



Globalization and Labour Market Outcomes

23 – 24 June 2011 International Labour Office, Geneva

Wages, Employment, and Trade

*Jonathan Eaton, Samuel Kortum,
Francis Kramarz and Raul Sampognaro*

CESifo GmbH
Poschingerstr. 5
81679 Munich
Germany

Phone: +49 (0) 89 9224-1410
Fax: +49 (0) 89 9224-1409
E-mail: office@cesifo.de
Web: www.cesifo.de

Wages, Employment, and Trade

Jonathan Eaton, Samuel Kortum, Francis Kramarz, and Raul Sampognaro

June 2011

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

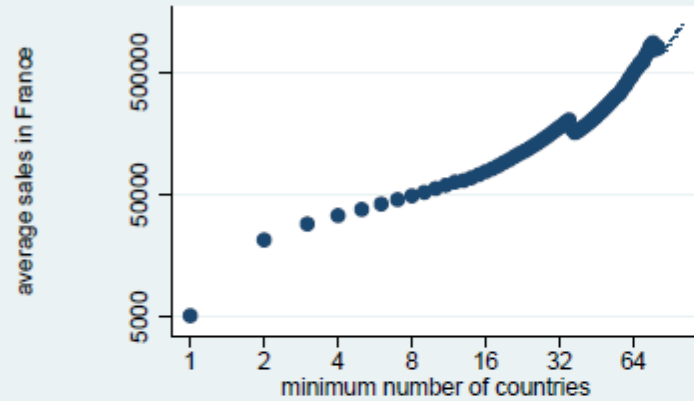
- Data: Bernard and Jensen (1995).
- Theory (on exports): Felbermayr, Prat, and Shmerer (2008), Egger and Kreickemeier (2009), Helpman, Itskhoki, and Redding (2010)
- Quantitative: Irarrazabal, Moxnes, and Ulltveit-Moe (2010), Klein, Moser, and Urban (2010), Frias, Kaplan, and Verhoogen (2010), Kramarz (2009).

A Look at the Data

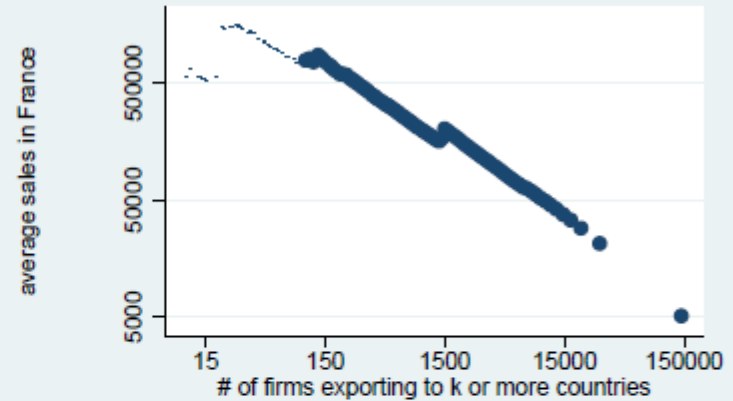
- Cross-section of 141,000 French manufacturing firms, in 2003
- Approximately 25,000 (20,000) of them export (import from) somewhere.
- Observe exports to (imports from) each of 112 destinations (origins)
- plus wages, employment (by skill-levels), purchases, and sales in France.
- Tables and Figures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

Exports and Sales in France

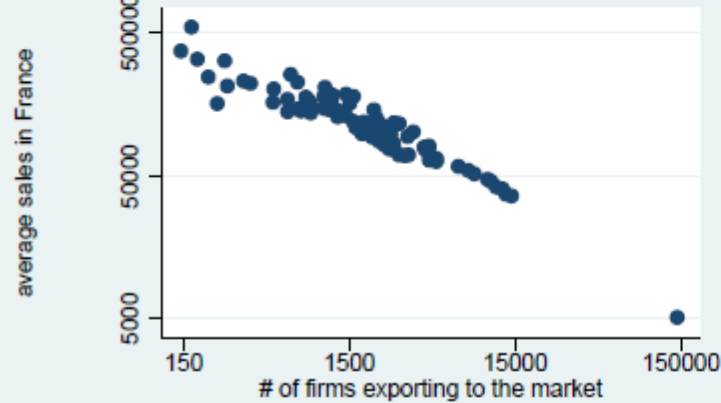
Sales in France and Exports



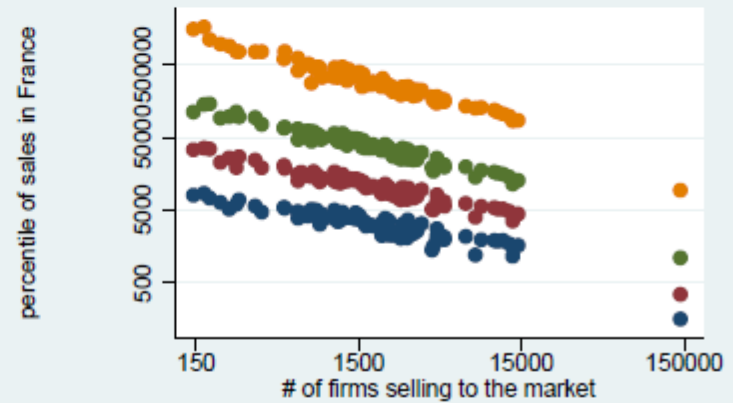
Sales in France and Nbr. of Countries



Sales in France and Nbr. of Importers

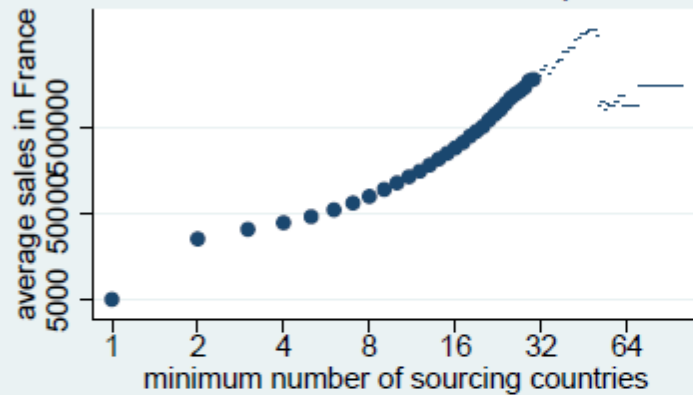


Distribution of sales in France

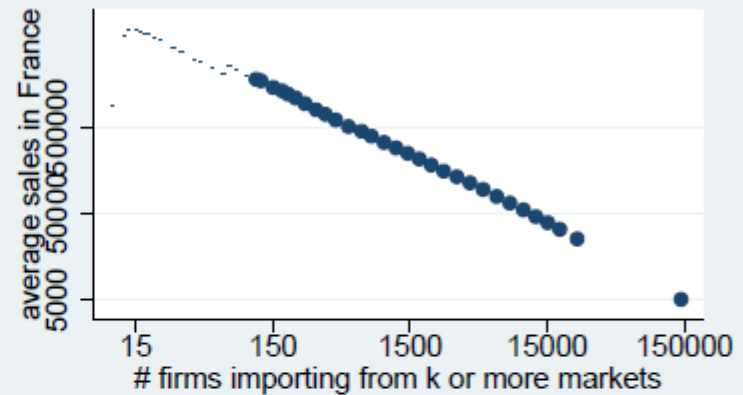


Imports and Sales in France

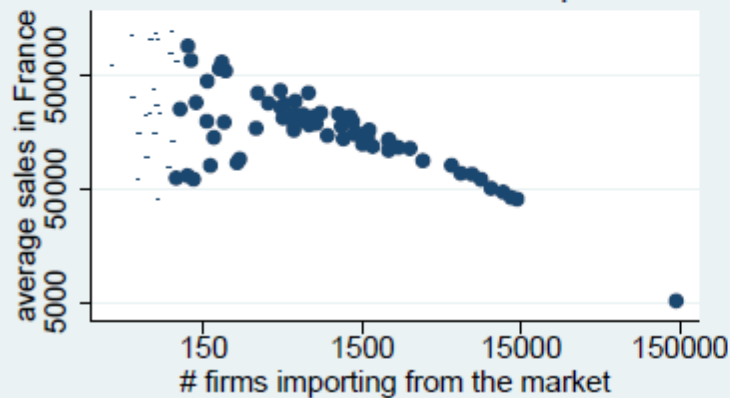
Sales in France and Imports



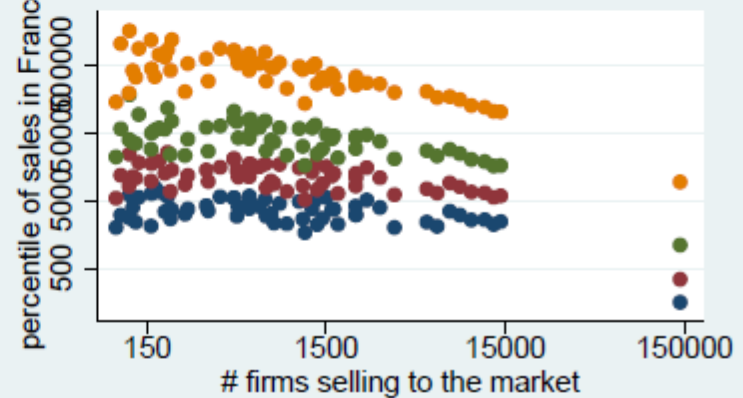
Sales in France and # of Partners



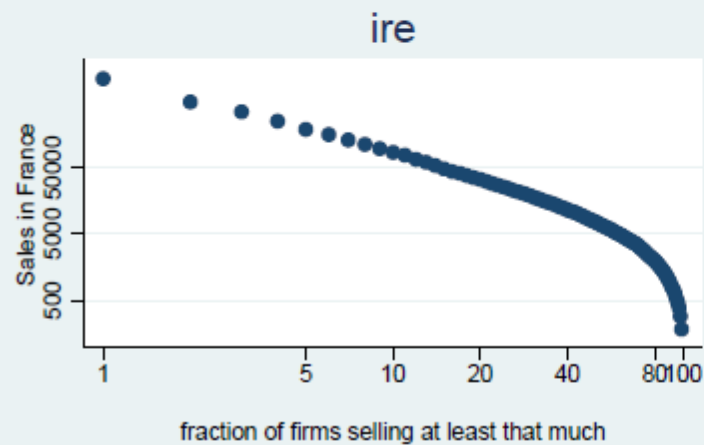
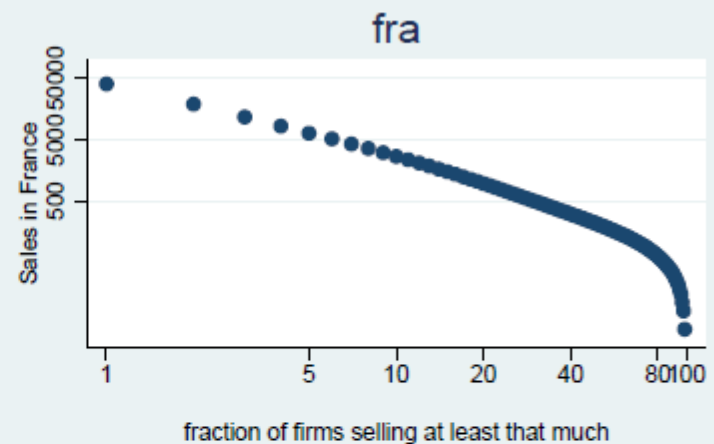
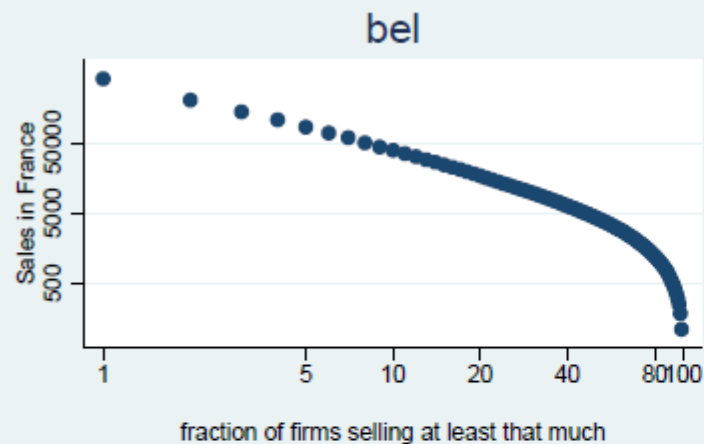
Sales in France and # Importers



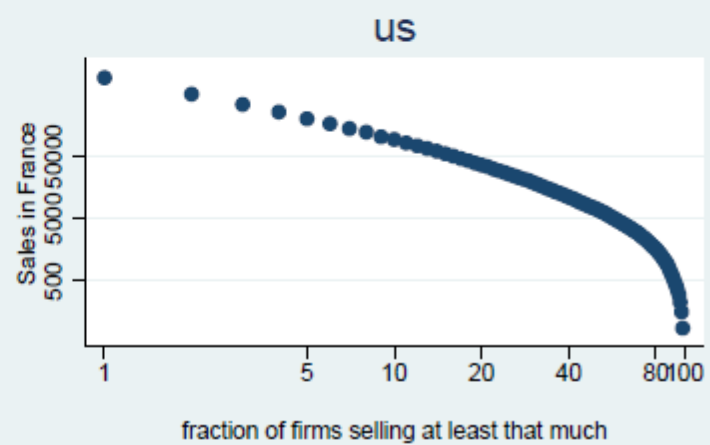
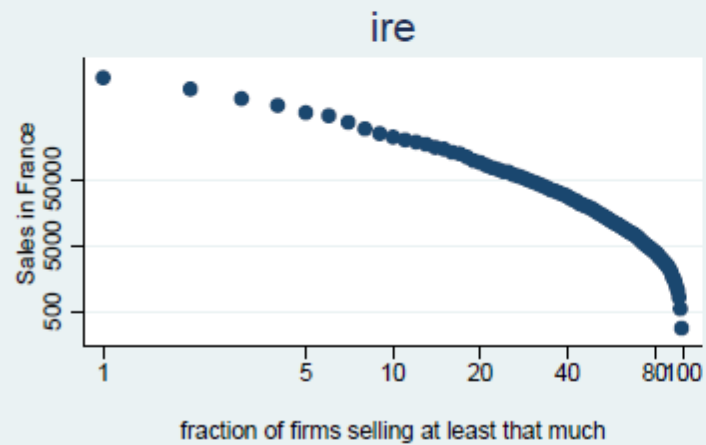
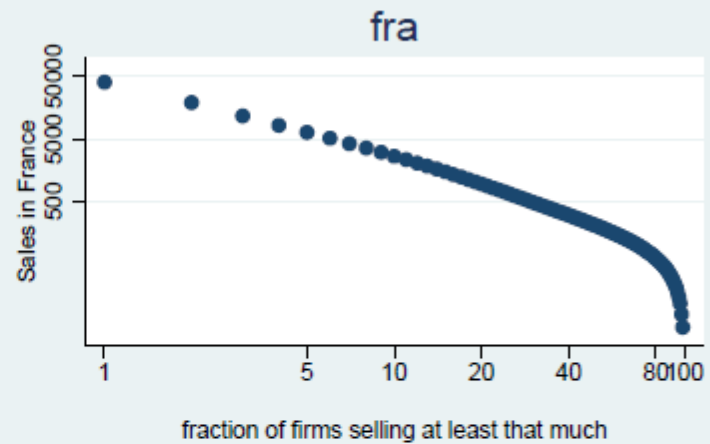
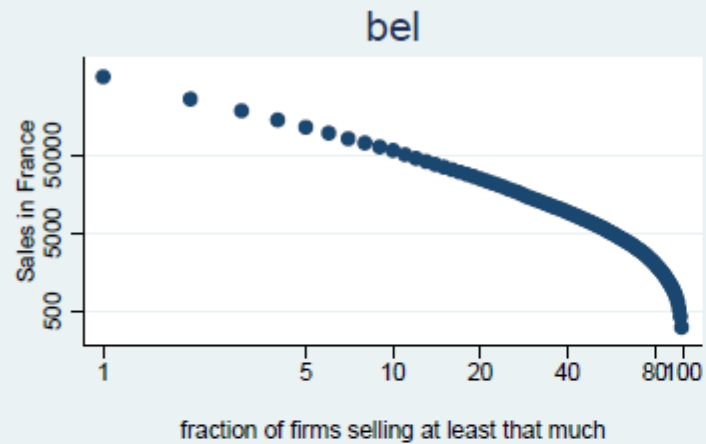
Distr. of sales in France



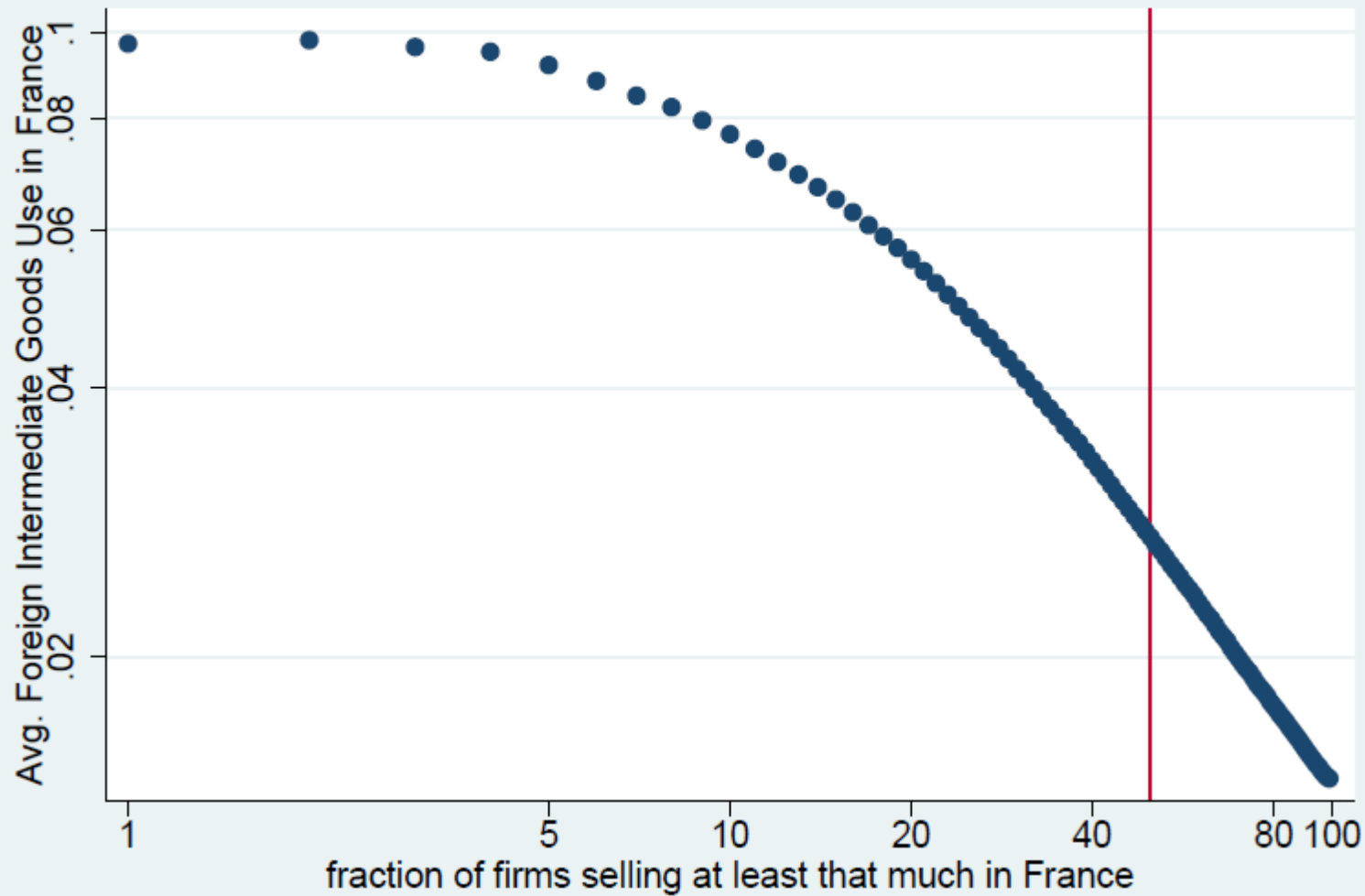
Distribution of Sales in France by Export Country



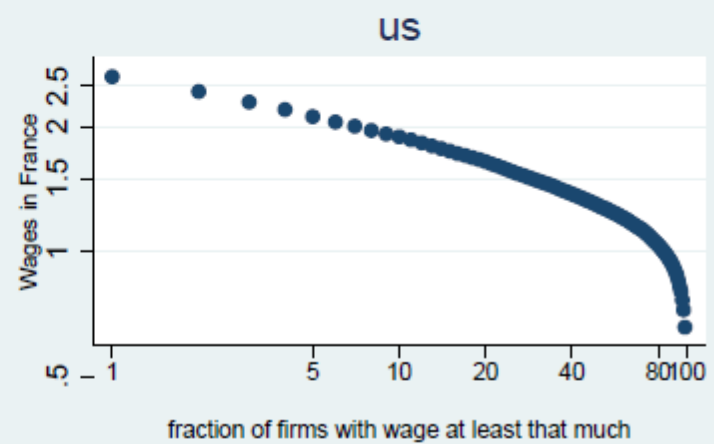
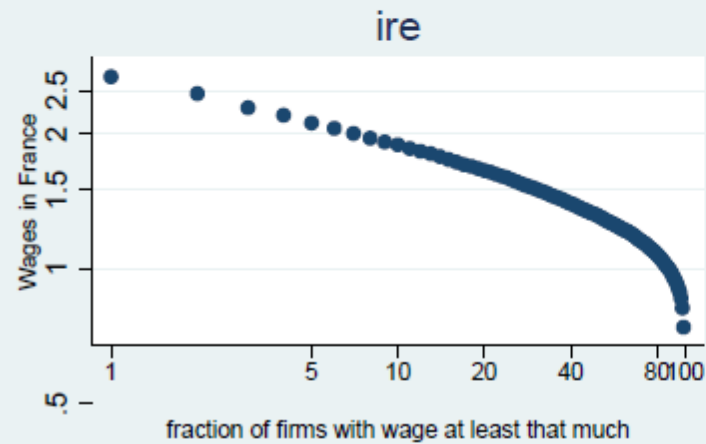
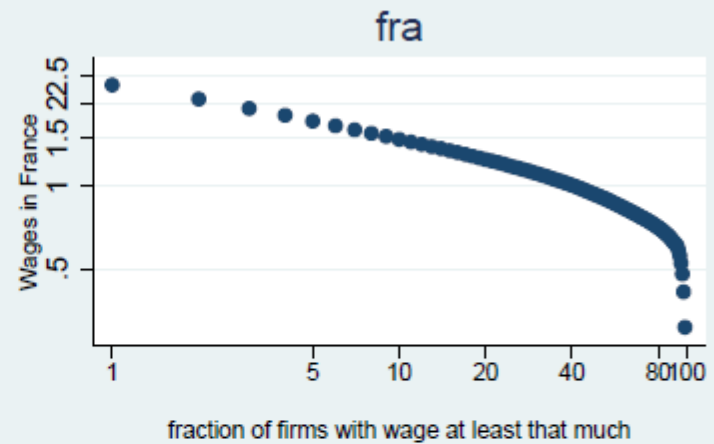
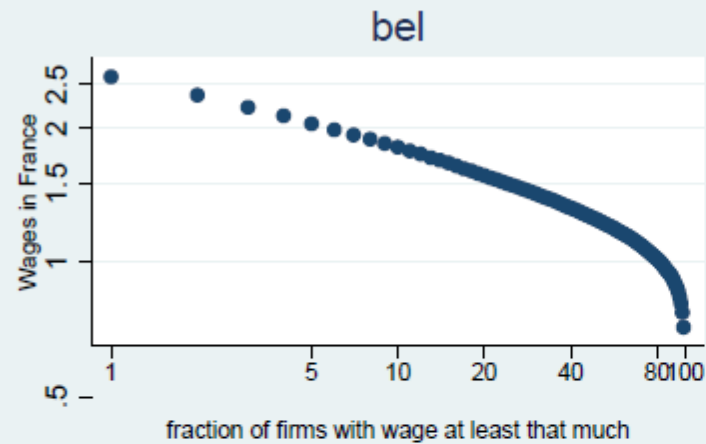
Distribution of Sales in France by Import Country



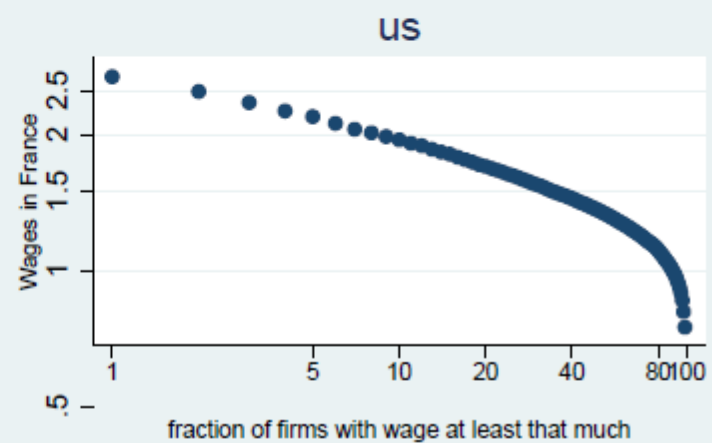
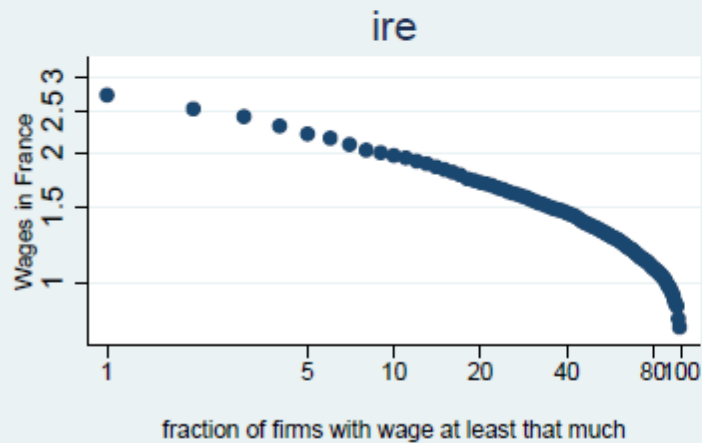
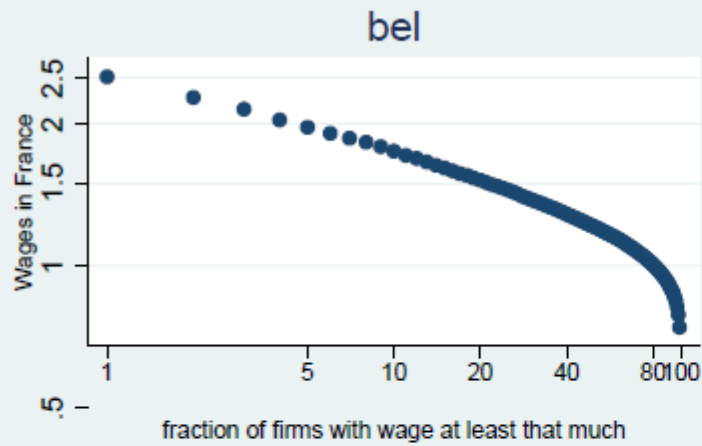
Sales in France and Imported Intermediate Goods Intensity



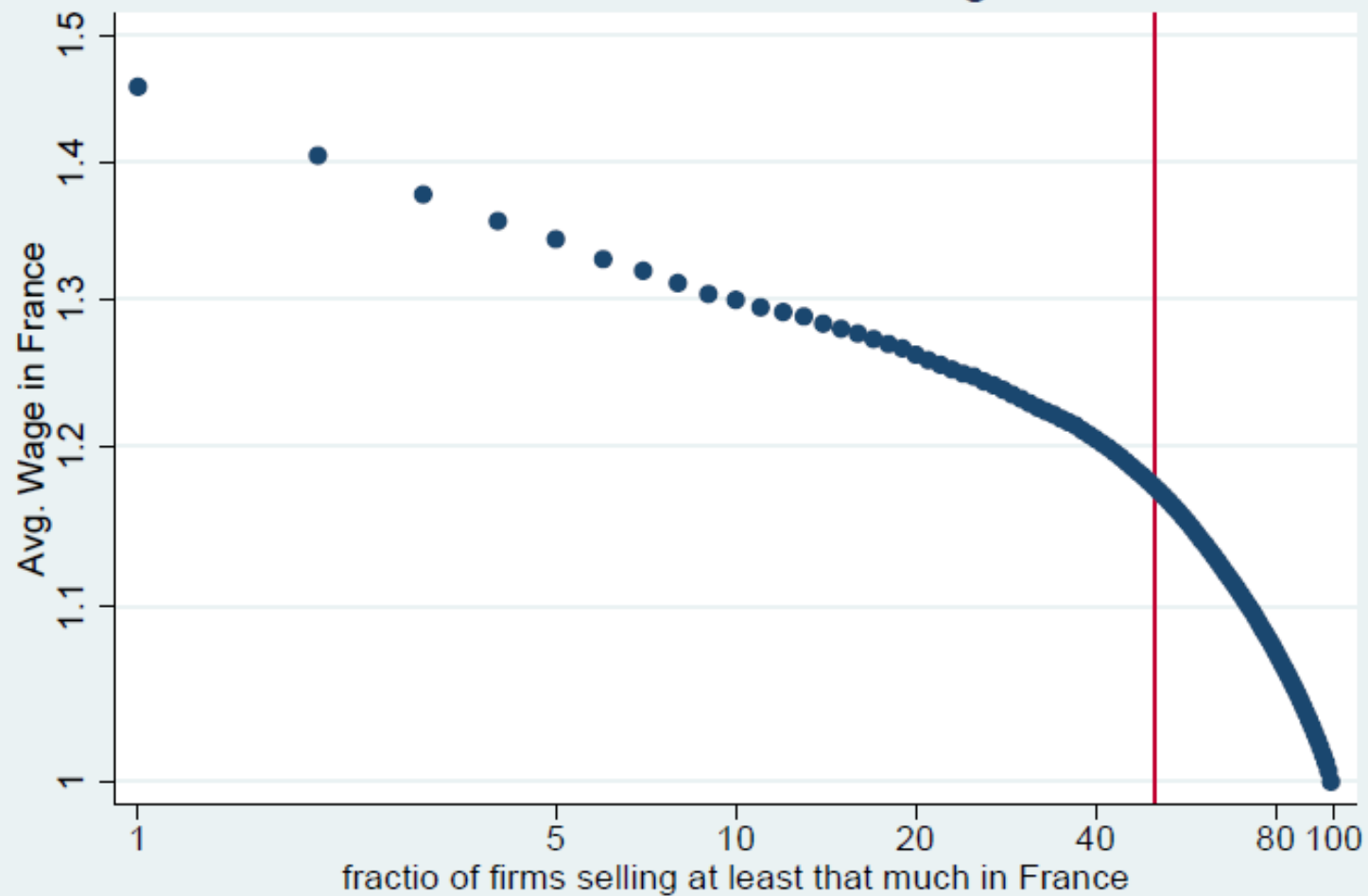
Distribution of Wages by Export Market



Distribution of Wages by Import Country

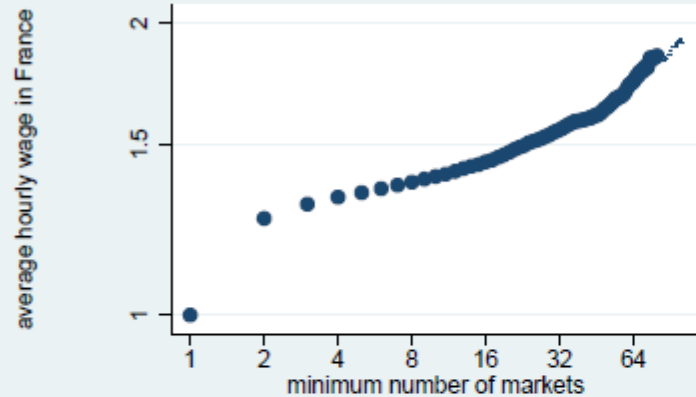


Sales in France and Wages

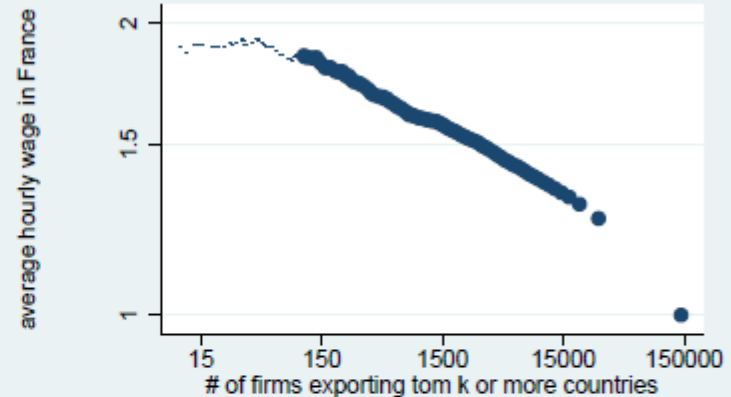


Exports and Wages in France

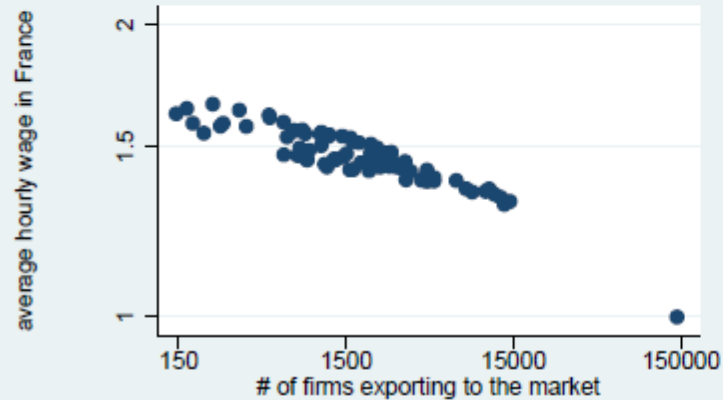
Wages in France and Exports



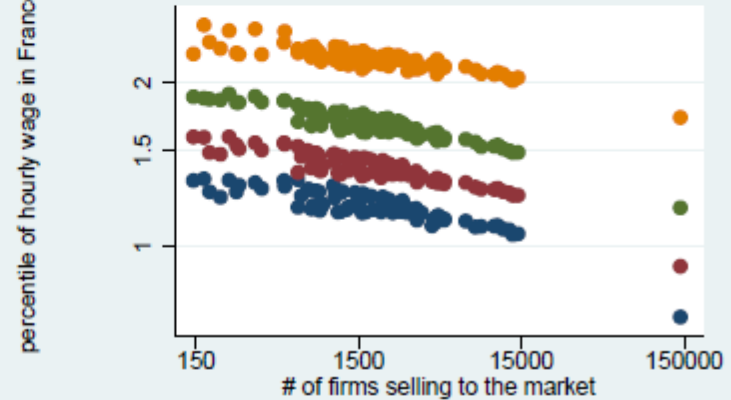
Wages in France and Nbr. of Countries



Wages in France and Nbr. of Exporters

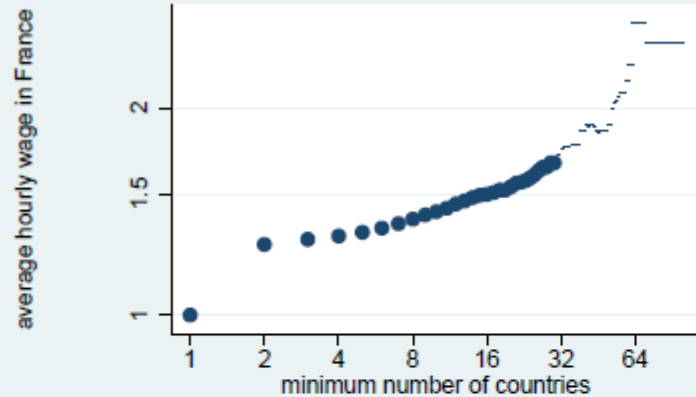


Distribution of wages in France

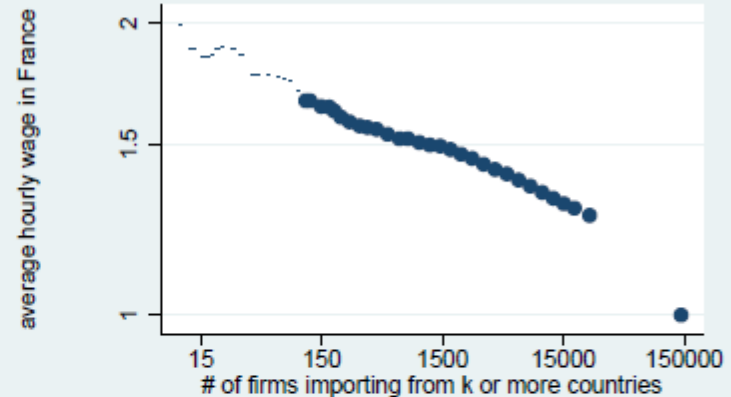


Imports and Wages in France

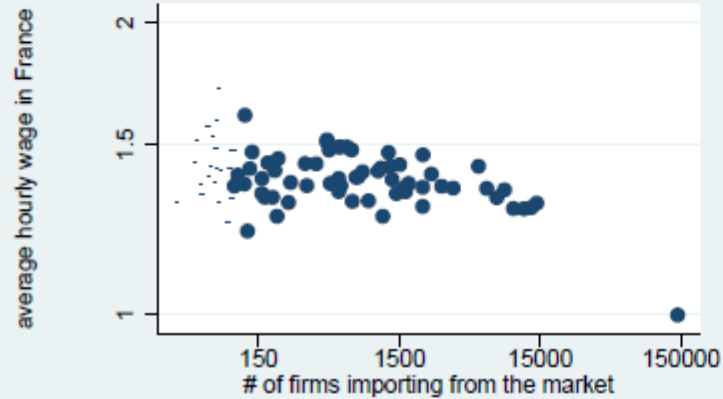
Wages in France and Imports



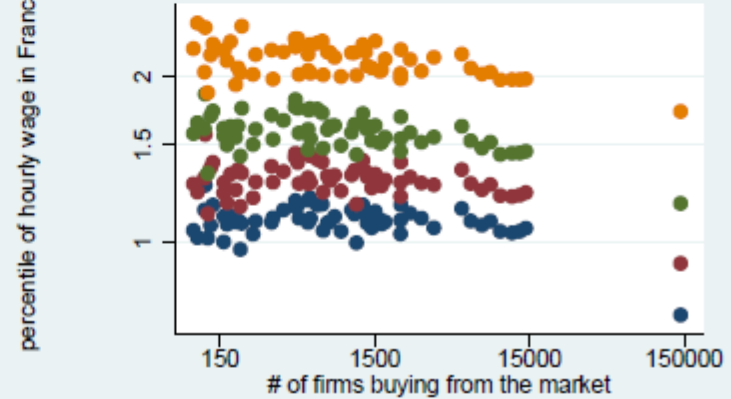
Wages in France and Nbr. of Countries



Wages in France and Nbr. of Importers

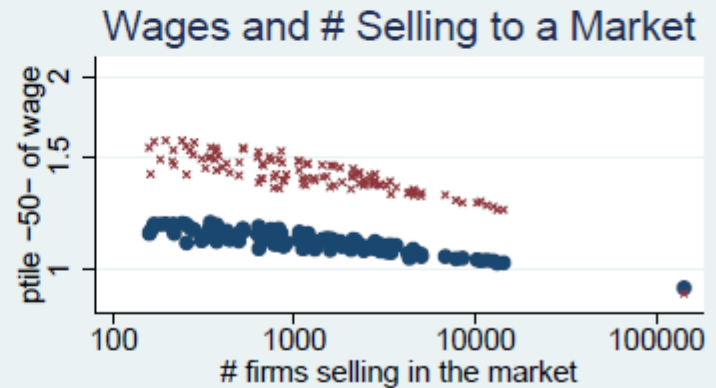
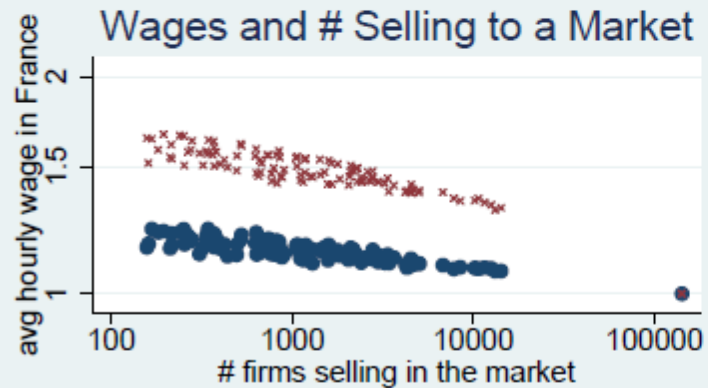
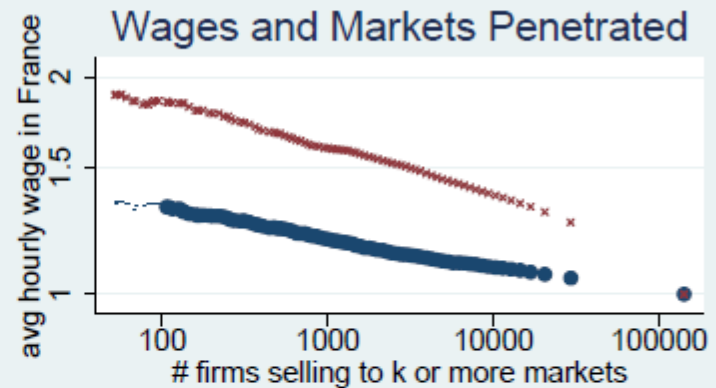
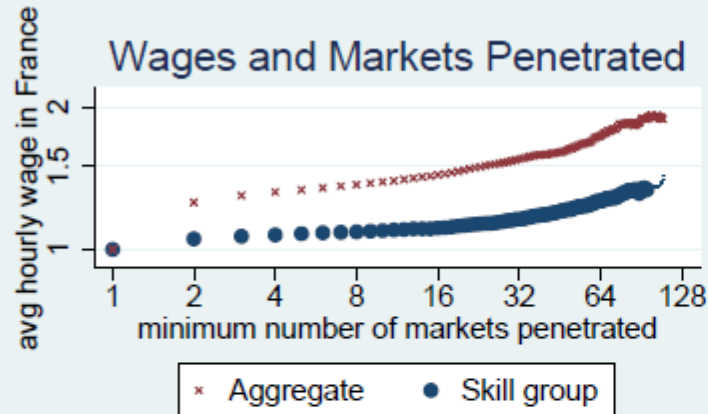


Distribution of wages in France



Exports and Average Hourly Wage

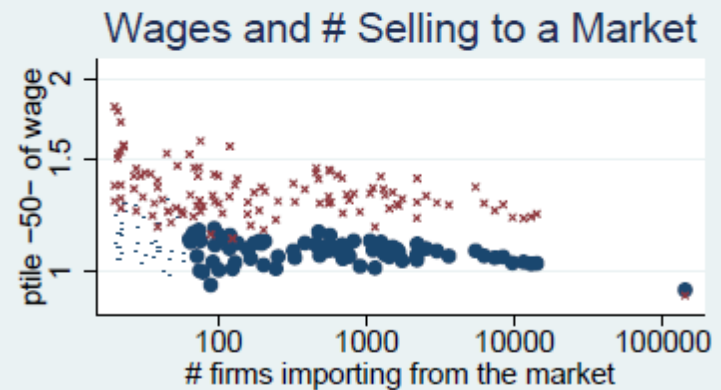
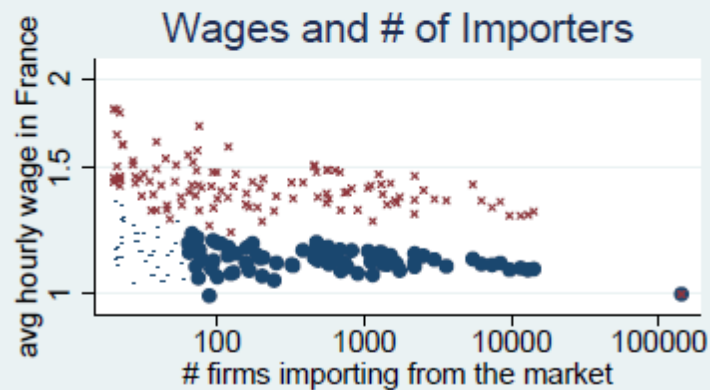
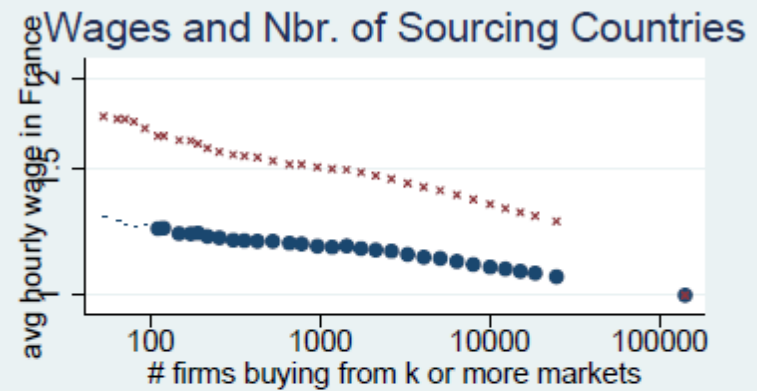
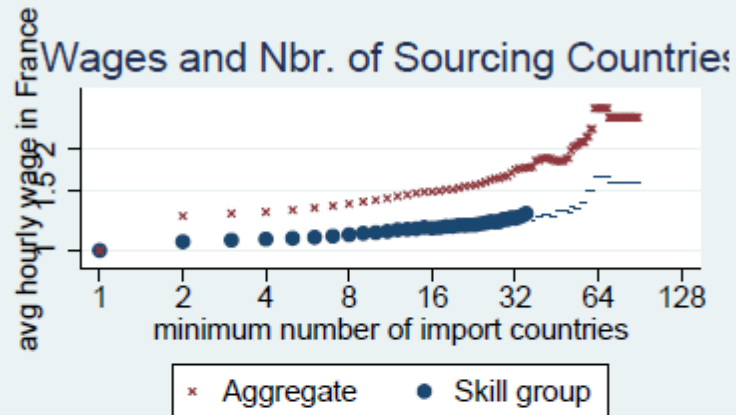
Administrative and commercial managers



Number of firms:30880 ; Number of exporters: 16556

Imports and Average Hourly Wage

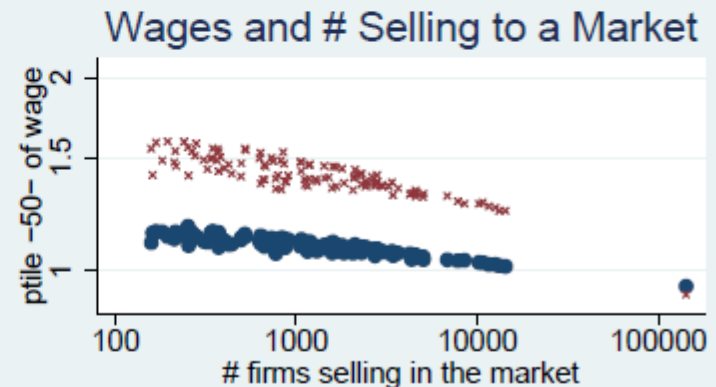
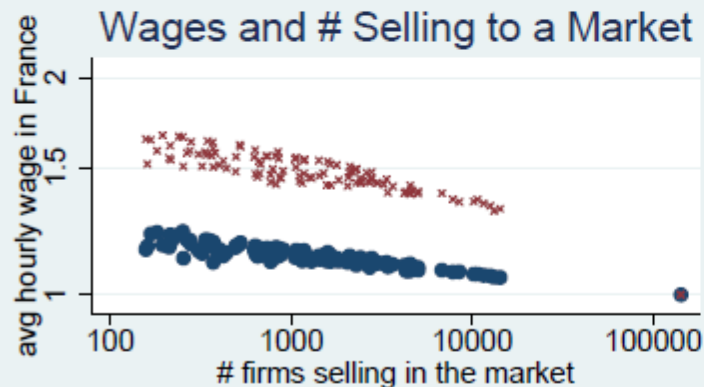
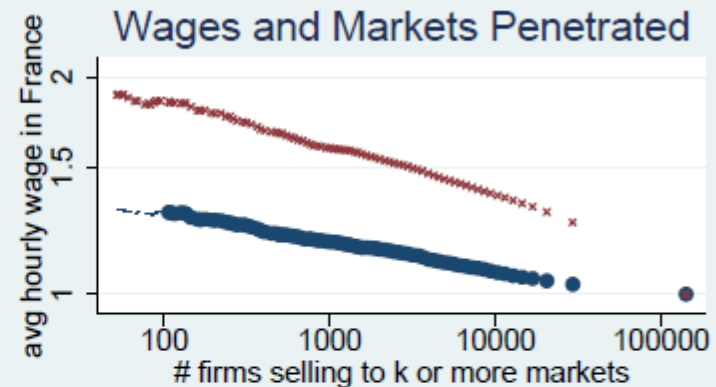
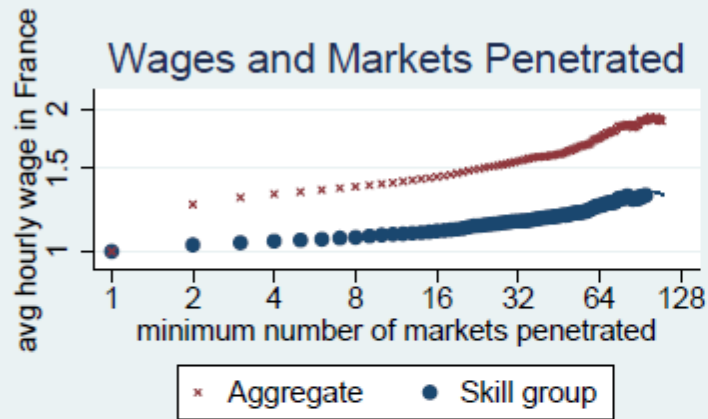
Administrative and commercial managers



Number of firms:30877 ; Number of importers: 15296

Exports and Average Hourly Wage

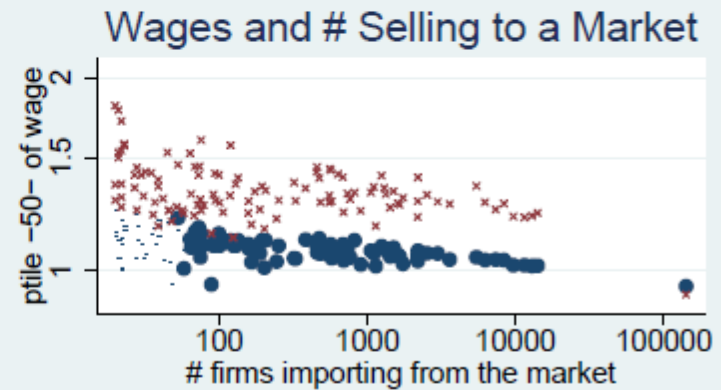
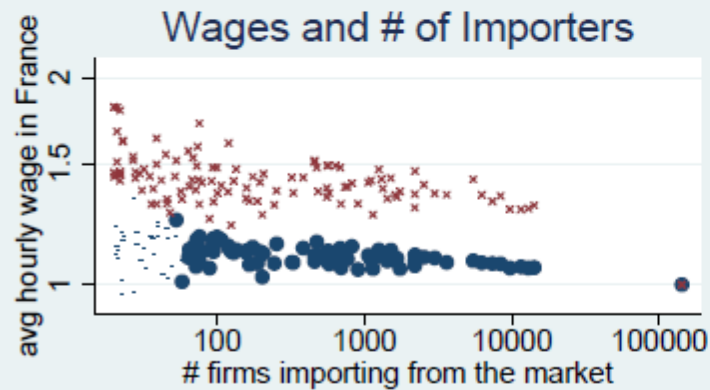
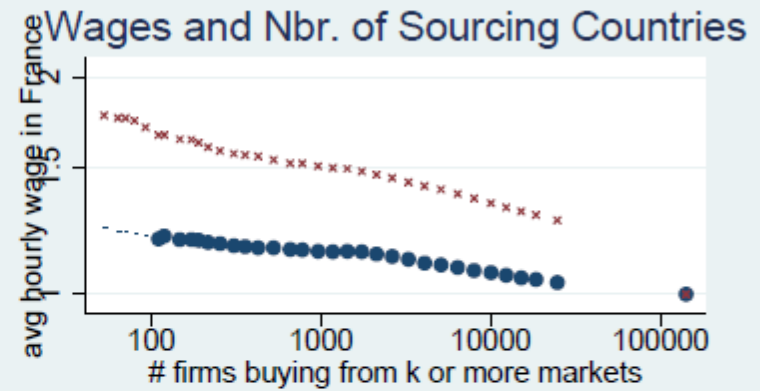
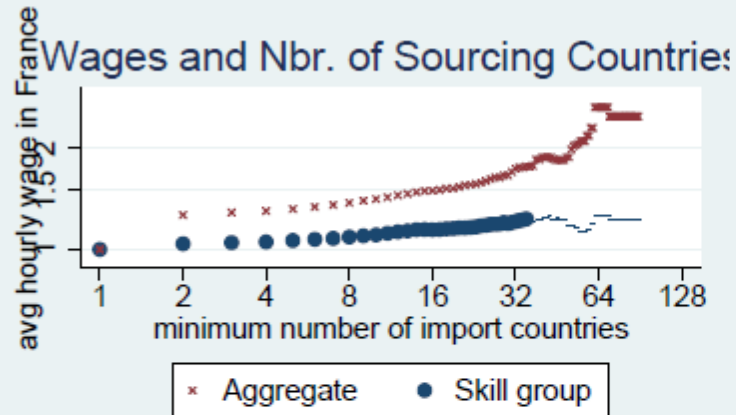
Technical managers and engineers



Number of firms:32757 ; Number of exporters: 17378

Imports and Average Hourly Wage

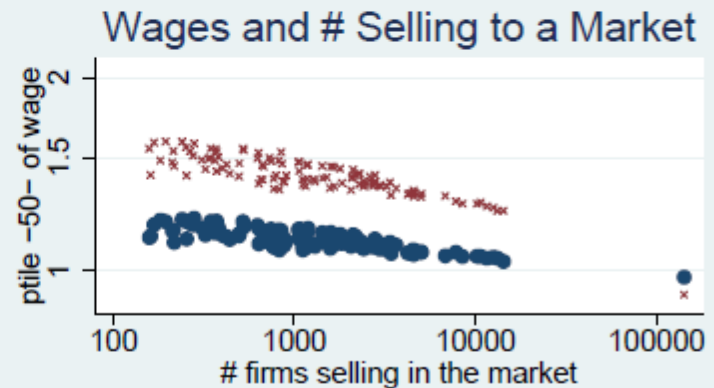
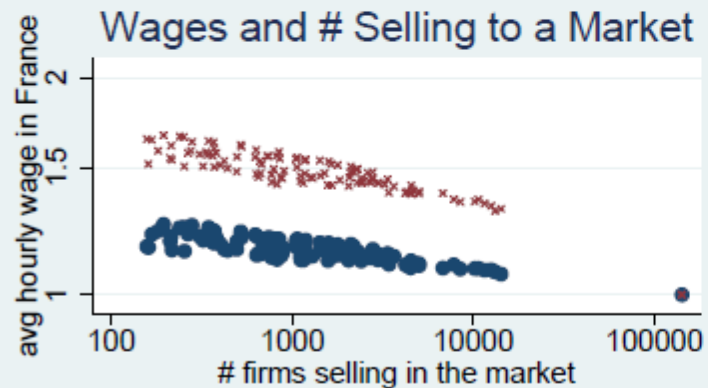
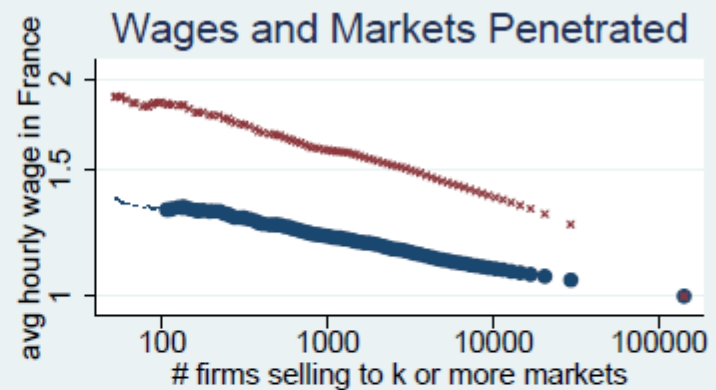
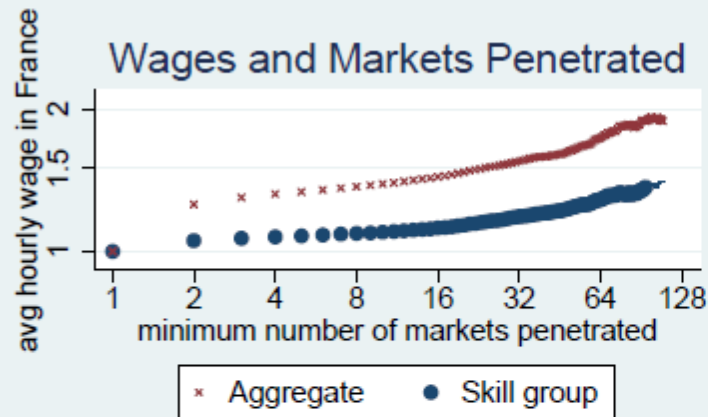
Technical managers and engineers



Number of firms:32752 ; Number of importers: 16055

Exports and Average Hourly Wage

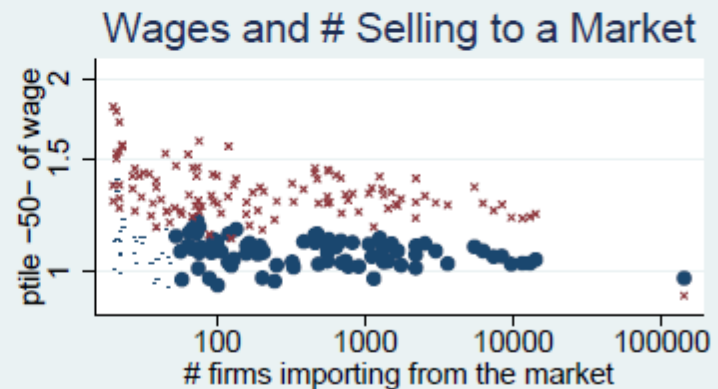
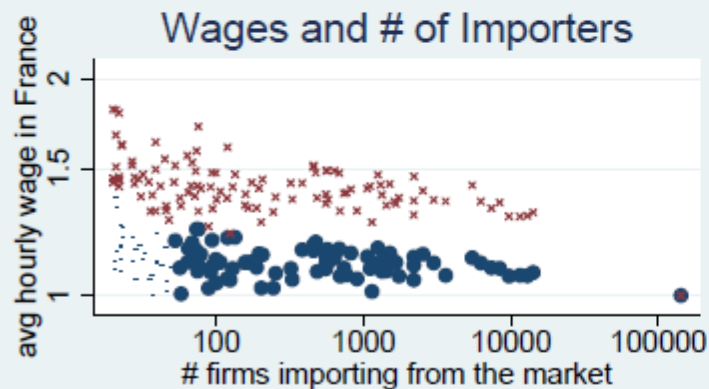
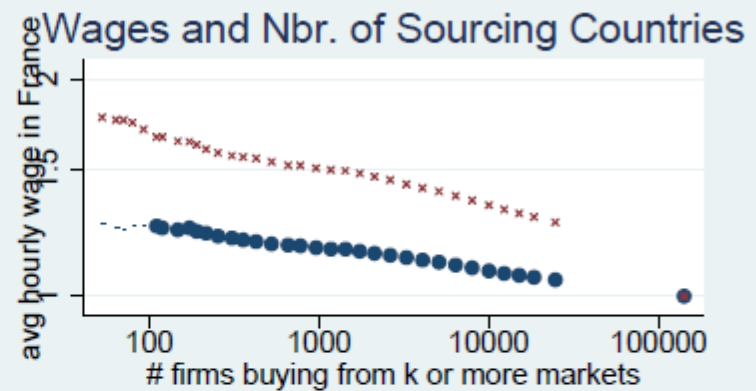
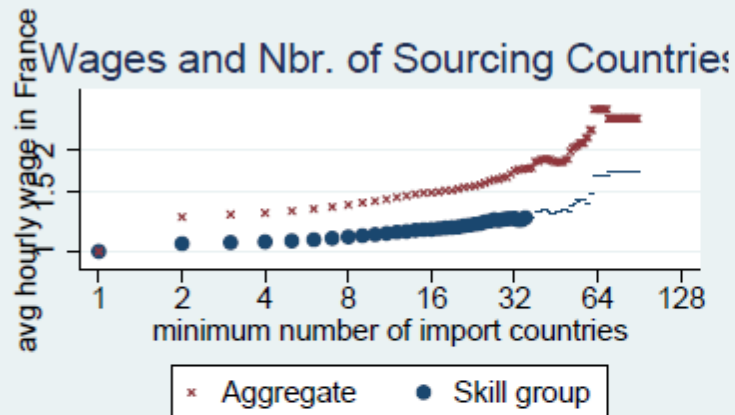
Skilled blue-collar workers (non-crafts)



Number of firms:66673 ; Number of exporters: 23631

Imports and Average Hourly Wage

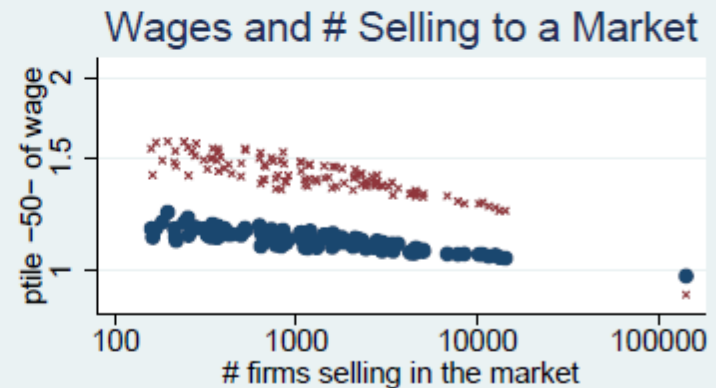
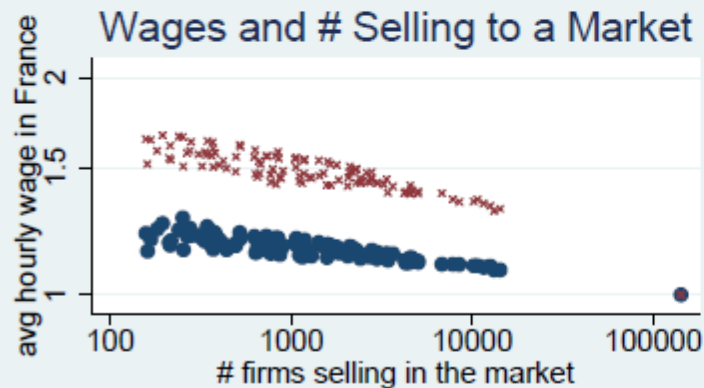
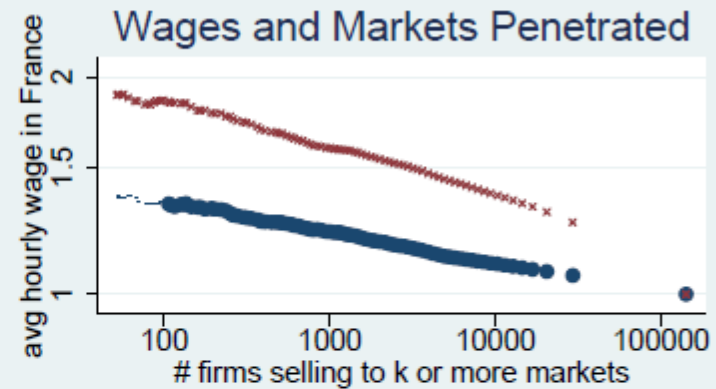
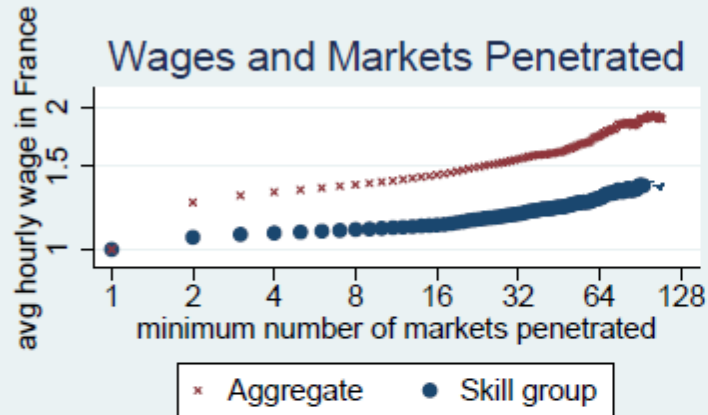
Skilled blue-collar workers (non-crafts)



Number of firms:66659 ; Number of importers: 20725

Exports and Average Hourly Wage

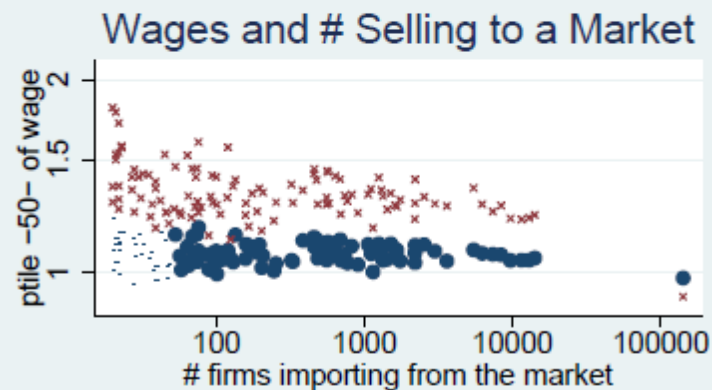
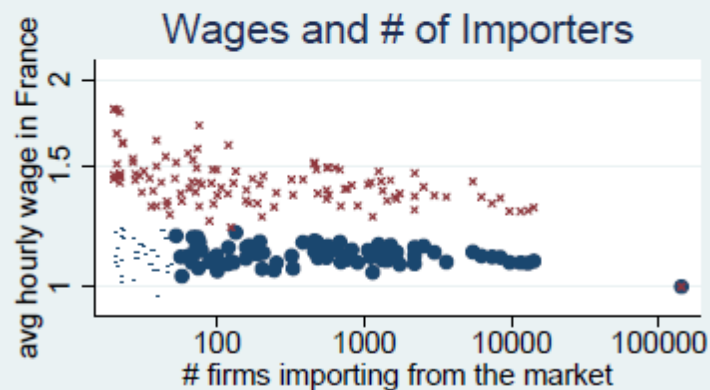
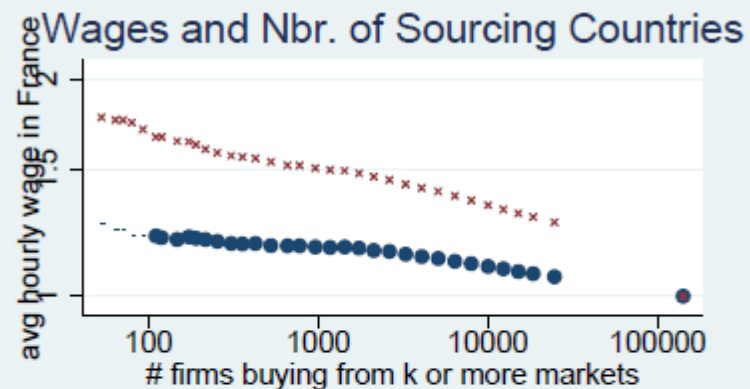
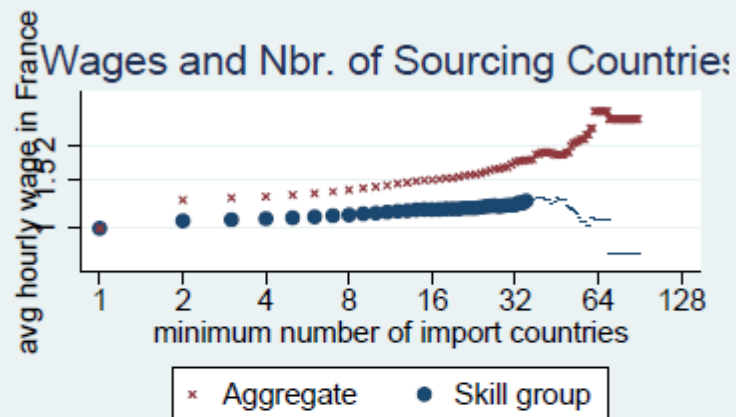
Unskilled blue-collar workers (non-crafts)



Number of firms:58376 ; Number of exporters: 21749

Imports and Average Hourly Wage

Unskilled blue-collar workers (non-crafts)



Number of firms: 58365 ; Number of importers: 19395

[illegible]

<i>Log of hourly wage</i>	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

[illegible]

<i>Share in wage bill</i>	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 $q_n(j) = z(j) [l_n(j)]^\beta [m_n(j)]^{1-\beta} / d_n$

- 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: K Inputs and Outsourcing I

- The production function is:

$$Y(j) = aZ(j)L_0(j)^{\beta_0} \prod_{k=1}^K [\delta_k L_k(j) + (1 - \delta_k)M_k(j)]^{\beta_k},$$

- Given prices of intermediates $\{p_k\}$, the cost of the input bundle is:

$$b(p_1, \dots, p_K) = (w_0)^{\beta_0} \prod_{k=1}^K (\min \{w_k, p_k\})^{\beta_k}.$$

Conjecturing that the distribution of prices paid for intermediate inputs, purchased from another firm, is $\Pr[P_k \leq p] = \left(\frac{p}{\lambda}\right)^\theta = F(p)$

EKKS: K Inputs and Outsourcing II

- We get (after multiple integrations) the distribution of costs:

$$\begin{aligned}\mu(c) &= \lambda^{-\theta K} T c^\theta (w_0)^{-\theta\beta_0} \prod_{k=1}^K (w_k)^{-\theta\beta_k} \left[\frac{\beta_k}{1 - \beta_k} (w_k)^\theta + \lambda^\theta \right] \\ &= \tilde{\lambda} \Phi c^\theta, \text{ still a function of } c^\theta\end{aligned}$$

- where λ is solution of the fixed-point equation:

$$\prod_{k=1}^K \left[\frac{\beta_k}{1 - \beta_k} (w_k)^\theta + \lambda^\theta \right] = \frac{X}{\sigma F} \frac{\theta - (\sigma - 1)}{\theta \Phi} (\lambda^\theta)^{K-1},$$

EKKS: Sales with Multiple Inputs and Outsourcing I

- Consider a 2—inputs economy (good 0 and $K = 1$).
- On top of final sales $X^F(c)$, a firm with cost c sells intermediates to a potential buyer with cost c' , an amount $X^M(c)$:

$$\begin{aligned}
 X^M(c) &= \beta_1 \delta_1 [c \leq w_1] \left[\frac{1}{\bar{m}} X^F(c') + X^M(c) \right] \\
 &= \beta_1 \delta_1 [c \leq w_1] \frac{T}{T \underline{z}^{-\theta}} \left\{ \frac{1}{\bar{m}} \int_{\underline{z}}^{\infty} \left(\frac{\bar{m} w_0^{\beta_0} c^{\beta_1}}{z'} \right)^{1-\sigma} \frac{X}{P^{1-\sigma}} \theta z'^{-\theta-1} dz' \right. \\
 &\quad \left. + \int_{\underline{z}}^{\infty} X^M \left(\frac{w_0^{\beta_0} c^{\beta_1}}{z'} \right) \theta z'^{-\theta-1} dz' \right\}
 \end{aligned}$$

- where z' is the efficiency of the buyer buying from firm with cost c :

$$z' = \frac{w_0^{\beta_0} c^{\beta_1}}{c'}$$

- and a minimal efficiency \underline{z} : $\underline{z} = \frac{w_0^{\beta_0} c^{\beta_1}}{\bar{c}}$

EKKS: Sales with Multiple Inputs and Outsourcing II

- All computations done, the expected sales of intermediates of a producer with unit cost c as:

$$X^M(c) = \beta_1 \delta_1 [c \leq w_1] \left\{ \bar{c}^{1-\sigma} \bar{m}^{-\sigma} \left(\frac{X}{P^{1-\sigma}} \right) \frac{\theta}{\theta - (\sigma - 1)} + \bar{c}^{-\theta} \Lambda^M \right\}$$

- with (note the Multiplier effect)

$$\Lambda^M = \frac{\beta_1 \bar{c}^{-(\sigma-1)} (w_1)^\theta \bar{m}^{-\sigma} \left(\frac{X}{P^{1-\sigma}} \right) \frac{\theta}{\theta - (\sigma - 1)}}{1 - \beta_1 \bar{c}^{-\theta} (w_1)^\theta}$$

.

- The extension to K inputs is straightforward (but tedious) with a similar flavor

EKKS: The Open Economy with Multiple Markets

- With N countries and K inputs:

$$X_n^M(c) = \pi_{nn} \sum_{k=1}^K \beta_{k,n} \delta_{k,n} [c \leq w_{k,n}] \bar{c}_n^{-\theta} \sum_{m=1}^N d_{mn}^{-\theta} \\ \times \left\{ \bar{m}^{-\sigma} \frac{X_m}{P_m^{1-\sigma}} \frac{\theta}{\theta - (\sigma - 1)} \bar{c}_m^{\theta - (\sigma - 1)} + \Lambda_m^M \right\}$$

- where $\Lambda^M = \{\Lambda_1^M, \Lambda_2^M, \dots, \Lambda_N^M\}'$

- $\widetilde{\mathbf{X}} = \left\{ \left(\frac{1}{\bar{P}_1} \right)^{1-\sigma} X_1 \bar{c}_1^{\theta - (\sigma - 1)}, \left(\frac{1}{\bar{P}_2} \right)^{1-\sigma} X_2 \bar{c}_2^{\theta - (\sigma - 1)}, \dots, \left(\frac{1}{\bar{P}_N} \right)^{1-\sigma} X_N \bar{c}_N^{\theta - (\sigma - 1)} \right\}'$

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

$$b_{nm} = \pi_{nn} \bar{c}_n^{-\theta} \sum_{k=1}^K \beta_{k,n} w_{k,n}^{\theta} d_{mn}^{-\theta}$$

- This yields the solution:

$$\Lambda^M = \frac{\theta \bar{m}^{-\sigma}}{\theta - (\sigma - 1)} [\mathbf{I} - \mathbf{B}]^{-1} \mathbf{B} \widetilde{\mathbf{X}}$$

- Finally, we extend the model to firms with heterogeneous number of inputs K and fixed cost F_K

EKKS: Bargaining on Wages and Employment + EKK

- We look at the simple case: l and m (extension to the above embellishments of EKK is straightforward).

- wage w , price P_F for intermediates, fixed costs $E_n(j)$, profit in n is:

$$\Pi_n(l, m, f, w) = x_n(l, m, f) - wl - P_F m - E_n(j) \text{ with } E_n(j) = \varepsilon_n(j) E_n M(f)$$

- workers and firm use efficient bargaining and maximize:

$$L_n(l, m, f, w) = (1 - \gamma) \ln \Pi_n(l, m, f, w) + \gamma \ln(wl - \underline{w}l),$$

- with $0 \leq \gamma \leq 1$ reflects the bargaining power of workers and \underline{w} workers' reservation wage, FOC yield:

$$\begin{aligned} w &= \underline{w} + \gamma \frac{x_n(l, m, f) - \underline{w}l - P_F m - E_n(j)}{l} \\ \frac{\partial x_n(l, m, f)}{\partial l} &= \underline{w} \end{aligned}$$

Solution for the Wage

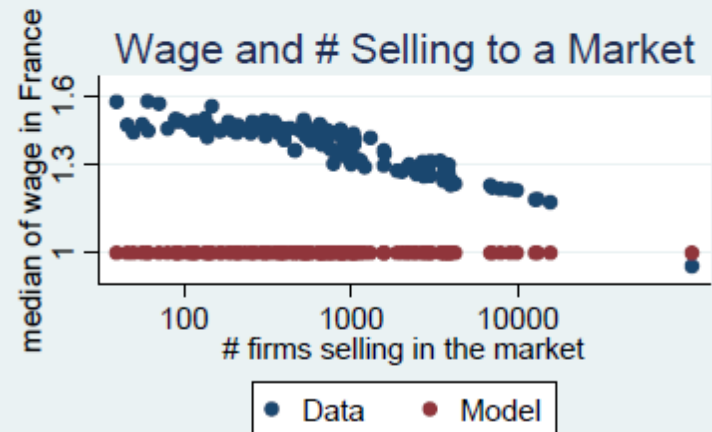
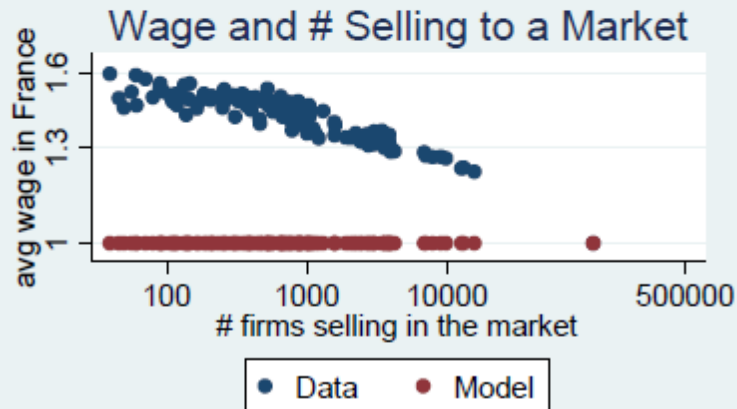
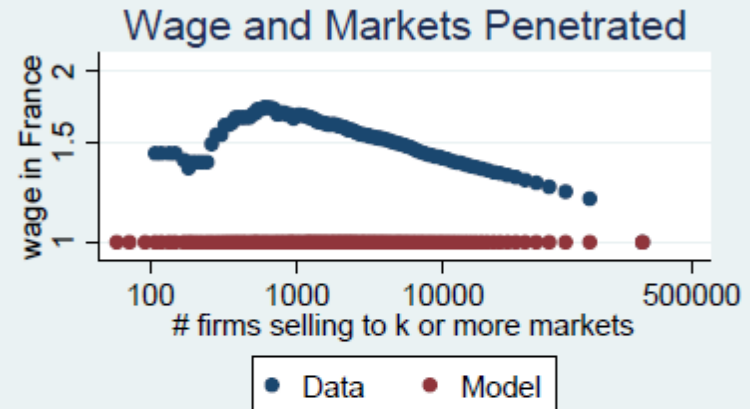
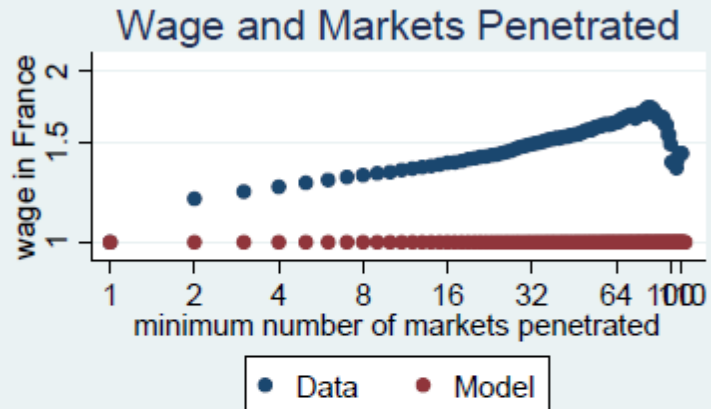
- Solving for the wage yields:

$$w = \underline{w} \left(1 + \frac{\gamma}{(\sigma - 1) \beta} \right) - \frac{\gamma \underline{w} \bar{m}}{\beta} \sum_n \frac{E_n(j)}{x_n(j)} \frac{x_n(j)}{x(j)}$$

- with $E_n(j)/x_n(j)$ increasing in the firm's cost
- It is easy to incorporate K observable skills
- It is easy to model fixed costs of export as labor (with useful consequences)

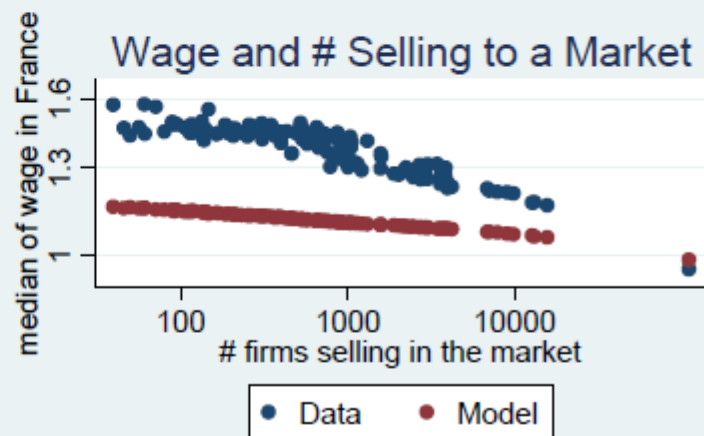
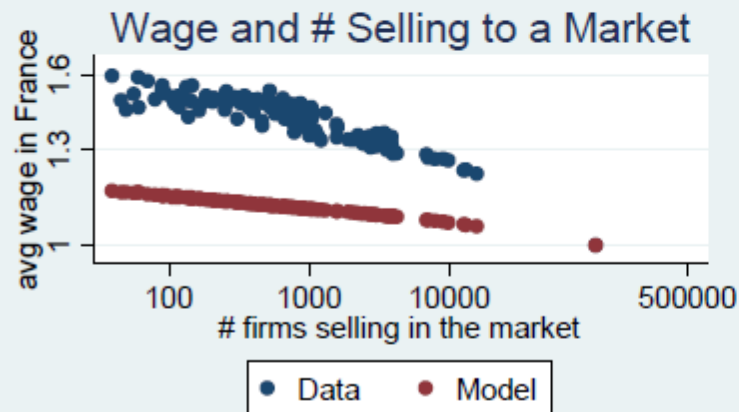
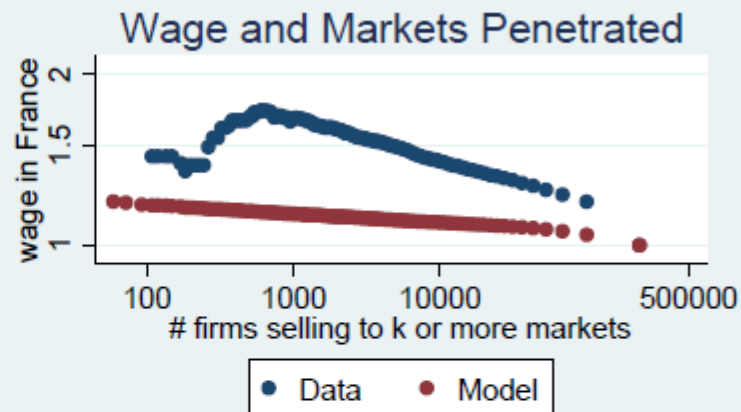
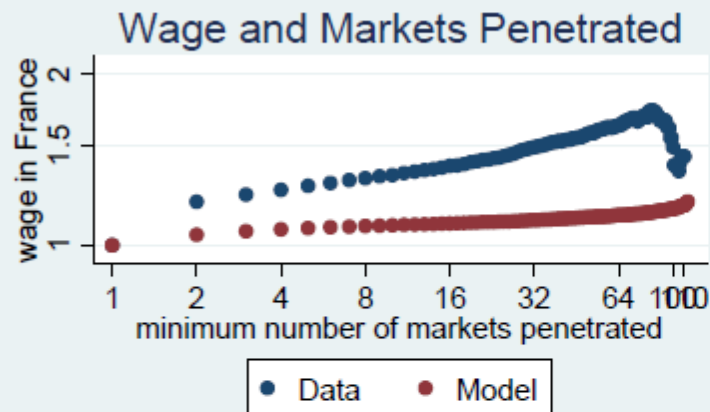
Model Fit: Wage and Exports

$\Gamma=0.0$, $\Sigma=3$, $\Theta=2.46$



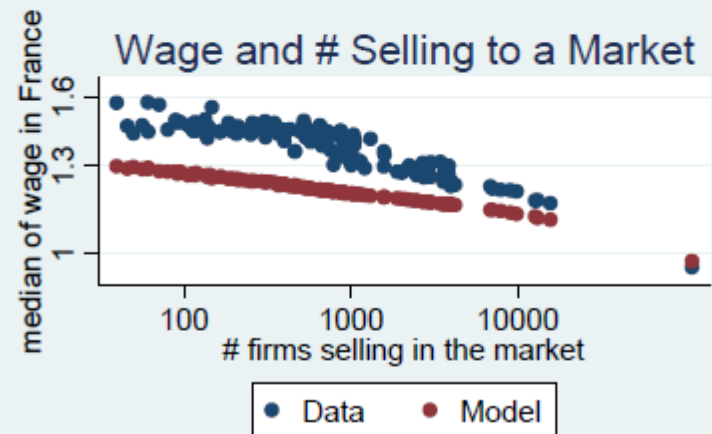
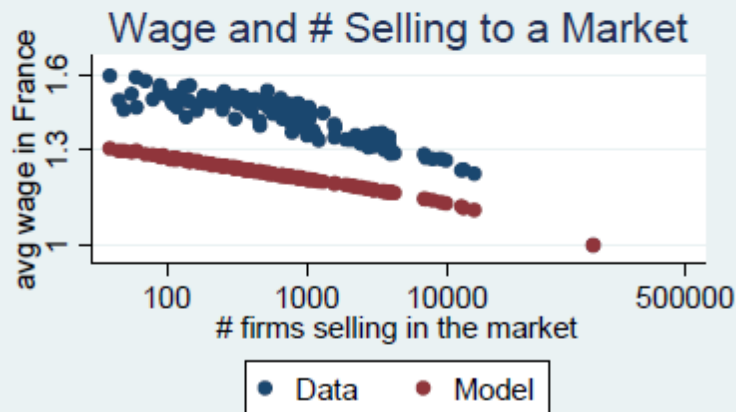
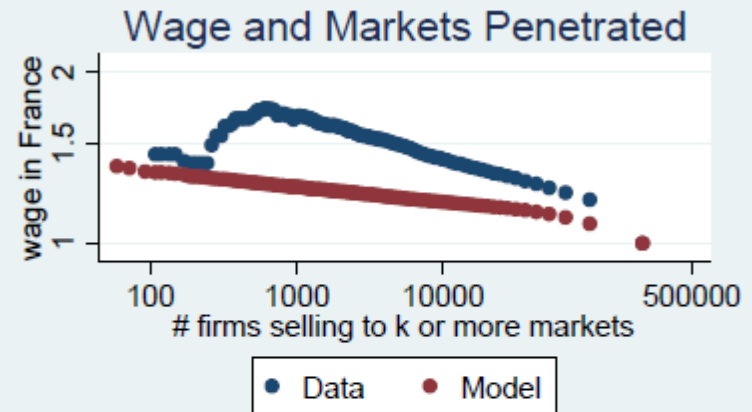
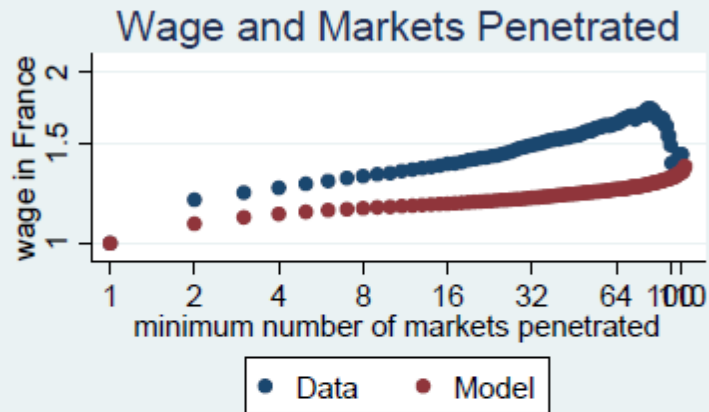
Model Fit: Wage and Exports

$\text{Gamma}=0.25$, $\text{Sigma}=3$, $\text{Thetatilde}=2.46$



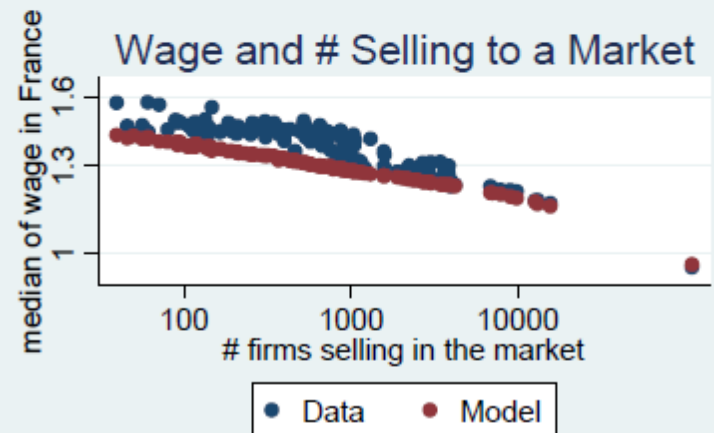
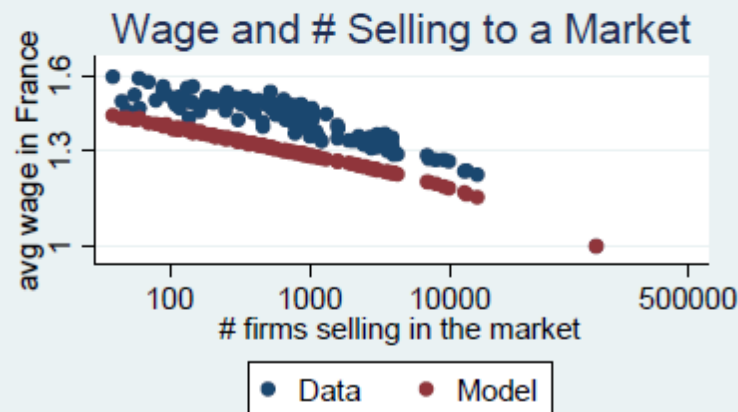
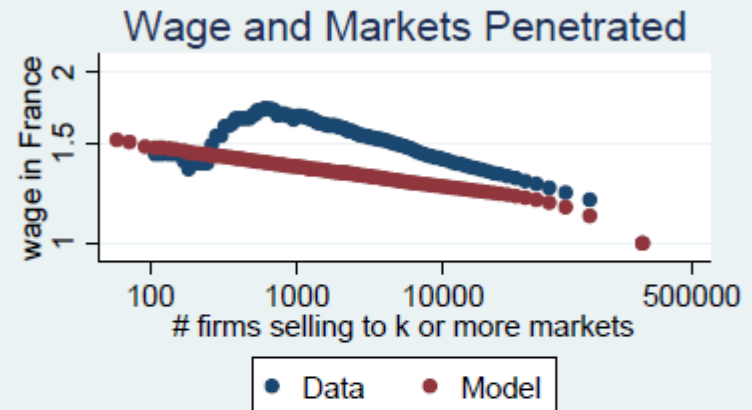
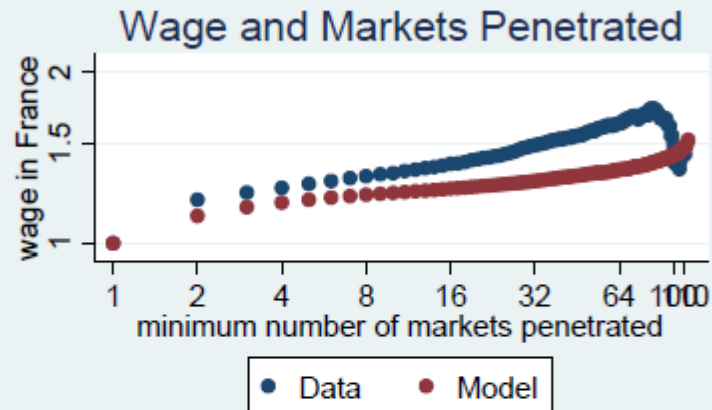
Model Fit: Wage and Exports

$\text{Gamma}=0.50$, $\text{Sigma}=3$, $\text{Thetatilde}=2.46$



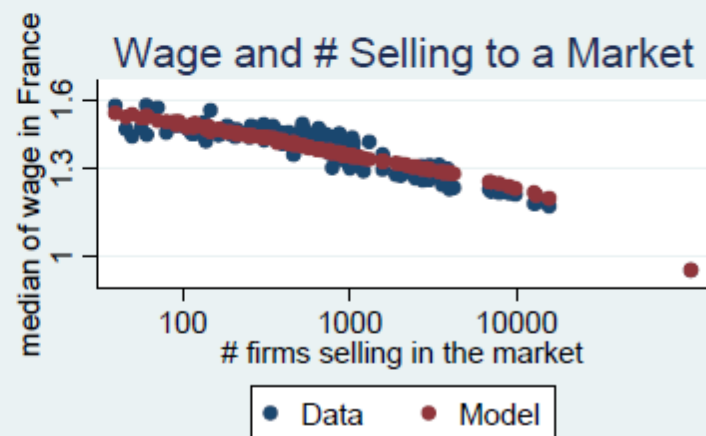
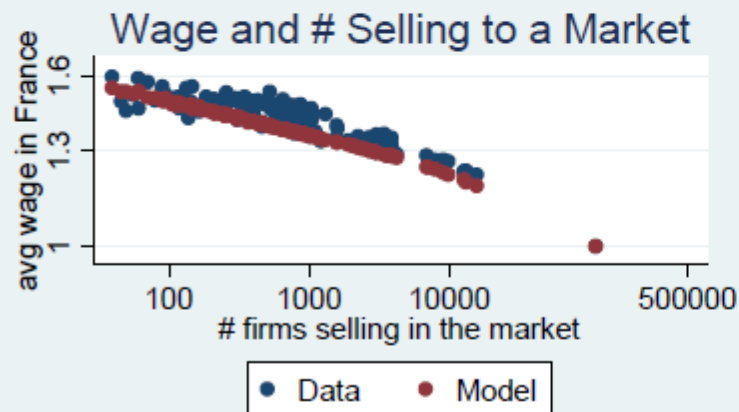
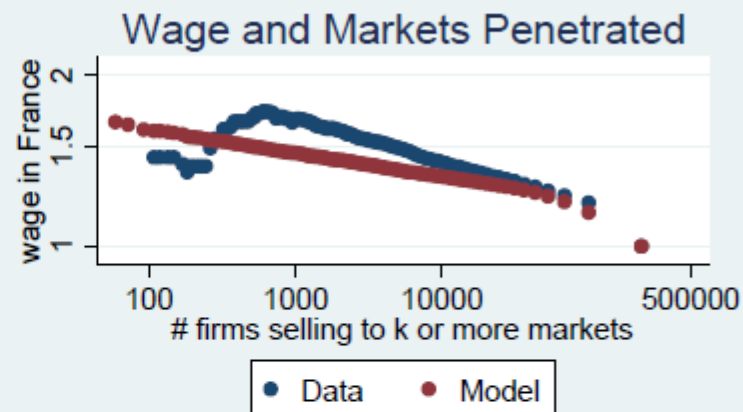
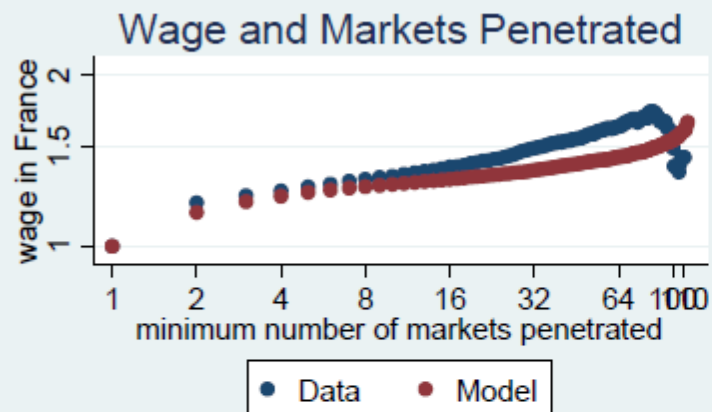
Model Fit: Wage and Exports

$\Gamma=0.75$, $\Sigma=3$, $\Theta=2.46$



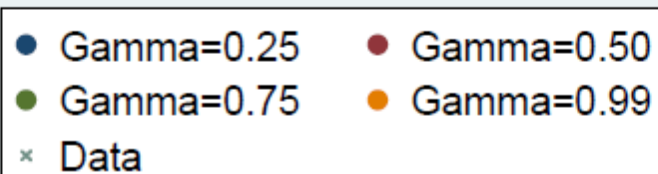
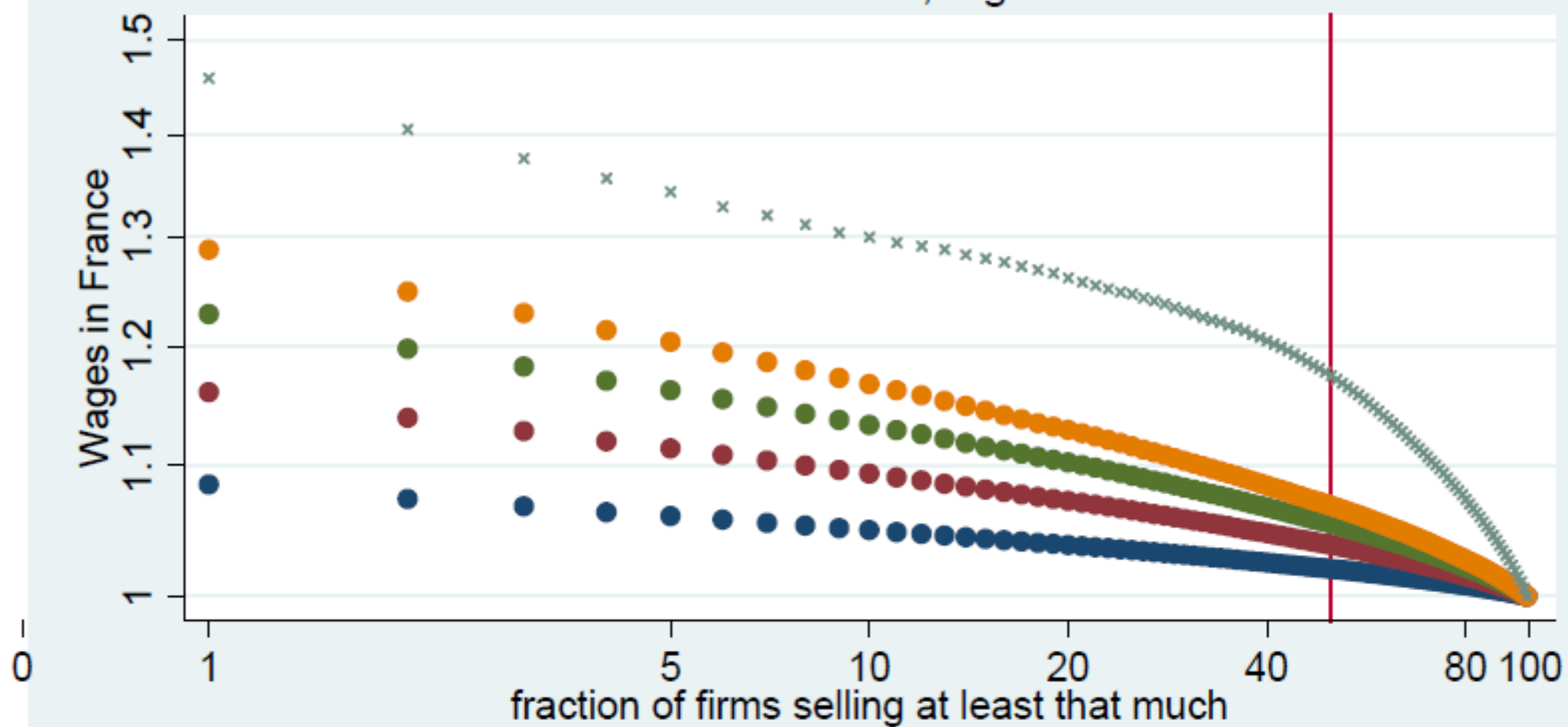
Model Fit: Wage and Exports

$\Gamma=0.99$, $\Sigma=3$, $\Theta=2.46$



Sales in France and Wages

$\Theta = 2.46$; $\Sigma = 3$



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,
- 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