

Immigration, Offshoring and American Jobs

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Introduction

- The relocation of jobs abroad by multinationals and the increased labor market competition due to immigrant workers are often credited with the demise of many “good” manufacturing jobs (tasks), once held by American citizens.
- While it is certainly true that manufacturing production and employment, as a percentage of the total economy, have declined over recent decades measuring the impact of globalization on jobs is more difficult. Why?

Introduction (cont.)

- The reason is that offshoring some production processes or hiring immigrants to perform them *directly reduces the demand for ('displaces') native workers*, others things equal.
- At the same time, the *cost-saving effect* of such restructuring of production increases the productivity and size of firms. This process increases overall production and *may indirectly increase the demand for native workers*.
- Possibly jobs are created not in the same tasks that were offshored/assigned to immigrant workers

Related Literature

- Recent papers have emphasized the potential *cost-saving effect* of offshoring arguing that this effect could partially offset the *displacement effect* on employment
 - Grossman and Rossi-Hansberg 2008,
 - Harrison and McMillan 2009,
 - Wright 2009
- Other papers have suggested that immigrants may generate a similar cost-saving effect by supplying *tasks that are complementary to those performed by natives*.
 - Peri and Sparber 2009,
 - Peri 2009

This Paper

- Building on Grossman and Rossi-Hansberg (2008), this paper develops a model and presents empirical evidence with respect to 58 U.S. manufacturing industries over the period 2000-2007
- Two main research questions:
 - How did the decrease in offshoring and immigration costs, affect the *employment* of native workers across manufacturing sectors? (use panel evidence on sector-employment)
 - What kinds of production *tasks* suffered most from the competition created by offshore and immigrant workers and what kinds of tasks benefited (if any)?

Theoretical Model

- Multi-Sector version of G-R (2008) with substitutable tasks:
 - Several sectors, indexed $s=1, \dots, S$
 - Each sector is not large enough to affect aggregate factor prices
 - All markets are perfectly competitive and all technologies are constant returns to scale.
 - All goods are freely traded, their relative price are internationally given.
 - Sectors have a different fixed factor
 - Focus on a sector and leave both the sector index s and the time dependence of variables t implicit .

Production Choices

- Two primary factors
 - Low skill workers (with employment level N_L)
 - Sector-specific high skill workers (with employment level N_H)
- Each worker is endowed with one unit of labor
 - High skill workers are employed in the production of high skill intermediates (called 'H-tasks')
 - Low skill workers are employed in the production of low skill intermediates (called 'L-tasks')

Production Choices (cont.)

- The two composite inputs are then transformed into final output (Y) by:

$$Y = AL^\alpha H^{1-\alpha}$$

- Each composite input is produced by a fixed measure of horizontally differentiated tasks (indexed i from 0 to 1)
- e.g. Low skill composite:

$$L = \left[\int_{[0,1]} L(i)^{(\sigma-1)/\sigma} di \right]^{\sigma/(\sigma-1)}$$

where $L(i)$ is the input of task i and $\sigma > 0$ is the elasticity of substitution between tasks. The index “ i ” captures the cognitive-communication complexity of the task.

Production Choices (cont.)

- Two possible locations for production, home and abroad
- Each L-task can be managed in three modes:
 - **Domestic** production by native workers (D)
 - Domestic production by **Immigrant** workers (M)
 - Production abroad by **Offshore** workers (O)

Production Choices (cont.)

- Low skill native, immigrant and offshore workers are perfectly substitutable in L-tasks
- H-tasks are assumed to be prohibitively expensive to perform by immigrant and offshore workers.

Offshoring

- L-tasks are defined so that they all require the same unit labor requirement a_L when performed by native workers.
- If task i is offshored, its unit input requirement is $\beta t(i)a_L$, with $\beta t(i) \geq 1$ and $t'(i) \geq 0$ so that higher complexity i corresponds to higher offshoring costs.
- Hence $1 / [\beta t(i)a_L]$ is the marginal productivity of offshore workers .
- The parameter $\beta \geq 1$, which is common to all tasks, can be used to capture technological change that decreases the cost of offshoring

Immigrant Workers

- When assigning tasks to immigrants firms face a task-specific cost $\tau(i) \geq 1$ implying that immigrants' marginal productivity in task i is $1/a_L \tau(i)$.
- Immigrants are relatively better at simple manual-routine tasks than at cognitive-communication complex ones: $\tau'(i) \geq 0$

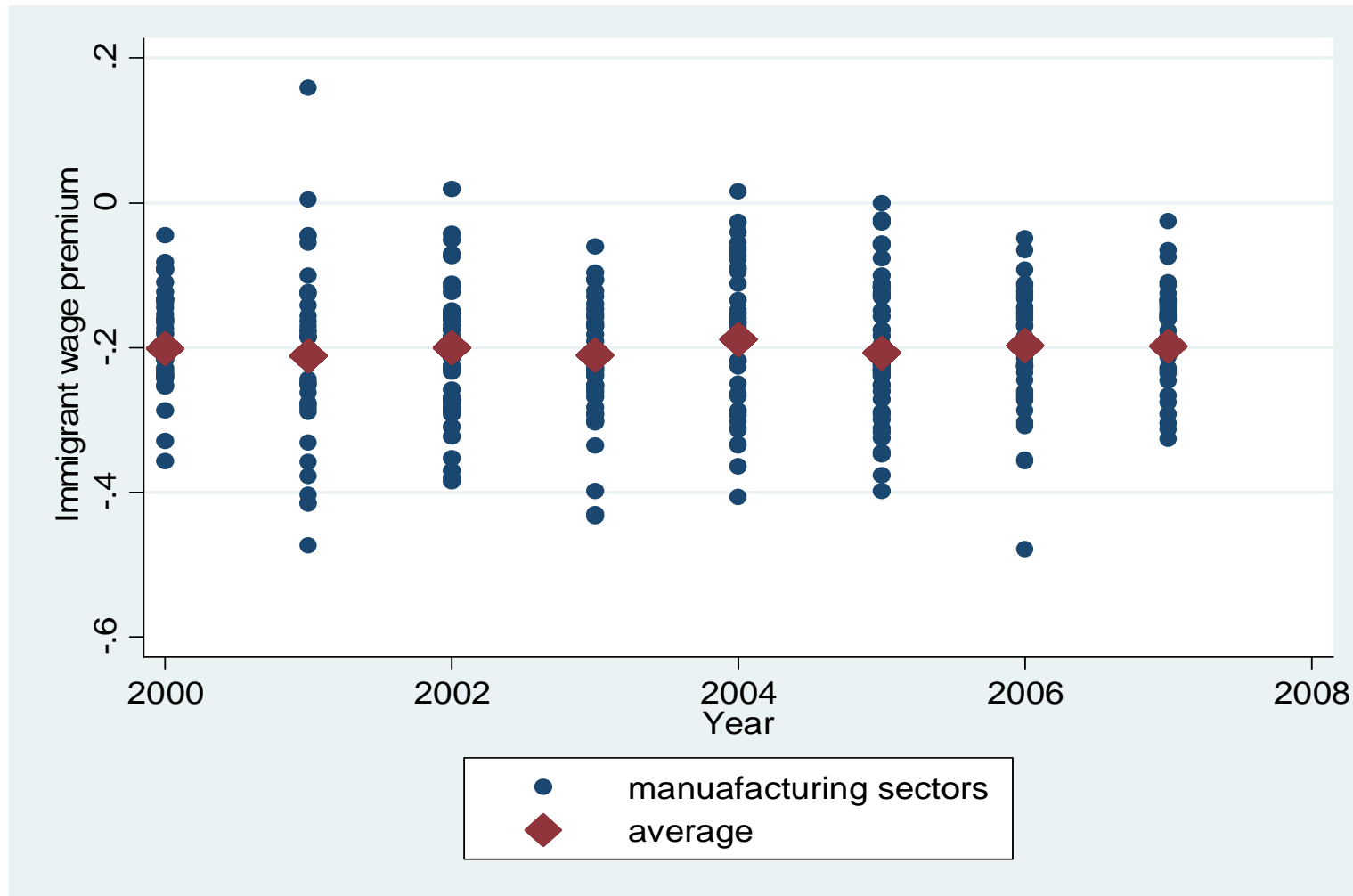
Immigrant Wages

- Firms are able to discriminate between natives and immigrants who are paid a lower wage $w^* < w$.
- Firms pay immigrants the lowest wage compatible with their outside option (i.e. wage in their own countries w^*):

$$w^* = w^* \delta$$

- $\delta \geq 1$ captures a frictional cost incurred by the immigrants

Wage Premium for less educated immigrants workers (negative)



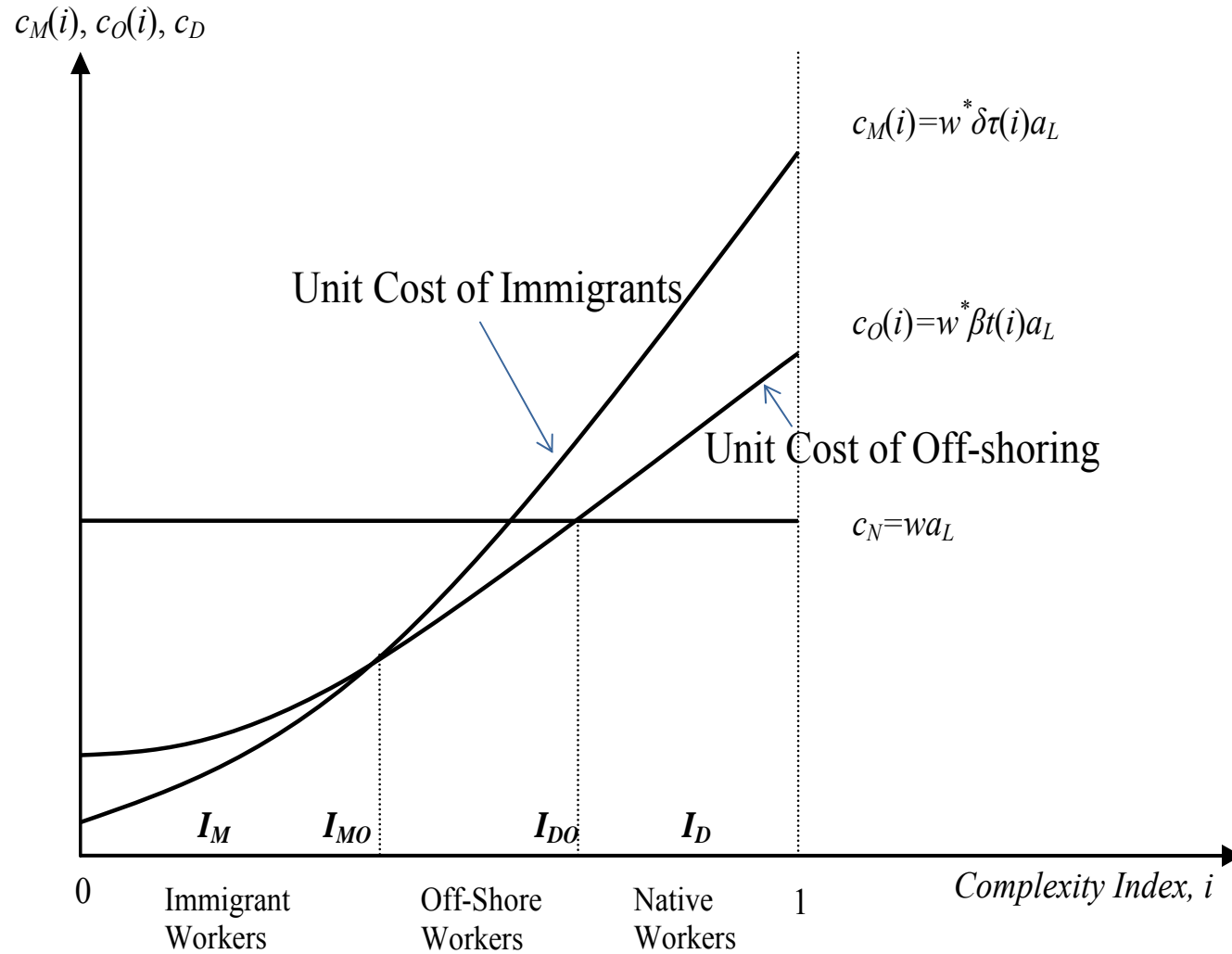
Native-Immigrant Wage Differential

- Antecol, Cobb-Clark and Trejo (2003), Butcher and Di Nardo (2004) show that immigrants from non-English speaking countries are paid 17-20% less than native with identical observable characteristics.
- Hendricks (2002) and Schoellman (2009) show that immigrant-native wage differential is highly correlated with the wage difference with their country of origin.

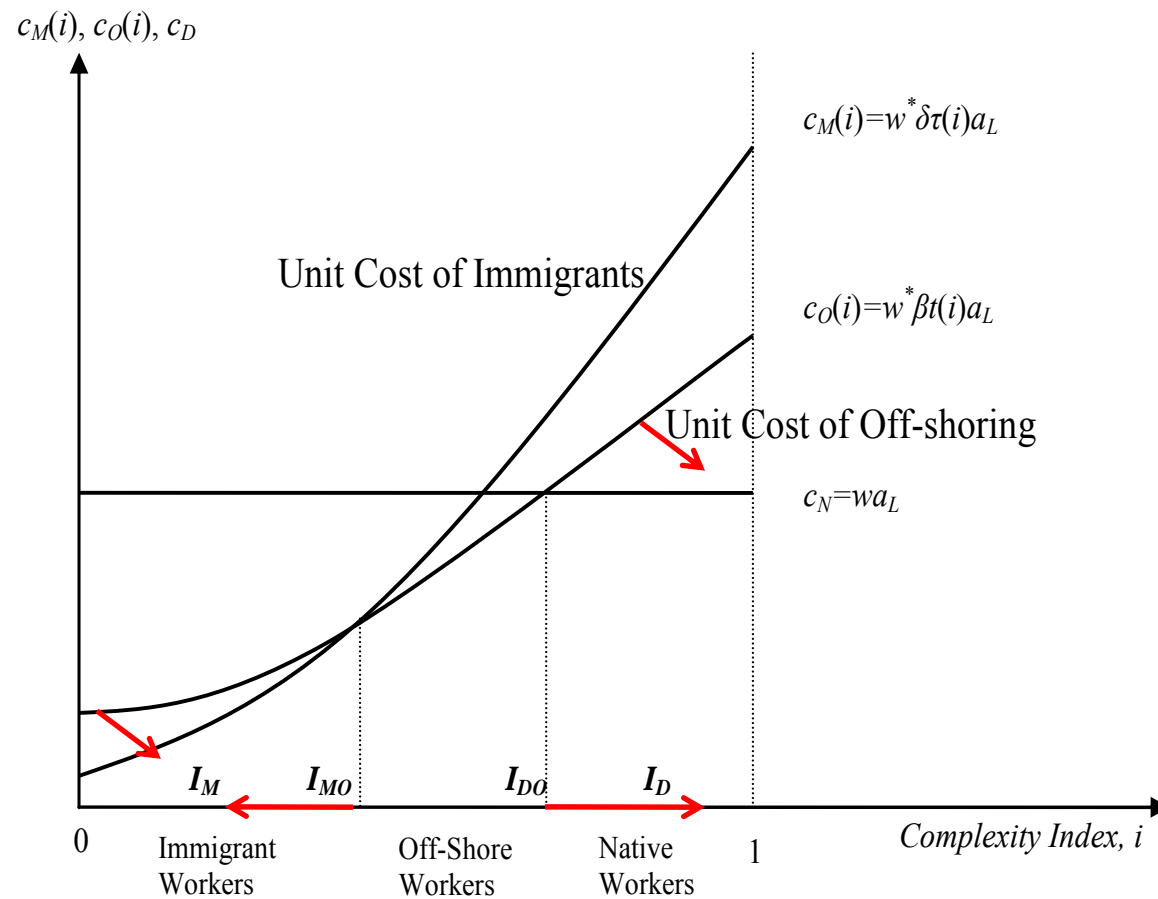
Production Choices (cont.)

- Different hypotheses on parameters δ , β and the shapes of the functions $\tau(i)$ and $t(i)$ lead to a proliferation of subcases.
- “Working hypotheses” allow us to focus on a special case relevant for empirical predictions:
 - The first, simplest manual task, is easier to assign to immigrants than to offshore $\delta\tau(0) < \beta t(0)$.
 - The immigrant comparative advantage in simple manual tasks is stronger than the increase in cost of offshoring due to complexity $\tau'(i) \geq \beta t'(i)$.

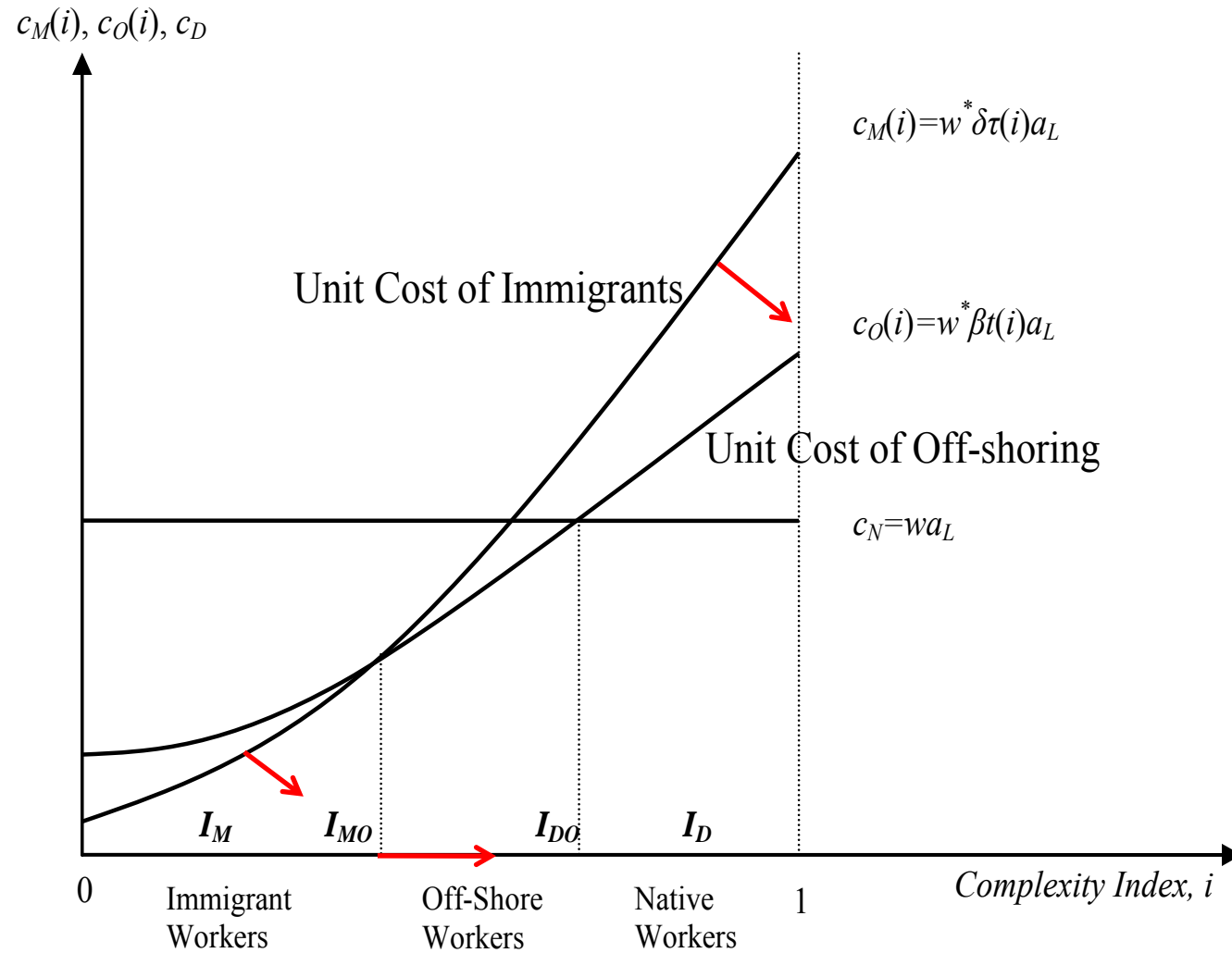
Task Allocation



Reduction in Offshoring Costs



Reduction in Immigration Costs



Effects on observable average tasks for natives (N) and immigrants (M)

The model predicts that:

- If offshoring costs β fall then the average migrant task I_M falls and the marginal native task I_N rises. The distance between native and immigrant tasks increases.
- If migration costs δ fall then the average immigrant task I_M rises and the average native task I_N remains unchanged. The distance between native and immigrant tasks decreases.

$$\frac{\partial I_N}{\partial \beta} < 0, \frac{\partial I_M}{\partial \beta} > 0, \frac{\partial I_M}{\partial \delta} < 0, \frac{\partial I_N}{\partial \delta} = 0$$

Effects on Employment shares

- If $\sigma > 1$ lower offshoring costs:
 - reduce the share of tasks performed by natives and immigrants (“direct displacement effect”);
 - increase the share performed by offshore workers.
- If $\sigma > 1$ lower $\frac{\partial s_M}{\partial \beta} > 0, \frac{\partial s_O}{\partial \beta} < 0, \frac{\partial s_N}{\partial \beta} > 0$
 - reduce the share of offshored tasks (“direct displacement effect”);
 - cause a small reduction of (or no effect on) the share of tasks performed by native workers;
 - increase the share of immigrant tasks.

$$\frac{\partial s_M}{\partial \delta} < 0, \frac{\partial s_O}{\partial \delta} > \frac{\partial s_N}{\partial \delta} \geq 0$$

Effects on unskilled employment

- Lower costs of offshoring and immigration enhance a sector's productivity, increasing its total labor demand.

$$\frac{\partial Empl_L}{\partial \delta} > 0, \frac{\partial Empl_L}{\partial \beta} > 0$$

- If the “productivity effect” of offshoring is strong enough it may offset the negative impacts of offshoring on the labor share of natives.
- If the “productivity effect” of immigration is strong enough it may generate positive effects on the employment of natives.

What is Sector-specific

- Sectors may differ in terms of:
 - offshoring and immigration costs: β_{st} or δ_{st} are indexed with s ;
 - Total Factor Productivity A_s (and fixed factor H_s): implying a fixed effect;
 - random productivity shocks, implying a (possibly) serially correlated error ε_{st} .
- Common wages w_t and w^*_t vary over time, calling for a time effect

Empirical Analysis

- Data description and construction of the variables
- Estimated effects on employment and shares
- Estimated effect of on average complexity task index

Employment

- Native employment: from IPUMS American Community Survey, 2000-2007. Sum of workers, born in the US, in each of 58 manufacturing industries (4-digit NAICS/BEA). Only those with some high school or less.
- Immigrant employment: from IPUMS American Community Survey, 2000-2007. Sum of workers, born abroad, in each of 58 manufacturing industries. Only those with some high school or less.
- Offshore employment: from BEA; all employees of offshore affiliates of US mother companies, plus imputed employees of outsourcing companies abroad. 58 manufacturing industries, period 2000-2007.

Figure 1
Offshore workers as share of total (US employment +offshore) in 58
manufacturing industries

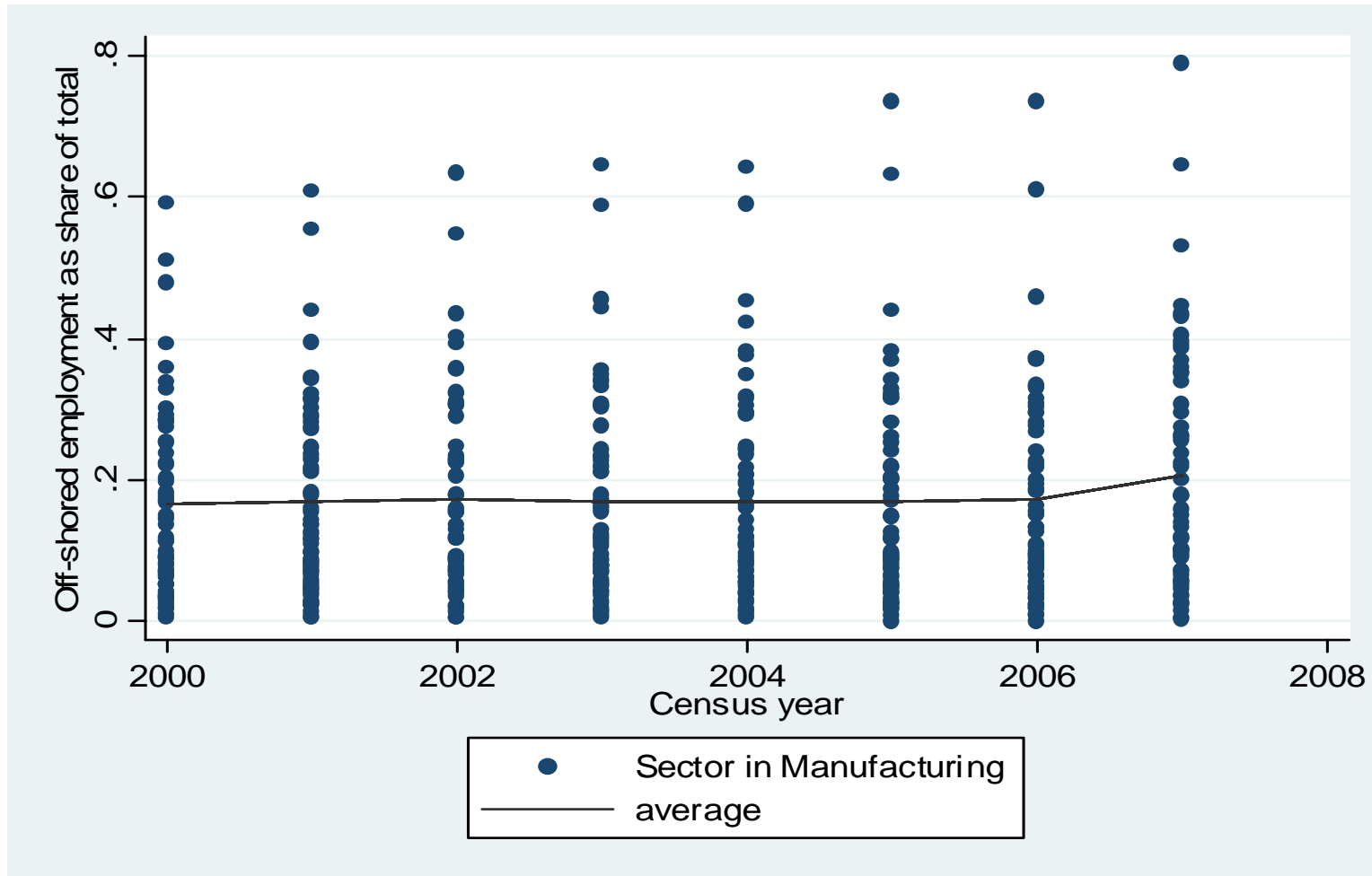
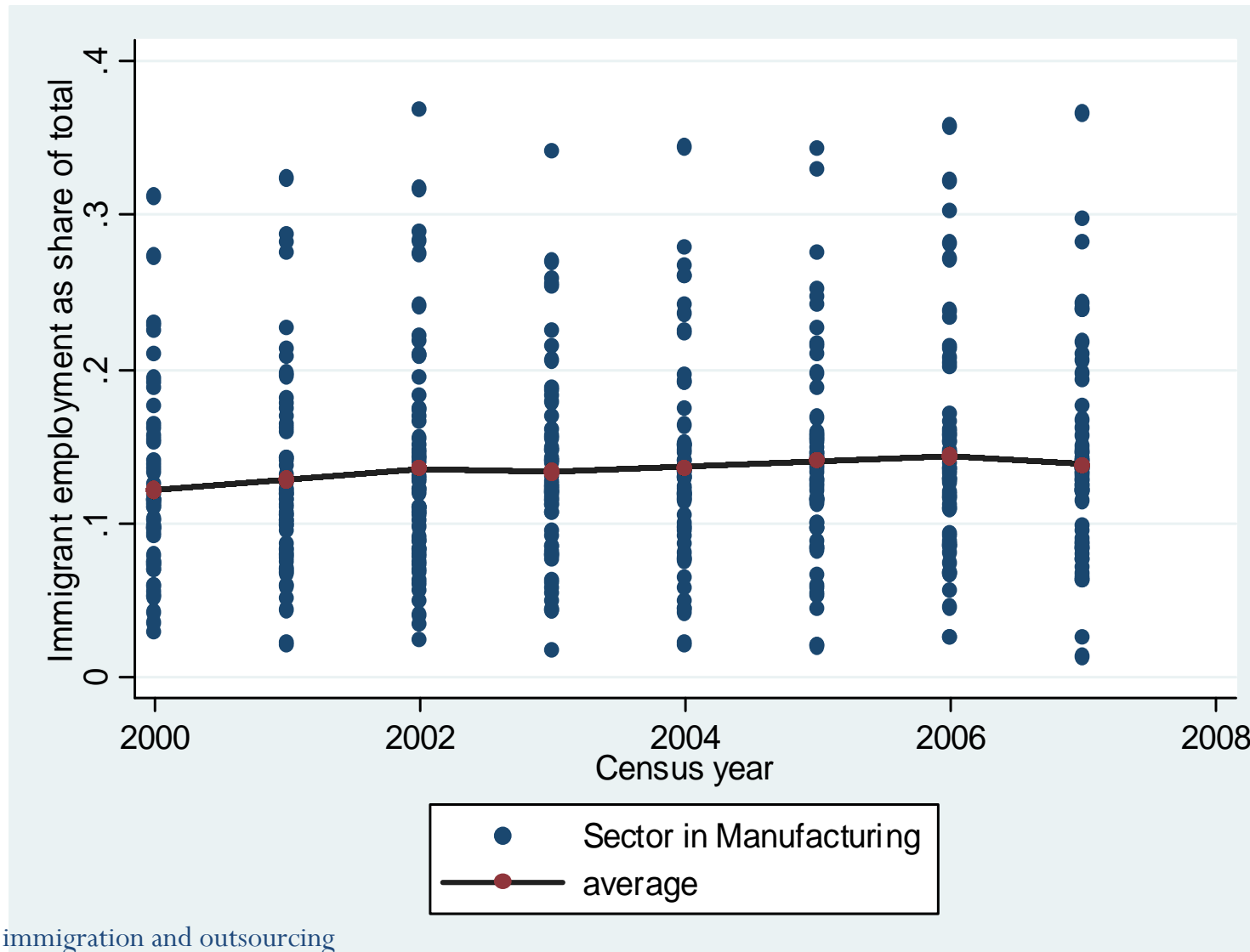


Figure 2
Immigrant workers as share of total (US employment +offshore) in 58 manufacturing industries



Immigrant workers as Percentage of industry employment	Us born workers as percentage of industry employment	Offshored workers as percentage of industry employment	Industry
Industries with high share of Us-born employment			
9	89	2	Ship and boat building
9	87	4	Cement and concrete products, Lime and gypsum products
9	84	7	Wood products
12	82	6	Hardware, Spring and wire products and Other fabricated metal products
5	81	14	Pulp, paper, and paperboard mills
9	80	10	Dairy products
13	80	7	Machine shops, turned products, and screws, nuts, and bolts
7	80	14	Iron and steel mills and ferroalloys, Steel products from purchased steel
11	79	10	Architectural and structural metals, Boilers, tanks, and shipping containers
13	78	9	Other nonmetallic mineral products
Industries with Intermediate share of US-born employment			
5	68	27	Agriculture, construction, and mining machinery
12	68	20	Navigational, measuring, and other instruments
9	67	24	Glass and glass products
17	65	18	Other miscellaneous manufacturing
9	65	26	Converted paper products
11	63	26	average
4	62	34	Pesticides, fertilizers, and other agricultural chemicals
20	62	18	Bakeries and tortillas
8	61	32	Railroad rolling stock
Industries with low share of US-born employment			
13	52	36	Communications equipment, Audio and video equipment
5	51	44	Household appliances
15	51	34	Computers and peripheral equipment
10	50	40	Pharmaceuticals and medicines
16	49	35	Leather and allied products
8	45	48	Cutlery and hand tools
12	43	45	Sugar and confectionery products
18	43	39	Fruit and vegetable preserving and specialty foods
5	40	55	Other transportation equipment
10	37	53	Soap, cleaning compounds, and toilet preparations

Complexity Index

- First merge each individual (US and foreign born) using her occupation (more than 400 groups) with the following O*NET (Bureau of Labor Statistics) skill and task indices, standardized to be between 0 and 1:
 - Manual (Limb, Hand, and Finger Dexterity; Body Coordination and Flexibility; Strength)
 - Communication (Oral and Written expression and comprehension)
 - Cognitive (Fluency of Ideas; Originality; Problem Sensitivity; Mathematical Reasoning; Number Facility; Deductive Reasoning; Inductive Reasoning;)
 - Routine (importance of executing repetitive tasks)
 - Interactive: mediating and communicating with others
- Complexity: $i = (\text{Cognitive} + \text{Communication} + \text{Interactive} - \text{Manual} - \text{Routine}) / 5 + 2 / 5$; varies between 0 and 1.

Average Complexity Task Index

- Aggregate individual task indexes “ i ” across US born workers in each industry and year, weighting by the sample weight and worked hours. This produces the average index I_D
- Aggregate individual task index “ i ” across foreign-born workers in each industry and year, weighting by the sample weight and worked hours. This produces the average index I_M .
- We have *no* information on the occupation of the employees of the affiliates, hence we cannot calculate their task index I_O .

Complexity Index: Native and Immigrants (average 200-2007 by industry)

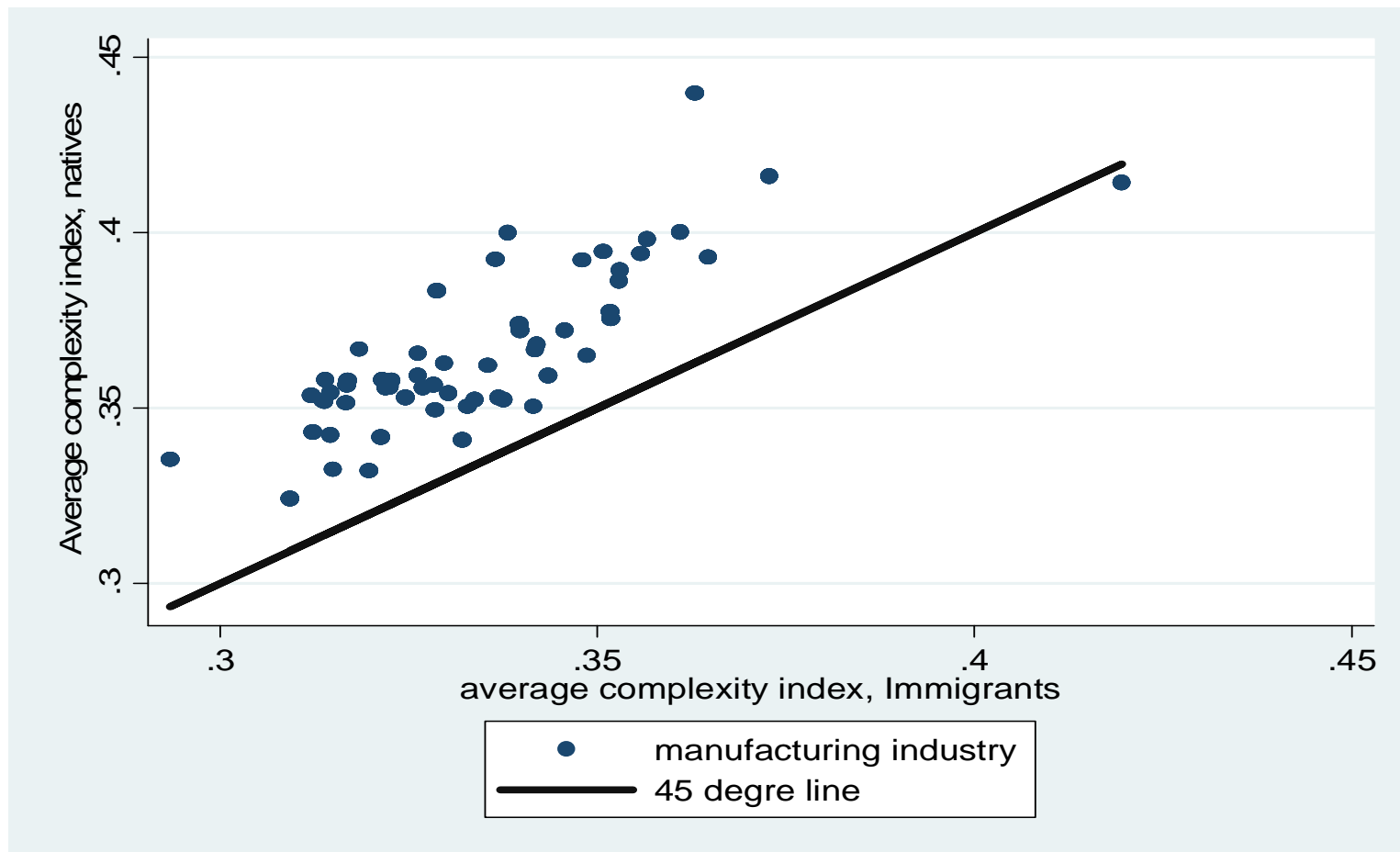


Figure 3
Average index for native workers with high school diploma or less (I_D)
58 sectors, 7 years

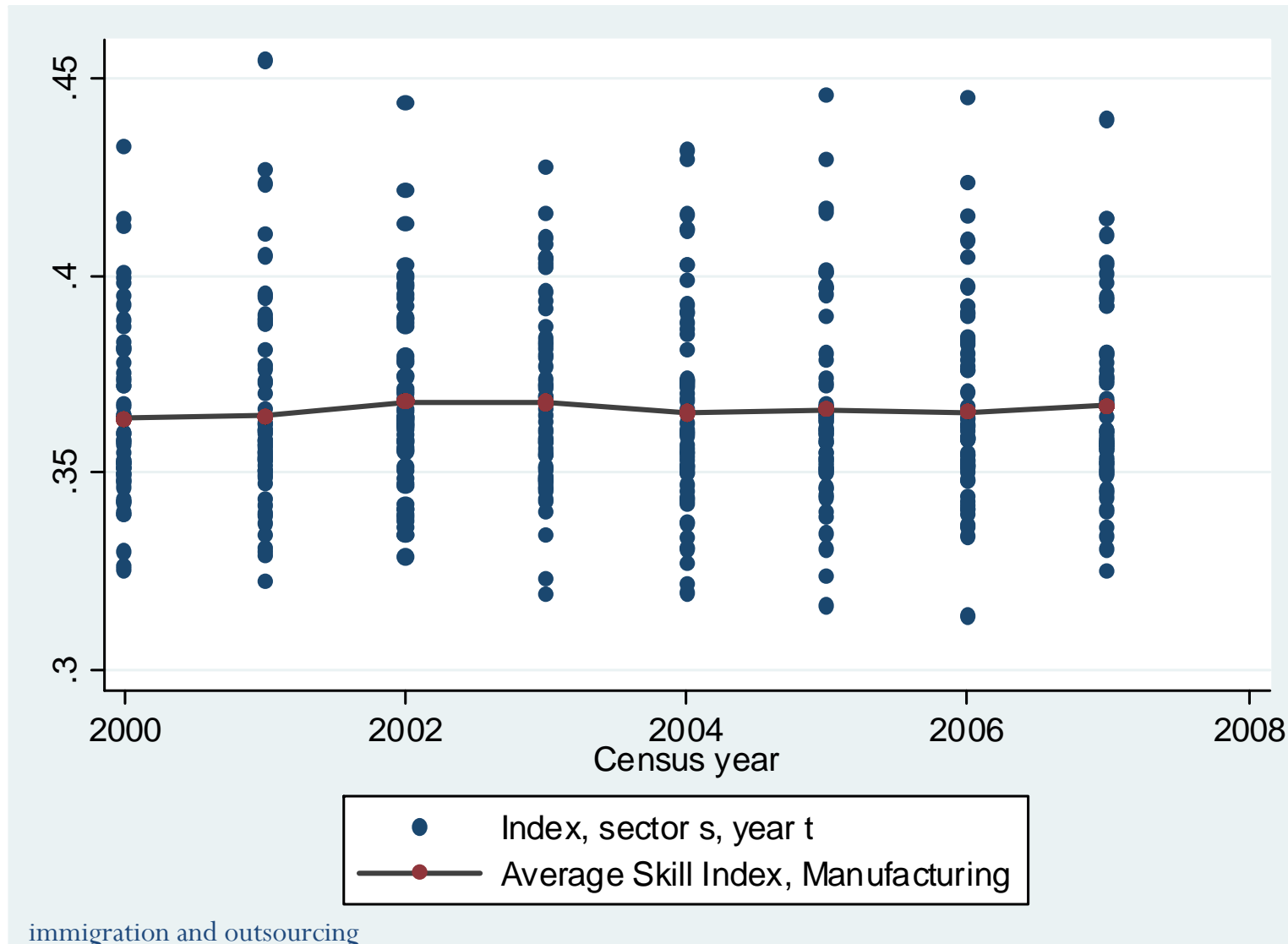
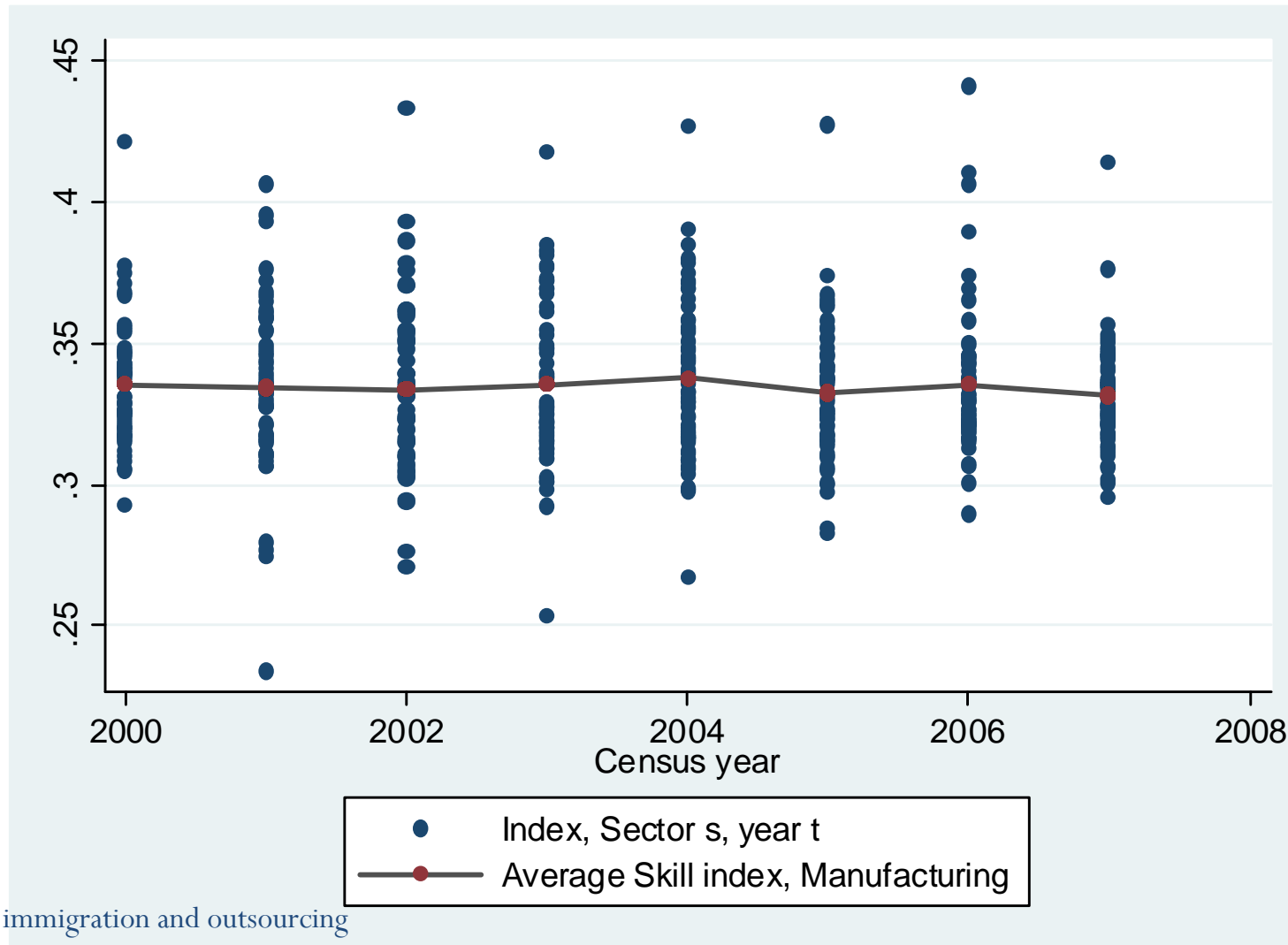


Figure 4
Average index for immigrant workers with high school diploma
or less (I_M)
58 sectors, 7 years



Ease of Offshoring (Imputed Offshoring)

- For each sector we measure (as in Feenstra and Hanson 1999) the share of inputs, within the same 3-digit industry, that is imported. Then we use the predicted variation of this share based on a gravity regression with country-effects only.
- We only use the variation in offshored input shares across sectors that depends on initial country composition of offshoring and increase in a nation importance as offshoring location.

Ease of immigration (Imputed Immigration)

- For each sector we calculate the imputed share of immigrants based on the initial composition of workers by country of origin and the growth in immigrants from that country:
 - Foreigners have changed their relative presence in the U.S. according to changes in migration costs from and domestic conditions in their countries of origin
 - The initial relative presence of immigrants in a sector makes that sector more or less subject to those cost/push factors

Effects on shares (“displacement”)

$$s_{Dst} = \phi_s^D + \phi_t^D + b_{DO}(\text{Imputed Offshoring}_{st}) + b_{DM}(\text{Imputed Immigration}_{st}) + \varepsilon_{st}^D$$

$$s_{Mst} = \phi_s^M + \phi_t^M + b_{MO}(\text{Imputed Offshoring}_{st}) + b_{MM}(\text{Imputed Immigration}_{st}) + \varepsilon_{st}^M$$

$$s_{Ost} = \phi_s^O + \phi_t^O + b_{OO}(\text{Imputed Offshoring}_{st}) + b_{OM}(\text{Imputed Immigration}_{st}) + \varepsilon_{st}^O$$

Imputed offshoring and imputed immigration capture the cost-driven share of increase in each activity, by sector. The predictions of the model are:

$$b_{DO} < b_{DM} \leq 0;$$

$$b_{MO} < 0, b_{MM} > 0;$$

$$b_{OO} > 0, b_{OM} < 0;$$

Table 1:
Effects of ease of offshoring and immigration on the shares of natives,
immigrants and offshore less educated workers
Only workers with a high school degree or less are included
58 manufacturing industries, 7 years: 2000-2007

Dependent variable:	Share of US-National in Employment of less educated workers			Share of Immigrants in employment of less educated workers			Share of offshore employees in employment of less educated workers		
Explanatory variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Imputed offshoring		-0.67** (0.21)	-0.66** (0.20)	-0.30** (0.10)		-0.23** (0.10)		0.96** (0.24)	0.90** (0.24)
Imputed Immigration:	0.09 (0.21)		0.02 (0.21)		0.39** (0.09)	0.34** (0.09)	-0.48** (0.24)		-0.36* (0.21)
Observations	464	464	464	464	464	464	464	464	464
Sector fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effects:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Effects on employment levels

$$Empl_{Dst} = \phi_s^D + \phi_t^D + B_{DO}(\text{Imputed Offshoring}_{st}) + B_{DM}(\text{Imputed Immigration}_{st}) + \varepsilon_{st}^D$$

$$Empl_{Mst} = \phi_s^M + \phi_t^M + B_{MO}(\text{Imputed Offshoring}_{st}) + B_{MM}(\text{Imputed Immigration}_{st}) + \varepsilon_{st}^M$$

$$Empl_{Ost} = \phi_s^O + \phi_t^O + B_{OO}(\text{Imputed Offshoring}_{st}) + B_{OM}(\text{Imputed Immigration}_{st}) + \varepsilon_{st}^O$$

$$Empl_{Lst} = \phi_s^L + \phi_t^L + B_{LO}(\text{Imputed Offshoring}_{st}) + B_{LM}(\text{Imputed Immigration}_{st}) + \varepsilon_{st}^L$$

B_{LO} and B_{LM} measure the intensity of the “productivity effect” due to increased eases of offshoring and immigration, while the other B ’s combine this productivity effect with the relative share effects estimated before

Table 3
Effects of ease of offshoring and immigration on the employment of natives,
immigrants and offshore less educated workers
Only workers with a high school degree or less are included.
58 manufacturing industries, 7 years: 2000-2007

Dependent variable:	Total Employment of US Born (in log points)	Total Employment of Immigrants (in log points)	Total Offshore Employment (in log points)	Total Employment, Native plus Immigrants plus Offshore (in log points)
Explanatory variable:	(1)	(2)	(3)	(4)
Imputed offshoring	-0.20 (0.74)	-2.75* (1.50)	0.52** (0.12)	2.03** (0.69)
Imputed Immigration:	1.30** (0.58)	1.11 (0.90)	0.97 (1.20)	0.96* (0.54)
Observations	646	646	646	646
Sector fixed effects	Yes	Yes	Yes	Yes
Time effects:	Yes	Yes	Yes	Yes

Focus on the “productivity” (size) effect

Dependent variable:	Total Employment of the sector	Total Employment of the sector	Total Labor compensation
Specification:	Basic	Controlling for wage of each group	Basic
	(1)	(2)	(3)
Imputed offshoring	2.03** (0.69)	1.58** (0.70)	1.02* (0.60)
Imputed Immigration:	0.96* (0.54)	0.85 (0.56)	1.10* (0.54)
Observations	646	646	646
Sector fixed effects	Yes	Yes	Yes
Time effects:	Yes	Yes	Yes
Other Controls		Wages of natives, Wages of immigrants, Wages of offshore workers	

Effects on Average Task Index: Native and Immigrants

$$I_{Dst} = \phi_s^D + \phi_t^D + d_{DO}(o_{st}) + d_{DM}(m_{st}) + \varepsilon_{st}^D$$

$$I_{Mst} = \phi_s^M + \phi_t^M + d_{MO}(o_{st}) + d_{MM}(m_{st}) + \varepsilon_{st}^M$$

Predictions of the model are:

$$d_{DO} > 0 \text{ and } d_{DM} = 0$$

$$d_{MO} < 0 \text{ and } d_{MM} > 0$$

Table 6:
Effects of the share of offshore employment and immigrant employment on average task intensity of natives and immigrants.

2SLS estimates using imputed offshoring and immigration as IV for shares
58 manufacturing industries, yearly 2000-2007.

Dependent variable:	Average Skill Index “I _N ” for less educated Natives	Average Skill Index “I _M ” for less educated Immigrants	Average Skill Index “I” difference between less educated (Natives- Immigrants)
Explanatory Variable:			
Share of Immigrants in employment	-0.12 (0.09) $d_{DM} = 0$	0.31 (0.19) $d_{MM} > 0$	-0.44** (0.21) $d_{DM} - d_{MM} < 0$
Share of Offshore employment	0.050 (0.043) $d_{DO} > 0$	-0.16 (0.10) $d_{MO} < 0$	0.22** (0.11) $d_{DO} - d_{MO} > 0$
Observations	464	464	464
Industry Effects	Yes	Yes	Yes
Year effects	Yes	Yes	Yes

Conclusions

- The predictions of the model on shares are matched and offshore workers have more of a displacement effect on the native share than immigrants.
- The productivity effect is estimated to be positive so that neither offshoring nor immigration have a negative effect on native employment levels.
- The increase in offshoring pushes native tasks towards more complex-cognitive-interactive and immigrants towards more simple-manual tasks
- The increase in immigration raises the cognitive-interactive content of immigrant tasks but does not affect the task index of natives.