Do Immigrants Spur Offshoring? Firm-Level Evidence

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Offshoring provides firms with opportunities for internationalization and growth. But, offshoring comes at a cost, especially in presence of inadequate information and trust friction. Immigrant employees could reduce such offshoring transaction costs through their knowledge of former home countries and via access to foreign networks. This is the first firm-level study on migration and offshoring. In estimating a firm-level gravity model on new employer-employee data for approximately 12,000 Swedish firms during the time period 1998-2007, we are able to show that immigrant employees have a significant and positive impact on offshoring. Hiring one additional foreign-born worker can spur offshoring with up to three percent on average, and even more to low-income countries. The findings of this study could have potentially important policy implications. In addition to showing that immigrants could provide options for countries that aim to promote offshoring, the results introduce a completely new channel through which migration may promote development, through offshoring. This could encourage governments of developed nations to enhance their emphasis on migration as a tool for supporting private sector development in emerging economies.

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1 Introduction

Firms' procurement of intermediate inputs sourced from foreign producers is often characterized as a trade-off between the benefit of lower purchase prices compared to domestic produced equivalents, versus higher information and coordination costs. Offshoring is associated with sunk costs (Antràs and Helpman, 2004). Offshoring also involves variable costs because it requires matching of firms and suppliers as well as long-distance transports, coordination and monitoring of the value-chain (Head et al. 2009; Cuberes 2013; Cristea 2012).

Do immigrants employed by a firm provide access to networks within the country of their birth, reducing information costs, and acting as a spur to its offshoring activities? We use detailed employer-employee data from Sweden to test if immigrants can help to lower these costs and explain whether, from where and how much intermediate goods are sourced from foreign suppliers. This is, to the best of our knowledge, the first firm-level study on migration and offshoring.

Our analytical approach is motivated by the assumption that migrants' ability to lower offshoring costs is the strongest at the employer-employee level. Geographical proximity through employment governs the intensity of interactions between migrants and the managers of a firm, which enhances the ability of immigrants to transmit their knowledge about the country of birth (Gould 1994; Rauch 2001; Herander and Saavedra 2005). The transmission of such information makes it more likely that the firm will offshore to that country and possibly also increase the size of that offshoring relationship. We address confounding factors, as well as potential endogeneity, through fixed effects and instrumental variable estimation.

The empirical results suggest that immigrant employees are particularly important for whether small and medium-sized enterprises (SMEs) conduct offshoring or not and that hiring immigrants is positively related to offshoring intensity for all firms. The immigrant impact on offshoring is the strongest with respect to low-income countries, for contract intensive inputs, and when SMEs employ skilled immigrant workers. This pattern of results supports the proposition that firms can utilize the knowledge and contacts of foreign-born employees to reduce offshoring transaction costs, and subsequently spur their offshoring.

The remainder of this paper is organized as follows. Section 2 describes the previous research. Section 3 provides a theoretical perspective on the role for migration in offshoring. Section 4 explains the empirical approach, including model and estimation strategies. Section 5 describes the data. The results are discussed in section 6. Section 7 concludes and provides some final remarks.

2 Previous Research

This study is related to two strands of the trade literature. First, we make a contribution to the literature on trade costs and offshoring, which emphasizes that firms may split production across countries to benefit from differences in, for example, labor costs or economies of scale (Grossman and Rossi-Hansberg 2008; 2012).[2] In addition to transportation costs, offshoring and the resulting intensive trade in intermediate goods and services (trade in tasks) comes at the cost of increased information and coordination frictions (Head et al. 2009; Cristea 2012; Cuberes 2013).[3] The information frictions increase with distance.[4] Differences in the business environment, alongside cultural factors, can complicate long-distance business relations and firms may therefore need to invest substantially more in building and sustaining those relations (Johanson and Vahlne 2009; Hasche 2013).[5]

Second, our study makes a contribution to the literature on the trade-migration relationship. Since the seminal papers of Gould (1994) and Head and Ries (1998), a number of studies have emerged on the trade facilitating influence of migration.[6] While most studies deal with how migrants affect aggregate trade

[2] Intermediate goods and services account for 56 percent and 73 percent of total trade, respectively, in the OECD countries. Annual growth has been 6-7 percent in recent years (Miroudot et al. 2009).

[3] Recent business surveys illustrate the importance of face-to-face meetings for business-to-business commerce and teamwork (e.g., Harvard Business Review 2009; Oxford Economics 2009; Forbes 2009).

[4] Blum and Goldfarb (2006), as well as Hortacsu et al. (2009), find that geographic distance discourages consumption even for e-commerce. Head et al. (2009) estimate the distance effects to be of similar magnitudes for goods and services. Additionally, Mok et al. (2007) discuss the importance of distance for interpersonal contact and support, before and after the Internet.

[5] These are examples of 'informal barriers to trade' that have received increased attention in the trade literature (e.g., Roberts and Tybout 1997; Anderson and Marcouiller 2002; Melitz 2003; Anderson and van Wincoop 2004; Nunn 2007; Melitz 2008; Felbermayr and Toubal 2010; Kneller and Pisu 2011; Petropoulou 2011).

[6] See, e.g., Herander and Saavedra (2005), Dunlevy (2006), Lewer (2006), White (2007); Hatzigeorgiou (2010a; 2010b); Requena-Silvente and Peri (2010); Bastos and Silva (2012); Egger et al. (2012). For reviews of the trade-migration literature, see Genc et al. (2011), Felbermayr et al. (2012) and Hatzigeorgiou and Lodefalk (2013). In another

flows, new evidence has started to appear based on matched employer-employee data. Hiller (2013) investigates the role of immigrant employees and regional immigrant communities for export intensity in Danish exporting firms, and confirms a statistically positive association between firm export sales and foreign-born workers. Hatzigeorgiou and Lodefalk (2013) adopt a heterogeneous firm trade model and panel data for Sweden and find evidence of a positive effect from immigrants on trade, which is assumed to be derived from reduced information frictions and increased trust.[7]

Our study is related most closely to Ghani et al. (2013). Unlike previous studies that focus mainly on labor market effects (e.g., Pouliakas et al. 2009; Beverelli et al. 2011; Ottaviano et al. 2012), and the offsetting effect of one of the phenomenon on the other (e.g., Bandyopadhyay and Wall 2010), Ghani et al. focus on outsourcing to India via an internet-based labor market. They show that outsourcing by company employees of likely Indian ethnicity via the internet-based job market is biased towards India and comes at a cost advantage.[8]

Bastos and Silva (2012), using a general equilibrium model with migrant networks and asymmetric countries, conclude that migrants affect both the decision to export and the volume exported.[9] Recent theoretical contributions highlight the role of migrants as a source of reducing transactions costs in international trade. Requena-Silvente and Peri (2010) extend the models by Krugman (1980) and Chaney (2008) to account for the role of immigrants on trade.[10] Requena-Silvente and Peri (2010) argue that immigrants lower the transactions costs associated with starting to export (fixed bilateral cost).

vein of the literature, a positive association is established between migration and foreign direct investment (e.g., Javorcik et al. 2011; Flisi and Murat 2011; Kugler and Rapoport 2011).

[7] Their model incorporate migrant employees and demand shocks related to migrants' home bias in demand. It predicts that additional migrant employees from a particular foreign country increase the propensity and intensity in trade with immigrant source countries through the information and trust channel. A larger migrant stock, on the other hand, lowers fixed and variable costs for all firms, as well as causes a general shock in demand from their country of origin.

[8] More generally, Sangita (2013) explores the macro-level interaction between migration and trade. In an attempt to control for migrants' home bias in demand, trade in intermediate goods is separated from trade in final goods; the results are very similar.

[9] The model draws on Chaney (2008), Lawless (2009), Eaton et al. (2011) and Crozet et al. (2012).

[10] Chaney (2008) allows both for firm heterogeneity in productivity, and fixed costs associated with exporting.

We assume that immigrant employees are especially important for low productivity firms with limited international networks—such as smaller firms and non-multinational firms—because these firms tend to have the largest scope for productivity gains through relocation of production. In addition, the effect of immigrants ought to be largest with respect to heterogeneous inputs since the information frictions—and the scope for immigrants to lower transaction cost—are larger for such products (Herander and Saavedra 2005).[12] Skilled immigrant employees also tend to have more qualified occupational positions and therefore have more say over business decisions (Aleksynska and Peri 2012; Mundra 2012). This is especially important in contracts where tacit information—contract intensive and R&D intensive offshoring—is more prevalent.

In short, we expect foreign-born employees to spur offshoring via improved 'offshoring technology' (Grossman and Rossi-Hansberg 2008; 2012). This potential offshoring-enhancing role of migrants is consistent with the predictions of network trade theory (Rauch 1996; 1999).[13] In line with the theoretical framework of Bastos and Silva (2012), as well as Hatzigeorgiou and Lodefalk (2013), we hypothesize that immigrant employees affect both the decision to offshore and how much to offshore. Through their knowledge and access to networks, immigrant employees can reduce offshoring transaction costs.

3 Theoretical Framework

In this section we argue that immigrants may lower the fixed and variable costs of offshoring. We assume firms are assumed to be inherently reluctant to source intermediate inputs (offshoring) due to incomplete contracts and potential technology leakage. Here it is argued that immigrants can increase the knowledge

[12] The ability of migrants to facilitate offshoring may depend on their knowledge in areas relevant to offshoring and the ability to disseminate this knowledge. Communication skills and job-related proficiencies, which tend to be correlated with education, could therefore increase the facilitating impact of migrants on offshoring.

[13] More generally, we expect migrants to reduce uncertainty in offshoring through their knowledge and networks. Establishing open flows of information and lowering the risk of surprising future 'bad news' can be important for firms seeking to enter into global value-chains by lowering the sunk costs involved (Bernanke 1983; Dixit 1989). When migrants provide firms with an information channel about their countries of origin, it makes investment decisions, such as offshoring, more elastic and more in touch with changes in external conditions in potential foreign markets (Bloom 2007).

about institutions and cultural differences in source countries. By hiring immigrants, downstream firms can reduce hold-up problems, increase the capacity to coordinate and monitor upstream suppliers of intermediate inputs and to some extent prevent technology leakage. Offshoring takes place when some inputs produced by a firm at home are replaced by imports from a foreign (internal or external) supplier.[14] It differs from trade in final goods in at least three important respects: (a) due to the geographic separation of production and headquarter (HQ) activities, a firm choosing to offshore resigns some control of production (Grossman and Rossi-Hansberg 2008), (b) the offshoring contract often involves some relationship-specific investments in capital or R&D assets by both parties, (c) there is knowledge transfer between HQ-activities and input suppliers abroad (Spencer 2005). Hence, the sunk and variable costs in offshoring are presumably larger than for trade in final goods.

We assume a model of heterogeneous final-good firms and monopolistic competition as in Helpman et al. (2004) and Antras and Helpman (2004).[15] The world is assumed to consist of two countries; North and South. Final-good producers are allocated in North using intermediate inputs produced in North or in South. Headquarter services such as knowledge in marketing; management or product-specific R&D assets are produced in North (Helpman 1984).[16]

Representative consumers have preferences for a homogeneous good, z, and an aggregate of the differentiated good $g(p_j)$, where j is a variety of a differentiated good (Garcia-Vega and Huergo 2011).[17] The demand function for the aggregate of differentiated products is $g(p_j) = E/P(p_j)^{\alpha-1}$, where E is the

[14] We will abstract from different implications that migrants may have on the decision in firms to engage in foreign direct investments (FDI) or outsource the production to independent foreign suppliers.

[15] In Antras and Helpman (2004), the decision to source from abroad or domestically also includes the choice for the final good supplier to vertically integrate with the intermediate-good supplier. We refrain, however, from the ownership structure and use the term offshoring that do not explicitly separate between integration and outsourcing.

[16] Knowledge generated by headquarters can without any costs be transferred to a domestic or a foreign intermediate-good supplier. For example blueprints from R&D labs in North could be transferred to an intermediate-good supplier in South to produce a new variety of the differentiated good. Likewise, knowledge about marketing the good and how to organize and coordinate the production may be used by domestic and foreign suppliers.

[17] In our analysis we assume that the inputs varieties are developed in North to be used in the production of the final good in North or in South.

amount spent on differentiated products. Further, P is the weighted aggregate price index, p_j is the price of variety j, and α is the elasticity of substitution between any two brands.

The only factor of production is labor, L, which is supplied inelastically. But, L is endowed with different skills and can be used to assemble the final-good and produce headquarter services in North, or produce intermediate inputs in either North or South. Wages and thus the variable costs are assumed to be lower in South since South have a Ricardian productivity advantage in producing inputs (lower wages), i.e., $w^S < w^N$. The reverse is true for the fixed costs $f^S > f^N$. The argument is that the search cost to find and write complete contracts with efficient input suppliers is higher in South and also that the physical and cultural distance may complicate communication, coordination and monitoring with the production abroad.

In the models by Williamson (1985), Grossman and Hart (1986), and Hart and Moore (1990), firms make relationship-specific investments with a supplier for the production of an intermediate good that involves sunk costs. Profits subsequently rely on furtherance of the contracts. In order to achieve a profit maximizing contract where both parties invest optimally, the contract needs to be long-term and the legal institutions in the country need to be able to enforce these contracts. In this sense, inadequate local legal institutions constitute a barrier to offshoring. Since institutions tend to be weaker in the South, the conventional wisdom is that informal barriers are higher in the South (e.g., Rauch 1991; 2001), although the sensitivity to weak contracting institutions may vary between industries.[18] It is also assumed that there is no alternative use for inputs, which gives important implications for drafting the contract between the upstream producer of intermediate inputs and the downstream final-good producer.

Since the upstream and downstream firms have different incentives regarding which profits should be maximized, a hold-up problem may arise, with resulting underinvestment in the relationship-specific investments. Hold-ups in investments can reduce the quantity of intermediate inputs supplied and increase

[18] In Levchenko's (2007) theoretical model, the quality of institutions and contract enforcements in the source country may act as a source of comparative advantage. Northern firms in industries that depend intensively on relationship-specific investment from their suppliers will be attracted to countries with better institutions.

the price for the final good when the input supplier maximize its own profit (Antras and Helpman 2004).[19] We assume that information about the technology used and knowledge about the country specific settings can change the distribution of bargaining power and reduce hold-up problems.

In Antras and Helpman (2004), not all firms are able to overcome the transaction costs associated with the sourcing of inputs from foreign suppliers. In their model, firms in the North produce differentiated goods, but only the firms with a higher productivity choose to source inputs from a foreign supplier.[20] A high productivity firm may then choose between sourcing inputs from a high-cost country in the North or a low-cost country in the South. This choice is determined by the contractibility in the activities that the firm wishes to source from a foreign supplier. Weaker contracting institutions in the South may lower the amount of contract specific investment there.[21]

Sourcing from input suppliers will give the firms productivity gains and due to the inherent Ricardian advantage, the gains from sourcing inputs are larger when the supplier is allocated in South. Following Garcia-Vega and Huergo (2011), we assume that the cost of producing a final good in North is $1/\sigma k_i$, where $k_i \geq 1$ is a multiplicative term that can increases productivity when inputs are sourced outside the firm. If firms produce their own inputs ($k_1 = 1$), there are no productivity gains. If, on the other hand, firms source domestically ($k_N > 1$), or in South ($k_S > k_N > 1$), there will be productivity gains due to lower average costs.[22] Firms differ in their productivity level σ. The higher σ, the lower are the marginal costs c.[23]

Productivity is drawn from a distribution, $G(\sigma)$, with $\sigma \in [1, \infty]$ for producing variety j. Firms endowed with more information about the source market will gain extra advantage against other firms,

[19] Naghavi and Ottaviano (2009) explicitly model how hold-ups reduces the supply of inputs, increases the price but decrease the upstream firms bargaining power.

[20] The model builds on Melitz (2003) and Helpman et al. (2004).

[21] Incomplete contracts may cause severe frictions even when the production of intermediate inputs is sourced from an integrated supplier, Grossman and Hart (1986).

[22] The multiplicative term also ensures that the increase in productivity is larger the higher the ex ante productivity (Garcia-Vega and Huergo 2011).

[23] In addition to the fixed costs, offshoring to South incur iceberg trade cost $\tau > 1$. The decision to source intermediate inputs domestically or abroad (offshoring) is thus a trade off between low variable costs in South and low fixed costs in North.

lowering the fixed costs for entering the market in South, such that $f^S > {f_k}^S$, where ${f_k}^S$ are firms with more information about the source country. Information generates a productivity effect that gives the firm an advantage relative less informed firms such that $(k_{Sk} > k_S > k_N > 1)$, where k_{Sk} is the productivity gain that generates lowers average costs $1/\sigma k_{Sk}$.

Garcia-Vega and Huergo (2011) claim that the final-good producer may be reluctant to offshore to countries where contracts are incomplete because these may lower the output of intermediate inputs. Inadequate property right protection may also give rise to harmful knowledge spillovers (leakage) to competing suppliers, especially in countries with poor institutions.[24]

We let ϱ define an inverse measure of leakage defined for $\varrho \in (0,1)$. For lower values (high leakage) other input suppliers in the same industry or region may improve their efficiency in producing similar inputs and final-goods and thus lowering the demand and the price for the final-good. If $\varrho = 1$, no leakage occurs. The demand for variety j of the differentiated good is therefore given by $g(p_j, \varrho) = E/P\varrho(p_j)^{\alpha-1}$. The leakage is smaller the more knowledge the final good producer has about the input market. The more knowledge, the easier it is for the final good producer to prevent leakage by monitoring the supplier.

Immigrants are endowed with general knowledge about the institutions and business practices in former home country, but perhaps more importantly, they master the language spoken there. The low level of institutional quality and protection of property rights in the South implies a potentially stronger offshoring impact of immigrants from South, especially in regard to especially able immigrants.

Immigrants are not the only source of information and knowledge that firms can utilize to lower offshoring costs. We let knowledge capital, κ_i, in firm i be given by $\kappa_i = f\left(\kappa^{R\&D}, \kappa^{Sp}, \kappa^H, \kappa^{Im}\right)$, where $\kappa^{R\&D}$ is R&D-expenditures, κ^{Sp} represents spillovers from domestic and foreign firms, κ^H is human capital

[24] North is often defined as industrialized or developed countries with similar quality of institutions and property right protection. In reality there is a large heterogeneity between countries in North and even though hold-up problems and technology leakage is assumed to be lower in Northern countries they may still constitute important obstacles that block or limit the scope for signing offshoring contracts.

and learning by doing, and κ^{Im} is country specific knowledge. The higher the knowledge capital, the less are the cost from technology leakage, monitoring and coordinating geographically separated production.[25]

If migrants lower the transaction costs associated with offshoring, we expect a stronger impact for tasks that require higher skills. Skilled immigrant employees are in a better position of being able to disseminate relevant knowledge (Gould 1994).

Finally, the model of Grossman and Helpman (2012) rests on the assumption that it is more difficult to invest in contracts with firms in the South, due to incomplete contracts and hold-up problems. At the same time, it is reasonable to assume that the largest potential for migrants to reduce offshoring costs is greatest for such markets. In this sense, migrants can substitute for external experts by having more information on the cultural and institutional settings in their country of origin and helping the firm to overcome the language barrier in contacts with an input supplier abroad.

4 Empirical Approach

The theoretical framework delivers five testable hypotheses:

- Hypothesis 1: Hiring immigrant employees in a firm increases the probability that a firm sources inputs from the immigrant's country of birth and increases the intensity in sourcing from that country.
- Hypothesis 2: The more skilled the immigrant employees, the higher is the probability that they influence offshoring.
- Hypothesis 3: Immigrant employees have a stronger effect on offshoring to low-income or developing countries relative to advanced economies..
- Hypothesis 4: Immigrant employees have the largest effect on sourcing of contract and R&Dintensive inputs.

[25] Assume that $\varrho = f(\kappa_i)$ i.e. the larger the knowledge in a final good firm, the higher is ϱ and the smaller is the leakage to rival input suppliers abroad.

- Hypothesis 5: The impact of immigrant employees on offshoring is largest in smaller and non-multinational firms.

We capture these various hypotheses using a reduced form log-linearized firm-level gravity model of offshoring. It draws on recent models of international trade. Our model integrates firm and market characteristics as determinants of trade behavior into a single estimating equation (e.g., Chaney 2008). We estimate the benchmark specification through two equations. The first equation models firm entry into offshoring,

$$P(O_{fjt} = 1) = P[\beta_0 + \beta_1 me_{fjt} + \beta_2 \ln(m_{jt}) + \sum_c \beta_c z_{cft} + \sum_d \beta_d g_{djt} + \varphi_f F_f + \pi_s P_s + \mu_n N_{fj} + \eta_i H_i + \tau_t T_t + \varepsilon_{fjt}], \quad (1)$$

and the second how much the firm offshores,

$$\ln(o_{fjt}) = \beta_0 + \beta_1 me_{fjt} + \beta_2 \ln(m_{jt}) + \sum_c \beta_c z_{cft} + \sum_d \beta_d g_{djt} + \varphi_f F_f + \pi_s P_s + \mu_n N_{fj} + \eta_i H_i + \tau_t T_t + \varepsilon_{fjt}, \quad (2)$$

where O_{fjt} is a zero-one indicator set equal to one if firm *f* offshores to source country *j* at time *t*, and $\ln(o_{fjt})$ represents logarithmic volume of intermediates import of firm *f* from country *j* at time *t*. The number of migrant employees in firm *f* at time *t* who are born in country *j* is represented by the variable me_{fjt}.

The defining feature of our empirical strategy, made possible by our comprehensive micro dataset, is the direct connection between the employment of migrants from country *j* by a firm with offshoring from that country. This represents an important component of the contribution of this paper to the broader empirical literature on trade and migration because migrant employees are expected to be closely connected to networks in their countries of origin. Members of migrant-based networks are characterized by having important knowledge which may affect trade between countries (Rauch 2001).

Another advantage of this study's empirical approach compared with those adopted by previous studies at the aggregate level is that it minimizes the risk of confounding factors of migration, which could be the result of transplanted home bias (White 2007). As noted in the literature on taste discrimination (Becker 1957; Phelps 1972), migrants may affect imports through their taste and demand preferences. This

issue has largely been ignored in the previous research. In an offshoring-migration context, the transplanted home bias could reasonably be considered to be of less importance. Still, the risk of transplanted home bias cannot be ignored and we address this issue by analyzing whether a pro-offshoring link is measurable for firms that employ foreign-born workers, through information and trust mechanisms, rather than because of transplanted home bias.

We address selection by utilizing a two-step selection model for panel data, while correcting for bias due to unobserved heterogeneity (Heckman 1979; Mundlak 1978; Chamberlain 1980; Wooldridge 2002; Helpman et al. 2008). The panel selection model allows factors that are expected to influence both the offshoring propensity and intensity, such as migrant employees, to have different impact on the two outcomes. The omitted variable bias correction of the model is advantageous, *inter alia*, because it takes the form of fixed effects and thus allows correlation between unobserved factors causing heterogeneity and the predictor variables.[27]

As an exclusion restriction we construct a measure of the fixed costs associated with offshoring to a particular destination using data on the regulatory burden imposed on business abroad. Based on World Bank (2011) data for 173 countries this measure contains information on policies related to the start-up and closedown costs of businesses as well as costs based on contractual obligations, and concern for investment protection. Our measure subsequently accounts for sunk costs associated with entry into a foreign market and uncertainty surrounding these entry costs.[28] In the spirit of Helpman et al. (2008), who also use a measure of the fixed regulatory cost as a means for identification in presence of selection, we interact our fixed cost measure with firm size to account for differential effects across firms of different size.[29]

We need to address the risk of reverse causality because firms' might make hiring decisions based on their existing offshoring to a particular foreign market, which would cause a positive relationship

[27] A Hausman test confirms the appropriateness of fixed effects specification over random effects.

[28] In estimation, the strategy performs well. The regulatory measure affects the propensity to offshore but not the intensity of offshoring. Since standard errors from Heckman estimation are known to be downward biased, and with the aim of dealing with serial correlation as well as heteroscedasticity, we cluster standard errors by firm-destination address and adopt the Huber/White/sandwich variance-covariance estimator.

[29] There are alternative, but less well theoretically founded, exclusion restrictions commonly used in the empirical literature, including common religion, trade experience and the share of white-collar workers.

between foreign-born workers and firm offshoring to immigrant-source countries. Previous studies have set out to remedy the potential endogeneity problem due to reverse causality in a number of ways. Gould (1994) applies a test of causality and comes to the conclusion that migration precedes trade, also noting that migration is subject to binding quotas and is thus more likely to be exogenous. Aguiar et al. (2007) discuss the direction of causation along those same lines. Hatzigeorgiou (2010a) emphasizes that trade is not a key determinant of migration.

Even though the direction of causation is likely to run from migration to offshoring at the macro level, the same might not be true at the micro level since firms could be making hiring and offshoring decisions simultaneously. Therefore, we explicitly deal this source of potential endogeneity in our analysis by lagging firms' immigrant employment and by using an instrumental variable (IV) approach. The use of lagged values is predicated on an assumption that differences in the timing of employment versus offshoring decisions are important. For the IV analysis, we apply a generalized-method-of moments (GMM) estimator with the instrument being the average number of immigrants from country *j* employed in Swedish firms other than *f,* lagged by one period.

This choice of instrument fulfils the conventional criteria for an appropriate instrument and is supported by several statistical tests. The lagged average number of immigrant workers from country *j* employed outside the firm's workforce is correlated with the number of immigrant workers from *j* employed by firm *f*. Larger numbers of immigrant workers from a given country outside of the firm affect the likelihood that a firm will hire immigrants from that country, but they are very unlikely to affect the offshoring decisions of the firm (other than through their role as employees). This is supported by recent research, which demonstrates that improved market access through immigrants' knowledge and networks is conditioned upon hiring of immigrants by the firm (Hatzigeorgiou and Lodefalk 2014).

A final concern surrounds the possibility of omitted variable bias explained by unobservable firm characteristics that are correlated with the decision to offshoring and the decision to hire non-Swedish born workers. For example, the management of a firm could be more internationally-focused and therefore choose to offshore some aspects of production and to hire immigrant workers. They may also display a

predisposition towards particular countries. We assume that these omitted variables exist at the firm-country level and are time invariant such that they can be captured by including relevant fixed effects. Controlling for firm-country specific factors constitutes an important measure since many firm-country specific factors related to offshoring may influence firms' propensity to hire foreign-born workers. In addition, the model accounts for unobserved country-pair heterogeneity and therefore controls for bilateral particularities related to offshoring and migration, irrespective of their positive or negative influence.[30]

We control for a range of firm and country determinants of offshoring in the regression. To control for differences in the stock of migrants from country *j* in Sweden, the stock of migrants from country *j*, m_{jt}, is added to the specification. A set of explanatory firm-specific supply side factors are included in z_{cft}. These are firm size, productivity, ownership status, previous trade experience, as well as human and physical capital intensities. Characteristics that affect bilateral trade resistance, g_{djt}, include economic 'mass'—measured in terms of GDP—and indicators that capture both observed and unobserved country-specific heterogeneity, including variables that are commonly used to proxy for factors such as transport costs, such as geographic distance. F_f represent indicators that capture firm specific effects, and P_p consists of indicators that capture both observed and unobserved country-specific heterogeneity, including variables that are commonly used to proxy for factors such as transport costs. N_{fj} represents indicators that capture specific effects of firm-country pairs, while H_i are industry indicator variables that control for industry specific heterogeneity at the 3-digit industry level. T_t is a vector of indicators that controls for unobserved time-variant variables. The idiosyncratic error term is ε_{fjt}.[31] The migrant stock variable, as all continuous covariates, is expressed in logs. The only exception is me_{fjt}, which we do not log because most firms do not have an employee from a randomly selected source country.

[30] We also sought to include specific fixed firm-year effects. However, despite working on powerful servers it has not been possible to perform estimations with the required number of dummies.

[31] Inclusion of partner country-year fixed effects adds substantially to the complexity of estimation and is therefore only included in the robustness analysis. Practically, firm specific and partner country specific effects are implemented by including firm-partner country fixed effects, following Andrews et al. (2006).

5 Data and Stylized Facts

The micro-level datasets are from Statistics Sweden and cover all Swedish manufacturing firms with at least ten employees during the years 1998-2007. We match and supplement the core micro-level data with detailed information on workers' country of birth, as well as the skill level of foreign-born employees. All dataset are register-based, include unique identifiers for firms and individuals. The combined data enables us to analyze the relationships between specific characteristics of firms, their employees and offshoring of those firms.[32]

Firm-specific and source-country-specific trade data are included at the Combined Nomenclature 8-digit (CN8) level. We consider the numerous and substantial changes to the nomenclature over time in line with the recommendations of Pierce and Schott (2012). For instance, we construct a detailed concordance of the CN8 between 1998 and 2007 matched with trade data for the 10-digit US nomenclature to the EU context. Imported products are considered as offshored if they are included in the category of intermediate goods of the Broad Economic Categories (BEC) classification of the UN (United Nations 2002).[33]

For 2007, the full sample contains economic and migration data from 6,855 Swedish firms, employing 599,333 full-time workers. Approximately 12,000 firms are represented over the whole period. The dataset includes information on macroeconomic, geographic, historic and cultural factors for 176 partner countries (Table A2). In total, our dataset includes approximately 12 million observations over ten years.

Table 1 provides a snapshot of our data for the year 2007. The average firm is a medium-sized company in terms of workforce, which offshores, yet is not part of a multinational enterprise. Less than a

[32] Information on the specific variables and their sources is available in Table A1, while a detailed account of the construction of the dataset is available upon request.

[33] BEC is a reclassification of the Standard International Trade Classification (SITC) according to main end-use of commodities: capital goods, intermediate goods, and consumption goods. Intermediary goods are contained in BEC codes 111, 121, 21, 22, 31, 322, 42 and 53.

fifth of employees of the average firm have a post-secondary education. Approximately a tenth of the employees were born outside of Sweden.

— Table 1. Snapshot of Swedish Manufacturing Firms —

Immigration to Sweden has increased substantially over the past seven decades. Between 1998 and 2007, immigration accounted for 77 percent of Sweden's total population increase. In 1940, the foreign-born population accounted for one percent of the total population, and in 1970, that figure rose to approximately seven percent. The most recent figure is approximately 16 percent. The largest immigrant groups by source country are Finland, Iraq, Poland, Serbia/former Yugoslavia and Iran.[34]

According to pairwise correlations (Table A3), firm offshoring is negatively related to the distance of source countries but positively related to the size of the firm and the market size of the source country. Offshoring is positively related to a larger country immigrant stock and more foreign-born employees from the source country.

During the period 1998-2007, immigration to Sweden increased by 22 percent and offshoring increased by 57 percent. Most offshoring is to high-income countries, particularly for contract intensive products. The top offshoring destination countries are all in Europe, except for the US, Russia, and Japan (Table A4). Similarly, the major immigrant source countries are mainly European, except for Iraq and Iran (Table A5). The rise in offshoring to low-income countries has occurred in tandem with a substantial rise in immigration from those countries. R&D intensive offshoring is mostly directed towards low-income countries as a result of a substantial increase during the relevant time period. The share of offshoring to low-income countries has increased by twice the offshoring to high-income countries.

— Table 2. Offshoring and Immigration —

Information on the GDP and population size of partner countries comes from the World Bank. Geographical indicators and other conventional gravity variables come from the Centre d'Etudes Prospective et d'Informations Internationales. Data on trade barriers are from the Heritage Foundation.

[34] Table A5 in the appendix presents a complete list of Sweden's largest immigrant groups, their respective size and share of population.

6 Results

6.1 Benchmark Estimation

Table 3 presents our estimation results based on the benchmark specification for both total imports and offshoring. Identification comes from the within firm-source-country variation over time.

The benchmark results demonstrate a positive and statistically significant relationship between immigrant employees and offshoring. We also find that larger and more efficient firms are more strongly associated with offshoring to high-income countries relative to low-income countries. The same pattern is displayed for multinational firms. We interpret this difference across firms of different size, efficiency and ownership structure as a result of the fact that contract intensive goods account for a much higher share of offshoring to high-income countries than to low-income countries. Most of the conventional firm-gravity covariates have the expected sign.

— Table 3. Benchmark Estimation Results —

As shown in column 3, the estimates fail to provide evidence in support of the hypothesis that immigrant employees raise propensity to offshore across the board. Nevertheless, in additional analysis we find a positive link for small and medium sized firms, particularly for small firms.

The coefficient on the total country immigrant stock is positive and statistically significant in the within firm-source-country Probit estimation. We think this result indicates a preference bias in demand for offshored goods, and/or an indirect impact of immigrants in a country on firm offshoring to source countries.

Unexpectedly, the impact of immigrant employees on offshoring to source countries is no different to the one on total imports (columns 4 versus 2). One explanation, which is confirmed by additional analysis where we split total trade into offshoring and other imports, is that offshoring drives the result for total imports.

Hiring one additional immigrant from country *j* is associated with a three percent rise in *f*'s offshoring to country *j*, on average. In line with our third hypothesis (immigrant employees from the South

will impact offshoring the most), we find that immigrant employees are more strongly associated with offshoring to low-income countries, which in general have lower institutional quality.

6.2 The Role of Inputs, Skills and Source Country Characteristics

In Table 4 we analyze the immigration-offshoring nexus across the character of goods offshored, the skill level of immigrant employees and sources country characteristics. We assume that some offshoring is particularly sensitive to information barriers, relation-specific investment and trust between sellers and buyers across national borders (Rauch 1999; Nunn 2007).

First, some products lack a fixed reference price, i.e., the price of the products cannot be determined without reference to more detailed information about brand, origin, producer and other characteristics. The price of such inputs may also be more susceptible to negotiation than the price of inputs for which knowledge about price and source is more readily available. Therefore, the drafting and negotiation of the contract for such offshoring tend to be particularly cumbersome. We define such differentiated input as contract intensive goods, following the 'strict' definition of Rauch (1999).[35]

Second, we assume that R&D intensive input is especially sensitive to information and trust related barriers. To consider this, we apply the list of high-technology products produced by the OECD, while taking the major revision conducted in 2007 into account. High-tech products are defined as goods whose production is R&D intensive (Hatzichronoglou 1997).

Although we cannot confirm our fourth hypothesis about immigration employees generally being instrumental in facilitating offshoring of goods that are contracting or R&D intensive, we find a substantially stronger link for contract intensive offshoring to low-income countries. Likewise, the association is more pronounced for offshoring of non-R&D intensive goods to low-income countries.

— Table 4. Estimation Results across Inputs, Skills and Source Countries —

[35] Our approach is related to the study by Nunn (2007), who establishes the contract intensity of industries based on the degree of 'relationship-specific investment' in intermediate inputs of those industries, where the degree of such investment is determined by the share of inputs that are differentiated goods.

The semi-elasticities in Table 4 are based on estimations of equation two and provide a clear pattern of results consistent with the hypothesis that the skill-level of immigrant employees influences the extent to which foreign-born workers facilitate offshoring. Skilled immigrant employees are more strongly associated with offshoring, both across products and source country groups. On average, the estimated trade influence of skilled immigrant workers is five times stronger relative to unskilled workers. The strongest link is for contract and R&D intensive offshoring to high-income countries. With respect to skills and low-income countries, the relationship is strongest for non-R&D intensive offshoring.

Subsequently, we find evidence in support of both the second hypothesis, which postulates that the skill level of migrants is positively related to offshoring, and the fourth hypothesis, which proposes that the migrant-offshoring link is stronger for contract and R&D intensive inputs.

6.3 The Role of Inputs, Skills and Firm Size

Table 5 presents results from estimation across inputs, skills of immigrant employees and firm size. The link is approximately three times stronger for SMEs. We attribute this result to the fact that SMEs tend to have less experience of foreign trade and other aspects of internationalization, including offshoring.

— Table 5. Estimation Results across Inputs, Skills and Firm Size —

There is a discrepancy regarding the importance of the skill-level of immigrant employees for offshoring across firm size. For SMEs, only unskilled immigrant employees are positively and statistically associated with offshoring, at conventional significance levels, while the opposite pattern is found for large firms, with only skilled immigrant employees being linked to offshoring. We believe this pattern of results can be explained by the fact that the average skill level in SMEs is substantially lower than in large firms; even at higher positions in SMEs, having a post-secondary education is quite uncommon, with the opposite being true for large firms. This could imply that occupation and position in the firm is driving the results.[36]

[36] Unfortunately we are not able to analyze the potential role of occupation due to lack of appropriate data.

Immigrants employed in SMEs are primarily associated with offshoring of contract intensive goods and of non-R&D intensive goods, in contrast to larger firms, where immigrants are most strongly linked to non-contract intensive and R&D intensive offshoring.

6.4 Does Multinational Status Matter?

Table 6 demonstrates that multinational firms exhibit the strongest link between immigrant employees and offshoring. Hence, we fail to find support of the fifth hypothesis, which postulates that less globalized firms have the most to gain from immigrants when it comes to offshoring. With respect to non-multinational firms, immigrant employees only appear to have an impact on offshoring of non-contract intensive goods. Nevertheless, as in most of the previous findings, the semi-elasticity is substantially stronger for skilled immigrant employees regardless of multinational status. The skill level is particularly important for multinational firms' offshoring of R&D intensive goods.

— Table 6. Estimation Results across Inputs, Skills and Multinational Status —

6.5 Robustness Checks and Further Analysis

Table 7 includes several checks of the robustness of our main results as well as further analysis to determine the direction of causation. We begin by testing whether our estimates depend on linear specification. Although a slightly quadratic relationship seems to be present (column 1), the relevant coefficient is too small to alter our main results. Columns 2 and 3 demonstrate that our results are not driven by main immigration or offshoring partner countries. Rather than weakening the link to offshoring, excluding the top five immigrant and offshoring countries enhances the estimated influence.

Column 4 includes results from a lagged approach, where immigrant employees and the country immigrant stock are lagged by three periods. These results suggest that the estimated offshoring-migration link at the firm-level runs from immigrant employment to offshoring. As explained, preparatory offshoring activities may have started at the firm several years before, why we emphasize the IV analysis.

— Table 7. Robustness Checks and Further Analysis —

In column 5, we test whether the results are sensitive to time-variant source country variation, such as price shocks. The results confirm that the results are robust to such source-time trends. Further, in column 6, we address potential selection bias via Heckman panel estimation with fixed effects. Although the level of significance of the main coefficient is lower, the main results seem largely robust to controlling for selection.

Column 7 presents the results from the IV analysis, which demonstrate that the main results are robust to accounting for endogeneity. In our view, the IV estimation results provide reliable evidence of the prediction that causality runs from immigrant employment to offshoring, rather than vice versa. In regard to instrument validity, the Kleibergen-Paap rk Lagrange multiplier and Wald F statistics reject the null hypotheses of under-identification and weak partial correlation between the instrument and the immigrant employment variable. The exogeneity of the instrument with respect to the error term is examined by Hansen's J test, on the basis of which we do not reject the null hypothesis of exogeneity at conventional significance levels.

Column 8 presents estimation results from a partial adjustment model implemented to further control for omitted variable bias and to pay attention to the known persistence in firms' internationalization behavior. Previous offshoring to a specific country is clearly a strong predictor of contemporary offshoring. Still, this does not undermine the main result that immigrant employees are positively linked to firm offshoring to immigrant employees' countries of origin.

7 Conclusion and Final Remarks

Today's international trade flows are largely made up of exchange in intermediate goods. As a result of complex value chains, firms have to rely on producers across many different countries. They themselves only account only for a thin slice of the value chains of their specific industry. Intermediate trade distinguishes itself from trade in general by being especially sensitive to distance in time and space, hold-up problems, incomplete contracts and weak institutions. Therefore, individuals with a unique knowledge

of foreign markets and access to trust enhancing networks—such as immigrants—could be instrumental in reducing transaction costs associated with offshoring. In this light, the gap in the literature is surprising as there are only a couple of studies on the offshoring-migration nexus.

The purpose of this study has been to bridge this gap. In specific, we wanted to contribute to the literature on trade costs in general, and in particular to the understanding of the role of migration for firms' internationalization.

To fulfil this aim, we utilized new and detailed employer-employee data for approximately 600,000 full-time employees, 12,000 firms and offshoring to 176 countries during the 1998-2007 period to estimate—using panel data techniques and IV analysis—a firm-level gravity model, which accounts for unobserved effects and the possible endogeneity of immigration.

The analysis provided novel evidence in support of a statistically and economically significant positive impact of immigrant employees on offshoring: hiring one additional foreign-born worker spurs offshoring with up to three percent on average. We found that immigration spurs offshoring to low-income countries in specific, and especially with respect to contract intensive inputs. The results indicated that the link between immigrant employees and offshoring is much stronger for skilled immigrant employees relative to unskilled ones. Additionally, we found the immigrant influence on offshoring to be approximately three times as strong for SMEs compared to larger firms.

The results of this study could have potentially important policy implications, indicating that immigrants could provide options for countries that aim to promote offshoring and internationalization among their firms, beyond conventional trade policy. Furthermore, this study has demonstrated that immigrants' influence on firms' offshoring is strongest with respect to developing countries. This result introduce a completely new channel through which migration may promote development in countries with net emigration, many of which are emerging economies in Asia and Latin America. In addition to a positive impact through trade (e.g., Hatzigeorgiou and Lodefalk 2014) and remittances (e.g., McKenzie and Yang 2015), we believe that migration could have a positive impact on development through increased offshoring from main emigrant destination countries. This means that governments of developed nations may want to

enhance their emphasis on migration as a tool for development, specifically when it comes to supporting private sector development in emerging economies.

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TABLES

Table 1. Snapshot of Swedish Manufacturing Firms

	Mean	Median	Std. dev.	Min.	Max.
Offshoring volume	36,007	28.275	405,208	0	20,814,582
Number of migrants	12.20	3.00	97.68	0	n/a
Share of migrants	0.12	0.09	0.13	0	1
No. of employees	87.43	24	507.26	10	n/a
Labor productivity	643.03	559.08	416.38	0	12,427
Human capital intensity	0.17	0.13	0.16	0	1
Physical capital intensity	293.55	161.80	490.16	0	11,681
Multinational status	0.32	0	0.47	0	1
Offshorer	0.57	1	0.50	0	1
Exporter	0.70	1	0.46	0	1
Importer	0.64	1	0.48	0	1

Note: Data refer to the year 2007. Number of firms is 6,855. Number of observations in the 1998-2007 period is 15,020,024. Monetary values are in 1,000 SEK (approximately 148 USD). Only merchandise trade is considered. Two maximum values are not disclosed for confidentiality reasons.

Table 2. Offshoring and Immigration – The Case of Sweden

	Offshoring volume 2007	Δ1998-2007 (%)	Contract-intensive offshoring (share) 2007	Δ1998-2007 (%)
High income countries	234,542,676	55	0.48	-18
Low income countries	12,286,768	106	0.31	-28
	R&D-intensive offshoring (share) 2007	Δ1998-2007 (%)	Country immigrant stock 2007	Δ1998-2007 (%)
High income countries	0.06	-32	824,116	0.13
Low income countries	0.14	47	395,510	0.46

Table 3. Benchmark Estimation Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Import		P(Offshoring)	Offshoring volume		
				Total	Low-income countries	High-income countries
Immigrant employees	0.000888	0.0366***	0.00137	0.0339***	0.0557***	0.0292***
	(0.003)	(0.010)	(0.002)	(0.009)	(0.014)	(0.009)
Immigrant stock (log)	0.0287**	-0.00167***	0.0463**	-0.000439***	0.0000271	-0.000971***
	(0.013)	(0.000)	(0.020)	(0.000)	(0.000)	(0.000)
Workforce (log)	0.289***	0.251***	0.284***	0.217***	0.0434***	0.466***
	(0.007)	(0.006)	(0.007)	(0.005)	(0.004)	(0.012)
Multinational (0,1)	0.0650***	0.0199***	0.0731***	0.0195***	-0.000912	0.0483***
	(0.007)	(0.005)	(0.008)	(0.005)	(0.003)	(0.011)
Offshorer (0,1)		2.787***		2.689***	2.455***	2.706***
		(0.042)		(0.045)	(0.132)	(0.048)
Labor productivity (log)	0.0156***	0.0302***	0.0151***	0.0282***	0.00592***	0.0601***
	(0.005)	(0.003)	(0.005)	(0.003)	(0.002)	(0.006)
Human cap intensity (log)	0.00309***	-0.00108***	0.00222**	-0.000645***	-0.000535***	-0.000804
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Physical cap intensity (log)	0.00552***	0.00228***	0.00491***	0.00180***	0.00102***	0.00289***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
GDP (log)	0.545***	0.0765***	0.593***	0.111***	0.163***	-0.0254
	(0.028)	(0.010)	(0.032)	(0.009)	(0.006)	(0.032)
Population (log)	0.417***	-0.518***	0.352***	-0.272***	-0.386***	-0.0433
	(0.078)	(0.031)	(0.088)	(0.028)	(0.022)	(0.054)
Obs.	9,218,137	8,608,859	9,109,283	8,608,859	5,001,484	3,607,375
Adjusted / Pseudo R^2	0,497	0.7456	0.500	0.7361	0.615	0.7432

Notes: Robust and clustered standard errors in parentheses. Firm, partner country, firm-partner country, industry, and year fixed effects are included throughout. In columns 2 and 4-6, dependent variables are in logs (1e-7 added to avoid truncation).

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4. Results across Inputs, Skills, Source Countries

		Immigrant employees		
		All	Skilled	Unskilled
All offshoring	Low-income	0.0557***	0.122**	0.0215
	High-income	0.0292***	**0.136*** **	0.0178*
Contract intensive	Total	0.0351***	0.100***	0.0227**
	Low-income	**0.0487*** **	0.0828*	0.0252
	High-income	0.0314***	0.105***	0.0196*
Non-contract intensive	Total	0.0361***	0.0765***	0.0284***
	Low-income	0.0221***	0.0727***	-0.0129*
	High-income	0.0362***	0.0809***	0.0291***
R&D-intensive	Total	0.0326***	**0.152*** **	0.00986
	Low-income	0.0290***	0.105***	-0.0237***
	High-income	0.0319***	**0.176*** **	0.00884
Non-R&D intensive	Total	0.0336***	0.107***	0.0197**
	Low-income	**0.0554*** **	0.0958**	0.0276
	High-income	0.0290***	0.108***	0.0164*
Contract and R&D	Total	0.0319***	0.196***	0.000713
	Low-income	0.0316***	0.111***	-0.0231**
	High-income	0.0312***	0.240***	-0.00213

Notes: Robust and clustered standard errors in parentheses. Dependent variables are in logs (1e-7 added to avoid truncation). Firm, partner country, firm-partner country, industry, and year fixed effects are included in all 34 within estimations.

* p <0.10, ** p < 0.05, *** p < 0.01

Table 5. Results across Inputs, Skills, Firm Size

		Immigrant employees		
		All	Skilled	Unskilled
All offshoring	Small	**0.0572*****	0.0700	**0.0545*****
	Medium	**0.0747*****	0.0711	**0.0754*****
	Large	0.0196***	0.0905***	0.00576
Contract intensive	Small	0.0553***	0.0592	**0.0545*****
	Medium	0.0412***	**0.107***	0.0285
	Large	0.0180**	**0.0780*****	0.00625
Non-contract intensive	Small	0.00886	0.0499	0.000246
	Medium	0.0308**	-0.0100	**0.0387****
	Large	0.0354***	**0.0754*****	0.0276***
R&D intensive	Small	0.00201	0.0296	-0.00377
	Medium	0.00151	0.0247	-0.00293
	Large	0.0344***	**0.152*****	0.0112
Non-R&D intensive	Small	0.0575***	0.0536	**0.0583*****
	Medium	0.0772***	0.0691	**0.0788*****
	Large	0.0193**	**0.0850*****	0.00641

Notes: Robust and clustered standard errors in parentheses. Dependent variables are in logs (1e-7 added to avoid truncation). Firm, partner country, firm-partner country, industry, and year fixed effects are included in all 30 within estimations.

* p <0.10, ** p < 0.05, *** p < 0.01

Table 6. Results across Inputs, Skills, MNE status

		Immigrant employees		
		All	Skilled	Unskilled
All offshoring	Non-MNE	**0.0276**	0.116**	0.0151
	MNE	0.0321***	0.107***	0.0177*
Contract intensive	Non-MNE	0.0238	0.0628	0.0183
	MNE	0.0330***	0.0961***	0.0209*
Non-contract intensive	Non-MNE	0.0190*	0.0596*	0.0133
	MNE	0.0367***	0.0750***	0.0294***
R&D intensive	Non-MNE	0.0112	0.0198	0.01000
	MNE	0.0329***	**0.155*** **	0.00934
Non-R&D intensive	Non-MNE	0.0275	0.124***	0.0140
	MNE	0.0317***	0.100***	0.0186**

Notes: Robust and clustered standard errors in parentheses. Dependent variables are in logs (1e-7 added to avoid truncation). Firm, partner country, firm-partner country, industry, and year fixed effects are included throughout.

* p <0.10, ** p < 0.05, *** p < 0.01

Table 7. Further Analysis and Tests of Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Quadratic	Excluding top five immigrant countries	Excluding top five offshoring countries	Lagged model (*t-3*)	Extended FE specification	Heckman panel estimation	IV analysis	Partial adjustment model
Immigrant employees	0.0579***	0.126***	0.0468***	0.0105*	0.0303***	0.007508*	0.0476***	0.0318***
	(0.008)	(0.016)	(0.010)	(0.006)	(0.007)	(0.004)	(0.010)	(0.009)
Immigrant employees^2	-0.0000339***							
	(0.000)							
Offshoring$_{t-1}$							2.688***	0.972***
							(0.045)	(0.012)
Obs.	8,608,859	8,363,410	8,363,423	4,593,656	8,608,859	144,202	8,368,261	8,608,859
Adjusted R^2	0.7361	0.7246	0.6877	0.7619	0.7429	0.391	-0.185	0.7429
Kleibergen–Paap rk (p)							0.0000	
Kleibergen–Paap Wald (F)							26.870	
Hansen J (p)							0.0476	

Notes: Dependent variable is firm offshoring in logs (1e-7 added to avoid truncation). All results are from fixed effects (within) estimation. Robust and clustered standard errors are in parentheses. Firm and gravity estimates are not reported due to space limitations. Firm, partner country, firm-partner country, industry, and year fixed effects are included throughout. In column 5, partner country-year fixed effects are added, while replacing the country immigrant stock with the regional immigrant stock.

* p <0.10, ** p < 0.05, *** p < 0.01

APPENDIX

Table A1. Variables Description and Sources

Variable	Definition	Source
Offshoring	Intermediate imports in 1,000 SEK (approx. 148 USD)	Statistics Sweden, FTS
Immigrant employees	Number of foreign born employees in firms	Statistics Sweden, RAMS and PS
Employees	Number of employees (full-time equivalents)	Statistics Sweden, SBS
Multinational	Multinational status dummy; unity if a firm is part of an enterprise with firms abroad, zero otherwise	Statistics Sweden, EGR
Offshorer	Unity if the firms imports intermediates, zero otherwise	Statistics Sweden, FTS
Labor productivity	Value-added per full-time employee	Statistics Sweden, SBS
Human capital intensity	Share of employees with post-secondary education	Statistics Sweden, RAMS
Physical capital intensity	Capital stock per full-time employee	Statistics Sweden, SBS
GDP	Partner's GDP calculated in constant prices	World Bank
Population	Partner's size of population	World Bank
Distance	Distance in kilometers between Stockholm and partner's capital (weighted by the two cities' populations)	CEPII
Adjacency	Unity if partner shares a national border with Sweden, zero otherwise	CEPII
Landlocked	Unity if partner is landlocked, zero otherwise	CEPII
English	Unity if English is official language in partner country, zero otherwise	CEPII
Trade openness	Index based on partner's trade-weighted average tariff, plus the incidence of non-tariff barriers to trade (0-100, where higher values correspond to freer trade)	Heritage Foundation
Business burden	Index of cumbersome business environment (0-1, where a higher value correspond to a more cumbersome business environment)	World Bank; authors' calculations
Common religion	Unity if partner is mainly Christian, zero otherwise	CIA World Factbook

Note: Sources from Statistics Sweden are Structural Business Statistics (SBS); Register Based Labor Market Statistics (RAMS), Foreign Trade Statistics (FTS); Population Statistics (PS); and Enterprise Group Register (EGR).

Table A2. Countries Included in the Sample

AMERICA	Kyrgyzstan	Oman	SOUTHEASTERN AFRICA
Antigua and Barbuda	Latvia	Qatar	Angola
Argentina	Lithuania	Saudi Arabia	Botswana
Bahamas	Moldova	Syrian Arab Republic	Burundi
Belize	Poland	United Arab Emirates	Comoros
Bermuda	Romania	Yemen	Ethiopia
Bolivia	Russian Federation		Eritrea
Brazil	Serbia and Montenegro	NORTHERN AFRICA	Kenya
Canada	Tajikistan	Algeria	Lesotho
Chile	Turkmenistan	Djibouti	Madagascar
Colombia	Ukraine	Egypt	Malawi
Costa Rica	Uzbekistan	Libya	Mauritius
Cuba		Morocco	Mozambique
Dominica	EASTERN PACIFIC	Tunisia	Namibia
Dominican Republic	Australia		Rwanda
Ecuador	Brunei Darussalam	REST OF EUROPE	Seychelles
El Salvador	Cambodia	Andorra	South Africa
Grenada	China	Austria	Sudan
Guatemala	East Timor	Belgium	Swaziland
Guyana	Fiji	/Luxembourg	Tanzania, United Rep. of
Haiti	Hong Kong	Cyprus	Uganda
Honduras	Indonesia	Denmark	Zambia
Jamaica	Japan	Finland	
Mexico	Kiribati	France	WESTERN AFRICA
Nicaragua	Korea	Germany	Benin
Panama	Lao People's Dem.	Greece	Burkina Faso
Paraguay	Malaysia	Greenland	Cameroon
Peru	Marshall Islands	Iceland	Cape Verde
Saint Kitts and Nevis	Micronesia	Ireland	Central African Republic
Saint Lucia	Mongolia	Italy	Chad
Saint Vincent and the Grenadines	New Zealand	Malta	Congo
Suriname	Palau	Netherlands	Congo (Democr. R.)
Trinidad and Tobago	Papua New Guinea	Norway	Côte d'Ivoire
United States of America	Philippines	Portugal	Equatorial Guinea
Uruguay	Samoa	San Marino	Gabon
Venezuela	Singapore	Spain	Gambia
	Solomon Islands	Switzerland	Ghana
EASTERN EUROPE & CENTRAL ASIA	Thailand	Turkey	Guinea
Albania	Tonga	United Kingdom	Guinea-Bissau
Armenia	Vanuatu		Liberia
Azerbaijan	Vietnam	SOUTHERN ASIA	Mali
Belarus		Bangladesh	Mauritania
Bulgaria	MIDDLE EAST	Bhutan	Niger
Czech Republic	Bahrain	India	Nigeria
Estonia	Iran	Maldives	Senegal
Georgia	Iraq	Nepal	Sierra Leone
Hungary	Israel	Pakistan	Togo
Kazakhstan	Jordan	Sri Lanka	
	Kuwait		
	Lebanon		

Table A3. Correlation

	Offshoring volume	Immigrant employees	Country immigrant stock	Workforce	Multinational	Offshorer	Labor productivity	Human capital int.	Physical capital int.	GDP	Population	Distance	Contiguity	Landlocked	English	Low income
Offshoring volume	1															
Immigrant employees	0.0850	1														
Country immigrant stock	0.1164	0.0302	1													
Workforce	0.1475	0.0685	-0.0006	1												
Multinational	0.1030	0.0234	-0.0001	0.5214	1											
Offshorer	0.9911	0.0758	0.1166	0.1427	0.1016	1										
Labor productivity	0.0363	0.0037	0.0071	0.1271	0.1514	0.0351	1									
Human capital int.	0.0501	0.0106	0.0029	0.2999	0.2459	0.0503	0.1079	1								
Physical capital int.	0.0217	0.0047	-0.0015	0.1124	0.0642	0.0205	0.1288	0.0164	1							
GDP	0.2177	0.0221	0.6252	-0.0009	0.0012	0.2182	0.0105	0.0044	-0.0012	1						
Population	0.1013	0.0166	0.6491	-0.0001	0.0003	0.1014	0.0017	0.0007	-0.0001	0.7508	1					
Distance	-0.2197	-0.0424	-0.3934	-0.0000	0.0000	-0.2175	-0.0000	-0.0000	-0.0000	-0.3348	-0.1712	1				
Contiguity	0.1985	0.0770	0.1348	0.0000	-0.0000	0.2026	-0.0000	0.0000	-0.0000	0.1156	0.0039	-0.2950	1			
Landlocked	-0.0265	-0.0094	0.0075	-0.0000	0.0000	-0.0257	-0.0000	-0.0000	-0.0000	-0.1624	0.1085	-0.0253	-0.0459	1		
English	-0.0270	-0.0136	-0.2699	-0.0000	-0.0000	-0.0261	-0.0000	-0.0000	0.0000	-0.2153	-0.3082	0.3187	-0.0630	-0.0959	1	
Low income	-0.1075	-0.0120	0.0092	0.0004	-0.0007	-0.1077	-0.0047	-0.0019	0.0004	-0.3753	0.2579	0.2161	-0.1085	0.2562	-0.1015	1

Note: All variables in logs, except dummy variables and the immigrant employee variable.

Table A4. Stylized Data for Main Partner Countries

Partner country	Volume	Share of offshoring	Contract-intensive share	R&D intensive share	Country immigrant stock
Germany	51,951,721	0,21	0,59	0,05	45,034
United Kingdom	25,840,320	0,10	0,59	0,09	18,486
France	22,234,729	0,09	0,42	0,12	6,946
Finland	20,604,045	0,08	0,33	0,00	178,179
Norway	19,575,599	0,08	0,21	0,06	44,59
Belgium and Luxembourg	12,979,255	0,05	0,51	0,01	1,837
Netherlands	11,747,551	0,05	0,31	0,12	7,204
Denmark	10,350,783	0,04	0,50	0,02	45,941
Italy	7,481,761	0,03	0,61	0,03	6,845
Poland	7,383,813	0,03	0,67	0,04	58,18
United States of America	6,602,223	0,03	0,51	0,14	15,309
Russian Federation	5,735,494	0,02	0,01	0,19	19,27
Japan	4,308,144	0,02	0,40	0,05	2,667
Czech Republic	3,733,535	0,02	0,69	0,02	7,961

Note: Top Swedish offshoring destinations in 2007, in 1,000 SEK (148 USD).

Table A5. Sweden's Largest Immigrant Groups

	Immigrant country	Total stock	Share of population		Immigrant country	Total stock	Share of population
1	Finland	163,867	1.71%	11	Norway	42,884	0.45%
2	Iraq	127,860	1.34%	12	Thailand	35,554	0.37%
3	Poland	75,323	0.79%	13	Chile	28,425	0.30%
4	Serbia/Yugoslavia	69,269	0.72%	14	Syria	27,510	0.29%
5	Iran	65,649	0.69%	15	China	26,824	0.28%
6	Bosnia-Herzegovina	56,595	0.59%	16	Lebanon	24,743	0.26%
7	Germany	48,731	0.51%	17	United Kingdom	22,670	0.24%
8	Turkey	45,085	0.47%	18	Romania	22,079	0.23%
9	Denmark	44,209	0.46%	19	Afghanistan	21,484	0.22%
10	Somalia	43,966	0.46%	20	India	19,415	0.20%

Source: Statistics Sweden (2013); authors' calculations.