Product Variety, Trade Costs and the Standard of Living Across Countries

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Motivation

- Penn World Table (PWT; Feenstra, Inklaar and Timmer, 2015) computes real GDP across countries, and is therefore comparing the cost of living *between* countries
- Current trade literature has focused on the impact of *foreign trade costs* on the gains from trade (ACR 2012), comparing the cost of living in two equilibria *within* a country
- Is it possible to extend that literature to measure the cost of living *between* countries?
- Cross-country productivity literature emphasizes differences in *domestic trade costs* (wholesale & retail margins, transport costs), and there is also the potential for *product variety* differences to be large across countries due to size differences, etc.
- Goal of this paper:
  - Extend existing literature to measure the relative importance of domestic trade costs, country size, and (endogenous) product variety in determining cross-country differences in the cost of living

Literature Review

- Domestic trade costs:
  - Anderson and van Wincoop (2004), Atkin and Donaldson (2015)
- Product variety and gains from trade:
  - Feenstra (1994), Arkolakis (2010), ACR (2012)
  - Broda and Weinstein (BW, 2006), Ossa (2015), Giri, Yi, and Yilmazkudayz (2020)
- Using International Comparisons Project (ICP) data to measure trade elasticities:
  - Eaton and Kortum (2002), Simonovska and Waugh (2014a,b)
- Using ICP/bar-code data to measure cost of living across countries:
  - Neary (2004), Argente, Hsieh, Lee (2020), Cavallo, Diewert, Feenstra, Inklaar, Timmer (2018)
- Impact of variety on productivity across sectors or countries:
  - Cuñat and Zymek (2018)

Theory: set-up

- Melitz-Chaney, but obtain ACR results in a slightly different way
- CES price index is defined over *domestic* and *foreign* varieties:

$$P = \left(M_d \int_{\varphi_d}^{\infty} p_d(\varphi)^{1-\sigma} \frac{g(\varphi)\, d\varphi}{[1 - G(\varphi_d)]} + M_x^* \int_{\varphi_x^*}^{\infty} p_x^*(\varphi)^{1-\sigma} \frac{g(\varphi)\, d\varphi}{[1 - G(\varphi_x^*)]} \right)^{\frac{1}{1-\sigma}}$$

- Treat domestic goods as "common" in the two equilibria, so from Feenstra (1994) the exact price index between the two equilibria is

$$\frac{P'}{P} = \underbrace{\left(\frac{M_d'}{M_d}\right)^{\frac{1}{1-\sigma}} \left(\frac{\tilde{\phi}_d'}{\tilde{\phi}_d}\right)^{-1}}_{\text{domestic goods price index}} \times \underbrace{\left(\frac{\lambda_d'}{\lambda_d}\right)^{\frac{1}{\sigma-1}}}_{\text{gains from importing}}$$

"Overall" product variety and ACR gains

- Solve for the cut-off productivities in the two equilibria, and find:

$$\text{Consumer "overall" product variety} \quad \left(\frac{M_d'/\lambda_d'}{M_d/\lambda_d}\right) = \left(\frac{X'/w'f_d'}{X/wf_d}\right)$$

- Allow for changes in the *foreign variables (only)* as in ACR and also adopt a one-sector model with trade balance

$$\Longrightarrow \quad \left(\frac{M'}{\lambda_d'}\right) = \left(\frac{M_d}{\lambda_d}\right) \Longrightarrow \text{with Pareto} \left(\frac{\phi_d^{*\prime}}{\phi_d^{*}}\right)^{-1} = \left(\frac{\lambda_d'}{\lambda_d}\right)^{\frac{1}{\theta}}$$

- So the change in the cost of living between equilibria is:

$$\frac{P'}{P} = \left(\frac{\lambda_d'}{\lambda_d}\right)^{\frac{1}{\theta}}$$

- Overall variety is constant with only a *foreign shock* and one sector (even though the number of varieties can change)

Allowing for changes in domestic variables

- In addition to iceberg foreign trade costs, we also introduce iceberg domestic trade costs $\tau_d \geq 1$
- Allow domestic trade costs, lower-bound to Pareto productivity A and country size L to differ across equilibria (countries)
- Make two versions of an assumption on fixed costs:

  Assumption 1. The fixed and sunk costs of producing for the home market are proportional: $f_d/f_d^i = f_e/f_e^i \;\; \forall i =' \text{ and } \; i = 1, \ldots, C$

  Assumption 1'. The fixed and sunk costs of producing for the home market are proportional to L^α, $f_d/f_d^i = f_e/f_e^i = L^\alpha/L^{i\alpha}$, $\forall i ='$ and $i = 1, \ldots, C$, with $0 \leq \alpha \leq 1$.

- Assumption 1' is motivated by Arkolakis (2010). Simonovska and Waugh (2014b) use the stronger version that $\alpha = 1$.

Change in the real wages between equilibria, part (a)

Proposition 1

(a) Under Assumption 1, the ratio of the real wages between two equilibria is:

$$\frac{w'/P'}{w/P} = \frac{A'}{A}\left(\frac{\lambda_d^{'}}{\lambda_d}\right)^{-1/\theta}\left(\frac{\tau_d^{'}}{\tau_d}\right)^{-1}\left(\frac{M_d^{'}/\lambda_d^{'}}{M_d/\lambda_d}\right)^{\frac{1}{\sigma-1}}\left(\frac{X'/w'L'}{X/wL}\right)^{-1/\theta}$$

- Domestic trade costs enter with the exponent of unity, whether they apply to imports or not
- "Overall" variety re-appears (due to differing country sizes), with exponent as in Feenstra (1994), BW (2006), Ossa (2015)
- We can think of the variety term as reflecting scale effects
- Final term reflects the trade balance with a single sector, or with multiple sectors it reflects expenditure on that sector (X) relative to aggregate expenditure (i.e. a budget share)

Change in the real wages between equilibria, part (b)

Proposition 1

(b) Under Assumption 1', the ratio of wages between two equilibria is:

$$\frac{w'/P'}{w/P} = \frac{A'}{A}\left(\frac{\lambda_d'}{\lambda_d}\right)^{-1/\theta}\left(\frac{\tau_d'}{\tau_d}\right)^{-1}\left(\frac{M_d'/\lambda_d'}{M_d/\lambda_d}\right)^{\frac{1}{\sigma-1}-\frac{1}{\theta}}\left(\frac{L'}{L}\right)^{\frac{1-\alpha}{\theta}},$$

and product variety is determined by:

$$\frac{M_d'/\lambda_d'}{M_d/\lambda_d} = \left(\frac{L'}{L}\right)^{1-\alpha}\left(\frac{X'/w'L'}{X/wL}\right).$$

- "Overall" variety term now has a different exponent that reflects selection rather than scale effects
- Overall variety is related to country population and the budget share for each sector. So a "partial" scale effect still operates, though it will have to prove itself using this regression.
- We will focus on measuring the cost of living from part (b).

Model-based cost of living and real consumption

- Adding a country supercript and solving for the price level from (b),

$$\frac{P^i}{P^j} = \left(\frac{w^i/A^i}{w^j/A^j}\right)\left(\frac{\lambda^{ii}}{\lambda^{jj}}\right)^{\frac{1}{\theta}}\left(\frac{\tau^{ii}}{\tau^{jj}}\right)\left(\frac{M^i/\lambda^{ii}}{M^j/\lambda^{jj}}\right)^{\frac{1}{\theta}-\frac{1}{\sigma-1}}\left(\frac{L^i}{L^j}\right)^{-\frac{(1-\alpha)}{\theta}}$$

- Dual approach: w^i/A^i = output price level, PL_y^i
- Wtih multiple sectors, the cost of living relative to the US is,

$$CoL^i \equiv \left(PL_y^i\right)^{W^{T_i}} \times$$

$$\prod_{s=1}^{S}\left(\frac{\lambda_s^{ii}}{\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s}}\left(\frac{\tau_s^{ii}}{\tau_s^{US}}\right)^{W_s^{T_i}}\left(\frac{M_s^i/\lambda_s^{ii}}{M_s^{US}/\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s}-\frac{W_s^{T_i}}{\sigma_s-1}}\left(\frac{L^i}{L^{US}}\right)^{-\frac{(1-\alpha)W_s^{T_i}}{\theta}}\left(PL_{cs}^{N_i}\right)^{W_s^{N_i}}$$

- $W_s^{T_i}$, $W_s^{N_i}$ are Sato-Vartia weights of traded and non-traded goods
- Compare this with PWT price level of consumption, which does not adjust for foreign or domestic trade costs or *variety* differences across countries

Source of Parameters

- Scale effect α obtained from regression of overall variety on population (or employment)
- Elasticity of substitution σ_s across broad sectors s taken from median estimates in BW (2006)
- Pareto parameter θ_s estimated using cross-country ICP prices as in Eaton and Kortum (2002) and Simonovska and Waugh (2014b).
- In order to extend the gravity estimation from Eaton and Kortum (2002) to the Melitz-Chaney model, Simonovska and Waugh (2014b) assume:

  Assumption 2. The fixed costs of domestic production in country, f_d^i, equals the fixed costs of exporting to country i from any other source country j, $\forall i, j = 1, \ldots, C$.

Sectoral Gravity Equation

Proposition 2.

(a) Under Assumptions 1 and 2, the value of exports, X^{ij}, from country i to j relative to total expenditure X^{j} in country j is

$$\lambda^{ij} \equiv \frac{X^{ij}}{X^{j}} = \frac{T^{i}\left(w^{i}\tau^{ij}\right)^{-\theta}}{\sum_{k=1}^{C} T^{k}\left(w^{k}\tau^{kj}\right)^{-\theta}}$$

where $T^{i} \equiv M_{e}^{i}\left(w^{i}\right)^{1-\frac{\theta}{\sigma-1}}$

(b) Under Assumptions 1' with $\alpha = 1$ and Assumption 2, and with the fixed costs of exporting paid in the destination country, then part (a) holds with $T^{i} \equiv M_{e}^{i}$ and the denominator is proportional to the country j price index raised to the power $-\theta$:

$$\left(P^{j}\right)^{-\theta} \propto \sum_{k=1}^{C} M_{e}^{k}\left(w^{k}\tau^{ki}\right)^{-\theta}$$

Estimating sectoral gravity

- Trade elasticities, θ_s, are estimated from a gravity estimation:

$$\ln\left(\frac{\lambda_s^{ij}}{\lambda_s^{ii}}\right) = -\theta_s\left(\ln\tau^{ij} - \ln\tau^{ii} + D_s^i - D_s^j\right)$$

  where λ^{ij} are country i's consumption expenditure shares on goods from j, and $\ln\tau^{ij}$ are trade costs

- Trade costs are unobservable, but can be inferred from observed prices (EK, 2002):

$$\ln\tau^{ij} = \max_{n\in\Omega(s)}\{\ln p_n^j - \ln p_n^i\}$$

- DATA: ICP 2011 national *item* prices on global core list products, which are more disaggregate than the "basic heading" level prices

Sectoral gravity: estimates of θ_s

- Estimate using methods of Simonovska and Waugh (2014a,b)

Sector	Code	Traded share, %	# Products	θ_s	Error	σ_s
Total traded consumption		47	490	3.51	0.01	
Food, beverages & tobacco	01-02	100	205	3.46	0	4.2
Clothing & footwear	03	97	47	2.96	0	3.5
Furnishing	05	88	69	4.77	0	2.5
Health	06	46	52	4	0.08	2.5
Transport	07	59	31	11.43	0.33	7.8
Recreation and culture	09	51	59	6.76	0.23	2.2
Other goods	12	25	23	14.77	0.23	2.5

- Using basic headings, single $\theta = 4.58$ (4.16 in Simonovska and Waugh, 201))
- Based on product items, single $\theta = 3.51$ (greater price variability)
- Higher *sectoral* $\theta_s \Rightarrow$ systematic price differences *between* sectors

Cost of living: Data, 2011, 43 countries

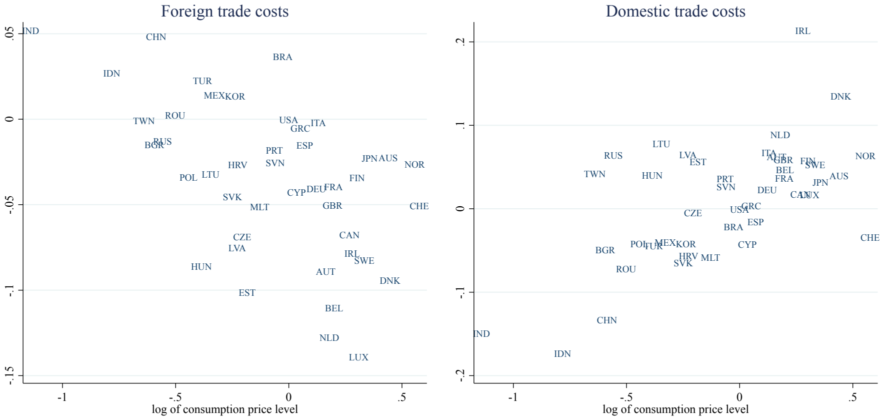
- Output price level PL_y^i is from **PWT 9.0**
- Nontraded consumption prices $PL_{cs}^{N_i}$ and Sato-Vartia weights are constructed from **ICP2011** data
- Domestic goods' share in consumption, λ_s^{ii}, is from **WIOD**
- Domestic trade costs are based on:
  - I-O tables from **WIOD**: τ_s^{ii} = consumption expenditure in s (gross of taxes) divided by the basic-prices value of expenditures
  - Data from **surveys** of wholesale and retail trade, for some countries
- Number of domestic varieties is based on number of domestic firms from **ORBIS**, **newly collected counts of barcodes across countries**

Domestic trade costs: Supply-Use Tables

Table: Margin Example: US and Netherlands, Supply-Use Table 2011

	United States			Netherlands		
	Food	Clothing	Fuel	Food	Clothing	Fuel
Total margin	60%	58%	29%	52%	70%	71%
Domestic Trade & Transport	54%	49%	21%	35%	54%	8%
Wholesale & Retail margin	52%	47%	20%			
Transport margin	2%	2%	1%			
Taxes	6%	9%	8%	17%	16%	63%

Foreign and domestic costs and consumption price level



Model-based cost of living and real consumption

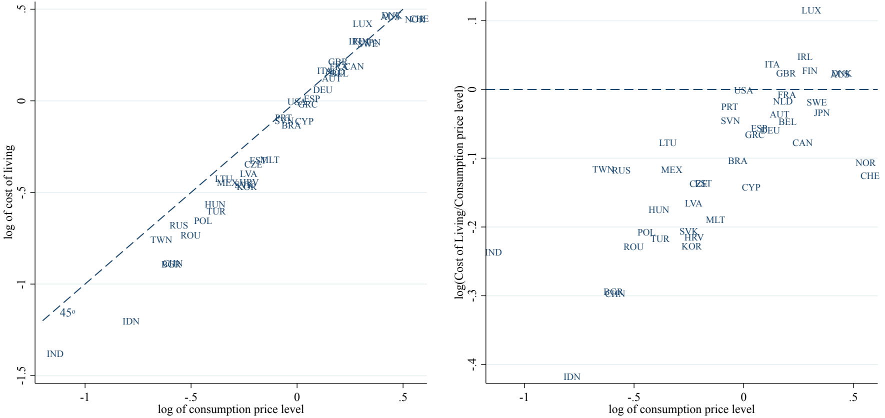
- The cost of living relative to the US, is

$$CoL^i \equiv \left(PL_y^i\right)^{W^{T_i}} \times$$

$$\prod_{s=1}^{S}\left(\frac{\lambda_s^{ii}}{\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s}}\left(\frac{\tau_s^{ii}}{\tau_s^{US}}\right)^{W_s^{T_i}}\left(\frac{M_s^i/\lambda_s^{ii}}{M_s^{US}/\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s}-\frac{W_s^{T_i}}{\sigma_s-1}}\left(\frac{L^i}{L^{US}}\right)^{-\frac{(1-\alpha)W_s^{T_i}}{\theta}}\left(PL_{cs}^{N_i}\right)^{W_s^{N_i}}$$

- Compare this with PWT price level of consumption, which does not adjust for foreign or domestic trade costs or *variety* differences across countries
- Initially make this comparison using only **the first three and the last terms on the right-hand side**
- So this initial calculation ignores the overall product variety term and the scale term (relative population)

The impact of trade costs only on the cost of living



Cost of living only using foreign and domestic trade costs

- We find that the model-based cost-of-living is *far below* the PWT cost-of-living for many countries. **Why is this?**
- **ICP and PWT:**
- PWT uses the United States as the base country, which has a high domestic share, but this does not matter because the multilateral index numbers are transitive
- PWT is also not very sensitive to breaking up the United States into regions (e.g. states), and using any one as the base region
- **Model-based cost of living:**
- Also transitive to using any comparison country
- But the home shares used the in model-base cost of living are *very sensitive* to breaking up the United States into regions
- **Conclude:** *it is essential to incorporate product variety in order to get the model-based cost-of-living right!*

Variety: Firm count and barcode data for 19 countries

- Barcode counts N_s^i from Billion Price Project (Cavallo, et al., 2018)
- Available for five sectors: food, clothing, furniture, electronics and other products (missing health and transport)
- For food and electronics only, country of origin is being collected manually in retail stores: packages of 500 "randomly" selected products are scanned in retailers from 19 countries (including US)
- *Robustness*: For the US, we can also compare the manually collected country of origin with scraped data from Walmart and Samsclub
- Barcode share is B_s^i, so domestically-produced barcodes are:

$$M_s^i \equiv N_s^i B_s^i$$

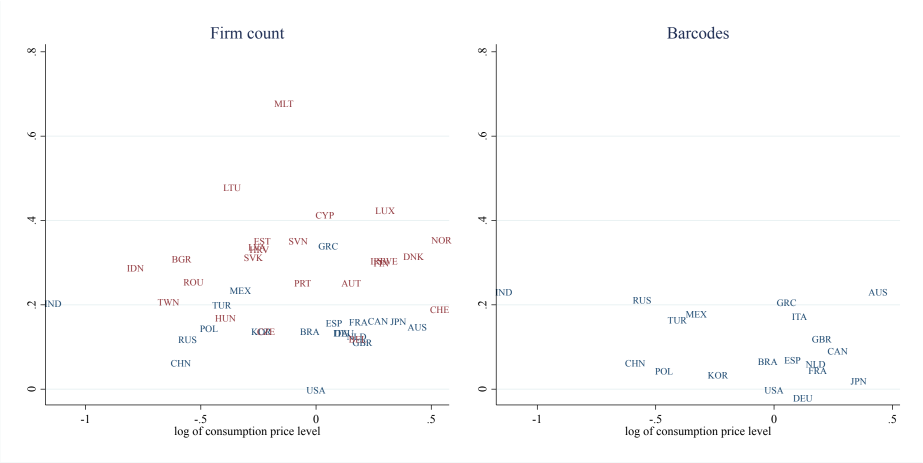
- Outside of food and electronics, we assume $B_s^i \approx \lambda_s^i$, so that:

$$M_s^i / \lambda_s^i \approx N_s^i$$

Domestically-produced varieties across countries

			Food & Beverages		Electronics	
Country	Orbis Firm Count (7 Sectors)	# Barcodes (5 Sectors, N)	# Barcodes (N)	Share Domestic Barcodes (B)	# Barcodes (N)	Share Domestic Barcodes (B)
Australia	63,482	117,992	9,738	0.61	29,217	0.01
Brazil	140,822	237,604	7,721	0.90	70,128	0.48
Canada	38,117	110,006	13,502	0.56	30,910	0.10
China	282,499	211,779	22,123	0.77	23,065	0.99
France	55,284	248,857	11,235	0.83	23,793	0.11
Germany	76,061	250,767	15,860	0.87	98,334	0.32
Greece	5,607	59,449	4,454	0.81	11,678	0.13
India	57,678	50,438	4,039	0.99	2,019	
Ireland	5,045	40,088	9,162	0.63	3,005	0.13
Italy	162,167	80,063	7,819	0.89	14,348	
Japan	65,994	563,973	16,163	0.88	165,692	0.16
Mexico	32,253	57,096	7,789	0.80	7,275	0.11
Netherlands	34,534	122,835	12,038	0.67	17,533	0.18
Poland	57,567	60,790	7,927	0.53	28,590	0.34
Russia	195,887	84,725	7,821	0.71	21,049	0.11
Spain	64,970	175,981	12,741	0.67	35,568	0.20
Turkey	66,240	97,158	6,753	0.78	8,910	0.38
United Kingdom	91,124	110,509	11,996	0.78	19,880	0.19
United States	359,967	375,943	22,386	0.89	80,598	0.24

Variety: Firm count versus barcodes

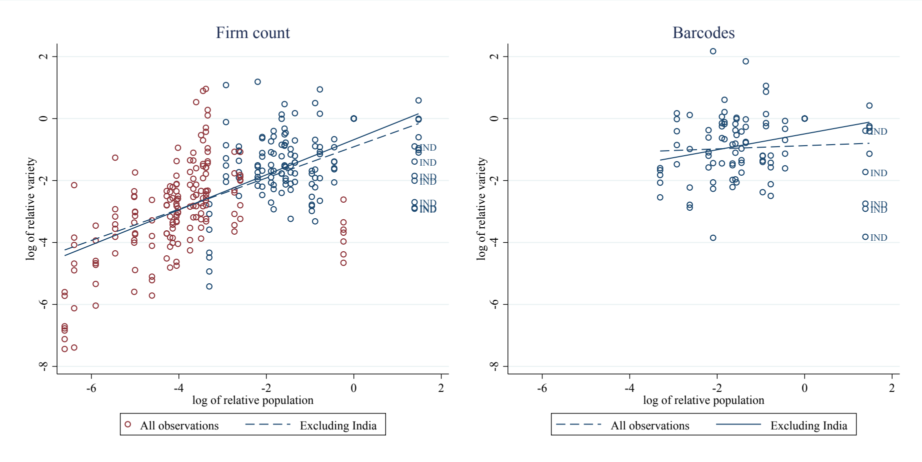


Scale Regression

Variety measure:	Firm count	Barcodes*	Firm count	Barcodes*
Size measure:	Employment	Employment	Population	Population
$\log[Size_i / Size_{USA}]$	0.501***	0.249***	0.496***	0.233***
	(0.0470)	(0.0801)	(0.0477)	(0.0839)
$\log[\frac{ExpenditureShare_i}{ExpenditureShare_{USA}}]$	0.107	0.0841	0.106	0.0906
	(0.0853)	(0.116)	(0.0864)	(0.117)
Constant	-0.947***	-0.546***	-0.962***	-0.573***
	(0.157)	(0.166)	(0.159)	(0.169)
Observations	298	89	298	89
R-squared	0.377	0.094	0.370	0.079

*: Excluding India

Scale Effect



Model-based cost of living and real consumption

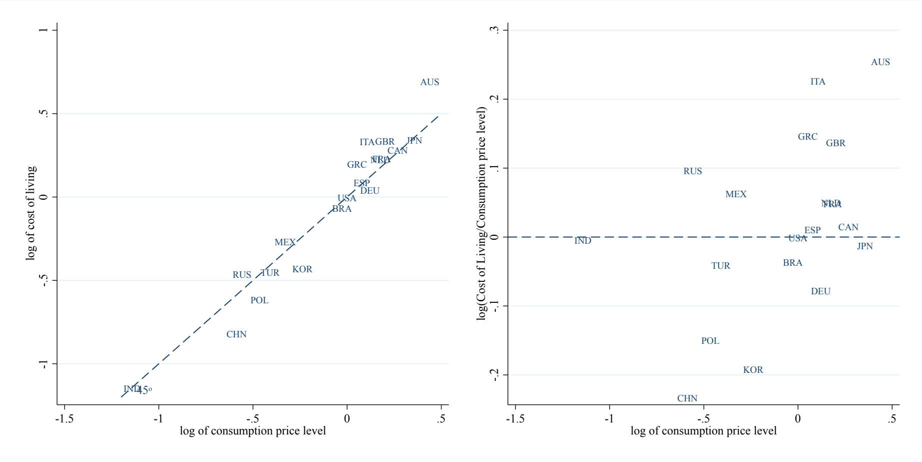
- The cost of living relative to the US, is

$$CoL^i \equiv \left(PL_y^i\right)^{W^{T_i}} \times$$

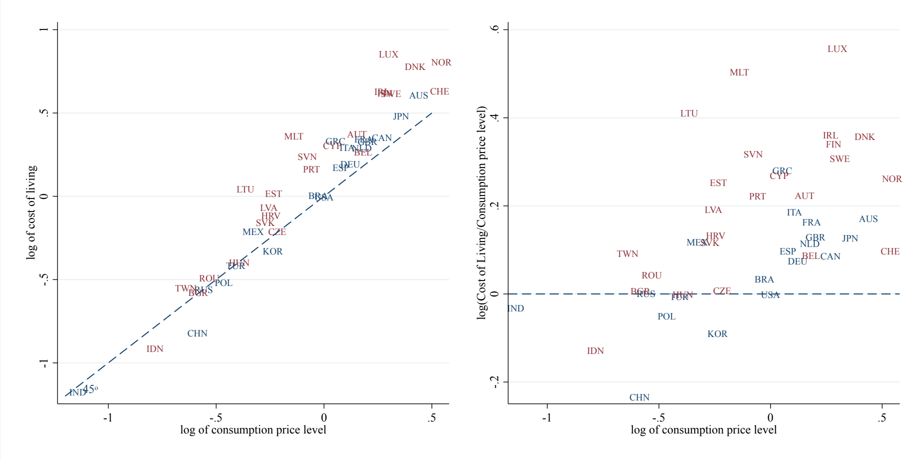
$$\prod_{s=1}^{S}\left(\frac{\lambda_s^{ii}}{\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s}}\left(\frac{\tau_s^{ii}}{\tau_s^{US}}\right)^{W_s^{T_i}}\left(\frac{M_s^i/\lambda_s^{ii}}{M_s^{US}/\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s}-\frac{W_s^{T_i}}{\sigma_s-1}}\left(\frac{L^i}{L^{US}}\right)^{-\frac{(1-\alpha)W_s^{T_i}}{\theta}}\left(PL_{cs}^{N_i}\right)^{W_s^{N_i}}$$

- Compare this with PWT price level of consumption, which does not adjust for foreign or domestic trade costs or *variety* differences across countries
- Now include **all terms except for the scale term (relative population)**

Relative cost of living: barcode variety, no scale effect



Relative cost of living: firm-count variety, no scale effect



Model-based cost of living and real consumption

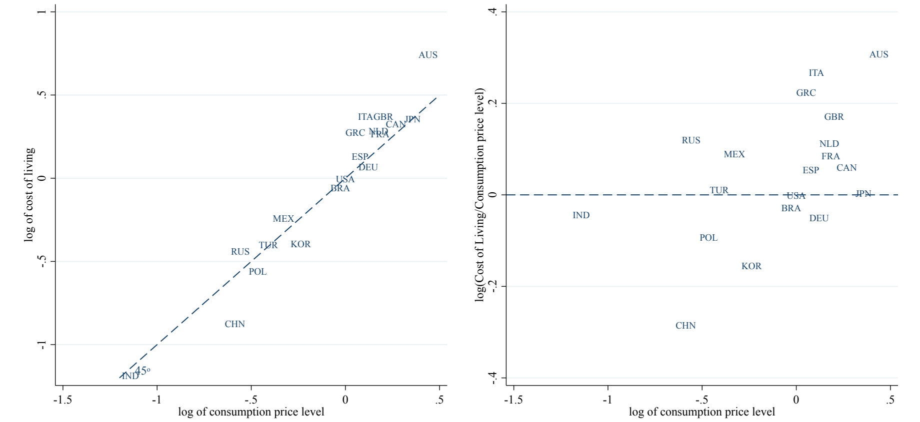
- The cost of living relative to the US, is

$$CoL^i \equiv \left(PL_y^i\right)^{W^{T_i}} \times$$

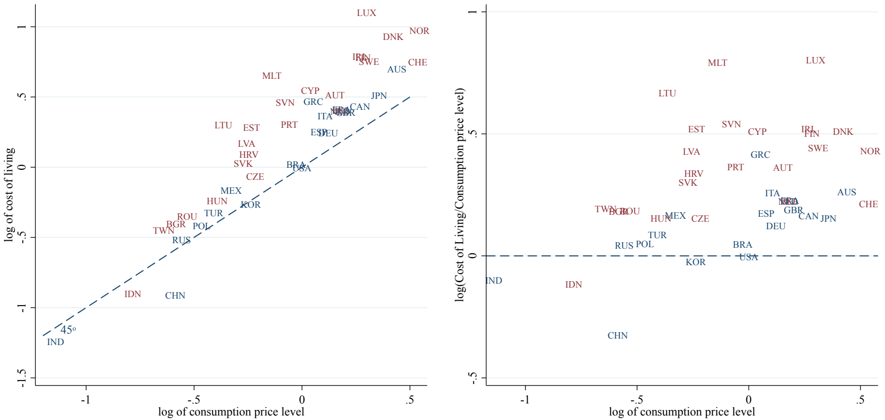
$$\prod_{s=1}^{S} \left(\frac{\lambda_s^{ii}}{\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s}} \left(\frac{\tau_s^{ii}}{\tau_s^{US}}\right)^{W_s^{T_i}} \left(\frac{M_s^i/\lambda_s^{ii}}{M_s^{US}/\lambda_s^{US}}\right)^{\frac{W_s^{T_i}}{\theta_s} - \frac{W_s^{T_i}}{\sigma_s - 1}} \left(\frac{L^i}{L^{US}}\right)^{-\frac{(1-\alpha)W_s^{T_i}}{\theta}} \left(PL_{cs}^{N_i}\right)^{W_s^{N_i}}$$

- Compare this with PWT price level of consumption, which does not adjust for foreign or domestic trade costs or *variety* differences across countries
- Now include **all terms**

Relative cost of living: barcode variety and scale



Relative cost of living: firm-count variety and scale



Cost of Living Decomposition 1

- First we run:

$$\ln CoL^i = \alpha_0 + \beta_0 \ln PL_c^i + \epsilon_0^i, i = 1, \dots, C$$

- Define $Z_k^i, k = 1, \dots, 6$ as (in logs):

$$\ln Z_1^i = W^{T_i} \ln PL_y^i$$

$$\ln Z_2^i = \sum_{s=1}^{S} \frac{W_s^{T_i}}{\theta_s} \ln \left(\lambda_s^{ii} / \lambda_s^{US} \right)$$

$$\ln Z_3^i = \sum_{s=1}^{S} W_s^{T_i} \ln \left(\frac{\tau_s^{ii}}{\tau_s^{US}} \right)$$

$$\ln Z_4^i = \sum_{s=1}^{S} W_s^{T_i} \left[\frac{1}{\theta_s} - \frac{1}{\sigma_s - 1} \right] \ln \left(\frac{M_s^i / \lambda_s^{ii}}{M_s^{US} / \lambda_s^{US}} \right)$$

$$\ln Z_5^i = -\frac{(1-\alpha) W_s^{T_i}}{\theta_s} \ln \left(L^i / L^{US} \right)$$

$$\ln Z_6^i = \sum_{s=1}^{S} W_s^{N_i} \ln (PL_{cs}^{N_i})$$

- Then we also run: $\ln Z_k^i = \alpha_k + \beta_k \ln PL_c^i + \epsilon_k^i, k = 1, \dots, 6$
- Because $\ln CoL_c^i = \sum_{k=1}^{6} \ln Z_k^i$, then $\alpha_0 = \sum_{k=1}^{6} \alpha_k$, $\beta_0 = \sum_{k=1}^{6} \beta_k$

Regression table 1

Variety:	No variety	FirmCount	Barcode	Firmcount	Barcode
Scale effect:	n.a.	No	No	Yes	Yes
Explanatory variable:			$\log(PLc)$		
CoL	1.224	1.228	1.147	1.278	1.186
	(0.039)	(0.050)	(0.080)	(0.073)	(0.081)
PLy	0.429	0.429	0.444	0.429	0.444
	(0.024)	(0.024)	(0.012)	(0.024)	(0.012)
Foreign trade costs	-0.062	-0.062	-0.066	-0.062	-0.066
	(0.014)	(0.014)	(0.016)	(0.014)	(0.016)
Domestic trade costs	0.114	0.114	0.120	0.114	0.120
	(0.027)	(0.027)	(0.028)	(0.027)	(0.028)
Variety		0.004	-0.058	0.004	-0.058
		(0.036)	(0.049)	(0.036)	(0.049)
Scale				0.050	0.039
				(0.036)	(0.015)
Non-traded prices	0.708	0.344	0.432	0.206	0.398
	(0.089)	(0.096)	(0.076)	(0.069)	(0.061)

Cost of Living Decomposition 2

- Take the difference between the model-based cost-of-living and the PWT relative price of consumption:

$$\Delta CoL^i \equiv CoL^i - PL_c^i$$

- Also combine the various PWT price terms to get

$$\Delta P^i \equiv W^{T_i} \ln PL_y^i + \sum_{s=1}^{S} W_s^{N_i} \ln(PL_{cs}^{N_i}) - \ln PL_c^i, i = 1, \ldots, C$$

- The we run

$$\Delta P^i = \alpha_0 + \beta_0 \Delta CoL^i + \epsilon_0^i, i = 1, \ldots, C$$

- Also define

$$\Delta Z_k^i \equiv Z_k^i - PL_c^i, k = 2, \ldots, 5$$

- Then we also run:

$$\Delta \ln Z_k^i = \alpha_k + \beta_k \Delta CoL^i + \epsilon_k^i, k = 2, \ldots, 5$$

Regression table 2

Variety:	No variety	FirmCount	Barcode	Firmcount	Barcode
Scale effect:	n.a.	No	No	Yes	Yes
Explanatory variable:			$\log(PLc)$		
Prices	0.708	0.344	0.432	0.206	0.398
	(0.089)	(0.096)	(0.076)	(0.069)	(0.061)
Foreign trade costs	-0.215	-0.149	-0.111	-0.116	-0.128
	(0.050)	(0.034)	(0.059)	(0.023)	(0.055)
Domestic trade costs	0.507	0.241	0.328	0.157	0.327
	(0.077)	(0.081)	(0.069)	(0.056)	(0.062)
Variety		0.564	0.351	0.430	0.288
		(0.104)	(0.078)	(0.072)	(0.087)
Scale				0.322	0.115
				(0.025)	(0.087)
Number of countries	43	43	19	20	21

Conclusions

- We have extended ACR to allow for comparisons of equilibria both *within and between* countries
- We have compared a model-based cost-of-living to the consumption price from PWT for 43 countries
- In this comparison it is essential to also correct for "overall" product variety (using the count of domestic varieties / home share)
- **Empirical results**
  - Using barcode data to count variety for 19 countries, the model-based cost of living is reasonably close to the PWT price level of consumption (but slightly worse using the firm count)
  - Using firm data to count variety, the other 24 countries in the sample have a PWT price level relative to the US that is sometimes substantially above the the model-based cost of living.
  - For those other 24 countries, the US enjoys relatively more gains from variety.