Service Trade, Regional Specialization and Welfare

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RBNZ, UQ and IMF, UQ

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- **Question**: How does **service trade** look like in the recent years? What's its role in shaping regional specialization and welfare?

What We Do?

- Exploit unique **Canadian** dataset (*"Inter-Regional Trade Flows"*, Stat Canada)
  - Include both **inter-provincial (domestic)** and **international service trade flows**
  - Ex. How much does Ontario export entertainment services (such as Netflix) to Northwest Territories?

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2. Calibrate the *off-the-shelf* multi-sector and multi-region model with domestic and international trade
   - Estimate HH's non-homothetic preferences for goods and services

3. Run counter-factual exercises to quantify the role of service trade in shaping **specialization** and **welfare** across Canadian provinces

What We Find?

- Empirics:

    1. Service trade, both domestic and international, is large, comparable to goods trade

    2. Substantial provincial heterogeneity in terms of production and net export of services

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  2. International service trade

     - Generate uniform losses to provinces: Most of provinces are net exporter of services

   - Again, the service sector shrinks

Contribution to the Literature

We make contributions to the following strands of literature

- To the literature that studies the welfare implications of domestic and international trade (e.g. Waugh, 2010; Di Giovanni, Levchenko and Zhang, 2014; Lewis, Monarch, Sposi and Zhang, 2022);

- To the literature that studies trade and industrial structure of an economy (e.g. Uy, Yi and Zhang, 2013; Swiecki, 2017; Cravino and Sotelo, 2019)

- To the literature that studies the process of regional specialization in service sectors (e.g. Rossi-Hansberg, Sarte and Schwartzman, 2019, 2021; Ecket, 2019; Duernecker, Herrendorf and Valentinyi, 2023).

Data and Empirical Analysis

Domestic and International Service Trade
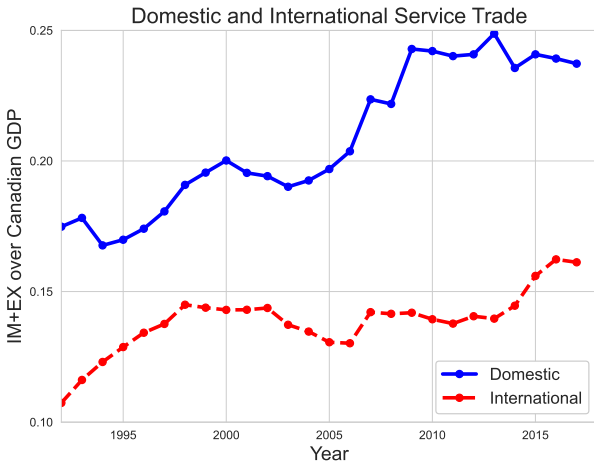
- Services, averaged over 1992–2017

  - Domestic: 0.21

  - International: 0.14

- Good, averaged over 1992–2017

  - Domestic: 0.24

  - International: 0.60

Canadian Data

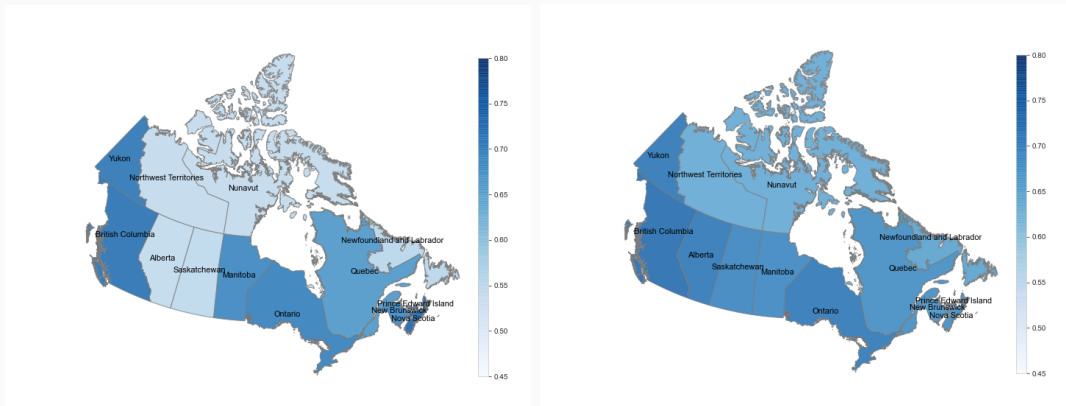# Service Categories by Tradability (EX+IM/Output) in 2017

Sector	Industry	(1) Total	(2) Domestic	(3) International
High-tradable services (> 30%)	Transportation and warehousing	63.52%	32.64%	30.88%
	Administrative and support	60.77%	31.48%	29.29%
	Accommodation and food services	57.34%	19.49%	37.85%
	Professional and technical services	53.81%	32.59%	21.23%
	Information and cultural industries	52.60%	33.13%	19.47%
	Arts, entertainment and recreation	50.68%	19.63%	31.05%
	Wholesale and retail trade	38.10%	26.62%	11.48%
Mid-tradable services (10% - 30%)	Finance, insurance, real estate and leasing	23.92%	16.32%	7.61%
	Other services (except public administration)	18.84%	15.16%	3.68%
Low-tradable services (< 10%)	Educational services	9.14%	2.80%	6.34%
	Health care and social assistance	2.85%	1.93%	0.92%

- Substantial heterogeneity in domestic services NEX/GDP but not in international services

- Significant regional heterogeneity in service production (VA share) but not in consumption (CEX share)

Correlation of Service Trade

| | (1) | (2) | (3) | (4) | (5) |
	VA share	Cons. share	$\frac{\text{NEX}}{\text{Regional GDP}}$	$\frac{\text{Dom. NEX}}{\text{Regional GDP}}$	$\frac{\text{Int. NEX}}{\text{Regional GDP}}$
Mean value	0.66	0.69	-0.06	-0.09	0.03
Standard dev.	0.08	0.03	0.08	0.08	0.02
Corr. with VA share	-	0.43	**0.33**	0.26	0.39
Corr. with high-trad. VA share	0.79	0.66	0.71	0.65	0.35
Corr. with mid-trad. VA share	0.95	0.52	0.35	0.28	0.33
Corr. with low-trad. VA share	0.58	-0.32	-0.43	-0.48	0.22

- For services, **NEX/GDP** and **VA share** are positively correlated

- Suggest that service trade contributes to regional **structural transformation**

Empirics: Key Takeaways

1. Service trade is large:

   - Domestic service trade $\approx$ domestic good trade

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We calibrate our model to match **these data features** and run counterfactuals

Model and Calibration

Model Environment

We extend Uy, Yi, and Zhang (2013) and incorporate domestic and international trade of both goods and services

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- **12 Regions**:
  - 11 Canadian provinces, and ROW ($\approx 90\%$ of int. trade)
  - A representative household with **non-homothetic CES preference** (Comin et al.2021)

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- **4 Sectors**: goods, high-tradable, mid-tradable, and low-tradable services:
  - A continuum of firms in each sector
  - Different iceberg costs in shipping goods and 3 types of services both domestically and internationally

Model: Production Technology

We follow Eaton and Kortum (2002)

- In each region i sector $k \in \{g, hs, ms, ls\}$, there is a continuum of goods' producers $z \in [0,1]$ whose production technology is given by

$$Y_{i,t}^k(z) = Z_{i,t}^k(z) \left[T_{i,t}^k L_{i,t}^k(z) \right]^{\lambda_{i,k}} \left[\prod_{n=g,hs,ms,ls} \left(M_{i,t}^{k,n}(z) \right)^{\gamma_{i,k,n}} \right]^{1-\lambda_{i,k}},$$

- $T_{i,t}^k$ is a region-time-sector-specific productivity
- $Z_{i,t}^k(z)$ is the realization of random efficiency drawn from a Fréchet distribution.:

$$F_{i,t}^k(Z) = e^{-Z^{-\theta}}, \text{where } \theta > 1$$

Firms operate in competitive markets and source inputs from cheapest supplier (given productivities and iceberg cost of trading goods and services)

Household: Non-Homothetic CES Preferences

We follow Comin et al. (2021). Take FOC and write expenditure ratio in a nested form. For each sector $k \in \{g, hs, ls\}$, we have

$$\frac{P_{it}^{ms} C_{it}^{ms}}{P_{it}^k C_{it}^k} = \frac{\omega_{ms}}{\omega_k} \left(\frac{P_{it}^{ms}}{P_{it}^k}\right)^{1-\sigma} \left(\frac{C_{it}}{L_{it}}\right)^{\epsilon_{ms} - \epsilon_k}, \tag{1}$$

ϵ_k is the income elasticity of sector k; σ is the price elasticity of substitution   HH maximization

The literature found

- Goods are necessities and services are luxuries: $\epsilon_s - \epsilon_g > 0$

- Goods and services are complements: $0 < \sigma < 1$

What if we have high-, mid-, and low-tradable services?

Calibration

1. **Firms**
   - Productivities across sectors and regions are calibrated using regional sectoral VA prices, wages data, and domestic absorption ratio data
   - Production function parameters are calibrated using regional input-output tables and VA data

2. **Trade**
   - Iceberg trade costs (τ_{ijt}^k) are calibrated to match import shares in Canadian provincial data

3. **Household**
   - Non-homothetic CES preferences parameters are using the consumption expenditure and prices data
   - We let $\{\omega_g, \omega_{ls}, \omega_{ms}, \omega_{hs}\}$ differ across regions

Estimated Preference Parameters

Preference parameters		Estimates	C.I.
ω_g	Relative weight for goods	0.34 (mean)	-
ω_{ls}	Relative weight for low-tradable services	0.05 (mean)	-
ω_{ms}	Relative weight for mid-tradable services	0.29 (mean)	-
ω_{hs}	Relative weight for high-tradable services	0.32 (mean)	-
ϵ_g	Income elasticity on Goods	0.47	[0.39,0.54]
ϵ_{ls}	Income elasticity on low-tradable services	1.46	[1.38,1.53]
ϵ_{ms}	Income elasticity on mid-tradable services	1.00	-
ϵ_{hs}	Income elasticity on high-tradable services	1.10	[1.05,1.15]
σ	Price elasticity across sectors	0.69	[0.58,0.76]

- Consistent with the literature: Goods and services are complements $(0 < \sigma < 1)$

- New findings: Low-tradable services are luxuries $(\epsilon_{ls} - \epsilon_k > 0$ for $k \in \{hs, ms\})$
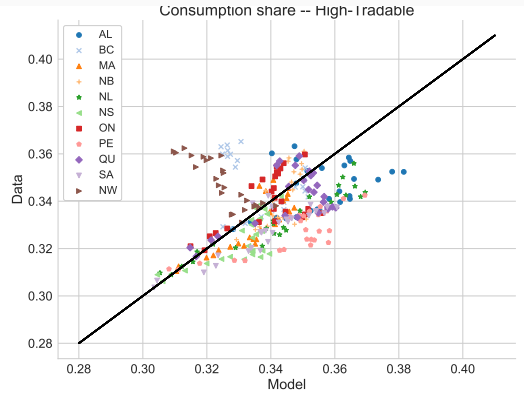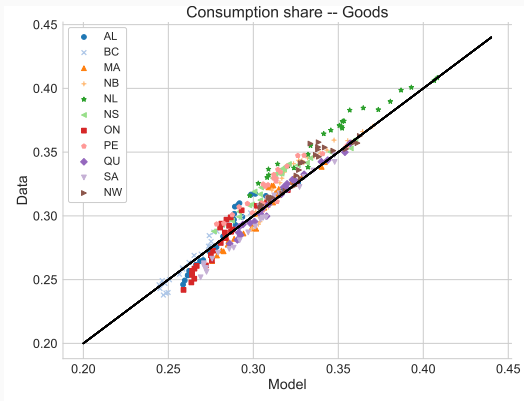
Counter-Factual Exercises
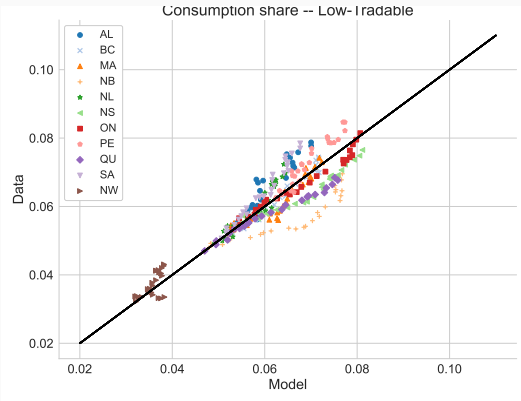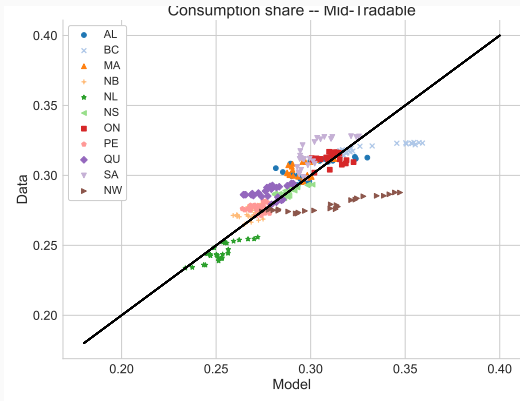
Counter-Factual Strategies

- We conduct two exercises under general equilibrium:

  1. No domestic service trade economy

  2. No international service trade economy

- We quantify the role of service trade in regional specialization and welfare

  - Examine changes in **sectoral VA shares**

  - **Real wages** (alternative: EV method by Comin (2021))
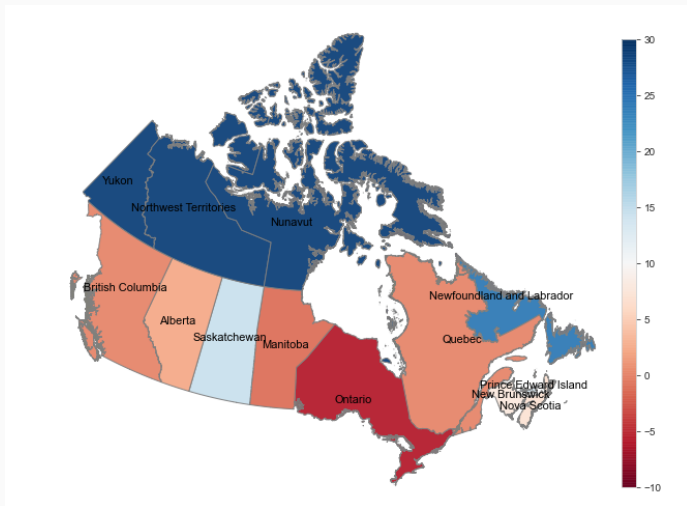
- Change in VA share varies significantly across provinces

Decomposing Domestic Service Trade

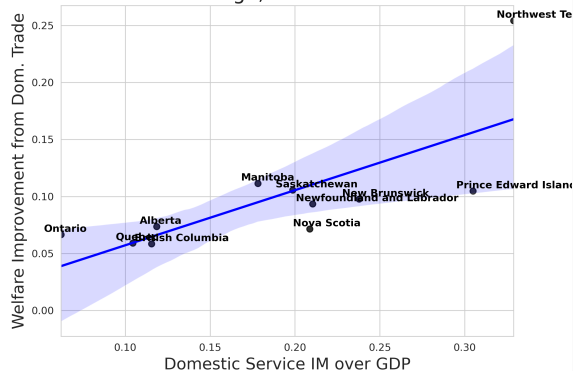| Average change (%) over 1992-2017	No Domestic Services Trade						
	C (1)	P_{hs}/P_{ms} (2)	P_{hs}/P_{ls} (3)	P_{hs}/P_g (4)	PC_S/PC (5)	NX_S/VA (6)	VA_S/VA (7)
Canadian Provinces							
Alberta	-6.6	2.2	5.9	5.9	-0.8	2.0	2.0
British Columbia	-5.4	2.6	4.9	4.7	-0.7	0.7	0.2
Northwest Territories & Nunavut	-26.8	21.4	28.8	33.6	-4.4	14.9	15.2
Manitoba	-9.9	4.6	9.1	8.1	-1.5	-0.2	-0.7
New Brunswick	-9.3	6.1	11.0	13.5	-1.0	6.7	5.3
Newfoundland and Labrador	-9.8	7.8	13.9	16.8	-1.0	11.2	14.5
Nova Scotia	-7.5	6.5	9.9	11.8	-0.8	5.8	4.1
Ontario	-5.3	2.2	3.3	1.1	-1.0	-4.3	-4.3
Prince Edward Island	-10.6	9.9	14.6	18.5	-1.1	9.6	7.8
Quebec	-5.5	2.0	4.7	4.5	-0.8	0.6	0.2
Saskatchewan	-10.7	6.1	12.2	14.0	-1.2	8.1	9.9

Table 1: Income effect ↓ (column 1), Price effect ↑ (column 2, 3, 4)
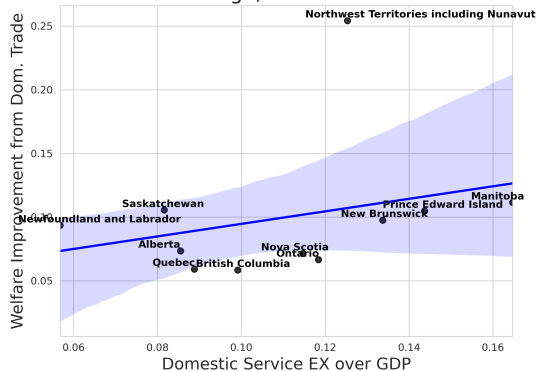
Welfare Gains (No Service Trade → w/ Service Trade)

|	Domestic trade		International trade	
	Services	Goods	Services	Goods
	(1)	(2)	(3)	(4)
Alberta	0.08	0.08	0.04	0.08
British Columbia	0.06	0.05	0.05	0.10
Manitoba	0.11	0.12	0.04	0.11
New Brunswick	0.10	0.14	0.05	0.20
Newfoundland and Labrador	0.09	0.08	0.03	0.07
Northwest Territories including Nunavut	0.26	0.09	0.05	0.10
Nova Scotia	0.07	0.10	0.04	0.09
Ontario	0.07	0.06	0.05	0.21
Prince Edward Island	0.11	0.11	0.04	0.05
Quebec	0.06	0.08	0.04	0.13
Saskatchewan	0.11	0.11	0.04	0.10
Average welfare gain	0.07	0.07	0.05	0.15
S.D. of welfare gain	0.05	0.03	0.01	0.05
Change in S.D. of log real wage	-0.17	-0.04	-0.02	-0.12

Welfare Gains and Import and Export

- Follow Di Giovanni, Levchenko, and Zhang (2019)
- Positive relationship between welfare gains and IM/GDP

Results Summary: No Domestic Service Trade

The liberalization of domestic service trade will

1. Decrease regional specialization in service production

    - **Three channels**: 1. income 2. relative price and 3. net export effects

2. Decrease welfare for all provinces with national welfare $+7\%$

3. Exacerbate disparity in real wages across regions

    - Low-income province cannot import cheaper tradable services
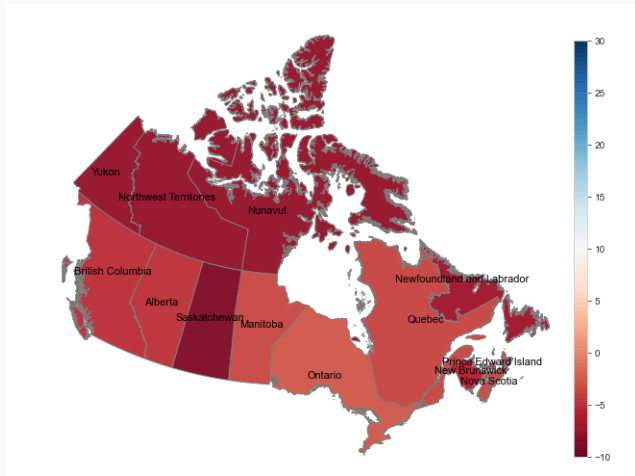
- VA share in tradable service drops uniformly
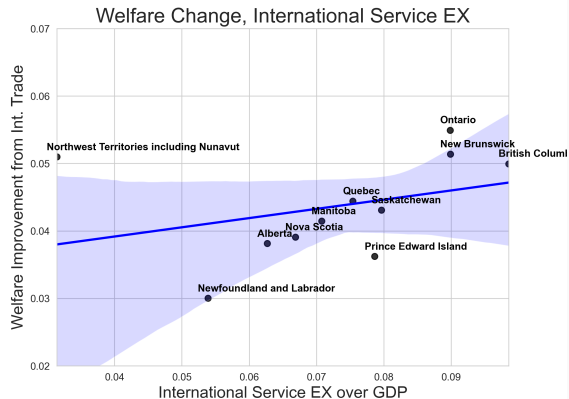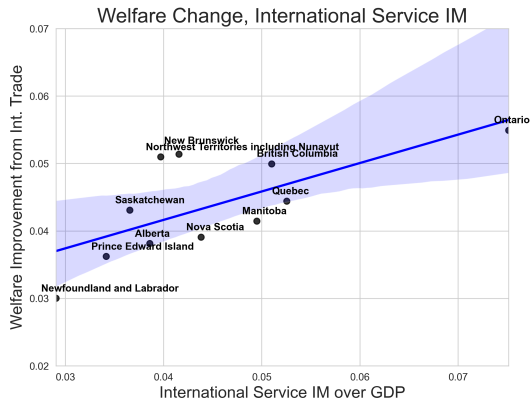
Decomposing International Service Trade

Average change (%) over 1992-2017	No International Services Trade						
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Alberta	-2.3	1.0	1.8	1.2	-0.4	-2.8	-3.2
British Columbia	-3.5	1.6	2.5	1.0	-0.6	-3.4	-3.4
Northwest Territories & Nunavut	-3.6	2.0	2.3	1.9	-0.7	-2.9	-4.2
Manitoba	-2.9	1.6	2.3	1.6	-0.5	-2.2	-2.2
New Brunswick	-3.5	1.3	2.1	0.3	-0.8	-3.7	-3.8
Newfoundland and Labrador	-1.9	0.8	1.4	0.8	-0.4	-2.9	-4.1
Nova Scotia	-2.8	1.3	1.9	0.6	-0.6	-2.0	-2.2
Ontario	-4.3	1.5	3.0	2.2	-0.7	-1.7	-1.7
Prince Edward Island	-2.4	0.8	1.6	0.4	-0.5	-3.3	-3.0
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Counterfactual: Welfare Gains (No Service Trade → w/ Service Trade)

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Welfare Gains and Import and Export

Conclusion

Trade in services significantly increases regional specialization and welfare:

- Domestic service trade promotes specialization and increase welfare by 7%

- Domestic service trade mitigates regional disparity through regional specialization

- International service trade uniformly increases tradable service share

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For future:

- More structure on service trade (Eaton and Kortum, 2018)

- Shock propagation through service trade (Caliendo et al, 2017)

Appendix

Canadian Service Trade Data

Unique trade data for services:

1. Domestic (inter-provincial) service trade

    - Collecting information from **surveys**
      (e.g. destination of sales)

    - Imputing from **regional demand and various statistics**
      (1. advertising sales and telephone communications, 2. financial services)

    - **Adjusted** to reconcile with provincial supply and demand from the IO tables

2. International service trade

    - Balance of International Payments data

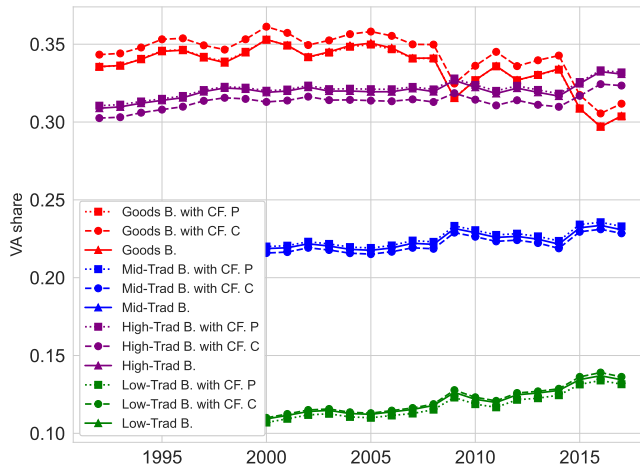Back

Non-Homothetic CES Preferences

We follow Comin et al. (2021).

- The household in region i in year t maximize the aggregate consumption, C_{it}

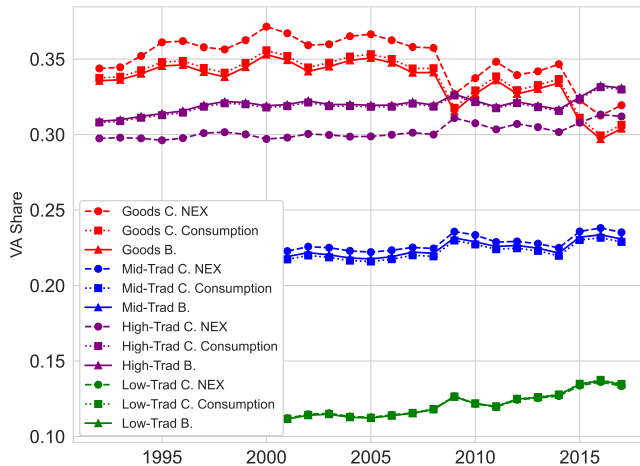- C_{it} is a composite of $(C_{it}^g, C_{it}^{hs}, C_{it}^{ms}, C_{it}^{ls})$ implicitly defined by

$$\sum_{k=g,sm,sn} \omega_k^{\frac{1}{\sigma}} \left(\frac{C_{it}^k}{L_{it}}\right)^{\frac{\sigma_k-1}{\sigma}} \left(\frac{C_{it}}{L_{it}}\right)^{\frac{\epsilon_k-\sigma}{\sigma}} = 1$$

- ϵ_k is the income elasticity of sector k

- σ is the price elasticity of substitution

Back

Model: Equilibrium

Definition

A competitive equilibrium is a sequence of goods and factor prices
$\left\{ P_{i,t}^g, P_{i,t}^{sm}, P_{i,t}^{sn}, w_{i,t} \right\}_{i \in J}$, allocations
$\left\{ L_{i,t}^g, L_{i,t}^{sm}, L_{i,t}^{sn}, Q_{i,t}^g, Q_{i,t}^{sm}, Q_{i,t}^{sn}, C_{i,t}^g, C_{i,t}^{sm}, C_{i,t}^{sn} \right\}_{i \in J}$ and trade shares
$\left\{ \pi_{i,j,t}^g, \pi_{i,j,t}^{sm} \right\}_{i,j \in J}$ such that, given prices, the allocations solve the firms'
maximization problems and the household's maximization problem and satisfy the
market clearing conditions in the labor market

$$L_{i,t} = L_{i,t}^g + L_{i,t}^{sm} + L_{i,t}^{sn},$$

and goods and services sectors $k \in g, sm, sn$

$$Q_{i,t}^k = C_{i,t}^k + \sum_{n=g,sm} (1 - \lambda^n) \gamma^{n,k} \sum_{j=1}^J \frac{\pi_{j,i,t}^n P_{j,t}^n Q_{j,t}^n}{P_{i,t}^k} + (1 - \lambda^{sn}) \gamma^{sn,k} \frac{P_{i,t}^{sn} Q_{i,t}^{sn}}{P_{i,t}^k}.$$