Firm-to-Firm Trade:

Imports, Exports, and the Labor Market

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April 2012

CAED, Nüremberg

Agenda

- Use data on French exporters/importers and their wages
- Display the detailed evidence.
- Extend the EKK version of Melitz to look at imports **and** exports
- Introduce labor markets (wages and employment)
- Combine efficient bargaining with firm export/import behavior
- Relate parameters of the model to the data (preliminary)

Related Literature

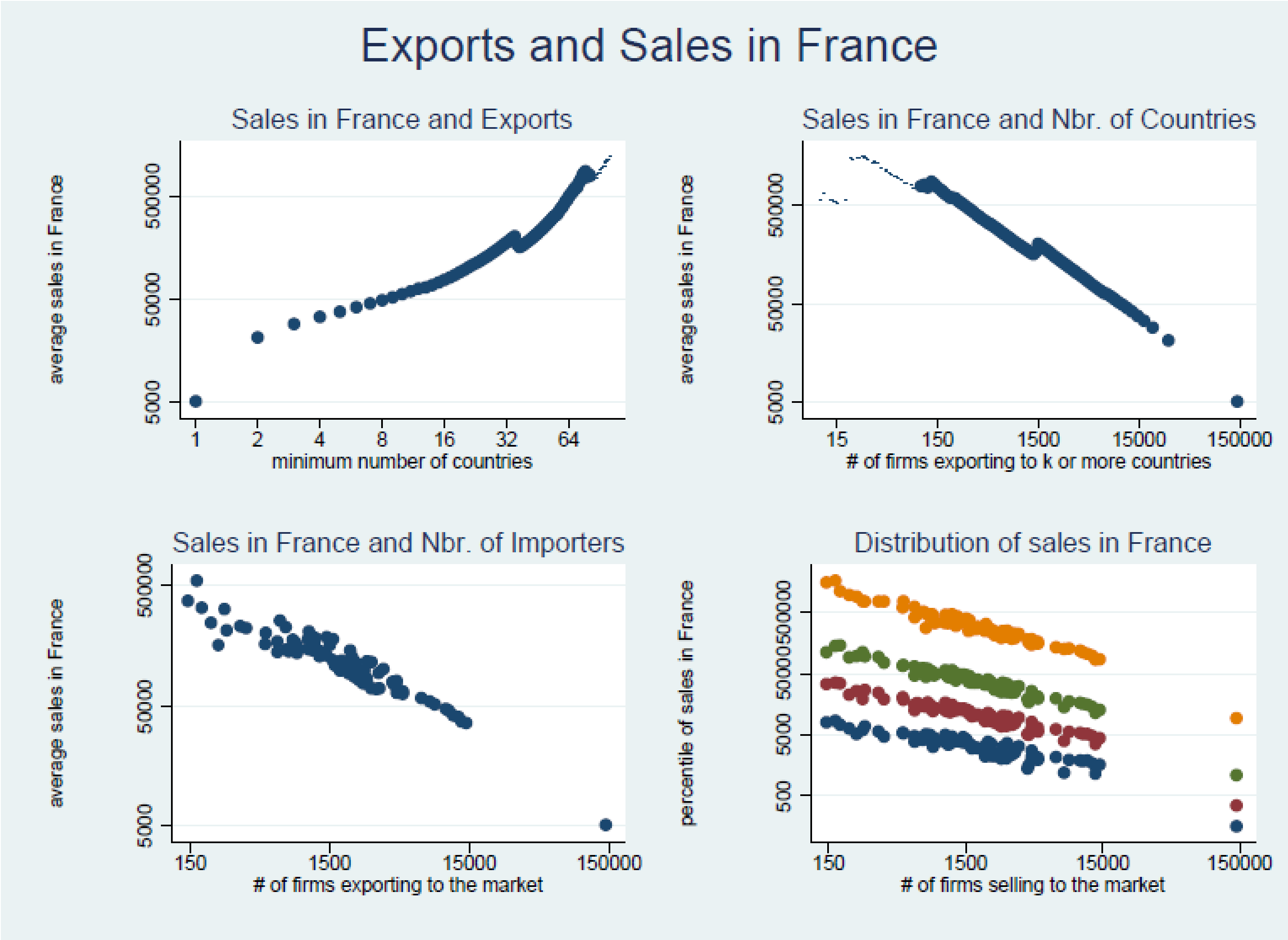
- Data: Bernard and Jensen (1995).

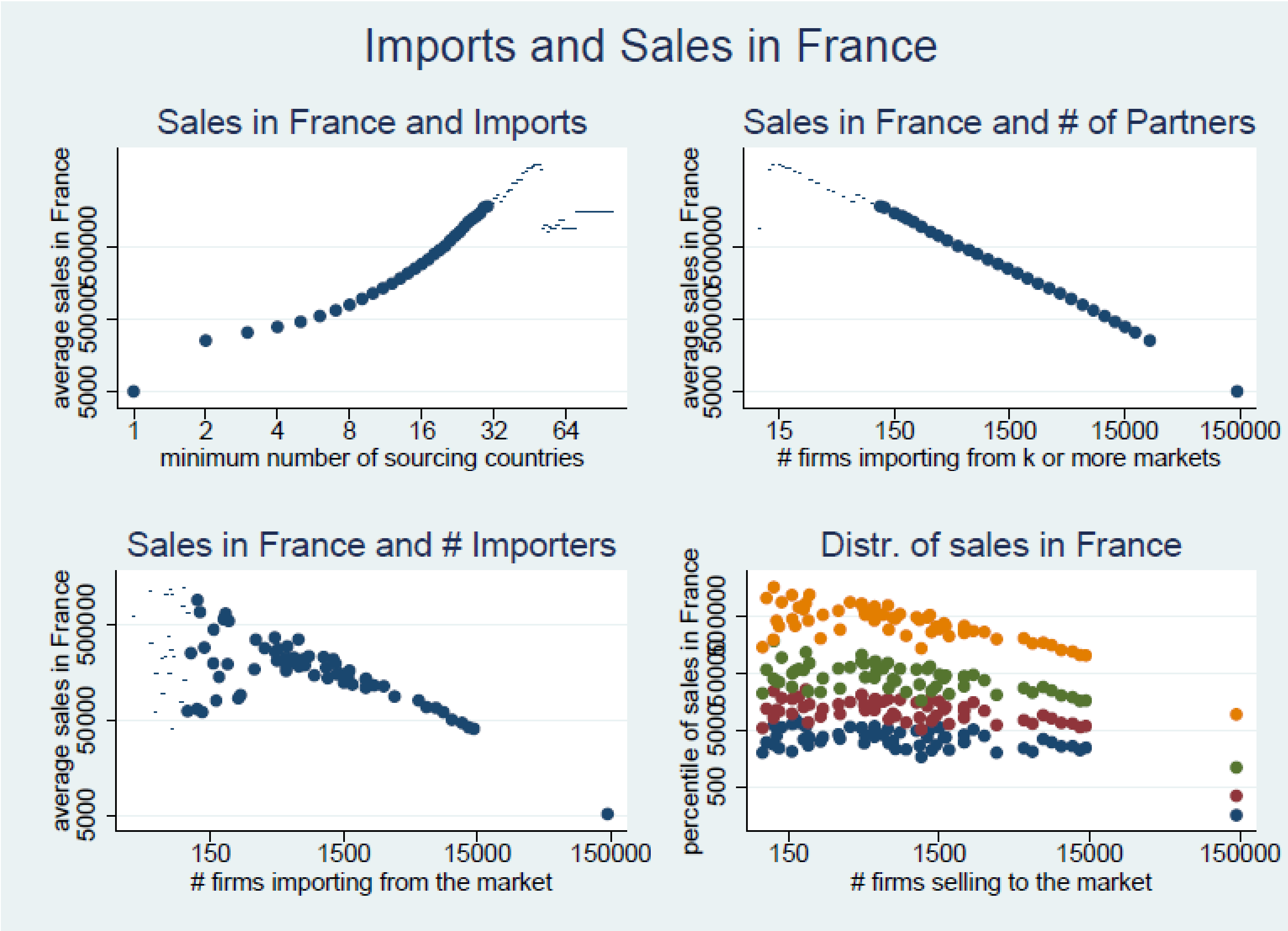
- Theory (on exports): Felbermayr, Prat, and Shmerer (2008), Egger and Kreickemeier (2009), Helpman, Itskhoki, and Redding (2010), Caliendo, Rossi-Hansberg (2012)

- Quantitative: Irarrazabal, Moxnes, and Ulltveit-Moe (2010), Klein, Moser, and Urban (2010), Frias, Kaplan, and Verhoogen (2010), Kramarz (2009), Caliendo, Monte, and Rossi-Hansberg (2012).

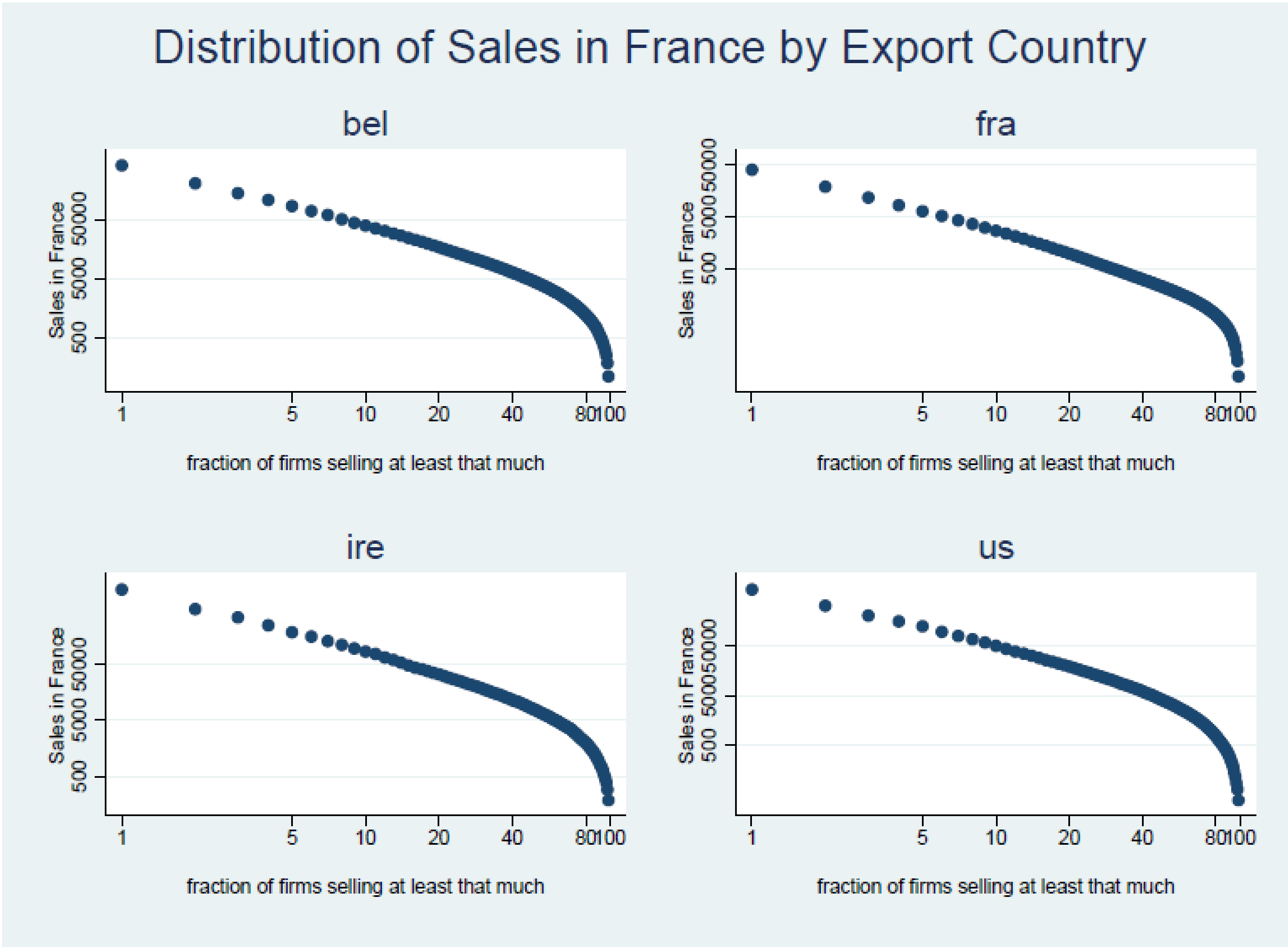
A Look at the Data

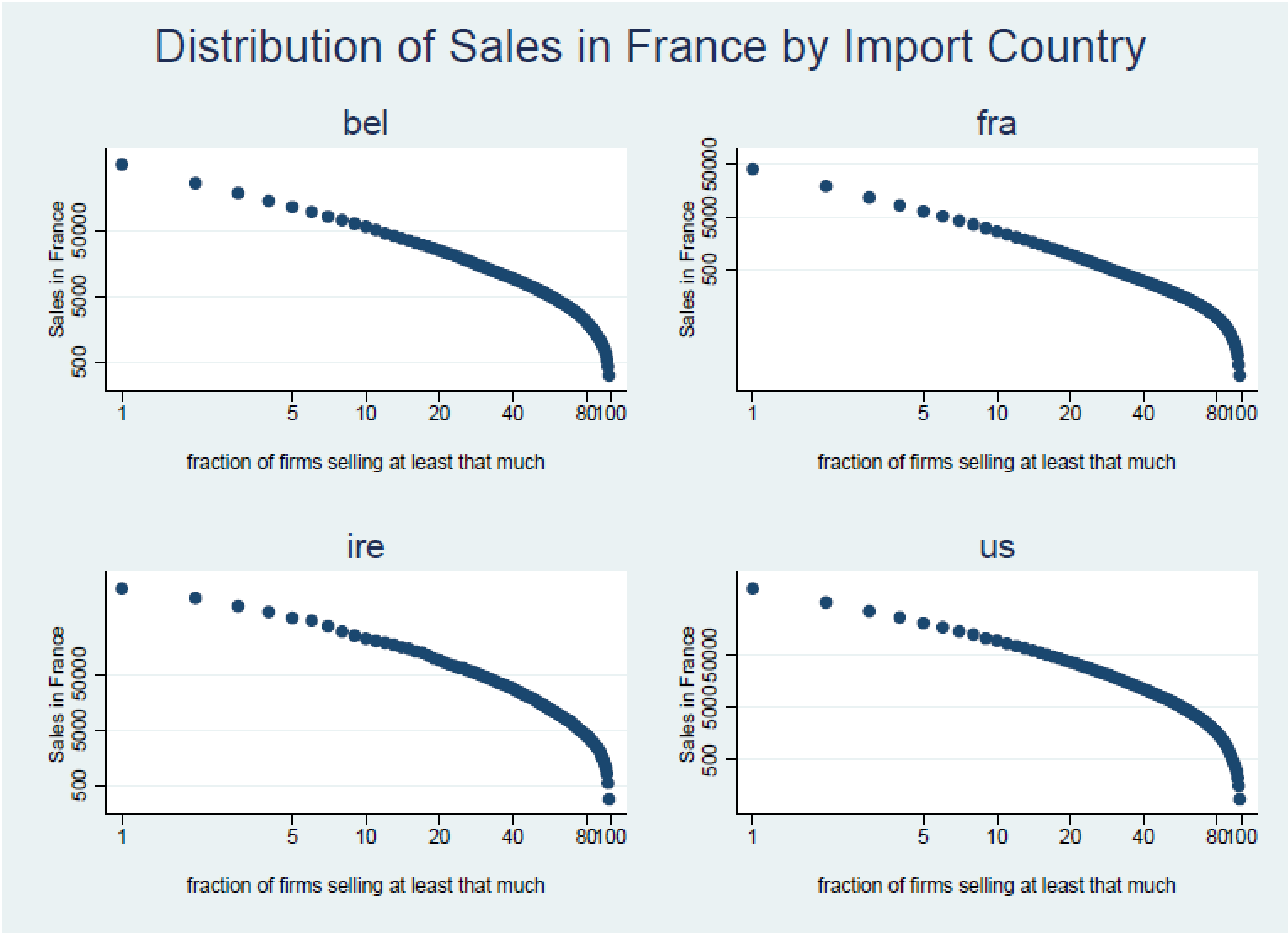
- Cross-section of 141,000 French manufacturing firms, in 2003
- Approximately 25,000 (20,000) of them export (import from) somewhere.
- Observe exports to (imports from) each of 112 destinations (origins)
- plus wages, employment (by skill-levels), purchases, and sales in France.
- Tables and Figures reveal some striking regularities ...


Exports and Sales in France
Sales in France and Exports
average sales in France
5000
50000
500000
1
2
4
8
16
32
64
minimum number of countries
Sales in France and Nbr. of Countries
average sales in France
5000
50000
500000
15
150
1500
15000
150000
# of firms exporting to k or more countries
Sales in France and Nbr. of Importers
average sales in France
5000
50000
500000
150
1500
15000
150000
# of firms exporting to the market
Distribution of sales in France
percentile of sales in France
500
5000
50000
500000
150
1500
15000
150000
# of firms selling to the market

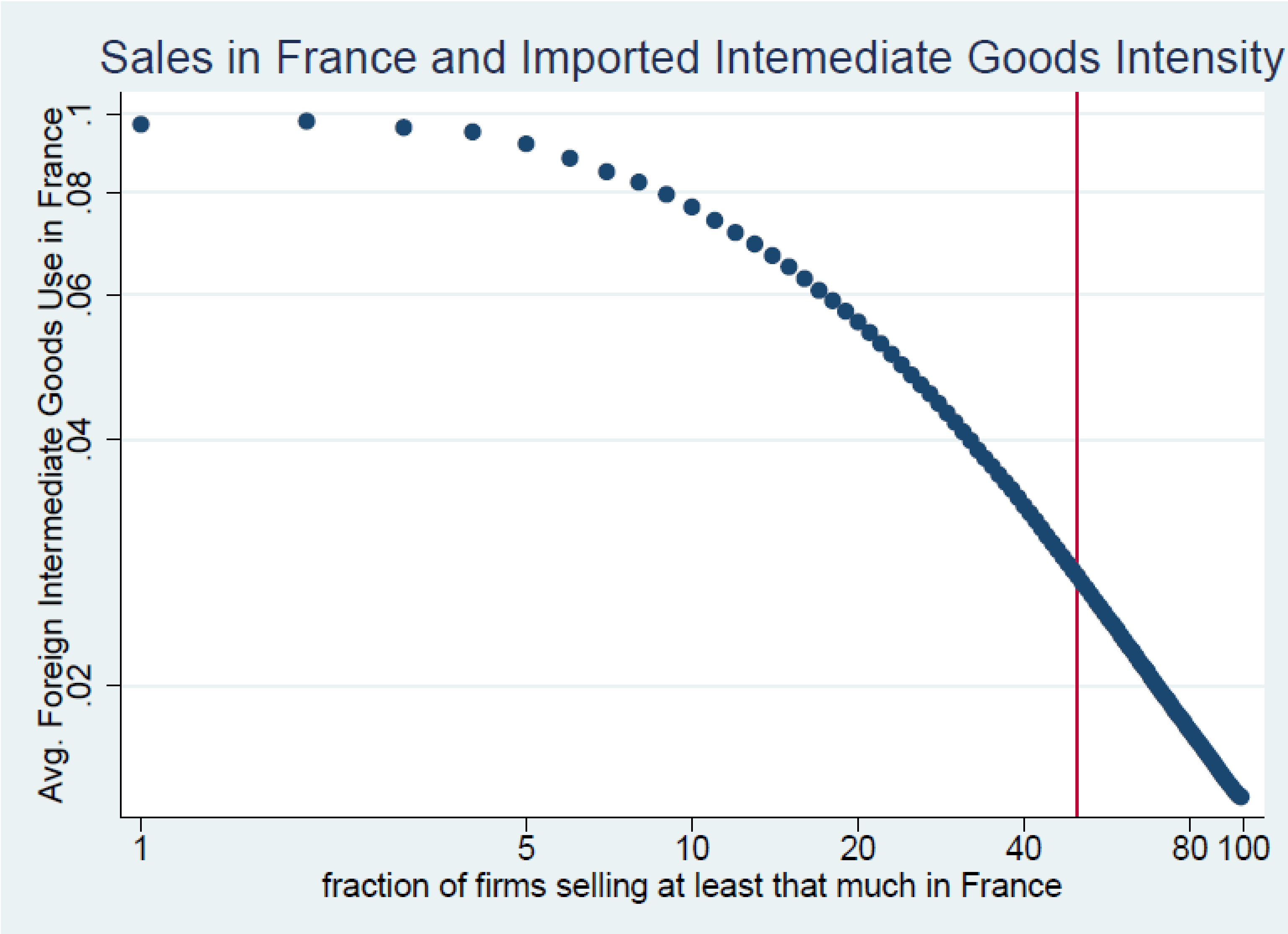


Imports and Sales in France
Sales in France and Imports
average sales in France
5000 50000 500000
1 2 4 8 16 32 64
minimum number of sourcing countries
Sales in France and # of Partners
average sales in France
5000 50000 500000
15 150 1500 15000 150000
firms importing from k or more markets
Sales in France and # Importers
average sales in France
5000 50000 500000
150 1500 15000 150000
firms importing from the market
Distr. of sales in France
percentile of sales in France
500 5000 50000 500000
150 1500 15000 150000
firms selling to the market

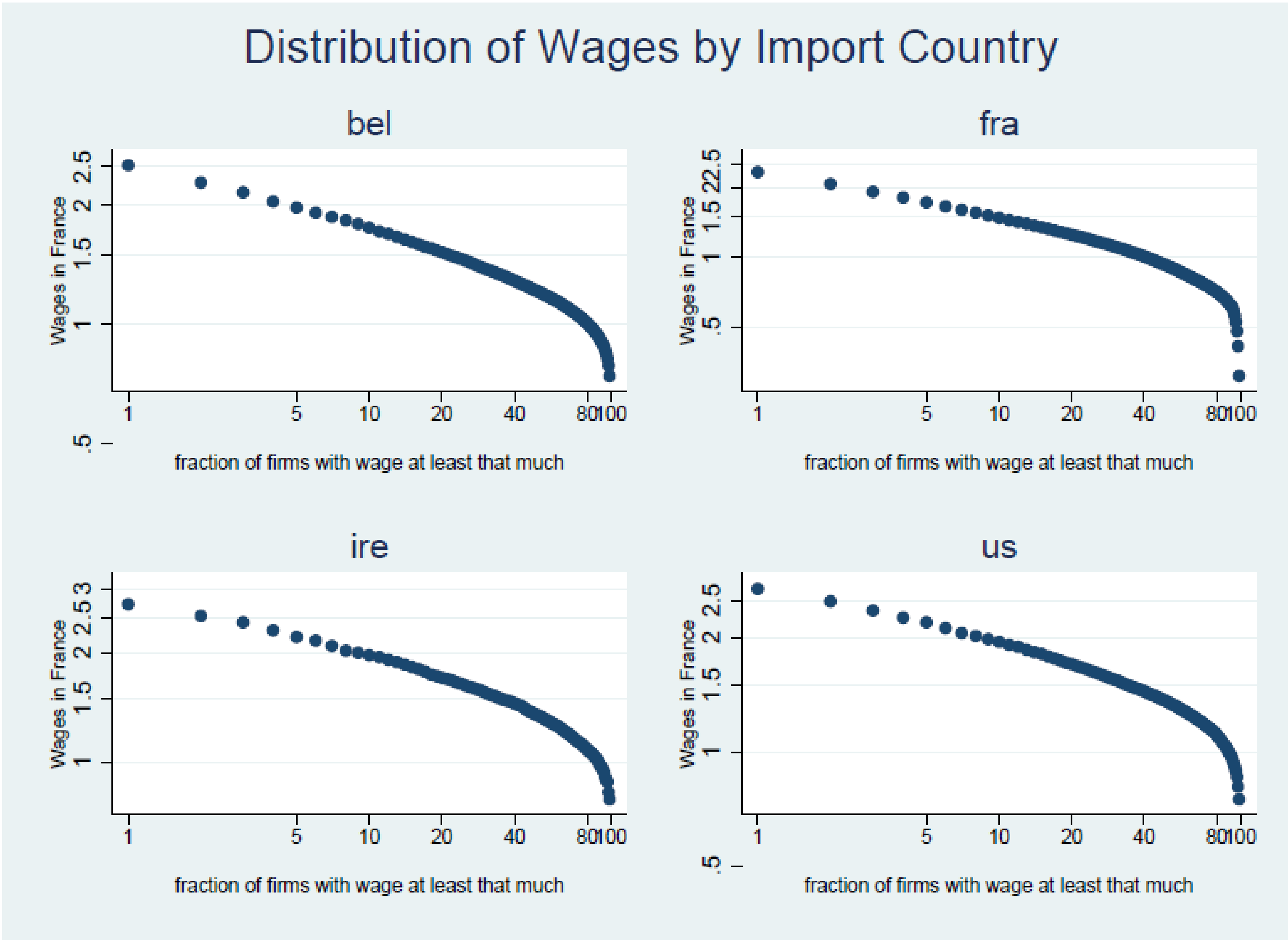

Distribution of Sales in France by Export Country
bel
fra
ire
us
Sales in France
500
5000
50000
1
5
10
20
40
80
100
fraction of firms selling at least that much



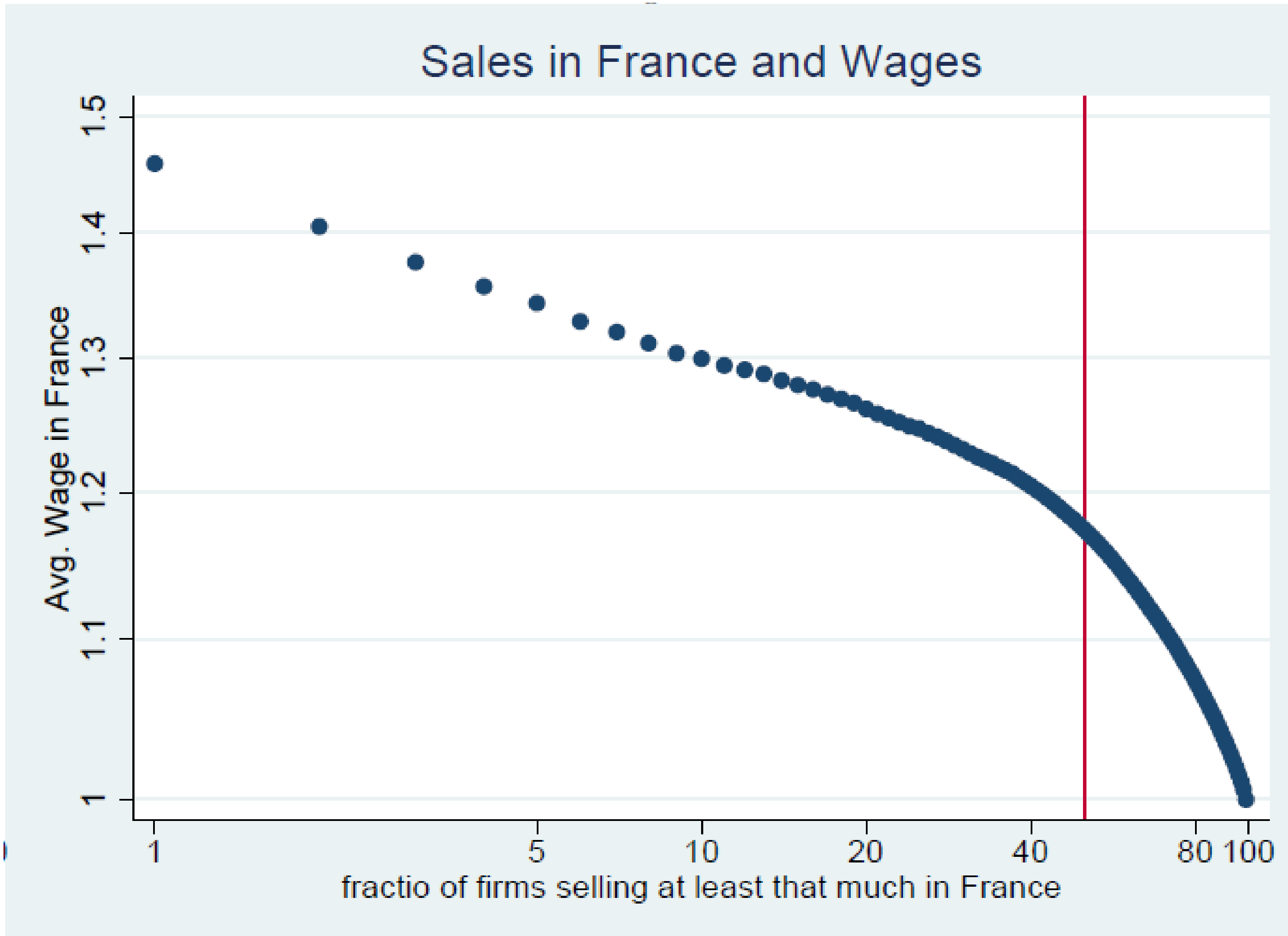
Distribution of Sales in France by Import Country
bel
fra
ire
us
Sales in France
500
5000
50000
1
5
10
20
40
80
100
fraction of firms selling at least that much

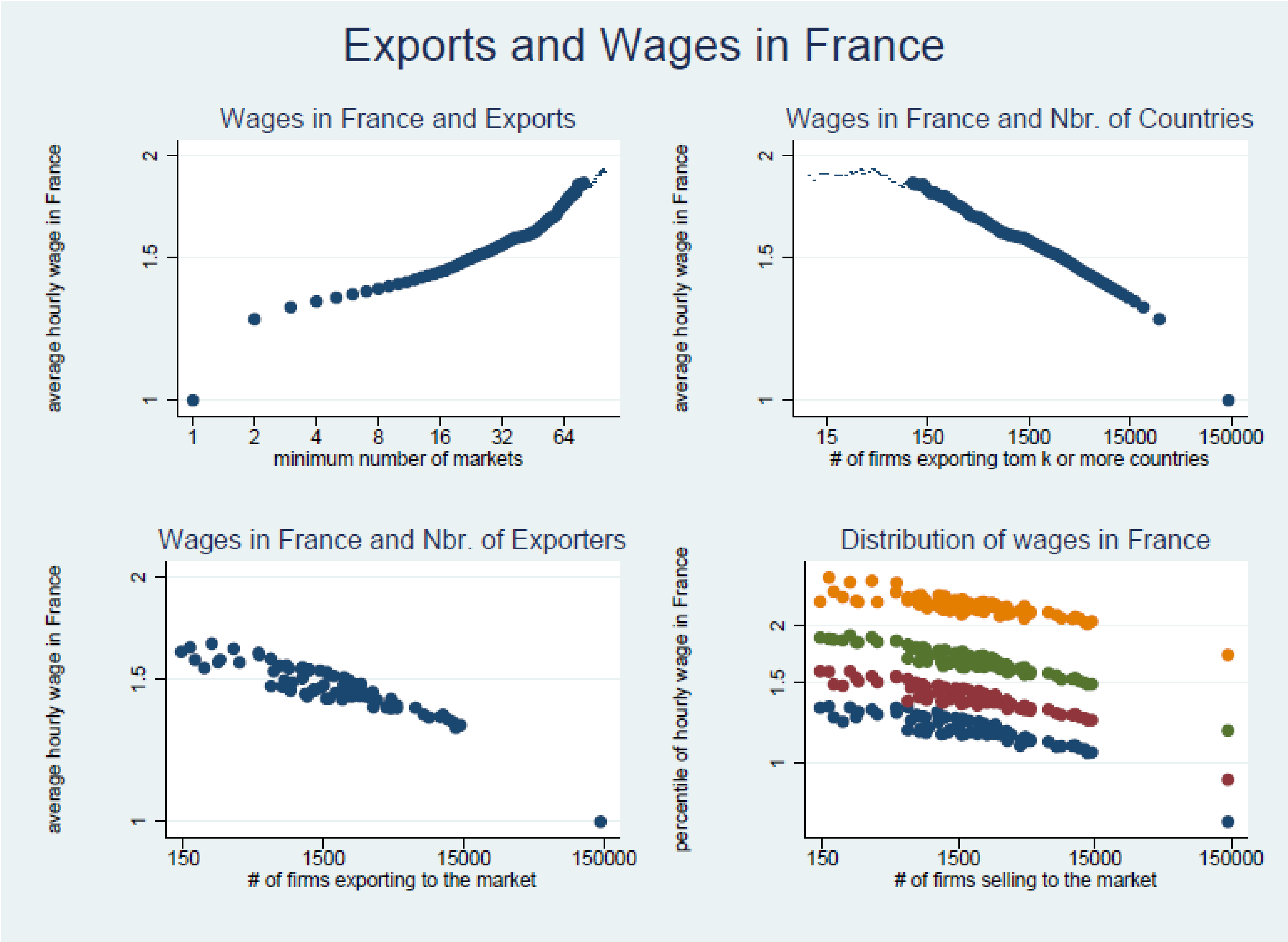

Sales in France and Imported Intemediate Goods Intensity
Avg. Foreign Intermediate Goods Use in France
.1
.08
.06
.04
.02
1
5
10
20
40
80 100
fraction of firms selling at least that much in France

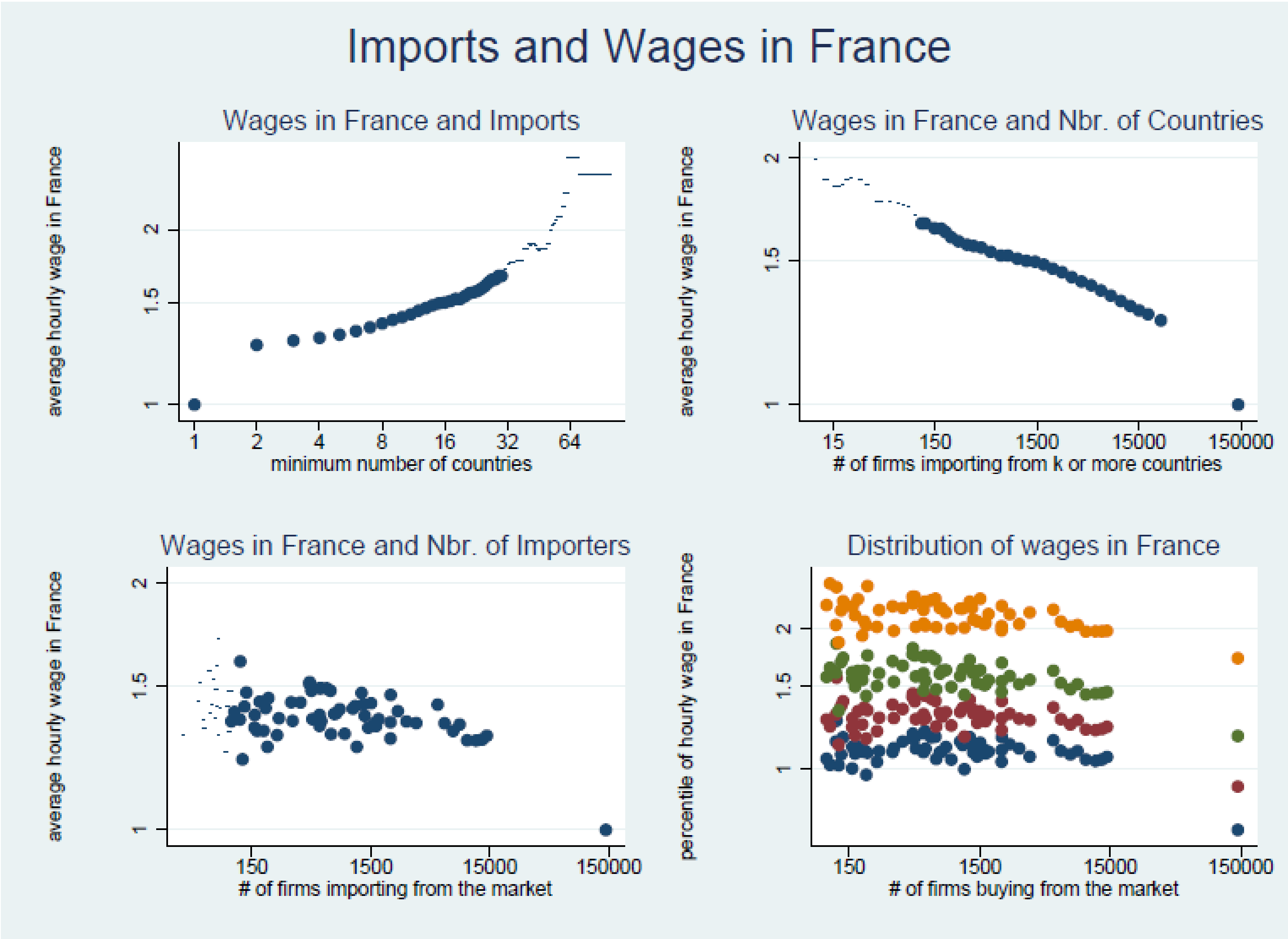
Distribution of Wages by Export Market
bel
fra
ire
us
Wages in France
fraction of firms with wage at least that much



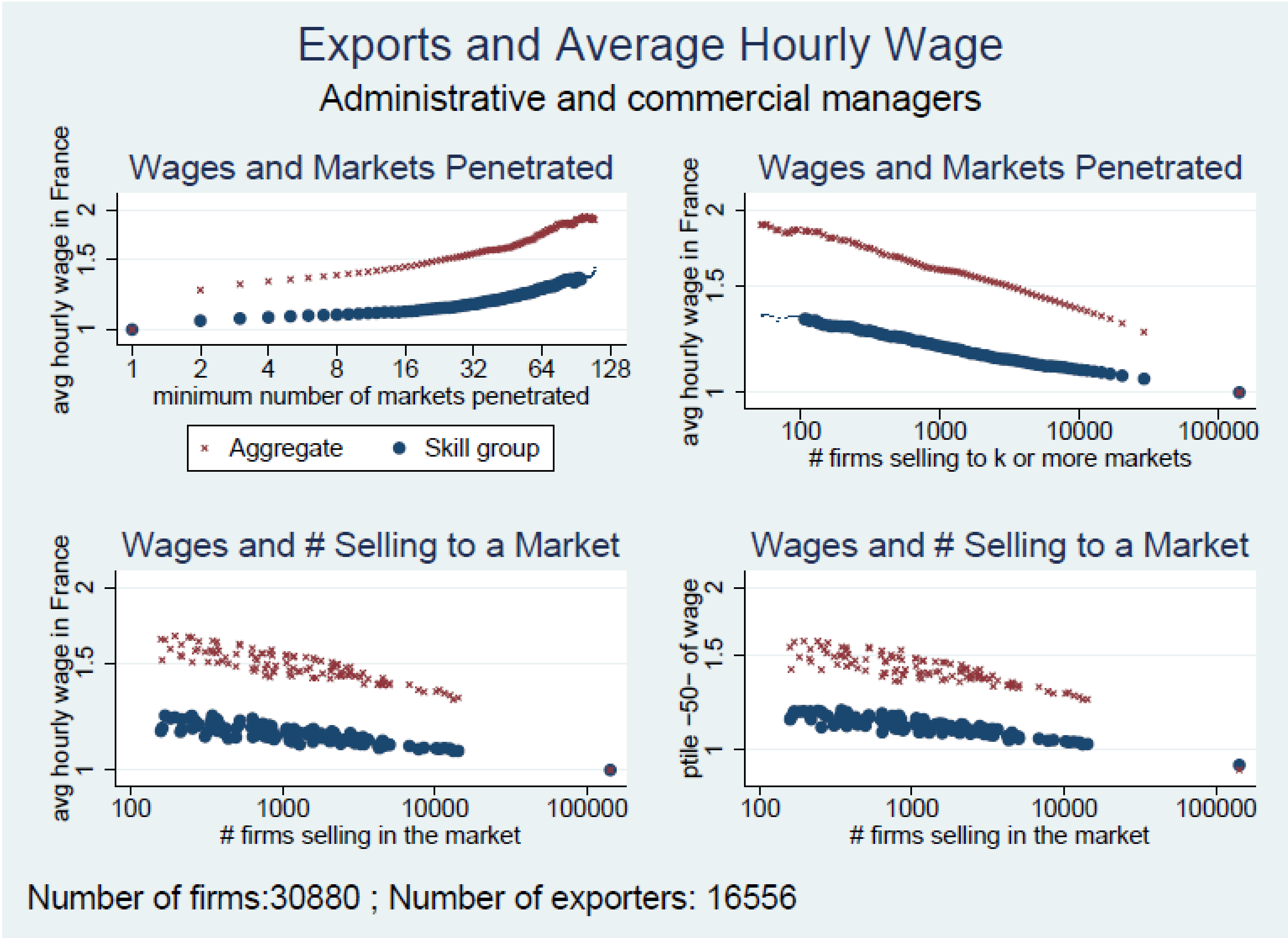
Distribution of Wages by Import Country
bel
fra
ire
us
Wages in France
fraction of firms with wage at least that much


Sales in France and Wages
Avg. Wage in France
1.5
1.4
1.3
1.2
1.1
1
1
5
10
20
40
80 100
fractio of firms selling at least that much in France

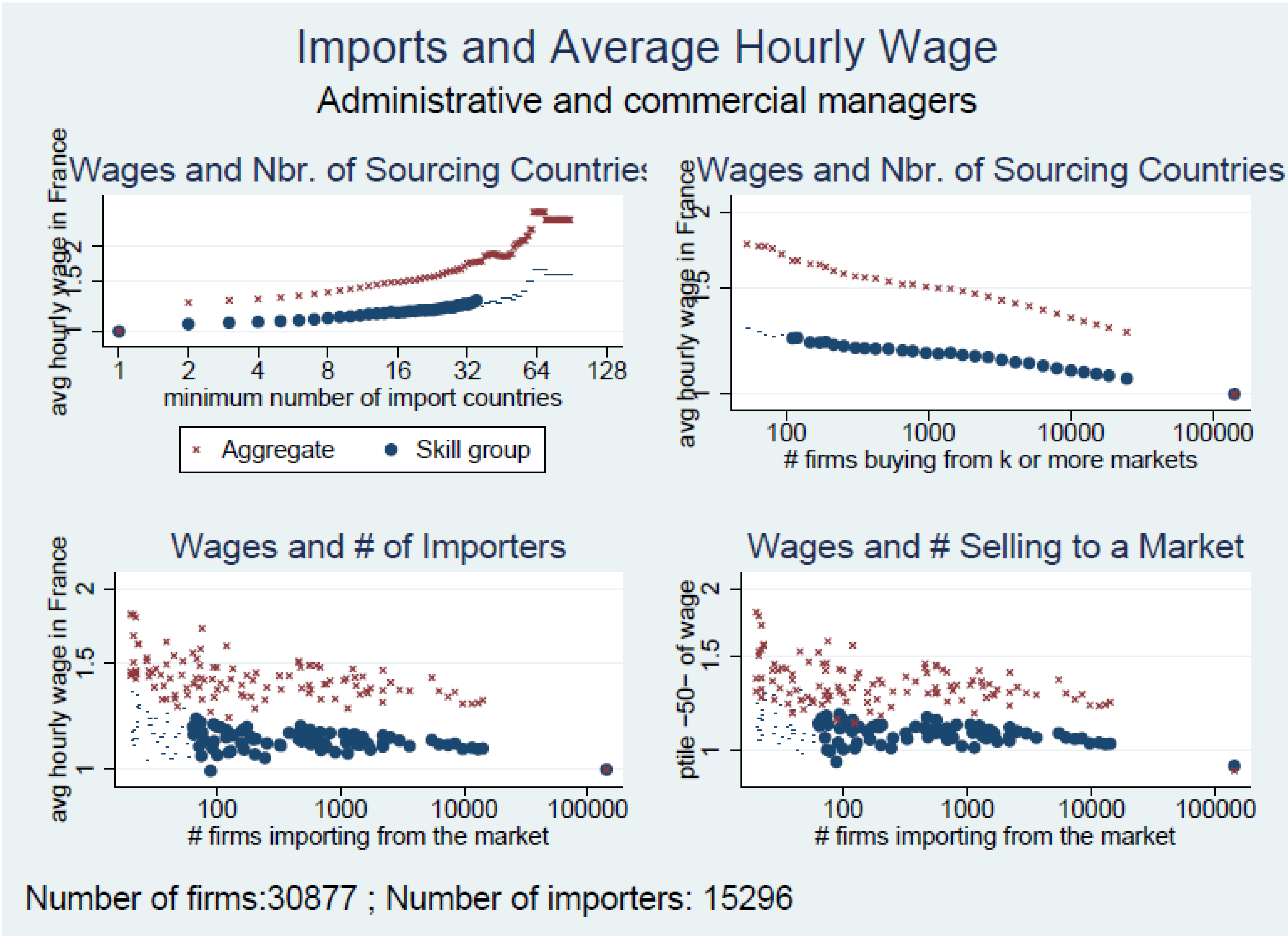

Exports and Wages in France
Wages in France and Exports
average hourly wage in France
2
1.5
1
1
2
4
8
16
32
64
minimum number of markets
Wages in France and Nbr. of Countries
average hourly wage in France
15
150
1500
15000
150000
# of firms exporting tom k or more countries
Wages in France and Nbr. of Exporters
average hourly wage in France
150
1500
15000
150000
# of firms exporting to the market
Distribution of wages in France
percentile of hourly wage in France
# of firms selling to the market

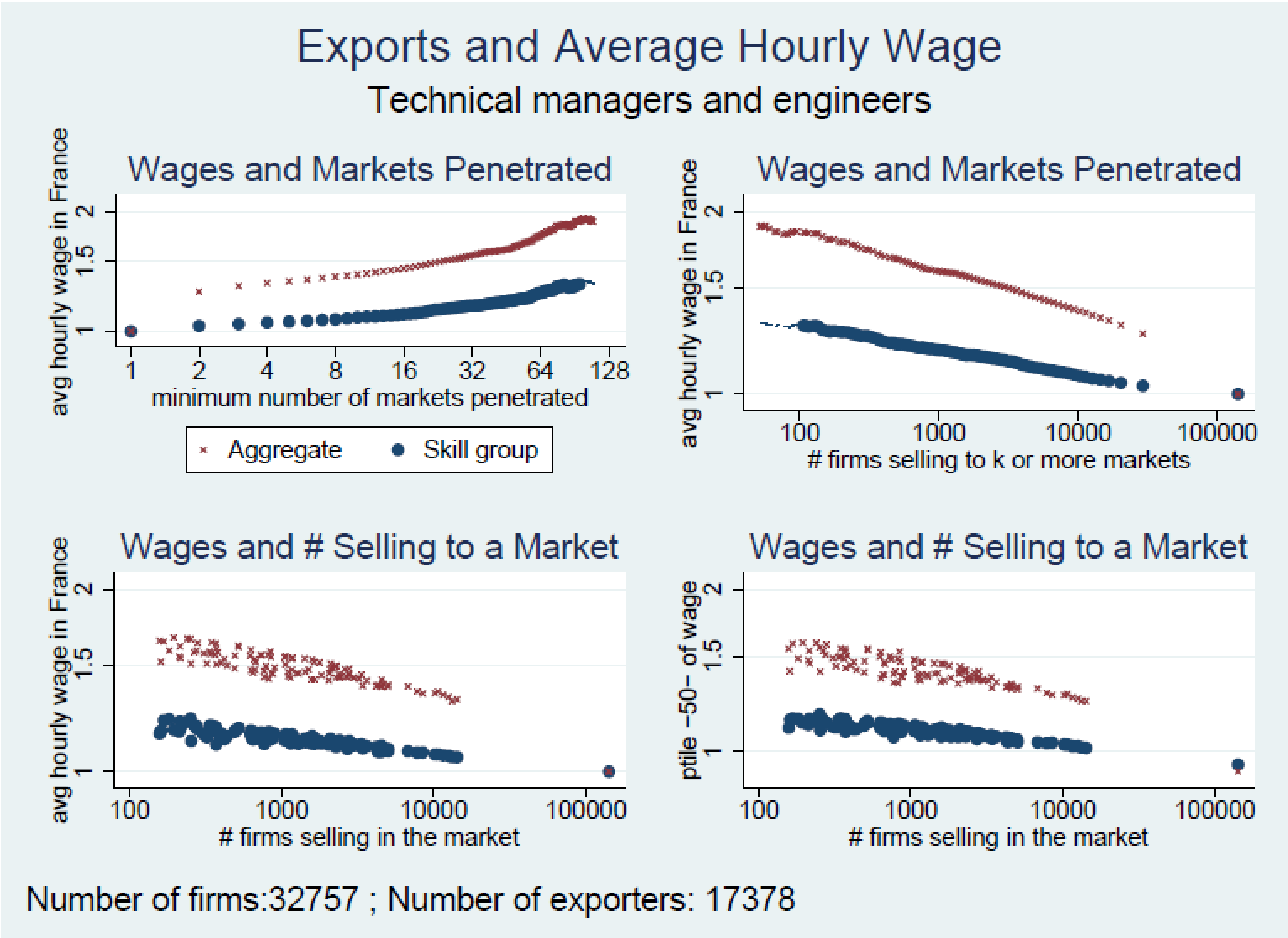


Imports and Wages in France
Wages in France and Imports
average hourly wage in France
minimum number of countries
1
2
4
8
16
32
64
1.5
Wages in France and Nbr. of Countries
# of firms importing from k or more countries
15
150
1500
15000
150000
Wages in France and Nbr. of Importers
# of firms importing from the market
Distribution of wages in France
percentile of hourly wage in France
# of firms buying from the market

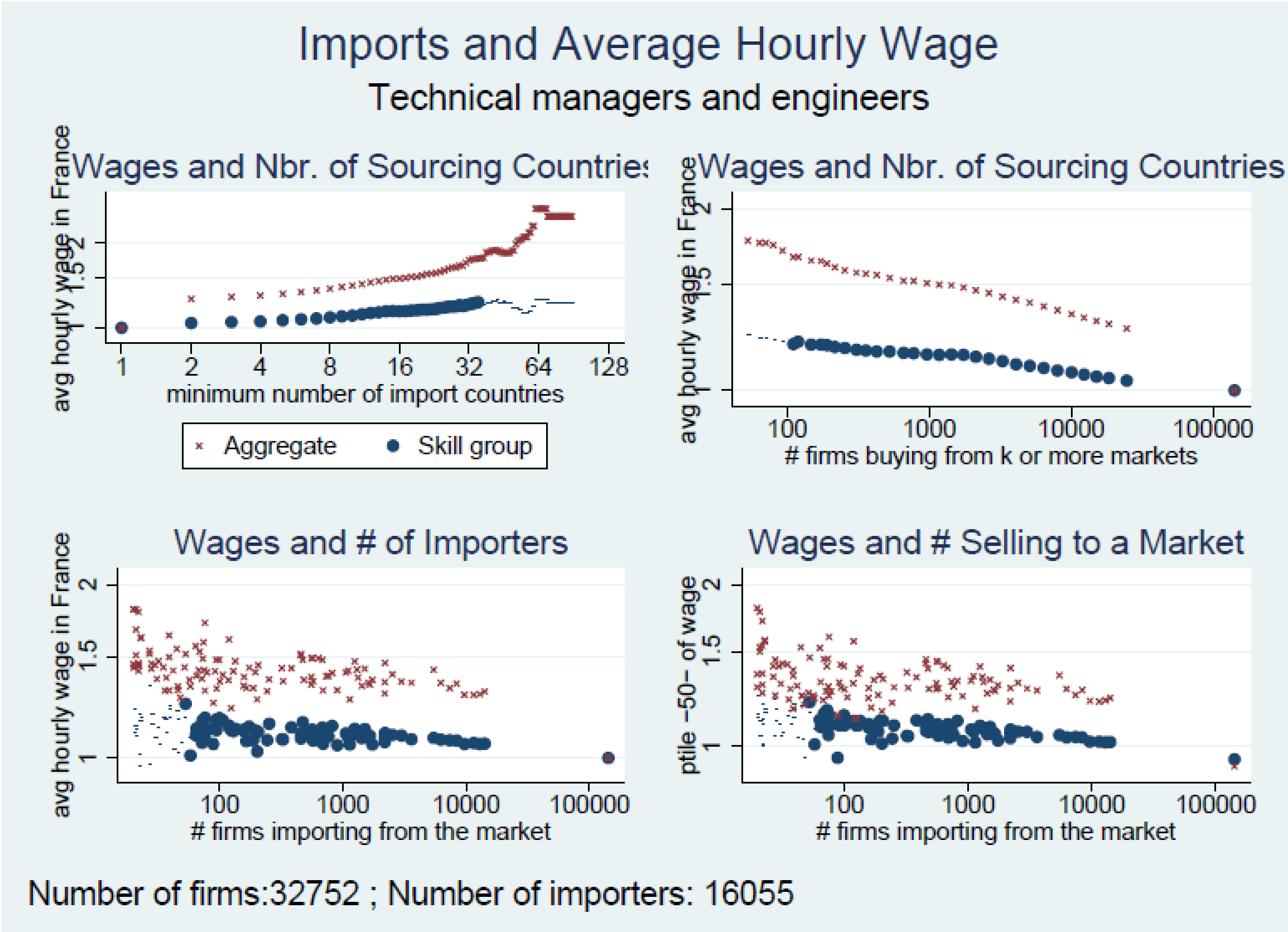


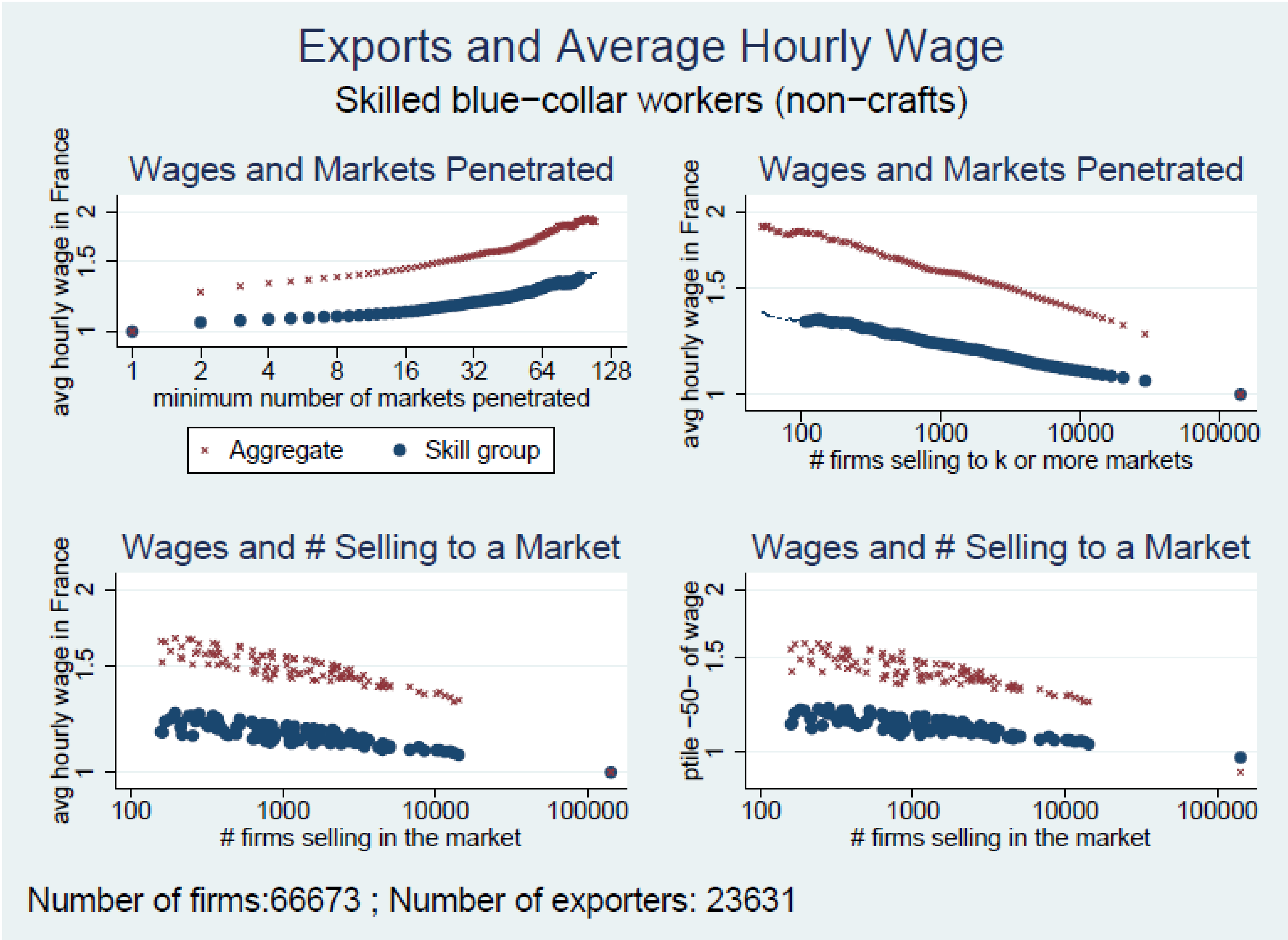
Exports and Average Hourly Wage
Administrative and commercial managers
Wages and Markets Penetrated
avg hourly wage in France
minimum number of markets penetrated
Aggregate
Skill group
firms selling to k or more markets
Wages and # Selling to a Market
firms selling in the market
ptile −50− of wage
Number of firms:30880 ; Number of exporters: 16556


Imports and Average Hourly Wage
Administrative and commercial managers
Wages and Nbr. of Sourcing Countries
avg hourly wage in France
minimum number of import countries
1
2
4
8
16
32
64
128
1
1.5
2
Aggregate
Skill group
Wages and Nbr. of Sourcing Countries
firms buying from k or more markets
100
1000
10000
100000
Wages and # of Importers
firms importing from the market
Wages and # Selling to a Market
ptile −50− of wage
Number of firms:30877 ; Number of importers: 15296

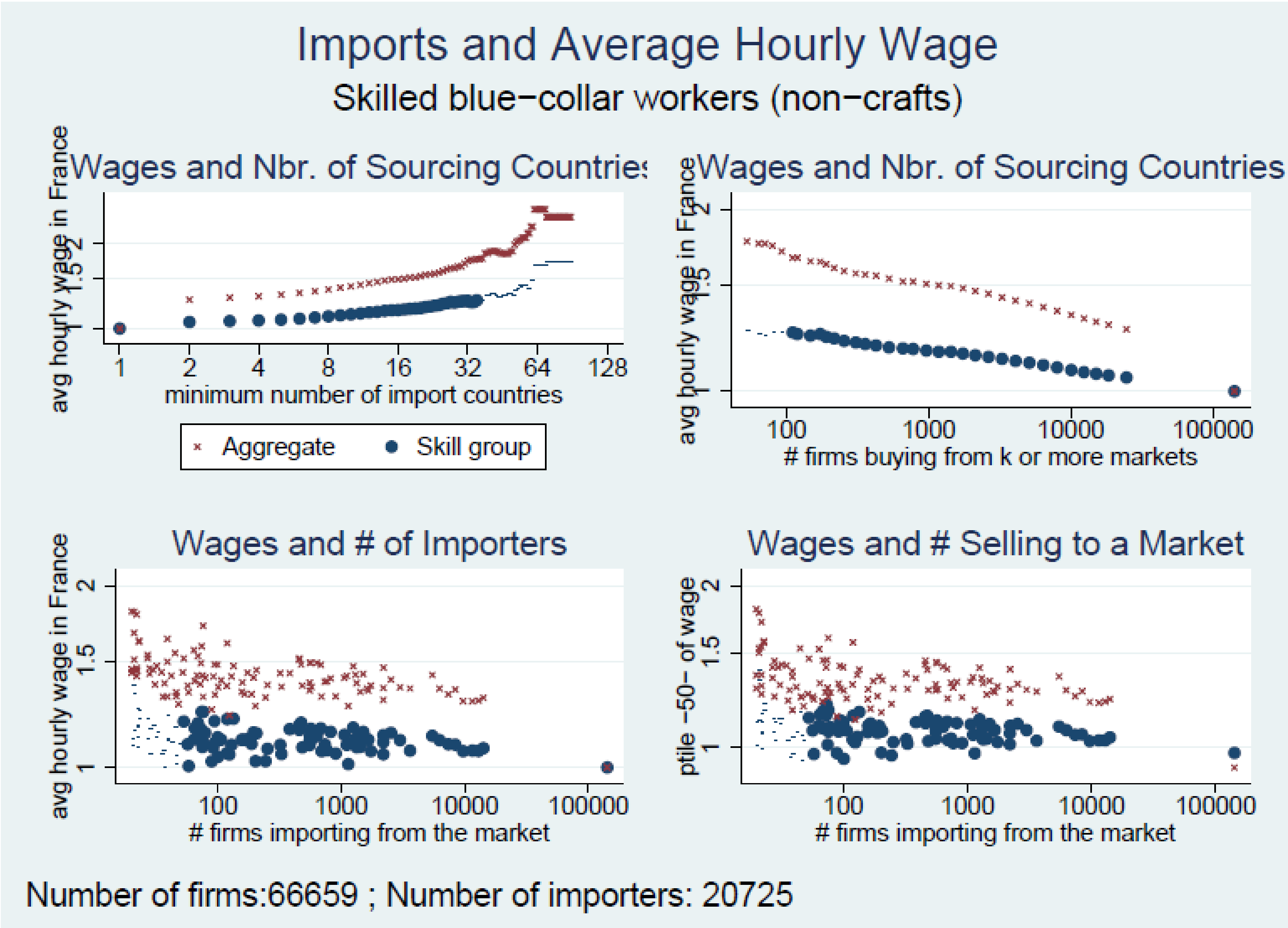


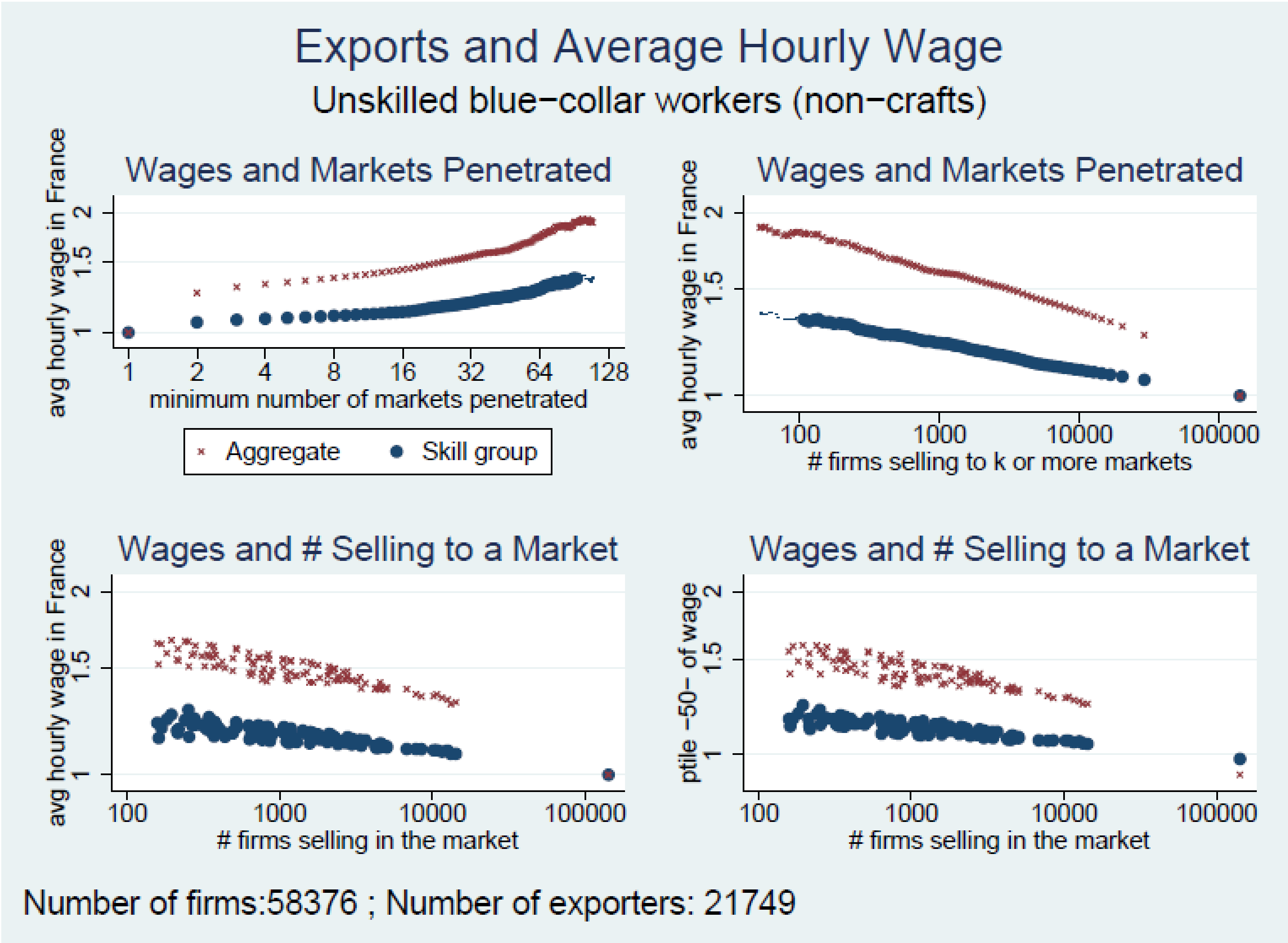
Exports and Average Hourly Wage
Technical managers and engineers
Wages and Markets Penetrated
avg hourly wage in France
minimum number of markets penetrated
Aggregate
Skill group
Wages and Markets Penetrated
avg hourly wage in France
firms selling to k or more markets
Wages and # Selling to a Market
avg hourly wage in France
firms selling in the market
Wages and # Selling to a Market
ptile −50− of wage
firms selling in the market
Number of firms:32757 ; Number of exporters: 17378


Imports and Average Hourly Wage
Technical managers and engineers
Wages and Nbr. of Sourcing Countries
avg hourly wage in France
1
1.5
2
1
2
4
8
16
32
64
128
minimum number of import countries
Aggregate
Skill group
Wages and Nbr. of Sourcing Countries
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms buying from k or more markets
Wages and # of Importers
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms importing from the market
Wages and # Selling to a Market
ptile −50− of wage
1
1.5
2
100
1000
10000
100000
firms importing from the market
Number of firms:32752 ; Number of importers: 16055

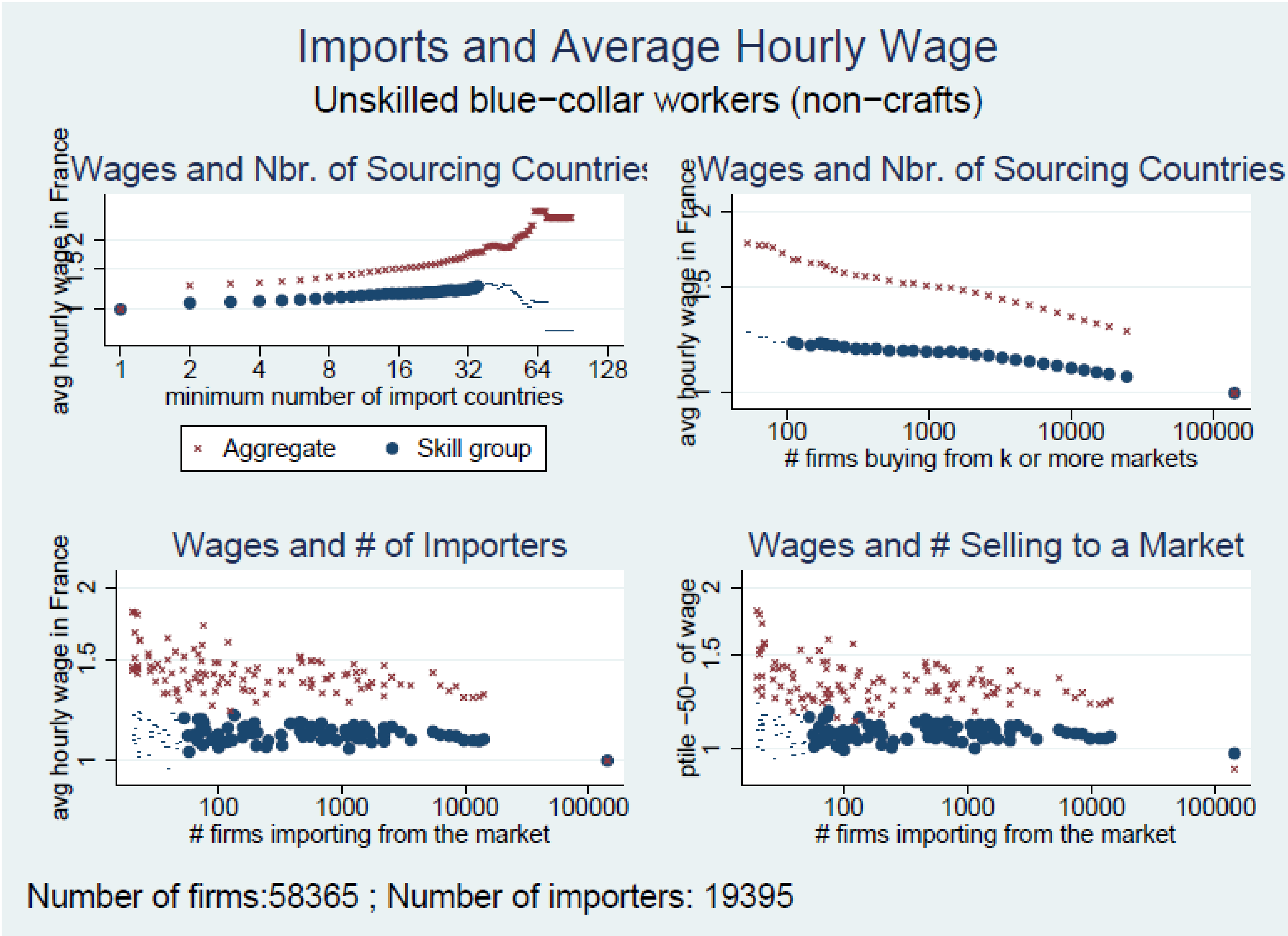


Exports and Average Hourly Wage
Skilled blue−collar workers (non−crafts)
Wages and Markets Penetrated
avg hourly wage in France
1
1.5
2
1
2
4
8
16
32
64
128
minimum number of markets penetrated
Wages and Markets Penetrated
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms selling to k or more markets
Aggregate
Skill group
Wages and # Selling to a Market
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms selling in the market
Wages and # Selling to a Market
ptile −50− of wage
1
1.5
2
100
1000
10000
100000
firms selling in the market
Number of firms:66673 ; Number of exporters: 23631


Imports and Average Hourly Wage
Skilled blue−collar workers (non−crafts)
Wages and Nbr. of Sourcing Countries
avg hourly wage in France
1
1.5
2
1
2
4
8
16
32
64
128
minimum number of import countries
Aggregate
Skill group
Wages and Nbr. of Sourcing Countries
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms buying from k or more markets
Wages and # of Importers
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms importing from the market
Wages and # Selling to a Market
ptile −50− of wage
1
1.5
2
100
1000
10000
100000
firms importing from the market
Number of firms:66659 ; Number of importers: 20725



Exports and Average Hourly Wage
Unskilled blue−collar workers (non−crafts)
Wages and Markets Penetrated
avg hourly wage in France
minimum number of markets penetrated
1 2 4 8 16 32 64 128
Aggregate
Skill group
Wages and Markets Penetrated
firms selling to k or more markets
100 1000 10000 100000
Wages and # Selling to a Market
firms selling in the market
Wages and # Selling to a Market
ptile −50− of wage
firms selling in the market
Number of firms:58376 ; Number of exporters: 21749



Imports and Average Hourly Wage
Unskilled blue−collar workers (non−crafts)
Wages and Nbr. of Sourcing Countries
avg hourly wage in France
1
1.5
2
1
2
4
8
16
32
64
128
minimum number of import countries
Aggregate
Skill group
Wages and Nbr. of Sourcing Countries
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms buying from k or more markets
Wages and # of Importers
avg hourly wage in France
1
1.5
2
100
1000
10000
100000
firms importing from the market
Wages and # Selling to a Market
ptile −50− of wage
1
1.5
2
100
1000
10000
100000
firms importing from the market
Number of firms:58365 ; Number of importers: 19395

	Purchases of Intermediates/Total Sales		*Purchases of Intermediates in France/Total Sales*		*Log Average Hourly Wage*		*Log Employment*	
number of destinations=2	0.0395		0.0350		0.0229		-0.0534	
number of destinations=3	0.0501		0.0464		0.0243		-0.0874	
number of destinations=4	0.0548		0.0512		0.0341		-0.1178	
number of destinations=5	0.0560		0.0482		0.0248		-0.1314	
number of destinations=6	0.0558		0.0592		0.0224		-0.1150	
number of destinations=7	0.0453		0.0494		0.0397		-0.0964	
number of destinations=8	0.0550		0.0551		0.0273		-0.1534	
number of destinations=9	0.0579		0.0640		0.0346		-0.1480	
number of destinations=10	0.0398		0.0497		0.0227		-0.1021	
number of destinations=11-20	0.0486		0.0588		0.0425		-0.1105	
number of destinations=21-50	0.0407		0.0699		0.0702		-0.1437	
number of destinations>50	0.0329		0.0834		0.0640		-0.2019	
number of origins=2	0.0546		-0.0091		0.0112		-0.1182	
number of origins=3	0.0690		-0.0280		-0.0054		-0.1764	
number of origins=4	0.0655		-0.0453		-0.0403		-0.1420	
number of origins=5	0.0686		-0.0547		-0.0498		-0.1716	
number of origins=6	0.0708		-0.0618		-0.0708		-0.1415	
number of origins=7	0.0694		-0.0770		-0.0795		-0.1391	
number of origins=8	0.0670		-0.0890		-0.0881		-0.1637	
number of origins=9	0.0756		-0.0896		-0.1002		-0.2181	
number of origins=10	0.0761		-0.1074		-0.1065		-0.2045	
number of origins=11-20	0.0844		-0.1417		-0.1345		-0.2630	
number of origins=21-50	0.1063		-0.1825		-0.1621		-0.3459	
number of origins>50	0.2201		-0.2300		-0.0728		-0.5157	
log sales	0.0070	0.0231	0.0110	0.0076	0.0949	0.0889	0.9520	0.9097
r2	0.2817	0.2572	0.2069	0.1934	0.4088	0.4061	0.8061	0.8045
N	141,046	141,046	141,046	141,046	141,046	141,046	142,333	142,333

Log of hourly wage	**Administrative and Commercial Managers**	**Engineers, Commercial Engineers**	**Skilled Blue-Collar**	**Unskilled Blue-Collar**
number of destinations=2	0.0062	-0.0073	0.0080	0.0079
number of destinations=3	-0.0053	-0.0207	0.0084	0.0189
number of destinations=4	0.0011	-0.0001	0.0109	0.0082
number of destinations=5	0.0130	-0.0093	0.0004	0.0125
number of destinations=6	0.0118	-0.0347	0.0078	0.0165
number of destinations=7	0.0145	0.0146	0.0065	0.0048
number of destinations=8	-0.0019	-0.0290	0.0109	0.0077
number of destinations=9	0.0273	-0.0318	0.0056	0.0055
number of destinations=10	0.0059	-0.0112	0.0082	0.0096
number of destinations=11-20	0.0088	-0.0066	0.0073	0.0162
number of destinations=21-50	0.0079	0.0192	0.0174	0.0268
number of destinations>50	0.0246	0.0427	0.0166	0.0391
number of origins=2	-0.0012	-0.0064	-0.0069	-0.0057
number of origins=3	0.0155	0.0013	-0.0187	-0.0032
number of origins=4	-0.0152	-0.0196	-0.0287	-0.0274
number of origins=5	-0.0035	-0.0190	-0.0298	-0.0116
number of origins=6	-0.0166	-0.0131	-0.0443	-0.0236
number of origins=7	-0.0242	-0.0244	-0.0455	-0.0304
number of origins=8	-0.0332	-0.0118	-0.0484	-0.0192
number of origins=9	-0.0012	-0.0235	-0.0490	-0.0120
number of origins=10	-0.0267	-0.0495	-0.0519	-0.0227
number of origins=11-20	-0.0331	-0.0396	-0.0623	-0.0336
number of origins=21-50	-0.0671	-0.0480	-0.0818	-0.0634
number of origins>50	-0.0001	-0.0600	-0.1311	-0.1610
log sales	0.0673	0.0600	0.0541	0.0422
r2	0.1125	0.1003	0.1871	0.1260
N	30,774	32,716	66,541	58,330

Share in employment	**Administrative and Commercial Managers**		**Engineers, Commercial Engineers**		**Skilled Blue-Collar**		**Unskilled Blue-Collar**	
number of destinations=2		0.0036		0.0043		-0.0023		0.0001
number of destinations=3		0.0022		0.0083		-0.0107		0.0030
number of destinations=4		0.0062		0.0050		-0.0134		0.0082
number of destinations=5		0.0038		0.0051		-0.0242		0.0099
number of destinations=6		0.0063		0.0079		-0.0160		0.0162
number of destinations=7		0.0079		0.0072		-0.0125		0.0005
number of destinations=8		0.0043		0.0106		-0.0187		-0.0029
number of destinations=9		0.0039		0.0101		-0.0294		0.0114
number of destinations=10		0.0045		0.0125		-0.0171		0.0070
number of destinations=11-20		0.0107		0.0111		-0.0300		-0.0015
number of destinations=21-50		0.0211		0.0178		-0.0460		-0.0220
number of destinations>50		0.0233		0.0092		-0.0495		-0.0225
number of origins=2		0.0066		0.0069		-0.0126		0.0075
number of origins=3		0.0006		0.0039		-0.0068		0.0167
number of origins=4		-0.0031		0.0033		-0.0027		0.0283
number of origins=5		-0.0028		-0.0014		-0.0008		0.0377
number of origins=6		-0.0071		0.0001		0.0028		0.0334
number of origins=7		-0.0059		0.0007		0.0068		0.0305
number of origins=8		-0.0096		0.0035		0.0189		0.0203
number of origins=9		-0.0084		0.0015		-0.0008		0.0187
number of origins=10		-0.0071		0.0013		0.0077		0.0066
number of origins=11-20		-0.0125		0.0035		-0.0125		0.0068
number of origins=21-50		-0.0190		0.0141		-0.0326		-0.0084
number of origins>50		-0.0335		0.0283		-0.0192		0.0409
log sales	0.0056	0.0049	0.0069	0.0044	0.0213	0.0264	0.0050	0.0037
r2	0.0727	0.0739	0.1113	0.1139	0.2865	0.2881	0.1473	0.1494
N	141,046	141,046	141,046	141,046	141,046	141,046	141,046	141,046

Share in wage bill	**Administrative and Commercial Managers**	**Engineers, Commercial Engineers**	**Skilled Blue-Collar**	**Unskilled Blue-Collar**
number of destinations=2	0.0060	0.0061	-0.0071	-0.0029
number of destinations=3	0.0046	0.0101	-0.0154	-0.0022
number of destinations=4	0.0094	0.0061	-0.0185	0.0012
number of destinations=5	0.0085	0.0061	-0.0285	0.0026
number of destinations=6	0.0118	0.0106	-0.0213	0.0074
number of destinations=7	0.0131	0.0098	-0.0197	-0.0066
number of destinations=8	0.0100	0.0122	-0.0244	-0.0074
number of destinations=9	0.0102	0.0115	-0.0365	0.0023
number of destinations=10	0.0103	0.0159	-0.0233	-0.0011
number of destinations=11-20	0.0207	0.0147	-0.0376	-0.0098
number of destinations=21-50	0.0368	0.0239	-0.0555	-0.0282
number of destinations>50	0.0436	0.0165	-0.0594	-0.0266
number of origins=2	0.0095	0.0086	-0.0155	0.0028
number of origins=3	0.0029	0.0061	-0.0104	0.0105
number of origins=4	-0.0024	0.0051	-0.0059	0.0197
number of origins=5	-0.0011	0.0000	-0.0048	0.0272
number of origins=6	-0.0088	0.0027	-0.0008	0.0256
number of origins=7	-0.0057	0.0031	0.0032	0.0244
number of origins=8	-0.0131	0.0072	0.0129	0.0171
number of origins=9	-0.0097	0.0033	-0.0022	0.0158
number of origins=10	-0.0101	0.0021	0.0058	0.0079
number of origins=11-20	-0.0159	0.0076	-0.0115	0.0092
number of origins=21-50	-0.0295	0.0232	-0.0300	-0.0029
number of origins>50	-0.0480	0.0349	-0.0363	0.0165
log sales	0.0112	0.0099	0.0189	-0.0018
r2	0.1029	0.1450	0.2596	0.1248
N	141,046	141,046	141,046	141,046

Lessons from the Data

- Imports and Exports are very similar (parallel?)

- The shapes of the Wage Figures are strikingly similar to those of sales (in EKK), with less variation though

- Both for Exports and Imports

- Firms that export (import) more and more widely pay more

- Firms that serve (are served by) less popular markets pay more

- Firms that sell more in France pay more

Grand Directions of the Model

- Model jointly the Export and Import decisions through a model of Outsourcing

- With Multiple Inputs Coming from France or abroad

- With heterogeneous firms: efficiency **and** number of skills (complexity)

- Introduce efficient bargaining (McDonald and Solow, 1981) for the labor market

- in an augmented EKK's version of Melitz.

Elements of the Model: EKK

- Firm j has efficiency $z(j)$, same across markets, and a demand shifter $\alpha_n(j)$ in each destination market n, preferences are CES with $\sigma > 1$

- measure of firms with efficiency above z is $\mu^z(z) = Tz^{-\theta}$. (Hence, distribution of costs is proportional to c^θ)

- charging p in market n, reaching a fraction f of consumers, sales in n are $x_n(j) = \alpha_n(j)f(j)X_n\left(\frac{p}{P_n}\right)^{-(\sigma-1)}$.

- with $l_n(j)$ firm's employment, $m_n(j)$ its use of intermediates, output is $q_n(j) = z(j)\left[l_n(j)\right]^\beta\left[m_n(j)\right]^{1-\beta}/d_n$

- Then, revenue as a function of l, m, and f is:

$$x_n(l, m, f) = [\alpha_n(j) f X_n]^{1/\sigma} \left(\frac{z(j) l^{\beta} m^{1-\beta} P_n}{d_n} \right)^{(\sigma-1)/\sigma}.$$

EKKS: 2-Inputs and Outsourcing (Base Model)

- The production function uses input 0, cost w_0 and has the choice of either labor at cost w_1 or an input, at cost p

- Given prices of intermediates p, the cost of the input bundle is:

$$b(p) = w_0^{\beta_0} \min\{w_1, p\}^{\beta_1}.$$

- The distribution of costs:

$$\mu(c) = \int_0^\infty \mu(c|b(p))dF(p) = Tc^\theta w_0^{-\theta\beta_0} \int_0^\infty \min\{w_1, p\}^{-\theta\beta_1} dF(p)$$

- with $\overline{c}$, largest cost entering, is solution of:

$$\mu(\overline{c}) = \frac{X}{\sigma E}\frac{\theta - (\sigma - 1)}{\theta},$$

- **Extended Model:** The number of suppliers j sampled is distributed Poisson with parameter $\lambda(\overline{c})$, an increasing function of $\overline{c}$. The probability to sample j suppliers is

$$g_j(\overline{c}) = \frac{e^{-\lambda(\overline{c})}\left[\lambda(\overline{c})\right]^j}{j!}$$

- If P_j is the price of the lowest cost supplier among these j. Its distribution is

$$\Pr[P_j \leq p] = F_j(p) = 1 - \left[1 - F(p)\right]^j .$$

- Now, summing over all js:

$$\mu(c) = Tc^{\theta} w_0^{-\theta\beta_0} \int_0^{\infty} \min\{w_1, p\}^{-\theta\beta_1} e^{-\lambda(\overline{c})F(p)} \lambda(\overline{c}) f(p) dp$$

- Plugging the Pareto distribution, we have $\mu(c) = \Psi(\overline{c})c^{\theta}$ with

$$\Psi(\overline{c}) = \Phi \left[\left(\lambda(\overline{c}) \left(\frac{w_1}{\overline{c}} \right)^{\theta} \right)^{\beta_1} \gamma \left(1 - \beta_1, \lambda(\overline{c}) \left(\frac{\varpi_1}{\overline{c}} \right)^{\theta} \right) + \left(e^{-\lambda(\overline{c})(\varpi_1/\overline{c})^{\theta}} - e^{-\lambda} \right. \right.$$

- As a consequence,

$$\begin{pmatrix} & w_1 \geq \overline{c} & w_1 \leq \overline{c} \\ \text{1 encounter} & \frac{\partial \mu(c)}{\partial \overline{c}} = 0 & \frac{\partial \mu(c)}{\partial \overline{c}} < 0 \\ \text{Poisson } \lambda(\overline{c}) \text{ encounters} & \frac{\partial \mu(c)}{\partial \overline{c}} \geq 0 & \frac{\partial \mu(c)}{\partial \overline{c}} \lessgtr 0 \end{pmatrix}$$

- As long as our choice of $\lambda(\overline{c})$ implies that $\Psi'(\overline{c}) \geq 0$ we are guaranteed that a drop in E increases $\mu(c)$

- The expected number of sales $E(N^s)$, is:

$$E(N^s) = \lambda \exp[-\lambda F(c)]$$

- A more efficient firm is more likely to thrive in an environment with more meetings.

EKKS: Sales with 2-Inputs and Outsourcing

- Expected intermediate sales of a seller in the market with unit cost c, equal to the expected number of buyers ($G(c)$ just derived) times expected sales per buyer.

- A buyer has efficiency Z which is distributed: $\Pr[Z \leq z] = 1 - \left(\frac{z}{\underline{z}(\overline{c})}\right)^{-\theta}$ with $\underline{z}(\overline{c})$ the lowest efficiency possible for a buyer facing a supplier with cost c ($\underline{z} = \frac{w_0^{\beta_0} c^{\beta_1}}{\overline{c}}$).

- The distribution of expected sales:

$$\Lambda^M(c) = G(c)\beta_1 \int_{\underline{z}(\overline{c})}^{\infty} \left[\frac{1}{\overline{m}} \frac{X}{P^{1-\sigma}} \left(\frac{\overline{m} w_0^{\beta_0} c^{\beta_1}}{z'} \right)^{1-\sigma} + \Lambda^M \left(\frac{w_0^{\beta_0} c^{\beta_1}}{z'} \right) \right] \theta \left[\underline{z}(\overline{c}) \right]^{\theta}$$

- All computations done (note the Fixed Point, above) yields:

$$\begin{aligned} \Lambda^M &= {}_{def} \int_0^{\overline{c}} \Lambda^M \left(c' \right) \theta \overline{c}^{-\theta} \left(c' \right)^{\theta-1} dc' \\ &= \frac{\beta_1 \overline{m}^{-\sigma} \frac{\theta}{\theta-(\sigma-1)} \frac{X}{P^{1-\sigma}} \left(\overline{c} \right)^{1-\sigma} \left(1 - \exp\left[-\lambda \left(\frac{\underline{\varpi_1}}{\overline{c}} \right)^{\theta} \right] \right)}{1 - \beta_1 (1 - \exp\left[-\lambda \left(\frac{\underline{\varpi_1}}{\overline{c}} \right)^{\theta} \right])} \end{aligned}$$

EKKS: Extension to K-Inputs

- The firm samples j_k suppliers for $k = 1, ..., K$, distributed Poisson with a parameter $\lambda(\overline{c})$

- $$\begin{aligned}\mu(c) &= Tc^{\theta} w_0^{-\theta\beta_0} \prod_{k=1}^{K} \int_0^{\infty} \min\{w_k, p_k\}^{-\theta\beta_k} e^{-\lambda(\overline{c})F(p_k)} \lambda(\overline{c}) f(p_k) dp_k \\ &= \Psi(\overline{c}) c^{\theta}\end{aligned}$$

- The measure of entrants is
$$\mu(\overline{c}) = \frac{X}{\sigma E} \frac{\theta - (\sigma - 1)}{\theta},$$

- with expected intermediate sales:

$$\Lambda^M = \frac{\sum_{k=1}^{K} \beta_k \overline{m}^{-\sigma} \frac{\theta}{\theta-(\sigma-1)} \frac{X}{P^{1-\sigma}} \overline{c}^{1-\sigma} \left(1 - \exp\left[-\lambda\left(\overline{c}\right)\left(\frac{\varpi_k}{\overline{c}}\right)^{\theta}\right]\right)}{1 - \sum_{k=1}^{K} \beta_k \left(1 - \exp\left[-\lambda\left(\overline{c}\right)\left(\frac{\varpi_k}{\overline{c}}\right)^{\theta}\right]\right)}$$

EKKS: Introducing Trade I

- All computations above can be extended to a multiplicity of N countries, by dividing appropriately by distance d_{mn} between m and n.

- For firms in country i:

$$\Psi_i(\bar{c}_i) = T_i w_{i,0}^{-\theta\beta_0} \prod_{k=1}^{K} \int_0^\infty \text{min}\left\{w_{i,k}, p_k\right\}^{-\theta\beta_k} e^{-\lambda_i(\bar{c}_i)F_i(p_k)} \lambda_i(\bar{c}_i) f_i(p_k) dp_k.$$

With the associated system of N equations as:

$$\frac{X_i}{\sigma E_i} \frac{\theta - (\sigma - 1)}{\theta} = \bar{c}_i^{\theta} \sum_{l=1}^{N} d_{il}^{-\theta} \Psi_l(\bar{c}_l).$$

EKKS: Introducing Trade II

- Expected sales are:

$$\Lambda_n^M(c) = \sum_{k=1}^{K} G_{n,k}(c)\beta_k \overline{c}_n^{-\theta} \sum_{m=1}^{N} d_{mn}^{-\theta} \left\{ \begin{array}{c} \overline{m}^{-\sigma} \frac{X_m}{P_m^{1-\sigma}} \frac{\theta}{\theta-(\sigma-1)} \overline{c}_m^{\theta-(\sigma-1)} \\ + \int_0^{\overline{c}_m} \Lambda_m^M\left(c''\right)\theta\left(c''\right)^{\theta-1} dc'' \end{array} \right\}$$

- Defining $\boldsymbol{\Delta}^M = \{\overline{c}_1^{\theta}\Lambda_1^M, \overline{c}_2^{\theta}\Lambda_2^M, ..., \overline{c}_N^{\theta}\Lambda_N^M\}'$

- $\widetilde{\mathbf{X}} = \left\{ \left(\frac{1}{P_1}\right)^{1-\sigma} X_1 \overline{c}_1^{\theta-(\sigma-1)}, \left(\frac{1}{P_2}\right)^{1-\sigma} X_2 \overline{c}_2^{\theta-(\sigma-1)}, ..., \left(\frac{1}{P_N}\right)^{1-\sigma} X_N \overline{c}_N^{\theta-(\sigma-1)} \right\}$

- $\mathbf{B}$ an $N \times N$ matrix with representative element:

$$\mathbf{b}_{nm} = \sum_{k=1}^{K} \beta_k \pi_{nn} \left(\bar{c}_n\right)^{-\theta} \left(1 - \exp\left[-\lambda_n \left(\frac{\varpi_{n,k}}{\bar{c}_n}\right)^{\theta}\right]\right) \left(d_{mn}\right)^{-\theta}$$

- The solution is

$$\boldsymbol{\Delta}^{M} = \frac{\theta \overline{m}^{-\sigma}}{\theta - (\sigma - 1)} \left[\mathbf{I} - \mathbf{B}\right]^{-1} \mathbf{B} \widetilde{\mathbf{X}}$$

EKKS: Bargaining on Wages and Employment

- The profit resulting from above

$$\Pi_n(l, m, w, \delta) = x_n^F(l, m, \delta) + x_n^M - w_0 l_{0,n} - \sum_{k=1}^{K} \Big[\delta_k w_k l_{k,n} + (1 - \delta_k) p_k m_{k,n} \Big] -$$

- with $e_{k,n}$ is the overhead labor of type k to enter market n implying a fixed cost $E_n = \sum_{k=0}^{K} w_k e_{k,n}$

- workers and firm use efficient bargaining and maximize:

$$\pounds(l, m, w, \delta) = (1-\gamma) \ln \Pi(l, m, w, \delta) + \gamma \ln \left[\sum_{k=0}^{K} (w_k - \underline{w}_k)(\delta_k l_k + e_k) \right],$$

- with $0 \leq \gamma \leq 1$ reflects the bargaining power of workers and $\underline{w}_k$ type k workers' reservation wage.

- Notice that we have assumed a status-quo $\pi_0 = 0$ for the firm (to be changed soon).

- **Solutions:** the share of the surplus going to labor;

$$\sum_{k=0}^{K} (w_k - \underline{w}_k)(\delta_k l_k + e_k) = \gamma S(l, m, \delta),$$

- with the rest going to profits

$$\Pi(l, m, w, \delta) = (1 - \gamma) S(l, m, \delta).$$

- intermediates purchased:

$$\delta_k = \begin{cases} 1 & \underline{w}_k \leq p_k \\ 0 & \underline{w}_k > p_k \end{cases}$$

- Finally,

$$\frac{\partial x^F(l, m, \delta)}{\partial l_k} = \underline{w}_k.$$

$$\frac{\partial x^F(l, m, \delta)}{\partial m_k} = p_k.\text{when } \underline{w}_k > p_k$$

EKKS: Solution for the Wage with $K = 1$

- The solution

$$w(j) = \underline{w}\left(1 + \frac{\gamma}{(\sigma - 1)\,\beta}\right) - \gamma\underline{w}\frac{1 + (\sigma - 1)\beta}{(\sigma - 1)\beta}\sum_n \frac{\frac{e_n(j)}{x_n(j)}}{\frac{\beta(\sigma-1)}{\underline{w}\sigma} + \frac{e_n(j)}{x_n(j)}}\frac{l_n(j) + e_n(j)}{l(j) + e(j)}$$

- The appendix shows that the ratio $e_n(j)/x_n(j)$ is increasing in v_n which implies that

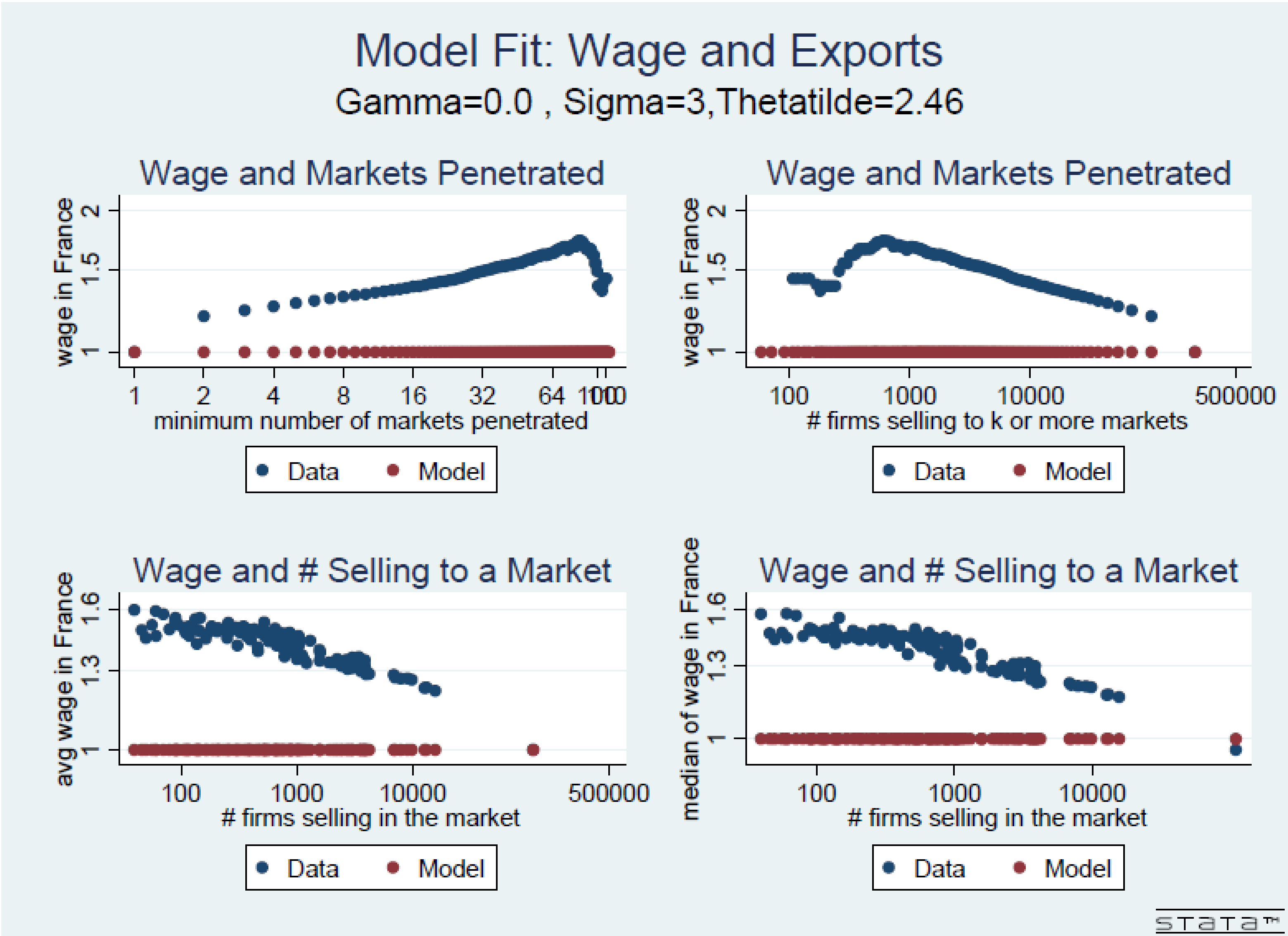
$$\frac{\frac{e_n(j)}{x_n(j)}}{\frac{(\sigma-1)\beta}{\underline{w}\sigma} + \frac{e_n(j)}{x_n(j)}}$$

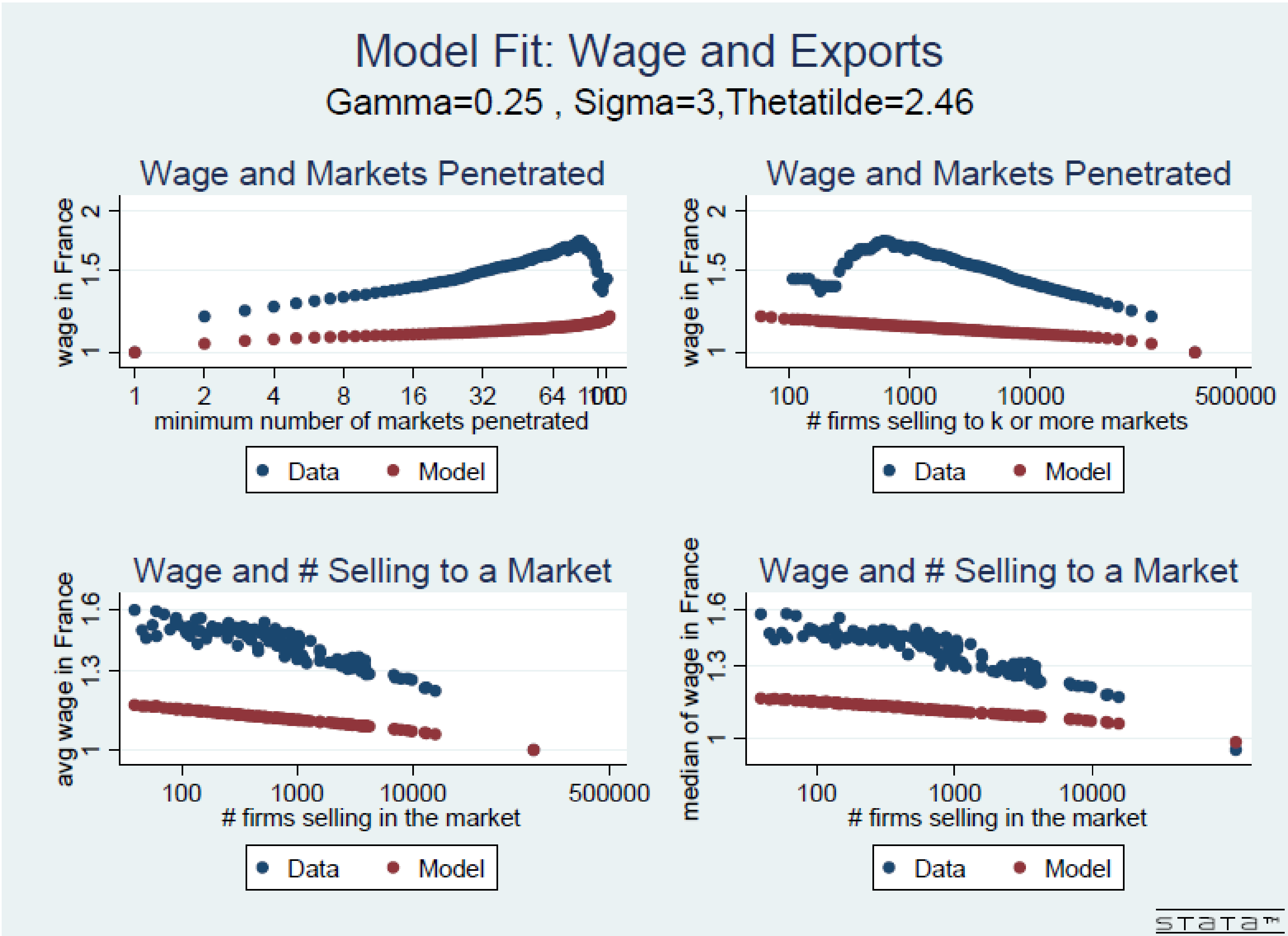
- is also increasing in v_n (as in the data).

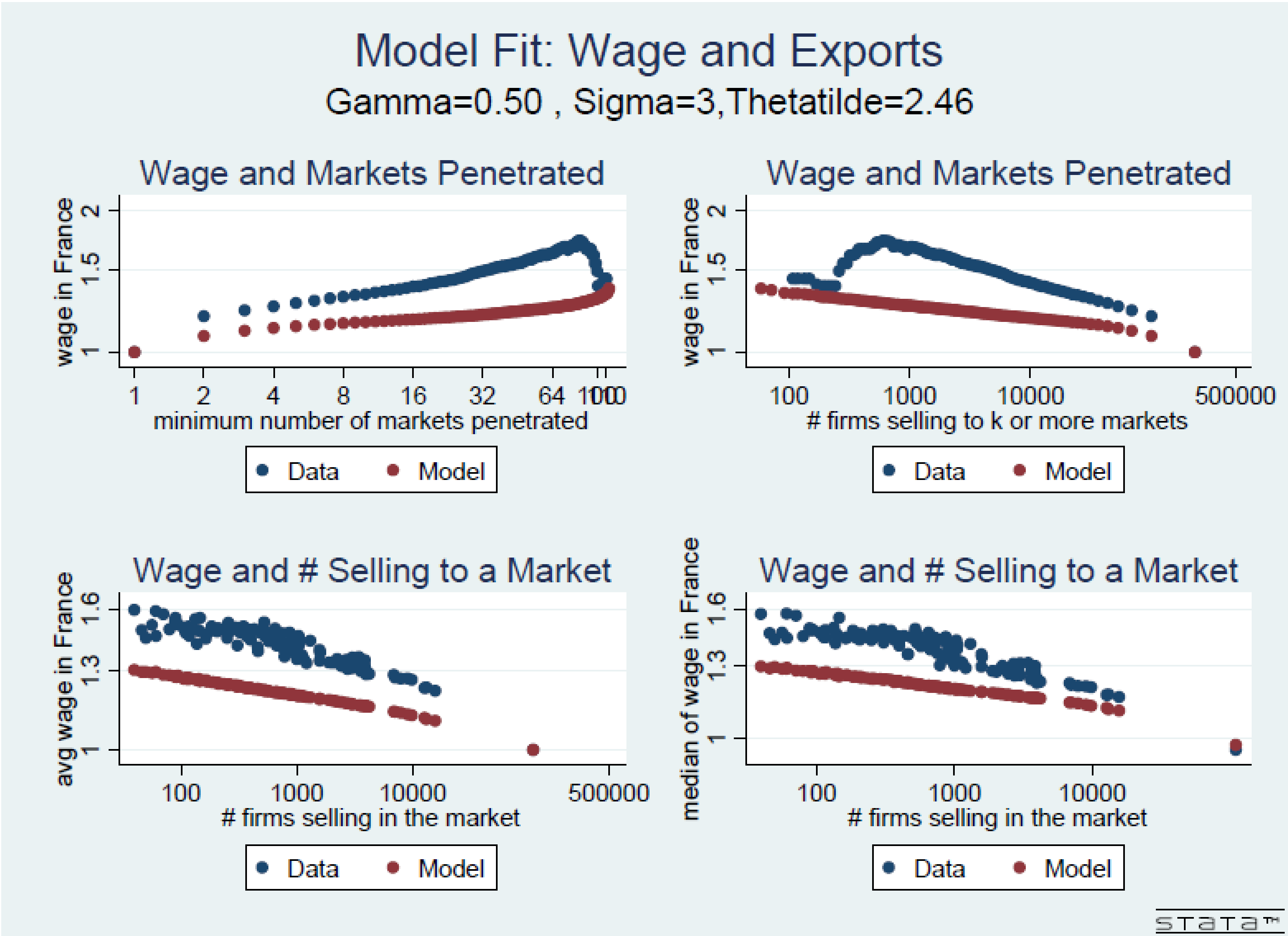
- Similarly

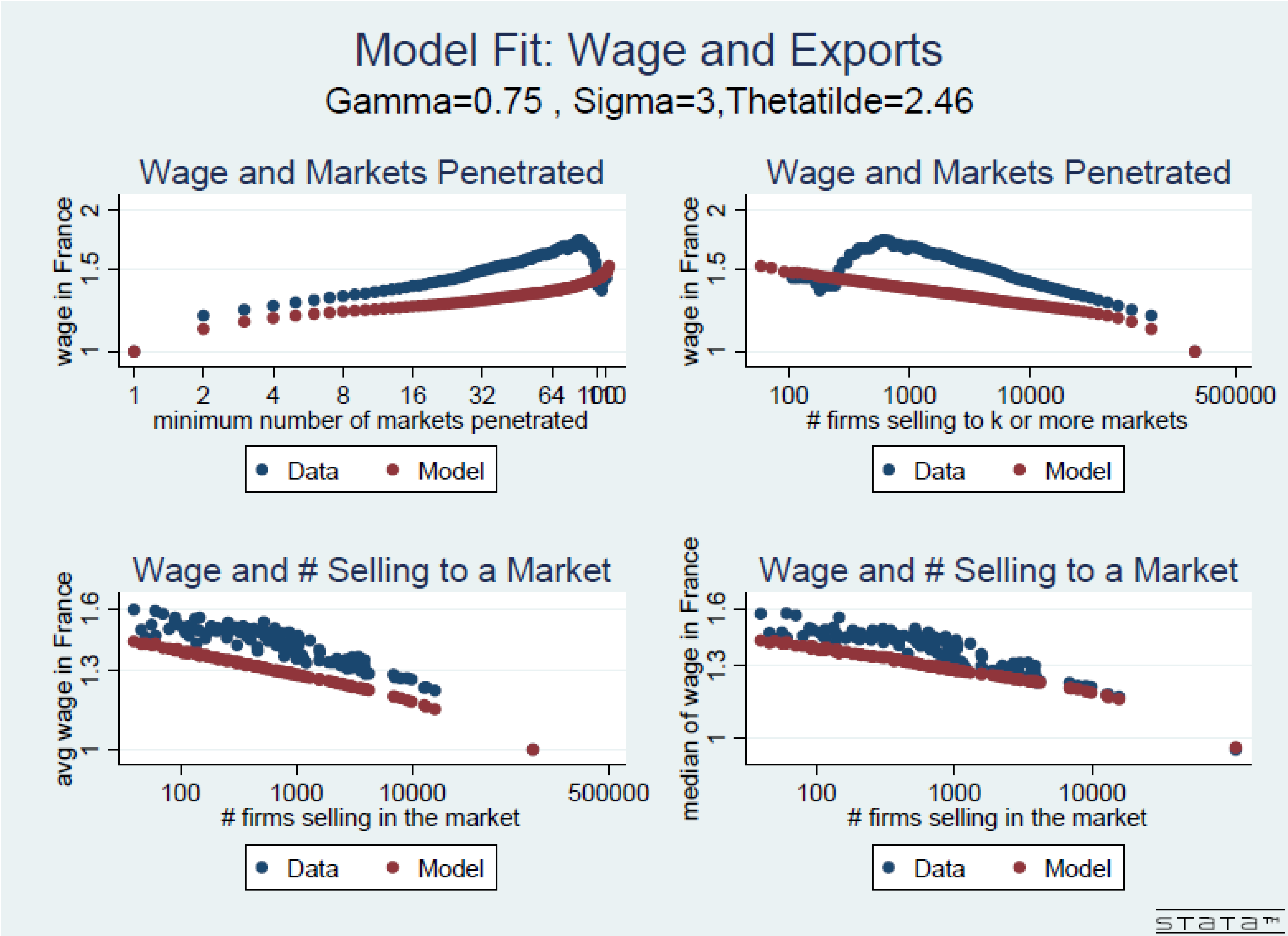
$$\begin{aligned}\frac{x(j)}{l(j)+e(j)} &= \sum_n \frac{x_n(j)}{l_n(j)+e_n(j)} \frac{l_n(j)+e_n(j)}{l(j)+e(j)} \\ &= \sum_n \frac{1}{\frac{\beta(\sigma-1)}{\underline{w}\sigma} + \frac{e_n(j)}{x_n(j)}} \frac{l_n(j)+e_n(j)}{l(j)+e(j)}.\end{aligned}$$

- whereas $\frac{x(j)}{l(j)}$ is equal to a constant

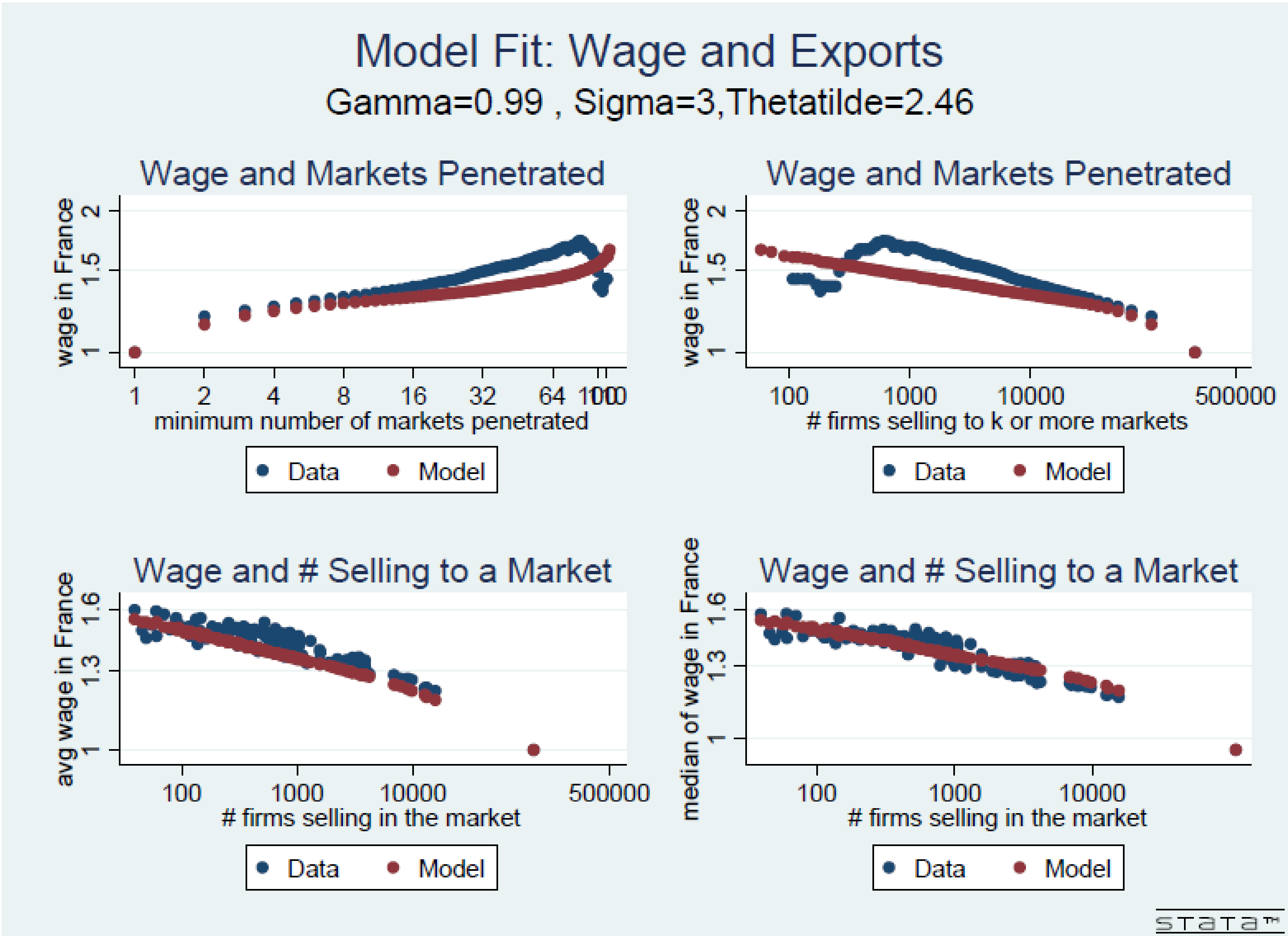

Model Fit: Wage and Exports
Gamma=0.0 , Sigma=3,Thetatilde=2.46
Wage and Markets Penetrated
wage in France
minimum number of markets penetrated
Wage and Markets Penetrated
wage in France
firms selling to k or more markets
Wage and # Selling to a Market
avg wage in France
firms selling in the market
Wage and # Selling to a Market
median of wage in France
firms selling in the market
Data
Model


Model Fit: Wage and Exports
Gamma=0.25 , Sigma=3,Thetatilde=2.46
Wage and Markets Penetrated
wage in France
minimum number of markets penetrated
firms selling to k or more markets
Wage and # Selling to a Market
avg wage in France
median of wage in France
firms selling in the market
Data
Model
stata

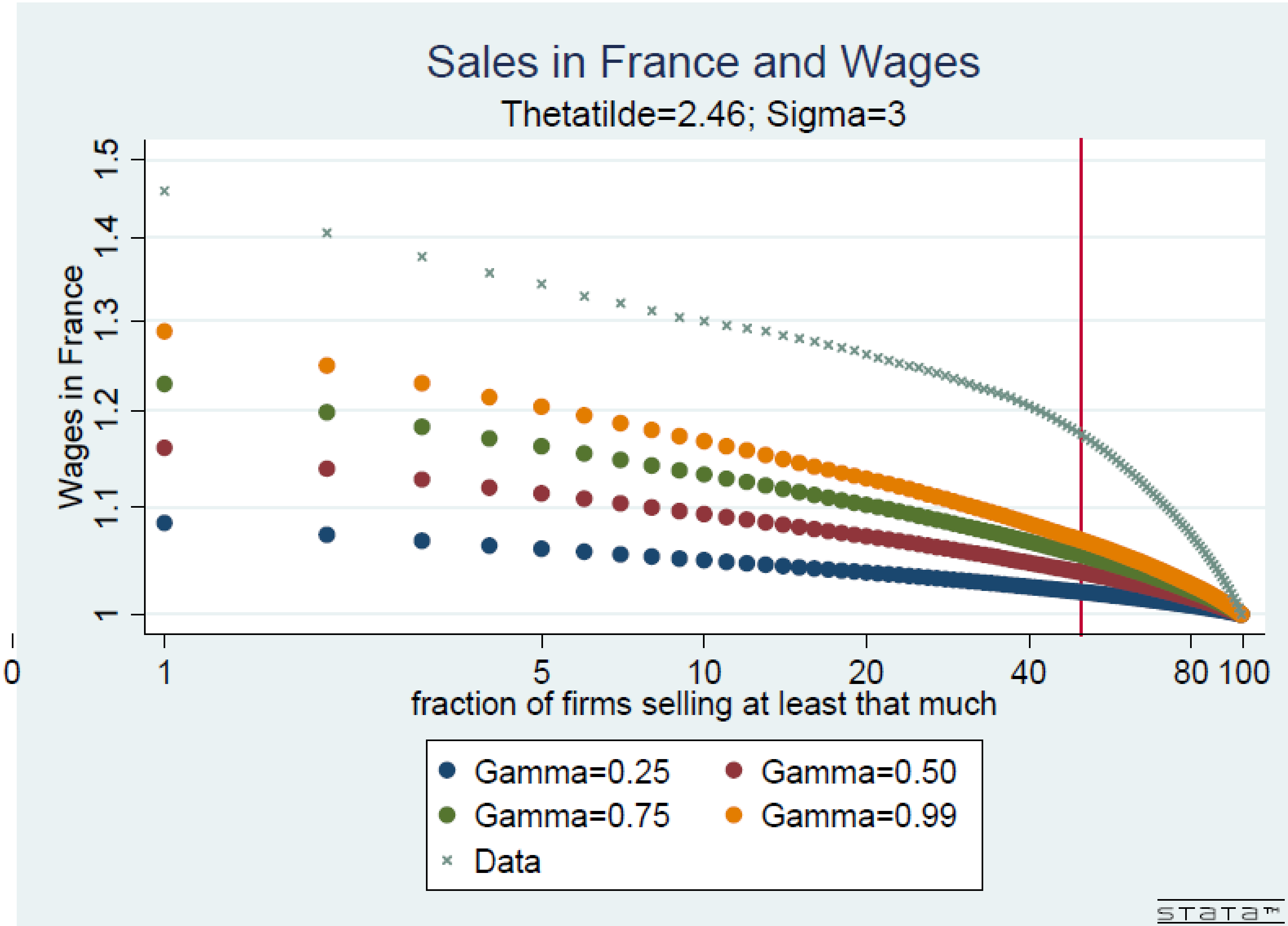

Model Fit: Wage and Exports
Gamma=0.50 , Sigma=3,Thetatilde=2.46
Wage and Markets Penetrated
wage in France
1
1.5
2
1
2
4
8
16
32
64
100
minimum number of markets penetrated
Data
Model
Wage and Markets Penetrated
wage in France
1
1.5
2
100
1000
10000
500000
firms selling to k or more markets
Data
Model
Wage and # Selling to a Market
avg wage in France
1
1.3
1.6
100
1000
10000
500000
firms selling in the market
Data
Model
Wage and # Selling to a Market
median of wage in France
1
1.3
1.6
100
1000
10000
firms selling in the market
Data
Model
stata™



Model Fit: Wage and Exports
Gamma=0.75 , Sigma=3,Thetatilde=2.46
Wage and Markets Penetrated
wage in France
1
1.5
2
1
2
4
8
16
32
64
100
minimum number of markets penetrated
Data
Model
Wage and Markets Penetrated
wage in France
1
1.5
2
100
1000
10000
500000
firms selling to k or more markets
Data
Model
Wage and # Selling to a Market
avg wage in France
1
1.3
1.6
100
1000
10000
500000
firms selling in the market
Data
Model
Wage and # Selling to a Market
median of wage in France
1
1.3
1.6
100
1000
10000
firms selling in the market
Data
Model
stata™



Model Fit: Wage and Exports
Gamma=0.99 , Sigma=3,Thetatilde=2.46
Wage and Markets Penetrated
wage in France
1
1.5
2
1
2
4
8
16
32
64
minimum number of markets penetrated
Data
Model
Wage and Markets Penetrated
wage in France
1
1.5
2
100
1000
10000
500000
firms selling to k or more markets
Data
Model
Wage and # Selling to a Market
avg wage in France
1
1.3
1.6
100
1000
10000
500000
firms selling in the market
Data
Model
Wage and # Selling to a Market
median of wage in France
1
1.3
1.6
100
1000
10000
firms selling in the market
Data
Model
stata™



Sales in France and Wages
Thetatilde=2.46; Sigma=3
Wages in France
1
1.1
1.2
1.3
1.4
1.5
0
1
5
10
20
40
80
100
fraction of firms selling at least that much
Gamma=0.25
Gamma=0.50
Gamma=0.75
Gamma=0.99
Data
stata™

Conclusion

- The EKK model can be "easily extended" to incorporate a parallel treatment of exports and imports

- It involves the construction of a fixed point (imports are in fact exports of some other foreign firm)

- The model can be further extended to an open economy, multiple inputs, multiple suppliers

- and firms of different efficiency z and complexity K

- On the labor market side, adding one bargaining parameter to an export model goes a long way in relating firms' wages and exports.

- Strong evidence that the Pareto distribution of heterogeneity in sales (efficiency) translates into wages.

- Unobserved individual skills are not accounted for

- Looks like a promising base for structural estimation