The direct and indirect effects of offshoring on local employment

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Abstract

Using matched worker-firm data from Sweden, we investigate the effects of offshoring on local employment. We contribute to the literature on several fronts: (a) we investigate the direct effect of the firm's offshoring on the worker's employment spell; (b) we study whether the type of offshoring (vertical FDI versus international outsourcing) matters; (c) we investigate whether offshoring may have indirect effects on local workers through linkages that the offshoring firms may have in the local market using highly disaggregated spatial data for Sweden; and (d) finally, we separate between two different exit decisions, exit directly to a new job or exit into unemployment. In order to deal with potential endogeneity, we use instruments based on world supply shocks and transport costs. Preliminary results suggest that the firm's import of intermediate goods seems not to push away employees while the probability of exit for the workers increases when a firm is engaged in vertical FDI. The results differ for skilled workers however who are found less likely to exit a job with increased importing. While skilled workers experience higher probability of exit when offshoring concerns vertical integration, they are more likely to exit into a new job and are hence more mobile and less likely to exit into unemployment than their less skilled counterparts. More results will become available soon.

JEL classification: F16, F66, J64

Introduction

Does offshoring lead to jobs moving abroad? A common view in the popular press is that globalization and offshoring destroy jobs, especially in high-income countries. A quick internet search for "*jobs move abroad*" in Swedish yields over 30 000 hits, and the most popular ones are about how jobs in Swedish firms move abroad while one needs to scroll down quite far in order to find reports about possible positive impact on firms and workers in Sweden due to finer division of labor.[1]

The answer to the above question is not simple, however, in economic theory. If offshoring results in moving tasks that are previously performed locally by a domestic worker, then the jobs associated with these very tasks may be affected. As these tasks are normally performed by the less skilled workers, it is this group of workers that is usually negatively affected (Feenstra and Hanson (1996)). It is however possible that with further specialization, the firm will become more productive and hence expand its operations domestically and internationally, which will result in positive employment outcomes for all workers (Grossman and Rossi-Hansberg (2008)). The consequences of the firm's actions are not limited to its own workers, however. Due to intensive domestic linkages, workers of other firms may be affected indirectly. One can think of upstream suppliers of the firm. The indirect effects on the workers of these firms are ambiguous as well. If the offshoring firm has offshored an intermediate input that is previously delivered by a local supplier, then one expects the workers of the supplier, both the skilled and less skilled, to be disadvantaged. If however, the offshoring firm expands and results in its increased demand from other local suppliers, then workers of these suppliers may benefit.

In this paper, we use matched employer-employee data from Sweden to answer the above question. In doing so, we are following a growing body of literature that uses micro-level data to study the offshoring decisions of firms and their labor market outcomes. While the vast majority of these studies focus on average wage adjustments that tend to have a long run scope, we investigate the short-run adjustment costs to incumbent workers following offshoring decisions. Few other studies have attempted to do so and fewer ones have done so using disaggregated data as we do. Short-run large adjustment costs due to employment effects may be large as argued by Davidson and Matusz (2011)[2].

Offshoring encompasses both international outsourcing where the firm does not own the foreign supplier and vertical foreign direct investment (FDI) in which the firm owns the foreign supplier (See the definition of offshoring in Hummels et al. (2014b)). However, the literature has tended to focus on outsourcing only mainly due to the lack of data on FDI and foreign daughters[3]. Our data allows us however to study both types of offshoring and estimate their differential effects on labor.

[1] This search was done in June 5 2015.

[2] Discuss shortly short run employment effects in the job displacement literature and in Autor et al papers

[3] For instance, Feenstra and Hanson (1997,1999) define offshoring as the import of intermediate goods from abroad.

[4] See also Martins and Opromolla (2009).

[5] Sweden came last among 34 OECD countries as the country with the most compressed wage structure in OECD Employment Outlook 2015

That the firm's offshoring activities may affect its workforce has long been acknowledged in the literature. What is less known however is how the firm's offshoring activities may affect workers in other firms through linkages. These indirect effects may be large as highlighted by Egger and Egger (2005). The main reason why the empirical literature has so far ignored such indirect effects is due to the lack of data on how firms may be interacting with other firms through value chains and supply channels. We address this issue and suggest an empirical methodology to estimate the wider effects of offshoring on the local economy by using unique data from Sweden on the exact location of the firm and its plants in very small spatial units (as small as 500m by 500m). This allows us to explore possible linkages of the firm with other firms in the same and the surrounding spatial units as well as estimate the exact distance between the firm and its potential suppliers. This way, offshoring effects are no longer limited to the firm but extend to other firms and workers. We are the first ones to use matched employer-employee data to estimate such indirect effects of offshoring as far as we know.

We also use the disaggregated firm-level data to construct firm-specific instruments similar to (Hummels et al. (2014a)) to deal with possible endogeneity issues in the empirical specification. For example, firms that offshore are likely to be larger employers and are more likely to keep people employed longer because they are more geared towards absorbing negative shocks.

The results underscore that the job exit decision is not influenced by whether we study the occupational or the educational status of the individual. High skilled and more educated individuals are more likely to exit, or they are more mobile. The firm's import of intermediate goods seems not to push away employees while the probability of exit increases when a firm is engaged in vertical FDI. This is not true, however, for highly skilled workers since their probability of exit is unchanged. Finally, we find that the higher mobility of the high-skilled workers is only true for switches into a new job (they are actually less likely to switch into unemployment) and firms' import of intermediates are positively correlated to exit through unemployment.

This paper is related to the large literature on the labor effects of offshoring. Traditionally, this literature uses aggregated industry-level data to estimate how offshoring affects wages and inequality. A vast majority of the earliest studies have studied the effects of offshoring on skill composition measured as cost shares (implying that the composition may change due to changes in wages and/or number of workers). The main finding is that offshoring increases the skilled labor's share of the wage bill in both the origin as well as the destination countries. For example, Feenstra and Hanson (1997, 1999) and Hsieh and Woo (2005) show that offshoring may explain a large part (up to 50 per cent) of the increased wage share of skilled workers in the US, Mexico, and Hong Kong respectively. Both studies use industry-level data, which might suffer from possible endogeneity problems. These problems have been addressed by using different types of instruments in many cases. However, even if one finds good instruments (as argued by Hummels et al. (2014)) there is always a possibility that an industry-level variable captures both the average firm reaction and the change in the composition of heterogeneous firms within an industry or a technical change or even a demand shock.

With improvement in data collection and accessibility, more recent studies employ firm-level data to deal with these problems. The results from these studies are however ambiguous. Castellani et al. (2008), using Italian firms, find that outward FDI has no impact on the skill composition except for outward FDI towards Central and Eastern European countries. Becker et al (2013), on the other hand,

finds that outward FDI increases the skill intensity of German firms. However, from the studies that address endogeneity problems that may arise even in the firm-level data such as Amiti and Davis (2011) and Mion and Zhu (2013), then the evidence tilts towards that offshoring has an impact on wages and employment in line with the discussion above (i.e. increased demand and wages for skilled workers in the offshoring firms).

While the literature has focused on real and relative wage effects, fewer studies have focused on the effects of offshoring on job separations or unemployment. One reason is due to the long-run perspective and the full employment conditions underlying trade theory. The ones that do study employment spells tend to do so using aggregated industry-level offshoring data however. Egger et al (2010), Geishecker (2008) and Munch (2010) all belong to this relatively small literature, using data from Austria, Germany and Denmark respectively. The overall conclusion from this literature, using different types of data and methodologies, is that offshoring increases the probability of job separation. Hence, as argued in Geishecker (2008), offshoring may increase the insecurity of employees, and both Munch (2010) and Görg and Görlich (2015) show that this effect may be asymmetric. Munch (2010), using Danish data, shows that less skilled workers are more likely to move into unemployment while skilled are more likely to switch to a new job. Görg and Görlich (2015) find, using German data, that the type of work contract matters since the jobs of temporary workers are more insecure.

Another related literature is the literature on jobs displacements. The vast literature shows that job displacements can have long-term effects on displaced workers and the losses to earnings may be substantial (see Jacobson at al. (1993) and Couch and Placzek (2010) for the US) although these effects seems to be less important in Europe (see Eliason and Storrie (2006) and Huttunen, Möen and Salvanes (2011)). Hummels et al (2014a) also show that the negative effect of offshoring on long-term earnings are significantly higher compared to workers displaced by other factors. A related study of Swedish firms by Nilsson Hakkala et al. (2014) support these findings. That is, a firm becoming a multinational enterprise boosts its cost share of non-routine jobs, and they argue that this is mostly due to changes in wages and not in head-counts. These results have recently been confirmed by using employer-employee data in Hummels et al. (2014a), which has the advantage to control for individual characteristics of the workforce.[4] A recent paper by Sly (2012) model the impact of trade adjustments on the matching behavior of workers.

Data description

Setting our context

The Swedish labor market is often characterized by a high security and a low flexibility compared to other countries. Botero et al (2004) show for example that Sweden is ranked very low when it comes to flexibility in the labor markets. This is compared to Sweden's southern neighbor Denmark, which is ranked as "one of the most flexible market in the world" (Hummels et al., 2014a). One important characteristic of the Swedish labor market is the high degree of collective relations. This implies that the local situation of employees is to a high degree determined by a centralized negotiation

[4] See also Martins and Opromolla (2009).

procedure between labor unions and employer organizations. Hence the room for individual wages is rather narrow, which is expressed in low wage ratio between the 9th and the 1st decile compared to other OECD countries.[5] That is, the collective wage agreements set the scope of the wage-increases and guaranties that individual employees should have a part of this increase. It is important to notice that collective agreements apply for all employees in a workplace, independent of whether they are members of a labor union or not, as long as the firm is a member of an employer organization behind the collective agreement. Hence around 90 per cent of all employees in Sweden are covered by collective labor agreements, and although we have seen increasing local or individual wage settings, especially for office-holders, collective agreements still dominate the Swedish wage structure. Since wages are to a large extent decided collectively, adjustments in the labor markets tend to occur through reallocation of labor between firms – for example between less productive to more productive firms.[6] Hence the low flexibility in Sweden when it comes to lay-offs is mostly about protecting individuals from idiosyncratic terminations. On the other hand when it comes to collective dismissals (plant closures), then Sweden is among the most flexible in OECD. The OECD ranks Sweden 7th in 2013 (out of 34) for restrictiveness in individual dismissals. But when it comes to its rankings for restrictiveness in collective dismissals, then Sweden is ranked 26th. In addition, Sweden is one of the least restrictive countries in OECD (ranked 29th) when it comes to the use of fixed-term and temporary work contracts.

Setting our sample

Our database stems from merging several Swedish register databases on the firms' balance sheets, trade activity, FDI activity, location, and socio-demographic information about all workers in Sweden (including their workplace). By merging these register databases, we have constructed a matched employee-employer database covering all firms (and their plants or establishments) as well as all individuals (above 16 years) for the period 1997-2011. We have very detailed information about bilateral exports and imports (quantities and volumes) at the 8-digit level (based on the Combined Nomenclature, CN). Our data is however more restrictive when it comes to information about FDI activities where we have information about the number of plants, workers and sales volumes as well as the industry (SNI code, Swedish Standard Industrial Classification system, which is based on the EU standard classification NACE) of firms' FDI activity in each country, but this is restricted to the period 2007-2011. This implies, since we would like to investigate whether the type of offshoring (arms-length versus integrated and horizontal versus vertical FDI) matter for worker's job, that our main period of interest is restricted to this period. However, we can follow job spells for a long period before the actual period of study since we have information about all individuals' job situation from 1997. That is, we will be able to count the number of firms each individual have worked on and the duration of each employer-employee relation initiated after 1997.

We do also trim our sample in order to avoid exits driven by retirements and firm restructures. Firstly, individuals in Sweden may work until they are 67 but they may also choose to retire after the age of 61. Hence in order to reduce any biases due to retirements, we exclude all individuals turning 61 during the period 2007-2011. This reduces the sample with 107,466 observations. Secondly, we follow each individual's job-spell over time, which implies that a job exit from one firm (or

[5] Sweden came last among 34 OECD countries as the country with the most compressed wage structure in OECD Employment Outlook 2015.

[6] Svanlund et al (2013) calls this for "external flexibility", and relate this to Swedish Rehn-Meidner approach developed in the 1940s and the 1950s.

organizational number) and a job entry into another the year after may be due to a firm restructure. That is, an individual may stay on the same job together with the same colleagues but be recorded as an exit due to that the firm change its organizational number due to, inter alia, a change in its legal status or ownership structure. Since we do not define these types of job switches as a job separation, we exclude individuals switching from one employer organizational number to another if the individual is still working together with at least 40 per cent of her or his old work colleagues. This excludes 18,934 observations. Finally, we restrict our dataset to manufacturing firms with positive sales volumes in order to avoid inactive firms and we drop employee-employer job spells with gaps in order to mitigate erroneous data registrations.

This leaves us with a sample consisting of 1,063,072 observations in the following three dimensions: 344,215 individuals, 10,611 firms and 5 years. When it comes to the number of unique combinations of individuals and firms, then we have 368,893 employee-employer specific observations and the range of the unique job-spells combinations of an individual and a firm range from 1 to 15 years. The number of events (i.e. when an individual exit a firm) amounts to 78,290 and the job durations for these spells range from 1 to 14 years, and Figure 1 shows the distribution of durations and the percentage of exits at each spell. This figure shows clearly that the share of the total number of job-separations is largest, around 8-17 per cent, during the first four years, while the share of exits drops down to around 4-6 per cent for jobs that prolong for five years or more. If we consider the exit event, then a majority (around 96 per cent) switches over to another firm the year after he or she exits, around 2.7 per cent switch to something else (excluding unemployment) while only 1.3 per cent stay unemployed.[7]

Figure 1: Distribution of job duration lengths

The dataset allows us also to categories between different occupational groups and educational levels, which may be essential according to Hakkala et al (2014). Hence Table 1 shows how the spell

[7] If an individual exit and has no job the year after, then we define the individual as unemployed if his or her major income stem from unemployment benefits. Otherwise the individual is defined as switching to something outside the labor market (e.g. education, military service, parenthood, etc.).

events or percentages of exits are distributed across different occupational and educational groups. One observes that a majority of all exits is related to blue-collar jobs (almost 45%) and secondary schooling (around 56%).[8] The figures do also support that it might be important to investigate whether there is a difference when it comes to how individuals behave according to their educational level compared to their occupation and their skill level. That is, we find individuals working with highly skilled occupations (such as managers and professionals) with a range of different educational levels although a majority has university degree.

	Managers	Professionals	White collar	Blue collar	Others	*Total*
University education (>3 years)	3.4	7.9	8.9	2.6	1.1	*23.9*
University education (<4 years)	1.2	0.8	3.3	1.8	0.4	*7.5*
Secondary school	2.1	1.1	11.9	33.1	7.5	*55.6*
Other	0.4	0.1	1.6	7.2	3.7	*13.0*
Total	*7.0*	*10.0*	*25.6*	*44.7*	*12.7*	

Table 1: Distribution of employment spell events across educational level and occupation (% of total exits)

Note: Occupations are defined by the following major groups (1-digit codes) of the International Standard Classification of Occupation; Managers (1), Professionals (2), White collar (3, 4, 5), Blue collar (6, 7, 8), and Others (9).

Offshoring, FDI and locality

One of the most important decisions of a firm relates to how different tasks in its production process should be organized. Helpman (2006) describes these decisions in a strategic matrix with two dimensions. One dimension is about whether the firm should use domestic or foreign sources when it comes to purchases of intermediate goods. The other dimension is about how the firm should organize its purchases of intermediate goods; it could choose an internal solution (i.e. vertical integration with the supplier of intermediate goods) or it could keep an arm's length distance (i.e. international outsourcing). Hence offshoring includes two different decisions, the decision to use foreign sources and the decision to either organize this trade vertically within the firm or from an arm's length distance. Since few databases have the possibility to separate these two different dimensions, most studies investigating the impact of these decisions on the firms and their workers focus either on importing or on FDI patterns in order to capture vertical integration in particular. In addition to the two-dimensional decision matrix of offshoring, any measurement of offshoring is also influenced by the tasks or products we include in our definition. This is not a straightforward definition since what we often mean with offshoring is when a firm moves production tasks from its domestic unit to a foreign one. Hence it is about when firms transform their domestic production process by relocating production tasks outside its domestic area.[9] This implies that offshoring is not about all types of input purchases since Swedish firms may never have the opportunity to actually drill for oil themselves domestically. Hence inputs such as raw material and fuel are excluded from

[8] Note that the distribution of the non-exit observations is very similar as the one presented in Table xx.
[9] See Hummels et al (2014b) for a in-depth discussion about offshoring definitions and measurements.

offshoring since these inputs has not transformed the organization of firms' production process so that a part of it moves from the domestic sphere to the foreign one.

The path breaking study of Feenstra and Hanson (1999) considered this by going from a broad definition of offshoring, which included all types of imported inputs, to a narrow definition based on imports of inputs originating from the same broad industry. Hence the narrow definition of offshoring is based the information about how much of the value-added in an industry that stems from the same industry. Feenstra and Hanson (1999) argue for that the narrow measurement captures the idea of offshoring better than the broader one. And the reason for this is that the narrow definition consists of inputs from an industry that actually exists in the importing country and these inputs are produced by broadly similar firms. Hence there may be a potential for a domestic production within the firm. Similar measurements have been used in several succeeding studies. A recent paper by Görg and Görlich (2015) uses a similar approach for industry-level offshoring indicators using world input-output tables for a study on job-separation in Germany while Munch (2010) uses Danish input-output tables for a study on job-separations in Denmark. A potential problem with industry-level offshoring indicators is firm heterogeneity when it comes to offshoring decisions, see e.g. Helpman (2006). This may lead to that changes in offshoring reflect a change in the firm composition within an industry instead of an actual shift of domestic tasks to foreign producers.

A recent development when it comes to the measurement of offshoring is found in Hummels et al (2014a), which makes use of firm level information in order to calculate one broad and one narrow offshoring measurement. Their narrow measurement of offshoring is defined as a firm's imports of products in the same product category (HS4 or HS2) as the product sold by the firm (excluding imports of raw materials and finished machines from the narrow definition). We use a slightly modified approach and define offshorable products by the products (8-digit level) sold by all Swedish firms belonging to the same 3-digit industry (narrow1) excluding raw materials, fuel and finished machines. The reason for including all products sold by firms within an industry is that we would like to capture the possibility of switching from domestic outsourcing to offshoring (either international outsourcing or imports from a foreign affiliate), which we discuss in more detail below. We do also use a slightly broader definition based on imports of each firm and the how these imports are classified according to the BEC classification (Broad Economic Categories). In this measure (narrow2), we single out imports of processed goods (food and industrial supplies) and parts and accessories (capital goods and transport equipment) as intermediate goods while all other goods (capital goods, passenger motor cars and other transports vehicles, consumer goods and goods not elsewhere specified) are excluded from this measurement.

We are also interested in how firms organize their offshoring activity, which was the focus of Nilsson Hakkala et al (2014) when they investigated the relationship between becoming a multinational and the mix of job tasks at firm level. One drawback of their measurement, however, is that they had no possibility to distinguish between vertical and horizontal FDI, which is crucial for our study since we would like to focus on how firms organize their offshoring activities. Hence we classify firms FDI activity in foreign country by investigating whether a firm's foreign affiliates is within the same 2-digit industry. Hence we use a similar definition of a vertical integration as the narrow measurement used in the literature of offshoring.

Finally, the offshoring literature focuses on the impact of imports of intermediate on firms due to that these inputs are not produced by the domestic firm anymore. We argue however that a likely scenario is that firms start outsourcing internationally and thereafter enter the global value-added chain by using foreign sources (XXXreferences). If this is the case, then the effects of offshoring on job separations may be less noticeable for the offshoring firm and more noticeable for earlier domestic suppliers in the same value-added chain. That is, the offshoring effects may be indirect through a squeezed demand of domestically produced inputs. Hence we will capture this indirect effect by summing up total offshoring, less the firms' own offshoring, at a 3-digit industry level. However, since industries tend to be spatially clustered, we will also include a spatially weighted offshoring measure (which also excludes the firms' own offshoring) using a fine spatial division (9,209 spatial units) of Sweden.[10] We have information of where each firm is located and hence we could construct a measure of the total imports of inputs in the firm's proximity, and we start by defining proximity as firms in the same 3-digit industry located in the neighborhood of the firm observed. And we use a rook weighting matrix with a 4th order of contiguity in order to define the neighborhood. This implies that a firm's neighborhood consists of the region of its location, the regions bordering to the firm's location and the neighboring regions of its neighbors in a sequence of four. The minimum number of neighbor regions is 6, the maximum is 328 and the mean number is around 100 neighbors. This implies that our neighbor-regions consists of approximately three times more SAMS regions compared to the average number we find inside Swedish municipalities, which is 31 SAMS regions.[11] Hence the industry offshoring variable (MS_{ft}) controls for nation-wide value-added chains while the import of intermediate goods in the proximity of the firm (MSR_{ft}) controls for local clusters. The formal definitions of these variables are as follows:

$$\begin{aligned} MS_{fst} &= \sum_{j \in \Omega_s} m_{j-f,t}, \\ MSR_{flst} &= \sum_{j \in \Theta_l} \sum_{j \in \Omega_s} m_{j-f,t}, \end{aligned} \tag{1}$$

where m_{j-f} is the offshoring of firm *j* (excluding firm f), who is located in the proximity *l* and member of industry *s*. As an alternative spatial offshore measurement we use the information about the distance between the SAMS regions in Sweden:

$$\begin{aligned} MSRd_{flst} &= \sum_{r \in R} \frac{MSR_{frst}}{d_{lr}}, \\ MSRd2_{flst} &= \sum_{r \in R} \frac{MSR_{frst}}{d_{lr}^2}, \end{aligned} \tag{2}$$

[10] These regions are called SAMS regions and consist of a much finer spatial division of Sweden than municipalities, which implies that we may aggregate without being concerned by the administrative borders of the 290 municipalities in Sweden.

[11] The minimum number of SAMS regions within a municipality is 3 while the maximum is 877.

where d_{lr} is the distance between region *l* and *r* (using d_{lr} =1). Hence these measures show how close each firm is to the importing source of those inputs defined as offshored.

Table 2 presents descriptive figures regarding some key variables for individuals and firms. When it comes to the characteristics of the individuals in the sample, then we may see that the dispersion is rather small and the mean income is found around 340,000 SEK per year. The mean birth year is 1970 and the age of the individuals is within the range of 17 and 60 years. In addition, around 24 per cent of the individuals are women while 95 per cent has a Swedish citizenship. If we focus on employees' exposure to trade then almost 80 per cent and only around 3.4 per cent of the individuals work in a firm with offshoring and vertical FDI respectively. When it comes to firms, then they show a greater dispersion compared to individuals. The mean size of the firm is 38 employees or a sales volume (in nominal prices) of around 120 million SEK. Only around 1 per cent of the firms are engaged in a vertical FDI activity while 28 per cent have offshoring, and around 47 and 41 per cent of the firm export and import respectively.

Variable	Mean	Standard deviation	
Individual variables (total sample)			
Salary (hundreds of SEK)	3 376	276 821	
Birth year	1970	10	
Job number	2.45	1.26	
Woman (binary variable)	0.24		
Swedish (binary variable)	0.95		
Working in a firm with vertical FDI (binary variable)	0.03		
Working in an exporting firm (binary variable)	0.88		
Working in an importing firm (binary variable)	0.86		
Working in an offshoring firm (binary variable)	0.79		
Firm variables (firm observations)			
Number of employees	39	322	
Sales (in real terms, thousands of SEK)	120 175	1 762 265	
Vertical FDI (binary variable)	0.01		
Exporting firm (binary variable)	0.47		
Importing firm (binary variable)	0.42		
Offshoring firm (binary variable)	0.28		

Table 2: Sample descriptive statistics

Instruments

As noted by Munch (2010), the use of an offshore indicator on industry level when we study its effects on firms or individuals may mitigate endogeneity problems due to a loop in the causality link. That is, offshoring is expected to lead to job-separations since it transforms the production process and hence makes some type of employees redundant. At the same time we may expect that firms with productivity issues due to a miss-match with employees may try to solve these problems by offshoring. Especially in an environment with restrictive procedures when it comes to individual dismissals. An industry level indicator may break this loop in causality but at the same time we face possible endogeneity problems due to heterogeneity within industries, which suggests that an industry indicator may pick up industry dynamics that has little to do with offshoring. Hence we consider the approach of Hummels et al (2014a) by using firm level instruments that picks up a variation on the world market influencing trade shocks at firm level while the instruments are unaffected by individual firm decision in Sweden. Hence we use the export-supply shock of each

exporter and construct a firm-level indicator with the help of pre-sample distribution of firm imports of each input across exporters. Formally we construct the instrument for imports as follows:

$$MIV_{ft} = \sum_{p}^{P} \sum_{c}^{C} s_{fcp.} x_{cpt} \tag{3}$$

where x_{cpt} is exporter *c*'s total exports of product *p* (defined by HS6) at time *t* while s_{fcp} is firm *f*'s import share of source *c* of product *p*. Note that the distribution key s_{fcp} is defined at the pre-sample period (which is 2006 in this case) as long as the firm imported. If the firm started to import after 2006, then we use the first import year as the distribution key for the complete time the firm is observed. This instrument should pick up shocks in the source countries influencing Swedish imports due to shocks in both demand and supply fundaments.

In addition to the export-supply shock in the sourcing countries, we use shocks in transport costs over time influencing Swedish imports. We use a slightly different approach compared to Hummels et al (2014a), however, since we lack information about the transportation mode used. Hence we use an approach inspired by Hummels (2007) by focusing on ad valorem measure of transport costs defined by the ratio between the cif and the fob value of a shipment of specific product from an exporter to each importer (excluding Sweden). This measure of bilateral transport costs are then explained with the bulk of the shipment (estimated by the value of the shipment divided by its measure in tonnes), the distance between the trading partners, product dummies in order to pick up time-invariant product-specific costs, time dummies in order to pick up changes in time variant costs such as oil prices and the interaction between time dummies and distance in order to pick up distance specific cost shocks due to these shocks. In order to capture different types of transportation modes, we estimate these relationships at a 3-digit BEC level. Thereafter the estimated coefficients are used to create a prediction of transport costs between the sourcing country and Sweden using the pre-sample bulk variable (indicated with *T* in equation 2) for total Swedish imports. We exclude the time-invariant product specific cost in this prediction since we are interested in capturing shocks in transport costs over time that is common for all products. We then create a firm level instrument in the same way as above by using the pre-sample distribution of imports across sourcing countries.

$$\begin{aligned}
&\frac{x_{cdpt}^{cif}}{x_{cdpt}^{fob}} = \frac{p_{cdpt} + t_{cdpt}}{p_{cdpt}} = y_{cdpt} = \alpha_p + \beta^j \ln\left(\frac{x_{cdpt}^{fob}}{q_{cdpt}^{fob}}\right) + \delta^j \ln(dist_{dc}) + \lambda_t^j + \varphi^j \ln(dist_{dc})\lambda_t^j, \\
&\hat{y}_{cSWEpt} = \hat{\beta}^j \ln\left(\frac{x_{cSWEpT}^{fob}}{q_{cSWEpT}^{fob}}\right) + \hat{\delta}^j \ln(dist_{cSWE}) + \hat{\lambda}_t^j + \hat{\varphi}^j \ln(dist_{cSWE})\hat{\lambda}_t^j, \\
&MTC_{ft} = \sum_{p}^{P} \sum_{c}^{C} s_{fcp.} \hat{y}_{cSWEpt}.
\end{aligned} \tag{4}$$

Empirical approach

The objective of this study is to investigate the effects of offshoring on employment durations, and we focus on those initiated after 1997. Hence we avoid problems of using a stock sample. That is, we

avoid overestimating the mean duration since longer spells tend to be observed more often (see Amemiya, 1999) in stock samples and we avoid left-truncated spells since we have no information about the starting point of employer-employee observations observed in 1997. In addition, although we us a flow sample, i.e. we only use new employer-employee relations since 1998, we are able to avoid a focus on only short durations since we could follow each new spell over a period of 15 years.

A common feature of duration data is that the underlying continuous durations are recorded in discrete units, which is the case in our data set. We observe every employee-employer relation each year but we have no information about whether it started or ended in the beginning or close to the end of the year. In order to take this into account, we use bivariate discrete-time hazard model with the following form for the employer-employee relation *fj*:[12]

$$\lambda_{fit} = \Lambda(x_{fit}'\beta + \lambda_t + \mu_{fi}), \tag{1.5}$$

where λ_t is the baseline hazard at time *t*, x_{fit} is a vector with individual and firm time-varying variables, calendar time indicators and industry and regional time-invariant indicators while β is a vector of parameters to be estimated. An advantage with a discrete duration model is that we could easily model unobserved heterogeneity as employer-employee specific by using as a random effect (μ_{fi}). The baseline hazard is modeled non-parametrically by using spell indicators.

Results

Conclusions

[12] See discussion in e.g. Jenkins (1995) and Gullstrand and Tezic (2008).

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Tables

Table 3: Duration length and spell events.

Length of duration	# of survivals	# of exits
1	75882	9865
2	71459	15263
3	58862	10914
4	88443	7871
5	111135	5602
6	100213	4140
7	72276	3754
8	59524	3416
9	61215	2939
10	66362	2503
11	54746	4579
12	70360	2627
13	50481	2594
14	43117	2223

Table 4: First stage regression.

	(1)	(2)	(3)	(4)	(5)
Offshoring instrument	Offshore (narrow1)	Offshore (narrow2)			
MIV (Supply shocks)	0.419 a	0.330 a			
MTC (transport shocks)	-0.956 a	-0.434 a			
Firm controls	Yes				
Individual controls	Yes				
Skill measure	Occupation: special skills	Occupation: special skills			
Spell dummies	Yes	Yes			
3-digit industry dummies	Yes	Yes			
County dummies	Yes	Yes			
SE cluster level	Firm	Firm			
R2-within	0.09	0.06			
No. of observations					

Note: a, b and c indicates a p-value lower than 0.01, 0.05 and 0.10 respectively.

Table 5: Firm level offshoring.

	(1)	(2)	(3)	(4)	(5)
Offshoring					
Imports	-0.001 c				
Instrumented imports		-0.001	-0.001	-0.001	-0.001
Instrumented imports x skill indicator				-0.003 b	-0.003 b
Vertical FDI indicator			0.014 c	0.013 c	0.013 c
Firm variables					
TFP	-0.005 c	-0.008 b	-0.008 b	-0.008 b	-0.008 a
No. employees	-0.005 a	-0.006 c	-0.006 c	-0.006 c	-0.007 c
Capital stock per employee	0.004 b	0.006 a	0.006 a	0.006 a	0.006 a
Individual variables					
Salary	-0.026 a	-0.029 a	-0.029 a	-0.029 a	-0.029 a
Experience (age)	-0.045 a	-0.065 a	-0.065 a	-0.065 a	-0.065 a
Woman	-0.007 a	-0.008 a	-0.009 a	-0.009 a	-0.009 a
No. of jobs	-0.010 a	-0.013 a	-0.013 a	-0.014 a	-0.014 a
Swede	0.019 a	0.021 a	0.021 a	0.021 a	0.021 a
Skill indicator	0.011 a	0.010 a	0.010 a	0.069 a	0.069 a
Offshore measure	Narrow2	Narrow2	Narrow2	Narrow2	Narrow1
Skill measure	Occupation: special skills	Occupation: special skills	Occupation: special skills	Occupation: special skills	Occupation: special skills
Spell dummies	Yes	Yes	Yes	Yes	Yes
3-digit industry dummies	Yes	Yes	Yes	Yes	Yes
County dummies	Yes	Yes	Yes	Yes	Yes
SE cluster level	Firm	Firm	Firm	Firm	Firm
Random effects level	No	Individual-Firm	Individual-Firm	Individual-Firm	Individual-Firm
R2-within	0.09	0.05	0.05	0.05	0.05
No. of observations					

Note: a, b and c indicates a p-value lower than 0.01, 0.05 and 0.10 respectively.

Table 6: Indirect effects regressions

	(1)	(2)	(3)	(4)	(5)
Offshoring					
Instrumented imports	-0.001	0.001			
Instrumented imports x skill indicator					
Vertical FDI indicator	0.015 b	0.010			
Offshoring – same industry level	0.009 b	-0.002			
Offshoring – same industry and location		-0.001 b			
Sales – same industry and location	-0.001 a	0.001			
Firm variables	Same as in Table XX	Same as in Table XX			
Individual variables	Same as in Table XX	Same as in Table XX			
Offshore measure	Narrow2	Narrow2 or 1			
Skill measure	Occupation: special skills	Occupation: special skills			
Spell dummies	Yes	Yes			
3-digit industry dummies	Yes	Yes			
County dummies	Yes	Yes			
SE cluster level	Firm	Firm			
Random effects level	Individual-Firm	Individual-Firm			
R2-within	0.05	0.05			
No. of observations					

Note: a, b and c indicates a p-value lower than 0.01, 0.05 and 0.10 respectively.