Estimating Unequal Gains across U.S. Consumers with Supplier Trade Data

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- How has the cost of living in the United States been affected by changes in import prices over the past 20 years?

- How have these import price changes affected different income groups in the United States?

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- How have these import price changes affected different income groups in the United States?
  - Matters for debate over effects of globalization on U.S. consumers/workers
  - Implications for evolution of real income inequality

- Important for policymakers to understand which economic channels drive import price changes:
  - Marginal cost changes
  - Markup adjustment
  - Product quality changes
  - Expansion (or contraction) in the set of available varieties

This Paper

- On the theory side, we develop a new framework based on non-homothetic preferences known as the S-branch utility tree:
  - Each of the four channels are flexibly allowed to contribute to changes in the price index
  - The model captures non-homotheticity both **across** and **within** sectors, while retaining exact linear aggregation (Gorman polar form) over consumers, even with variety entry and exit
  - Our framework nests the standard, homothetic, CES monopolistic competition model as special case

This Paper

- On the estimation side, we extend the GMM estimator of Feenstra (1994) to our framework, relying on the relationship between income elasticities and price elasticities to compute variety-specific demand parameters.

- On the data side, we apply our approach to 2 sets of U.S. data from 1998-2014
  - Use foreign supplier-product level prices and sales covering the universe of U.S. goods imports to define a variety.
  - Use expenditure shares by income decile to calculate income group specific import price indices.

Household Preferences (S-branch utility tree)

- Household h has standard CES preferences over sectors s:

$$V_{ht} = [\sum_{s \in S} \varphi_{hst}^{\frac{\sigma-1}{\sigma}} Q_{hst}^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{1}$$

- Consumption in sector s is:

$$Q_{hst} = [\sum_{v \in G_s} \varphi_{vt}^{\frac{\sigma^s-1}{\sigma^s}} (q_{hvt} - \alpha_v)^{\frac{\sigma^s-1}{\sigma^s}}]^{\frac{\sigma^s}{\sigma^s-1}} \tag{2}$$

  where supplier-product varieties are indexed by v.

- These are **Generalized CES** preferences over varieties (α_v can be positive, zero, or negative).

Household Import Price Indices

- Using the expenditure function for these preferences, we can write the import price index as:

$$\frac{P_{ht+i}}{P_{ht}} = \frac{\left[\sum_{s\in S} \varphi_{hst+i}{}^{\sigma-1} P_{st+i}{}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}}{\left[\sum_{s\in S} \varphi_{hst}{}^{\sigma-1} P_{st}{}^{1-\sigma}\right]^{\frac{1}{1-\sigma}}} \left(\frac{Y_{hk} - \sum_{s\in S}\sum_{v\in G_s} \alpha_v p_{vt}}{Y_{hk}}\right) + \left(\frac{\sum_{s\in S}\sum_{v\in G_s} \alpha_v p_{vt+i}}{Y_{hk}}\right)$$

- Thus, households of different incomes will experience different import price inflation rates if either $\exists(\alpha_v \neq 0)$ or the φ_{hst} differ with income

Producer Behavior

- Next consider each monopolistically competitive producer.
- The price elasticity of demand for a particular producer is:

$$\varepsilon_{vt} \equiv -\frac{\partial q_{vt}}{\partial p_{vt}} \frac{p_{vt}}{q_{vt}} = \left(\frac{q_{vt} - \alpha_v n_t}{q_{vt}} \right) (\sigma^s) \tag{3}$$

- Producers set prices as a markup over marginal cost:

$$p_{vt} = \frac{\varepsilon_{vt}}{\varepsilon_{vt} - 1} \cdot \underbrace{\delta_{vt} \left(1 + \omega_s\right) q_{vt}^{\omega_s}}_{MC_{vt}} \tag{4}$$

Estimation

- We can estimate the parameters of this model in two stages
  - No need for assumptions about the distribution of firm productivity or a full general equilibrium framework.

- First, we estimate the parameters of the variety demand functions at the aggregate market level by extending the GMM estimator of Feenstra (1994) and applying it to supplier data.

- Second, we estimate the parameters of the sectoral demand functions at the household level using additional data from the BLS Consumer Expenditure Survey and an instrumental variables strategy.

Data (1): Longitudinal Firm Trade Transactions Database

- U.S. import data at the supplier level, studied and cleaned in Kamal and Monarch (2016)
- Around 1000 HS4 sectors (over 95 percent of U.S. goods imports)
- Nearly 40 million unique suppliers (HS10-exporter pairs) exporting to the U.S. from 1998-2014.
- Each transaction contains
  (a) Unique exporter identifier (known as **Manuf. ID**).
  (b) Value and quantity (and thus "unit value")
  (c) HS 10 industry code.

- Example:

QUAN KAO COMPANY
1234 BEIJING LANE
BEIJING, CHINA 100044

CNQUAKAO1234BEI

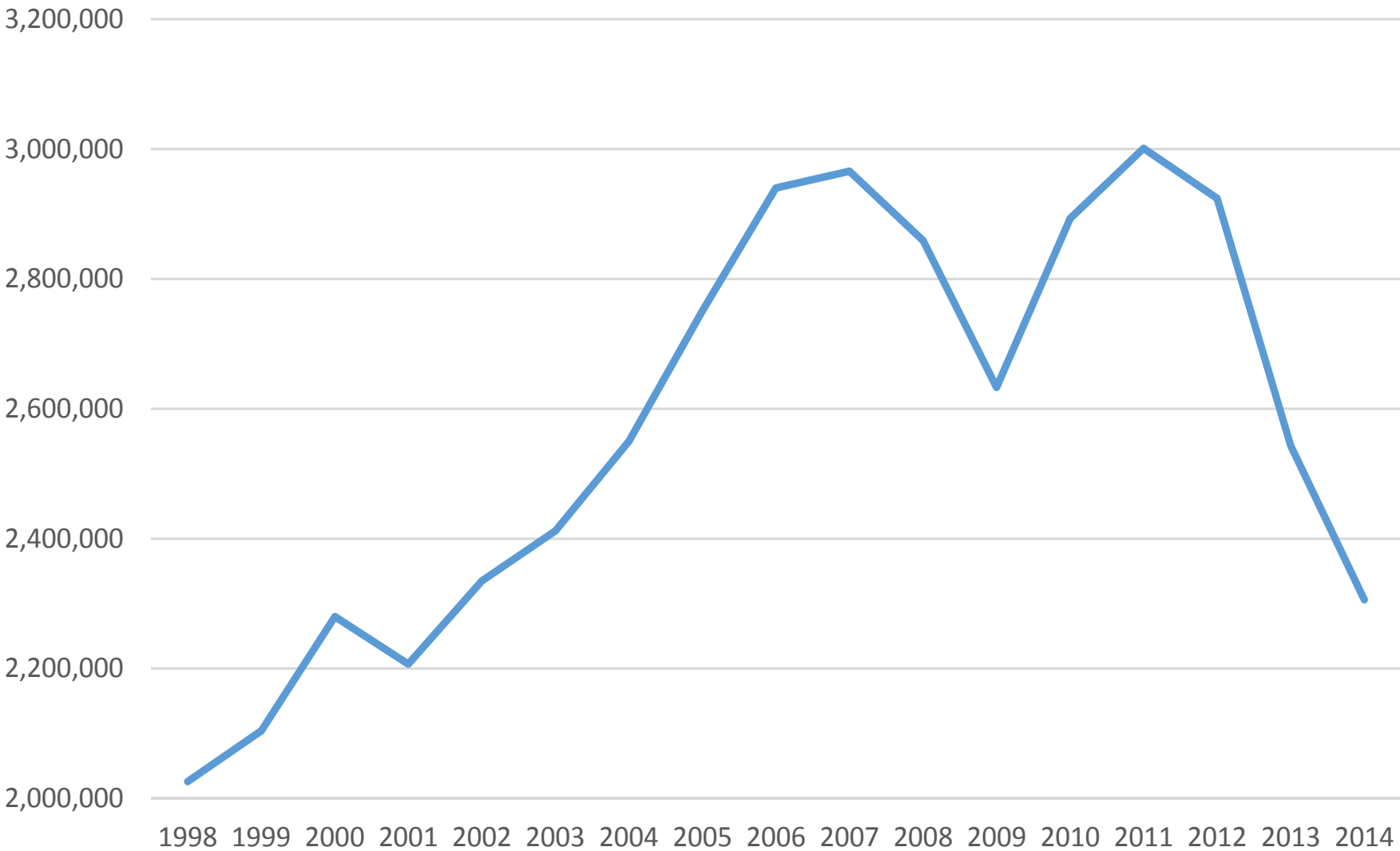
Data (2): Consumer Expenditure Survey

- To get sector expenditure by income decile (Y_{hst}):
  1. Use the Consumer Expenditure Survey and Census income data to obtain product-expenditure in every year for every decile.
  2. Concord the CE categories to HS4 codes (Furman, Russ, and Shambaugh 2017).
  3. Apply the import share in domestic absorption to create decile-specific imported expenditure in each HS4 category.

- This leaves us with 228 HS4 sectors (about 55 percent of U.S. goods imports).

Results

Figure: Number of Imported Varieties



$$\alpha_v = (\mathbb{1}^C \beta_s^C + \mathbb{1}^S \beta_s^E) \cdot \min_t (q_{vt})$$

Table: Summary of σ^s

10%	Median	90%
3.06	4.93	8.59

Table: Summary of β_s^C (Continuers)

10%	Median	90%
9.96 $\times$ E-5	0.33	0.39

Table: Estimates of σ

IV estimate	95% C.I.
2.78	(2.60 - 2.97)

Table: Summary of β_s^E (Non-Continuers)

10%	Median	90%
-5.97 $\times$ E-5	-2.55 $\times$ E-9	-1.08 $\times$ E-10

Estimated Markups

Table: Markup Variation across HS4 Sectors ($\frac{\varepsilon_{vt}}{\varepsilon_{vt}-1}$)

	10.00%	Median	90.00%
Average	1.132	1.250	1.482

Table: Median Markup Over Time (Sales-Weighted)

Year	1998	2002	2006	2010	2014
Markup	1.235	1.226	1.215	1.215	1.215
Markup- Continuers	1.234	1.174	1.134	1.130	1.132

- Markups fell between 1998-2006, but have been flat since.

Figure: Aggregate Import Price Index: 1998-2014

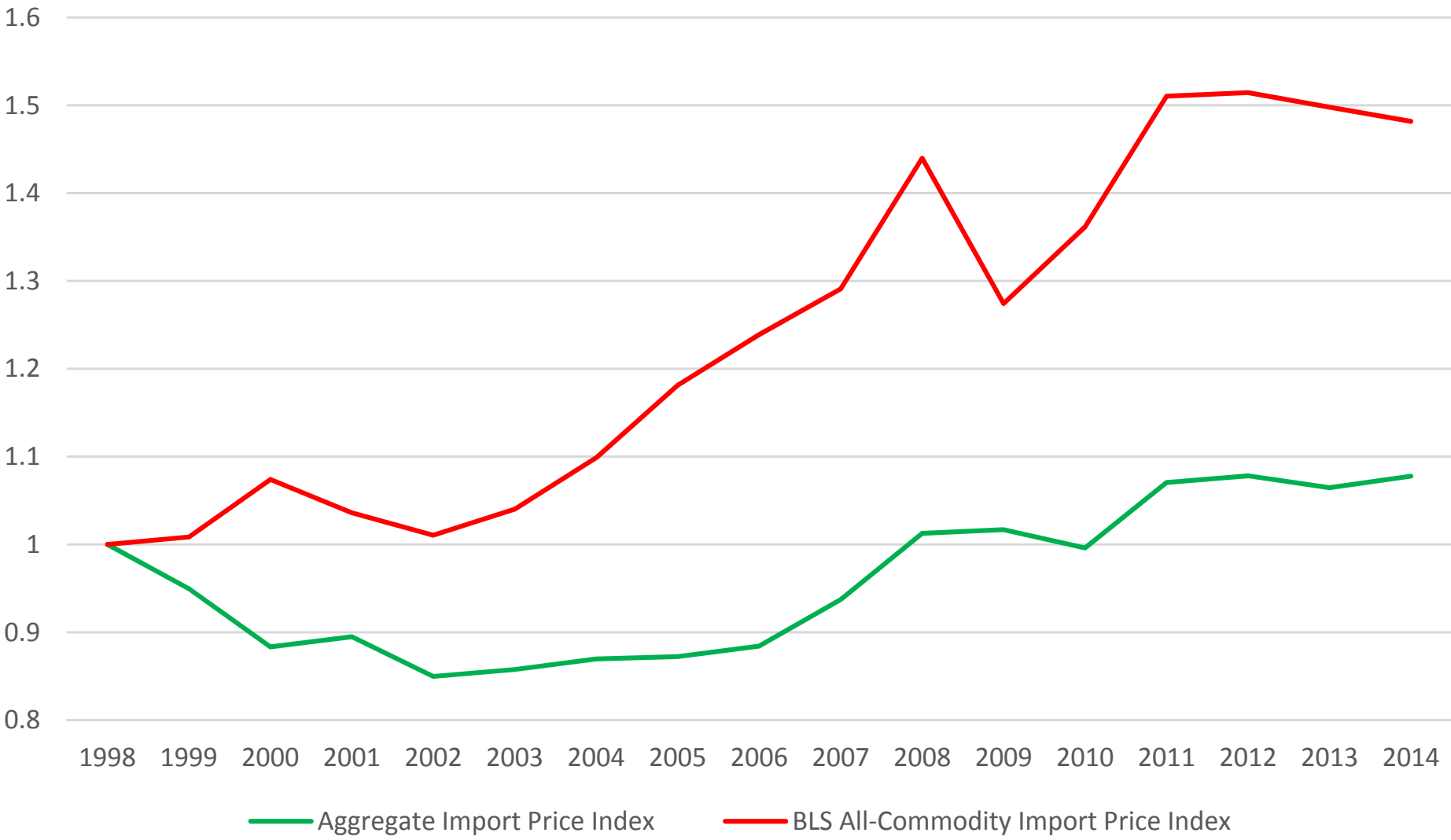


Figure: Income-Group Specific Import Price Indexes

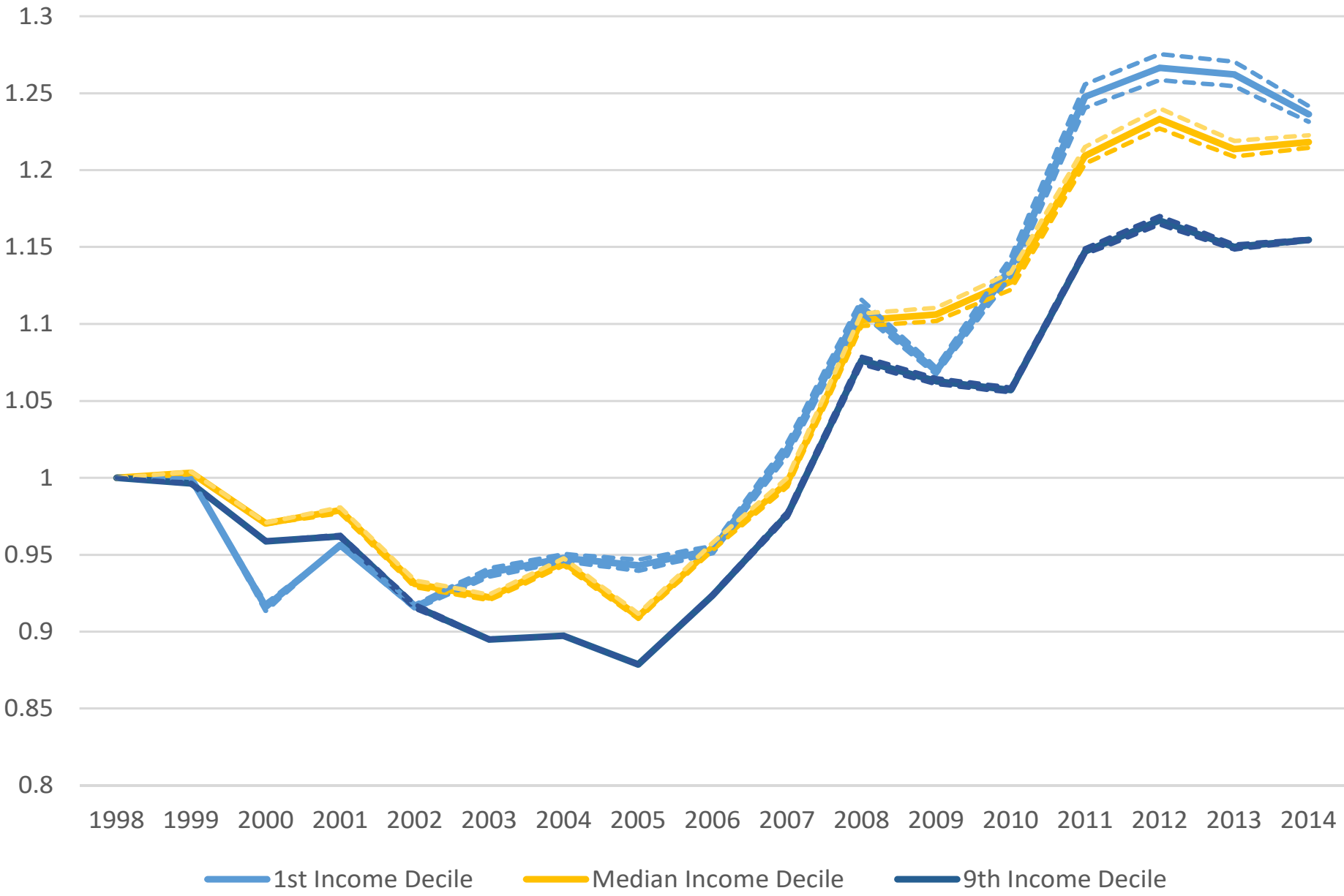
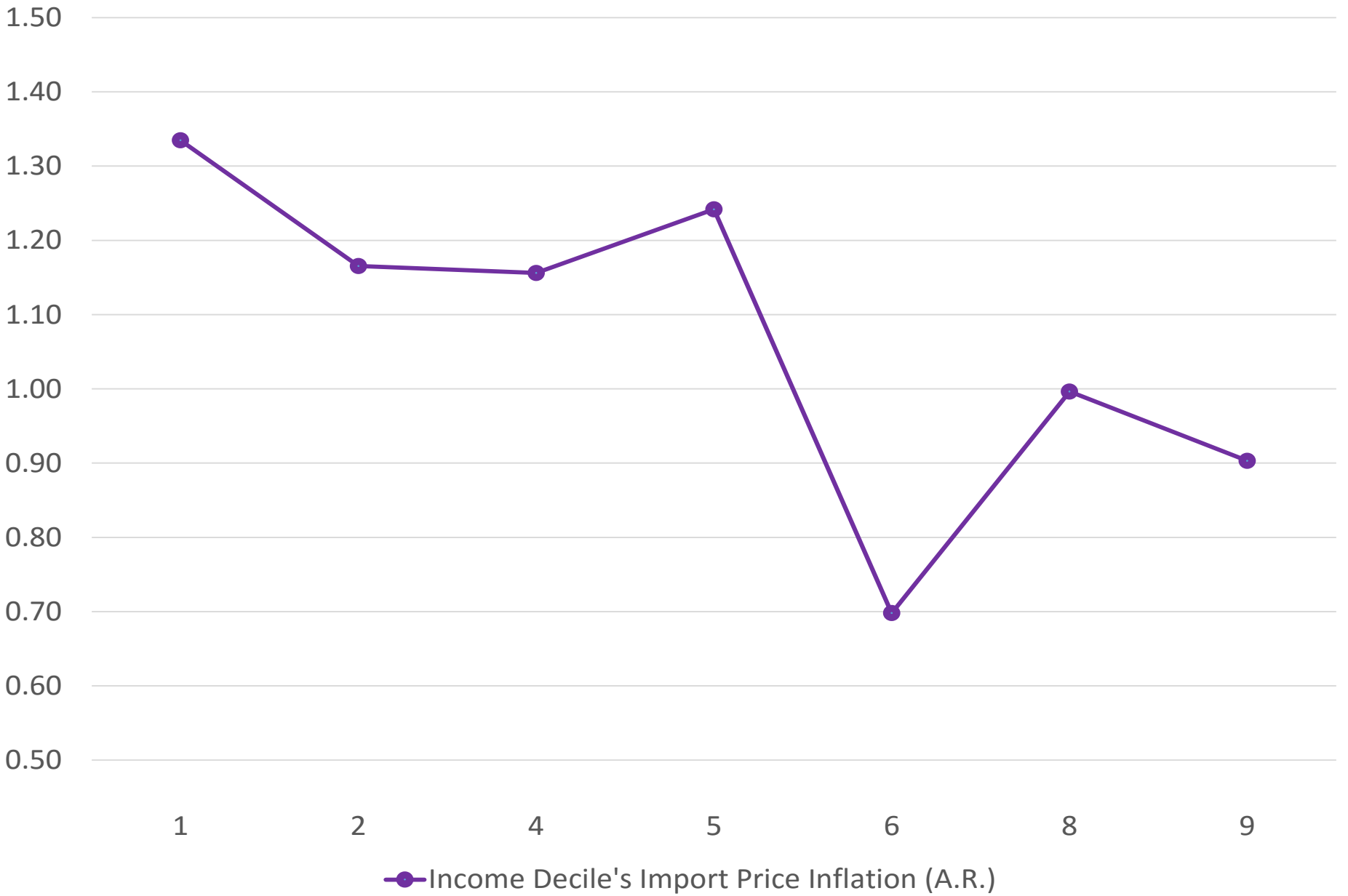


Figure: Average Annual Import Price Inflation by Decile: 1998-2014



Conclusion

- We develop a non-homothetic framework and estimate it using consumer expenditure and customs-level trade data. Our results:
  - A U-shaped pattern for aggregate U.S. import prices from 1998-2014
  - This patterns corresponds with significant growth, and then eventual reversal in the number of imported varieties
  - Foreign-supplier markups fell in the first half of the time period, and then remain about flat
  - Highest income households experienced the least import price inflation
- No evidence that the consumption channel has mitigated the distributional impacts of trade over the last two decades