \begin{bmatrix} D_{1,1} & 0 & 0 & 0 & 0 \\ 0 & D_{2,2} & 0 & & 0 \\ 0 & 0 & D_{3,3} & 0 & 0 \\ 0 & 0 & 0 & D_{4,4} & 0 \\ 0 & 0 & 0 & 0 & D_{5,5} \end{bmatrix} \begin{bmatrix} X_{1,t-1} \\ X_{2,t-1} \\ X_{3,t-1} \\ X_{4,t-1} \\ X_{5,t-1} \end{bmatrix} + \begin{bmatrix} E_{1,1} & 0 & 0 & 0 & 0 \\ 0 & E_{2,2} & 0 & 0 & 0 \\ 0 & 0 & E_{3,3} & 0 & 0 \\ 0 & 0 & 0 & E_{4,4} & 0 \\ 0 & 0 & 0 & 0 & E_{5,5} \end{bmatrix} u_t,$$

where $u_t \sim N(0, Q)$

Kalman filter

- Measurement equation:

$$\begin{bmatrix} C_{1,t} \\ C_{2,t} \\ C_{3,t} \\ C_{4,t} \\ C_{5,t} \\ Ctotal_t \end{bmatrix} = \begin{bmatrix} A_{1,1} & 0 & 0 & 0 & 0 \\ 0 & A_{2,2} & 0 & 0 & 0 \\ 0 & 0 & A_{3,3} & 0 & 0 \\ 0 & 0 & 0 & A_{4,4} & 0 \\ 0 & 0 & 0 & 0 & A_{5,5} \\ A_{1,1} & A_{2,2} & A_{3,3} & A_{4,4} & A_{5,5} \end{bmatrix} \begin{bmatrix} X_{1,t} \\ X_{2,t} \\ X_{3,t} \\ X_{4,t} \\ X_{5,t} \end{bmatrix} +$$

$$\begin{bmatrix} \beta_{1,1} & 0 & 0 & 0 & 0 \\ 0 & \beta_{2,2} & 0 & & 0 \\ 0 & 0 & \beta_{3,3} & 0 & 0 \\ 0 & 0 & 0 & \beta_{4,4} & 0 \\ 0 & 0 & 0 & 0 & \beta_{5,5} \\ \beta_{1,1} & \beta_{1,2} & \beta_{1,3} & \beta_{1,4} & \beta_{5,5} \end{bmatrix} \begin{bmatrix} I_{1,t} \\ I_{2,t} \\ I_{3,t} \\ I_{4,t} \\ I_{5,t} \end{bmatrix} + \begin{bmatrix} B_{1,1} & 0 & 0 & 0 & 0 \\ 0 & B_{2,2} & 0 & 0 & 0 \\ 0 & 0 & B_{3,3} & 0 & 0 \\ 0 & 0 & 0 & B_{4,4} & 0 \\ 0 & 0 & 0 & 0 & B_{5,5} \\ B_{1,1} & B_{2,2} & B_{3,3} & B_{4,4} & B_{5,5} \end{bmatrix} \nu_t,$$

  where $\nu_t \sim N(0, H)$
- Linear equality constraint on national accounts
- Income by quintile as regression component

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- Linear equality constraint on national accounts
- Income by quintile as regression component

Estimating missing years

- Once the model parameters are estimated $\rightarrow$ we can estimate the latent variables
  - The KF operates to find optimal estimates of $X_t \sim N(a_t, P_t)$
  - The KF computes the conditional mean a_t and variance P_t of the distribution of X_t conditional on observations up to time t
- When data is available, the KF estimates X_{t+1} using the estimates of the current state and the current observation Y_t by estimating

$$a_{t+1} = Da_t + K_t(Y_t - AX_t)$$
$$P_{t+1} = DP_t(D - K_tX_t)' + Q.$$

  where K_t is the Kalman gain

- When there is an observation missing, the Kalman filter can still use the transition equation and compute

$$a_{t+1} = Da_t$$
$$P_{t+1} = DP_tD' + Q$$

Estimating missing years

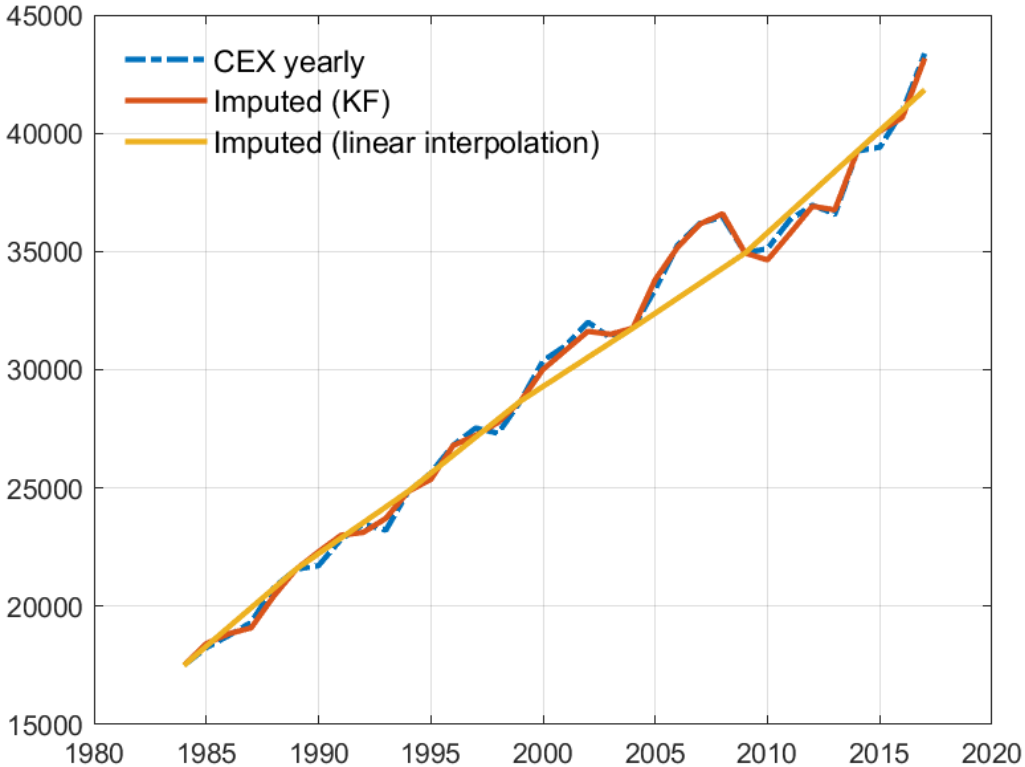
- Then we use the measurement equation to predict Y_t

$$\hat{y} = AX_t$$

How to assess our technique?

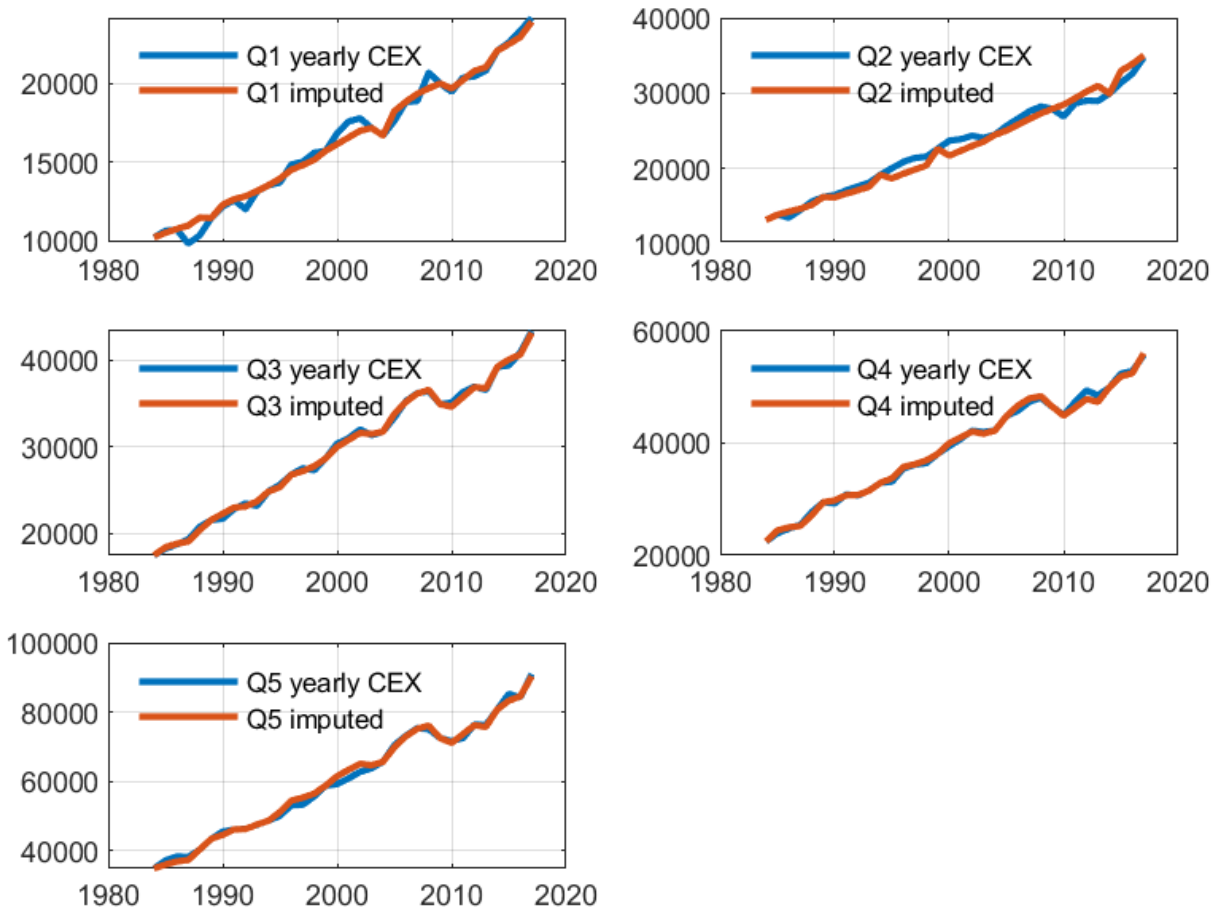
- Is the constraint enough to discipline the Kalman filter ? Are series consistent?
- Why not just use linear interpolation?
- CEX data for the US offer us a counterfactual
- We simulate infrequent series as for France, with a 5-year gap
- Estimate the Kalman filter to impute missing years

Validating with US data



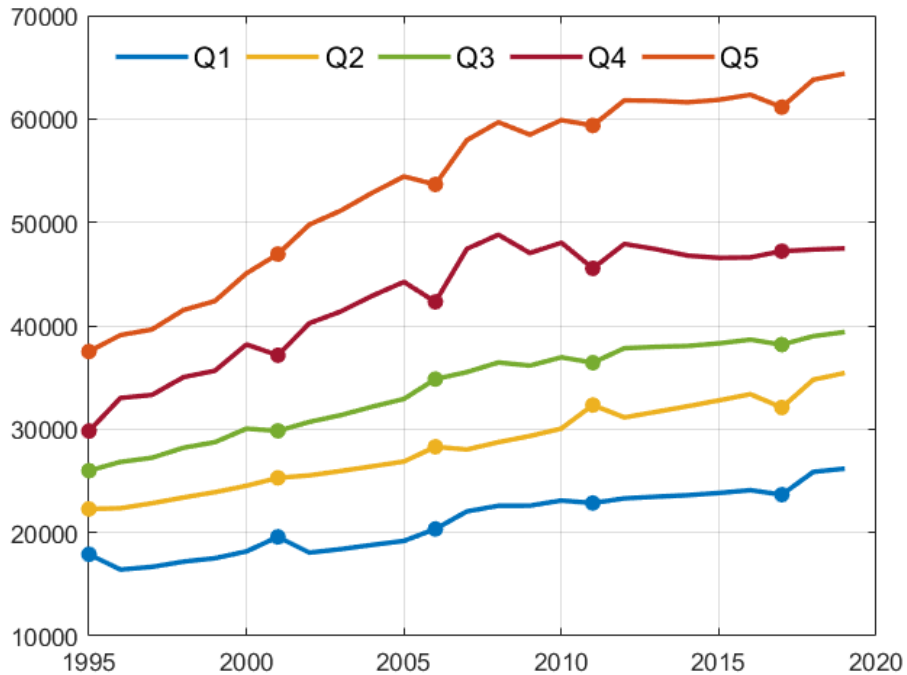
- Based on counterfactual US data, the Kalman filter outperforms linear interpolation
- **Better match of cyclical variations**, and lower RMSE

Validating with US data



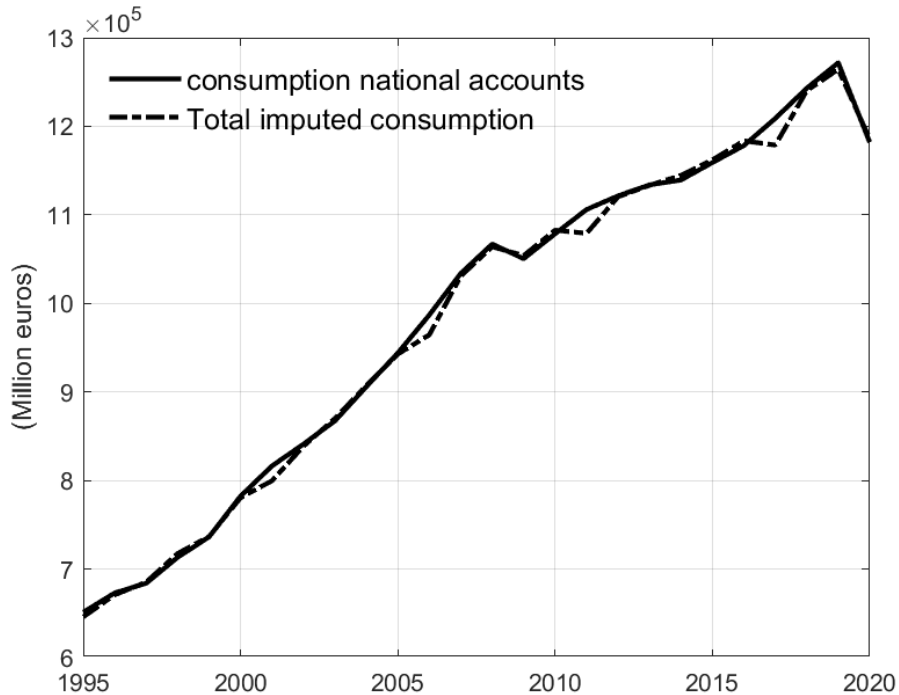
- Closer match for upper quintiles (partly due to higher weight in total consumption)

Getting yearly consumption by income quintiles for France



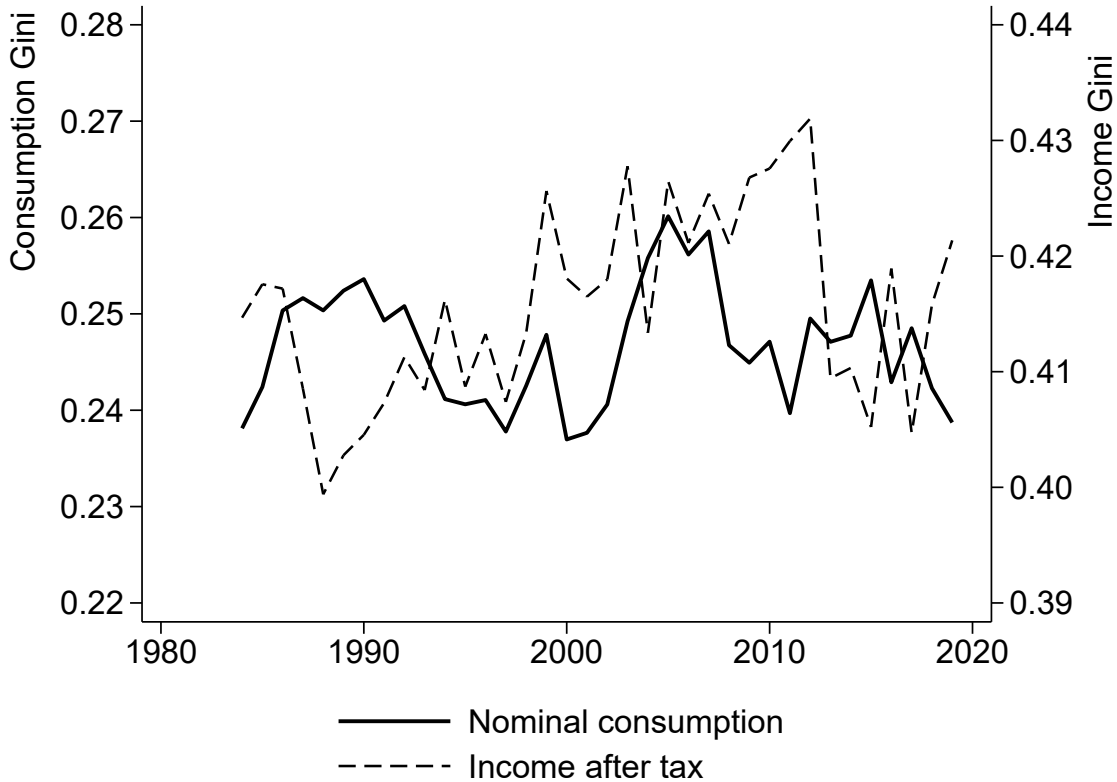
- Higher cyclicality of upper quintiles consumption, similar to the US

Comparison with national accounts



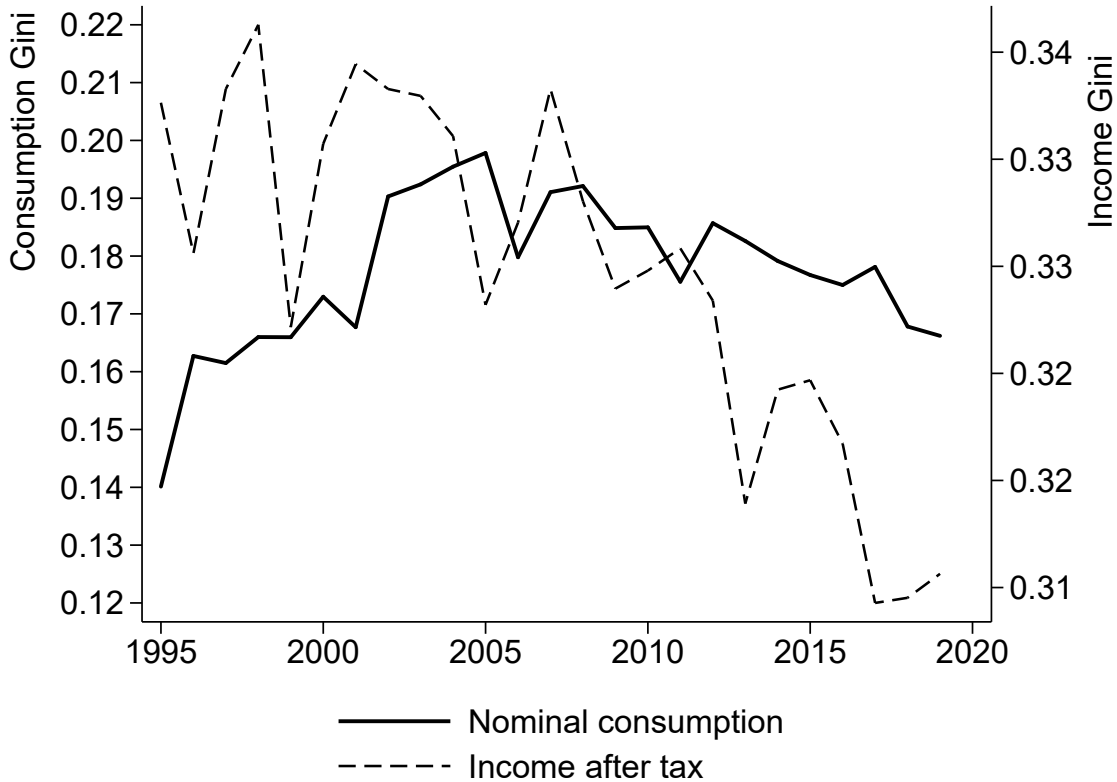
Inequality statistics

Consumption did not mirror income inequality (US)



- Consumption inequality lower than income inequality
- Over the long period we study, cyclical variations of consumption inequality around a rather stable trend
- Income inequality has increased from the late 80's to the begining of the 2010's before recently receding

Consumption did not mirror income inequality (FR)



- Consumption inequality lower than income inequality
- As in Chevalier (2018), C&I inequality did not track each other, especially so during GFC when they went in opposite directions
- Overall both on decreasing trends even if consumption inequality increased in the earliest part of the sample (and income did not)

Higher inequality in the US

Table 1 : France

Year	Income		Consumption	
	Gini	Q5/Q1	Gini	Q5/Q1
1995	0.217	3.14	0.14	2.1
2001	0.25	3.80	0.17	2.39
2017	0.225	3.42	0.178	2.58

Table 2 : United States

Year	Income		Consumption	
	Gini	Q5/Q1	Gini	Q5/Q1
1995	0.409	12.88	0.241	3.64
2017	0.404	12.53	0.249	3.77

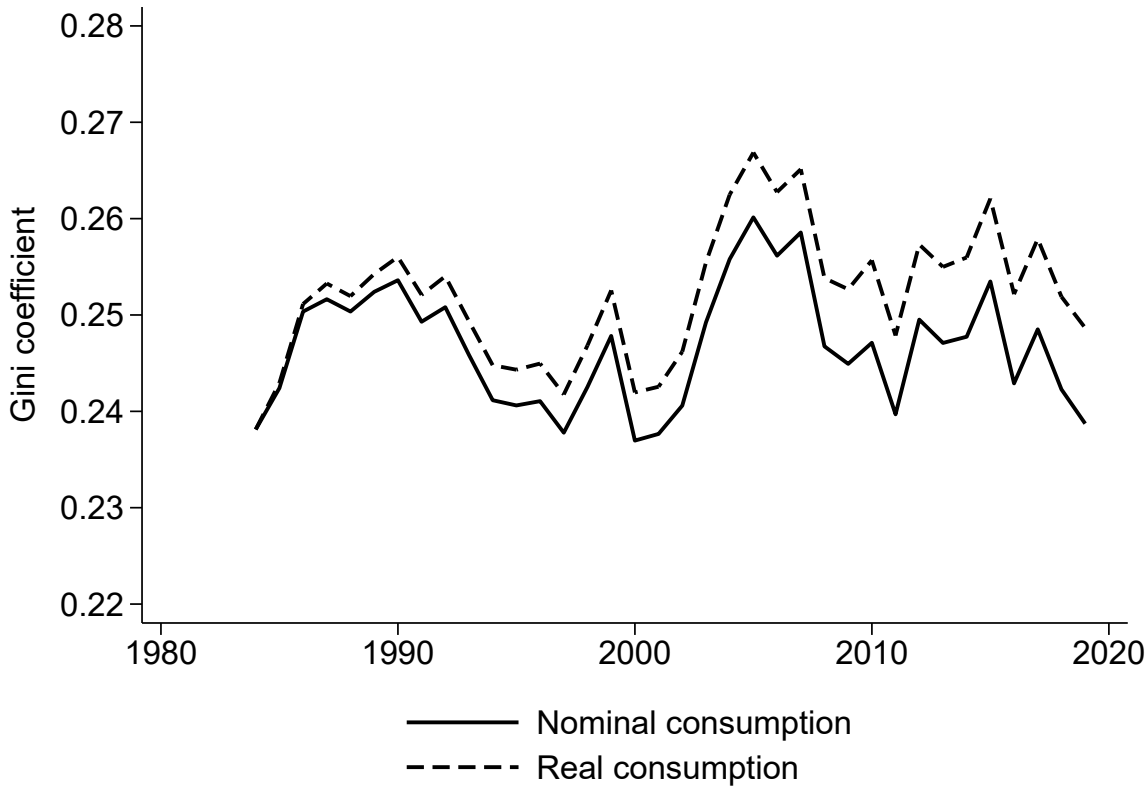
- Results hold regardless of the measure of income we use for France (WID vs BdF)
- Difference of the **ratio Q5/Q1 for consumption is 1.5 times bigger in the US** compared to FR, and **3.6 for income**

Deflator across income quintiles (United States)

- No striking difference, unless we go into higher level of disaggregation Disaggregation

Deflator across income quintiles (France)

Real consumption inequality (United States)



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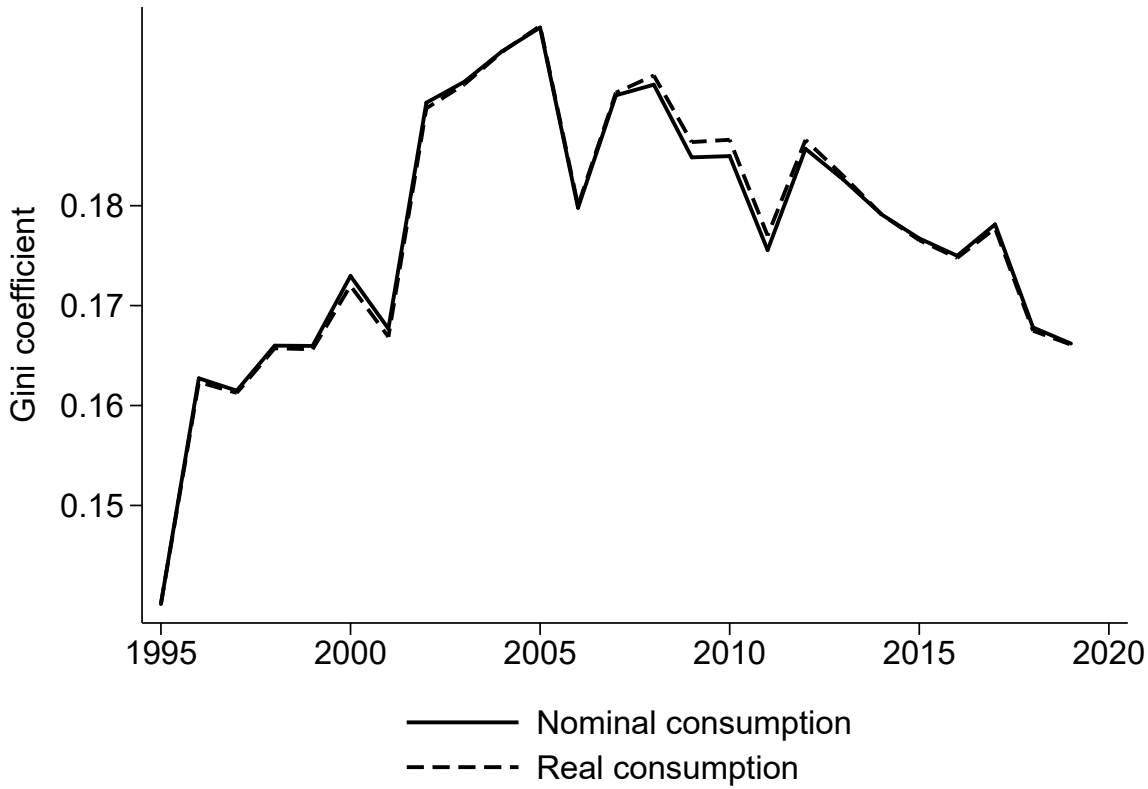
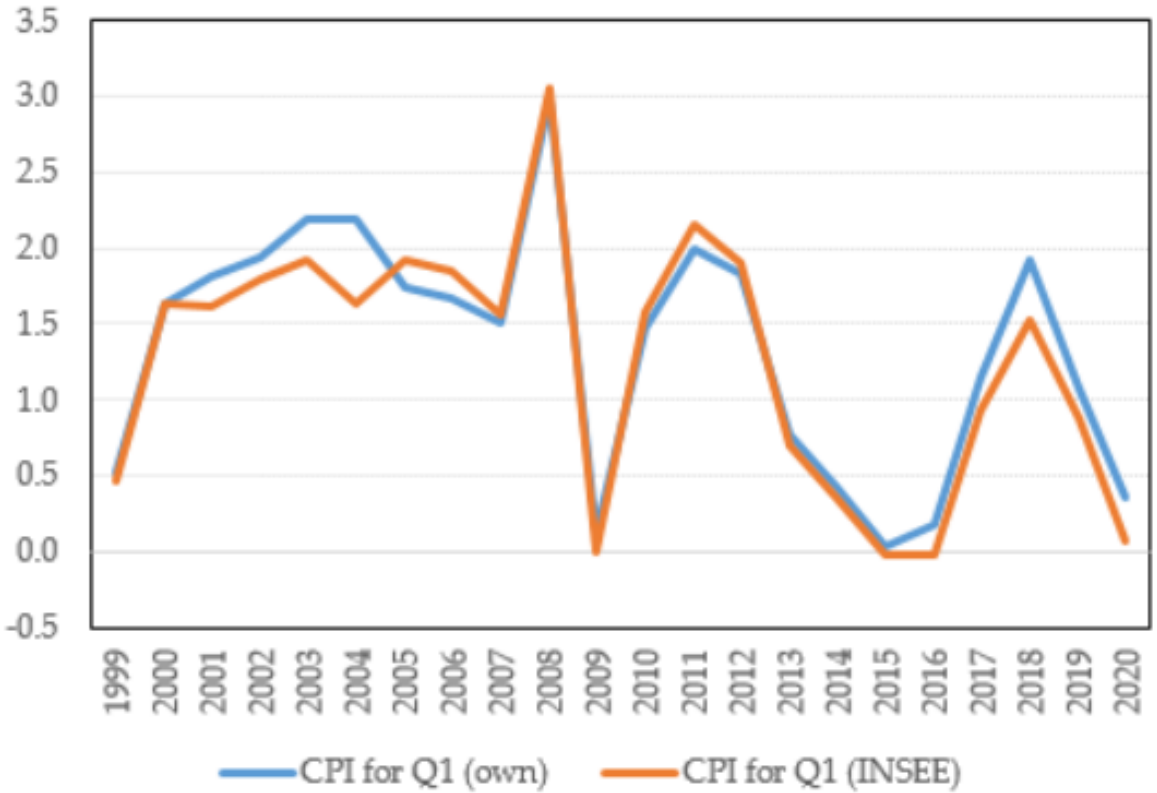


Building price indices (FR)



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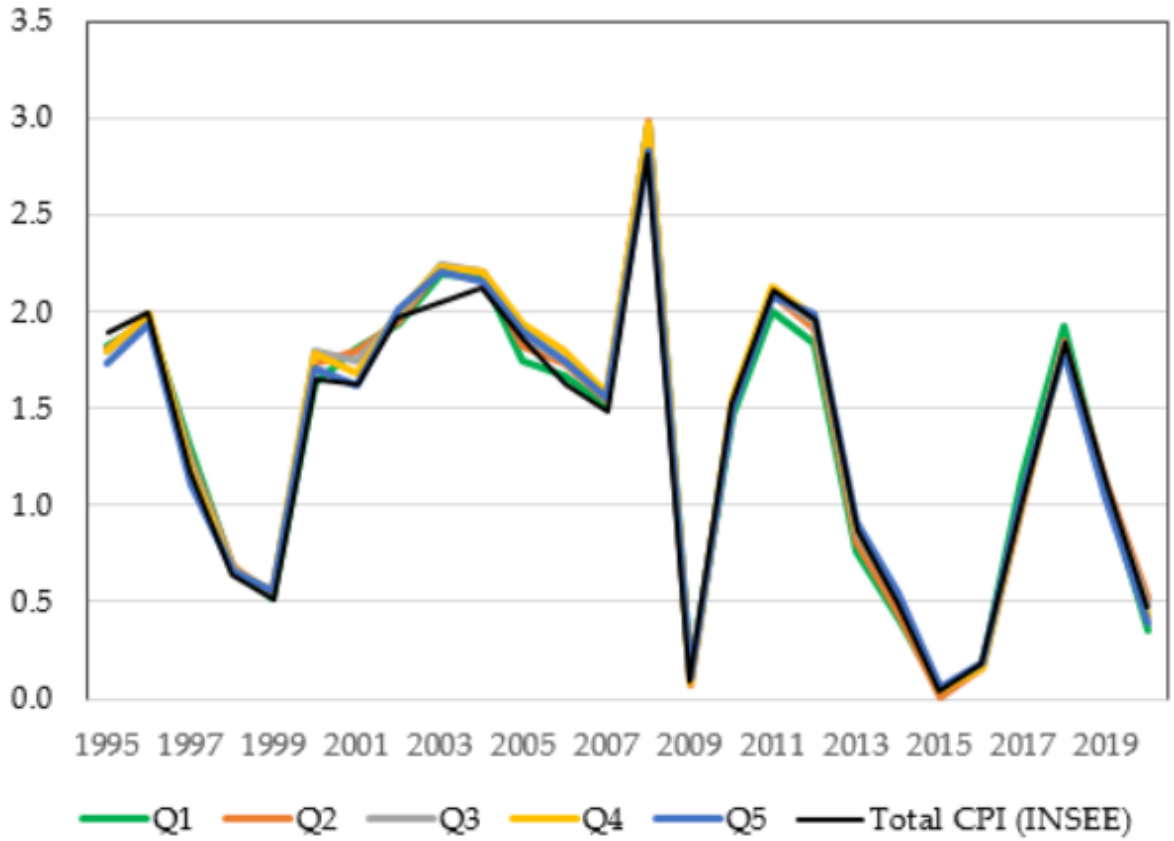


IPC computation

Concluding remarks

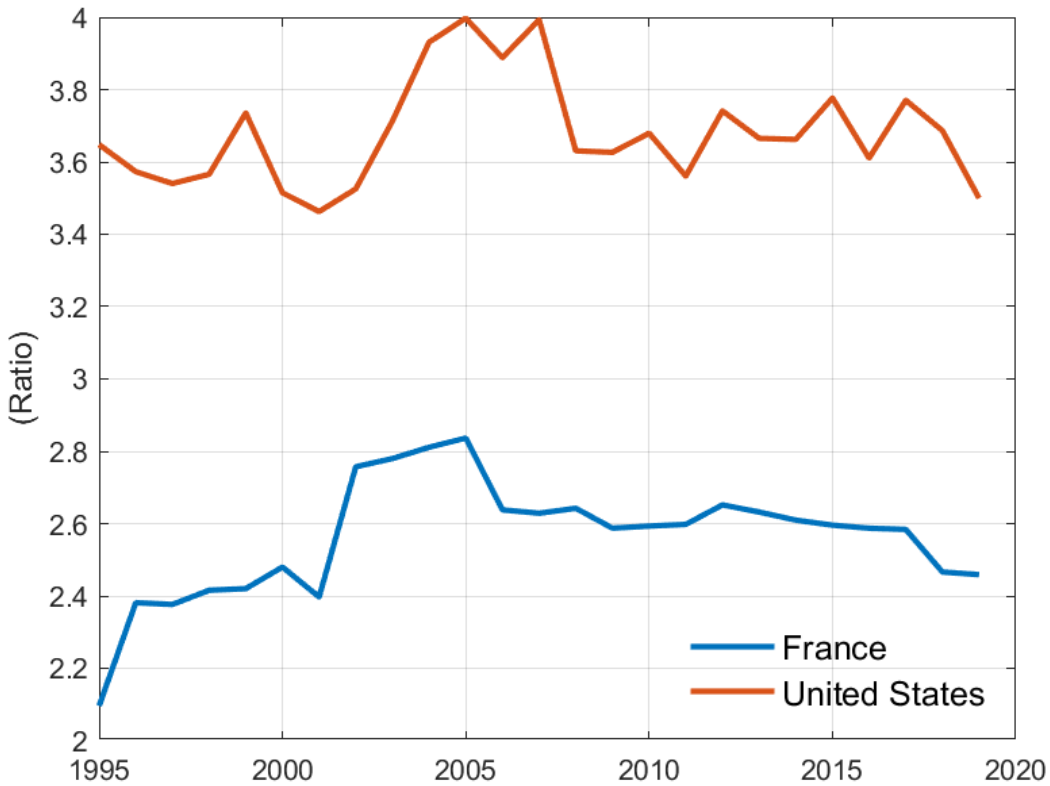
- Addressed shortcomings of infrequent micro data on consumption
- Analysing inequality through consumption provides a different perspective than through income
- **Consumption inequality** is much **lower than income inequality**
- **Consumption inequality did not mirror income inequality**
  - US: rise in income inequality over past decades but consumption inequality rather stable
  - FR: decrease of income inequality over the long run, whereas consumption inequality has only started to decrease during the last decade
- Both inequalities are **higher in the US** than in France
- **No difference in inflation experiences** across income quintiles

Next steps

- Data
  - Higher level of disaggregation (around 60 functions) for France
  - Extend time series
  - Bring in wealth to study how fluctuations in income and wealth transmit to consumption
- Analysis of the impact of monetary policy
- Rationalize data with a model

Thank you!

Dynamics in the US vs France



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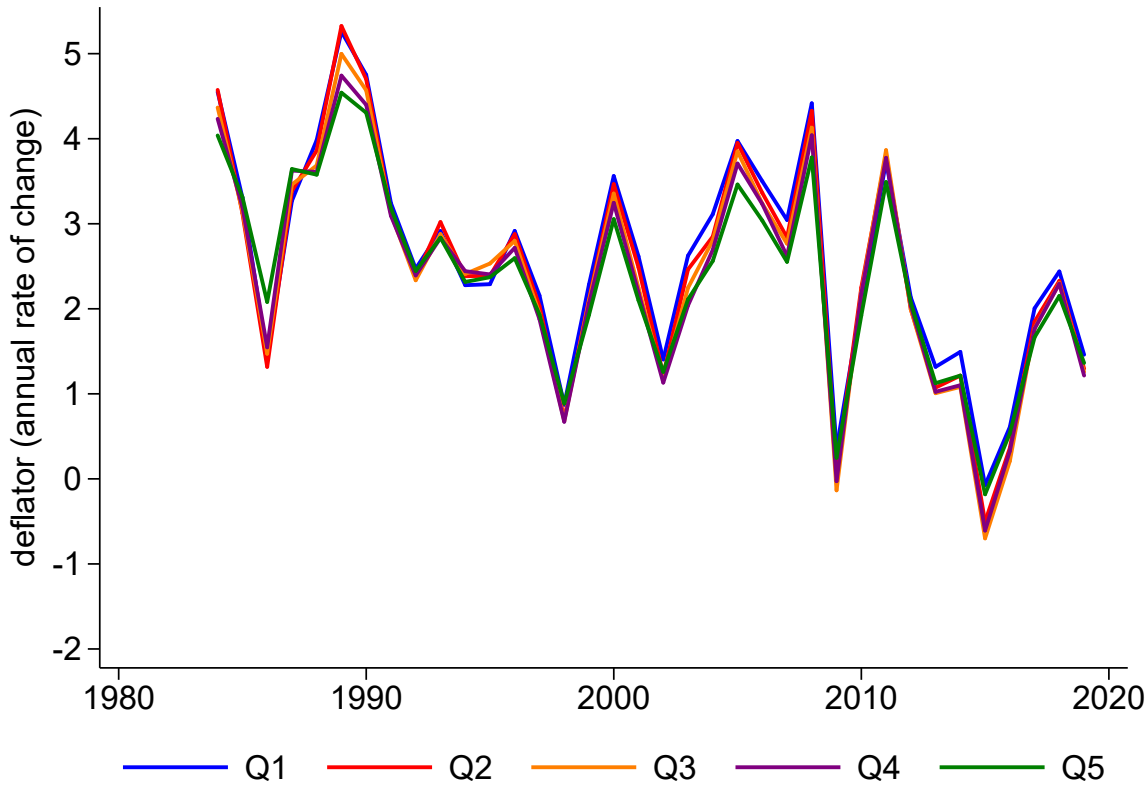
Deflator across income quintiles (United States)



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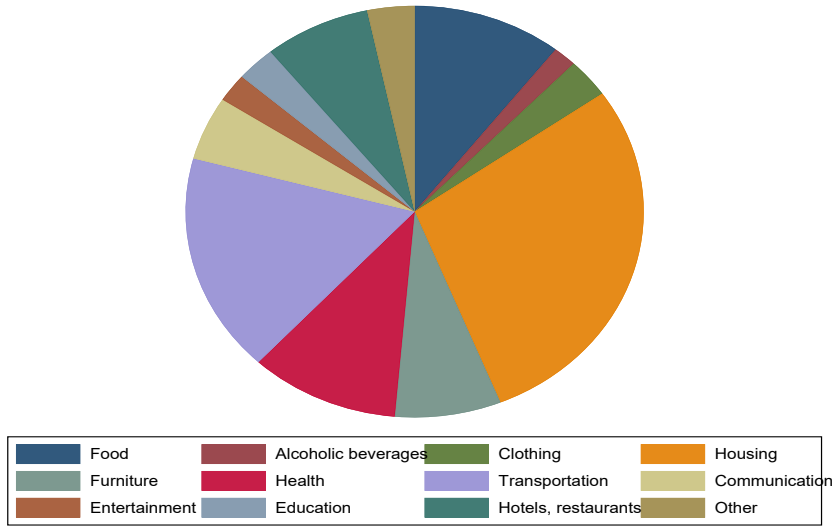
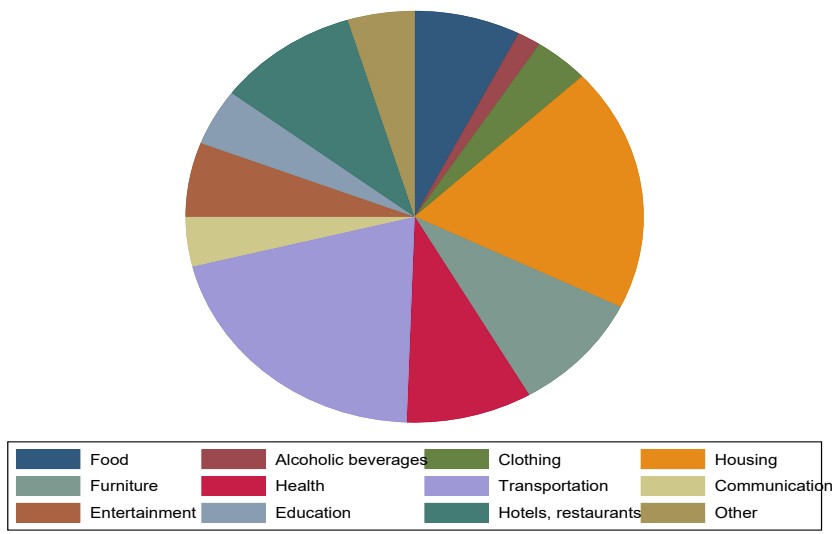
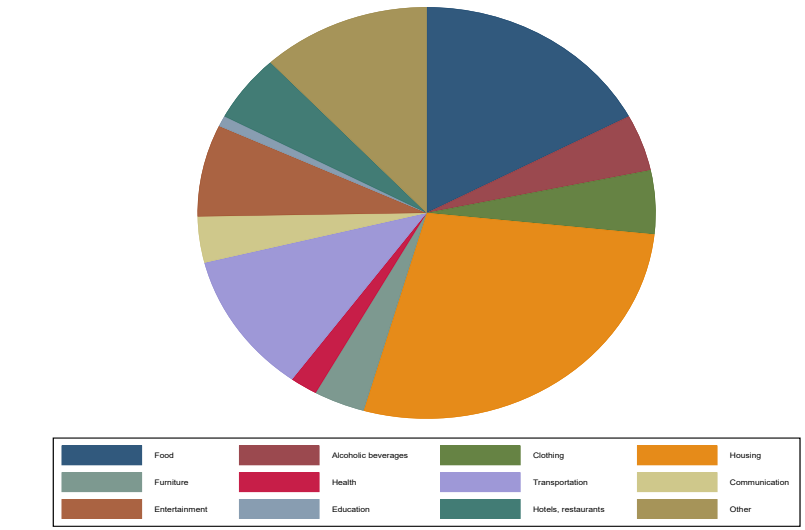
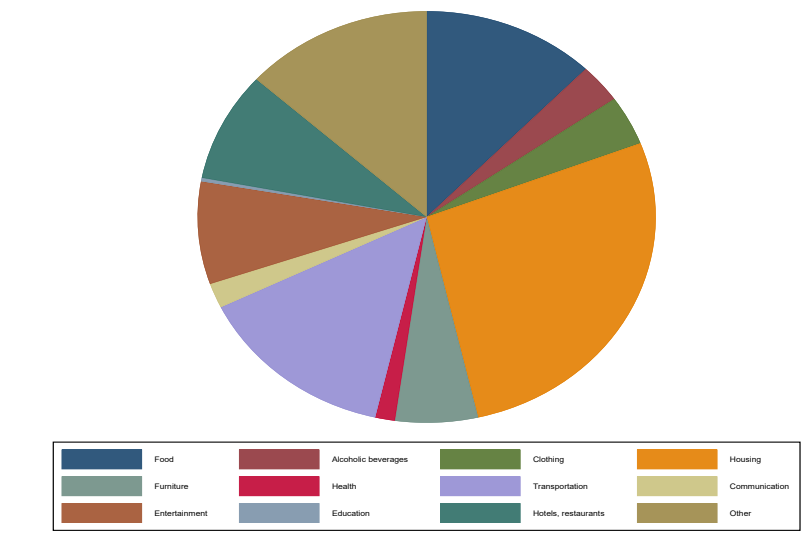
Consumption structure Q1 vs Q5 (US)





Consumption structure Q1 vs Q5 (FR)





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Price index measure

- Computation of the IPC (INSEE)

$$IPC = \sum_{i=1}^{12} \rho_i pond_i IPC_i$$

where $pond_i$ are CPI weights, and ρ_i is ratio of Q1 share of i's consumption in Q1 total consumption, over share of all households

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