Foreign Direct Investment and Wage Inequality: Is Skill Upgrading the Culprit?

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Abstract

This paper examines whether inward FDI is a source of wage inequality between skilled and unskilled labor in developing countries. While the literature has explored wage inequality issues, we study the impacts of FDI on skill upgrading comprehensively, together with trade and other factors (such as FDI externalities). Specifically, our analysis introduces the origin of FDI, controls for plant heterogeneity, and relates the results to the FDI theory on multinational enterprises. The results show that, on average, FDI caused wage inequality due to FDI-led skill biased technological change. However, Japanese and Taiwanese investments helped to alleviate the inequality. Japanese and Taiwanese FDI is motivated by cost advantages achieved through vertical FDI and thus increases relative demand for unskilled labor.

JEL classification: F21; F23; J31

Keywords: Multinational Enterprises (MNE); Skill Upgrading; Vertical FDI; Wage Inequality

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1. Introduction

Does globalization improve standards of living in developing countries? This question is of significant policy concern in the field of economic development. International organizations advocate the merit of accessing the global economy via foreign direct investment (FDI). Anti-globalization proponents do not necessarily agree that FDI will improve conditions in developing countries. Self-interested, multinational companies may exploit a host country's resources, impairing economic growth. Specifically, those opposing globalization argue that FDI accounts for recent rising wage inequality within developing countries. FDI-induced wage distortion is one of the major policy debates faced by the World Bank and IMF.

This paper examines whether inward FDI is a source of wage inequality between skilled and unskilled labor in developing countries. Previous works have reported wage gaps between foreign multinational companies and domestic companies (Aitken, et al. [1996] for Mexico and Venezuela; Lipsey and Sjöholm [2004] for Indonesia). Foreign companies tend to pay higher wages than domestic companies, even after controlling for factors such as industry and plant characteristics. The results suggest that foreign companies could have different factor demands. Studying wage inequality, Feenstra and Hanson (1997) argue that skilled labor is more likely to be demanded by foreign company's operating in Mexico. As the volume of inward FDI increases, stronger demand for skilled labor increases the premium on such labor.

Wage inequality between skilled and unskilled labor has been thoroughly explored in the literature. The earlier literature studies U.S. wage inequality beginning in the late 1970s, observing that demand shifts from unskilled to skilled labor (i.e., skill upgrading) increased skilled labor wages relative to unskilled labor ones. Skill biased technological change is shown to be a major reason for the labor demand shift (Berman et al., 1994; Autor et al., 1998). Others argue that trade-related factors, rather than technological innovation, explain the increased relative demand for skilled labor. However, this argument "has been largely dismissed in the academic literature" (Feenstra and Hanson, 1997, p.372). These works argue that outsourcing (measured by the import of intermediate inputs by domestic companies) and exports are strong predictors of skill upgrading (Feenstra and Hanson, 1996; Bernard and Jensen, 1997). More recent papers introduce FDI in discussing U.S. wage inequality (outward FDI in Slaughter, 2000;

inward FDI in Blonigen and Slaughter, 2001). Similar arguments in the U.S. papers are applied when considering wage inequality in less developed countries. For example, Hanson and Harrison (1999) study wage inequality in Mexico after trade liberalization. Feenstra and Hanson (1997) and Harrison and Hanson (1999) introduce the role of FDI to examine Mexican wage inequality during the 1980s. Pavcnik (2003) tries to identify factors contributing to wage inequality in Chile.

Our analysis is motivated by some of the unresolved puzzles that still exist. First, the literature provides mixed results regarding the effects of FDI on wage inequality. Blonigen and Slaughter (2001) find "that inward FDI has not contributed to U.S. within-industry skill upgrading," while Feenstra and Hanson (1997) and Harrison and Hanson (1999) show that FDI is an important factor when trying to explain Mexican wage inequality. We wonder whether country characteristics (i.e., developed or developing countries) lead to the different results. Can we conclude that inward FDI caused wage inequality in developing countries but not in developed countries? Second, the effects of FDI may change once we control for unobserved plant characteristics within industries.[1] While the empirical IO literature emphasizes the importance of plant heterogeneity, previous works in the area account for few observable plant characteristics (e.g., the age of the plant in Bernard and Jensen, 1997 and average plant sizes using the number of workers in Harrison and Hanson, 1999). Finally, FDI may have different effects on wage inequality depending on its origin. As Japanese investments are often treated differently from other countries' investments, we wonder whether the results change when controlling for investment origin.

We examine which results in the literature hold when applied to a country with different characteristics, specifically Thailand. Thailand has experienced success under a policy of FDI-led growth, making the country relevant for analyzing FDI's impacts on wage inequality.[2] One

[1] Pavcnik (2003) shows that adopting foreign technology is not attributed to an increased demand for skilled labor when the analysis controls for plant fixed effects, while it is attributed to increased demand if the analysis does not control for plant fixed effects.

[2] Thailand has welcomed FDI since the 1960s. However, FDI inflows into Thailand began to increase significantly in 1988. It was during this time that the government shifted its trade policy from import substitution, as was typical

particularly interesting feature is the dominance of Japanese multinational companies in Thailand. If Japanese investments are different from other countries' investments, the results are expected to differ from those in the literature. Again, previous works exploring the extent to which wage inequality in less developed countries is attributed to FDI yield different results. Our analysis will help to clarify under which conditions FDI causes wage inequality.

The analysis uses establishment-level panel data from an industrial survey from 1998 to 2002. We focus on the time period after the East Asian Crisis of 1997, when Thailand experienced a surge of FDI inflows. Our analysis incorporates methodological advances in empirical models common in the literature and accounts for plant heterogeneity within industries. One possible hypothesis regarding wage inequality is that the demand for skilled labor increases due to FDI-led skill biased technological changes. Establishment-level data allow us to study the relative demand shift towards skilled labor within industries.

Our analysis is distinctive in that it incorporates different FDI effects on labor demand. FDI could increase skilled labor demand two distinct channels. The production processes at foreign-owned companies often use advanced technologies thus increasing skilled labor demand. When this is the case, FDI causes wage inequality through skill biased technological change. We refer to wage inequality resulting from this process as direct effects. Additionally, FDI may have externalities such as technology spillover effects on local companies in a host country. FDI could change wage structures in the local labor market. Our analysis refers to wage inequality resulting from externalities as indirect effects. We also introduce a proxy index for factors that affect labor demand. Specifically, we examine whether FDI's impacts on labor demand differ depending on FDI origin. The literature rarely examines the effects due to data limitations, which we have been able to overcome. The results of the analysis are related to the FDI theory

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in the 1960s and 1970s, to export promotion which prevailed throughout the 1980s. Correspondingly, the economic growth rate increased from 5.9% (the average rate between 1980 and 1987) to 9.1 % (the average rate between 1988 and 1995). More recently, Thailand experienced another large increase in FDI after the Asian Financial Crisis. This paper considers the more recent FDI intensive time period.

on multinational enterprises (such as horizontal FDI and vertical FDI; see e.g., Markusen, 2002 for the recent overview). We discuss the results in terms of different FDI motivations.

The findings are that, on average, FDI increased demand for skilled labor via skill biased technological change. The entry of FDI could create job opportunities for both skilled and unskilled workers, but relatively in favor of skilled labor complementing the technological advances. Another notable feature of Asian FDI is that it is intrinsically different from other countries' investments. Japanese and Taiwanese FDI helped alleviate wage inequality between skilled and unskilled labor. The two countries' FDIs, which are dominant in Thailand, were motivated by comparative advantage, i.e., cheap factor inputs. This particular FDI increased unskilled labor demand. More precisely, Japanese and Taiwanese FDI may have increased demand for relatively skilled operatives among unskilled labor and reduced wage inequality between skilled and unskilled labor. If skilled operatives are specific to vertical MNEs that export products back to a home country, wage inequality will be smaller in the vertical MNE sector than other sectors. This is because wage levels of skilled operatives are higher than the ones of unskilled operatives. Furthermore, we confirm that wage inequality increased with export orientation. The result agrees with aforementioned literature on trade reforms.

The paper proceeds as follows. In Section 2, we summarize the data used for the analysis. Section 3 describes the empirical model used for studying wage inequality. Results of the analysis are presented in Section 4. Section 5 concludes the paper and suggests future lines of research.

2. Data

We use an establishment-level panel dataset from an industrial survey conducted by the National Statistical Office (NSO) of Thailand between 1999 and 2003 (and an industrial census in 1997). The NSO staff interviewed the owners of the manufacturing establishments with 10 persons or more which were selected using a combination of stratified sampling and systematic sampling. The NSO stratified establishments in each province according to industry codes and the number of workers. Then samples were selected from each province-industry-worker stratum using systematic sampling. The samples cover nearly half of the establishments with 10 persons or

more operating in Thailand and, thus, represent Thailand companies from various industries and sizes. The survey provides information on ownership, output, labor, capital, material and electricity costs, location, and industrial classification. The survey provides information on the prior years date (e.g., the 2001 survey provides 2000 data). The analysis examines Thailand manufacturing from 1998-2002. The inflow of FDI increased rapidly during the period, making this specific time period particularly relevant for analyzing.

Other data are from the Bank of Thailand (http://www.bot.or.th/bothomepage/databank/EconData/EconData_e.htm). We deflate capital by using a capital equipment deflator, wages by a consumer price index, and value added by a production price index by product group. All variables are measured in 2000 Thai Baht.

Table 1 presents the sample's summary statistics. We have 22,749 observations (about 5,600 establishments in each year) after eliminating outliers and establishments with missing variables. The sample includes 23 industries at the 2-digit ISIC level. The hourly wages paid for skilled labor (76.7 Baht) is twice that paid for unskilled labor (39.6 Baht).[3] The difference in our sample seems to be smaller than one may expect, specifically to those who are familiar with Thailand. The level of hourly wages paid for unskilled workers (39.6 Baht) is higher than Bangkok vicinity's minimum wage rate during the sample period (around 20 Baht). A minimum wage rate often plays an important role for very small establishments. In 2002, about 94% of manufacturing establishments are very small (less than or equal to 15 persons) in Thailand. Our sample covers establishments with either more than or equal to 10 persons. The magnitude of wage inequality could be much larger that seen in our study once very small establishments are included. Another distinguishing characteristic is that much of Thailand's FDI originates from Japan. Taiwan is the second major FDI source, but the number of establishments with Taiwanese FDI is less than half of those with Japanese FDI. U.S. FDI's share is considerably

[3] The analysis uses the classification "Operatives" in the industrial survey as unskilled labor and "Other employees" as skilled labor. The former includes "persons who were directly engaged in the production or other related activities of the establishment" and the latter includes "administrative, technical and clerical personnel such as salaried managers and directors, laboratory and research workers...and the like" (NSO, 2003, p.39).

smaller than Japan or Taiwan's. 29% of establishments have Japanese FDI while only 4.6% have U.S. FDI. Additionally, 28% of establishments import materials and 24% of establishments export goods abroad.

3. Model

We examine the sources of growing wage inequality by using a translog cost function. This specification is common in the literature on wage inequality. Translog cost functions approximate cost functions in a second order polynomial without imposing any input substitutability. The analysis assumes that establishments minimize the cost of skilled and unskilled labor, given that capital is a quasi-fixed input.[4] The cost minimization assumption allows us to express relative demand for skilled labor using the following function:

$$Share = \beta_0 + \beta_1 \frac{\ln w_s}{\ln w_{us}} + \beta_2 \frac{\ln K}{\ln Y} + \beta_3 \ln Y + \beta_4 Tech + \varepsilon . \quad (1)$$

$Share$ is the share of skilled labor's wages in an establishment's total wage bill. Wages of skilled (or unskilled) labor, w_s (or w_{us}), are calculated as total skilled (or unskilled) labor wage bill divided by total skilled (or unskilled) labor employment. K is capital, Y is real value added, $Tech$ is a technology measure, and ε is an unobserved component. The analysis uses imported materials as a share of total establishment materials purchased as a measure of technology.[5] We

[4] "…capital… (are) treated as variables not affected by the current wagebill share of skilled workers. Since investment at time *t* does not enter capital until *t*+1 in the data, capital is not affected by unobserved shocks that affect the wagebill share of skilled workers (Pavcnik, 2003, p. 317)."

[5] Imported materials as a share of total plant materials purchased is commonly used as a measure of technology in the literature (e.g., Harrison and Hanson, 1999; Pavcnik, 2003). Feenstra and Hanson (1996) use a similar term, the imported intermediate inputs by domestic companies, to examine the effect of outsourcing on an increased relative demand for skilled labor in the U.S. Other candidates for measures of technology include R&D expenditures

use two technology measures: a 0-1 dummy to indicate whether an establishment imports materials and four categories of imported materials as a share of total establishment materials purchased (0: 0%, 1: 1-49%, 2: 50-69%, 3: 70-100%).

We are interested in the sign of estimated coefficient on *Tech*. If technology measures are skill biased, β_4 is positive. This could be evidence that foreign affiliates contributed to increased demand for skilled labor. Interpretation of the other coefficient estimates is as follows. If β_1 is estimated to be positive (or negative), the cross-establishment elasticity of substitution between skilled and unskilled labor is below (or above) one. If capital complements skilled labor, the coefficient, β_2, is estimated to be positive. The term, *Y*, controls for the effects of establishment sizes.

Introducing the effects of inward FDI and trade, we use a variation of Equation (1):

$$\begin{aligned} Share_{ijt} = \beta_0 + \beta_1 \frac{\ln w_{is,t}}{\ln w_{ius,t}} + \beta_2 \frac{\ln K_{it}}{\ln Y_{it}} + \beta_3 \ln Y_{it} + \beta_4 Tech_{it} \\ + \beta_5 FDI_{it} + \beta_6 Trade_{it} + \beta_7 \delta_t + \beta_8 \delta_r + \beta_9 \delta_j + \varepsilon_{ijt}, \end{aligned} \tag{2}$$

where an establishment i is in industry sector j at time t.[6] The two terms, *FDI* and *Trade*, evaluate the effects of cross-border capital movements and of trade in goods on skilled labor demand in Thailand.

(Bernard and Jensen, 1997), royalty payments for patents (Harrison and Hanson, 1999), and the expenditure on foreign technical assistance (Pavcnik, 2003). Unfortunately, our data set does not provide this information.

[6] Most previous works study the effects of either trade (goods) or FDI (capital) on skill upgrading. The former literature's primary motivation is to examine the effects of trade reforms and the latter literature is an exploration of capital market liberalization (or the boom in FDI inflows to developing countries that occurred in the 1990s). Our model is similar in spirit to Harrison and Hanson (1999) in that it incorporates both effects, although they examine whether trade reform affected wage inequality in Mexico.

An FDI index, *FDI*, takes a value of one if foreigners hold equity at the establishment level and zero otherwise.[7] This is the original classification used by the Thailand industry survey. Although others have noted that "FDI is the acquisition of shares by a firm in a foreign-based enterprise that exceeds a threshold of *10 percent*, implying managerial participation in the foreign enterprise" (Goldin and Reinert, 2006, p.80), our data do not provide foreign equity share. In order to check the relevance of the term "FDI" we refer to the 1996 census. The 1996 census shows that the share held by foreigners is at least 50 percent among 36% of establishments with foreign shares. The rest (64%) are classified as establishments where less than 50 percent of shares are held by foreigners. While even the 1996 census does not provide further information, use of the term FDI seems appropriate. As an extension, we generate an alternative FDI index using the percentage of foreign ownership at the establishment level using the 1996 census. Furthermore, the effects of FDI source countries are examined by introducing an FDI origin index. We return to this point later.

The *FDI* term captures factors that are not encompassed by the *Tech* term. FDI could increase skilled labor demand through several channels. Inward FDI could simply create job opportunities for either skilled and/or unskilled labor. Specifically, the production processes at foreign-owned companies often use advanced technologies and require sophisticated factor inputs in order to satisfy high quality standards. When this is the case, the relative demand for skilled labor increases. Similarly, local input materials may not satisfy the product standards of foreign-owned companies. This increases the ratio of imported materials compared to total materials purchased. The *Tech* term captures the effects. We call this channel the direct effect.

[7] While our data allow us to use an establishment level index, other works use a sector level index (Aitken and Harrison, 1999; Harrison and Hanson, 1999; Blonigen and Slaughter, 2001). This is calculated as foreign equity share averaged over all plants in the sector using a weight of the fraction. The fraction is the number of employees in a plant divided by the total number of employees in all plants in the industry: $\sum_{i=1}^{m} \mu_{ijt} emp_{ijt} \Big/ \sum_{i=1}^{m} emp_{ijt}$, where μ_{ijt} is foreign equity share, emp is the number of employees, and m is the total number of plants in industry j.

However, FDI may introduce other externalities (such as technology spillovers) and different wage structures into a host country's labor market. Some works show that FDI improves local companies' productivity (see e.g., Görg and Strobl (2001) for a survey).[8] If this is the case, local companies also increase skill labor demand. Additionally, previous works have reported wage gaps between foreign multinational companies and local companies (Aitken et al. (1996) for Mexico and Venezuela; Lipsey and Sjöholm (2004) for Indonesia). Multinational companies tend to pay higher wages, even after controlling for factors such as industry and workers characteristics. The efficiency wage theory is one possible explanation. If the ratio of skilled to unskilled labor is higher in foreign-owned companies than in local companies, a change in wage structures triggered by FDI also causes wage inequality between skilled and unskilled labor. We call the latter channel the indirect effect. By introducing the FDI term our analysis enables us to distinguish the indirect effect from the direct effect when examining whether FDI shifts relative demand from unskilled labor to skilled labor and, as a result, causes wage inequality between skilled and unskilled labor.

A trade index, *Trade*, tries two measures of export orientation: a 0-1 dummy to indicate whether an establishment exports its goods and four categories of export percentages (0: 0%, 1: 1-49%, 2: 50-69%, 3: 70-100%) at the establishment level.[9] The analysis is motivated by the discussion in the literature on the relationships between trade reforms and wage inequality.

[8] The literature has explored the impacts of FDI on domestic companies' productivity. Caves (1974) on Australia, Globerman (1979) on Canada, and Blomström and Persson (1983) on Mexico are seminal empirical studies. More recent works include Kokko (1994) on Mexico and Blomström and Sjöholm (1999) on Indonesia; both use cross-sectional analysis. Haddad and Harrison (1993) on Morocco and Aitken and Harrison (1999) on Venezuela employ firm-level panel data analysis. Keller and Yeaple (2003) and Javorcik (2004) introduce the simultaneity problem (or endogenous input decision-making) into their analysis on FDI's productivity spillovers. In spite of the multitude of studies conducted, the literature has yet to reach a consensus regarding the impacts of FDI on domestic companies' productivity.

[9] While our data allow us using an establishment-level index, other works use a sector level index: the share of exports in total sales at the industry level.

Trade reform could be associated with increasing wage inequality if skilled labor is specific to the export sector and unskilled labor is specific to the import sector (Harrison and Hanson, 1999). We examine whether a similar logic applies to our context.

Other terms incorporate unobservable factors that may influence the relative demand for skilled labor. Year fixed effects, δ_t, are time varying elements that affect all regions and industries in a given year. Regional fixed effects, δ_r, are time and sector invariant elements that differ across regions. For example, higher quality infrastructure in a particular region would be controlled for with a regional fixed effect. Industry fixed effects (classified by 2-digit ISIC), δ_j, capture time and region invariant elements that differ across industries.

We estimate Equation (2) without the relative wage term in order to avoid an endogeneity problem. The levels of relative wages across plants could be a function of the share of skilled labor. Most previous works omit the relative wage term in their estimation (Feenstra and Hanson, 1996; Bernard and Jensen, 1997; Autor et al., 1998; Harrison and Hanson, 1999; Slaughter, 2000; Blonigen and Slaughter, 2001; Pavcnik, 2003). Only a few works uses the model with the relative wage term (Berman et al., 1994; Slaughter, 2000).

We further extend our analysis by introducing an FDI origin index. The effects of FDI may vary depending on FDI origin. While the literature rarely examines the effects (due to possible data unavailability), our data allow us to perform the analysis. We compare the effects of four *FDI origins*: Japan, Taiwan, the U.S., and other origins.[10] In Thailand, Japanese and Taiwanese owned companies are dominant. Previous works often study countries with U.S. and European investments. Additionally, the robustness of our analysis is examined by using alternative variable specification. Initially, we use a coarse FDI index of a 0-1 dummy whether foreigners hold any equity of an establishment. To enhance the analysis, we generate another FDI index in percentage at the establishment level. Using the 1996 census, we first estimate a relationship between the percentage of equity owned by foreigners and other factors such as level of capital, labor and materials, the degree of export orientation and import materials as well as region and industry controls at the establishment level. Then, by using the estimated empirical

[10] FDI origin: Unclassified means establishments receiving foreign investments from plural host countries.

model, we predict the FDI percentage share of each establishment during the sample period. One drawback to this approach is the assumption that the FDI share of an establishment did not change drastically between 1996 and the sample period.

We compare our results with those in the literature where plant fixed-effects are not used. Omitted plant heterogeneity such as management quality and financial conditions may affect the relative demand for skilled labor, while the FDI term may proxy for part of the heterogeneity. The analysis controls for time invariant unobserved characteristics, δ_i, using fixed effects at the establishment level. We estimate Equation (2) by taking the first differences of the data to control for the heterogeneity.

The analysis with establishment fixed effects requires matching data in different years for the same establishments. Due to privacy considerations, the original survey does not provide an identifier for each establishment in different years. Additionally, the data is unbalanced panel meaning that establishments surveyed in one year are not necessarily surveyed the following year. We try to match different establishment data across years by using ISIC codes, resident regions, the existence of foreign equity, the level of capital at the end of this year and the level of capital at the beginning of next year. We conjecture that those who are matched using these criteria are the same establishments in the following analysis. In other words, our matching system enables us to overcome the data limitations and identify which establishments remain in the data from year to year.

4. Results of the Analysis

Table 2 shows the results of estimating Equation (2). Column (1) omits *FDI* and *Trade* indices; alternatively Column (1) is an estimation of Equation (1). Column (2) adds *FDI*, Column (3) adds *Trade*, and Column (4) adds both *FDI* and *Trade*. We initially employ a 0-1 dummy for all *Tech*, *FDI*, and *Trade*. The analysis controls for year, region, and industry fixed effects. Huber-White standard errors are in parenthesis.

FDI increased demand for skilled labor via direct and indirect effects and caused wage inequality between skilled and unskilled labor in Thailand. The coefficient of *Tech* is estimated

to be positive, indicating a direct effect. Foreign-owned companies use advanced technologies and, thus, require skilled labor. The coefficient of *FDI* is also estimated to be positive, indicating an indirect effect. The *FDI* term captures factors, including externalities, which are not encompassed by the *Tech* term. The magnitude of estimated coefficients of *Tech* is smaller once we include the *FDI* term. It could be the case that local companies also increased skill labor demand due to FDI-induced positive technology spillovers. FDI may have changed the labor market structure in favor of skilled labor due to efficiency wage motivation.

We further examine whether *Tech* has different effects depending on four different levels of technology. Correspondingly, the analysis controls for four different levels of export orientation. Column (5) does not control for indirect FDI effects, Column (6) adds *FDI*, Column (7) adds *Trade*, Column (8) adds both *FDI* and *Trade*, and Column (9) adds *FDI origin* to Column (5). The magnitudes of estimated *Tech* coefficients increase as the fraction of imported materials as a share of total establishment materials purchased increases. The results make sense as a higher level of technology implies stronger demand for skilled labor thus causing more wage inequality. Columns (6)-(8) indicate that the *FDI* term captures factors that are not encompassed by the *Tech* term. The magnitude of estimated coefficients of *Tech* falls after including the *FDI* term, and the positive coefficient on *FDI* suggests an indirect effect. Column (9) decomposes the effects of FDI depending on FDI origin. The coefficients of both U.S. and Japanese investments are estimated to be positive indicating that the two countries' FDI projects tend to demand more skilled labor when compared to establishments without FDI. Specifically, the magnitude of the coefficient on U.S. investments is larger than that of other investments. We cannot reject the null hypothesis of no effect regarding the estimated coefficient on investments from Taiwan. Establishments with Taiwanese investments are similar to establishments without any FDI. Lastly, we also try an FDI percentage index. The results are similar to 0-1 FDI index. The coefficient is estimated to be positive at statistically significant levels (the results are not shown in the table). In sum, the analysis shows that FDI increased demand for skilled labor via both direct and indirect effects and caused wage inequality between skilled and unskilled labor in Thailand.

The share of skilled labor's wages in total wage bill of an establishment becomes smaller with a higher degree of export orientation. The coefficient on *Trade* is estimated to be negative and the magnitude becomes larger as companies export more goods abroad. The results are non-intuitive if skilled labor is specific to the export sector and unskilled labor is specific to the domestic sector, as in a specific factor model. In Table 2, some results, such as *FDI origin* and *Trade*, do not allow for clear interpretation.

We examine the robustness of the above analysis after controlling for establishment fixed effects (Table 3). The results in Table 3 are comparable to those in Table 2. Column (1) contains the results without *FDI* and *Trade* indices. Column (2) adds *FDI*, Column (3) adds *Trade*, and Column (4) adds both. Again, we initially use a 0-1 dummy for all *Tech*, *FDI*, and *Trade*.

We still observe that FDI increased demand for skilled labor via direct effects. The coefficient on *Tech* is estimated to be positive. The magnitude of the estimate is similar what it was in Table 2. Additionally, the magnitude of estimated *Tech* coefficients increases as the fraction of imported materials as a share of total establishment materials purchased increases. However, the sign on the coefficient of *FDI* changes and is estimated to be negative. A plausible explanation is related to the nature of Japanese and Taiwanese direct investments. The two countries' FDI was motivated by comparative advantage rather than access to the Thailand market. While their FDI increased demand for both skilled and unskilled labor, the demand for unskilled labor increased relatively more.

Following FDI theory, it can be surmised that vertical multinational enterprises (MNEs) dominate Japanese and Taiwanese direct investments. Since export sales (but not local sales) are important for vertical MNEs, we examine the relationships between FDI origin and export orientation (Table 4). Among Japanese owned establishments in Thailand, 741 of 887 have exports. Similarly, 282 of the 405 Taiwanese owned establishments have exports. Stated as a percentage, 84% of Japanese MNEs export their goods while only 16% of them sell their goods only in the local market. Considering that 16% of establishments without foreign ownership exports goods, the figure related to Japanese MNEs is very high. Vertical MNEs develop to split production processes into more than one location. Imported materials as a share of total

establishment materials purchased should be large. The middle part of Table 4 cross-tabulates the relationships between FDI origin and import materials. Here, 83% of Japanese MNEs import materials and only 17% of them purchase all materials in the local market. One may wonder whether export orientation implies material importation. The bottom part of the table shows that, on average, 65% (=3,546/5,428) of establishments with export orientation import materials. The level of Japanese MNEs is very high compared to the average. Taiwanese MNEs also show a similar trend.[11]

The specification presented in Column (9) further examines the effects of FDI origin. The coefficients on Japanese and Taiwanese investments are estimated to be negative. The results imply that Japanese and Taiwanese FDI did not increase skilled labor demand and, thus, did not cause wage inequality. These two countries' FDI rather increased unskilled labor demand. The results are consistent with Blonigen and Slaughter (2001). They find that Japanese investments were "significantly correlated with lower, not higher, relative demand for skilled labor" (p. 364). The finding is consistent with FDI theory. Japanese investments took the form of vertical integration where the purpose of FDI is to seek for lower factor costs (unskilled labor in this case). Additionally, we cannot reject the null hypothesis for the estimated coefficient on U.S. FDI. U.S. FDI is not related to increased skilled labor demand after controlling for *Tech* effects. These results are more intuitive than those in Table 2. Labor demand is influenced by major FDIs coming from Japan and Taiwan.

Quality distinction within the category of unskilled labor provides an additional explanation for our results. The analysis classifies skilled and unskilled labor but does not

[11] We also observe that U.S. FDI shows a similar trend in both export orientation and import materials. At first glace, this is unexpected, since we expect that U.S. MNEs are motivated by horizontal FDI. Nonetheless, the result is still consistent with our expectation if U.S. MNEs serve Southeast Asia markets with U.S. brands (better quality). This increases both exports and imports even if U.S. MNEs are motivated by horizontal FDI. The current data do not allow us to confirm the hypothesis. Doing so would require detailed data such on export destination at the establishment level. The empirical analysis conducted does confirm that U.S. FDI is different from Japanese and Taiwanese FDI.

further distinguish the quality of unskilled labor. Unskilled labor can be further decomposed into skilled and unskilled operatives.[12] Skilled operatives can be specific to the export sector. It is reasonable to expect that Japanese and Taiwanese MNEs demand skilled operatives in production processes, as both countries export their products back to home markets with quality standards higher than those in the Thailand market. If Japanese and Taiwanese FDI increased demand for skilled operatives, consequently increasing skilled operatives' wages, then on average, relative wage levels of unskilled labor increased. Thus, wage inequality between skilled and unskilled labor fell.

The results of *Trade* impacts also change but in a more intuitive way. Lower levels of export orientation do not affect the share of skilled labor's wage bill in total wage bill of an establishment. We cannot reject the null hypothesis of no effect when export orientation is less than 70%. However, the share of skilled labor's wage bill is positively related to a high level of export orientation (more than 70%). The results are similar to the one in the literature on the relationships between trade reforms and wage inequality. Specifically, trade reform is associated with increasing wage inequality if skilled labor is specific to the export sector. Additionally, both *Tech* and *Trade* terms affect skilled labor demand only if their levels are high (at least 70%).

We obtain more intuitive results after controlling for establishment characteristics. Some results change completely once we control for establishment fixed effects, a finding consistent with other works (see footnote 1). As the recent empirical IO literature emphasizes, the importance of controlling for heterogeneity at the establishment level should not be ignored.

5. Concluding remarks

This paper examines the distributional effects of FDI in a developing country. While the literature shows that capital deepening increased relative demand for skilled labor, our analysis distinguishes foreign from domestic capital and focuses on FDI's impacts on skill upgrading. The analysis is motivated by a hypothesis that FDI is associated with increasing wage inequality

[12] The 1996 census data allows researchers to distinguish skilled operatives from unskilled operatives, depending on the length of work experience. Our survey data do not contain this information.

in developing countries if skilled labor is specific to foreign-owned companies. We analyze the effects of FDI comprehensively by controlling for several factors affecting wage inequality, including FDI origin, trade characteristics, establishment heterogeneity, and technological externalities.

The results show that, on average, FDI increased demand for skilled labor via skill biased technological change. FDI created job opportunities for skilled labor complementing advanced technologies. However, Japanese and Taiwanese FDI helped to alleviate wage inequality between skilled and unskilled labor. The two countries' FDIs were motivated by relatively inexpensive factor inputs, increasing unskilled labor demand. We also confirm that wage inequality increases with export orientation. In sum, the analysis demonstrates that FDI's distributional effects are explained by not only host country characteristics (either developed or developing country) but FDI origin which is closely related to FDI motivations (such as vertical FDI or horizontal FDI).

Our analysis is applicable to other interesting but more complicated situations. One possible extension could be to examine the effects of different FDI styles, for example, M&A and Greenfield investments. We suspect the results focusing on Greenfield investments would be similar as such investments dominate Japanese FDI. As is discussed above, detailed data such as export destination and the quality of unskilled labor (skilled operatives vs. unskilled operatives) enriches our analysis. Another extension could be to consider alternative specifications. Change is the *Y* term could be decomposed into domestic sales and export sales (i.e., foreign contributions) and each term examined stand-alone. This specification would directly relate the results to FDI theory. Domestic sales are important for horizontal FDI and export sales are for vertical FDI. However, above we use a different approach: value-added (but not sales) is the *Y* term. Additionally, it is possible to use lagged value added when we estimate Equation (2) without controlling for establishment heterogeneity, since value added could be a function of the share of skilled labor employed in a plant. We follow the current approach not only because there is very little variation in the time series but also since Pavcnik (2003) find that the results are not sensitive to using either the current or lagged value added. Though these extensions may change some of the results obtained in this paper, we believe main conclusion will still be valid. All of these topics represent potential future lines of research.

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Table 1 Summary Statistics

Variables		Observation	Mean	Std. Dev.
Share		22,749	0.18	0.20
Skilled labor's wage bill	Baht	22,749	3,811,145	26,486,870
Unskilled labor's wage bill	Baht	22,749	10,103,000	41,952,430
Skilled labor's hourly wage rate	Baht	14,403	76.71	80.35
Unskilled labor's hourly wage rate	Baht	19,248	39.63	38.05
Number of skilled labor	person	22,749	19.59	111.46
Number of unskilled labor	person	22,749	111.63	371.87
Capital	Million Baht	22,749	126	1,180
Value-added	Million Baht	22,749	81	698
		Frequency	Percent	Cum. Percent
Technology	No import materials	16,342	71.84	71.84
(0-1 dummy)	Import materials	6,407	28.16	100
Technology	0<imports<50	2,314	10.17	
(share; percent)	50=<imports<70	1,739	7.64	
	70=<imports	2,354	10.35	
FDI	No FDI	19,720	86.69	86.69
	FDI	3,029	13.31	100
FDI-origin	Japan	887	3.9	
	Taiwan	405	1.78	
	U.S.A.	140	0.62	
	Other origins	693	3.05	
	Unclassified	904	3.97	
Trade	No Export	17,321	76.14	76.14
(0-1 dummy)	Export	5,428	23.86	100
Trade	0<exports<50	2,207	9.7	
(share; percent)	50=<exports<70	617	2.71	
	70=<exports	2,604	11.45	

Note: Share is the share of skilled labor's wage bill in an establishment's total wage bill.

Table 2 Results of the Analysis (without controlling for establishment fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(capital/value-added)	0.059	0.056	0.061	0.059	0.059	0.056	0.058	0.055	0.055
	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***
ln(value-added)	0.025	0.024	0.027	0.026	0.025	0.024	0.027	0.026	0.026
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Technology	0.022	0.018	0.026	0.022					
Binary	(0.003)***	(0.003)***	(0.003)***	(0.004)***					
Technology					0.021	0.018	0.022	0.019	0.018
0<imports<50					(0.005)***	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Technology					0.021	0.017	0.028	0.023	0.024
50=<imports<70					(0.005)***	(0.005)***	(0.005)***	(0.005)***	(0.006)***
Technology					0.022	0.018	0.029	0.024	0.024
70=<imports					(0.005)***	(0.005)***	(0.005)***	(0.005)***	(0.005)***
FDI		0.021		0.028		0.021		0.034	
Binary		(0.005)***		(0.005)***		(0.005)***		(0.005)***	
FDI origin									0.026
Japan									(0.007)***
FDI origin									0.010
Taiwan									(0.010)
FDI origin									0.056
U.S.A.									(0.019)***
FDI origin									0.037
Others									(0.008)***
FDI origin									0.045
Unclassified									(0.007)***
Trade			-0.018	-0.024					
Binary			(0.004)***	(0.004)***					
Trade							0.018	0.013	0.013
0<exports<50							(0.005)***	(0.005)**	(0.005)***
Trade							-0.021	-0.028	-0.027
50=<exports<70							(0.008)***	(0.008)***	(0.008)***
Trade							-0.052	-0.061	-0.061
70=<exports							(0.005)***	(0.005)***	(0.005)***
Constant	-0.205	-0.187	-0.228	-0.211	-0.205	-0.186	-0.232	-0.212	-0.209
	(0.014)***	(0.014)***	(0.015)***	(0.015)***	(0.014)***	(0.014)***	(0.015)***	(0.015)***	(0.015)***
Adjusted R-squared	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.20
Observations	22749	22749	22749	22749	22749	22749	22749	22749	22749

Huber-White standard errors in parentheses.
* Statistically significant at the 10% level; ** at the 5% level; *** at the 1% level.

Table 3 Results of the Analysis (after controlling for establishment fixed effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δln(capital/value-added)	0.078	0.070	0.078	0.070	0.077	0.067	0.072	0.062	0.061
	(0.127)	(0.126)	(0.127)	(0.125)	(0.127)	(0.126)	(0.126)	(0.124)	(0.124)
Δln(value-added)	0.025	0.024	0.025	0.024	0.025	0.024	0.024	0.023	0.023
	(0.010)**	(0.010)**	(0.010)**	(0.010)**	(0.010)**	(0.010)**	(0.010)**	(0.010)**	(0.010)**
Technology	0.022	0.034	0.021	0.030					
Binary	(0.013)*	(0.015)**	(0.016)	(0.016)*					
Technology					0.013	0.024	0.015	0.023	0.025
0<imports<50					(0.016)	(0.017)	(0.018)	(0.019)	(0.019)
Technology					0.025	0.035	0.025	0.032	0.033
50=<imports<70					(0.023)	(0.024)	(0.025)	(0.025)	(0.025)
Technology					0.044	0.064	0.038	0.054	0.049
70=<imports					(0.027)	(0.029)**	(0.029)	(0.030)*	(0.030)*
FDI		-0.036		-0.042		-0.040		-0.047	
Binary		(0.019)*		(0.019)**		(0.019)**		(0.019)**	
FDI origin									-0.060
Japan									(0.025)**
FDI origin									-0.100
Taiwan									(0.041)**
FDI origin									0.011
U.S.A.									(0.064)
FDI origin									-0.008
Others									(0.031)
Trade			0.001	0.013					
Binary			(0.016)	(0.016)					
Trade							-0.011	0.000	-0.003
0<exports<50							(0.021)	(0.021)	(0.021)
Trade							-0.035	-0.022	-0.024
50=<exports<70							(0.035)	(0.033)	(0.034)
Trade							0.020	0.035	0.037
70=<exports							(0.019)	(0.020)*	(0.020)*
Constant	-0.032	-0.031	-0.032	-0.032	-0.032	-0.030	-0.032	-0.032	-0.031
	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***	(0.008)***
Adjusted R-squared	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Observations	1484	1484	1484	1484	1484	1484	1484	1484	1484

Huber-White standard errors in parentheses.
* Statistically significant at the 10% level; ** at the 5% level; *** at the 1% level.
FDI origin: Unclassified means establishments with foreign investments from plural host countries. No "Unclassified" observations in this sample.

Table 4 Vertical FDI

FDI Origin and Export Orientation				
		Export		
		0	1	Total
FDI	0	16,610	3,110	19,720
	1	711	2,318	3,029
	Total	17,321	5,428	22,749
FDI-Japan	1	146	741	887
FDI-Taiwan	1	123	282	405
FDI-U.S.A.	1	35	105	140
FDI Origin and Import materials				
		Import		
		0	1	Total
FDI	0	15,598	4,122	19,720
	1	744	2,285	3,029
	Total	16,342	6,407	22,749
FDI-Japan	1	151	736	887
FDI-Taiwan	1	132	273	405
FDI-U.S.A.	1	34	106	140
Export and Import Materials				
		Import		
		0	1	Total
Export	0	14,460	2,861	17,321
	1	1,882	3,546	5,428
	Total	16,342	6,407	22,749