The Nottingham Lectures in International Economics

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Lecture 2: Gains in Worker Productivity and Wages through Foreign Firms and Foreign Experts

Background papers:

Malchow Møller, Nikolaj, James R. Markusen and Bertil Schjerning, "Foreign Firms, Domestic Workers", 2007 wp.

Markusen, James R. and Natalia Trofimenko (2007). "Teaching the Locals New Tricks: Foreign Experts as a source of Productivity Transfer", NBER working paper 12872, CEPR paper 6118. Under revision for the *Journal of Development Economics*.

Foreign Owned Firms, Productivity Transfers, and Entrepreneurship

Nikolaj Malchow-Møller
James R. Markusen
Bertel Schjerning

Motivation

Widespread believe that multinational firms bring productivity benefits to host countries.

Mixed empirical support for this (see various Keller papers), depends where one looks for "spillovers"

Theoretical microfoundations are limited. Two mechanisms that have gotten some attention are backwards linkages and worker learning.

Purpose of this paper: provide some theoretical microfoundations, and examine these using matched firm and worker data from Denmark

Our approach: combines

    Heterogeneous firm model of Meltiz
    Learning-on-the job model of Ethier and Markusen

High and moderate productivity firms, domestic and foreign firms

    All HP domestic and foreign firms can enter
    Only domestic MP firms can enter

Workers learn in proportion to firm's productivity, and carry part of that learning when switching firm types or switching to self-employment

Theoretical results:

    foreign firms pay, on average, higher wages
    have higher wage growth
    employees earn more in subsequent employment in domestic firms or
        in self-employment

BUT, the foreign firm effect disappears when controlling for firm size

Empirical results:

    working for a foreign firm increases wages, wage growth, and
        subsequent earnings.

    this effect is significantly reduced, but not eliminated when controlling
        for firm size and worker experience.

Model

(1) Two firm types, high (HP) and moderate (MP) productivity.

(2) Domestic and foreign firms take productivity draws,
    Small number of domestic and foreign firms draw HP
    Large number of domestic and foreign firms draw MP

(3) Entry costs for foreign firms

(4) All domestic and foreign HP firms can enter (sufficient mkt size)
    Zero profits (free entry) determines the number of domestic MP firms
    Foreign MP firms cannot enter due to entry costs.

(5) *Average* productivity of a domestic firm < foreign firm

(6) Symmetric demand for varieties ⇒ HP firms larger
    Average size of a domestic firm < foreign firm

(7) Quasi-dynamic: firms long lived, fixed costs per period,
      demand stationary.
      No investment or borrowing
      MP firms can decide to enter or not in any period
      Analyze a single "steady state" period

(8) Quasi-overlapping generations feature.
      Each worker has a two-period career, initially identical
      Join MP firm: stationary productivity
      Join HP firm: higher initial productivity, higher yet 2nd period

(9) Skills not firm-specific
      Workers with one-period of HP firm experience earn their
          full productivity in period 2.
      HP workers can transit to MP firms for their 2nd period

(10) At the beginning of the second period, workers take a draw
      Either high or low productivity in self-employment
      Workers switching to self-employment exit the industry.

(11) Partial equilibrium

Unlimited supply of inexperienced workers available

Fixed total expenditure on the industry

Notation

r_i^h labor productivity (in physical units of X output) in HP firms, where i = 1 is an inexperienced worker and i = 2 is an experienced worker. Workers in MP firms do not learn: $r_i^m = 1$.

r_t^m A worker with one-period of experience in a HP firm can transit to a MP firm, with r_t^m denoting that worker's productivity. We assume that

$1 < r_t^m < r_2^h$ (will be endogenized)

w_i^h wage of an inexperienced worker (i = 1) and an experienced worker (i = 2) in a HP firm, or a transit worker.

n_d^h, n_f^h -   number of type-h firms of domestic (d) and foreign (f) origin. These are *constants* (all existing HP firms can enter).

n^m number of type-m firms, free entry. This is a *variable.*

p^h price of a representative differentiated good of a type-h firm.

p^m price of a representative good produced by a type-m firm.

v multiplier (>1) giving self-employment earings for workers who get a good draw (e.g., earnings $= w_2^h * v$ for a worker from a H firm).

α the share of workers who, at the beginning of period 2 of their career, learn that they have a higher productivity as self-employed

δ the discount factor, $0 < \delta = 1/(1+r) < 1$, where r = discount rate

Demand for an individual firm

$$X_i = p_i^{-\sigma} \left[\sum_k p_k^{1-\sigma} \right]^{-1} I \tag{1}$$

First-order conditions for employment of experienced and inexperienced workers by HP firms.

$$p^h (1 - 1/\sigma) r_1^h \leq w_1^h \qquad\qquad X_1^h \tag{3}$$

$$p^h (1 - 1/\sigma) r_2^h \leq w_2^h \qquad\qquad X_2^h \tag{4}$$

Market clearing condition, that first-period workers in HP firms are all employment in their second period

$$(1 - \alpha)[n_d^h(F_d^h + X_1^h/r_1^h) + n_f^h(F_f^h + X_1^h/r_1^h)] \geq$$

$$n_d^h(F_d^h + X_2^h/r_2^h) + n_f^h(F_f^h + X_2^h/r_2^h) + n^m(s^t F^m + X_t^m/r_t^m)$$

$$\text{where } s^t = (X_t^m/r_t^m)/(X_t^m/r_t^m + X^m) \qquad w_2^h \qquad (5)$$

Free entry or indifference condition for workers when they start their career in choosing between HP and MP firms.

$$w_1^h \geq 1 - \delta(1 - \alpha)(w_2^h - 1) - \delta\alpha(w_2^h v - v) \qquad w_1^h \qquad (6)$$

First-order conditions for MP firms employing inexperienced and transit workers.

$$p^m(1 - 1/\sigma) \leq 1 \qquad\qquad X^m \qquad (7)$$

$$p^m (1 - 1/\sigma) r_t^m \leq w_2^h \qquad\qquad X_t^m \qquad (8)$$

Free-entry (zero-profits) condition for MP firms.

$$p^m X_1^m + p^m X_t^m \leq F^m + X^m + w_2^h X_t^m / r^t \qquad\qquad n^m \qquad (9)$$

Demand for a HP firm and MP firm respectively.

$$X_1^h + X_2^h = (p^h)^{-\sigma} \left[(n_d^h + n_f^h)(p^h)^{1-\sigma} + n^m (p^m)^{1-\sigma} \right]^{-1} I \qquad p^h$$

$$(10)$$

$$X^m + X_t^m = (p^m)^{-\sigma} \left[(n_d^h + n_f^h)(p^h)^{1-\sigma} + n^m (p^m)^{1-\sigma} \right]^{-1} I \qquad p^m$$

$$(11)$$

Productivity of a transit worker: decreasing in the share of transit workers in total MP firm employment.

$$r_t^m = \gamma + \rho(X^m/(X^m + X_t^m/r_t^m)) = \gamma + \rho(1 - s^t) \qquad (\gamma + \rho) > 1$$

$$r_t^m \qquad (12)$$

Endogenizing this transit productivity prevents bang-bang solution in which either zero or all workers with one-period of HP firm experience shift to MP firms.

Technical fudge, but captures a "spillover" idea. MP firm workers benefit from watching the transit worker, but this effect diminishes with the share of transit workers in the firm.

Analytical solution:

FOCs (3), (4), and indifference condition (6) give

(A) $\quad w_1^h, w_2^h,$

$\qquad w_1^h < 1 \quad w_2^h > 1 \quad w_1^h + w_2^h > \quad w_1^m + w_2^m = 2$

FOCs (7), (3), (A) give

(B) $\quad p^m, p^h, \quad p^m > p^h$

Zero-profit condition (9) and (B) give

(C) $\quad$ output per type-M firm

The consumer's MRS condition and (C) give

    (D)   output per HP firm,
               output per HP firm > output per MP firm

Results:

    HP firms are larger

    HP firms pay a worker more over two time periods, *bigger* diff when
        discounting is greater (discount factor δ is *smaller*)
        self-employment probability is *smaller*
        self-employment premium is *smaller*

    HP firms have a higher rate of wage growth

    Foreign ownership has no explanatory power when firm size and
        worker experience are accounted for.

Workers in MP firms who previously worked in HP firms earn more than other MP workers.

However:

When there are lots of workers switching from HP to MP firms, the HP firms have a lot of inexperienced workers at any point in time.

The *average* wage (across all workers) within HP firm can be *lower* than in a MP firm due to this composition effect.

In effect, HP firms are "nurseries" for workers going on to domestic firms or self employment.

Experiment 1: raise γ, transit productivity

Average wage (across all workers) in foreign firms falls, average domestic wage rises, and can exceed the latter - composition effect

Wages of *individual* foreign-firm workers unchanged in each period.

More workers switch, HP firm size unchanged, the higher γ

Experiment 2:   raise α, probability of a high self-employment
                   productivity increases expected self-employment bonus
                   for HP workers relative to LP workers

Average wage (across all workers) in foreign firms falls relative to
   domestic-firm wage and can fall below the latter

Wage of *individual* HP workers fall: willing to accept lower wages in HP
   firms in expectation of higher (expected) self-employment earnings.

More workers switch the higher α. Higher α attracts more workers to HP
   firms, lowers wages for both experienced and inexperienced workers,
   and induces more (who get back draws) to switch.

HP firm size increases the higher is α.

Experiment 3: Increase the minimum wage (only impacts on w_1^h)

Average wage (across all workers) in foreign firms increases relative to domestic-firm wage

Wages of *individual* workers in HP firms have increased earnings in both periods,

though it is still the case that, corrected for firm size and experience, foreign ownership does not add any explanatory power.

Size of HP firms is reduced relative to MP firms.

Experiment 4: Progressive income tax (tax on earnings above w = 1)

Average before-tax wage (across all workers) in foreign firms increases relative to the domestic-firm wage

Individual workers in HP firms have higher earn more in both periods, flatter take-home wage profile.

Size of HP firms is reduced relative to MP firms.

Data

Integrated Data Base (IDA) for Labor Market Research compiled by Statistics Denmark combined with firm level information

IDA contains register based annual data since 1980 on all individuals with Danish residence. It provides detailed information on individuals

All workers are linked to workplaces (plants) which in turn can be linked to firm level information about turnover, exports, size and ownership

Bad news:Information about foreign ownership is only available since 2000. As a consequence, we use a panel for the years 2000 to 2002

Problem: using worker fixed effects implies foreign effect only identified by switching workers; but theory model implies negative or no first-year effect.

Table 4.2: Worker Flows, by Ownership of the Firm

Workers employed in foreign-owned firms

Status the following year	2001	
Same firm, for owned	111,501	69.8%
Same firm, dom owned	6,453	4.0%
New firm, for owned	12,511	7.8%
New firm, dom owned	19,664	12.3%
Self-employment	883	0.6%
Unemploy/non-employ	8,793	5.5%
Total	159,805	100.0%

Workers employed in domestically-owned firms

Status the following year		
Same firm, dom owned	1,295,233	74.6%
Same firm, for owned	15,804	0.9%
New firm, dom owned	265,977	15.3%
New firm, for owned	39,621	2.3%
Self-employment	14,991	0.9%
Unemploy/non-employ	104,912	6.0%
Total	1,736,538	100.0%

Table 4.3: Worker Flows, by Firm Size

Workers employed in large firms

Status the following year	2001	
Same firm, large	733,039	73.8%
Same firm, small	14,818	1.5%
New firm, large	129,061	13.0%
New firm, small	52,578	5.3%
Self-employment	4,908	0.5%
Unemploy/non-employ	58,304	5.9%
Total	992,708	100.0%

Workers employed in small firms

Status the following year		
Same firm, small	742,365	72.1%
Same firm, large	19,944	1.9%
New firm, small	132,061	12.8%
New firm, large	53,700	5.2%
Self-employment	12,157	1.2%
Unemploy/non-employ	69,772	6.8%
Total	1,029,999	100.0%

Note: Large firms are fims with more than 500 employees.   Note: Large firms are fims with more than 500 employees.

Table 4.4: Average Wages and Wage Growth for Employees

	Average wages			Wage growth	
	2000	2001	2002	2000-1	2001-2
Domestic	181	189	192	4.5%	2.8%
Foreign	208	216	222	4.8%	3.1%
Small (0-49)	176	184	186	4.2%	2.2%
Medium (50-499)	190	199	203	4.7%	3.1%
Large (500+)	191	199	204	5.0%	3.5%

Note: Average wages are hourly wages in DKK.

Table 4.5: Average Income, New Self-Employed

	Average wages	
	2001	2002
Domestic	264,292	274,735
Foreign	342,318	331,848
Small (0-49)	255,529	280,049
Medium (50-499)	305,774	383,044
Large (500+)	303,027	340,548

Note: Average gross income in DKK.

Table 5.1: OLS and Fixed Effects Estimates for Wage Employed

	Dependent variable: log(hourly wages)									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	OLS	OLS	OLS	OLS	FE	FE	FE	FE	FE
foreign	**0.134**	**0.110**	**0.090**	**0.095**	**0.081**	**0.020**	**0.013**	**0.014**	**0.015**	**0.014**
	(216.47)**	(173.95)**	(174.40)**	(185.41)**	(160.06)**	(36.53)**	(24.32)**	(25.85)**	(26.81)**	(26.65)**
ln(firmsize)		**0.019**	**0.014**	**0.013**	**0.012**		**0.012**	**0.011**	**0.011**	**0.011**
		(234.76)**	(195.11)**	(167.22)**	(155.67)**		(101.14)**	(95.86)**	(90.00)**	(89.84)**
age			0.045	0.043	0.042					
			(248.50)**	(234.98)**	(232.47)**					
age^2 x 10e-3			-0.520	-0.492	-0.484					
			(239.79)**	(227.45)**	(225.53)**					
X, experience			0.013	0.014	0.015			0.054	0.054	0.054
			(120.68)**	(132.74)**	(147.08)**			(66.35)**	(66.35)**	(66.28)**
X^2 x 10e-3			-0.150	-0.184	-0.219			-1.074	-1.073	-1.072
			(58.19)**	(71.58)**	(85.83)**			(199.51)**	(199.27)**	(199.12)**
years of educ.			0.058	0.053	0.051					
			(716.20)**	(629.81)**	(604.90)**					
female			-0.185	-0.197	-0.199					
			(513.68)**	(530.80)**	(544.91)**					
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummies				yes	yes				yes	yes
Regional dummies					yes					yes
Observations	3,584,810	3,537,563	3,491,421	3,491,421	3,491,421	3,584,810	3,537,563	3,537,563	3,537,563	3,537,563
Number of individuals						1,449,607	1,443,101	1,443,101	1,443,101	1,443,101
R-squared	0.02	0.03	0.32	0.34	0.35	0.09	0.09	0.11	0.11	0.11

NOTES: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.

Table 5.2: Wage growth within job-spells

	Dependent variable: dlog(hourly wages)				
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
foreign	**0.07**	**-0.18**	**-0.18**	**-0.15**	**-0.17**
	(2.05)*	(5.44)**	(5.35)**	(4.41)**	(4.81)**
ln(firmsize)		**0.21**	**0.24**	**0.25**	**0.25**
		(42.10)**	(49.60)**	(47.20)**	(46.68)**
age			**-0.77**	**-0.77**	**-0.77**
			(54.06)**	(53.89)**	(53.92)**
age^2 x 10e-3			**7.26**	**7.26**	**7.26**
			(44.94)**	(44.84)**	(44.86)**
experience			**-0.10**	**-0.10**	**-0.10**
			(13.04)**	(12.67)**	(12.32)**
$exper.^2$ x 10e-3			**2.40**	**2.26**	**2.20**
			(13.51)**	(12.70)**	(12.33)**
years of educ.			**0.11**	**0.08**	**0.07**
			(20.16)**	(13.76)**	(12.96)**
female			**0.43**	**0.39**	**0.39**
			(17.13)**	(15.08)**	(15.02)**
Time dummies	yes	yes	yes	yes	yes
Industry dummies				yes	yes
Regional dummies					yes
Observations	1,728,268	1,704,367	1,684,944	1,684,944	1684944
R-squared			0.02	0.02	0.02

NOTES: All coefficients are multiplied by 100. Robust t statistics in parentheses.

* significant at 5%; ** significant at 1%.

Table 5.3: OLS and Fixed Effects Estimates for Wage employed

	Dependent variable: log(hourly wages)			
	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
foreign	**0.089**	**0.069**	**0.075**	**0.071**
	(87.33)**	(51.51)**	(56.99)**	(52.75)**
ln(firmsize)	**0.010**	**0.010**	**0.010**	**0.010**
	(102.99)**	(81.95)**	(75.81)**	(76.55)**
	(27.19)**	(20.17)**	(21.84)**	(21.55)**
controls: education, experience, gender, tenure, etc.				
Ten. in prev. Empl, F-firm		**0.016**		**0.010**
		(25.08)**		(14.37)**
(Ten. in prev. Empl, F-firm)^2 x 10e-3		-0.785		-0.488
		(17.54)**		(10.18)**
Ten. in prev. Empl, Large			**0.011**	**0.009**
			(37.07)**	(29.35)**
(Ten. in prev. Empl, Large)^2 x 10e-3			-0.517	-0.431
			(27.40)**	(21.44)**
Time dummies	Included	Included	Included	Included
Industry dummies	Included	Included	Included	Included
Regional dummies	Included	Included	Included	Included
Observations	3,491,695	2,091,542	2,091,542	2,091,542
R-squared	0.35	0.33	0.33	0.33

NOTES: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%

Table 5.4: Earnings of new self-employed

	Dependent variable: log(gross annual earnings)				
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
foreign$_{t-1}$	**0.135**	**0.073**	**-0.044**	**0.067**	**-0.031**
	(6.11)**	(3.11)**	(1.070)	(2.85)**	(0.720)
ln(firmsize$_{t-1}$)		**0.022**	**0.022**	**0.016**	**0.018**
		(7.44)**	(7.44)**	(4.16)**	(4.51)**
controls: education, experience, gender, tenure, etc.					
Prev. exper in F-firm			**0.047**		**0.043**
			(3.05)**		(2.59)**
(Prev. exper in F-firm)^2 x 10e-3			-1.899		-1.91
			(2.15)*		(2.04)*
Prev. exper in large firm				**0.012**	**0.006**
				(1.790)	(0.880)
(Prev. exper in large firm)^2 x 10e-3				-0.247	0.001
				(0.670)	
Time dummies	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes
Regional dummies	yes	yes	yes	yes	yes
Observations	23,125	20,183	20,183	20,183	20,183
R-squared	0.08	0.09	0.09	0.09	0.09

NOTES: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%

Summary, Conclusions

We develop a theoretical model with heterogeneous firms and learning on the job, learning proportional to firm productivity

Workers in foreign firms on average (over all workers) earn more, have higher wage growth, and do better in subsequent employment in domestic firms and in self-employment.

However, the foreign-firm effect disappears when controlling for firm size
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Empirically, workers in foreign firms on average (over all workers) earn more, have higher wage growth, and do better in subsequent employment in domestic firms and in self-employment.

However, a significant amount of the foreign-firm effect disappears when controlling for firm size and worker observables, but not all.