Intensive and Extensive Margins of Offshoring and Associated Wage Effects: Empirical Evidence from Matched Employer-Employee Data

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Abstract

In this paper we analyse the role of the extensive margin of offshoring on individual wages. To do so, we combine matched employer-employee data that enables us to identify firms that enter into offshoring to low- and high-wage countries and to assess the associated wage effects for firms' employees that follow. While explicitly accounting for heterogenous firms' selection into multiple offshoring modes we find pronounced negative wage effects of an expansion of offshoring along its extensive margin for low-skilled workers that points to significant displacement effects from entering offshoring. However, these negative displacement effects are partly counteracted by positive productivity effects from offshoring as suggested in, e.g., Grossman and Rossi-Hansberg (2008).

JEL: F16, F14

Keywords: Offshoring, extensive margin, wage, firm productivity

1 Introduction

Since the early 1990s Offshoring and the associated labour market effects have spurred considerable public and academic interest. Particularly, the rapid growth of offshoring to Central and Eastern Europe and to low-wage countries in general has raised concerns. There is ample empirical evidence, mostly at the industry level, that in the short-run offshoring reduces relative wages of low and medium-skilled workers and raises their job loss risk while high-skilled workers universally gain (see e.g. Crino, 2009 for an extensive survey of the literature). More recently the focus has shifted to the firm-level, analysing firms' selection into offshoring activities and the immediate wage and displacement effects for affected workers (e.g., Becker et al. 2013, Hummels et al., 2014).

Theoretically, the labour market effects of offshoring are, however, not clear cut. On one hand, lower offshoring costs and associated increased imports of intermediate inputs will reduce the range of tasks carried out within domestic firms thereby displacing labour and putting downward pressure on wages. On the other hand, the availability of cheaper inputs may increase firms' competitiveness leading to an expansion of remaining tasks, yielding positive employment and wage effects (see e.g., Grossman and Rossi-Hansberg, Kohler and Wrona, 2011). Importantly, the direction of effect will depend on the extent to which offshoring expands along its intensive and extensive margin. For instance, in the model of Grossman and Rossi-Hansberg (2008) the positive wage effect of offshoring accrues through cost reductions for already offshored tasks. This is comparable to the effects from labour augmenting technological progress leading to increased labour demand driving up wages. However, this positive wage effect is counteracted by a displacement effect from the expansion of the set of offshored tasks, i.e. an expansion of the extensive margin of offshoring. In contrast, Keuschnigg and Ribi (2009) solely focus on the extensive margin of offshoring by modeling the discrete offshoring decision of firms and ruling out any remaining domestic production after a firm has moved offshore. Accordingly, any potential productivity effect of offshoring is switched off in the model and a reduction in offshoring costs unambiguously leads to the displacement of domestic workers.[1]

Albeit these interesting theoretical discrepancies the existing empirical literature, to

[1]See Kohler and Wrona (2011) for a lucid discussion of the possible extremes of modeling choices and associated labour market implications.

the best of our knowledge, is largely silent about the different implications of the extensive and intensive margins of expanding offshoring. The present paper sets out to close this gap. We simultaneously model the wage effects of firms' offshoring expansion along the extensive and intensive margin drawing on matched employer-employee data for the universe of Danish manufacturing firms. These data are unique as they contain information on the volume, goods-type (HS-6 digit) and source country of firms's imports as well as detailed information on firm and worker characteristics over time. Our work relates to Hummels, Jorgensen, Munch and Xiang (2014) who draw on similar data and provide a very thorough analysis of wage effects of an expansion of offshoring along it's intensive margin. The present paper, however, goes beyond their analysis and makes several important new contributions to the existing literature. First of all, we explicitly model the effects of a firms discrete offshoring decision on wages of firms' workers alongside changes in the intensive margin of offshoring. Second, we differentiate between offshoring to different geographic regions (low-wage vs high wage countries) and measure such geographically decomposed offshoring activities much more accurately than respective studies drawing on aggregated data. Third, we explicitly model firms' selection into offshoring based on pre-offshoring characteristics and condition on respective propensity scores which allows us to better separate the productivity effect of offshoring from selection into offshoring. Fourth, we consider expansions of the extensive margin of offshoring for incumbent offshorers along the product dimension.

2 Empirical Methodology

Our identification strategy is similar in spirit to the difference in difference propensity score matching approach of e.g., Girma and Görg (2007) in that it augments regression analysis with propensity score models to explicitly model selection of firms into respective treatments, to use the terminology from the micro econometric evaluation literature. However, to accommodate different modes of offshoring our approach allows for multiple treatments and multiple propensity scores. In a first step, in order to account for selection of certain discernable firm types into offshoring, we separately estimate a multinominal propensity score model predicting the offshoring modes: ($z = 1$) non-offshoring (the default), ($z = 2$) offshoring to high-wage countries, ($z = 3$) offshoring to low-wage countries, ($z = 4$) offshoring to both, high- and low-wage countries for each and every manufacturing industry.[2] Assuming a standard logistic probability distribution function we estimate the probability p_{jtz} that firm j at time t selects itself into one of the offshoring treatments $z \epsilon 1, 2, 3, 4$:

$$p_{jtz} = \begin{cases} \frac{1}{1+\sum_{m=2}^{4} \exp(X_{jt-1}\beta_z)} & \text{, if } z = 1 \\ \\ \frac{\exp(X_{jt-1}\beta_z)}{1+\sum_{m=2}^{4} \exp(X_{jt-1}\beta_z)} & \text{, if } z > 1 \end{cases} , \quad (1)$$

where $X_{jt-1}\beta_z$ represents a flexible function based on a quadratic polynomial of the pre-treatment covariates *labour productivity*, *number of employees*, *sales*, *average low-skill and overall wages* and their full interactions, two dummy variables capturing *high-wage* and *low-wage country export status* as well as a full set of *time dummies*. Coefficients are estimated through maximum likelihood, respective coefficient tables for the 11 industry-level propensity score models are presented in Appendix A. Following Rosenbaum and Rubin (1983) and Rubin (1997) pre-treatment differences in observable firm-characteristics and the associated selection bias can be removed by conditioning on the propensity score for a single treatment if estimated propensity scores balance pre-treatment differences between the treatment and control group. As shown in Imbens (2000) this also holds for multiple treatments with respective multiple propensity scores. We proceed by performing balancing tests for the key firm-level covariats by carrying out mean comparison tests with and without controlling for three out of four propensity scores and their mutual interactions while imposing the common support restriction. Moreover, as reported in Table 1 we indeed succeed in balancing significant pre-treatment differences between both groups.

In a second step we match firm-level data with employee data and estimate Mincer wage equations conditioning on a large set of firm-, industry- and person-specific observ-

[2]We differentiate between two-digit manufacturing industries but aggregate ISIC (rev 3) industries 15-16, 17-19, 20-21, 23-25, 27-28, 30-33, 34-35 to have sufficient degrees of freedom for our industry-by-industry propensity score models.

Table 1: Balancing Test

	Non	Offshoring High-Wage	Low-Wage	High- and Low-Wage
log Productivity				
unconditional mean	12.72	12.97	12.79	12.98
T-test		p=0.00	p=0.00	p=0.00
mean conditional on propensity scores	12.63	12.63	12.63	12.63
T-test		p=0.78	p=0.78	p=0.92
log Number of Employees				
unconditional mean	2.59	3.76	2.99	4.17
T-test		p=0.00***	p=0.00***	p=0.00***
conditional mean on Propensity scores	2.24	2.55	2.55	2.54
T-test		p=0.162	p=0.53	p=0.88
log Sales				
unconditional mean	16.10	17.67	16.77	18.21
T-test		p=0.00***	p=0.00***	p=0.00***
conditional mean on Propensity scores	15.57	15.56	15.60	15.57
T-test		p=0.56	p=0.19	p=0.98
Average firm-level wage				
unconditional mean	152.49	174.06	158.79	175.96
T-test		p=0.00***	p=0.00***	p=0.00***
conditional mean on Propensity scores	142.68	142.56	142.60	142.68
T-test		p=0.85	p=0.94	p=0.99
Average low-skill firm-level wage				
unconditional mean	133.38	150.86	137.29	151.86
T-test		p=0.00***	p=0.02**	p=0.00***
conditional mean on Propensity scores	125.07	125.06	125.07	142.54
T-test		p=0.81	p=0.98	p=0.99
Exporter High-Wage				
unconditional mean	0.28	0.84	0.76	0.93
T-test		p=0.00***	p=0.00***	p=0.00***
conditional mean on Propensity scores	0.00	-0.01	0.00	0.00
T-test		p= 0.74	p=0.29	p=0.72
Exporter Low-Wage				
unconditional mean	0.18	0.70	0.65	0.87
T-test		p=0.00***	p=0.00***	p=0.00***
conditional mean on Propensity scores	0.00	0.00	0.01	0.00
T-test		p= 0.57	p=0.23	p=0.23

Note: * statistically significant at 10 %, ** 5 %, *** 1 %.

able characteristics, a flexible function of the three propensity scores obtained in the first step and employer-employee-match-specific fixed effects controlling for unobserved confounding firm-, employee-, and match-specific confounding variables that cannot be taken into account in the propensity score estimation. Instead of using matching techniques or inverse propensity score weighting we follow an approach recently proposed by Spreeuwenberg, Bartak, Croon, Hagenaars, Busschbach, Andrea, Twisk and Stijnen (2010) to analyse multiple treatments in non-randomized clinical studies. Accordingly, we simultaneously condition on multiple propensity scores by including them as regressors and thus avoid comparing pairwise treatment effects with potentially small matched samples as would be required with standard matching methods or inverse propensity score weighting. As demonstrated in Rosenbaum and Rubin (1983) this method is in comparison to standard regression techniques better suited to capture the potentially non-linear relationship between confounding factors and the treatment variables.[3]

We estimate variants of the following model:

$$\begin{aligned}
\ln w_{ijst} &= \alpha_{ij} + \delta_t + \theta F\left(p_{jt-3,z=2}, p_{jt-3,z=3}, p_{jt-3,z=4}\right) \\
&+ \beta^{hw} TOS^{hw}_{jt-3} + \beta^{lw} TOS^{lw}_{jt-3} + \beta^{hlw} TOS^{hlw}_{jt-3} \\
&+ \gamma^{hw} TOS^{hw}_{jt-3} \times \ln OS^{hw}_{jt-3} \\
&+ \gamma^{lw} TOS^{lw}_{jt-3} \times \ln OS^{lw}_{jt-3} \\
&+ \gamma^{hlw} TOS^{hlw}_{jt-3} \times \ln OS^{hlw}_{jt-3} \\
&+ \zeta^{hw}_{EX} \ln OS^{hwEX}_{st-3} + \zeta^{hw}_{IN} \ln OS^{hwIN}_{st-3} \\
&+ \zeta^{lw}_{EX} \ln OS^{lwEX}_{st-3} + \zeta^{lw}_{IN} \ln OS^{lwEX}_{st-3} + \omega Y_{st-3} \\
&+ \pi DEM_{it} + \phi FIRM_{jt} + \epsilon_{ijst}
\end{aligned} \tag{2}$$

with $\ln w_{ijst}$ representing log hourly wages of employee i in firm j of manufacturing industry s at time t. Employee-firm-match-specific fixed effects are denoted by α_{ij}, time fixed effects are represented by δ_t. Accordingly, all subsequent coefficients are identified through within employee-firm-match specific variation that departs from overall time-specific variation. To control for the selection of certain firm types into different offshoring modes we include the estimated propensity scores form the first step p_z as control variables entering the model through a flexible quadratic polynomial $F(...)$.

TOS^{hw}, TOS^{lw} and TOS^{hlw} are dummy variables respectively taking the value one

[3] Furthermore, as propensity score estimation, i.e. the modeling of selection into offshoring modes, in the present paper is done industry-by-industry, directly controlling for all confounding factors would require to include a large polynomial interacted with a full set of industry dummies.

if firm j offshores to high-wage countries, low-wage countries, or both. This dummy set, thus, represents the different treatments from our propensity score model and captures the wage effects of an expansion of the extensive margin of offshoring. The interaction terms ($TOS^r \times \ln OS^r$ and capture the intensive margin of offshoring to high- and low-wage countries with $OS^r, withr = hw, lw, hlw$ denoting narrowly defined offshoring volumes corresponding to each offshoring mode.

To allow for spillover-effects of offshoring across firms within industries and to relate our paper to micro-level studies implementing industry-level offshoring (e.g., Baumgarten, Geishecker, Görg) we also control for industry-level offshoring to high- and low-wage countries. All offshoring related covariats enter with a three years lag to avoid simultaneity between the offshoring treatment and wages.[4]

Employee characteristics are captured by DEM and include controls for work experience, age group, partnership status, children and occupation type. Firm characteristics $FIRM$ include contemporaneous measures of productivity, sales and number of employees. Following Hummels et al. (2014) we compare offshoring effects between model specifications with and without contemporaneous firm controls to assess the importance of the productivity effect of offshoring. In this context it is, however, worth noting that we can only quantify productivity effects of offshoring that materialize with some delay. Productivity effects of offshoring that immediately materialise are captured by the estimated propensity scores that among other things reflect firms' productivity in the year of offshoring and thus are always controlled for.

With our two step estimation procedure we control for the selection of firms into different modes of offshoring based on observable time-variant and unobservable time-fixed characteristics as well as the selection of workers into specific firms based on time-changing observable and time-fixed unobservable worker characteristics in a flexible way. Nevertheless, a sceptical reader may worry about firm selection into different offshoring modes based on unobservable time changing characteristics such as unobserved firm-specific productivity shocks that may be correlated with offshoring. However, it is important to note that our estimated propensity scores precisely reflect such firm characteristics. In our view

[4]Accordingly, our first period of wage analysis is 1999 analysing the effects of offshoring that has taken place in 1996, selection into which we model with pre-treatment variables from 1995.

it is hard to conceive a process that affects wages and is correlated with offshoring but cannot be captured by our firm-level controls, particularly labour productivity and firm size. Accordingly omitted variable bias is not a major concern and we assume the remaining error term ϵ_{ijst} to be orthogonal. To accommodate the matched employer-employee data structure we allow for error correlation within firm clusters.

Wage of employees of firms that switch from non-offshoring to high-wage country offshoring (hw), low-wage country offshoring (lw) or both (hlw) are predicted to change by:

$$(\exp(\beta^r + \gamma^r OS^r_{jt-3}) - 1) * 100 \text{ percent.} \tag{3}$$

with $r = hw, lw, hlw$.

Wage effects of an expansion of the intensive offshoring margin by continuous offshorers to high- and low-wage countries or both are derived as:

$$\frac{\partial \ln w_{ijst}}{\partial OS^r_{jt-3}} = \gamma^r TOS^r_{jt-3} \tag{4}$$

with $r = hw, lw, hlw$.

3 Results

We start by estimating a simplified variant of Equation where we exclude all interaction terms with the level of offshoring thus constraining the wage effects of an expansion of offshoring to be independent of the actual offshoring level. Wage effects of an extensive offshoring expansion in Equations to thus simplify to $(\exp(\beta^r) - 1) * 100$ percent with with $r = hw, lw, hlw$. To save space Table 4 directly reports corresponding wage effects of the extensive offshoring expansion and associated significance levels while we abstain from including the six underlying coefficient tables.[5]

We find statistically significant wage reductions associated with firms' discrete decision to offshore to low-wage countries for low- and medium skilled workers while the introduc-

[5] Full regression tables are reported in Appendix A.

tion of offshoring to high-wage countries or simultaneously to high-and low-wage countries has no effects. Low-skilled workers in firms that three years earlier newly started to offshore to low-wage countries on average experience contemporaneous wage cuts of 1.4 per cent. For medium-skilled workers the respective wage reduction 1 percent. As previously discussed these wage effects reflect the outcome of potentially opposing productivity and displacement effects of offshoring. To quantify the productivity effect of offshoring we, similar to Hummels et al. (2014), estimate a further model specification conditioning on a set of contemporaneous firm characteristics: productivity, number of employees, sales, export status to high- and low-wage countries. Comparing columns 1 and 2 and 3 and 4 in Table 4 shows that after muting potential productivity effects of offshoring, negative wage effects for low- and medium skilled workers become more pronounced. For high-skilled workers we find a moderate but statistically significant positive wage effect in firms starting to offshore to high-wage countries while other offshoring modes are rendered insignificant. As reported in Column 5 of Table 4 high-skilled workers on average experience wage gains of 0.8 per cent three years after their respective firm newly started to offshore to high-wage countries. Similar to before, this wage effect is substantially reduced and even becomes statistically insignificant after contemporaneous firm characteristics are controlled for. This suggests that offshoring indeed is positively correlated with subsequent productivity gains counteracting any potential displacement effects.

Table 2: Wage Effects Extensive Offshoring Margin irrespective of Offshoring Level

	Low-Skilled		Medium-Skilled		High-Skilled	
	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.
New Offshorer High-Wage	0.32	-0.04	0.37	-0.04	0.80**	0.49
	(0.34)	(0.37)	(0.30)	(0.28)	(0.38)	(0.34)
New Offshorer Low-Wage	-1.38**	-1.43***	-0.96**	-1.08**	-0.40	-0.42
	(0.54)	(0.52)	(0.44)	(0.42)	(0.80)	(0.73)
New Offshorer High- and Low-Wage	0.46	0.10	0.39	-0.02	0.84	0.51
	(0.41)	(0.42)	(0.35)	(0.32)	(0.49)	(0.45)

Note: The six underlying regressions are conditional on employee-employer fixed effects, a full set of year dummies, a full set of demographic controls and a flexible function of propensity scores from Equation 1 applying the common support restriction.

We now extend the model and estimate Equation with all interaction terms. For one, this allows wage effects of the discrete offshoring decision to vary with the corresponding offshoring level according to Equation . Second, this specification also enables us to assess wgae effects of the intesnive offshoring margin for continuously offshoring firms. To save space we again report percentage wage effects from expanding the extensive margin of offshoring but abstain from reporting coefficient estinmates from the underlying 6 regressions. Table 3 shows that offshoring may have positive or negative wage effects depending on where offshoring takes place. Low-skilled workers in a firm that three years earlier started to offshore to high-wage countries experience contemporaneous wage gains between 1.2 per cent for very low offshoring levels (bottom decile) and 0.5 per cent for moderate offshoring levels (median). However, had the otherwise identical firms instead selected into offshoring to low-wage countries low-skilled workers on average would experience wage cuts that increase with the level of low-wage country offshoring and can reach -1.7 per cent for the top offshoring decile. In comparison the effects of a simultaneous expansion of the extensive offshoring margin to both high-and low-wage countries cannot be identified with sufficient precision probably reflecting counteracting effects of high- and low-wage offshoring. Wage effects for medium skilled workers go into a similar direction but are somewhat less pronounced than those for low-skilled workers. Finally, high-skilled workers are found to experience moderate wage gains of up to 0.83 per cent in firms that previously have started to offshore to high-wage countries. Similar to before we control for contemporaneous firm characteristics thereby muting any potential productivity effects associated with offshoring. As becomes visible by comparing wage effects with and without firm controls for all skill-groups in Table 3 positive wage effects from starting to offshore become smaller while negative wage effects become more pronounced as was the case in the previous simplified model without interaction effects. However, regarding the magnitude of the productivity effect and its relation with offshoring levels there is no conclusive pattern.

With the comprehensive model we also assess the importance of offshoring activities of continuous offshorers, i.e. we quantify the wage effects of an expansion of offshoring along its intensive margins. There is considerable heterogeneity across firms regarding the

Table 3: Wage Effects Extensive Offshoring Margin, in per cent

	Low-Skilled		Medium-Skilled		High-Skilled	
New Offshorer High-Wage	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.
OS 10th pct	1.16***	1.11***	0.82**	0.53*	0.83*	0.54
	(0.42)	(0.40)	(0.36)	(0.30)	(0.45)	(0.41)
OS 50th pct	0.54*	0.26	0.46	0.08	0.80**	0.50
	(0.32)	(0.33)	(0.29)	(0.26)	(0.38)	(0.34)
OS 90th pct	-0.05	-0.56	0.13	-0.34	0.77*	0.46
	(0.36)	(0.37)	(0.33)	(0.31)	(0.44)	(0.40)
New Offshorer Low-Wage	Low-Skilled		Medium-Skilled		High-Skilled	
	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.
OS 10th pct	-0.75	-0.80	-1.03	-1.07	0.41	0.44
	(0.89)	(0.84)	(0.79)	(0.78)	(1.60)	(1.42)
OS 50th pct	-1.26**	-1.34***	-1.04**	-1.16**	-0.31	-0.33
	(0.52)	(0.52)	(0.46)	(0.45)	(0.87)	(0.77)
OS 90th pct	-1.66***	-1.76***	-1.04**	-1.22***	-0.87	-0.93
	(0.63)	(0.58)	(0.52)	(0.46)	(0.78)	(0.76)
New Offshorer High- and Low-Wage	Low-Skilled		Medium-Skilled		High-Skilled	
	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.
OS 10th pct	-0.10	-0.74	-0.16	-0.93	0.82	0.34
	(0.49)	(0.50)	(0.42)	(0.38)	(0.63)	(0.57)
OS 50th pct	0.03	-0.50	0.09	-0.45	0.81	0.44
	(0.42)	(0.43)	(0.37)	(0.34)	(0.54)	(0.49)
OS 90th pct	0.16	-0.28	0.33	0.02	0.80	0.55
	(0.47)	(0.47)	(0.42)	(0.40)	(0.58)	(0.53)

dynamics of offshoring levels in each mode resulting in a wide range of potential wage effects. To compare the magnitude of potential wage effects Table **??** reports predicted wage changes after a hypothetical increase of offshoring levels by 10 percent.

While high-skilled workers appear to be unaffected we find significant wage effects of an expansion of high-wage offshoring intensity for low- and medium-skilled workers. A ten per cent increase in offshoring towards high-wage countries reduces wages of low-skilled workers by about 2 per cent. After controlling for contemporaneous firm chartacteristics that appear to be correlated with previous offshoring levels the corresponding negative wage effect is 2.6 per cent. Similarly, medium skilled workers experience a 1.1 per cent wage reduction after continuous offshoring to high-wage countries is raised by 10 per cent. When netting out correlated productivity effects the corresponding wage reduction becomes 1.4 per cent. Thus, as with the analysis of the extensive offshoring margin we find evidence for a positive productivity effects of offshoring that counteracts the displacements effect.

Table 4: Wage Effects Intensive Offshoring Margin in per cent, calculated for 10 per ent increase in offshoring level

	Low-Skilled Workers		Medium-Skilled Workers		High-Skilled Workers	
	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.	No Firm Ctrl.	Firm Ctrl.
High-Wage ($r = hw$)	-1.9009 ***	-2.63 ***	-1.09 *	-1.38 ***	-0.08	-0.13
	(0.7009)	(0.65)	(0.61)	(0.51)	(0.75)	(0.69)
Low-Wage ($r = lw$)	-1.3783	-1.47	-0.02	-0.23	-1.93	-2.07
	(1.6857)	(1.47)	(1.43)	(1.31)	(2.56)	(2.37)
Both ($r = hlw$)	0.0199	0.04	0.04	0.07	0.00	0.02
High- and Low-Wage	(0.0358)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)

Note: The six underlying regressions are conditional on employee-employer fixed effects, a full set of year dummies, a full set of demographic controls and a flexible function of propensity scores from Equation 1 applying the common support restriction.

4 Conclusion

From a theoretical perspective there are marked differences in labour market effects depending on whether offshoring grows along its extensive or intensive margin. While there exist numerous studies assessing the intensive margin of offshoring and its labour market effects (e.g., Baumgarten at al., 2013, Hummels et al. 2014) labour market effects of an expansion of offshoring along its extensive margin so far have not been empirically analysed. The paper sets out to fill this gap. To do so, we combine matched employer-employee data that enables us to identify firms that enter into offshoring to low- and high-wage countries and to assess the associated wage effects for firms' employees that follow. We find pronounced negative wage effects of an expansion of offshoring along its extensive margin for low-skilled workers that points to significant displacement effects from entering offshoring. However, these negative displacement effects are partly counteracted by positive productivity effects from offshoring as suggested in, e.g., Grossman and Rossi-Hansberg (2008).

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Appendix A

Table 5: Regression Table, Simple Model

	Low-Skilled Workers		Medium-Skilled Workers		High-Skilled Workers	
	no firm ctrls	firm ctrls	no firm ctrls	firm ctrls	no firm ctrls	firm ctrls
β^{hw}	0.0032	-0.0004	0.0037	-0.0004	0.0080**	0.0049
	-0.0034	-0.0037	-0.0030	-0.0028	-0.0037	-0.0034
β^{hw}	-0.0139**	-0.0144***	-0.0097**	-0.0109**	-0.0041	-0.0042
	-0.0055	-0.0053	-0.0045	-0.0043	-0.0081	-0.0073
β^{hlw}	0.0046	0.0010	0.0039	-0.0002	0.0084*	0.0051
	-0.0041	-0.0042	-0.0035	-0.0032	-0.0049	-0.0045
ζ^{lw}_{EX}	0.0003	-0.0003	0.0007	0.0002	0.0004	-0.0001
	-0.0006	-0.0006	-0.0005	-0.0004	-0.0008	-0.0007
ζ^{lw}_{IN}	0.0005	-0.0006	0.0006	-0.0006	0.0005	-0.0005
	-0.0011	-0.0012	-0.0011	-0.0010	-0.0016	-0.0015
ζ^{hw}_{EX}	-0.0011**	-0.0008*	-0.0011**	-0.0008**	-0.0015**	-0.0008
	-0.0005	-0.0005	-0.0004	-0.0003	-0.0007	-0.0005
ζ^{hw}_{IN}	-0.0267***	-0.0206***	-0.0220***	-0.0157***	-0.0029	0.0025
	-0.0057	-0.0051	-0.0072	-0.0054	-0.0132	-0.0105

Note: All regressions are conditional on employee-employer fixed effects, a full set of year dummies, a full set of demographic controls and a flexible function of propensity scores from Equation 1 applying the common support restriction.

Table 6: Regression Table, Full Model

	Low-Skilled Workers		Medium-Skilled Workers		High-Skilled Workers	
	no firm ctrls	firm ctrls	no firm ctrls	firm ctrls	no firm ctrls	firm ctrls
β^{hw}	0.0287***	0.0348***	0.0179**	0.0177***	0.0090	0.0066
	-0.0096	-0.0087	-0.0082	-0.0066	-0.0100	-0.0091
β^{hw}	0.0027	0.0028	-0.0103	-0.0091	0.0184	0.0198
	-0.0205	-0.0184	-0.0178	-0.0169	-0.0339	-0.0308
β^{hlw}	-0.0029	-0.0108	-0.0053	-0.0165***	0.0083	0.0018
	-0.0073	-0.0074	-0.0061	-0.0057	-0.0090	-0.0081
γ^{hw}	-0.0019***	-0.0026***	-0.0011*	-0.0014***	-0.0001	-0.0001
	-0.0007	-0.0006	-0.0006	-0.0005	-0.0008	-0.0007
γ^{lw}	-0.0014	-0.0015	0.0000	-0.0002	-0.0019	-0.0021
	-0.0017	-0.0015	-0.0014	-0.0013	-0.0026	-0.0024
γ^{hlw}	0.0000	0.0000	0.0000	0.0001**	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ζ^{lw}_{EX}	0.0003	-0.0003	0.0007	0.0002	0.0004	-0.0001
	-0.0006	-0.0006	-0.0005	-0.0004	-0.0008	-0.0007
ζ^{lw}_{IN}	0.0006	-0.0005	0.0007	-0.0005	0.0006	-0.0005
	-0.0011	-0.0012	-0.0011	-0.0010	-0.0016	-0.0015
ζ^{hw}_{EX}	-0.0010**	-0.0008*	-0.0011**	-0.0008**	-0.0015**	-0.0008
	-0.0005	-0.0005	-0.0004	-0.0003	-0.0007	-0.0005
ζ^{hw}_{IN}	-0.0267***	-0.0205***	-0.0222***	-0.0160***	-0.0029	0.0024
	-0.0057	-0.0050	-0.0072	-0.0054	-0.0133	-0.0106

Note: All regressions are conditional on employee-employer fixed effects, a full set of year dummies, a full set of demographic controls and a flexible function of propensity scores from Equation 1 applying the common support restriction.