# Foreign workers and indirect exports: Firm-level evidence from Viet Nam

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*Preliminary version, please do not circulate.*

**Abstract**

This paper explores the link between the use of trade intermediaries and foreign employment, and its implications for Vietnamese firms. The role of trade intermediaries – which "purchase from suppliers for resale to buyers or [...] help buyers and sellers to meet and transact" (Spulber, 1996) – is closely related to the export-enhancing role of foreign workers. We use a heterogeneous firm model to show that foreign employment favors the selection of firms into indirect exports, as long as the gain realized by indirectly accessing all destinations is higher than the advantage to export directly toward the destination of interest. We use a sample of foreign and domestic firms collected through the Viet Nam Industry Investor Survey 2010 by the UNIDO. Using a two-stage Heckman selection model, we find evidence of a positive impact of foreign employment on the probability to export indirectly and, conditional on the export mode, on the export value. Our results suggest that the employment of foreign workers ease the access to trade intermediaries.

**Key words**: Firm heterogeneity; Foreign employment; Trade intermediation; Viet Nam
**JEL classification**: F10, F12, F22, J61

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# 1 Introduction

This paper explores the link of substitution between the use of trade intermediaries and foreign employment, and its implications for the exports of Vietnamese firms. Following Spulber (1996), a trade intermediary can be defined as an economic agent who purchases from suppliers for resale, or who helps sellers and buyers to meet and transact. International trade intermediaries allow manufacturers to overcome informational frictions that can prevent them to export directly by mitigating risk and by easing matching between buyers and sellers. Schröder et al. (2005) distinguishes two types of intermediaries: *traders* who trade on their own account and *brokers* who work on a commission basis for buyers and sellers.

A number of papers suggest that trade intermediaries account for a substantial share of trading activities. Intermediate trade represents about 10% of U.S. exports in value (Bernard et al., 2007), 20% of total French exports in value (Schröder et al., 2005; Crozet et al., 2013), 22% of Chinese exports in value (Ahn et al., 2011), 17% of all Turkish exports in value (Abel-Koch, 2013) and 15% of Swedish exports in volume Akerman (forthcoming).[1]

Just as trade intermediaries, foreign workers – especially skilled individuals – enhance exports at both trade margins (Rauch, 2001; Parsons and Winters, 2014). They convey information on their origin country, they have a general knowledge of foreign markets and they are usually part of international business networks. Thus, they lower informational barriers and reduce both *ad valorem* and fixed export costs for their employing firm.

To the best of our knowledge, no bridge has been done so far between the literature on trade intermediaries and the literature on foreign workers, although they seem to hold similar roles with respect to exporting firms. Based on this observation, one may wonder whether foreign workers could substitute trade intermediaries by helping firms to export directly, or rather foster the use of intermediaries by easing access to this export mode thanks to their business network.

To address this research question, we use a simple heterogeneous firm model *à la* Melitz (2003) with an intermediation technology as proposed by Ahn et al. (2011). In this framework, intermediary firms grant manufacturing firms an indirect access to all export destinations. In line with Mitaritonna et al. (2016) and Marchal and Nedoncelle (2017), we assume that foreign employment reduces export costs and increases firm productivity. At the extensive margin, the model predicts that foreign employment favor indirect over direct exports, as long as the benefit to export directly toward a given destination is lower than the gain realized by accessing all other destinations indirectly. At the intensive margin, foreign employment should foster more direct than indirect exports.

[1] As noted by Bernard et al. (2015), the definition of an intermediary firm varies across empirical papers. While some papers identify wholesalers and/or retailers using information from the main activity of the firms contained in custuoms data (Akerman, forthcoming; Bernard et al., 2007, 2015; Blum et al., 2010; Crozet et al., 2013; Schröder et al., 2005), others withdraw information from firms' names (Ahn et al., 2011) or from questions answered by firms in surveys (Abel-Koch, 2013; Grazzi and Tomasi, 2016; Fryges, 2007; McCann, 2013).

We test these theoretical predictions using a firm-level cross-section dataset on Viet Nam. Since the *Doi Moi* (Renovation) policy in 1986, the Vietnamese economy has been characterized by a high growth and a reduction of its poverty rate. This economic development has been mainly driven by the expansion of trade and investment (UNIDO, 2012). Incidentally, the country joined the World Trade Organization in December 2006. In 2010, Viet Nam was regarded as a lower middle-income country and its GDP *per capita* amounted to 1,333.6 constant US$ (World Bank data).

More especially, we use a sample of foreign and domestic firms collected through the Viet Nam Industry Investor Survey 2010 by the UNIDO. This dataset contains 1,493 firms, across nine provinces and three main sectors of the Vietnamese economy (manufacturing, construction and utilities sectors). These firms accounts for about 70% of total Vietnamese exports. In this dataset, indirect exports represent 3.18% of total exports in value. Crucially, the dataset contains information on the labor force composition of firms in terms of skills and origin country (native and foreign workers). We implement a two-stage Heckman selection model that allows us to correct for a potential bias due to the endogenous nature of the selection process into direct or indirect exports. We find evidence of a positive impact of foreign employment on the probability to export indirectly and, conditional on the export mode, on the export value. Our results suggest that foreign workers ease the access to trade intermediaries. Our findings are robust to the use of an IV procedure to control for reverse causality and to a number of robustness tests.

The contributions of this paper are the following. First, we analyze why some firms trade directly while others trade indirectly, by exploring how foreign employment determines this decision. Second, we extend the literature on the export-enhancing role of foreign workers by investigating their impact on the export mode of their firm, while the literature focuses almost entirely on direct exports. Lastly, we focus our empirical analysis on Viet Nam. The welfare benefits of trade intermediation have been highlighted by Akerman (forthcoming). The analysis of indirect exports thus makes sense for a developing economy which growth is mainly led by trade and investment.

The rest of the paper is organized as follows. We present the related literature in the following section. We present the UNIDO survey and a number of stylized facts in Section 3. In Section 4, we develop a number of theoretical predictions using a heterogeneous firm model, that we then test with a two-stage Heckman selection model in Section 5. Finally, we conclude on our main findings in Section 6.

# 2 Literature

## 2.1 The role of intermediaries in facilitating trade

### Empirical evidence

The literature on trade intermediation is recent and has been blooming thanks to the increase in data availability. Schröder et al. (2005) have been the first to study intermediation in foreign trade. Using French customs data for the years 1985, 1988 and 1990, they show that trade intermediaries are used to serve markets that are small and difficult to access. Intermediaries help firms to tackle export costs for these markets otherwise unreachable. The characteristics of the export destination have been studied in a number of empirical papers (Ahn et al., 2011; Akerman, forthcoming; Bernard et al., 2015; Crozet et al., 2013). These papers consistently show that the use of trade intermediation increases with the geographic and linguistic distance to the export destination and more generally with trade costs, and decreases with the market potential and the quality of institutions of the destination.

Following the recent developments of the literature on firm heterogeneity, most papers show that the firm's export mode is determined by its productivity or its size in terms of sales or employment. Fryges (2007) use survey data on German and British firms in 1997 and 2003 to show that the size of a firm has a significantly positive effect on its probability to change from indirect to direct exports. The authors interpret this result as evidence that large firms have sufficient resources to establish their own distribution network abroad. Most existing empirical papers exhibit such a sorting pattern of small firms into indirect exports and large firms into direct exports (Abel-Koch, 2013; Ahn et al., 2011; Akerman, forthcoming; Blum et al., 2010; Felbermayr and Jung, 2011; Grazzi and Tomasi, 2016).

Some papers also look at importers and how their import mode relates to their export mode. Using the BEEPS data which consists in a cross-section of firm-level data for several countries during the 21st century, Grazzi and Tomasi (2016) find that when considering firms involved in both exporting and importing activities, direct two-way traders are on average more productive than firms trading indirectly on one of the two trade sides. The latter are in turn more efficient than indirect two-way traders.

Finally, some papers look at other firm-level or product-level determinants of trade intermediation. More especially, McCann (2013) analyzes whether multi-product firms tend to use more trade intermediaries than single-product firms. Using BEEPS data for Eastern Europe and Central Asia during the 21st century, they find that multi-product firms are more likely to export indirectly, although they tend to be more productive. Their results corroborate the idea that multi-product firms use mixed exporting strategies. They have smaller export sales per product which makes the use of intermediation more attractive.

Crozet et al. (2013) analyze how quality differentiation interacts with the possibility of choosing intermediation as an alternative export mode. Using French firm-level data in 2007, they find that, consistently with the fact that intermediary firms export the products of the least efficient firms, their prices are higher than those of direct exporters. Yet, this premium is lower for quality-sorting goods. Abel-Koch (2013), using a World Bank Survey conducted in Turkey in 2005, find that product quality is on average negatively correlated with indirect as opposed to direct exports.

### The theory

One of the first theoretical model of trade intermediation has been proposed by Schröder et al. (2005). The authors use a model of monopolistic competition with intra-industry trade *à la* Krugman (1980), in which they explicitly distinguish between variable and fixed costs to trade in order to introduce a trade intermediary that can pool fixed export costs among exporting firms. They derive that the use of intermediaries increases with the cost to access a market and decreases with the size of the export market.

The remaining of the literature rests upon a Melitz (2003)-type partial equilibrium model. Most papers use the assumption that intermediary firms are able to pool export costs across goods. More especially, Felbermayr and Jung (2011) take into account the presence of contracting frictions between producers and intermediaries, which results in lower revenues from indirect than from direct exports. Consequently, large firms tend to incur higher fixed costs to build their own distribution network and to export directly, while small firms export indirectly which allows them to save on the fixed costs.

Then, Ahn et al. (2011) consider that firms face a trade-off between paying high costs to export directly to a specific market, and low costs to export indirectly through an intermediary which passed its distribution costs to the foreign consumer. Their model predicts that firms of intermediate levels of productivity export indirectly while the most productive firms export directly. The papers of Crozet et al. (2013) and Akerman (forthcoming) exhibit the same sorting pattern. Crozet et al. (2013) assume that firms that offer high-quality products face a higher demand and thus sort into a direct export mode to save on variable trade costs. Finally, Akerman (forthcoming) builds a general equilibrium model which allows him to derive that wholesalers increase welfare. In this model, wholesalers are able to spread fixed export costs across goods, and charge an additional markup on the procurement price of the firm to cover these fixed costs. This markup generates the expected sorting pattern of firms into export modes.

## 2.2 Foreign workers and exports

### Information

While a large number of studies look at how immigration fosters trade at the aggregate level, the micro-level literature focusing on the impact of foreign employment on exports is rather scant.[2] A number of papers show that foreign workers reduce both *ad valorem* and fixed export costs by relaxing informational barriers thanks to their deeper knowledge of foreign markets. For a sample of Danish firms between 1995 and 2005, Hiller (2013) finds that both the regional immigration stock and the firm's foreign employment matter for the composition of exports, as well as for the exported volume. The author shows that firms should employ foreign workers in order to fully access the knowledge embedded in the foreign population of their country. Then, Bastos and Silva (2012) match firm-destination data from Portugal with emigration stocks in each export destination country in 2005, in order to examine the effect of migrant networks on export participation and intensity across markets. Using a gravity framework and accounting for self-selection into the export markets, they find that migrant networks are important drivers of export participation and intensity. Finally, Hatzigeorgiou and Lodefalk (2016) use Swedish employer-employee data over the 1998-2007 period and find that foreign-born workers (in particular skilled and recently arrived individuals) increase exports at both trade margins, especially for small firms.

### Productivity

In a recent paper, Mitaritonna et al. (2016) explicitly analyze the link between immigration and productivity gains. Using French firm-level data over the 1995-2005 period, they find that an increase in the local supply of immigrants increases the total factor productivity of firms located in that area. This effect is found to be stronger for firms with initially low productivity and small size. In addition, the authors find that this positive productivity effect is associated with larger exports. Finally, using French firm-level data over the 1997-2008 period, Marchal and Nedoncelle (2017) show that the employment of foreign workers fosters exports at both margins of trade. This effect can be decomposed in a non-individual effect – to which any foreign worker contributes – and a destination-specific effect – to which only foreign workers who were born in the export destination contribute. For the intensive margin, they find that a firm employing foreign-born workers exports 30% more in value than a control firm, and that this increase is spread over all the destinations, suggesting that the effect of foreign-born workers goes beyond a destination-specific informational channel, and that a productivity effect may be at play.

[2]There is a large macroeconomic literature on the link between trade and immigration. Two main channels through which immigrants affect trade have been identified in this literature. Immigrant workers have a preference for products from their home country and they reduce the transaction costs between their host and home countries. Through these channels, immigrants foster bilateral trade (both imports and exports). See the seminal paper of Gould (1994) and subsequent work surveyed by Rauch (2001) and Parsons and Winters (2014).

# 3 Data and stylized facts

## 3.1 Descriptive statistics

The Viet Nam Industry Investor Survey 2010 has been undertaken in 2009 and 2010 by the UNIDO in collaboration with Vietnamese institutions[3] (UNIDO, 2012). It contains 1,490 firms across nine major provinces – Ba Ria-Vung Tau, Bac Ninh, Binh Duong, Dong Nai, Vinh Phuc, Da Nang, Ha Noi, Hai Phong and Ho Chi Minh City – and across three sectors of the economy – the manufacturing, construction and utilities sectors. The last sector includes the public sector and energies. This sample counts 72.54% of foreign firms, 22.44% of domestic firms and 5.02% of state-owned firms. This dataset is biased toward foreign firms, as the Viet Nam General Statistics Office (GSO) estimates that the Vietnamese economy was composed of 2.6% of foreign firms, 96% of domestic firms and 1.4% of state-owned firms in 2010. Note that to take part in the survey, firms should had a capital larger than 225,000 US$ and employed more than 50 employees.

For this study, we only keep manufacturing and exporting firms which represents 65.50% of the initial sample (976 firms). A number of descriptive statistics are provided in Table 1. The survey collects information on firm characteristics such as the value of assets, domestic sales and exports. The data also contains characteristics specific to foreign firms such as the market entry mode and the origin country of the investor (about 38.92% of foreign firms come from Asia and 46.85% from East Asia).

Using data from the GSO, we find that this sample captures about 68.34% of Vietnamese exports realized by manufacturing firms in 2009.[4] Most firms export only to one destination. We identify nine main export destinations (Australia, China, the EU, Japan, South East Asia, South Korea, Taiwan, the US and others), the most important destinations being Japan (19.08%), the EU (17.34%), the US (15.36%), Taiwan (14.25%) and South East Asia (11.89%).

Crucially, the survey provides us with information on the export mode of the firm. Respondent firms had to answer the following question: "What percentage of this enterprise's total sales by value was: sold in Viet Nam, exported directly, exported indirectly?" Total exports represent about 49.40% of total sales, and indirect exports represent about 3.18% of total exports.

Finally, the survey contains detailed information on the workforce composition of the firms, disaggregated in four skill categories: (i) technical and supervisory employees, (ii) managers, (iii) clerical and administrative employees and (iv) production workers. Henceforth, we refer to the first two groups as skilled workers, and to the last two groups as unskilled workers. For each skill category, we know the number of native and foreign workers. On average, foreign workers account for 1.80% of total employment. Looking at skills, foreign workers account for about 16.70% of skilled

[3]The Ministry of Planning and Investment, the Viet Nam Chamber of Commerce and Industry and the General Statistics Office.

[4]In this sample, only 13.11% of manufacturing exporters were surveyed in 2010. We thus use 2009 as the reference year for our analysis.

employment and about 0.40% of unskilled employment. Note that 27.51% of firms do not employ foreign workers, 30.36% do not employ skilled foreign workers and 85.12% do not employ unskilled foreign workers.

Table 1: Descriptive statistics on manufacturing and exporting firms

| | **Obs.** | **Mean** | **Std. Dev.** | **Min** | **Max** |
|---|---|---|---|---|---|
| Total (fixed and current) assets (in US$) | 964 | 6.62e+07 | 5.68e+08 | 5,860 | 9.34e+09 |
| Capital intensity (fixed assets in US$/empl.) | 963 | 177,502 | 2,041,667 | 29.3 | 4.06e+07 |
| Sh. of foreign capital | 976 | 0.697 | 0.445 | 0 | 1 |
| Age of the firm | 976 | 12.494 | 9.529 | 2 | 113 |
| Size (nr. of full time employees) | 975 | 714.799 | 1,446.205 | 22 | 20,034 |
| Total sales (in US$) | 973 | 6.09e+07 | 5.62e+08 | 12,599 | 1.10e+10 |
| Domestic sales (in US$) | 973 | 3.24e+07 | 4.13e+08 | 0 | 9.10e+09 |
| Exports (in US$) | 976 | 3.00e+07 | 2.73e+08 | 22.04 | 6.85e+09 |
| Sh. of indirect exports (over total exports) | 803 | 0.102 | 0.274 | 0 | 1 |
| Nr. of export destinations | 807 | 2.390 | 1.568 | 1 | 9 |
| Sh. of foreign workers | 876 | 0.018 | 0.040 | 0 | 0.889 |
| Sh. of foreign skilled workers | 876 | 0.167 | 0.230 | 0 | 1 |
| Sh. of foreign unskilled workers | 876 | 0.004 | 0.034 | 0 | 0.909 |

### 3.2 Stylized facts

We derive two stylized facts from the UNIDO dataset. First, Figure 1 shows the distribution of firms with respect to their assets for indirect-only and direct-only exporters. We observe that larger firms tend to select into direct exports while small firms select into indirect exports. This sorting pattern is in line with the literature detailed herein-before in Section 2.1. It confirms that although the share of indirect exports in Viet Nam is rather low as compared to other developed and developing countries (3.18% according to the UNIDO dataset), this study-case should enable us to conduct our analysis on the impact of foreign employment on the export-mode decision of the firm.

Second, Figure 2 shows the distribution of firms with respect to their employment of skilled foreign workers for indirect-only and direct-only exporters. The two distributions are quite distinct. We observe that direct exporters tend to hire less skilled foreign workers than indirect exporters. Although not reported, the difference between the two groups of firms in terms of skilled foreign employment is significantly different from zero at the 1% level. In the remaining of the paper, we further investigate this difference in order to derive a causal relation between foreign employment and the export mode.

Figure 1: Kernel distribution of firms with respect to their assets

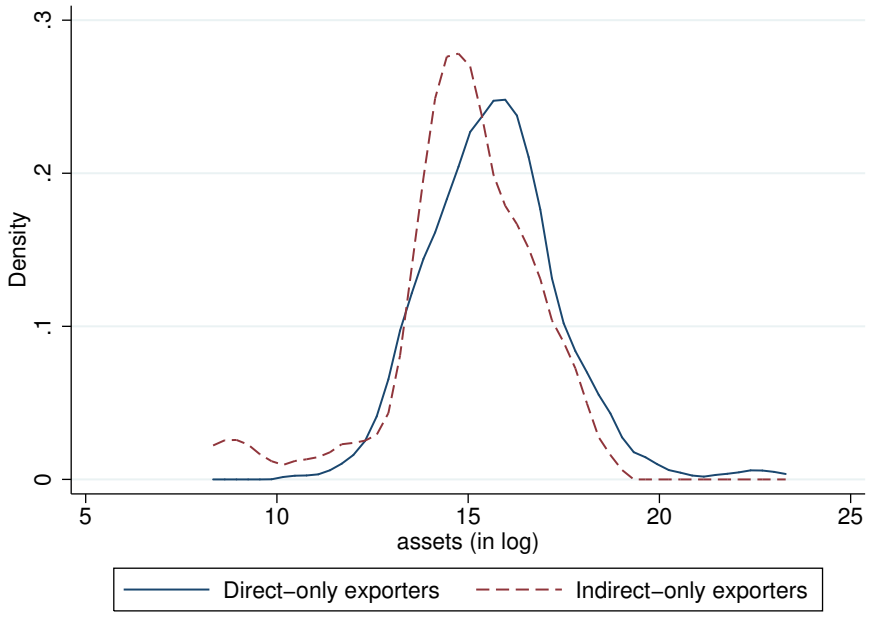
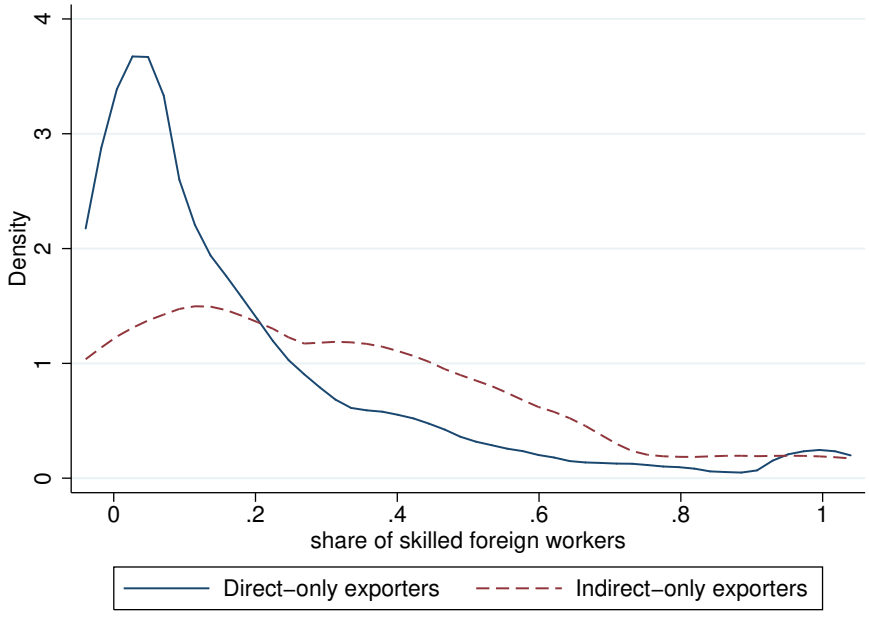



Figure 2: Kernel distribution of firms with respect to their skilled foreign employment



# 4 Theoretical framework

## 4.1 Model set-up

Following Melitz (2003), we consider a world with $n+1$ symmetric countries open to trade, a domestic country and $n$ foreign countries indexed by $x$. In each country, firms operate under monopolistic competition. Each manufacturing firm faces the following demand function on market $x$:

$$q^x = \xi^x \left(p^x\right)^{-\sigma} \tag{1}$$

where $\xi^x$ is the demand shock faced by the firm on market $x$, $p^x$ is the price of the firm's variety on market $x$ and $\sigma$ denotes the elasticity of substitution between any two goods.

Each firm is characterized by a productivity level denoted $\varphi$ and given by:

$$\varphi = \phi\alpha \tag{2}$$

where $\phi$ denotes an exogenous productivity level drawn from a random distribution denoted $G(\phi)$ and $\alpha$ denotes an endogenous productivity level. $\varphi$ is increasing in both arguments.

Following Marchal and Nedoncelle (2017), $\alpha$ depends on the foreign employment of the firm and is given by $\alpha = a(\lambda)$ where $\lambda = \sum_{x=1}^{n} \lambda_x$ and $\lambda_x$ represents the share of workers born in a foreign country $x$ $(\forall x = 1...n)$ and employed by the firm. The function is symmetric and concave in its arguments such that there exists an optimal level of foreign employment that maximizes the endogenous productivity of the firm. However, due to factor scarcity, its foreign employment is always sub-optimal such that:

$$\frac{\partial\alpha}{\partial\lambda} \geq 0 \tag{3}$$

Allowing the derivative to equal zero, we account for non-linearity in the effect of foreign employment on the firm productivity. Additionally, assuming that the derivative is never negative, we restrain our analysis to firms that can indeed benefit from foreign employment.[5]

## 4.2 Direct exports

Let us denote the technology of the firm to produce $q^x$ units to be directly exported to market $x$:

$$c_d^x = \frac{\tau^x}{\varphi} q^x + f_d^x \tag{4}$$

[5]Here, we consider that firms that would face a productivity loss due foreign employment would never employ such workers. See Marchal and Nedoncelle (2017) for a thorough discussion of this assumption.

where the wage of one unit of labor is normalized to unity. To export directly, the firm incurs a destination-specific fixed cost denoted $f_d^x$ and a bilateral iceberg cost denoted $\tau^x$.

Foreign workers provide valuable information on foreign markets and give access to business networks, which help their firm to overcome trade barriers. Thus, export costs to market $x$ decrease with the firm's employment of foreign workers, such that $\frac{\partial f_d^x}{\partial \lambda} \leq 0$ and $\frac{\partial \tau^x}{\partial \lambda} \leq 0$.

After profit maximization, we obtain the price charged by the firm and the corresponding export quantity:

$$p_d^x = \left(\frac{\sigma}{\sigma - 1}\right) \frac{\tau^x}{\varphi} \tag{5}$$

$$q_d^x = \xi^x \left[\left(\frac{\sigma}{\sigma - 1}\right) \frac{\tau^x}{\varphi}\right]^{-\sigma} \tag{6}$$

The firm's profit derived from direct exports is given by:

$$\pi_d^x = \frac{1}{\sigma} \xi^x \left[\left(\frac{\sigma}{\sigma - 1}\right) \frac{\tau^x}{\varphi}\right]^{1-\sigma} - f_d^x \tag{7}$$

Finally, the optimal value sold directly on market $x$ is given by:

$$v_d^x = \xi^x (\sigma)^{1-\sigma} (\sigma - 1)^{\sigma-1} \left(\frac{\varphi}{\tau^x}\right)^{\sigma-1} \tag{8}$$

where $v_d^x = p_d^x q_d^x$.

### 4.3 Indirect exports

Following Ahn et al. (2011), firms exporting indirectly rely on an intermediary sector that operates under perfect competition. Instead of exporting directly and paying the destination-specific fixed cost, firms pay a fixed cost to the intermediary denoted $f_i$ that grants them an indirect access to all destinations. In line with the literature, we assume that $f_i < f_d^x \, \forall x$ (Schröder et al., 2005; Ahn et al., 2011). It implies that intermediaries can spread their fixed costs across manufacturers which lowers the costs for each individual firm.

Foreign workers pertain to a business network that eventually includes workers involved in trade intermediation. Thereby, we assume that foreign workers help their firm to access intermediary firms such that $\frac{\partial f_i}{\partial \lambda} \leq 0$.

The price of a variety exported to destination $x$ by an intermediary is given by:

$$p_i^x = \gamma \tau^x p_i \tag{9}$$

where $\gamma$ is a per-unit cost incurred by the intermediary firm to prepare the variety for the foreign market and $p_i$ denotes the price charged by a manufacturer to the intermediary.

Using equation (9) and maximizing the manufacturer's variable profit, we obtain the price for indirect exports and the corresponding export quantity:

$$p_i = \frac{1}{\varphi}\left(\frac{\sigma}{\sigma-1}\right) \tag{10}$$

$$q_i^x = \xi^x\left[\gamma\frac{\tau^x}{\varphi}\left(\frac{\sigma}{\sigma-1}\right)\right]^{-\sigma} \tag{11}$$

The variable profit derived from indirect exports to market $x$ is given by:

$$\varpi_i^x = \gamma^{-\sigma}\frac{1}{\sigma}\xi^x\left[\frac{\tau^x}{\varphi}\left(\frac{\sigma}{\sigma-1}\right)\right]^{1-\sigma} \tag{12}$$

Finally, the optimal value sold indirectly on market $x$ is given by:

$$v_i^x = \xi^x(\sigma)^{1-\sigma}(\sigma-1)^{\sigma-1}(\varphi)^{\sigma-1}\left(\frac{1}{\gamma\tau^x}\right)^{\sigma} \tag{13}$$

### 4.4 Decision to export

A firm that serves the domestic market should decide whether or not to export – indirectly or directly – and its export volume. The indirect export cut-off determines the firm that is indifferent between paying $f_i$ to gain indirect access to all foreign markets or not. This cut-off is determined by the zero-profit condition where the aggregate profit across destinations from indirect exports is:

$$\pi_i = \sum_{x=1}^{n}\varpi_i^x - f_i \tag{14}$$

Thus, the indirect export cut-off is given by:

$$\varphi_i = \left(\frac{1}{\xi^x}\gamma^{\sigma}\sigma f_i\right)^{\frac{1}{\sigma-1}}\left(\frac{\sigma}{\sigma-1}\right)\sum_{x=1}^{N}\tau^x \tag{15}$$

Additionally, there are $n$ cut-offs that determine the firms that are indifferent between direct and indirect exports for each foreign market $x$, that is whenever $\pi_d^x = \varpi_i^x$:

$$\varphi_x^d = \left(1-\gamma^{-\sigma}\right)^{\frac{1}{1-\sigma}}\left(\frac{\sigma f_d^x}{\xi^x}\right)^{\frac{1}{\sigma-1}}\left(\frac{\sigma}{\sigma-1}\right)\tau^x \tag{16}$$

Finally, in order to determine the sorting pattern, we follow Ahn et al. (2011) and assume that a firm exporting directly to one market, may also export indirectly to the remaining $n-1$ markets.

In that case, the following condition should hold: $\sum_{x=1}^{n} \varpi_i^x > \varpi_d^x$ or equivalently:

$$\gamma^{-\sigma} \frac{1}{\sigma} \xi^x \sum_{x=1}^{n} \left[ \left( \frac{\sigma}{\sigma - 1} \right) \frac{\tau^x}{\varphi} \right]^{1-\sigma} > \frac{1}{\sigma} \xi^x \left[ \left( \frac{\sigma}{\sigma - 1} \right) \frac{\tau^x}{\varphi} \right]^{1-\sigma} \tag{17}$$

The aggregate indirect profit from the remaining countries is thus enough to cover the fixed cost of exporting indirectly. This assumption is sufficient, but not necessary to ensure $\varphi_i < \varphi_d^x$.

Under this assumption, the model exhibits the following sorting pattern: firms with a productivity that lies in the interval $[\varphi_i, \varphi_d^x]$ export indirectly to market $x$, and firms with a productivity greater than $\varphi_d^x$ export directly to market $x$. This sorting pattern is standard in the literature on indirect exports (Ahn et al., 2011; Akerman, forthcoming; Crozet et al., 2013; Schröder et al., 2005).

## 4.5 Comparative statics

### 4.5.1 Impact of foreign employment on the export mode

Let us look at what happens to the export cut-offs when the firm increases its employment of foreign workers. We find that foreign employment lowers both indirect and direct export cut-offs:

$$\frac{\partial \varphi_i}{\partial \lambda} = \left(\gamma^{-\sigma}\right)^{\frac{1}{1-\sigma}} \left( \frac{\sigma}{\xi^x} \right)^{\frac{1}{\sigma-1}} \left( \frac{\sigma}{\sigma - 1} \right) (f_i)^{\frac{1}{\sigma-1}} \left[ \left( \frac{1}{\sigma - 1} \right) \frac{1}{f_i} \frac{\partial f_i}{\partial \lambda} \sum_{x=1}^{n} \tau^x + \frac{\partial \tau^x}{\partial \lambda} \right] \leq 0 \tag{18}$$

$$\frac{\partial \varphi_d^x}{\partial \lambda} = \left(1 - \gamma^{-\sigma}\right)^{\frac{1}{1-\sigma}} \left( \frac{\sigma}{\xi^x} \right)^{\frac{1}{\sigma-1}} \left( \frac{\sigma}{\sigma - 1} \right) (f_d^x)^{\frac{1}{\sigma-1}} \left[ \left( \frac{1}{\sigma - 1} \right) \frac{1}{f_d^x} \frac{\partial f_d^x}{\partial \lambda} \tau^x + \frac{\partial \tau^x}{\partial \lambda} \right] \leq 0 \tag{19}$$

In this paper, we investigate to what extent foreign employment may complement or substitute trade intermediaries. On the one hand, foreign workers help their firm to access trade intermediaries, which can favor the indirect export mode. Under the assumptions of the model, we find that, as long as the following condition holds:

$$\begin{aligned} &(f_d^x)^{\frac{1}{\sigma-1}} \left[ \frac{\partial \tau^x}{\partial \lambda} + \frac{\partial f_d^x}{\partial \lambda} \frac{1}{f_d^x} \left( \frac{1}{\sigma - 1} \right) \tau^x \right] - (\gamma^\sigma - 1)^{\frac{1}{\sigma-1}} (f_i)^{\frac{1}{\sigma-1}} \left[ \frac{\partial \tau^x}{\partial \lambda} + \frac{\partial f_i}{\partial \lambda} \frac{1}{f_i} \left( \frac{1}{\sigma - 1} \right) \tau^x \right] \\ &\geq (\gamma^\sigma - 1)^{\frac{1}{\sigma-1}} (f_i)^{\frac{1}{\sigma-1}} \frac{\partial f_i}{\partial \lambda} \frac{1}{f_i} \left( \frac{1}{\sigma - 1} \right) \sum_{\substack{k=1 \\ k \neq x}}^{n} \tau^k \end{aligned} \tag{20}$$

foreign employment lowers more importantly the indirect export cut-off than the direct export cut-off for market $x$:

$$\frac{\partial \varphi_i}{\partial \lambda} \leq \frac{\partial \varphi_d^x}{\partial \lambda} \tag{21}$$

Condition (20) implies that the benefit to export directly toward a given destination should be lower than the gain realized by indirectly accessing all other destinations. In other words, the difference in cost to export indirectly instead of directly to market $x$, should be at least equal to the gain realized by indirectly accessing all other markets but $x$.

On the other hand, foreign workers help their firm to reach the direct export cut-off by lowering fixed export costs, which may favor direct over indirect exports. As long as condition (20) does not hold, the direct export cut-off for market $x$ reacts more importantly to foreign employment than the indirect export cut-off:

$$\frac{\partial \varphi_i}{\partial \lambda} > \frac{\partial \varphi_d^x}{\partial \lambda} \tag{22}$$

#### 4.5.2 Impact of foreign employment on the intensive margin

Let us now look at what happens to the value exported indirectly and directly to market $x$. In line with previous empirical evidence, we find that both derivatives with respect to foreign employment are positive:

$$\frac{\partial v_d^x(\varphi)}{\partial \lambda} = (\tau^x)^{1-\sigma} \xi^x \sigma \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} (\varphi)^{\sigma-2} \left(\frac{\partial \varphi}{\partial \lambda} - \frac{\varphi}{\tau^x}\frac{\partial \tau^x}{\partial \lambda}\right) \geq 0 \tag{23}$$

and:

$$\frac{\partial v_i^x(\varphi)}{\partial \lambda} = (\gamma\tau^x)^{-\sigma} \xi^x \sigma \left(\frac{\sigma-1}{\sigma}\right)^{\sigma} (\varphi)^{\sigma-2} \left(\frac{\partial \varphi}{\partial \lambda} - \frac{\varphi}{\tau^x}\frac{\partial \tau^x}{\partial \lambda}\right) \geq 0 \tag{24}$$

Here again, we focus our analysis on the consequences of foreign employment on the export mode, by comparing the indirect and the direct export values to destination $x$. Let us re-write equation (24) as follows:

$$\frac{\partial v_i^x(\varphi)}{\partial \lambda} = \frac{\gamma^{-\sigma}}{\tau^x} \frac{\partial v_d^x(\varphi)}{\partial \lambda} \tag{25}$$

Given that $0 \geq \frac{\gamma^{-\sigma}}{\tau^x} \geq 1$, we can conclude that foreign workers increase more importantly direct than indirect exports to market $x$:

$$\frac{\partial v_i^x(\varphi)}{\partial \lambda} \leq \frac{\partial v_d^x(\varphi)}{\partial \lambda} \tag{26}$$

# 5 Empirical analysis

## 5.1 The Heckman selection model and specification

Our empirical analysis aims to shed light on the induced effect of foreign employment on the export mode and the export value of Vietnamese firms. Following the literature, we expect the effect of foreign workers on exports to be positive at both trade margins. The originality of our study lies in the comparison of indirect and direct exporters. At the extensive margin, it is rather unclear from the theory whether foreign workers should favor direct over indirect exports, or the opposite. At the intensive margin, our model predicts that foreign employment should foster more direct than indirect exports.

The difficulty of our analysis lies in the fact that the export-mode choice of the firm – to export indirectly or directly – may condition the value it exports toward each foreign market. Therefore, estimating the impact of foreign employment on the share of indirect exports over total exports or over total sales – as done by Abel-Koch (2013) and Ahn et al. (2011) respectively – one could fail to control for a potentially strong selection bias.

To tackle this difficulty, we use a two-stage selection model *à la* Heckman (1976, 1979) to identify the impact of foreign workers on (i) the export-mode decision of the firm, and (ii) its export value conditional on its export mode. In other words, the Heckman selection model allows us to estimate the probability of a firm being in one of the two groups of exporters (indirect or direct exporters), and then to use the estimated probability to analyze the firm's export value.

Let us denote the total export value of a firm by:

$$v = \sum_{x=1}^{n} v_i^x + \sum_{x=1}^{n} v_d^x \tag{27}$$

and the share of indirect exports over total exports by:

$$sh_i = \frac{\sum_{x=1}^{n} v_i^x}{v} \tag{28}$$

Let us define a *selection* equation as follows:

$$M = aW + u_1 \tag{29}$$

where $M$ is a binary variable equal to one if the firm exports only indirectly ($sh_i = 1$) and zero if the firm exports only directly ($sh_i = 0$). For now, we exclude firms exporting both directly and indirectly from our sample. $W$ denotes a vector of regressors and $u_1$ is an error term following a bivariate normal distribution such that $u_1 \sim N(0, 1)$.

Then, we can define a *response* equation as follows:

$$v|M = bZ + u_2 \tag{30}$$

where $Z$ denotes a vector of regressors and $u_2$ is an error term following a normal distribution such that $u_2 \sim N(0, \sigma)$. We assume that $\text{corr}(u_1, u_2) = \rho$, which implies that the export-mode decision and the export value may not be independent from each other.

In a first step, we estimate the selection equation using a Probit model. The vector $W$ may include the following variables of interest: the number of foreign workers employed by the firm, its total assets, a binary variable equal to unity for multinational companies, the number of destinations served, the age of the firm, a binary variable equal to unity for mono-product firms, a binary variable equal to unity if the firm's buyers are mainly located inside Viet Nam, a binary variable equal to unity if the firm imports indirectly, the total population and the poverty rate of the firm's province in 2008. Province-level data come from the Viet Nam GSO. All continuous variables are in logarithm. Depending on the regression, we may also include sector, province, export-destination and survey-year fixed effects.

In a second step, we use the estimated vector of parameters ($a$) to compute the inverse Mills ratio. We then include this ratio as an explanatory variable in the response equation that we estimate using an OLS estimator. It allows us to correct for a potential bias due to the endogenous nature of the selection process into direct or indirect exports. A significant coefficient associated to the inverse Mills ratio implies that the error terms in the selection and the response equations are correlated. In that case, the use of a two-stage model *à la* Heckman is appropriate.

In addition to the inverse Mills ratio, the vector $Z$ may include the following explanatory variables: the number of foreign workers employed by the firm, its total assets, a binary variable equal to unity for multinational companies, the age of the firm, the total population and the poverty rate of the firm's province in 2008. We may also include sector, province, export-destination and survey-year fixed effects.

## 5.2 Results

### First-stage estimates

Probit estimates for the selection equation are presented in Table 2. In column (1), we estimate the impact of employing skilled foreign workers on the probability of a firm being an indirect exporter. We find a positive and highly significant effect. The sign and magnitude to this coefficient is robust to the inclusion of additional firm-level control variables (column 2) and a large set of fixed effects (column 3). In column (4), we control for province-level variables instead of including province fixed-effects, such as the population and poverty rate.

In column (5), we include a dummy variable controlling for firms which declare that more than 50% of their long-term buyers are located inside Viet Nam. Doing so, we control for the fact that firms with a large distribution network abroad are expected to sort into direct exports, while firms saving on these fixed costs are expected to sort into indirect exports (Fryges, 2007). We find that firms having a network of buyers mainly inside Viet Nam, have a significantly higher probability to select into indirect exports.

In column (6), we control for firms which are indirect importers. Note that the variable capturing the import status is poorly correlated with the assets and the multinational status of the firm. In line with Grazzi and Tomasi (2016), we expect indirect exporters to have a higher probability to export indirectly. However, similarly to Abel-Koch (2013), we find no significant effect.

In column (7), we look at the impact of foreign employment without distinguishing workers by skill categories, on the probability of being an indirect exporter. We find that the coefficient is positive and significant at the 10% level. In column (8), we only look at unskilled foreign workers. In that case, the coefficient becomes negative and losses its significance. These results suggest that the firm's probability of being an indirect exporter is mainly determined by skilled foreign workers. Following available evidence on exports and immigration, one could have expected that all foreign workers would have had a positive impact, the effect of unskilled individuals being lower (Rauch, 2001; Parsons and Winters, 2014). Here, the nil effect of unskilled foreign workers may be due to the low number of firms employing unskilled foreign workers in the dataset (14.88%). Another possible explanation may be that unskilled foreign workers eventually come from countries that are closer to Viet Nam (as compared to skilled individuals), since the literature on south–south migration shows that concerned migrants are mainly low-skilled workers (Lackzo and Appave, 2014). They would thus provide less valuable information to their firms.

Finally, looking at columns (1) to (8), we find that bigger firms in terms of assets and number of destinations served have a lower probability to export indirectly. Multinational firms also tend to favor direct over indirect exports. This result corroborates available evidence on the sorting pattern of firms across export modes: small firms select into indirect exports while large firms select into direct exports, as shown by the literature on indirect exports (*c.f.* Section 2.1).[6] We also find that being a mono-product firm does no significantly impact the probability to export indirectly, while we would expect a significant and negative coefficient (McCann, 2013). Then, although export-destination dummies are not reported in the table, we find that the largest export markets – namely Japan, the EU and the US – show negative and significant coefficients. Here again, this result is in line with available evidence and corroborates that smaller and poorly accessible markets are served through trade intermediaries, while larger and easily accessible markets are served directly.

[6] Although not reported in the table, we investigate whether the impact of foreign workers on the firm's export-mode decision may depends on its size. Yet, the coefficient associated to the interaction between foreign employment and the size of the firm is never significant.

**Second-stage estimates**

OLS estimates for the response equation are presented in Table 3, which strictly reproduces the structure of Table 2. In columns (1) to (4), we find that, conditional on the export-mode choice, the employment of skilled foreign workers positively and significantly determines the export value. This result is in line with previous papers looking at how foreign workers impact the intensive margin of trade (*c.f.* Section 2.2). In columns (5) and (6), we respectively control for the network of buyers and the import status of the firm in the first-stage regression. Results regarding foreign employment are also as we expected. Then, we find that the effect of foreign workers is slightly lower when we consider all skill categories (column 7), and it losses its significance when we only consider unskilled foreign workers (column 8).

For each specification, the coefficient associated to the inverse Mills ratio is positive and significant which indicates that the results of a standard linear model would have been upwardly biased due to a lack of control for the selection process. In other words, we can conclude that foreign workers impact more importantly firms selecting into direct exports than firms selecting into indirect exports, as predicted by the theoretical model developed herein-before.

Looking at control variables from columns (1) to (8), we see that the larger the assets of the firm, the larger its export value. We also find that multinational firms tend to export lower values. This could be explained by a large heterogeneity in trade performance across types of multinational companies (foreign companies, domestic-dominated and foreign-dominated joint ventures). It could also be explained by the motivations lying behind the foreign investment. For instance, an affiliate could be settled in Viet Nam in order to serve the domestic market more easily. Finally, the population of the firm's province positively impacts its exports, while the poverty rate negatively impacts its export value.

### 5.3 Additional endogeneity concern

Studies analyzing the impact of immigration on trade outcomes face a well known endogeneity issue due to the presence of a potential reverse causality bias (Hatzigeorgiou and Lodefalk, 2014; Parsons and Winters, 2014). In our empirical analysis, we cannot exclude that a firm may hire a foreign worker because it already serves a foreign market, or because it plans to export in the future. In case of multinational firms, foreign workers may be expatriates sent by the mother company or by an affiliate in order to develop trade activities. Alternatively, the export performance of a firm may determine its capacity to attract a certain type of workers, and thus bias the estimation. On the link between foreign employment, export experience and export performance, see Choquette and Meinen (2015) and Minondo (2011).

In line with the literature, we insulate our results from reverse causality using an instrumental variable (IV) approach. We use three instruments. First, we use the UNIDO data to compute the

Table 2: Heckman model - Estimation of the *selection* equation

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Skilled foreign empl. | 0.244$^a$ | 0.270$^a$ | 0.283$^a$ | 0.264$^a$ | 0.457$^a$ | 0.279$^a$ | | |
| | (0.088) | (0.093) | (0.099) | (0.096) | (0.152) | (0.103) | | |
| Assets | -0.166$^a$ | -0.191$^a$ | -0.233$^a$ | -0.200$^a$ | -0.329$^a$ | -0.230$^a$ | -0.214$^a$ | -0.172$^a$ |
| | (0.056) | (0.061) | (0.069) | (0.066) | (0.100) | (0.071) | (0.067) | (0.064) |
| MNE | -0.502$^b$ | -0.436$^c$ | -0.604$^b$ | -0.589$^b$ | -0.282 | -0.662$^a$ | -0.549$^b$ | -0.204 |
| | (0.222) | (0.232) | (0.237) | (0.235) | (0.353) | (0.238) | (0.239) | (0.223) |
| Export destination nr. | -0.492$^b$ | -0.538$^b$ | -0.562$^b$ | -0.577$^b$ | -0.606$^c$ | -0.609$^b$ | -0.615$^b$ | -0.591$^b$ |
| | (0.231) | (0.237) | (0.285) | (0.276) | (0.314) | (0.279) | (0.289) | (0.285) |
| Age | | 0.247 | 0.271 | 0.243 | 0.525$^b$ | 0.296 | 0.248 | 0.190 |
| | | (0.160) | (0.202) | (0.194) | (0.222) | (0.205) | (0.197) | (0.187) |
| Mono-product | | -0.044 | 0.012 | -0.037 | 0.190 | -0.003 | 0.013 | -0.008 |
| | | (0.174) | (0.188) | (0.190) | (0.249) | (0.191) | (0.187) | (0.183) |
| Population | | | | 0.056 | | | | |
| | | | | (0.146) | | | | |
| Poverty rate | | | | -0.090 | | | | |
| | | | | (0.130) | | | | |
| Domestic network of buyers | | | | | 1.074$^a$ | | | |
| | | | | | (0.269) | | | |
| Indirect importer | | | | | | -0.398 | | |
| | | | | | | (0.260) | | |
| Foreign empl. | | | | | | | 0.218$^b$ | |
| | | | | | | | (0.088) | |
| Unskilled foreign empl. | | | | | | | | -0.031 |
| | | | | | | | | (0.125) |
| Constant | 1.587$^c$ | 1.391 | 3.040$^b$ | 2.131 | 2.406 | 3.208$^a$ | 2.946$^b$ | 2.212$^c$ |
| | (0.813) | (0.871) | (1.185) | (1.622) | (1.475) | (1.223) | (1.192) | (1.215) |
| Sector FE | no | no | yes | yes | yes | yes | yes | yes |
| Province FE | no | no | yes | no | yes | yes | yes | yes |
| Export-destination FE | no | no | yes | yes | yes | yes | yes | yes |
| Survey-year FE | no | no | yes | yes | yes | yes | yes | yes |
| Observations | 648 | 648 | 481 | 497 | 317 | 481 | 481 | 482 |

Note: This table provides Probit estimates for equation (29). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.

Table 3: Heckman model - Estimation of the *response* equation

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Skilled foreign empl. | 0.389$^a$ | 0.395$^a$ | 0.422$^a$ | 0.374$^a$ | 0.537$^a$ | 0.360$^a$ | | |
| | (0.077) | (0.077) | (0.101) | (0.094) | (0.092) | (0.091) | | |
| Assets | 0.451$^a$ | 0.442$^a$ | 0.435$^a$ | 0.472$^a$ | 0.384$^a$ | 0.497$^a$ | 0.474$^a$ | 0.517$^a$ |
| | (0.073) | (0.073) | (0.104) | (0.091) | (0.093) | (0.095) | (0.093) | (0.085) |
| MNE | -0.540$^a$ | -0.502$^a$ | -0.623$^a$ | -0.541$^b$ | -0.459$^b$ | -0.496$^b$ | -0.501$^a$ | -0.058 |
| | (0.164) | (0.157) | (0.216) | (0.215) | (0.188) | (0.199) | (0.189) | (0.126) |
| Age | | 0.112 | 0.024 | -0.016 | 0.229 | -0.021 | -0.021 | -0.069 |
| | | (0.094) | (0.111) | (0.116) | (0.151) | (0.104) | (0.106) | (0.104) |
| Population | | | | 0.166$^c$ | | | | |
| | | | | (0.086) | | | | |
| Poverty rate | | | | -0.228$^a$ | | | | |
| | | | | (0.079) | | | | |
| Foreign empl. | | | | | | | 0.310$^a$ | |
| | | | | | | | (0.073) | |
| Unskilled foreign empl. | | | | | | | | -0.020 |
| | | | | | | | | (0.068) |
| Inverse Mills ratio | 1.060$^a$ | 1.014$^a$ | 0.855$^b$ | 0.717$^b$ | 0.706$^a$ | 0.584$^c$ | 0.760$^b$ | 0.883$^b$ |
| | (0.320) | (0.299) | (0.366) | (0.358) | (0.135) | (0.327) | (0.337) | (0.351) |
| Constant | 5.843$^a$ | 5.763$^a$ | 8.395$^a$ | 7.110$^a$ | 7.252$^a$ | 7.725$^a$ | 8.032$^a$ | 7.312$^a$ |
| | (0.706) | (0.703) | (1.303) | (1.151) | (1.529) | (1.213) | (1.228) | (1.187) |
| Sector FE | no | no | yes | yes | yes | yes | yes | yes |
| Province FE | no | no | yes | no | yes | yes | yes | yes |
| Export-destination FE | no | no | yes | yes | yes | yes | yes | yes |
| Survey-year FE | no | no | yes | yes | yes | yes | yes | yes |
| Observations | 648 | 648 | 481 | 497 | 317 | 481 | 481 | 482 |
| R-squared | 0.469 | 0.470 | 0.494 | 0.466 | 0.491 | 0.493 | 0.491 | 0.493 |

Note: This table provides OLS estimates for equation (30). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.

number of foreign workers employed by other firms located in the province or in the sector of the firm. Second, we use the internal migration rate in 2005 in the firm's province provided by the Viet Nam GSO. The latter instrument excludes international immigrants and only considers movements of nationals across provinces. Importantly, no instrument includes the number of foreign workers of the firm. These instruments should be correlated with the firm's employment of foreign workers, but poorly correlated with its economic performance. Tables 6, 7 and 8 (presented in Appendix), show that each instrument is reasonably correlated with the firm's employment of skilled foreign workers (between 8% and 15%), and poorly correlated with our independent variables. The instruments appear weaker in the case of unskilled foreign employment.

**First-stage estimates**

The first-stage results of the Heckman selection model using theses instrumental variables are presented in Table 4. Due to the inclusion of province-level instruments, we now favor the use of province-level control variables (population and poverty rate) over province fixed effects.

Column (1) shows that the impact of skilled foreign employment is robust to the control of a reverse causality bias. The coefficient is highly significant and larger than in the baseline regression (Table 2, column 4). In column (2), we control for firms having more than 50% of their long-term buyers located inside Viet Nam. In column (3), we control for firms which are also indirect importers. Our previous findings remain unchanged for both specification. Then, looking at columns (4) and (5), we see that the effect of unskilled foreign employment has no impact on the export mode of the firm, since the coefficients for total and unskilled foreign employment are not significant.

In each specification, the size of the firm still has a significantly negative impact on the probability to export indirectly, which corroborates previous studies on trade intermediation.

Finally, we perform a Wald test of the exogeneity of the instrumented variable. Results are reported at the bottom of the table. The test is never significant; thus, we cannot reject the null hypothesis. In other words, the test does not allow us to conclude on the presence of an endogeneity bias due to reverse causality.

**Second-stage estimates**

The second-stage results are reported in Table 5. Column (1) shows that conditional on the firm's export-mode decision, the employment of foreign skilled workers positively determines the export value. In column (2), we control for firms having more than 50% of their long-term buyers located inside Viet Nam. In column (3), we control for firms which are also indirect importers. Our previous findings remain unchanged for both specification. Then, columns (4) and (5) show that the effect of foreign employment on the export value is mainly driven by skilled individuals.

Previous results regarding control variables related to the firm size are also unchanged. For each specification except in column (3) which controls for the import status in the first-stage regression,

the inverse Mills ratio is positive and significant, showing the relevance of using a two-stage Heckman selection model.

We perform an Durbin endogeneity test to see whether foreign employment could be treated as an exogenous variable. Results are reported at the bottom of the table. As the test is significant when we consider skilled foreign workers (columns 1 to 3), we must continue to treat this variable as endogenous. We also perform a Hansen J-test. The test is never significant which confirms the orthogonality of at least one instrument.

### 5.4 Robustness tests

We perform three robustness checks which results are reported in Appendix. Hereafter, we compare the results we obtain with our baseline estimates presented in column (4) of Tables 2 and 3, and in column (1) of Tables 4 and 5.

First, we use a broader definition of indirect and direct exporters. We now define $M$ as a binary variable equal to one if the firm exports at least 90% of its total exports indirectly ($sh_i \geq 0.9$) and zero if the firm exports at least 90% of its total exports directly ($sh_i \leq 0.1$). This broader definition allows us to slightly increase our sample from 497 to 508 observations. The first- and second-stage results using a standard Heckman selection model are reported in column (1) of Tables 9 and 10 respectively. Results using a Heckman model including instrumental variables are presented in column (1) of Tables 11 and 12. For both empirical strategies, the results are fully in line, both in terms of significance and magnitude, with our baseline estimates.

Second, we use the total value of stocks (in logarithm) as an alternative measure of the firm size. Results are reported in column (2) of Tables 9, 10, 11 and 12. In line with what we expected, the size of the firm plays a negative and significant impact on the probability to export indirectly and a positive impact on the export value, whether we use the total assets of the firm (as in the baseline specification) or its stocks.

Lastly, we control for outliers by excluding the top-5% of the distribution of firms in terms of assets. Results are reported in column (3) of Tables 9, 10, 11 and 12. Excluding the largest firms does not change the impact of the size of the firm on its export-mode decision and its export value. The coefficients associated to foreign employment prove to be robust as well.

## 6 Conclusion

In this paper, we analyze whether foreign employment impacts the decision of the firm to export either directly or indirectly and its export value. To this end, we first develop a heterogeneous firm model with an intermediation technology in line with Ahn et al. (2011). The model predicts that, at the extensive margin, foreign workers should favor indirect over direct exports, as long as the benefit to export directly toward a given destination is lower than the gain realized by accessing all

Table 4: Heckman model with IV - Estimation of the *selection* equation

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Skilled foreign empl. | 0.328$^a$ | 0.445$^a$ | 0.354$^a$ | | |
| | (0.101) | (0.166) | (0.096) | | |
| Assets | -0.213$^a$ | -0.293$^a$ | -0.216$^a$ | -0.178$^a$ | -0.130$^b$ |
| | (0.066) | (0.091) | (0.067) | (0.066) | (0.063) |
| MNE | -0.667$^a$ | -0.430 | -0.763$^a$ | -0.477$^c$ | -0.090 |
| | (0.245) | (0.339) | (0.236) | (0.287) | (0.232) |
| Export destination nr. | -0.578$^b$ | -0.647$^b$ | -0.618$^b$ | -0.607$^b$ | -0.465 |
| | (0.275) | (0.305) | (0.269) | (0.277) | (0.297) |
| Age | 0.260 | 0.480$^b$ | 0.291 | 0.215 | 0.122 |
| | (0.192) | (0.212) | (0.191) | (0.188) | (0.187) |
| Mono-product | -0.038 | 0.113 | -0.054 | -0.036 | -0.055 |
| | (0.189) | (0.237) | (0.192) | (0.188) | (0.179) |
| Population | 0.063 | 0.335 | 0.021 | 0.058 | 0.017 |
| | (0.146) | (0.205) | (0.151) | (0.145) | (0.137) |
| Poverty rate | -0.095 | -0.284 | -0.151 | -0.076 | -0.040 |
| | (0.130) | (0.173) | (0.132) | (0.129) | (0.123) |
| Domestic network of buyers | | 1.078$^a$ | | | |
| | | (0.268) | | | |
| Indirect importer | | | -0.336 | | |
| | | | (0.242) | | |
| Foreign empl. | | | | 0.164 | |
| | | | | (0.125) | |
| Unskilled foreign empl. | | | | | -0.438 |
| | | | | | (0.397) |
| Constant | 2.263 | -0.585 | 2.961$^c$ | 1.890 | 1.268 |
| | (1.610) | (2.005) | (1.712) | (1.648) | (1.582) |
| Sector FE | yes | yes | yes | yes | yes |
| Province FE | no | no | no | no | no |
| Export-destination FE | yes | yes | yes | yes | yes |
| Survey-year FE | yes | yes | yes | yes | yes |
| Observations | 497 | 331 | 497 | 497 | 498 |
| Wald test | 0.276 | 0.924 | 0.111 | 0.632 | 0.272 |

Note: This table provides IV-Probit estimates for equation (29). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.

Table 5: Heckman model with IV - Estimation of the *response* equation

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Skilled foreign empl. | 0.461$^a$ | 0.582$^a$ | 0.412$^a$ | | |
| | (0.095) | (0.106) | (0.096) | | |
| Assets | 0.475$^a$ | 0.412$^a$ | 0.522$^a$ | 0.509$^a$ | 0.536$^a$ |
| | (0.079) | (0.090) | (0.078) | (0.073) | (0.069) |
| MNE | -0.615$^a$ | -0.572$^a$ | -0.511$^a$ | -0.421$^b$ | -0.001 |
| | (0.197) | (0.213) | (0.197) | (0.169) | (0.123) |
| Age | -0.017 | 0.188 | -0.051 | -0.062 | -0.097 |
| | (0.115) | (0.149) | (0.111) | (0.109) | (0.107) |
| Population | 0.173$^b$ | 0.234$^c$ | 0.160$^c$ | 0.167$^c$ | 0.140 |
| | (0.087) | (0.133) | (0.087) | (0.086) | (0.086) |
| Poverty rate | -0.235$^a$ | -0.337$^a$ | -0.229$^a$ | -0.208$^a$ | -0.201$^a$ |
| | (0.078) | (0.097) | (0.081) | (0.077) | (0.078) |
| Foreign empl. | | | | 0.288$^a$ | |
| | | | | (0.069) | |
| Unskilled foreign empl. | | | | | -0.144 |
| | | | | | (0.117) |
| Inverse Mills ratio | 0.595$^b$ | 0.588$^a$ | 0.356 | 0.578$^b$ | 0.778$^b$ |
| | (0.288) | (0.131) | (0.259) | (0.281) | (0.306) |
| Constant | 7.174$^a$ | 5.779$^a$ | 6.853$^a$ | 6.811$^a$ | 6.406$^a$ |
| | (1.078) | (1.491) | (1.089) | (1.068) | (1.093) |
| Sector FE | yes | yes | yes | yes | yes |
| Province FE | no | no | no | no | no |
| Export-destination FE | yes | yes | yes | yes | yes |
| Survey-year FE | yes | yes | yes | yes | yes |
| Observations | 497 | 331 | 497 | 497 | 498 |
| R-squared | 0.453 | 0.437 | 0.455 | 0.460 | 0.463 |
| Durbin test | 0.003 | 0.000 | 0.014 | 0.077 | 0.208 |
| Hansen-J test | 0.708 | 0.271 | 0.677 | 0.674 | 0.944 |

Note: This table provides IV-2SLS estimates for equation (30). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.

other destinations indirectly. The prediction is therefore ambiguous. At the intensive margin, we find that foreign employment should foster more direct than indirect exporters.

We test these predictions using a sample of foreign and domestic firms collected through the Viet Nam Industry Investor Survey 2010 by the UNIDO. We implement a two-stage Heckman sample selection model in order to account for the fact that the export value of a firm may be conditioned by its selection into a specific export-mode. We find a robust impact of employing skilled foreign workers on the probability of a firm to be an indirect exporter. We also corroborate the fact that firms with a large distribution network abroad sort into direct exports, while firms saving on these fixed costs sort into indirect exports. Finally, we find that conditional on the export mode of the firm, the employment of skilled foreign workers positively and significantly determines its export value. Our findings are robust to the use of an IV procedure to control for reverse causality and to a number of robustness tests.

Our results are quite instructive on the role of foreign workers on the firm export-mode decisions. It goes beyond the existing literature by looking at indirect exports, while most studies only consider direct exports. Nonetheless, further research could try to further identify who these foreign workers are, and the mechanisms through which they affect the decisions of their firm.

In the light of the available empirical literature, our results imply a number of policy recommendations. Trade intermediation presents a potential for welfare improvement (Akerman, forthcoming). Yet, indirect exports in Viet Nam do not represent a large share of total exports, as it is the case in a number of middle income countries, for instance in China and Turkey (Abel-Koch, 2013; Ahn et al., 2011). Thus, there seems to be a potential to improve export-led growth thanks to indirect exports in Viet Nam. Our results suggest that such a commercial policy could include a pro-active immigration policy that would favor foreign employment by manufacturing firms.

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# Appendix

Table 6: Correlation matrix - instruments for skilled foreign employment

| | (a) | (b) | (c) | (d) | (e) | (f) |
|---|---|---|---|---|---|---|
| (a) $M$ (indirect export dummy) | 1.000 | | | | | |
| (b) $v$ (export value) | -0.083 | 1.000 | | | | |
| (c) Skilled foreign empl. | 0.026 | 0.318 | 1.000 | | | |
| (d) Province skilled foreign empl. | -0.036 | -0.041 | 0.110 | 1.000 | | |
| (e) Sector skilled foreign empl. | -0.001 | 0.032 | 0.077 | -0.038 | 1.000 | |
| (f) Province internal migration rate | 0.040 | -0.053 | -0.148 | -0.374 | 0.031 | 1.000 |

Table 7: Correlation matrix - instruments for total foreign employment

| | (a) | (b) | (c) | (d) | (e) | (f) |
|---|---|---|---|---|---|---|
| (a) $M$ (indirect export dummy) | 1.000 | | | | | |
| (b) $v$ (export value) | -0.083 | 1.000 | | | | |
| (c) Foreign empl. | 0.020 | 0.308 | 1.000 | | | |
| (d) Province foreign empl. | -0.028 | -0.048 | 0.113 | 1.000 | | |
| (e) Sector foreign empl. | 0.031 | -0.001 | 0.004 | 0.061 | 1.000 | |
| (f) Province internal migration rate | 0.040 | -0.053 | -0.144 | -0.255 | 0.117 | 1.000 |

Table 8: Correlation matrix - instruments for unskilled foreign employment

| | (a) | (b) | (c) | (d) | (e) | (f) |
|---|---|---|---|---|---|---|
| (a) $M$ (indirect export dummy) | 1.000 | | | | | |
| (b) $v$ (export value) | -0.083 | 1.000 | | | | |
| (c) Unskilled foreign empl. | -0.010 | 0.101 | 1.000 | | | |
| (d) Province unskilled foreign empl. | 0.005 | -0.059 | 0.040 | 1.000 | | |
| (e) Sector unskilled foreign empl. | 0.066 | -0.064 | 0.030 | 0.198 | 1.000 | |
| (f) Province internal migration rate | 0.040 | -0.050 | -0.050 | 0.170 | 0.146 | 1.000 |

Table 9: Heckman model - Estimation of the *selection* equation - Robustness tests

| | (1) | (2) | (3) |
|---|---|---|---|
| Skilled foreign empl. | 0.246$^a$ | 0.206$^b$ | 0.257$^b$ |
| | (0.0919) | (0.100) | (0.0998) |
| Assets | -0.188$^a$ | | -0.174$^b$ |
| | (0.0632) | | (0.0742) |
| MNE | -0.523$^b$ | -0.613$^b$ | -0.574$^b$ |
| | (0.232) | (0.254) | (0.238) |
| Export destination nr. | -0.529$^b$ | -0.736$^b$ | -0.568$^b$ |
| | (0.266) | (0.309) | (0.275) |
| Age | 0.234 | 0.229 | 0.223 |
| | (0.190) | (0.211) | (0.196) |
| Mono-product | 0.0365 | -0.0964 | -0.0594 |
| | (0.184) | (0.195) | (0.193) |
| Population | 0.0361 | 0.0384 | 0.0579 |
| | (0.143) | (0.159) | (0.146) |
| Poverty rate | -0.104 | -0.131 | -0.0851 |
| | (0.127) | (0.143) | (0.129) |
| Stocks | | -0.106$^a$ | |
| | | (0.0381) | |
| Constant | 2.004 | 1.157 | 1.819 |
| | (1.590) | (1.656) | (1.671) |
| Sector FE | yes | yes | yes |
| Province FE | no | no | no |
| Export-destination FE | yes | yes | yes |
| Survey-year FE | yes | yes | yes |
| Observations | 508 | 469 | 474 |

Note: This table provides Probit estimates for equation (29). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.

Table 10: Heckman model - Estimation of the *response* equation - Robustness tests

| | (1) | (2) | (3) |
|---|---|---|---|
| Skilled foreign empl. | 0.391$^a$ | 0.625$^a$ | 0.378$^a$ |
| | (0.0942) | (0.0829) | (0.0877) |
| Assets | 0.468$^a$ | | 0.501$^a$ |
| | (0.0919) | | (0.0860) |
| MNE | -0.518$^b$ | -0.758$^a$ | -0.534$^a$ |
| | (0.210) | (0.215) | (0.207) |
| Age | -0.0278 | 0.236$^c$ | -0.0236 |
| | (0.114) | (0.125) | (0.0944) |
| Population | 0.145$^c$ | 0.216$^b$ | 0.143$^c$ |
| | (0.0842) | (0.108) | (0.0770) |
| Poverty rate | -0.243$^a$ | -0.157 | -0.166$^b$ |
| | (0.0826) | (0.0992) | (0.0750) |
| Stocks | | 0.115$^c$ | |
| | | (0.0594) | |
| Inverse Mills ratio | 0.791$^b$ | 1.175$^a$ | 0.736$^b$ |
| | (0.382) | (0.321) | (0.348) |
| Constant | 7.325$^a$ | 10.93$^a$ | 6.761$^a$ |
| | (1.187) | (1.071) | (1.111) |
| Sector FE | yes | yes | yes |
| Province FE | no | no | no |
| Export-destination FE | yes | yes | yes |
| Survey-year FE | yes | yes | yes |
| Observations | 508 | 469 | 474 |
| R-squared | 0.469 | 0.284 | 0.432 |

Note: This table provides OLS estimates for equation (30). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.

Table 11: Heckman model with IV - Estimation of the *selection* equation - Robustness tests

| | (1) | (2) | (3) |
|---|---|---|---|
| Skilled foreign empl. | 0.303$^a$ | 0.287$^a$ | 0.338$^a$ |
| | (0.102) | (0.103) | (0.102) |
| Assets | -0.200$^a$ | | -0.192$^a$ |
| | (0.0642) | | (0.0737) |
| MNE | -0.597$^b$ | -0.724$^a$ | -0.673$^a$ |
| | (0.248) | (0.267) | (0.245) |
| Export destination nr. | -0.528$^b$ | -0.744$^b$ | -0.568$^b$ |
| | (0.265) | (0.307) | (0.272) |
| Age | 0.248 | 0.247 | 0.244 |
| | (0.187) | (0.208) | (0.192) |
| Mono-product | 0.0350 | -0.103 | -0.0611 |
| | (0.184) | (0.195) | (0.192) |
| Population | 0.0422 | 0.0410 | 0.0676 |
| | (0.143) | (0.160) | (0.146) |
| Poverty rate | -0.108 | -0.137 | -0.0900 |
| | (0.127) | (0.143) | (0.129) |
| Stocks | | -0.113$^a$ | |
| | | (0.0380) | |
| Constant | 2.134 | 1.256 | 1.994 |
| | (1.584) | (1.630) | (1.648) |
| Sector FE | yes | yes | yes |
| Province FE | no | no | no |
| Export-destination FE | yes | yes | yes |
| Survey-year FE | yes | yes | yes |
| Observations | 508 | 469 | 474 |
| Wald test | 0.345 | 0.147 | 0.160 |

Note: This table provides IV-Probit estimates for equation (29). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.

Table 12: Heckman model with IV - Estimation of the *response* equation - Robustness tests

| | (1) | (2) | (3) |
|---|---|---|---|
| Skilled foreign empl. | 0.463$^a$ | 0.743$^a$ | 0.455$^a$ |
| | (0.0913) | (0.0935) | (0.0959) |
| Assets | 0.482$^a$ | | 0.491$^a$ |
| | (0.0755) | | (0.0763) |
| MNE | -0.571$^a$ | -0.860$^a$ | -0.608$^a$ |
| | (0.187) | (0.227) | (0.200) |
| Age | -0.0383 | 0.235$^c$ | -0.0140 |
| | (0.113) | (0.128) | (0.0962) |
| Population | 0.151$^c$ | 0.215$^c$ | 0.153$^b$ |
| | (0.0854) | (0.110) | (0.0778) |
| Poverty rate | -0.242$^a$ | -0.160 | -0.173$^b$ |
| | (0.0783) | (0.0993) | (0.0737) |
| Stocks | | 0.122$^b$ | |
| | | (0.0561) | |
| Inverse Mills ratio | 0.598$^b$ | 1.011$^a$ | 0.689$^b$ |
| | (0.282) | (0.287) | (0.292) |
| Constant | 7.296$^a$ | 11.00$^a$ | 6.889$^a$ |
| | (1.081) | (1.133) | (1.034) |
| Sector FE | yes | yes | yes |
| Province FE | no | no | no |
| Export-destination FE | yes | yes | yes |
| Survey-year FE | yes | yes | yes |
| Observations | 508 | 469 | 474 |
| R-squared | 0.456 | 0.262 | 0.421 |
| Durbin test | 0.003 | 0.001 | 0.011 |
| Hansen-J test | 0.619 | 0.379 | 0.702 |

Note: This table provides IV-2SLS estimates for equation (30). Robust standard errors are shown in parentheses. The superscripts $a$, $b$ and $c$ respectively denote significance at the 1%, 5% and 10% levels.