Firm-to-Firm Trade

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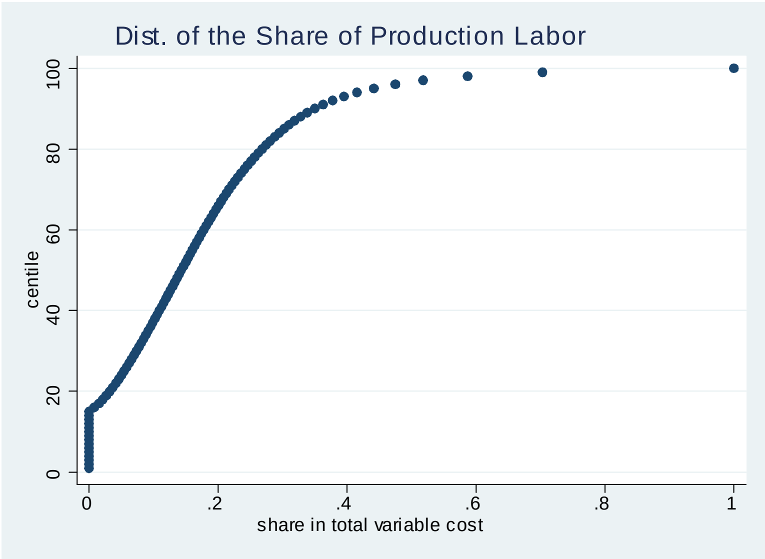
- The Ultimate Goal: Understanding the impact of interfirm trade, particularly outsourcing, on labor market outcomes

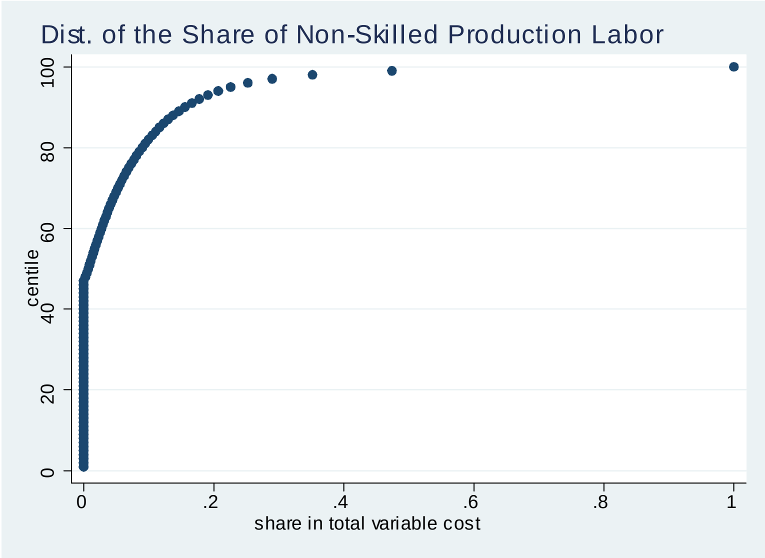
- Previous work this decade: accommodating producer heterogeneity into general equilibrium analysis

Data Issue 1

- Huge heterogeneity in firm input and purchasing decisions

- Example: labor shares and unskilled labor shares


Dist. of the Share of Production Labor
centile
0
20
40
60
80
100
0
.2
.4
.6
.8
1
share in total variable cost

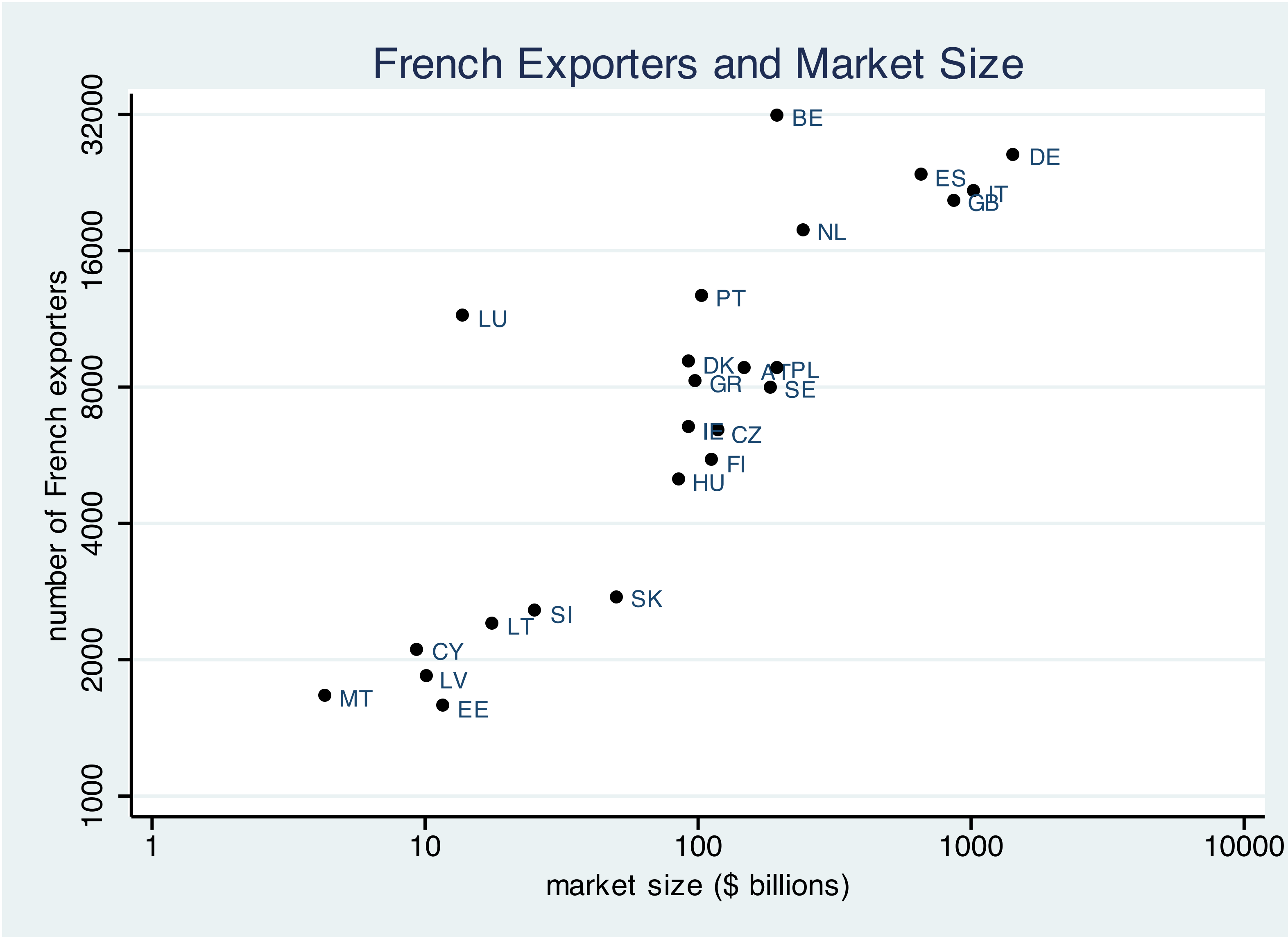

Dist. of the Share of Non-Skilled Production Labor
centile
0
20
40
60
80
100
0
.2
.4
.6
.8
1
share in total variable cost

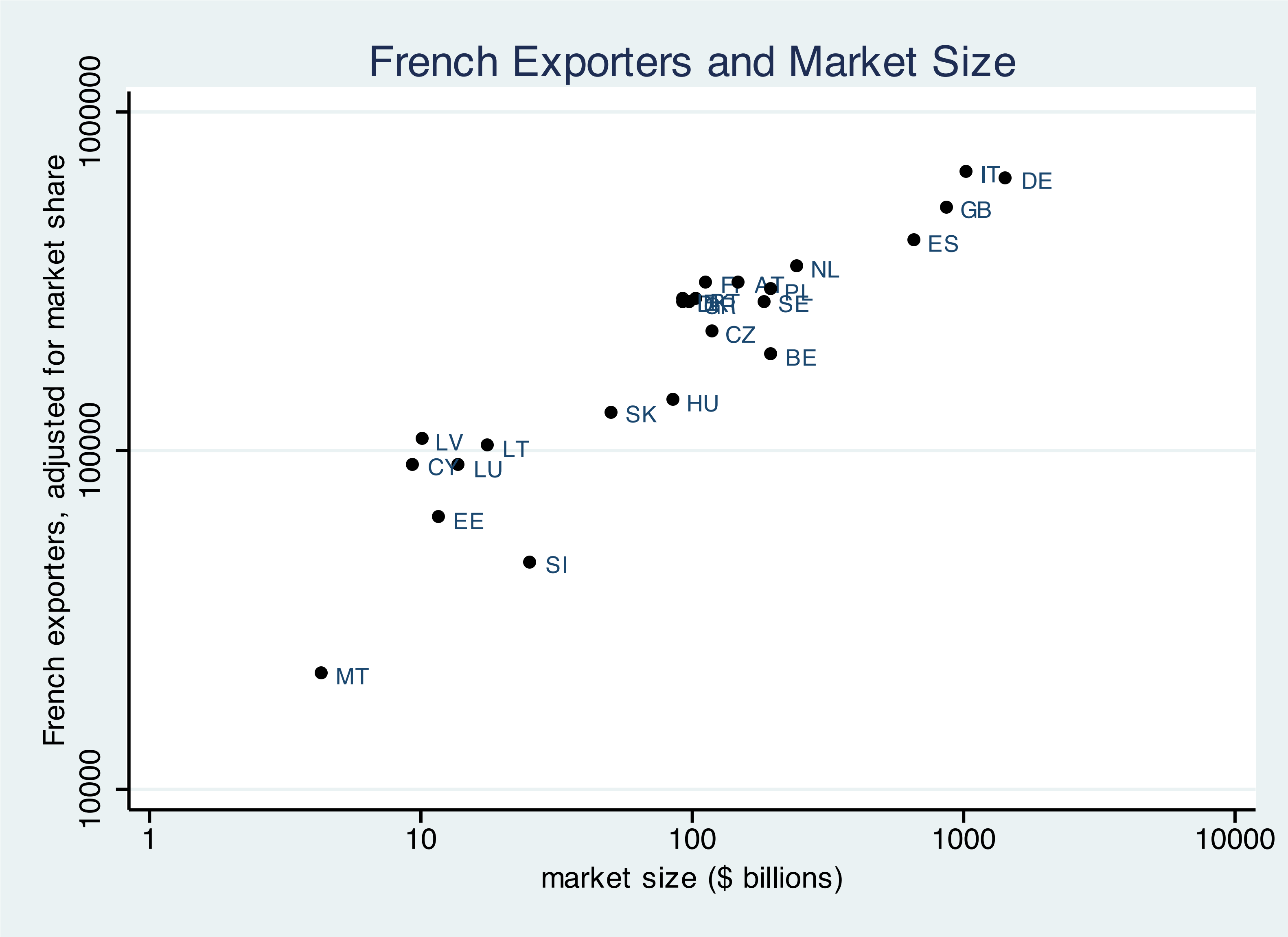
But standard models have a common production function with common shares across firms, at least within a sector

Data Issue 2

- Huge heterogeneity in the number of buyers a firm has and in the sales to a given buyer.

- Some EU evidence


French Exporters and Market Size
number of French exporters
1000
2000
4000
8000
16000
32000
market size ($ billions)
1
10
100
1000
10000
BE
DE
ES
IT
GB
NL
PT
LU
DK
AT
PL
GR
SE
IE
CZ
FI
HU
SK
SI
LT
CY
LV
MT
EE



French Exporters and Market Size
French exporters, adjusted for market share
10000
100000
1000000
market size ($ billions)
1
10
100
1000
10000
IT
DE
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NL
FI
AT
PL
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CY
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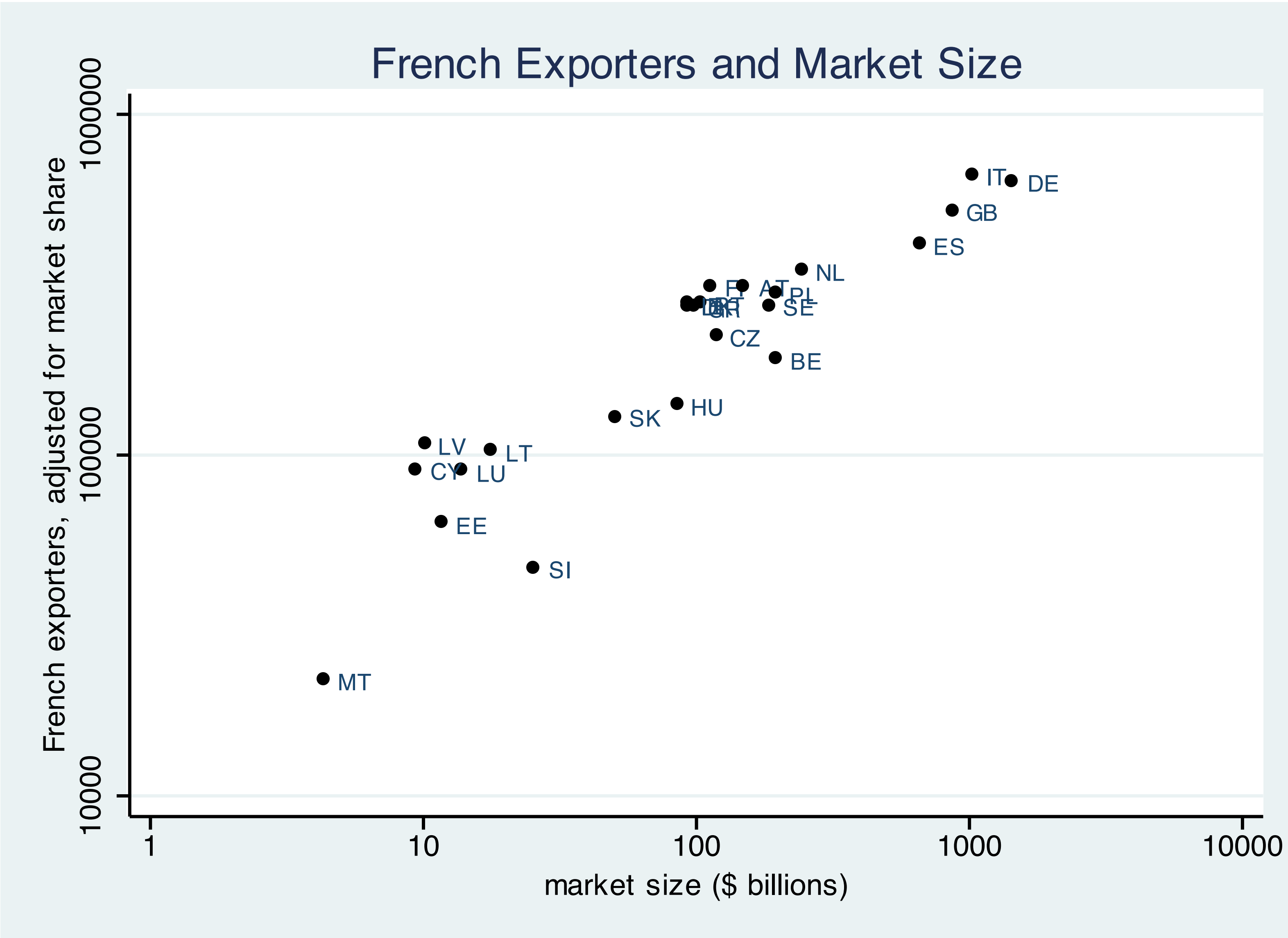
MT


French Exporters and Market Size
French exporters, adjusted for market share
market size ($ billions)
10000
100000
1000000
1
10
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IT
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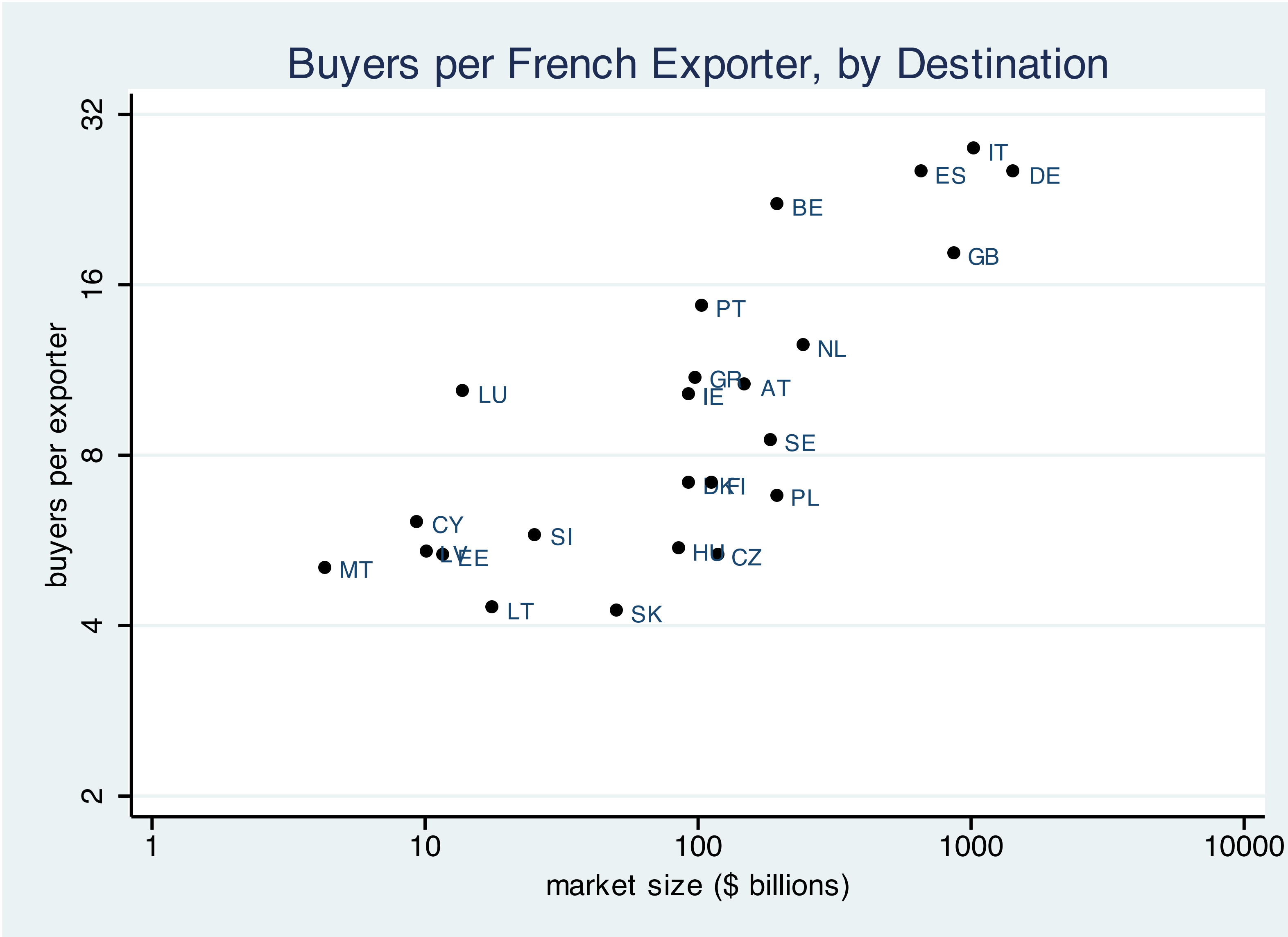
Buyers per French Exporter, by Destination
buyers per exporter
market size ($ billions)
2
4
8
16
32
1
10
100
1000
10000
IT
ES
DE
BE
GB
PT
NL
LU
AT
IE
SE
PL
CY
SI
MT
HU
CZ
EE
LT
SK

Customers per French Exporter

	Destination Market			
	Lithuania	Denmark	UK	Germany
Market Size ($billions)	18	94	882	1480
Customers per Exporter:				
Mean	4.2	7.1	17.9	24.9
Percentiles:				
25th	1	1	1	2
50th	2	2	3	4
75th	4	5	9	12
90th	9	12	25	35
95th	15	21	48	70
99th	40	77	224	329

Data are for 2005.

But standard models have a demand function determined by an aggregate demand system (but see recent work by Armenter and Koren)

Can we build a general equilibrium model that can capture these features without surrendering ground on the successes of Marc Melitz (2003), Thomas Chaney (2008), and Costas Arkolakis (2010)?

Successes in France (EKK, 2011)

- Patterns of Entry
- Sales Distributions given entry
- Export Market Success and Size in France
- Export Destination Hierarchies

Further Successes

- Granular Version (dropping the continuum): Explains zeroes (EKS, 2013) and aggregate fluctuations (di Giovanni and Levchenko, 2012)

- Firm dynamics: Erzo Luttmer (2007) and Costas Arkolakis (2013)

Progress so Far

- Continuum at the aggregate. Otherwise general equilibrium analysis is problematic

- But outcomes for individual firms and households are granular

- So far, theory is ahead of measurement

Related Literature

- Much

- But particularly Chaney (2013) and Oberfield (2013).

Model Basics

Standard Ricardian Assumptions

- N countries which we normally index by i when an entity in the country is the seller and by n when an entity in the country is a buyer.

- Country i has L_i^l workers of type l.

- Workers are the final buyers.

Buyers (Households or Firms)

- $k = 1, .., K$ **purposes** (household **needs** or firm **tasks**)
- Cobb-Douglas share α_k for households or β_k for firms
- Purpose k can be fulfilled with a particular good or with a type of labor.

Technological Heterogeneity (Melitz-Chaney-EKK)

- Each country n has a measure of potential sellers with unit cost below c given by

$$\mu_n(c) = \Upsilon_n c^\theta$$

- $\Upsilon_n > 0$ and $\theta > 0$ given at first, but derived from more basic assumptions below

- We continue to lean on the crutch of the continuum in the aggregate.

- A purpose can also be fulfilled by a worker of the appropriate type l at a wage $w_{k,n}$ with productivity Q drawn from the distribution:

$$F(q) = \mathsf{Pr}[Q \leq q] = e^{-q^{-\phi}}$$

where $0 < \phi \leq \theta$ (Fréchet)

- For each purpose k an individual buyer encounters only a finite subset of the continuum of sellers

- For a given buyer the arrival rate of potential sellers with unit cost c is:

$$e_{k,n}(c) = \lambda_{k,n} c^{-\varphi}$$

  where $\varphi \geq 0$ and:

$$\phi + \varphi = \theta$$

- Special case $\varphi = 0$ and $\phi = \theta$: no match advantage to low cost firms.

- $\varphi > 0$ gives lower cost producers a bigger chance of meeting a buyer.

- Key new parameter $\lambda_{k,n}$, how easy is it for potential buyers and sellers to encounter each other.

- Number of goods a buyer encounters with unit cost below c is distributed Poisson with parameter:

$$\begin{aligned}\rho_{k,n}(c) &= \int_0^c e_{k,n}(c) d\mu_n(c) \\ &= \int_0^c \lambda_{k,n} x^{-\varphi} \theta \Upsilon_n x^{\theta-1} dx \\ &= \frac{\theta}{\phi} \lambda_{k,n} \Upsilon_n c^{\theta-\varphi}\end{aligned}$$

- Remember that θ, φ,and $\lambda_{k,n}$ are parameters but Υ_n reflects the endogenous measure of sellers (derived below).

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- Extension: Let λ vary by source as well as destination and task, so that it's $\lambda_{k,ni}$.

- For each task k the buyer regards goods or offered by potential sellers or the appropriate type of labor as perfect substitutes, so she chooses the one offered at the lowest (quality adjusted) price.

Pricing

- Various alternatives: Bertrand, Cournot, Nash bargaining, efficient bargaining, etc.

- Here: marginal cost pricing (Nash bargaining with the buyer having all the power)

- We can't then have fixed costs of entry as in Melitz-Chaney-Arkolakis, but we won't need them to explain some basic patterns.

Cost Distribution

- From the Poisson, the probability no good is available at cost $C \leq c_k$:

$$e^{-\rho_{k,n}(c_k)} = \mathsf{exp}\left[-\left(\frac{\theta}{\phi}\lambda_{k,n}\Upsilon_n c_k^{\theta-\varphi}\right)\right]$$

- The probability that the appropriate workers can't perform the task below cost $c_k = w_{k,n}/q$:

$$F(w_{k,n}/c_k) = e^{-(w_{k,n}/c_k)^{-\phi}}$$

- Distribution of the lowest cost c ($= 1 - Pr$[no input or worker can perform the task at cost below c]):

$$\begin{aligned} G_{k,n}(c_k) &= 1 - e^{-\rho_{k,n}(c_k)}F(w_{k,n}/c_k) \\ &= 1 - \exp\left[-\left(\frac{\theta}{\phi}\lambda_{k,n}\Upsilon_n + w_{k,n}^{-\phi}\right)c_k^{\phi}\right] \\ &= 1 - e^{-\Xi_{k,n}c_k^{\phi}} \end{aligned}$$

(Weibull) where:

$$\Xi_{k,n} = \frac{\theta}{\phi}\lambda_{k,n}\Upsilon_n + w_{k,n}^{-\phi}$$

summarizes the ability to access low cost inputs for task k in market n.

Producers

- Measure of firms with efficiency greater than z in country i:

$$\mu_i^Z(z) = T_i z^{-\theta}$$

- Unit cost:

$$c_{ni}(j) = \frac{d_{ni} b_i(\boldsymbol{c})}{z},$$

where

$$b_i(\boldsymbol{c}) = \prod_{k=1}^{K} c_k^{\beta_k}$$

where c_k is the firm's cost for task k.

- $d_{ni} \geq 1$ iceberg cost of delivering 1 unit from i to n, with $d_{ii} = 1$.

- Measure of potential producers from i that can deliver to market n at a unit cost below c:

$$\begin{aligned}\mu_{ni}(c) &= \int_0^\infty ... \int_0^\infty \mu_i^z(d_{ni}b_i(\boldsymbol{c})/c)dG_{1,i}(c_1)...dG_{K,i}(c_K) \\ &= T_i d_{ni}^{-\theta} c^\theta \prod_{k=1}^{K} \left(\int_0^\infty c_k^{-\theta\beta_k} dG_{k,i}(c_k) \right) \\ &= BT_i \Xi_i d_{ni}^{-\theta} c^\theta\end{aligned}$$

where:

$$B = \prod_{k=1}^{K} \Gamma(1 - \widetilde{\beta}_k); \;\; \Gamma(a) = \int_0^\infty y^{a-1} e^{-y} dy; \;\; \widetilde{\beta}_k = \frac{\theta}{\phi}\beta^k; \;\; \Xi_i = \prod_{k=1}^{K} \Xi_{k,i}^{\widetilde{\beta}_k}$$

- Note how T_i and Ξ_i work together to lower prices.

- Aggregating:

$$\begin{aligned} \mu_n(c) &= \sum_{i=1}^{N} \mu_{ni}(c) \\ &= \Upsilon_n c^{\theta} \end{aligned}$$

where:

$$\Upsilon_n = B \sum_i T_i \Xi_i d_{ni}^{-\theta}$$

- Inserting the definition of Ξ_i and factoring out $w_{k,1}^{\phi}$, the Υ_i's solve:

$$\Upsilon_n = B \sum_i T_i \left(\overline{w}_i d_{ni}\right)^{-\theta} \prod_k \left(\frac{\theta}{\phi} \lambda_{k,i} \Upsilon_i w_{k,i}^{\phi} + 1\right)^{\widetilde{\beta}_k},$$

where

$$\overline{w}_i = \prod_k w_{k,i}^{\beta_k}$$

Trade Shares

- Probability a potential producer in n with unit cost below c is from i is:

$$\pi_{ni} = \frac{T_i \Xi_i d_{ni}^{-\theta}}{\sum_{i'} T_{i'} \Xi_{i'} d_{ni'}^{-\theta}}$$

  which is independent of c.

Consumer Demand

- Final spending on goods or labor services in n, X_n^C.

- Share $\alpha_k > 0$ for need k.

Final Customers

- Number of *potential* final customers in n for need k for a seller with unit cost c is distributed Poisson with parameter:

$$e_{k,n}(c)L_n = \lambda_{k,n}c^{-\varphi}L_n.$$

- Number of *actual* final consumers in n for need k for a seller with unit cost c is distributed Poisson with parameter:

$$\eta^C_{k,n}(c) = \lambda_{k,n}e^{-\Xi_{k,n}c^{\phi}}c^{-\varphi}L_n,$$

- Number of *total purchases* by final consumers in n for a seller with unit cost c is distributed Poisson with parameter:

$$\eta_n^C(c) = \sum_{k=1}^{K} \eta_{k,n}^C(c).$$

- Expected revenue from final sales in market n of a seller with unit cost c:

$$
\begin{aligned}
x_n^C(c) &= \sum_{k=1}^{K} \eta_{k,n}^C(c)\alpha_k y_n \\
&= \left(\sum_{k=1}^{K} \alpha_k \lambda_{k,n} e^{-\Xi_{k,n} c^{\phi}}\right) c^{-\varphi} X_n^C.
\end{aligned}
$$

- Integrating over c to get total sales:

$$\begin{aligned}\int_0^\infty x_n^C(c)d\mu_n(c) &= X_n^C \int_0^\infty \left(\sum_{k=1}^K \alpha_k \lambda_{k,n} e^{-\Xi_{k,n} c^\phi}\right) c^{-\varphi} \Upsilon_n \theta c^{\theta-1} dc \\ &= \left(1-\alpha_n^L\right) X_n^C,\end{aligned}$$

where α_n^L is the (endogenous) share of labor in final demand:

$$\alpha_n^L = \sum_l \alpha_n^l$$

and

$$\alpha_n^l = \sum_{k\in\Omega_l} \alpha_k \frac{w_{k,n}^{-\phi}}{\frac{\theta}{\phi}\lambda_{k,n}\Upsilon_n + w_{k,n}^{-\phi}}$$

is the fraction of needs fulfilled directly by labor of type l:

- Share of goods in final spending:

$$\Phi_n^C = (1 - \alpha_n^L)$$

Intermediate Demand

- Endogenous measure of active producers M_n

- Number of *potential* intermediate buyers in n for task k for a seller with unit cost c is distributed Poisson with parameter:

$$e_{k,n}(c)M_n = \lambda_{k,n}c^{-\varphi}M_n.$$

- Number of *actual* intermediate buyers in n for task k for a seller with unit cost c is distributed Poisson with parameter:

$$\eta^I_{k,n}(c) = \lambda_{k,n}e^{-\Xi_{k,n}c^\theta}c^{-\varphi}M_n.$$

- Number of *total purchases* by intermediate buyers in n from a seller with unit cost c is distributed Poisson with parameter:

$$\eta_n^I(c) = \sum_{k=1}^{K} \eta_{k,n}^I(c).$$

- By the properties of the Poisson distribution, $\eta_n^I(c)$ is also the expected number of intermediate sales for a seller with unit cost c in market n.

- Defining y_n^M as average value of production per producer in n, a firm with cost c therefore expects revenue from intermediate sales in n of:

$$\begin{aligned} x_n^I(c) &= \sum_k \beta_k \eta_{k,n}^I(c) y_n^M \\ &= \left(\sum_k \beta_k \lambda_{k,n} e^{-\Xi_{k,n} c^\theta} \right) c^{-\varphi} Y_n^M. \end{aligned}$$

where $Y_n^M = M_n y_n^M$ is the total value of gross production.

- Aggregating $x_n^I(c)$ over the cost distribution for firms selling in country n, total intermediate sales there are:

$$\begin{aligned} X_n^I &= \int_0^\infty x_n^I(c) d\mu_n(c) \\ &= (1 - \beta_n^L) Y_n^M, \end{aligned}$$

where:

$$\beta_n^l = \sum_{k \in \Omega_l} \beta_k \frac{w_{k,n}^{-\phi}}{\frac{\theta}{\phi}\lambda_{k,n}\Upsilon_n + w_{k,n}^{-\phi}}.$$

is the share of labor of type l in production and:

$$\beta_n^L = \sum_l \beta_n^l$$

is the total share of all types of labor in labor in manufacturing production. The share of intermediates in total costs is thus:

$$\mathbf{\Phi}_n^I = \mathbf{1} - \beta_n^L.$$

Labor Compensation/Gross Production
Austria
Belgium
Canada
Czech Republic
Denmark
Estonia
Finland
France
Germany
Greece
Hungary
Iceland
Ireland
Israel
Italy
Japan
Korea
Luxembourg
Mexico
Netherlands
New Zealand
Norway
Poland
Portugal
Slovak Republic
Slovenia
Spain
Sweden
United Kingdom
United States
West Germany
LC ratio
.3
.25
.2
.15
.1
1970
1990
2010
Year
Graphs by Country

Aggregate Relationships

- Manufacturing Equilibrium:

$$
\begin{aligned}
Y_i^M &= \sum_{n=1}^{N} \int_0^{\infty} \left[x_n^C(c') + x_n^I\left(c'\right)\right] d\mu_{ni}(c') \\
&= \sum_{n=1}^{N} \pi_{ni} \left[\Phi_n^C X_n^C + \Phi_n^I Y_n^M\right].
\end{aligned}
$$

- Matrix form:

$$
\boldsymbol{Y}^{\boldsymbol{M}} = \boldsymbol{\Pi}\left(\boldsymbol{\Phi}^C \boldsymbol{X}^C + \boldsymbol{\Phi}^I \boldsymbol{Y}^{\boldsymbol{M}}\right)
$$

where:

$$\mathbf{Y}^{\boldsymbol{M}} = \begin{bmatrix} Y_1^M \\ Y_2^M \\ . \\ . \\ . \\ Y_N^M \end{bmatrix}, \quad \boldsymbol{X}^C = \begin{bmatrix} X_1^C \\ X_2^C \\ . \\ . \\ . \\ X_N^C \end{bmatrix}$$

$$\mathbf{\Phi}^j = \begin{bmatrix} \Phi_1^j & 0 & \dots & 0 & 0 \\ 0 & \Phi_2^j & \dots & 0 & 0 \\ . & . & . \; . \; . & . & . \\ . & . & . \; . \; . & . & . \\ . & . & . \; . \; . & . & . \\ 0 & 0 & \dots & \Phi_{N-1}^j & 0 \\ 0 & 0 & \dots & 0 & \Phi_N^j \end{bmatrix} \quad j = C, I$$

and:

$$\mathbf{\Pi} = \begin{bmatrix} \pi_{11} & \pi_{21} & \cdots & \pi_{N-1,1} & \pi_{N1} \\ \pi_{12} & \pi_{22} & \cdots & \pi_{N-1,2} & \pi_{N2} \\ . & . & . \quad . \quad . & . & . \\ . & . & . \quad . \quad . & . & . \\ . & . & . \quad . \quad . & . & . \\ \pi_{1,N-1} & \pi_{2,N-1} & \cdots & \pi_{N-1,N-1} & \pi_{N,N-1} \\ \pi_{1N} & \pi_{2N} & \cdots & \pi_{N-1,N} & \pi_{NN} \end{bmatrix}$$

We can then solve for $\boldsymbol{Y^M}$ conditional on wages $\mathbf{w}$:

$$\boldsymbol{Y^M} = (\boldsymbol{I_N} - \mathbf{\Pi}\mathbf{\Phi}^I)^{-1}\mathbf{\Pi}\mathbf{\Phi}^C\boldsymbol{X}^C$$

where $\boldsymbol{I_N}$ is the $N \times N$ identity matrix.

Labor-Market Equilibrium

- Balanced trade, final spending on manufactures in country i, X_i^C, is equal to wage income Y_i^L, which corresponds in this model to GDP:

$$X_i^C = Y_i^L = \sum_l w_i^l L_i^l.$$

- Equilibrium in the market for labor of type l in country i solves the expression:

$$w_i^l L_i^l = \alpha_i^l Y_i^L + \beta_i^l Y_i^M.$$

- These sets of equations, for each l and i, determine w_i^l.

Simulation 1: Labor-Market Outcomes among Symmetric Economies

Table 1: Parameter Settings for Counterfactual

Parameter	symbol	value
Pareto parameter	theta	2
Technology level	T	1
Labor force (per country)	L	0.5
Labor by type (fractions of labor force):		
Nonproduction		0.6
Skilled		0.2
Unskilled		0.2
Task shares in production:	beta	
Nonproduction		0.4
Skilled		0.3
Unskilled		0.3
Task shares in consumption:	alpha	
Nonproduction		0.4
Skilled		0.3
Unskilled		0.3
Outsourcing parameters:	lambda	
Nonproduction		0
Skilled		0.01
Unskilled		1

Table 2: Counterfactual Results

	Level of iceberg trade cost					
	d=16	d=4	d=2	d=1.5	d=1.1	d=1
Mfg. value added share :						
Share of GDP	0.09	0.09	0.10	0.10	0.11	0.11
Share of mfg. gross production	0.42	0.42	0.40	0.39	0.38	0.37
Fraction of tasks outsourced:						
Skilled	0.05	0.05	0.07	0.08	0.10	0.11
Unskilled	0.55	0.56	0.58	0.61	0.64	0.66
Labor share of mfg. variable cost:						
Skilled	0.28	0.28	0.28	0.28	0.27	0.27
Unskilled	0.14	0.13	0.12	0.12	0.11	0.10
Import share	0.00	0.06	0.20	0.31	0.45	0.50
Wage:						
Nonproduction	0.81	0.82	0.83	0.84	0.86	0.87
Skilled	1.74	1.74	1.74	1.74	1.73	1.73
Unskilled	0.82	0.81	0.77	0.74	0.69	0.67
Skill premium (skilled/unskilled)	2.11	2.14	2.25	2.35	2.52	2.58
Real wage:						
Nonproduction	1.16	1.17	1.19	1.22	1.27	1.30
Skilled	2.47	2.48	2.51	2.54	2.57	2.59
Unskilled	1.17	1.16	1.12	1.08	1.02	1.00
Welfare (real per capita consumption)	1.42	1.43	1.44	1.46	1.48	1.49

1. Total payments to labor around the world are normalized to 1.

Implications of the Model for Firm-Level Outcomes: I. Number of Sellers

- Poisson parameter for the number of buyers of a seller with unit cost c in market n:

$$\begin{aligned}\eta_n(c) &= \eta_n^C(c) + \eta_n^I(c) \\ &= (L_n + M_n)\, c^{-\varphi} \sum_{k=1}^{K} \lambda_{k,n} e^{-\Xi_{k,n} c^{\phi}}\end{aligned}$$

where M_n remains to be determined.

Implications of the Model for Firm-Level Outcomes: II. Number of Producers

- Poisson parameter for the number of buyers anywhere of a seller with unit cost c in market i:

$$\begin{aligned} \eta_i^W(c) &= \sum_{n=1}^{N} \eta_n(cd_{ni}) \\ &= c^{-\varphi} \sum_{n=1}^{N} (L_n + M_n)\, d_{ni}^{-\varphi} \sum_{k=1}^{K} \lambda_{k,n} e^{-\Xi_{k,n} c^{\phi}} \end{aligned}$$

- To produce a seller has to have at least one buyer.

- Measure of firms producing in i

$$M_i = BT_i \Xi_i \int_0^{\infty} (1 - e^{-\eta_i^W(c)}) \theta \Upsilon_i c^{\theta-1} dc$$

- A complicated fixed point since $\eta_i^W(c)$ depends on M_n in each destination.

Implications of the Model for Firm-Level Outcomes: III. Buyers per Seller

- S_n number of customers in n, given c:

$$\Pr[S_n = s|c] = \frac{e^{-\eta_n(c)}\,[\eta_n(c)]^s}{s!}$$

- Expected number of buyers per active seller:

$$\begin{aligned} E[S_n|S_n &> 0] = \frac{1}{N_n}\int_0^\infty \eta_n(c)d\mu_n(c) \\ &= \frac{L_n + M_n}{N_n}\sum \frac{\frac{\theta}{\phi}\lambda_{k,n}\Upsilon_n}{\frac{\theta}{\phi}\lambda_{k,n}\Upsilon_n + w_n^{-\phi}} \end{aligned}$$

where N_n is the measure of active sellers.

- Because of the continuum, solving the aggregate model is easy.

- But for individual firm-level outcomes, the math gets complex.

Simulation 2: Market Size and Entry

Table 1: Parameter Settings for Simulation

Parameter	symbol	value
Pareto parameters:		
efficiency distribution	theta	5
price distribution	phi	3
Technology level per person	T_i/L_i	1
World labor force	L	1
Labor by type (fractions of labor force):		
nonproduction		0.6
production		0.4
Iceberg trade cost	d	1.2
Task shares in production (by labor type):	beta	
nonproduction		0.4
production		0.6
Task shares in consumption: same as for production	alpha	
Tasks by type of labor (equal shares)	K	
nonproduction		4
production		12
Outsourcing parameters:	lambda	
Nonproduction tasks		0
Production tasks		0.2

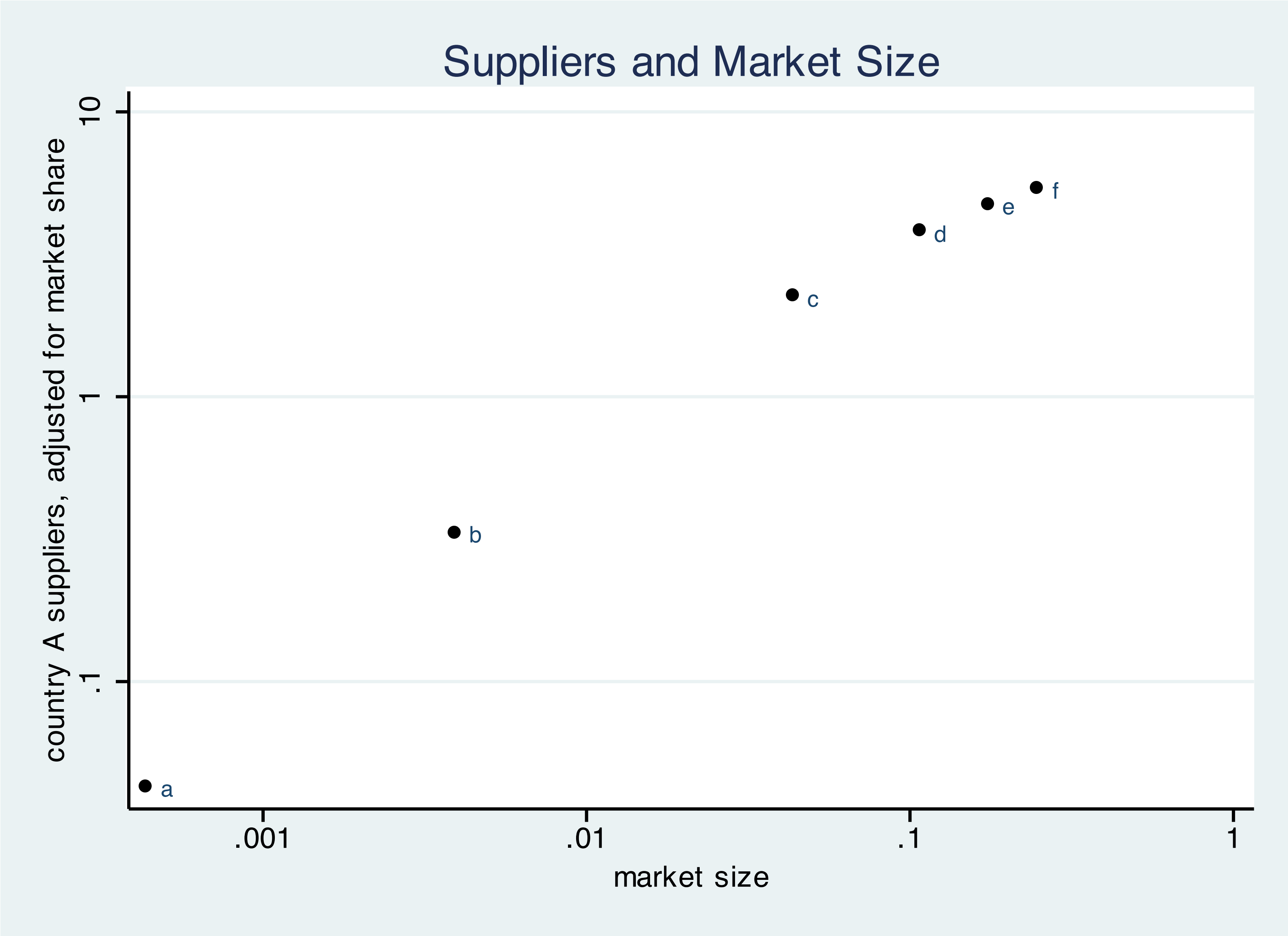
Table 2: Aggregate Results of Simulation

	Country Size					
	L=0.001	L=0.009	L=0.09	L=0.2	L=0.3	L=0.4
Mfg. value added share :						
Share of GDP	0.133	0.133	0.134	0.135	0.135	0.135
Share of mfg. gross production	0.27	0.27	0.26	0.24	0.23	0.22
Fraction of tasks outsourced:	0.55	0.55	0.57	0.60	0.62	0.64
Import share	1.00	0.98	0.79	0.61	0.49	0.39
Wage:						
nonproduction	0.91	0.91	0.96	1.01	1.06	1.11
production	0.93	0.93	0.92	0.91	0.91	0.90
Skill premium (nonproduction/production)	0.98	0.10	1.04	1.11	1.17	1.23
Real wage:						
nonproduction	1.39	1.40	1.46	1.54	1.61	1.67
production	1.42	1.42	1.41	1.39	1.37	1.36
Welfare (real per capita consumption)	1.40	1.41	1.44	1.48	1.51	1.54

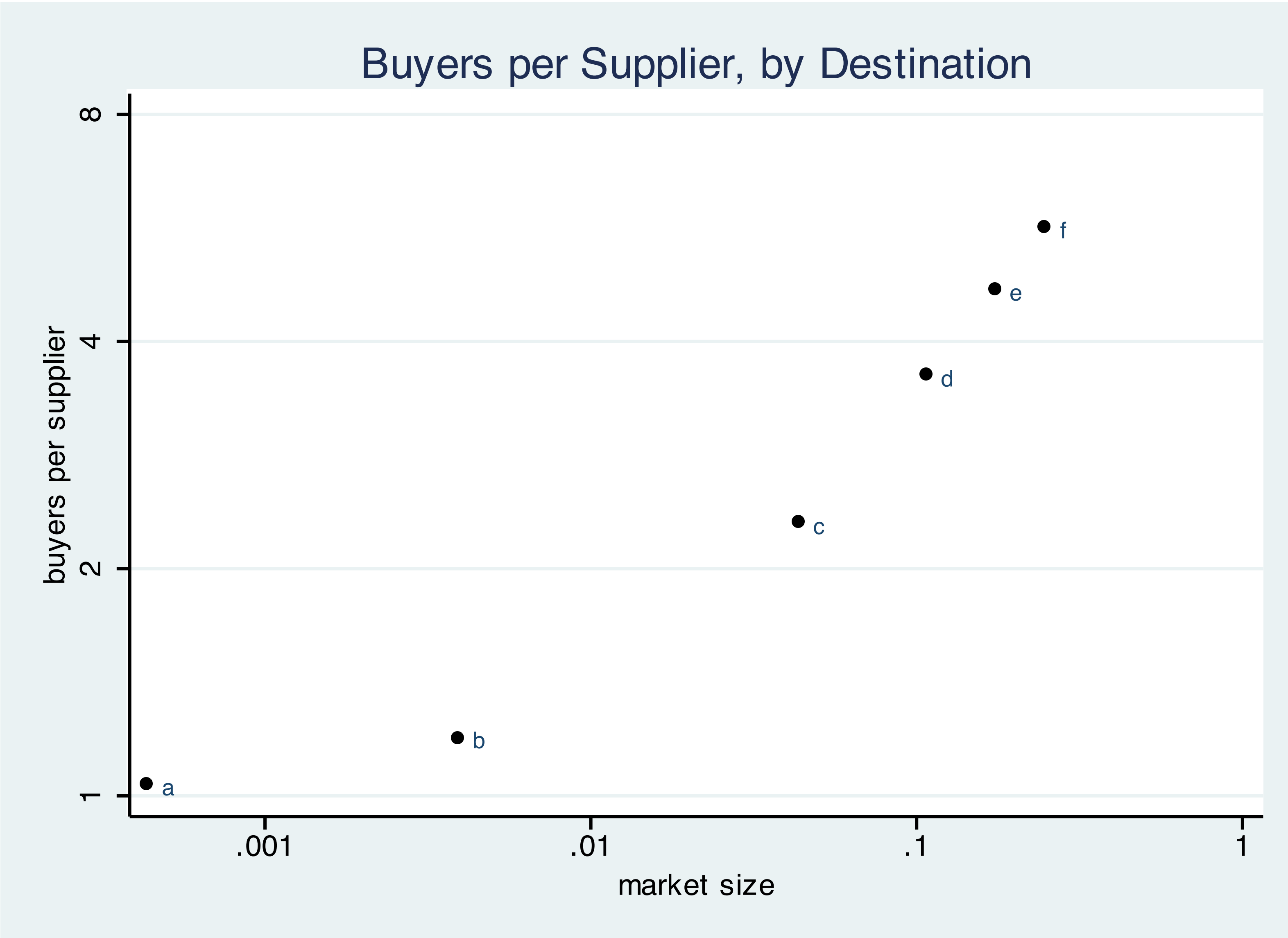
1. Total payments to labor around the world are normalized to 1.

Table 3: Firm-Level Results of Simulation

	Country Size					
	L=0.001	L=0.009	L=0.09	L=0.2	L=0.3	L=0.4
Measures of firms:						
producing	0.01	0.05	0.64	1.65	2.59	3.47
selling	0.04	0.34	2.21	3.72	4.62	5.27
Measures normalized by Labor:						
producing	5.7	5.8	7.1	8.2	8.6	8.7
selling	42.4	37.7	24.5	18.6	15.4	13.2
Fraction of firms:						
exporting						
selling domestically	0.02	0.15	0.71	0.88	0.92	0.93
Mean # customers per firm:	1.03	1.19	2.28	3.58	4.65	5.62
Size distribution (percentiles):						
25th	1	1	1	1	1	1
50th	1	1	1	2	2	2
75th	1	1	2	3	4	5
90th	1	2	4	7	10	12
95th	1	3	6	12	17	21
99th	2	4	15	30	43	55



Suppliers and Market Size
country A suppliers, adjusted for market share
10
1
.1
a
b
c
d
e
f
.001
.01
.1
1
market size



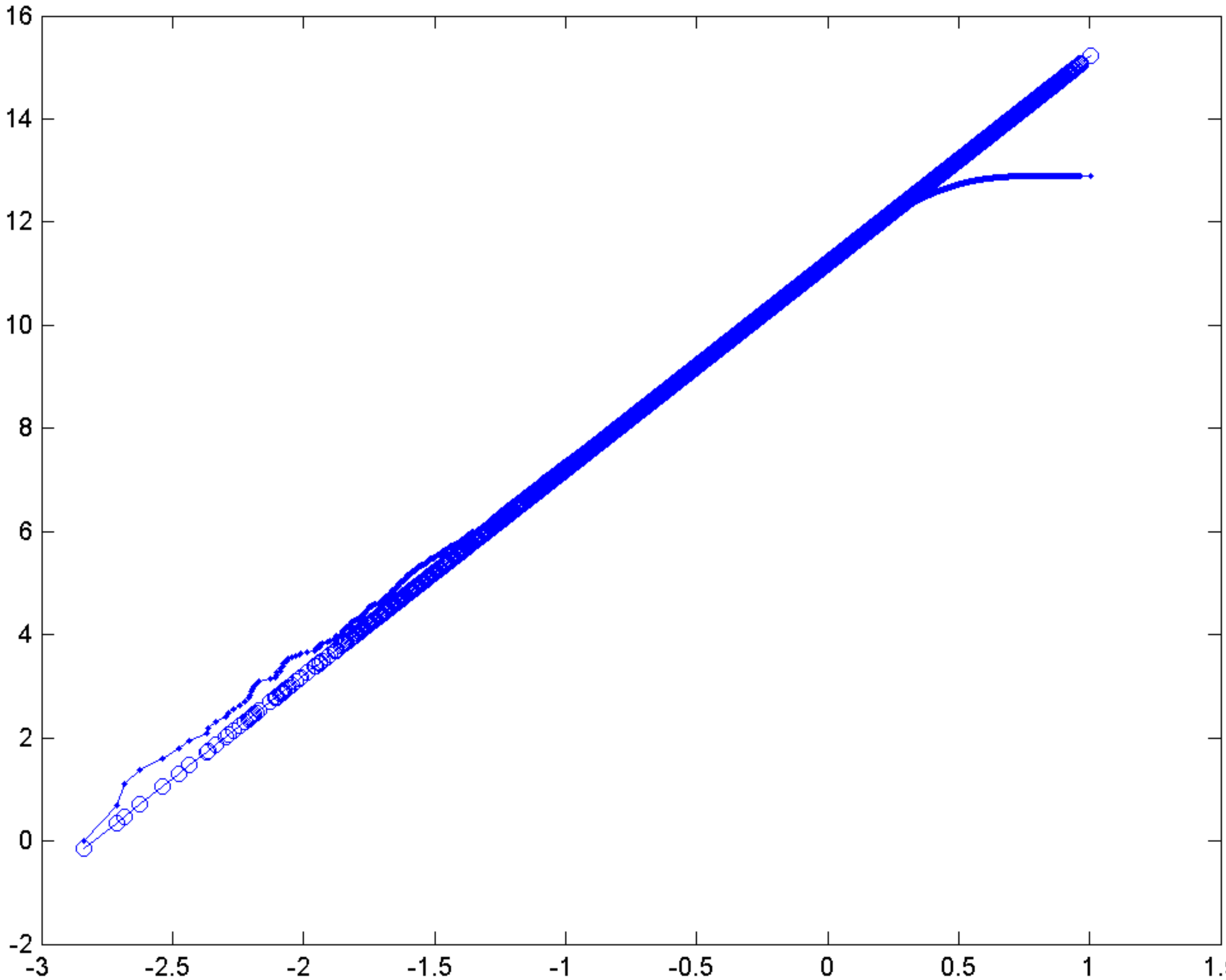
Buyers per Supplier, by Destination
buyers per supplier
1
2
4
8
.001
.01
.1
1
market size
a
b
c
d
e
f

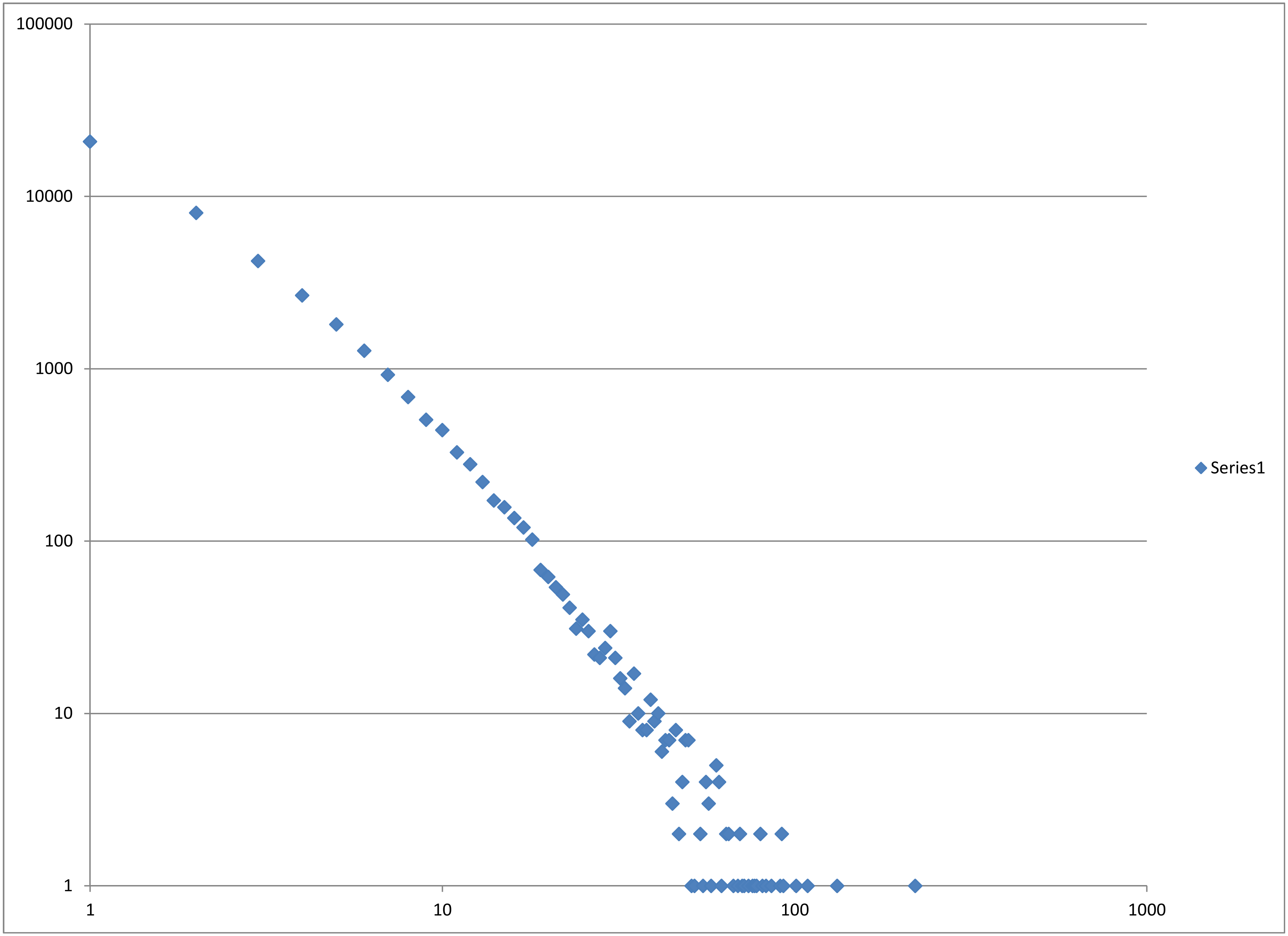
Simulation 3: Potential Producers, Active Sellers, and the Distribution of Buyers and Sales

Parameters for Finite-Firm Simulation (Closed Economy)

θ	4
φ	2
T	400,000
K	6
β	1/6
α	1/6

Cost distribution (in logs)





100000
10000
1000
100
10
1
1
10
100
1000
Series1

Implications

- A continuum of potential producers and workers

- Thus simple expressions for aggregate such as total consumption, production, and trade flows

- But individual producers buy from and sell to only a finite number of customers which can vary enormously from firm to firm (like Klette and Kortum, 2004).

- Individual firms are heterogeneous in size for four reasons:

1. As in Melitz, BEJK, or EKK I, in terms of underlying efficiency.

2. The efficiency of the input suppliers they hook up with.

3. How many buyers they meet up with.

4. How big those buyers are.

- The first two generate heterogeneity in unit cost, which is common across all destinations.

- The second two generate size heterogeneity for given unit cost which varies from destination to destination.

- Heterogeneity in unit cost, as in the Melitz, BEJK, or EKK can't explain why an efficient producer would ever skip over a market that a less efficient producer from the same source would sell in.

- It also can't explain why two producers from the same source don't sell in the same proportion in the markets where both do sell.

- EKK resorted to market-specific taste and entry cost shocks for an explanation.

- But luck in meeting buyers and in meeting buyers who are big varies from market to market, explaining why the fates of individual producers can very so much from destination to destination.

- The first two sources of heterogeneity reenforce each other.

- Firms heterogeneity in size and in use of inputs.

- Larger markets attract more sellers, but not proportionately more, in line with evidence on entry

- BEJK could not do this at all while Melitz requires entry costs that vary with market size with a particular elasticity (EKK).

- Fixed costs not needed.

Welfare and Largeness

- Melitz-Chaney-Arkolakis-EKK I: Largeness $\longrightarrow$ more active sellers $\longrightarrow$ higher welfare through greater variety

- EKK II: Largeness $\longrightarrow$ more active sellers $\longrightarrow$ same welfare (λ is what matters).

Easy Extensions

- Introducing λ_{ni} so that difficulty in meeting would be an alternative to iceberg trade costs (the d_{ni}'s) as a deterrent to trade. The two have different implications, however, since a smaller λ_{ni} makes a meeting more difficult, but does not render it more difficult to beat out the competition once a meeting occurs.

Hard Extensions

- A benchmark model: matches are random
  - without effort on either the seller's or buyer's part
  - independent of current contacts
- Hence it's a model of network formation without "networking."
- Dynamics