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Consumer Taste in Trade

Research Question

- How important are taste differences across countries ?

- Can we measure taste at the level of the trade flow in micro-trade data (firm-product-country exporters data from Belgium) ?

- Does consumer taste behave very differently from quality?

- How important is the international dimension in taste? Does taste vary mostly by country, by variety or over time?

Objectives

- In this paper we develop a new empirical method to identify consumer taste at the level of the trade flow

- In future, this method can be used in future to :
  - identify taste shocks after the pandemic
  - Assess the importance of consumer taste for export entry

Relevance?

- Workhorse models in trade do not consider demand heterogeneity across countries *e.g. a CES model of trade assumes that international preferences for a product are the same as in home*
- Current emprical estimates of demand, use the residual as a proxy for taste *e.g. the unexplained part of the variation in sales*
- A residuals approach is bound to be noisy *e.g. demand residual may involve other demand ànd cost shifters*
- Challenge: how to purge consumer taste out of the demand residual ?
  - *Taste needs to be quantified to avoid endogeneity of estimated demand coefficients*
  - *Taste is unobservable so a traditional IV approach cannot be used*
  - *We use a control function approach e.g. a polynomial defined over at least 2 variables, that are likely to be strongly correlated with consumer taste*

Identifying Consumer taste from *general* demand estimation

Estimation of a *general* demand function Q_{ijdt} for product i exported by firm j to destination d in year t:

$$q_{jidt} = Q_{jidt}[p_{jidt}, \lambda(X')_{jidt}, \delta(Y')_{jidt}, \gamma_{idt}, \epsilon_{jidt}]$$

- $\mathbf{q_{jidt}}$ is the quantity of product i sold by firm j that is consumed in country d and year t (exports data)
- $\boldsymbol{\lambda(X')_{jidt}}$ represents the control function for **consumer taste** where X is a set of variables to proxy for the unobservable consumer taste
- $\boldsymbol{\delta(Y')_{jidt}}$ represents the control function for **quality** where Y is a set of variables to proxy for the unobservable quality
- $\mathbf{p_{jidt}}$ is the price (f.o.b.) of product i provided by firm j exclusive of transport cost and distribution cost
- $\boldsymbol{\Upsilon_{idt}}$ represents a set of product-country-year fixed effects e.g. captures market size, market structure, distance and distribution costs in the destination country
- $\boldsymbol{\varepsilon_{jidt}}$ is the residual term that may still contain unobserved demand and cost shifters such as trade costs correlated with price hence price needs to be instrumented

Note:

- Without **λ(X')** and **δ(Y ')** and fixed effects demand elasticity (σ) on price $\mathbf{p_{jidt}}$ would be biased

Identification strategy

1) Hausman (1996) instrument on price e.g. average price of the same firm-product (ji) to all alternative destinations (≠ d) and excluding neighboring countries
2) Control function for Taste

$$ln\lambda(X')_{jidt} = ln\lambda[WND_{jdt}, z_{idt}]$$

- **WND_{jdt}** is a weighted national dish index that reflects the similarity of food taste between the destination country d and Belgium measured by the **overlap in national dish ingredients**
  - e.g. we construct data set to identify the national dishes for each country and then trace the recipes and ingredients of each dish from publicly available data and websites
  - We then use a text recognition tool Latent Semantic Analysis (LSA) to compare the similarity and overlap in dish ingredients

Consumer Taste (continued)

1) Control function for Taste

$$ln\lambda(X')_{jidt} = ln\lambda[WND_{jdt}, z_{idt}]$$

The similarity index of national dishes (ND) is destination (d) specific but will be weighted by a weight, $\mathbf{s_{jdt}}$, defined as the ratio of each firm j's sales exported to country d to firm j's global exports in year t.

Notes:

1) this weight is defined at the firm-level **(s_{jdt})** to avoid potential endogeneity with the dependent variable (q_{jidt}).

2) The use of the weight ensures that we measure taste at (ijdt) level, Measuring all parameters of interest (quality and marginal cost) at the same level of aggregation allows for a **decomposition** later on to assess the contribution of each parameter to export revenues.

Consumer Taste (continued)

1) Control function for Taste

$$ln\lambda(X')_{jidt} = ln\lambda[WND_{jdt}, z_{idt}]$$

- **Z_{idt}** is the share of country d's import of product i from Belgium over its total import of product i fro the World and therefore **exogenous**:

$$z_{idt} = \frac{M_{id,BE,t}}{\sum_{v \in W} M_{idvt}},$$

- M_{idBEt} is country d's imports of product i from country Belgium and **W** is the set of countries in the world that product i can be sourced from. This data is at the product-level and is from COMTRADE

Control function for Quality

We follow the literature (Bastos et al. (2018); Khandelwal (2010), De Loecker et al. (2016):

$$ln\delta(Y')_{jidt} = ln\delta[PIMP_{jt}, WGDP_{jit}, LGDP_{jidt}, f_{jidt}]$$

- Where ($PIMP_{jt}$) are import prices e.g. we calculate the weighted sum of import prices (unit values) of each imported product within a firm
- the weighted GDP per capita across destinations ($WGDP_{jit}$) e.g. the higher the average GDP of all the countries that a firm export its product to, the higher the quality of the product
- the weighted local GDP per capita of the destination ($LGDP_{jidt}$) e.g. that firms may offer higher quality to countries with higher local GDP per capita
- firm-product market share within the destination (f_{jidt}) e.g. higher quality products can have higher market shares

Demand and Cost Estimation

1) Demand Estimation

- Demand estimation when accounting for IV and unobservables taste and quality:

$$\ln q_{jidt} = \gamma_{idt} - \sigma_{id} \ln p_{jidt} + \ln\lambda(X^{'})_{jidt} + \ln\delta(Y^{'})_{jidt} + \epsilon_{jidt}$$

- allows us to empirically identify three important parameters e.g. the elasticity of demand $\boldsymbol{\sigma_{id}}$, the consumers' taste $\boldsymbol{\ln\lambda_{jidt}}$ and the quality index $\boldsymbol{\ln\delta_{jidt}}$

Cost Estimation

We use the **optimal equilibrium pricing** condition for profit maximization under monopolistic competition to back out the **marginal cost** from the prices :

$$p_{jidt}[1 - (1/\sigma_{id})] = MC_{jidt}$$

- Our estimates for marginal cost (**MC_{jidt}**) thus vary at the firm-product-destination level since we back out cost from destination level prices, using the demand elasticities' estimates

Data

- Belgian customs data of manufacturing **firms** for the period 1998-2005 with information on firms **exports** in quantities and values by food product and by destination and firm imports by **product and country** of origin
- At the most disaggregate level our customs data consist of over 100,000 trade flows in food & beverages

- We create a novel data set on **national dish similarity** between countries based on the overlap in their ingredients to account for taste.
- The National Dish Index obtained via LSA takes values lying between 1 (recipes are identical) and -1 (recipes are entirely different).

Observations by Regions

Table 2: Number of Observations by (HS2)Industries and Regions

	15	16	17	18	19	20	21	22	Total
AU	65	1	174	507	75	84	85	108	1,099
EA	360	78	706	1,945	337	605	558	675	5,264
EE	1,283	662	1,137	2,482	1,193	1,367	1,562	1,203	10,889
ME	522	139	787	1,816	579	1,156	664	524	6,187
NA	41	36	406	1,018	208	443	205	377	2,734
SA	49	8	81	181	57	52	89	120	637
SAM	311	74	327	1,002	282	506	319	395	3,216
SSA	321	64	443	376	337	395	471	448	2,855
WE	4,990	11,273	7,294	11,046	7,719	10,073	8,972	6,234	67,601
Total	7,942	12,335	11,355	20,373	10,787	14,681	12,925	10,084	100,482

Notes: Regions: AU: Australia and New Zealand, EA: East Asia, EE: East Europe, ME: Middle East, NA: North America, SA: South Asia, SAM: South America, SSA: Sub-Saharan Africa , WE: Western Europe.
(HS2)Industries: 15: Animal or Vegetable Fats and Oils, 16: Meat, Fish or Crustaceans, 17: Sugars and Sugar Confectionery, 18: Cocoa and Cocoa Preparations, 19: Preparations of Cereals, Flour, Starch or Milk, 20: Preparations of Vegetables, Fruit, Nuts, 21: Miscellaneous Edible Preparations, 22: Beverages, Spirits and Vinegar.

National Dish similarity

Table 3: Average Bilateral Indices on Similarity in National Dish between Belgium and Destinations

Similarity in National Dishes					
		Top Seven Countries		Bottom Seven Countries	
Region	Index	Country	Index	Country	Index
AU	0.1502	France	0.7596	China	-0.0669
EA	0.2081	Ireland	0.7423	Norway	-0.0638
EE	0.4020	Hungary	0.7297	India	-0.0566
ME	-0.0353	Argentina	0.6264	Turkey	-0.0353
NA	0.5647	Portugal	0.5714	Korea	-0.0120
SA	-0.0566	U.S.A.	0.5654	New Zealand	0.0040
SAM	0.3678	Canada	0.5634	Peru	0.0569
SSA	0.3997				
WE	0.3851				

Notes: ND: Similarity in National Dishes. The similarity measure based on LSA takes values lying between 1 (recipes are identical) and -1 (recipes are entirely different). Regions: AU: Australia and New Zealand, EA: East Asia, EE: East Europe, ME: Middle East, NA: North America, SA: South Asia, SAM: South America, SSA: Sub-Saharan Africa ,WE: Western Europe.
The similarity in National Dishes (ND) is based on public information on national dishes and their ingredients https://www.foodpassport.com/ and https://nationalfoods.org/. Details on the construction of the national dish indicator can be found in Appendix B.

Demand Elasticities

Table 4: Average Demand Elasticities by (HS2)Sectors

HS2 Industries	Mean(σ)	S.D.(σ)	Number of (HS4)Product-Country Pairs
15	3.0957	1.2838	24
16	2.2733	1.4236	18
17	2.0799	0.7683	23
18	1.4330	0.3705	16
19	1.8770	0.6499	29
20	2.9737	1.3741	49
21	2.0759	0.8249	35
22	1.9430	1.0012	23

Notes: The estimated demand elasticities are averaged over product categories and regional blocs. (HS2)Industries: 15: Animal or Vegetable Fats and Oils, 16: Meat, Fish or Crustaceans, 17: Sugars and Sugar Confectionery, 18: Cocoa and Cocoa Preparations, 19: Preparations of Cereals, Flour, Starch or Milk, 20: Preparations of Vegetables, Fruit, Nuts, 21: Miscellaneous Edible Preparations, 22: Beverages, Spirits and Vinegar.

Estimated Parameters: Sum Stats agregated Indices

Table 5: Summary Statistics of Demand and Cost Indices

Region	Quality Index ($ln\hat{\delta}$)	Taste Index ($ln\hat{\lambda}$)	MC Index ($ln\hat{c}$)
AU	4.2784	0.4286	-1.6121
EA	3.9891	0.6910	-1.2814
EE	4.1254	0.6897	-1.1785
ME	4.0105	0.8693	-1.4870
NA	3.7953	0.7420	-1.6173
SA	4.6292	0.0607	-0.5600
SAM	4.4220	0.8313	-0.7671
SSA	3.7471	2.1486	-0.7556
WE	3.8428	1.5944	-1.0288
S.D.	1.4601	1.2006	1.2897

Correlation Matrix of Demand and Cost Indices

Table 6: Correlation Matrix of Quality, Tastes and MC indices

	Quality Index ($ln\hat{\delta}$)	Taste Index ($ln\hat{\lambda}$)	MC Index ($ln\hat{c}$)
Quality Index ($ln\hat{\delta}$)	1		
Taste Index ($ln\hat{\lambda}$)	-0.0925	1	
MC Index ($ln\hat{c}$)	-0.0722	-0.0255	1

Quality, Taste and Cost do not seem to be very correlated !

Variance Decomposition of Indices

Table 7: Variance Decomposition of Indices

Variation in:	Taste Index	Quality Index	MC Index
Firm	8%	66%	43%
Product	43%	31%	47%
Country	49%	3%	10%
	100%	100%	100%

Notes: We decompose the variance of the taste (quality and cost) index into three components: (1) Variance across firms within the same (HS6) Product-Country market; (2) Variance across (HS6) Products within the same country; (3) Variance across countries. The decomposition of the variance of the taste index is defined as $\sum_{jid}(ln\lambda_{jidt} - ln\lambda_t)^2 = \sum_{jid}(ln\lambda_{jidt} - ln\lambda_{idt})^2 + \sum_{jid}(ln\lambda_{idt} - ln\lambda_{dt})^2 + \sum_{jid}(ln\lambda_{dt} - ln\lambda_t)^2 + 2\sum_{jid}(ln\lambda_{jidt} - ln\lambda_{idt})(ln\lambda_{idt} - ln\lambda_{dt}) + 2\sum_{jid}(ln\lambda_{jidt} - ln\lambda_{idt})(ln\lambda_{dt} - ln\lambda_t) + 2\sum_{jid}(ln\lambda_{idt} - ln\lambda_{dt})(ln\lambda_{dt} - ln\lambda_t)$. The first term represents the variance across firms, the second term represents the variance across products, and the third term represents the variance across countries. The last three terms represent the covariances of the indices. The covariance terms are empirically negligible so we do not report them here.

Decomposition Result of **Export Revenues** into Indices

Table 8: Decomposition of Firm-Product Export Revenues

	(1)	(2)	(3)	(4)
β_λ (Tastes)	0.45	0.14	0.16	0.14
	(.002)***	(.002)***	(.002)***	(.002)***
β_δ (Quality)	0.24	0.24	0.25	0.26
	(.002)***	(.003)***	(.003)***	(.003)***
β_c (MC)	0.15	0.13	0.14	0.13
	(.003)***	(.003)***	(.003)***	(.000)***
β_M (Market Competition)	0.17	0.11	0.09	0.09
	(.003)***	(.003)***	(.003)***	(.003)***
β_R (Demand Residuals)		0.37	0.37	0.38
		(.003)***	(.003)***	(.003)***
Observations	39,001	31,265	32,239	32,034

See Equations Equations (11a) to (11e) for the regression equations.
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Notes: In Column (1) we treat the demand residuals as the taste index so that the contribution of taste index and demand residuals are combined in the contribution of taste index. Columns (2)-(4) reflect the use of a control function for taste but with different proxy variables. In specification (2) the weight for the nation dish index is given by the initial fraction of firm-(CN8)Product sales in the destination country. In specification (3) we use the fraction of firm-level sales in the destination country as the weight for the national dish index instead. In specification (4) we use the fraction of product-level sales in the destination country as the weight for the national dish index instead.

Gravity Estimation with Consumer Taste

Table 10: Simplified Gravity Model

	(1)	(2)	(3)	(4)	(5)
$\ln(\text{GDP})_{dt}$	0.3552	0.2807	0.2907	0.1756	0.1827
	(0.007)***	(0.007)***	(0.007)***	(0.007)***	(0.006)***
$\ln(\text{DIST})_{d}$	-0.2934	-0.3048	-0.3369	-0.0943	-0.1215
	(0.007)***	(0.007)***	(0.007)***	(0.007)***	(0.007)***
$ln\hat{\gamma}_{HS4,dt}$		0.2235	0.2655	0.2531	0.2987
(Market effect)		(0.008)***	(0.008)***	(0.008)***	(0.007)***
$ln\hat{\delta}_{idt}$			0.2463		0.2613
(Quality Index)			(0.006)***		(0.005)***
$ln\hat{\lambda}_{idt}$				0.4308	0.4449
(Taste Index)				(0.007)***	(0.007)***
Constant	-0.0418	-0.0371	-0.0313	-0.0391	-0.0331
	(0.017)**	(0.017)**	(0.016)**	(0.015)***	(0.014)**
Year	yes	yes	yes	yes	yes
(HS6)Product FE	yes	yes	yes	yes	yes
Observations	16,793	16,793	16,793	16,793	16,793
R-squared	0.365	0.391	0.448	0.500	0.564

Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: $ln(\hat{\gamma}_{HS4,dt})$ capture the market effect that is estimated from the demand function. (HS6)Product-country level quality index ($ln\hat{\delta}_{idt}$) is constructed by $ln\hat{\delta}_{idt} = \sum_{j\in\Omega_{idt}} w_{jidt} ln\hat{\delta}_{jidt}$, where w_{jidt} is the share of firm j's export sales of product i over total Belgian export of product i to destination country d. $ln\hat{\lambda}_{idt}$ is the (HS6)Product-country level taste index that we used in column (4) of Table 8.

Conclusion

- We provide evidence that demand is as important for trade as the supply side…or more !
- Within the demand side, quality explains most of the export sales variation but consumer taste also matters, depending on the product
- Identifying consumer taste is important to get unbiased estimates in demand estimation and not confounding it with quality.
- Controlling for **taste in a gravity** model, substantially reduces the coefficient on **distance**
- We show the existence of **consumer heterogeneity** in space
- This is important to understand the arrival of **diverging product standards** across countries, but without mutual recognition in trade agreements, this may undermine the efficiency of FTAs (see Brexit)