Offshoring and Relative Labor Demand from a Task Perspective

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The Idea:

- **Situation:** Large literature on offshoring and relative labor demand.

  - Researchers seek to answer who is affected by offshoring.
  - Usually low-skilled labor is found to suffer.

  $\Rightarrow$ Recent offshoring theory adds the notion of tasks.
  $\Rightarrow$ Either to better understand effects on skill groups or as a
  measure of its own.

- Theoretical predictions on relative labor demand for skills become
  ambiguous; for tasks they are clear.

  $\Rightarrow$ Relative home demand for tasks with low offshoring cost
  attributes declines.

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The Idea:

1. What determines the offshoring costs of tasks?
   - How important is personal interaction (A. Blinder 2006)?
   - How routine is the task (D. Autor et al. 2003)?

   $\Rightarrow$ Create an empirical measure of offshoring cost based on above job-content.

2. Do tasks differ from skills at all?
   - Could be that routine tasks are always low skilled tasks.
   - Is there a new determinant of heterogeneity in the impact of offshoring on labor markets?

   $\Rightarrow$ Estimate the effect of offshoring on relative task demand *within* skill groups.

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This paper offers the following contributions:

- estimate the link between relative labor demand for "vulnerable" jobs and offshoring

- Uses modified method to calculate task-related offshoring costs.
- The analysis is at the sector level.
- A (much more) recent sample is used: 1998 - 2007.

- The effect is explicitly estimated within skill groups.
- Offshoring is measured as worldwide and non-OECD offshoring.
- It offers evidence for offshoring being related to between-job reallocation.

Theoretical Motivation:

$\rightarrow$ Draw on Grossman and Rossi-Hansberg (2008):

- Firms produce goods employing a continuum of tasks $i \in [0, 1]$.
- here: no distinction between high- and low-skilled labor
- These tasks can be performed at home or abroad. The marginal task is implicitly given by:

$$w = w^* \beta t(I).$$

- $\beta t(i) \geq 1$ and tasks are ordered such that $t'(i) > 0$.
- Offshoring (following $\beta \downarrow$) shifts out the marginal task I:

$$\frac{dI}{d\beta} = -\frac{t(I)}{t'(I)\beta} < 0$$

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Theoretical Motivation II

- Similar to Wright (2011), home task-type intensity of sector j can be approximated as:

$$S_{nr}(I, j) = \frac{\int_I^1 D(i, j) \ i \ di}{\int_I^1 D(i, j) di}$$

$\Rightarrow$ This reflects employment share of high-i tasks (difficult-to-offshore).

- Offshoring (understood as $\beta \downarrow$) leads to $I \uparrow$ which shifts up $[S_{nr}(I, j)]$:

$$\frac{dS_{nr}(.)}{dI} = \frac{D(i, j)}{\int_I^1 D(i, j) di} \times [S_{nr}(.) - I] > 0$$

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Empirical Analysis

- What could be an empirical counterpart for the task-type intensity?

- Vector of occupations with different task content.
- occupations are seen as fixed bundles of tasks.
- task set could be specified in contract.
- intuition: firms move occupations around the world.
- Related papers treat occupational task content as fixed.

$\Rightarrow$ The cost of moving the whole occupation matters for offshoring.

Empirical Analysis - Data (cont.)

- "vulnerable" task intensity:

$$\theta^{nk}(i) = \frac{\text{\# routine and non-interactive tasks performed by indiv. n in k}}{\text{\# all tasks performed by individual n in k}}$$

- These intensities are averaged within (74) KldB88 2-digit occupations:
$\theta^k(i) = \sum \theta^{nk}/L^k$

Empirical Analysis - Data (cont.)

Next, sector-level "vulnerable" task intensities $S_{r,jt}$ are calculated.

Employment shares:

$$S_{r,jt}^E = \sum_k \theta^k \times \delta^{kjt} \tag{1}$$

Cost shares:

$$S_{r,jt}^C = \frac{\sum_k \widetilde{w}_{kjt} \times \theta^k}{\sum_k \widetilde{w}_{kjt}} \tag{2}$$

$\Rightarrow$ Variation comes from employment share and wage movements at the occupation level.

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Empirical Analysis - Data (cont.)

Task data:

- BIBB/IAB survey 1998/99

- . . .

Employment and income data:

- "BA-Employment-Panel (SUF) 1998-2007"
- 2% sample of social security statistics
- about 600,000 individuals per wave
- income and employment information
- Has a representative distribution of occupational employment within 2-digit sectors.

Empirical Analysis - Data II

The offshoring intensities:

- based on Feenstra and Hanson (1996) and Geishecker (2006) as:

$$OFF_{jt} = \frac{IMP_{j^*t} \times \Omega_{j^*jt}}{Y_{jt}}$$

- "narrow" concept of offshoring
- The imports of intermediates in industry j from the same industry j^* abroad over total output Y_j in year t.
- Ω_{j^*jt} is derived from yearly input-output tables.
- Offshoring is calculated worldwide and for non-OECD countries.

Empirical Analysis - Descriptives

sector name	offshoring world			offshoring non-OECD			cost share of "'vulnerable"' tasks
	1998	2007	change	1998	2007	change	change
Food Products And Beverages	3.27	4.08	0.81	0.50	0.75	0.26	36.63 37.17 0.54
Textiles	11.19	8.83	-2.36	4.21	4.85	0.63	45.54 43.41 -2.13
Wearing Apparel; Dressing ...	17.99	13.27	-4.72	6.77	7.28	0.51	32.32 26.25 -6.06
Wood Products, Except Furniture	4.80	3.57	-1.23	0.98	1.21	0.23	45.56 45.39 -0.17
Pulp, Paper And Paper Products	9.19	8.55	-0.63	0.45	0.77	0.32	44.57 45.75 1.19
Publishing, Printing ...	0.09	0.88	0.79	0.00	0.08	0.07	33.82 29.61 -4.21
Chemicals And Chemical Products	11.46	14.28	2.82	0.78	1.20	0.42	34.32 33.83 -0.48
Rubber And Plastic Products	0.97	1.70	0.72	0.09	0.25	0.16	47.77 47.20 -0.57
Other Non-metallic Mineral Products	2.26	2.02	-0.24	0.22	0.39	0.17	43.18 41.92 -1.26
Basic Metals	13.24	20.79	7.55	2.17	4.99	2.82	48.44 49.86 1.42
Fabricated Metal Prod., excl. Mach.	1.48	1.75	0.27	0.25	0.43	0.17	46.38 46.76 0.38
Machinery And Equipment NEC	6.10	8.30	2.20	1.05	2.33	1.28	40.37 38.73 -1.64
Office Machinery And Computers	10.75	9.34	-1.41	2.65	4.42	1.77	25.26 22.46 -2.80
Electrical Machinery ...	5.78	6.82	1.04	0.99	1.68	0.69	36.94 35.77 -1.17
Radio, Television, Communication	5.16	13.80	8.64	1.20	5.35	4.15	32.80 28.80 -4.00
Medical, Precision And Optical ...	4.38	5.15	0.78	0.65	0.97	0.32	33.44 32.08 -1.36
Motor Vehicles, Trailers ...	6.90	9.52	2.62	0.20	0.61	0.41	44.24 41.56 -2.68
Other Transport Equipment	8.16	9.98	1.82	0.37	1.05	0.68	36.67 32.93 -3.74
Furniture; Manufacturing NEC	7.23	9.26	2.04	2.12	4.38	2.25	42.18 40.36 -1.82

Empirical Analysis - General Set-up

The common trans-log short-run cost function approach gives rise to the following estimation set-up:

$$
\begin{aligned}
S_{r,jt} &= \beta_1 OFF_{jt} + \beta_2 lnY_{jt} + \beta_3 ln(K/Y)_{jt} + \beta_4 ln(w_r/w_{nr})_{jt} \\
&\quad + \gamma Z_{jt} + \delta_j + \delta_t + u_{jt}
\end{aligned}
\tag{3}
$$

- lnY_{jt}: log-output of sector j

- $ln(K/Y)_{jt}$: log capital intensity of sector j

- Z_{jt}: further shift variables e.g. R&D or institutions.

- δ_j and δ_t: sector and year FE, respectively

Results

Table 2: *Regressions Based on Employment Shares*

all skills	1	2	3	4	5	6
offshoring intensity	-0.0613**		-0.0745**		-0.0764**	
	(0.0233)		(0.0284)		(0.0301)	
offshoring intensity to non-OECD		-0.360***		-0.357***		-0.363***
		(0.0844)		(0.0997)		(0.106)
$ln(Y_{jt})$	0.0120	0.00902	0.0242	0.0176	0.0248	0.0181
	(0.0211)	(0.0145)	(0.0211)	(0.0160)	(0.0207)	(0.0155)
$ln(K_{jt}/Y_{jt})$	-0.0232	-0.0280**	-0.0191	-0.0223	-0.0173	-0.0203
	(0.0195)	(0.0131)	(0.0182)	(0.0129)	(0.0181)	(0.0130)
RnD intensity			0.237*	0.126	0.219	0.105
			(0.121)	(0.153)	(0.128)	(0.161)
ln (labor share)			0.018	0.0121	0.0164	0.0102
			(0.0186)	(0.0162)	(0.0192)	(0.0166)
ln (rel. wage)					0.0212	0.0232
					(0.0257)	(0.0228)
sector fixed-effects	yes	yes	yes	yes	yes	yes
year fixed-effects	yes	yes	yes	yes	yes	yes
Observations	190	190	162	162	162	162
R-squared	0.571	0.633	0.610	0.650	0.614	0.655
Number of sector	19	19	18	18	18	18

Robust standard errors in parentheses

$***p < 0.01, **p < 0.05, *p < 0.1$

Results

Table 3: *Regressions Based on Cost Shares*

all skills	1	2	3	4	5	6
offshoring intensity	-0.0618***		-0.0771***		-0.0815**	
	(0.0209)		(0.0262)		(0.0304)	
offshoring intensity to non-OECD		-0.343***		-0.320***		-0.335***
		(0.0871)		(0.0986)		(0.108)
$ln(Y_{jt})$	0.0126	0.00955	0.0242	0.0173	0.0256	0.0184
	(0.0234)	(0.0177)	(0.0228)	(0.0202)	(0.0221)	(0.0193)
$ln(K_{jt}/Y_{jt})$	-0.0310	-0.0353**	-0.0288*	-0.0311*	-0.0247	-0.0269*
	(0.0187)	(0.0139)	(0.0162)	(0.0151)	(0.0160)	(0.0150)
RnD intensity			0.248*	0.160	0.208	0.115
			(0.143)	(0.164)	(0.153)	(0.177)
ln (labor share)			0.0294	0.0232	0.0259	0.0192
			(0.0235)	(0.0215)	(0.0236)	(0.0212)
ln (rel. wage)					0.0483**	0.0495**
					(0.0207)	(0.0188)
sector fixed-effects	yes	yes	yes	yes	yes	yes
year fixed-effects	yes	yes	yes	yes	yes	yes
Observations	190	190	162	162	162	162
R-squared	0.561	0.602	0.605	0.623	0.622	0.642
Number of sector	19	19	18	18	18	18

Robust standard errors in parentheses

$***p < 0.01, **p < 0.05, *p < 0.1$

Results

Table 4: *Cost Share Regressions by Skill Groups*

VARIABLES	1	2	3	4	5	6	7	8
	low-skilled only				high-skilled only			
offshoring intensity	-0.0498***		-0.0653***		-0.0346		-0.0538**	
	(0.0131)		(0.0166)		(0.0200)		(0.0204)	
offshoring intensity to non-OECD		-0.300***		-0.259***		-0.214**		-0.262**
		(0.0793)		(0.0689)		(0.101)		(0.0969)
$ln(Y_{jt})$	0.0236	0.0212	0.0284	0.0225	0.0376**	0.0360**	0.0539**	0.0491**
	(0.0222)	(0.0176)	(0.0209)	(0.0199)	(0.0169)	(0.0140)	(0.0214)	(0.0177)
$ln(K_{jt}/Y_{jt})$	-0.0191	-0.0231**	-0.0268**	-0.0285***	0.0143	0.0113	0.0203	0.0179
	(0.0164)	(0.0101)	(0.00997)	(0.00921)	(0.0149)	(0.0126)	(0.0188)	(0.0157)
RnD intensity			0.274**	0.206			0.0414	-0.0410
			(0.118)	(0.134)			(0.0741)	(0.0973)
ln (labor share)			0.0348	0.0296			0.0262**	0.0220*
			(0.0250)	(0.0239)			(0.0112)	(0.0105)
sector fixed-effects	yes	yes	yes	yes	yes	yes	yes	yes
year fixed-effects	yes	yes	yes	yes	yes	yes	yes	yes
Observations	190	190	162	162	190	190	162	162
R-squared	0.261	0.324	0.368	0.387	0.227	0.265	0.284	0.318
Number of sector	19	19	18	18	19	19	18	18

Robust standard errors in parentheses
$* * *p < 0.01, * * p < 0.05, *p < 0.1$

Notes: high-skilled defined as tertiary education, low-skilled otherwise.

Results

Table 5: *GMM-IV Regressions for Cost Shares by Skill*

	1	2	3	4	5	6
	all skills		low-skilled only		high-skilled only	
offshoring intensity	-0.159		-0.248**		-0.0516	
	(0.117)		(0.114)		(0.111)	
offshoring intensity to non-OECD		-0.790***		-0.594***		-0.688*
		(0.260)		(0.201)		(0.359)
$ln(Y_{jt})$	0.0266	0.0244*	0.0374**	0.0226	0.0605***	0.0634***
	(0.0185)	(0.0132)	(0.0164)	(0.0165)	(0.0208)	(0.0172)
$ln(K_{jt}/Y_{jt})$	-0.0597***	-0.0435***	-0.0653***	-0.0412***	0.00650	0.00754
	(0.0142)	(0.0132)	(0.0189)	(0.0112)	(0.0153)	(0.0169)
RnD intensity	0.125	0.0162	0.226**	0.0799	0.00245	-0.0421
	(0.106)	(0.0813)	(0.112)	(0.0829)	(0.114)	(0.0952)
ln (labor share)	0.0620**	0.0282	0.0788***	0.0357**	0.0418**	0.0326*
	(0.0260)	(0.0173)	(0.0297)	(0.0171)	(0.0186)	(0.0172)
sector dummies	yes	yes	yes	yes	yes	yes
year dummies	yes	yes	yes	yes	yes	yes
Observations	126	126	126	126	126	126
R-squared	0.996	0.996	0.993	0.994	0.958	0.955
Hansen J-Statistic	2.912	0.884	2.888	0.294	2.476	0.008
p-value	0.0879	0.347	0.0893	0.5879	0.1156	0.93

Robust standard errors in parentheses
$***p < 0.01, **p < 0.05, *p < 0.1$

high-skilled defined as tertiary education, low-skilled otherwise.

What do the results imply?

- The estimated coefficient (from gmm) is $\widehat{\beta_1} = 0.79$.

$\Rightarrow$ 1 ppt increase in non-OECD offshoring leads to a 0.79 ppt decrease in the cost share of routine tasks.

$\Rightarrow$ around 67% of the observed change in "task upgrading" can be explained by the observed increase in offshoring.

Empirical Analysis - Further Robustness

The results are robust to a number of alterations.

- Using different ways to measure offshoring (alt. deflation or Geishecker (2006) data) ✓
- Using a Spitz-Oener (2006) like task measure ✓
- Varying the sample span (deleting first or last two years) ✓
- Dropping the sectors (32, 27) with the largest increase in non-OECD offshoring ✓
- Including lagged values of the relative wage variable ✓

Summary of Findings

- There is evidence for the "task-trade-mechanism" to occur in practice: offshoring is correlated with a decrease in routine and non-interactive ($=$ idiosyncratically easy to offshore) tasks.

- Task reallocation is related to occupational employment changes.
- Shift in relative labor demand is stronger for non-OECD offshoring.
- It holds for both employment shares and cost shares.
- The relative demand shift is present within classic skill groups.

Thank you!

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