

## Foreign investment and female employment in Viet Nam<sup>+</sup>

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This paper investigates how the interplay between foreign direct investment (FDI) and the availability of technology affects labour market outcomes for women in Viet Nam. Using household surveys, we explore the relationship between industrial exposure to FDI, access to technology, and employment and wages. We find that FDI is associated with increases in employment and wages *by more* in high-technology areas of the country. In areas of the country with weak technology, foreign investment is associated with lower employment and lower wages, particularly for men. Together, these results highlight the importance of absorptive capacity; that is, to truly benefit from foreign investment, the domestic economy needs a sound education system and established technology. We also find that an equal increase in foreign investment in high-tech provinces is associated with larger increases in top wages for men than for women. In general, these results suggest that foreign investment may be associated with a rising gender wage gap at the high end of the wage distribution.

**Keywords:** FDI, gender wage gap, information technology, skills, Viet Nam

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## 1. Introduction

Attracting foreign direct investment (FDI) is at the forefront of economic policies in many developing countries, supported by the academic literature, which shows that FDI increases productivity and economic growth, among other outcomes.<sup>1</sup> In addition, many developing countries have experienced increases in the availability of computing technologies in the past few decades. The technology available in a host country can facilitate the development and contribution of FDI to the local economy. Meanwhile, there is widespread concern that technological progress and foreign investment in some sectors or industries may displace lower-skilled workers.<sup>2</sup> Furthermore, as women constitute the bulk of the world's poor and tend to work in lower-skilled and more vulnerable jobs, economic policy must address the differential impact of FDI and technology on women relative to men.

This paper investigates how industry-specific FDI is associated with labour market outcomes for women in Viet Nam. We further inquire about how the association between FDI and the labour market may vary across provinces that have different degrees of access to computing technology. As multinational enterprises may benefit from pre-existing technologies in the host country, we hypothesize that these two economic forces have an interactive effect on the labour market, and particularly on outcomes specific to women.

The paper relies on household surveys from Viet Nam and annual greenfield foreign investment data from the United Nations Conference on Trade and Development (UNCTAD) to explore local (industry-province-time) variation in labour market outcomes, such as employment, wages, and the wage gap between the 90<sup>th</sup> and 10<sup>th</sup> percentiles of the wage distribution. To alleviate concerns that local labour market outcomes could drive foreign investment, we lag the key FDI variable by two years. Furthermore, our main estimations progressively control for industry, province, and year fixed effects to capture time-invariant factors, such as the industry's unobserved underlying productivity, the province's unobserved level of development and the average effect of Viet Nam's many policy reforms over this time period. In addition, our analysis controls for several time-varying variables at the province and industry levels. In the most stringent specification, we also control for province-by-year fixed effects to capture all provincial time-varying factors. Our results are robust when we use alternative measures for computing technology and FDI.

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<sup>1</sup> For example, see Djankov and Hoekman (2000), Conyon, et al. (2002), Girma and Gorg (2007), and Arnold and Javorcik (2009).

<sup>2</sup> See, for example, Acemoglu and Autor (2011) for the United States, and Almeida, Corseuil, and Poole (2019) for a developing country context.

Our results suggest that in provinces with low access to computers, FDI is associated with a decrease in employment and average wages. The decreases in average wages appear to be driven by decreases in wages at the top of the wage distribution (90th percentile). By contrast, in high-tech provinces, FDI is associated with a differential increase in employment, average wages, and the 90th percentile of wages.

Importantly, these results differ somewhat between men and women. While both women and men see large relative increases in employment and average wages in high-tech provinces following investment liberalization, the increases in wages for women are driven by relative increases in the 10th percentile of the distribution, while for men the increases in average wages are driven by increases at the 90th percentile of the wage distribution. Together, these results provide suggestive evidence that the employment expansion for women (relative to men) with increased foreign investment is in lower-wage, low-skilled jobs.

The rest of this paper is organized as follows. Section 2 presents brief background information on Viet Nam's main economic reforms leading to significant FDI attraction and changes in the labour market, particularly for women. In section 3, we review the literature on FDI and technology. In section 4, we present our main data and descriptive statistics. Section 5 presents our preferred reduced-form empirical model. Section 6 describes and discusses our main results, and we offer conclusions and policy implications in section 7.

## **2. Background**

Viet Nam launched important reforms under the Doi Moi renovation plan in 1986. The plan formally shifted the economy toward a new economic strategy, based on integration in global markets, export diversification, and the attraction of FDI. The open economy approach evolved jointly with national development strategies centred on agricultural development, light industrialization, and a continued role for State-owned enterprises, meanwhile encouraging growth of the private sector (Thoburn, 2013).

Before 2007, FDI was prohibited in a number of sectors mostly related to national security and the financial sector, such as national defence, insurance, banking, and other services. The reforms led to a significant increase in FDI inflows and greenfield projects. Moreover, in preparation for its accession to the World Trade Organization (WTO) in 2007, Viet Nam significantly reduced restrictions on FDI and allowed merger and acquisition activity (UNCTAD, 2008). Viet Nam continues to be a major host economy for FDI, driving the growth of foreign investment inflows in South-East Asia, alongside Singapore, Indonesia, and Thailand. Processing and manufacturing still represent the lion's share of FDI into the country, although FDI

into tourism, heavy industry, and real estate has been increasing in recent years. Strong investment within the Association of Southeast Asian Nations (ASEAN), as well as investment from other Asian economies, contributed to this performance (UNCTAD, 2019). FDI in Viet Nam has supported the rapid development of the export-oriented manufacturing sector, created more than one million jobs, offered higher-than-average wages, generated high levels of exports, transferred knowledge and skills, and accounted for a significant portion of tax revenue (UNCTAD, 2008).

Employment of women in Viet Nam was fostered by economic reforms and education policies targeting gender equality (IMF, 2018). The reforms were accompanied by the overhaul of the education system – Education for All – that has been sustained over time. Viet Nam stands out in terms of female participation in the labour force and is one of the few Asian countries that has thrived in reaching gender parity in educational attainment and equal participation in the labour force (see Goldin and Olivetti (2012) and UN Women (2016)). Moreover, Viet Nam’s national development plan, and the ASEAN comprehensive economic integration agreement, emphasize skills development for modern industry. Despite impressive basic literacy and numeracy achievements, there is still a skill shortage in the job market. For instance, numerous firms report a shortage of workers with the necessary technical skills. Also, firms are increasingly demanding cognitive skills, such as problem-solving and critical thinking, as well as behavioural skills in non-manual tasks (World Bank, 2014).

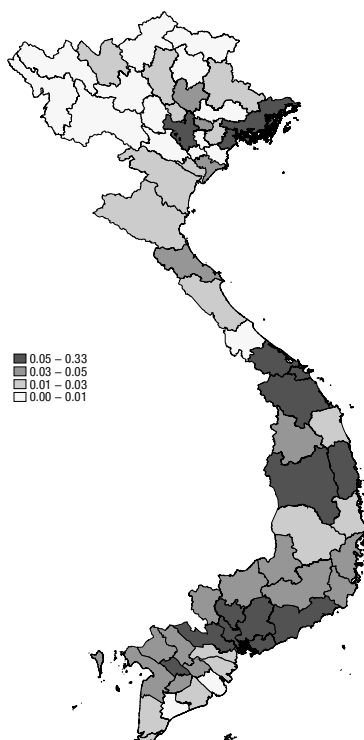
Foreign investment has been an important source of job creation, including for women, and has allowed the insertion of women into the formal labour force. Foreign firms employ a higher percentage of women than national companies and State-owned enterprises, partly as a result of the high level of employment in trade-oriented industries such as apparel and footwear. For instance, the 2016 policy report of the UN Women Viet Nam Country Office states that wage employment offers comparatively more favourable conditions to women workers, in particular, if they are employed in the public sector or foreign-owned enterprises. The main export-oriented manufacturing industries are female-intensive. Either they were female-intensive to start with (garments) or are increasingly becoming so (electronics and vehicle parts).

Viet Nam has also strengthened its legal framework to guarantee equality and non-discriminatory practices in the labour market, which explains the relative success in bringing high-skilled women into the workforce. The country has also propelled generous family-friendly laws regarding childcare and maternity. However, gaps and regional imbalances persist in terms of more secure economic alternatives for women with low levels of formal education and from disadvantaged rural regions and for women from ethnic minority groups (UN Women, 2016).

Despite high growth rates and poverty reduction resulting from the major reforms and institutional developments, gains have not spread homogenously. Consequently, income inequality has increased between and within regions of the country. Structural transformation from agriculture to manufacturing is heterogeneous by region, and this likely contributes to unequal growth (Sarma et al., 2017). Moreover, the observed increases in inequality in incomes and opportunities may be explained by changing patterns of employment, for both men and women – specifically, employment shifting away from agriculture and away from lower-skill jobs to higher-skill and higher-productivity non-farm jobs (IMF, 2016).

Concerning technology adoption, Viet Nam has only limited technological infrastructure, including access to computers, and faces other impediments to productivity, such as the high cost of internet access. Recently, however, the share of the population that has a personal computer has been rising, albeit with significant variation across provinces, with northern provinces still lagging behind (figure 2.1). In terms of access to computers in Asia, the country ranks just behind Malaysia and China (WDI, 2016). Technology adoption, skills and access to finance have been noted as key impediments to firm performance in the country (World Bank, 2014).

**Figure 2.1: Computer coverage in Viet Nam, 2004 (percentage of households)**



Source: VHLSS.

### 3. Literature review

This section reviews the literature on the impact of technology and FDI on female labour market outcomes in Viet Nam. To the best of our knowledge, not many papers address the interaction between FDI and technological capability, and even fewer take the perspective of women. Thus, evidence-based research on this topic will help inform policy in local governments and international organizations to prioritize the expansion of socially responsible foreign investment.

The impact of FDI on labour outcomes in Viet Nam has been analysed from different angles, mostly focusing on the effects on wages and productivity. Fukase (2013) shows that foreign firms pay higher wages than domestic firms. These foreign wage premia are larger for highly educated workers and are partially explained by longer working hours. Looking at gender outcomes, Fukase (2013) shows that unskilled women experience a larger foreign wage premium than unskilled men.

Newman et al. (2015) study the relationship between FDI and the productivity of Viet Nam's domestic firms, although the paper does not assess gender-related specific outcomes. The paper relies on a unique survey of over 4,000 manufacturing firms in Viet Nam, and distinguishes between productivity gains along the supply chain (i.e., direct transfers of knowledge and technology among linked firms) and productivity effects through indirect FDI productivity spillovers. The paper provides evidence of productivity gains through forward linkages for domestic firms which receive inputs from foreign-owned firms.

Coniglio et al. (2017) show that, compared with domestic firms, foreign firms create more employment opportunities for unskilled female workers, pay lower average wages (for both male and female workers) and widen the gender wage gap. Coniglio and Hoxhaj (2018) report similar findings on employment and wages. They also find that foreign firms significantly reduced the gender wage gap among unskilled workers but had only limited effects on gender wage gaps in employment for skilled workers.

As far as technology and the labour market is concerned, the demand for educated, skilled labour is associated with recent technological developments, which contribute to the rising skill premium. Sakellariou and Patrinos (2003) study the impact of computer use on wages in Viet Nam, as well as the determinants of computer use. Higher-educated workers experience larger average annual wage increases with computer use than do lower-skilled workers, leading to growing wage inequality. Konstadakopoulous (2005) studies the characteristics of firms adopting technology and assesses whether adoption leads to greater regional cooperation. The study finds that significant penetration of information and communications technology are limited to export-oriented sectors based in more urban areas, where the share of people with an internet connection is higher.

The information technology industry has received high levels of foreign investment in Viet Nam. The country is an attractive destination because of the relatively low wages and operating costs (Shillabeer, 2013), combined with a young workforce that has growing technological and scientific skills, as well as a high percentage of English speakers (Thangvelu, 2013). The impact of increased investment in information technology has relatively benefited Viet Nam's younger population who see the opportunity for higher wages and the heightened social status of working for a foreign company (Shillabeer, 2013).

## 4. Data

We build panel data for province-industry observations from several main data sources. Data on employment and access to computing technology come from household surveys. To measure levels of FDI, we use greenfield investment information from UNCTAD.

### 4.1. Household data

We use five waves of the Viet Nam Household Living Standards Surveys (VHLSS) – every two years from 2006 to 2014. Survey samples are representative at the national level and are stratified geographically. The survey is conducted for households from the 63 provinces, which constitute eight geographical regions of the country. Every survey wave consists of questions asked about the household in general, and about individual members of the household.

**Labour market outcomes.** Our main dependent variables of interest are employment, wages, and the wage gap between the 90<sup>th</sup> and the 10<sup>th</sup> percentiles of the wage distribution. We use individual member survey information on the industry of employed people.<sup>3</sup> An individual's industry is defined by the main product and industry code of his or her salaried employment. The industrial classification in the VHLSS follows the International Standard Industrial Classification (ISIC), with increasing disaggregation over time. For a time-consistent classification of industries, we use the aggregate two-digit ISIC, Revision 3, as the benchmark classification, similar to the approach in McCaig (2011).

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<sup>3</sup> A limitation of our data and analysis is that we cannot distinguish between individuals working at foreign firms and individuals working in domestic firms. Although the VHLSS does ask a question about what kind of firm a worker is employed in, only a very small percentage of workers respond to this question, so the data are more flawed than helpful in this respect. We view this as an avenue for future research.

**Table 4.1: Summary statistics**

	Mean	Standard Deviation	Minimum	Maximum
Total Employment	14	37	1	416
Average Wage	26,260	23,050	440	328,404
10 <sup>th</sup> percentile Wage	18,534	20,472	0	328,404
90 <sup>th</sup> percentile Wage	35,940	34,932	440	541,800
Wage Gap	3.8	8.4	1.0	245.5
Computer Share (2004)	0.100	0.061	0.000	0.300
FDI Value (USD Millions)	306	847	0	7 673

Sources: VHLSS (2004-2014); UNCTAD.

Notes: Wage variables are in thousands of VND.

We aggregate across all workers employed in a province and an industry in each survey year. Table 4.1 offers simple descriptive statistics on the main variables of interest during our study period, from 2006 to 2014. The average number of employees per industry and province is about 14. Average annual earnings are about VND 26 million (approximately \$1,300), with a standard deviation of about VND 23 million. The ratio between the 90th and the 10th percentiles in wages is 3.8.

**Technology.** The VHLSS asks households about whether they have a computer at home, information that we rely on to create a province-specific share of households that own a computer. To alleviate concerns about the endogeneity of the computing technology variable, we rely on a time-invariant, pre-period (or 2004) measure of access to computers around the country. Figure 2.1 plots the distribution of the main technology variable across the country's provinces. Table 4.1 shows that, on average, only 10 per cent of households had a computer at home in 2004. Yet access to computers varies greatly across provinces, with some provinces having no households that own a computer and others provinces having about one-third of households reporting owning a computer.

**Controls.** We also rely on the VHLSS to generate important province-by-time and industry-by-time control variables. Specifically, we create measures related to the share of households in the province that are among the ethnic minority, the share of households in the province that are in urban areas, and the age composition of the population of the province. We also characterize the educational composition of employment in the industry.

## 4.2. FDI data

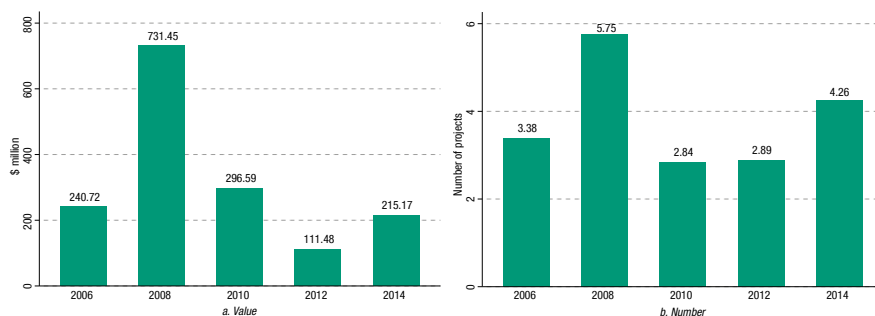
To measure levels of FDI, we use annual greenfield investment data at the two-digit industry level from UNCTAD. Greenfield investment is a type of FDI through which



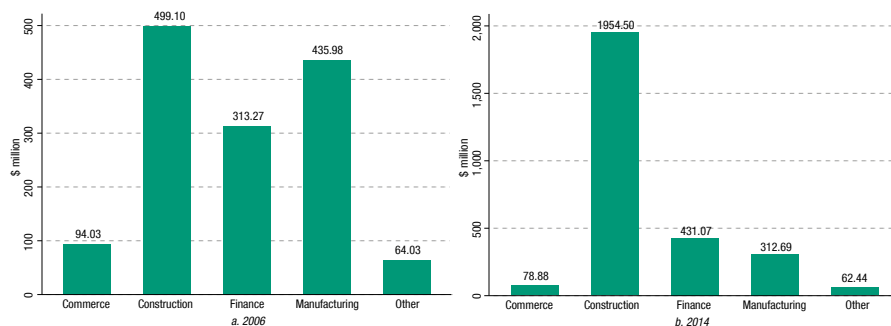
foreign parent companies create a new subsidiary in a host country from the ground up, rather than merging with or buying existing businesses in the host country. The greenfield data report the number of announced greenfield projects and the value in millions of dollars for each industry in each year. As is reported in table 4.1, the average value of greenfield FDI in Viet Nam during our time period was \$306 million, though the maximum value for a single project reached \$7.7 billion.

Figure 4.1 shows that greenfield investment in Viet Nam has fluctuated over the years, with the highest average amount of \$731 million and an average of six projects per industry received in 2008 after Viet Nam joined the WTO.<sup>4</sup> Construction receives the highest value of greenfield investment (figure 4.2), while finance receives the highest number of projects (figure 4.3).

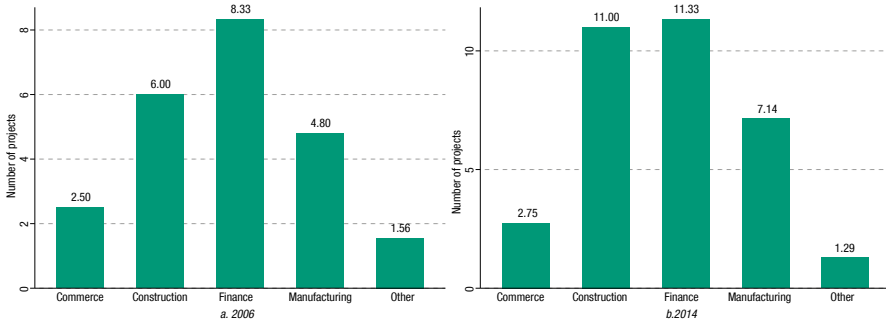
**Figure 4.1: Foreign direct investment announced greenfield projects, by value and number, 2006–2014**



**Figure 4.2: Foreign direct investment values, by industry, 2006 and 2014**



<sup>4</sup> In 2008, Viet Nam received record foreign investment, as it became an increasingly attractive location for FDI in labour-intensive manufacturing and other industrial activities. The increase in investment reflects increases in investor confidence in the country's long-term growth prospects (UNCTAD 2011). Finally, several incentive programmes to encourage foreign investment may have played a role in attracting foreign investment projects. We re-estimated the model, and the results were robust to the exclusion of 2008.

**Figure 4.3: Foreign direct investment projects, by industry, 2006 and 2014**

## 5. Empirical methodology

Our goal in this paper is to uncover how FDI and technology are associated with labour market outcomes for women. As noted, we rely on pre-reform, province-specific information on computing technology and industry-specific information on exposure to FDI and begin with the following framework:

$$y_{kpt} = \gamma_1 (FDI_{k(t-2)} * TECH_{p, 2004}) + \beta_1 FDI_{k(t-2)} + \varphi_k + \varphi_p + \delta_t + X_{pt} + X_{kt} + \varepsilon_{kpt} \quad (1)$$

where  $k$  indexes the industry,  $p$  indexes the provincial location, and  $t$  indexes time from 2006 to 2014.

We relate the industry-by-province labour market outcomes ( $y_{kpt}$ ), defined as the logarithm of employment, average wages, and the wage gap between the 90<sup>th</sup> percentile and 10<sup>th</sup> percentile of the wage distribution to the industry, provincial-, and time-varying variables of interest. In this setting,  $FDI_{k(t-2)}$  represents the logarithm of the value of FDI projects plus 1 in industry  $k$  and lagged survey wave. We lag the variable FDI to alleviate simultaneity concerns that the local labour market outcomes may drive FDI investment. The variable  $TECH_{p, (2004)}$  denotes the share of households in province  $p$  and in a pre-reform time period (2004) that own a computer. We examine the technology variable in 2004, two years before the main data analysis in order to alleviate concerns about the endogeneity of the computing technology variable. This pre-period level of technology across provinces is our proxy for the baseline level of development, technology, and absorptive capacity of the province.<sup>5</sup>

<sup>5</sup> Other sources of heterogeneity across provinces may be picked up by the computer access variable. However, given that we rely on the pre-reform differences across provinces in access to technology and include province-by-year fixed effects, we believe most of the cross-province differences are well accounted for.

Our baseline estimation also includes industry fixed effects ( $\varphi_k$ ) to capture time-invariant factors, such as the industry's unobserved underlying productivity, and province fixed effects ( $\varphi_p$ ) to capture the province's unobserved level of development, which may influence both the labour market outcomes and the likelihood of access to information technology. By controlling for province fixed effects, we absorb the coefficient on the pre-existing level of computing technology. We also include year-specific dummies ( $\delta_t$ ) to control for the average effect of Viet Nam's many policy reforms over this time period.  $X_{pt}$  are time-varying provincial control variables related to the share of households in the province that are among the ethnic minority, the share of households in the province in urban areas, and the age composition of the population in the province.  $X_{kt}$  characterizes the educational composition of employment in the industry. In the most stringent specification, we also control for province-by-year fixed effects to capture all time-varying differences across provinces.

## 6. Results

Table 6.1 reports results from the ordinary least squares estimation of a variation of equation (1) in section 5, in which we include industry-by-year controls, industry fixed effects and province-by-year fixed effects as the most robust specification for all workers. We perform the analysis for five main dependent variables: log employment, log of average wages, log of the 10<sup>th</sup> percentile of the wage distribution, log of the 90<sup>th</sup> percentile of the wage distribution, and log of the wage gap between the 90<sup>th</sup> and the 10<sup>th</sup> percentile of the wage distribution. Table 6.2 reports the results for labour market outcomes for women, while table 6.3 reports results for labour market outcomes for men. Figures 6.1 to 6.5 plot the marginal effects of foreign investment on the five outcomes at different pre-existing levels of computing technology.<sup>6</sup> In what follows, we first consider the implications of foreign investment and technology on employment, then wages and finally the wage gap. The analysis considers all workers and then the differential effects on women and men.

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<sup>6</sup> The 1<sup>st</sup>, 10<sup>th</sup>, 50<sup>th</sup>, 90<sup>th</sup>, and 99<sup>th</sup> percentiles of access to computing technology correspond to 0 per cent, 0.9 per cent, 3 per cent, 13 per cent, and 30 per cent, respectively.

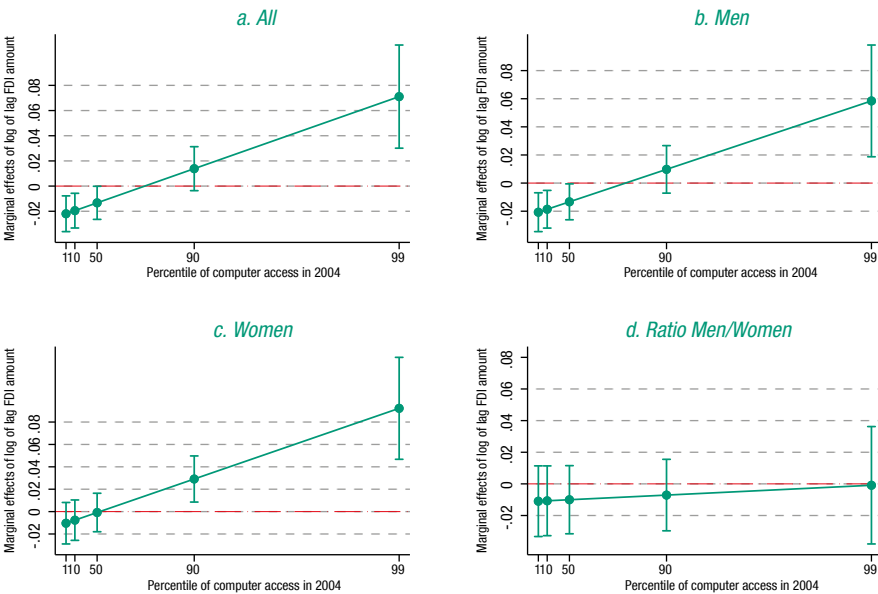
**Table 6.1: Foreign investment and labour market outcomes**

Dep. Variable:	Log (Employment) <sub>kpt</sub>	Log (Wage) <sub>kpt</sub>	Log (10 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (90 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (Wage Gap) <sub>kpt</sub>
Log (FDI) <sub>kt-2</sub>	-0.022** (0.009)	-0.016** (0.007)	-0.014 (0.010)	-0.021*** (0.008)	-0.008 (0.010)
TECH <sub>t2004</sub> * Log (FDI) <sub>kt-2</sub>	0.282*** (0.082)	0.127*** (0.038)	0.068 (0.054)	0.167*** (0.047)	0.100 (0.061)
Observations	6,594	5,619	5,618	5,619	5,618
R-squared	0.727	0.600	0.484	0.563	0.307
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

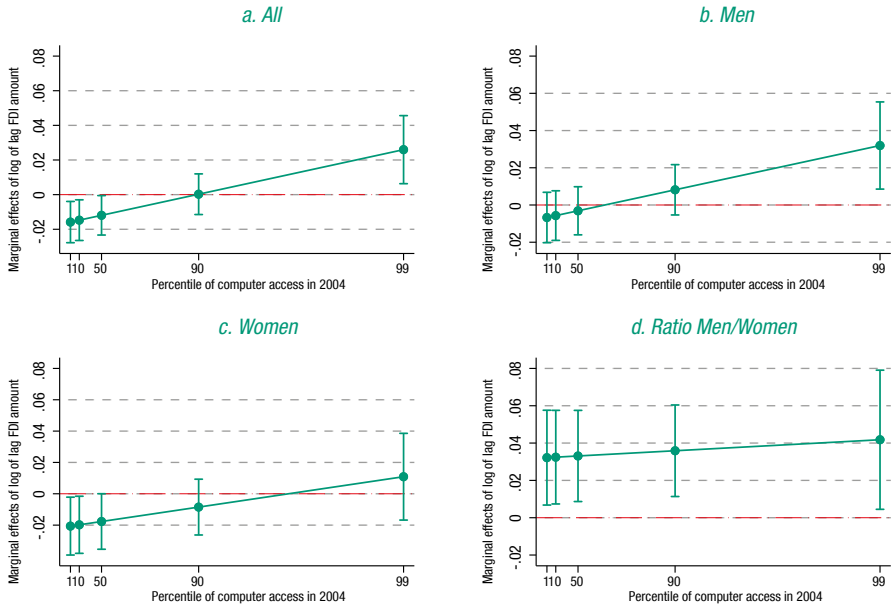
Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation on equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

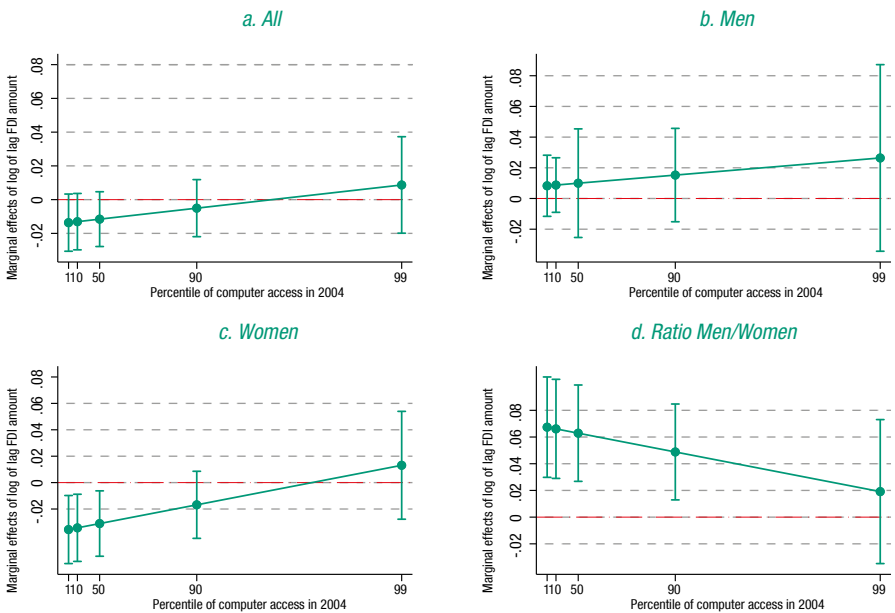
**Figure 6.1: Effects of FDI on employment at different levels of computer access**



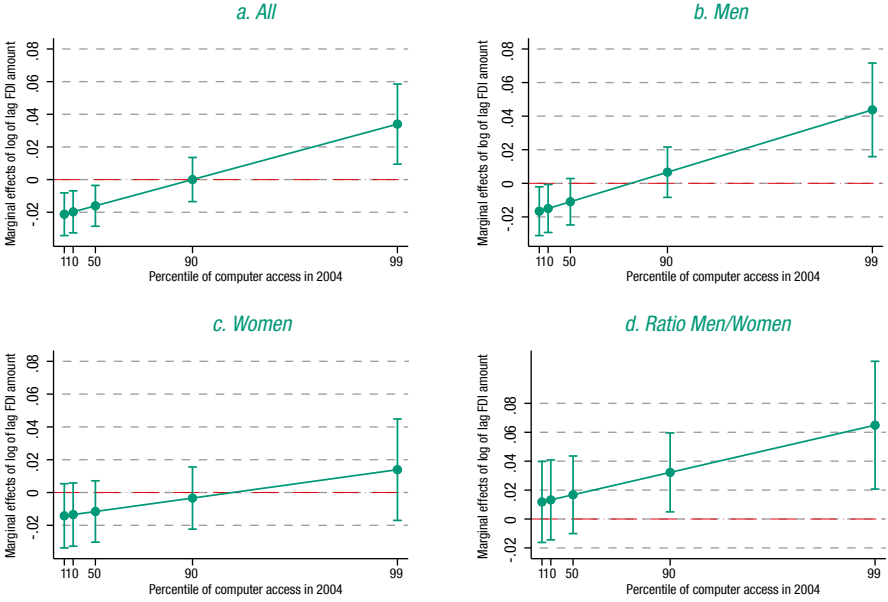
**Figure 6.2: Effects of FDI on average wages at different levels of computer access**



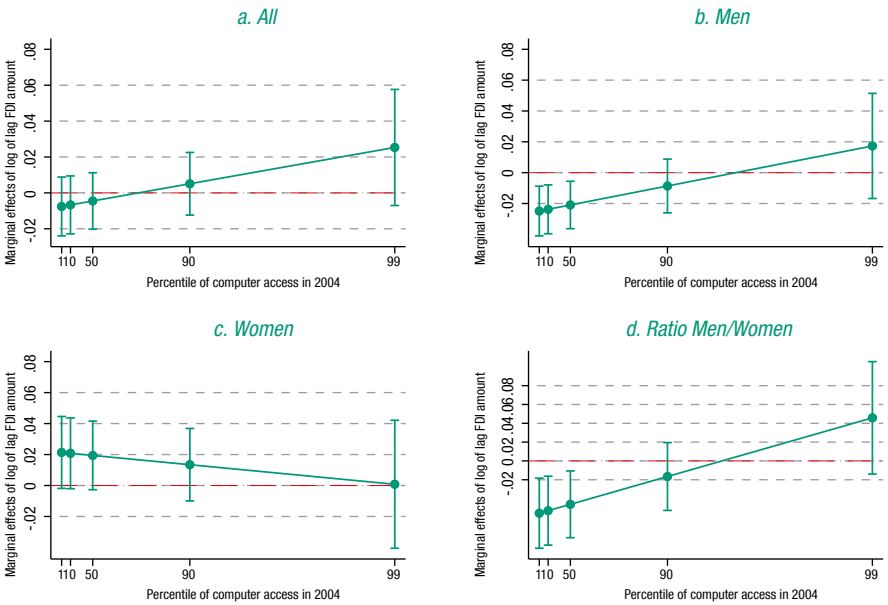
**Figure 6.3: Effects of FDI on the 10<sup>th</sup> percentile of wages at different levels of computer access**



**Figure 6.4: Effects of FDI on the 90<sup>th</sup> percentile of wages at different levels of computer access**



**Figure 6.5: Effects of FDI on the wage gap at different levels of computer access**



The coefficient of  $\log(FDI)_{kt-2}$  in table 6.1 (and the corresponding panel A of figure 6.1) shows that FDI is associated with small decreases in employment in provinces with weak access to technology (10th percentile and lower). This effect is wholly driven by the employment of men (table 6.3) – that is, female workers face no decrease in employment opportunities in weak technology areas of the country in response to foreign investment liberalization (table 6.2). Thus, in provinces with weak initial access to computers, a 1 per cent increase in foreign investment is associated with a 2 per cent decline in the employment of men.

**Table 6.2: Foreign investment and female labour market outcomes**

Dep. Variable:	Log (Employment) <sub>kpt</sub>	Log (Wage) <sub>kpt</sub>	Log (10 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (90 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (Wage Gap) <sub>kpt</sub>
Log (FDI) <sub>kt-2</sub>	-0.010 (0.011)	-0.021* (0.011)	-0.036** (0.016)	-0.014 (0.012)	0.021 (0.014)
TECH <sub>p2004</sub> *Log (FDI) <sub>kt-2</sub>	0.311*** (0.092)	0.096* (0.052)	0.147* (0.076)	0.085 (0.059)	-0.062 (0.080)
Observations	4,486	3,425	3,425	3,425	3,425
R-squared	0.772	0.609	0.501	0.584	0.297
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation of equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

Tables 6.1 to 6.3 also point to changes in average earnings with increased foreign investment. Across all workers, average wages fall with advances in FDI in weak-technology provinces. These effects appear to be driven by female wages at the low-end of the wage distribution, though there are also some declines in the 90th percentile of wages for men in weak-technology provinces in the aftermath of increased foreign investment. Because of this effect, increased FDI reduces wage inequality among working men in such areas.

Taken together, these results offer suggestive evidence of foreign investment replacing skilled opportunities for men in low-technology areas of the country, as would be hypothesized in a brains versus brawn story. For example, prior to foreign investment, the male labour force performed the many routine, manual (and relatively

**Table 6.3: Foreign investment and male labour market outcomes**

Dep. Variable:	Log (Employment) <sub>kpt</sub>	Log (Wage) <sub>kpt</sub>	Log (10 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (90 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (Wage Gap) <sub>kpt</sub>
Log (FDI) <sub>kt-2</sub>	-0.021** (0.008)	-0.007 (0.008)	0.008 (0.011)	-0.017* (0.009)	-0.025** (0.010)
TECH <sub>pt2004</sub> *Log (FDI) <sub>kt-2</sub>	0.240*** (0.079)	0.117*** (0.045)	0.055 (0.060)	0.183*** (0.054)	0.128* (0.066)
Observations	5,634	4,566	4,565	4,566	4,565
R-squared	0.687	0.569	0.486	0.538	0.316
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation of equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

brute force) tasks. If foreign firms bring advanced labour-saving technologies to automate the production process, this differentially harms the male workers.

Interestingly, the story is very different in areas with more advanced technologies and high absorptive capacity. When FDI flows to areas with strong technological capabilities, employment and wages differentially improve. That is, the interaction coefficient between  $\log(FDI)_{kt-2}$  and the pre-existing technology variable in table 6.1 is positive, implying that an increase in FDI is associated with a differential increase in employment in provinces with greater technological capacity. Specifically, in a province where about a third of households own a computer, a 1 per cent increase in FDI is associated with about a 6.5 per cent increase in employment (see figure 6.1).

This differential increase in employment in strong technology areas holds for both men and women. In fact, average wages also differentially increase in response to an equal foreign investment shock in strong relative to weak technology provinces. However, the relative increase in average wages for women arises from increases at the low end of the wage distribution (10th percentile), whereas the relative increase in average wages for men arises from increases at the top of the wage distribution (90th percentile).

Therefore, the absorptive capacity of an area in this setting tends to benefit men relatively more. Though women find more opportunities for employment, they are relatively low-wage opportunities. The increased employment opportunities for men



associated with increased foreign investment in high-tech areas tend to be skilled and pay higher average wages. Altogether, these results point to a widening of the gender wage gap, especially at the top of the wage distribution.

**Robustness.** Table 6.4 estimates a variation of equation (1) in which the main dependent variable is the ratio of labour market outcomes for men relative to those for women (i.e. log male employment over log female employment). Because men and women are not both employed in all province-industry pairs over time, the number of observations in table 6.4 is smaller than the number of observations in tables 6.2 and 6.3, and thus we should keep this in mind in our interpretation. Yet, the analysis of the relative labour market outcomes offers a more definitive picture of how foreign investment and technology affect women relative to men.

**Table 6.4: Robustness check, male/female relative labour market outcomes**

Dep. Variable:	Log (Employment) <sub>kpt</sub>	Log (Wage) <sub>kpt</sub>	Log (10 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (90 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (Wage Gap) <sub>kpt</sub>
Log (FDI) <sub>kt-2</sub>	-0.011 (0.014)	0.032** (0.015)	0.067*** (0.023)	0.012 (0.017)	-0.056** (0.023)
TECH <sub>p2004</sub> *Log (FDI) <sub>kt-2</sub>	0.031 (0.068)	0.029 (0.069)	-0.146 (0.100)	0.161* (0.084)	0.307*** (0.116)
Observations	3,526	2,372	2,372	2,372	2,372
R-squared	0.522	0.191	0.223	0.217	0.274
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation of equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

Though both men and women see strong relative increases in employment and wages in strong technology areas in the aftermath of foreign investment liberalization, table 6.4 reports a statistically insignificant interaction coefficient – suggesting there is no difference across genders in this effect. Both men and women report better employment and average wage opportunities with foreign investment in areas with high absorptive capacity. However, there is a positive relative impact on wages at the 90th percentile of the distribution, suggesting that men benefit from even larger wage gains at the top of the wage distribution in such circumstances. Once

again, this evidence points to a widening gender wage gap, particularly at the top of the wage distribution, as foreign investment in high-tech areas increases the demand for a skilled workforce, complementing the existing technology. These skilled workers largely appear to be men.

As our main analyses include province-industry-time variables as the main dependent variables and regressor of interest, our main analyses use only robust standard errors. Because employment and wages may be serially correlated over time in industries and provinces, in table 6.5, we present two-way clusters of the standard errors by industry and by province. The main findings are largely the same as in table 6.1. Foreign investment in high-tech provinces differentially increases average wages in Viet Nam.

**Table 6.5: Robustness check, two-way clustered standard errors**

Dep. Variable:	Log (Employment) <sub>kpt</sub>	Log (Wage) <sub>kpt</sub>	Log (10 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (90 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (Wage Gap) <sub>kpt</sub>
Log (FDI) <sub>kt-2</sub>	-0.022 (0.014)	-0.016** (0.006)	-0.014 (0.010)	-0.021*** (0.006)	-0.008 (0.010)
TECH <sub>pt2004</sub> *Log (FDI) <sub>kt-2</sub>	0.282 (16.129)	0.127*** (0.006)	0.068 (9.888)	0.167 (0.992)	0.100*** (0.006)
Observations	6,594	5,619	5,618	5,619	5,618
R-squared	0.727	0.600	0.484	0.563	0.307
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation of equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

The main analyses in this section use the logarithm of the value of greenfield projects to measure FDI and the share of households in a province that have computers at home to measure pre-existing computing technology. In table 6.6, we consider the logarithm of the number of announced greenfield projects as the main measure of foreign investment, while in table 6.7, we rely on the share of firms in the province that use a computer from the World Bank's Enterprise Survey database. Both of these checks yield similar results as the baseline estimation in table 6.1.

**Table 6.6: Robustness check, number of projects**

Dep. Variable:	Log (Employment) $_{kpt}$	Log (Wage) $_{kpt}$	Log (10 <sup>th</sup> percentile Wage) $_{kpt}$	Log (90 <sup>th</sup> percentile Wage) $_{kpt}$	Log (Wage Gap) $_{kpt}$
Log (FDI) $_{kt-2}$	-0.086*** (0.024)	-0.028 (0.019)	-0.024 (0.029)	-0.041* (0.022)	-0.017 (0.028)
TECH $_{p2004}$ *Log (FDI) $_{kt-2}$	0.791*** (0.207)	0.238** (0.104)	-0.003 (0.156)	0.390*** (0.130)	0.393** (0.174)
Observations	6,594	5,619	5,618	5,619	5,618
R-squared	0.728	0.600	0.484	0.562	0.307
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation of equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

**Table 6.7: Robustness check, alternative technology**

Dep. Variable:	Log (Employment) $_{kpt}$	Log (Wage) $_{kpt}$	Log (10 <sup>th</sup> percentile Wage) $_{kpt}$	Log (90 <sup>th</sup> percentile Wage) $_{kpt}$	Log (Wage Gap) $_{kpt}$
Log (FDI) $_{kt-2}$	-0.101*** (0.021)	-0.050*** (0.016)	-0.029 (0.023)	-0.065*** (0.018)	-0.037* (0.022)
TECH $_{p2004}$ *Log (FDI) $_{kt-2}$	0.050*** (0.009)	0.021*** (0.007)	0.009 (0.009)	0.028*** (0.007)	0.019** (0.008)
Observations	3,741	3,183	3,183	3,183	3,183
R-squared	0.745	0.448	0.389	0.429	0.339
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation of equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

Finally, as we note in section 4, in 2008 Viet Nam attracted record foreign investment, as investor confidence in the country's long-term growth prospects grew (UNCTAD, 2011). In table 6.8, therefore, we re-estimate our baseline model, excluding 2008 as a possible outlier in the foreign investment data. Once again, the main results are robust to this exclusion.

**Table 6.8: Robustness check, excluding 2008**

Dep. Variable:	Log (Employment) <sub>kpt</sub>	Log (Wage) <sub>kpt</sub>	Log (10 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (90 <sup>th</sup> percentile Wage) <sub>kpt</sub>	Log (Wage Gap) <sub>kpt</sub>
Log (FDI) <sub>kt-2</sub>	-0.012 (0.009)	-0.013* (0.008)	-0.014 (0.011)	-0.017** (0.009)	-0.004 (0.011)
TECH <sub>p2004</sub> *Log (FDI) <sub>kt-2</sub>	0.304*** (0.093)	0.120*** (0.041)	0.061 (0.060)	0.156*** (0.052)	0.095 (0.069)
Observations	5,376	4,598	4,598	4,598	4,598
R-squared	0.726	0.615	0.498	0.576	0.307
Industry-Year Controls	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES
Province-Year Fixed Effects	YES	YES	YES	YES	YES

Sources: VHLSS (2004-2014); UNCTAD.

Note: This table reports coefficients from a variation of equation (1) in the paper, where the dependent variables are as in the column headers. \*\*\* denotes significance at the 1% level; \*\* denotes significance at the 5% level; \* denotes significance at the 10% level. Robust standard errors are reported in parentheses.

## 7. Concluding remarks and policy implications

In this paper, we investigate how the interplay between FDI and technology affects labour market outcomes for women in Viet Nam. We explore household survey data combined with industry-specific exposure to FDI and province-specific access to technology. We find that increases in foreign investment differentially increase employment and average wages in high-technology areas of the country. We also investigate these impacts across gender and find that an equal increase in foreign investment in high-tech provinces increases male wages at the top of the wage distribution. Although foreign investment in areas with absorptive capacity brings new employment opportunities for all workers, increases in the employment of women tend to be concentrated at the low end of the wage distribution, while increases in the employment of men are concentrated in higher-wage, skilled jobs. Together, these results imply that foreign investment in Viet Nam contributes to a widening of the gender wage gap, particularly at the top of the earnings distribution.

From a policy standpoint, our work contributes to an understanding of job requirements and job security in the increasingly technology-driven and integrated world economy. It also offers insights for other less developed countries that face similar challenges as they move up the development ladder. Exposure to foreign investment and access to computing technology raises the demand for different types of skills, and although they have positive effects for the economy as a whole, some workers may be left behind.

The importance of absorptive capacity is highlighted in our results. Increases in foreign investment in areas of the country with weak technology actually reduce employment and wages, notably for men. We hypothesize that foreign firms in low-tech provinces bring advanced, labour-saving automation technologies that disproportionately displace brute force, manual labour performed by men. In the more technologically-advanced areas of the country, investment improves employment and wages, but mostly for skilled men. This provides further evidence for the notion that to truly benefit from foreign investment a domestic economy needs a sound education system that supports all workers—male and female.

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