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Immigrant-employing Firms in Thai Manufacturing

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Abstract

This study provides a picture of immigrant employment in manufacturing of Thailand. It distinguishes immigrant-employing firms from non-immigrant firms. The data from the Productivity and Investment Climate Survey (PICS) of Thailand in 2007 reveals that 19 percent of 1,043 firms in 9 industries employed immigrants. These shares range widely from a high of 35 percent in food processing to a low of 5 percent in electronic components. Textiles and food processing industries hire 70 percent of the total of 10,837 immigrants. The average share of immigrants in total firm employment is 5 percent, ranging from a high of 14 percent in food processing to a low of 0.3 percent in electrical appliances. Comparing immigrant-employing firms to non-immigrant firms, we find that immigrant firms tend to have higher export share and sale growth, but lower foreign share in ownership, computer-controlled machinery, capital per worker and skill per worker, and pay lower wage to both skilled and unskilled workers. Analyzing attributes that may influence immigrant employment, we find that firms with high export share and high sale growth tend to employ immigrants, while firms with high foreign share in ownership, high share of controlled-computer machinery and high average wage paid to workers tend not to employ immigrants.

Keywords: Immigrant, Manufacturing, Thailand, Firm-level Data

1. Introduction

More than two millions unskilled immigrants from Burma, Cambodia and Laos are estimated to be working in Thailand. This number is approximately 5 percent of total Thai labor force, or 10 percent of Thai labor force with primary school education or lower. Immigration has brought many economic concerns. For example, immigrants steal jobs from the Thai workers because of their willingness to work for lower wage. Complaint also includes free riding on public welfare such as hospitals and schools, and that the Thai industries are spoiled by cheap labor and neglect new production and technology. Consequently, Thailand will never get out of its middle income trap.

It is however argued that immigrants do not take jobs away from Thai workers because they work in the sectors such as construction and fishery in which Thai workers do not want to work. Two econometric research studies, namely Kulkolkarn and Potipiti (2007) and Bryant and Rukumnuykit (2007), have shown that if any, immigrants decrease domestic wage very little. The results are similar to a large majority of international studies (e.g., Dustmann et al. 2008, Friedberg and Hunt 1995, Longhi et al., 2005, 2008, Okkerse, 2008) that suggest insignificant effects of immigration on exerting native labor market outcomes. Even large, sudden inflows of immigrants were not found to reduce native wages and employment significantly (Card 1990, Friedberg 2001). Moreover, Susangkarn (1996) and Martin (2007) estimate that 700,000 and 1.8 million immigrants help increase GDP in 1995 and 2005 by 0.5 percent and 1.25 percent, respectively. Although study of the impact of immigration on public finances of Thailand is still silent, immigrants do pay tax in a form of registration fee equivalent to one month salary, or 8.3 percent income tax. In 2007 the total registration fee paid by immigrants is 405 million baht. Moreover, they pay VAT when purchasing consumer products in Thailand. In the international literature on public finances (e.g., Gustman and Steinmeier 2000, Borjas and Trejo 1991, Baker and Benjamin 1995), the estimated net fiscal impact of migrants varies substantially across studies partly due to different settings and policies, but also due to differences in methodology and assumptions, but the overall magnitudes relative to the GDP remain modest.

The study of immigration on production is relatively rare, but reviewed in detail here as it is related to our research topic. Tella (2006) wrote that one threat to productivity of the U.S. economy is cheap immigrant labor. Krikorian (2001) explained how illegal immigration slowed productivity growth in American agriculture. He used raisin grapes as an example. In the late 1950s, grape farmers in Australia, faced with a labor shortage, came up with a more efficient way of producing raisins whereby instead of cutting the grapes off vines by the bunch with a knife, then laying them on paper trays and repeatedly turning them by hand for drying, the grapes

dried naturally on the vine and were knocked into bins by a tractor-mounted harvester. Labor use was cut drastically and yields rose tremendously. It was claimed that this new technique did not transfer to raisin farmers in the United States because of the availability of cheap immigrant workers that lowered the incentive to make the expenditure to switch to the more efficient method. Florida's sugar cane harvest is another example. Working conditions such as bending at the waist, dealing with heat, mosquitoes, and snakes are so bad that sugar companies were often sued on behalf of sugar harvesters who during 1980s are mostly imported Indian guestworkers. Employers finally decided to mechanize the sugar harvest. As a result, by the 1992-93 season, 50 percent of Florida sugar cane was harvested by machine, and today virtually all of it is, resulting in dramatic increase in productivity.

Saring et al. (2000) analyzed fruit and vegetable crop mechanization in the United States. They found that there has been little investment in mechanized harvesting by growers since 1980 because of the availability of cheap labor. Moreover, the period from the end of the Bracero[1] program to the beginning of the mass illegal immigration, or during 1960 to 1975, was a period of considerable mechanization with the average labor-hours per acre used in harvesting horticultural crops dropping 20 percent. Lind (2006) wrote that the availability of low-wage immigrant labor has caused the U.S. to lag behind Japan, Australia and others with advanced mechanical harvesting. And home construction in the U.S. remains low-tech and inefficient. A tight labor market in the U.S. would force rapid productivity gains in nontraded domestic industries that at the present are labor-intensive.

Martin (2001) wrote that in 1960, 80 percent of the 45,000 peak harvest workers used to pick 2.2 million tons of the tomatoes used to make catsup in California were Mexican laborers and growers testified that the use of Braceros is absolutely essential to the survival of the tomato industry. This had happened before in the 1880s when there were proposals to stop Chinese immigration to California. Farmers responded that without Chinese farmworkers agriculture will be crippled, with farmers going out of business, fruits and vegetable prices soaring, and America made vulnerable by dependence on food imports from abroad. However, in 1999 about 5,000 workers were employed to ride machines to sort 12 million tons of tomatoes harvested by machine on 300,000 acres. Therefore, in the tomato case, the end of the Bracero program led to the mechanization of the tomato harvest. The expanding production helped reduce the price of processed tomato products, which helped to fuel the fast-food boom.

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[1] The Bracero program was initiated in 1942 for the importation of temporary contract laborers from Mexico to the United State. It brought close to five million Mexican farmworkers to the United States before it was abolished in 1964.

In manufacturing, Quispe-Agnoli and Zavodny (2002) developed a regression model that showed changes in the labor supply due to immigration appear to lower labor productivity in both the low- and high-skilled sectors. Lewis (2005) examined the impact of low-skilled immigrant labor on technology adoption in manufacturing. It concluded that plants with fast labor supply growth adopted automation technology more slowly and even de-adoption was not uncommon. Thus, the relative supply of less-skilled labor reduced demand for technology. In Thailand, Kulkolkarn (2010) picks garment industry to compare firms' characteristics and productivity of firms employing immigrants with firms that do not employ immigrants. She finds that out of twenty six characteristics immigrant-employing firms are inferior in twelve characteristics such as type and age of machine, ownership by foreigners, future plan for enhancing production capacity and quality, sales to MNEs, R&D investment, customers' participation in R&D and employee training, business network brand ownership, and product improvement. She however finds no evidence of the difference in productivity between the two.

This paper aims to provide some stylized facts from the analysis of micro datasets on how immigrant-hiring firms differ from non-immigrant-hiring firms in terms of firm's characteristics and performances, and what kinds of firms tend to use immigrants. This will help develop an understanding of attributes that influence firms' decision to employ immigrants. The analysis will cover nine manufacturing industries in Thailand: food processing, textiles, garments, automobile components, electronic components, electrical appliances, rubber and plastics, furniture and wood, and machinery and equipments. Section 2 provides a model of a firm's decision to employ immigrants. Section 3 is data overview on immigrant employing in the Thai manufacturing. Section 4 analyses the differences in characteristics and performances between immigrant-employing firms and non-immigrant firms. Sector 5 analyzes what kinds of firms tend to employ immigrants. Section 6 concludes.

2. Firm's Decision to Employ Immigrants

Firms can use immigrant workers to substitute native workers and capital. When wage of native workers increases, a profit-maximizing firm will demand less of native workers and may delay capital update by employing more of immigrant workers if all factors are substitutes for one another. The degree of substitution among factors depends on technology. Suppose technology is linear such that the production function $(x_1, x_2) = ax_1 + bx_2$. In this case, factors 1 and 2 are perfect substitutes. The firm will use whichever is cheaper. Technology varies across and within industry. Some industries may be more capital intensive. Some may be more labor intensive. Within the same industry, firm attributes play an important role in determining firm's technology and as a result a decision to employ immigrants.

Therefore, besides capital intensity and skill intensity perhaps the most obvious firm attributes that influence a decision to employ immigrants to consider are those related to past success. Bad firms tend to use immigrants to avoid updating technology, expensive native workers and investing in capital. On the other hand, good firms do not rely on immigrants when native labor is in shortage and even though immigrants are cheaper. The measures of firm success we consider include

- Firm size: Size may proxy for several effects; larger firms by definition have been successful in the past, but size may be associated with lower average, or marginal costs, providing a separate mechanism for size to decrease the likelihood of employing immigrants.
- Firm age: Older firms have better performance compared with younger firms because they have more experience in the market.
- Vintage of firm capital: Recently purchased machinery embodies the appropriate technology and has contributed to improving firm performance.
- Firm Export: Exporter firms improve their performance from exposure to international market and competition.
- Foreign ownership: Foreign firms tend to be more productive as they often have access to more advanced technology and management.
- Computer-controlled machinery: Firms better equipped with machinery tend to have higher productivity.
- Multi-plant: Multi-plant firms are associated with lower average, or marginal costs, decreasing the likelihood of employing immigrants.
- Average wage: We expect the quality of workforce to be negatively related with employing immigrants. To proxy workforce quality, we use average wage.
- Productivity: Three common measures of productivity – labor productivity, total factor productivity (TFP), and sales growth -- capture different aspects of firm performance. The first two measure the level of productivity in a relatively objective way, while the last captures the change in sales, which can be the result of productivity as well as a host of other factors that influence a company's success.

3. Immigrant Employment in Thai Manufacturing

This section provides an overview of immigrant employment in the Thai manufacturing. In this paper, we use data from the Productivity and Investment Climate Survey (PICS) of Thailand of which the general purpose is to understand the investment climate in Thailand and how it affects business performance. PICS is a collaborative effort of the Royal Thai Government and the World Bank. It was funded by the Royal Thai Government and carried out by the Foundation for Thailand Productivity Institution (FTPI) under the supervision of the Ministry of

Industry, with technical assistance from the World Bank on survey design and implementation. Guidance was provided by the Technical advisory Committee composed of representatives from the World Bank, the Ministry of Industry, the National Economic and Social Development Board, the Bank of Thailand, the National Statistics Office, and other agencies.

PICs was conducted two rounds, the first round (PICS 2004) between March 2004 and February 2005, and the second round (PICS 2007) between April 2007 and November 2007. Due to data accessibility during the research period, only observations in PICS 2007 will be used in this study. Some 1,043 manufacturing firms from nine industries (food processing, textiles, garments, automobile components, electronic components, electrical appliances, rubber and plastics, furniture and wood, and machinery and equipments) in six regions (North, Central, metropolitan Bangkok, East, Northeast, and South) were surveyed in PICS 2007. The survey included interviews with CEOs, Chief Financial Officers, Human Resource managers, and workers. It provides information on firm's characteristics, subjective assessments by firm managers and objective measures of various aspects of the investment climate, as well as information on corporate finance for 2003-2006.

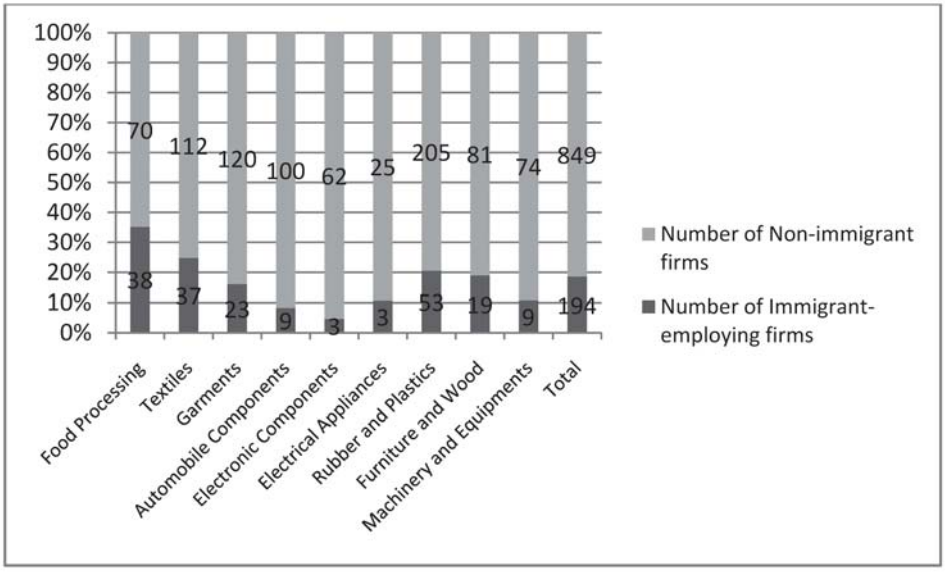
First let's look at the share of firms in each industry that employ immigrants. As shown in Figure 1, it reveals that immigrant employment occurs in all manufacturing industries, not only in low skilled or labor-intensive sectors, namely food processing, garment and textile, but also high skilled and capital-intensive sectors such as automobile components, electronic components and electrical appliances. Overall, 194 firms out of 1,043 surveyed firms employed immigrants. Thus, the overall share of manufacturing firms that employ immigrants is at 19 percent, but that this share ranges rather widely from a high of 35 percent in food processing to a low of 5 percent in electronic components.

Altogether all firms in the survey employed 10,837 immigrants. This represents 2 percent of 535,732 registered immigrants or 0.6 percent of 1,800,000 registered and non-registered immigrants in Thailand in 2007. As shown in Figure 2, 37 percent of all immigrants, or 4,031 immigrants are employed in textiles and 33 percent (3,633 immigrants) in food processing. Furniture and wood and rubber and plastics each employ 9 percent (1,023 immigrants and 992 immigrants, respectively). Garments employ 7 percent (730 immigrants) while electronic components employ 2 percent (172 immigrants). Automobile components, machinery and equipments and electrical appliances each employ 1 percent (116 immigrants, 83 immigrants and 57 immigrants, respectively). The number of immigrants reported in the survey should include only registered immigrants so the actual numbers of immigrants employed are expected to be higher.

The average share of immigrants in total firm employment is approximately 5 percent as shown in Figure 3. Here, too, there is substantial variation across industries, ranging from a high of 14 percent in food processing to a low of 0.3 percent in electrical appliances. Moreover, the data reveals high concentration of firm in immigrant employment. The top 5 percent of firms that most employs immigrants account for 87 percent of total immigrant employment. Again, this varies quite largely from 51 percent in food processing to 100 percent in electronic components.

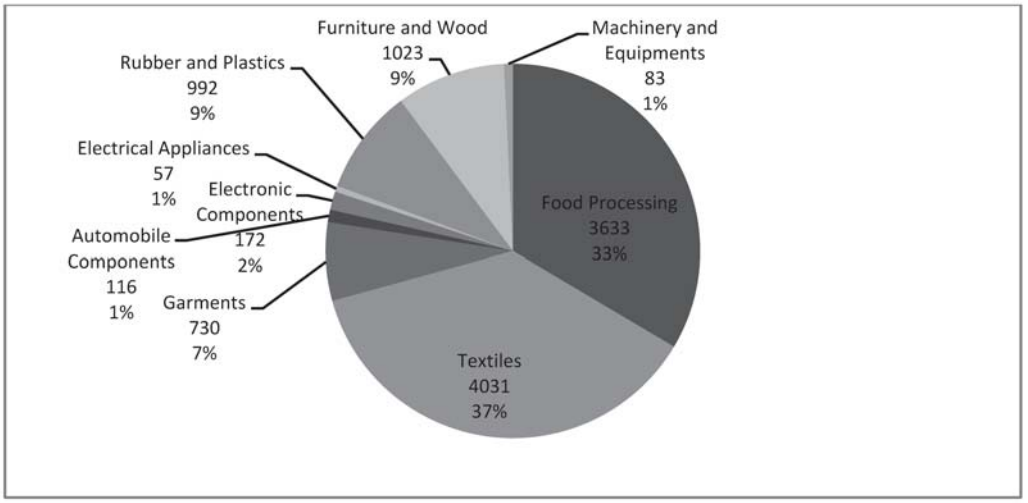
Considering 194 firms that employ immigrants, the average number of immigrants hired by a firm varies from 109 in textiles to 9 in machinery and equipments as shown in Table 1. The textile firm that employs immigrants the most employs as high as 880 immigrant workers. The share of immigrant in total firm employment varies from 40 percent in food processing to 3 percent in electrical appliances. The firm with the highest immigrant share is a textile firm with the ratio as high as 100 percent.

Figure 1: Share and Number of Firms that Employ Immigrants



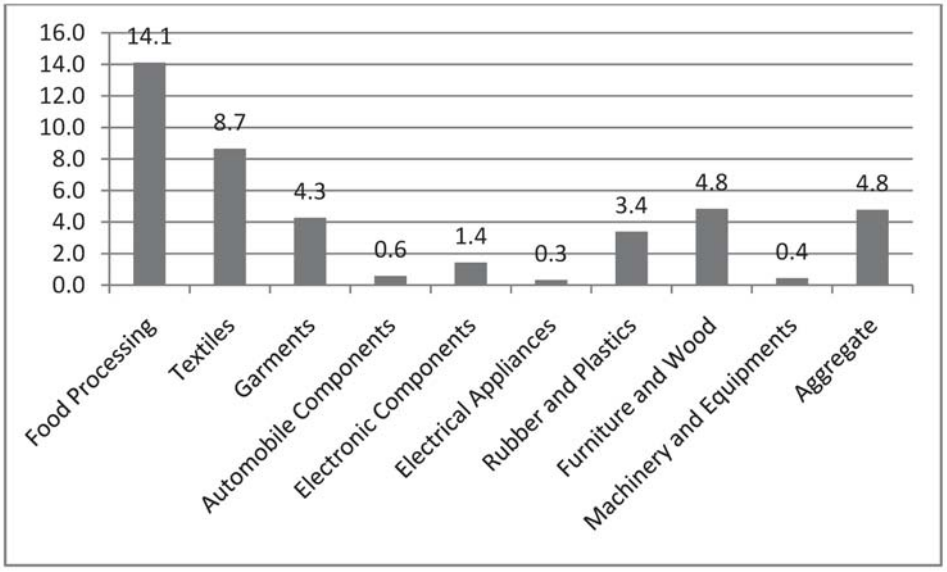
Source: Author's calculation

Figure 2: Share and Number of Immigrants Across Industries



Source: Author's calculation

Figure 3: Immigrants per Native Workers



Source: Author's calculation

Table 1: Number of Immigrants and Immigrant-native Ratio in Immigrant Employing Firms

Industry	No. of Immigrants			Immigrant-Native Ratio (%)		
	Mean	Max	StdDev	Mean	Max	StdDev
Food processing	96	436	116	40	65	29
Textiles	109	880	185	35	100	32
Garments	32	246	54	27	96	27
Automobile components	15	81	27	8	40	13
Electronic components	57	171	98	31	90	51
Electrical appliances	19	41	20	3	5	2
Rubber and plastics	19	181	36	17	80	22
Furniture and wood	46	210	63	22	50	19
Machinery and equipments	9	58	19	4	10	4

Source: Author's calculation

4. Immigrant Employment and Firm's Characteristics and Performances

In this section, we compare immigrant-employing firms with other firms. We will consider the following firm's characteristics and performances:

- Firm size is measured by firm's total employment as well as total output measured as operating revenue.
- Firm age is measured by the difference between the year of the survey and the year operations were started in Thailand.
- Vintage of firm capital is defined as percentage of a firm's machinery and equipment that is less than five years old.
- Firm export is measured by the sum of percentages of direct export and indirect export to total sales.
- Foreign ownership is defined as the percentage of the firm owned by private sector foreign firms.
- Computer-controlled machinery is measured by the percentage of the value of computer-controlled machinery in firm's fixed asset.
- Unskilled wage per unskilled worker is measured by wage expenditure paid to unskilled labor divided by the number of unskilled workers.
- Capital intensity is measured by the value of machinery and equipment per worker.
- Skill intensity is measured by the ratio of skilled labor which is the sum of the number of management, professionals and skilled production and nonproduction workers to total labor.
- Multi-plant is defined as number of plants a firm has.

- Average wage is total wage divided by total employment. Average skilled wage is total wage paid to skilled workers divided by number of skilled workers. Average unskilled wage is total wage paid to unskilled workers divided by number of unskilled workers.
- Labor productivity is the value-added produced by each worker. The calculation of labor productivity is straightforward mathematically, equaling the value-added divided by the number of workers. Higher labor productivity mainly resulted from four factors: more capital or machinery per worker; better skills; more advanced or adopted technology; and a better business environment. Mathematically, it is defined as:

$$VAL_i = \frac{y_i - m_i}{l_i}$$

  where i stands for firm; y is output measured as operating revenue, m is intermediate costs defined as the sum of direct material cost, electricity expenditures, and fuel and other energy expenditures; l is the total number of labor.
- Total factor productivity is defined as the residual of output or value-added that cannot be explained by factor inputs. It measures the contribution to output beyond those made by skilled and unskilled labor, the intermediate input, and the machinery/capital used. As the contribution of capital and skill is already accounted for in the production function estimation, TFP captures primarily the impact of technology and investment climate. TFP is estimated by applying the Levinsohn and Petrin (2003) technique to use intermediates as a proxy. The production function considered assumes that output is produced by skilled and unskilled labor, intermediate inputs, and capital. Capital stock is defined as the book value of machinery and equipment. Potentially, there is correlation between input levels and the unobserved firm-specific productivity shocks in the estimation of the parameters of the production function. Ordinary least squares (OLS) estimates of production functions will thus yield biased parameter estimates of productivity. Levinsohn and Petrin (2003) correct for a firm's decision of input adjustment in response to productivity shock and their result yields comparatively unbiased estimators.
- Sales growth is measured as the annual growth rate of sales. Assuming that firms can choose the level of output to maximize profit in a free market, firms that have more rapid sales growth should have higher productivity. Mathematically, it is defined as the change in logarithm of operating revenue. Or, $SG_i = \ln(y_{it}) - \ln(y_{it-1})$ where t stands for time, and y s are deflated by the Consumer Price Index of the Bank of Thailand.

Data summaries of these variables are provided in Tables 2.0-2.9 in the appendix. We estimate OLS regression of the plant characteristic on an indicator variable denoting the firm's immigrant-employing status. Each row of Table 3 summarizes the average value of a particular plant characteristics and performances. The first column shows the value for non-immigrant firms. The second column shows the value for immigrant-employing firms. While the figure in the first column is the intercept, the figure in the second column is the sum of the intercept and the coefficient of the indicator variable. The last column reports p-values of the indicator coefficients indicating whether a particular characteristic or performance of non-immigrant firms and immigrant-employing firms are statistically different.

Table 3: Difference between Non-migrant Firms and Migrant-employing Firms: All Industries

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	249	277	0.557
Output	498,000,000	462,300,000	0.768
Age	15	14	0.296
Vintage Capital	33	33	0.937
Export	27	36	0.005***
Foreign Owner	17	10	0.005***
Multi-plant	1.22	1.19	0.602
Computer	13	7	0.000***
Value Added per Worker	573,605	475,618	0.264
Sale Growth	0.05	0.19	0.000***
TFP	8,495,754	6,146,806	0.279
Average Wage	120,585	97,369	0.000***
Skilled Average Wage	210,004	182,827	0.009***
Unskilled Average Wage	85,448	68,916	0.044**
Capital per Worker	250,213	174,640	0.099*
Skill per Worker	0.33	0.29	0.017**

We first estimate the whole dataset before splitting it into industries. As shown in Table 3.0, we can see that immigrant-employing firms are inferior to non-immigrant firms in term of foreign ownership, computer-controlled machinery, average wage paid to unskilled and skill workers, capital per worker and skill per worker. However, they have higher share of export in production and higher sale growth.

In particular, the share of foreign ownership in immigrant-hiring firms is 10 percent comparing to 17 percent in non-immigrant firms. The share of computer-controlled machinery is 7 percent comparing to 13 percent. The average wage paid is 97,369 baht comparing to 120,585 baht. The average skill wage paid is 182,827 baht comparing to 210,004 baht. The average unskilled wage paid is 68,916 baht comparing to 85,448 baht. Capital per worker is 174,640 baht comparing to 250,213 baht. Skill per worker is 0.29 comparing to 0.33. However, export share is 27 percent comparing to 36 percent. Sale growth is 19 percent comparing to 5 percent. Attributes that are not different between immigrant-employing firms and non-immigrant firms include firm size as measured by firm's total employment and total output, firm age, vintage of firm capital, number of plants a firm has, value-added per worker and TFP.

The estimated results in each industry are presented in Tables 3.1-3.9 shown in appendix. Table 4 summarizes all results. We can see that immigrants-employing firms in electrical appliances employ fewer workers while those in machinery and equipments have higher total output. Immigrants-employing firms in food processing are younger. Those in garments use older capital, while those in machinery and equipments use newer. Those in electrical appliances, rubber and plastics and furniture and wood have higher export share. Those in rubber and plastics have lower foreign share and use lower capital per worker than non-immigrants firms. Those in food processing, textiles and garments have fewer plants, while those in furniture and wood have more plants. Those in textiles have lower share of computer-controlled machinery in firms' fixed asset. Those in food processing, textiles, garments, rubber and plastics, and machinery and equipments have higher sale growth. Those in textiles have lower value-added per worker. Those in food processing and automobile components pay lower wage while those in electrical appliances pay higher wage. Moreover, those in textiles, automobile components and machinery and equipments pay lower wage to skilled workers, while those in electrical appliances pay higher. Lastly, TFP, wage paid to unskilled workers and skill per worker are not different in any industry.

Table 4: Summary of Difference between Non-migrant Firms and Migrant-employing Firms

Characteristics/Industry	All	1	2	3	4	5	6	7	8	9
Total Employment										+
Output							-			
Age		-								
Vintage Capital				-						+
Export	+						+	+	+	
Foreign Owner	-							-		
Multi-plant		-	-	-					+	
Computer	-		-							
Value Added per Worker			-							
Sale Growth	+	+	+	+				+		+
TFP										
Average Wage	-	-			-		+			
Skilled Average Wage	-		-		-		+			-
Unskilled Average Wage	-									
Capital per Worker	-							-		
Skill per Worker	-									

Note: + denotes that the characteristic value of immigrant-hiring firms is higher. - denotes that the characteristic value of immigrant-hiring firms is lower. Industries 1-9 are food processing, textiles, garments, automobile components, electronic components, electrical appliances, rubber and plastics, furniture and wood, and machinery and equipments, respectively.

5. What Kinds of Firms Tend to Employ Immigrants

In this section, we look at firm attributes that may influence firms' decision to use immigrants. There are several potential estimation strategies for the binary choice framework. One of the key choices in the various binary variable models involves the cumulative distribution function. The five commonly used binary outcome models include linear probability models (LP), probit, logit, complementary log-log (Cloglog) and tobit. All of these five models will be estimated in this study. Due to small sample size of electronic components and electrical appliances, we group these two industries together so that their results are estimated in one regression.

In general, the results estimated by the five models are consistent. For the whole data set as shown in Table 5.0, one percentage point increase in the export share increases immigrant-native worker ratio by 0.14 percent and the probability to

employ immigrants by 0.001. Moreover, one percentage point increase in the sale growth increases immigrant-native worker ratio by 28 percent and the probability to employ immigrants by 0.16. However, one percentage point increase in the share of foreign ownership decreases immigrant-native worker ratio by 0.25 percent and the probability to employ immigrants by 0.001. One percentage point increase in the share of computer-controlled machinery decreases immigrant-native worker ratio by 0.43 percent and the probability to employ immigrants by 0.002. One percent increase in average wage paid to workers decreases immigrant-native worker ratio by 18 percent and the probability to employ immigrants by 0.08.

To summarize, two variables that increase the chance of employing immigrants are higher export share and higher sale growth. Three variables that decrease the chance of employing immigrants include higher foreign share in ownership, higher share of controlled-computer machinery and higher average wage paid to workers. The explanation for these results might be that firms with high sale growth are those in urgent need of labor and thus necessarily use immigrant labor. It is always urgent that they may not have time to purchase more efficient equipment, and they continue to use their old capital and technology. Firms with high export share may use immigrants as a risk buffer. Export volume relatively more fluctuates and firms need to adjust labor employment accordingly. When export is high, firms hire immigrants to meet their high demand for labor. When export is slow, firms could easily decrease number of immigrants employed. Foreign firms may be more ready to respond to the shortage of Thai workers by buying efficient equipment that substitutes other inputs for the scarce native labor or that embodies labor-saving technologies. They may also be able to adopt new technology that permits the substitution of resources that are not in short supply for resources that are scarce. Moreover, firms with high foreign share in ownership may want to avoid cost and difficulties of employing immigrant workers and willing to pay higher wage to employ Thai workers. Firms with higher share of controlled-computer machinery are firms with lower labor intensity. Thus, they would tend to be less likely to employ immigrants.

Table 5: The Decision to Employ Immigrants: All Industries

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	1.610	0.0110	0.0113	0.0109	0.00914
	(2.280)	(0.0130)	(0.0124)	(0.0129)	(0.0119)
ln (Value added per Worker)	-1.570	-0.000811	0.00105	0.00321	0.00221
	(2.773)	(0.0169)	(0.0152)	(0.0158)	(0.0143)
Skill per Worker	-9.341	-0.0221	-0.0360	-0.0350	-0.0339
	(11.01)	(0.0583)	(0.0598)	(0.0620)	(0.0572)
ln (Capital per Worker)	-0.589	-0.00403	-0.00388	-0.00385	-0.00297
	(1.367)	(0.00823)	(0.00751)	(0.00780)	(0.00729)
Age	-0.489*	-0.00164	-0.00159	-0.00167	-0.00135
	(0.263)	(0.00137)	(0.00140)	(0.00146)	(0.00132)
Export	0.141**	0.000948**	0.000837***	0.000868**	0.000767**
	(0.0598)	(0.000372)	(0.000323)	(0.000339)	(0.000307)
Foreign Ownership	-0.246***	-0.00115***	-0.00142***	-0.00133***	-0.00153***
	(0.0920)	(0.000396)	(0.000513)	(0.000502)	(0.000513)
Computer	-0.432***	-0.00151***	-0.00207***	-0.00191***	-0.00200***
	(0.134)	(0.000488)	(0.000744)	(0.000707)	(0.000741)
Vintage Capital	-0.0860	-0.000442	-0.000463	-0.000402	-0.000351
	(0.0759)	(0.000433)	(0.000414)	(0.000429)	(0.000388)
ln (Wage)	-17.85***	-0.0825***	-0.0767***	-0.0854***	-0.0639***
	(4.952)	(0.0285)	(0.0264)	(0.0275)	(0.0236)
Sale Growth	28.38***	0.166***	0.150***	0.155***	0.103***
	(5.369)	(0.0356)	(0.0313)	(0.0314)	(0.0199)
Multi-plant	1.039	0.00933	0.00874	0.00989	0.00810
	(2.902)	(0.0177)	(0.0149)	(0.0160)	(0.0127)
ln (TFP)	0.479	2.17e-05	-0.00204	-0.00259	-0.00261
	(1.095)	(0.00645)	(0.00605)	(0.00617)	(0.00585)
Constant	187.5***	1.171***			
	(54.95)	(0.310)			
Observations	1,010	1,010	1,010	1,010	1,010
R-squared		0.147			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results of each industry are presented in Table 5.1-5.8 shown in appendix. Table 6 summarizes the results from Tables 5.0-5.8 when the variables are significant in at least 4 estimated models. In food processing industry, foreign firms tend to not use immigrant workers while firms with higher sale growth tend to use immigrant workers. In textiles, firms with higher share of computer-controlled machinery, valued added per worker and average wage tend not to employ immigrants while firms with higher sale growth and TFP tend to employ immigrants. In garments, firms with higher total employment and share of machinery and equipment that is less than five years old tend not to use immigrants while firms with higher sale growth tend to use immigrants. In rubber and plastics, firms with higher share of computer-controlled machinery tend not to use immigrants while firms with higher export share and sale growth tend to use immigrants. For other industries, the variables we consider do not seem to explain what kinds of firms tend to employ immigrants.

Table 6: Summary Results of Tables 5.0-5.8

Characteristics/Industry	**All**	**1**	**2**	**3**	**4**	**5&6**	**7**	**8**	**9**
Total Employment				-					
Output									
Age									
Vintage Capital				-					
Export	+						+		
Foreign Owner	-	-							
Multi-plant									
Computer	-		-				-		
Value Added per Worker			-						
Sale Growth	+	+	+	+			+		
TFP			+						
Average Wage	-		-						
Skilled Average Wage									
Unskilled Average Wage									
Capital per Worker									
Skill per Worker									

Note: The positive and negative signs indicate direction of the correlation between characteristic variable and the immigrant-native ratio in tobit model, or the probability of employing immigrants in the other models. Industries 1-9 are food processing, textiles, garments, automobile components, electronic components, electrical appliances, rubber and plastics, furniture and wood, and machinery and equipments, respectively. The sign are reported only if the characteristic variable is significant in at least 4 models.

Another variable that should be added into our regressions is firm location. Firms that locate at the border of the neighboring countries should employ more immigrants. After adding this variable into all regressions, the results do not indicate a significant impact of firm location. This might due to small sample size of firms located at the border. There are only 55 firms out of 1,043 situated at the border. Future research that wishes to analyze why some firms employ immigrants must deal with endogeneity problem. For example, the endogeneity between average wage and immigrant employment because firms that pay low wage tend to employ immigrants. At the same time, employing immigrants allow firms to pay lower wage. Therefore, the causality direction in this case is unclear. To understand firms' decision to employ immigrants, one could consider using Heckman two-stage estimation to deal with selection bias.

6. Conclusions

This study provides a picture of immigrant employment in manufacturing of Thailand. It distinguishes immigrant-employing firms from non-immigrant firms and attempts to find firm attributes that may help explain why the firms employing immigrants by using the data from the Productivity and Investment Climate Survey (PICS) of Thailand in 2007. We find that immigrant employment occurs in all 9 manufacturing industries. Out of 1,043 surveyed firms, 194 firms employed immigrants. Thus, the overall share of manufacturing firms that employ immigrants is at 19 percent, but that this share ranges rather widely from a high of 35 percent in food processing to a low of 5 percent in electronic components. Altogether all firms in the survey employed 10,837 immigrants. Of all immigrants 37 percent (4031 immigrants) are employed in textiles, 33 percent (3633 immigrants) in food processing, 9 percent each (1023 immigrants and 992 immigrants, respectively) in furniture and wood and rubber and plastics, 7 percent (730 immigrants) in garments, 2 percent (172 immigrants) in electronic components, and 1 percent each (116 immigrants, 83 immigrants and 57 immigrants, respectively) in automobile components, machinery and equipments and electrical appliances.

The average share of immigrants in total employment of each firm is approximately 5 percent. Here, too, there is substantial variation across industries, ranging from a high of 14 percent in food processing to a low of 0.3 percent in electrical appliances. Moreover, the data reveals high concentration of firm in immigrant employment. Considering 194 firms that employ immigrants, the average number of immigrants hired by a firm varies from 109 in textiles to 9 in machinery and equipments. The textile firms that employ immigrants the most employs as high as 880 immigrant workers. The share of immigrant in total firm employment varies from 40 percent in food processing to 3 percent in electrical appliances. The firm with the highest immigrant share is a textile firm with the ratio as high as 100 percent.

When comparing immigrant firms with non-immigrant firms, we find that immigrant-employing firms tend to have higher export share and higher productivity measured by sale growth, but lower foreign share in ownership, computer-controlled machinery, capital per worker and skill per worker. They also pay lower wage to both skilled and unskilled workers. These results however vary across industries. In food processing, immigrant-employing firms are on average newer firms, have fewer plants and higher sale growth, and pay lower wage. In textiles, they have fewer plants, less computer-controlled machines, lower value added per worker, higher sale growth and pay lower wage to skilled workers. In garments, they use older capital, have fewer plant, but higher sale growth. In automobile components, they pay lower wage especially to their skilled workers. In electrical appliances, they are smaller when measured by total employment but they have higher export share, and pay higher wage especially to their skilled workers. We cannot distinguish between them in electronic components. In rubber and plastics, they have higher export share and sale growth, but lower capital per worker and foreign ownership. In furniture and wood, they have higher export share and more plants. In machinery and equipments, they are larger when measured by total employment. They have higher export share and sale growth, but pay lower wage to skilled workers.

We also analyze firm attributes that may influence firm's decision to employ immigrants. Two variables that tend to increase the chance of employing immigrants are higher export share and higher sale growth. Three variables that tend to decrease the chance of employing immigrants include higher foreign share in ownership, higher share of controlled-computer machinery and higher average wage paid to workers. The explanation for these results might be that firms with high sale growth are those in urgent need of labor and thus necessarily use immigrant labor. Firms with high export share may use immigrants as a risk buffer. Foreign firms may be more ready to respond to the shortage of Thai workers by buying efficient equipment that substitutes other inputs for the scarce native labor or that embodies labor-saving technologies. They may also be able to adopt new technology that permits the substitution of resources that are not in short supply for resources that are scarce. Moreover, firms with high foreign share in ownership may want to avoid cost and difficulties of employing immigrant workers and willing to pay higher wage to employ Thai workers. Firms with higher share of controlled-computer machinery are firms with lower labor intensity. Thus, they would tend to be less likely to employ immigrants.

It is worth noting that this paper does not aim to examine what attributes cause a firm to use immigrants. If one wants to understand why some firms employ immigrants, endogeneity problem must be considered. For example, firms that pay low wage may able to only employ immigrants while employing immigrants allow firms to pay lower wage. In this case, the causality direction is unclear. To understand

firms' decision to employ immigrants, future research could consider using Heckman two-stage estimation to deal with selection bias. For policy implication, we find that firms with higher share of computer-controlled machinery tend not to rely on immigrant workers. Thus, the government could discourage immigrant employment in manufacturing by assisting firms during their transition into more use of computer-controlled machinery.

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Appendix

Table 2.0: Data Summary: All Industries

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	1043	4.78	15.67	0.00	99.50
Output	1043	491,000,000.00	1,520,000,000.00	26,231.40	18,300,000,000.00
Total Employment	1043	253.89	591.51	8.00	9,083.00
Value Added per Worker	1043	555,379.30	1,102,285.00	-807,833.00	14,000,000.00
Skill per Worker	1043	0.32	0.22	0.02	1.00
Capital per Worker	1043	236,156.10	575,550.30	0.00	7,816,075.00
Age	1043	15.29	9.48	1.00	61.00
Export	1043	28.16	38.40	0.01	100.00
Foreign Owner	1043	15.40	29.81	0.01	100.00
Computer	1036	11.46	20.81	0.07	100.00
Vintage Capital	1042	33.29	30.73	1.00	100.00
Average Wage	1042	116,263.00	78,062.83	6,876.63	1,307,038.00
Sale Growth	1031	0.08	0.40	-3.85	3.44
Multi-plant	1043	1.22	0.74	1.00	10.00
TFP	1034	8,061,858.00	27,100,000.00	2,808.93	399,000,000.00

Table 2.1: Data Summary: Food Processing

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	108	14.11	25.78	0.00	90.00
Output	108	695,000,000.00	1,700,000,000.00	2,075,955.00	12,200,000,000.00
Total Employment	108	442.27	1,141.44	10.00	9,083.00
Value Added per Worker	108	637,091.00	1,419,612.00	-32,636.80	13,200,000.00
Skill per Worker	108	0.33	0.22	0.05	1.00
Capital per Worker	108	276,574.80	814,157.10	0.10	7,816,075.00
Age	108	17.21	10.86	2.00	50.00
Export	108	50.94	43.42	0.01	100.00
Foreign Owner	108	14.47	27.65	1.00	100.00
Computer	107	5.84	13.62	1.00	80.00
Vintage Capital	108	38.51	35.28	1.00	100.00
Average Wage	108	109,566.00	95,073.56	20,011.21	824,922.00
Sale Growth	108	0.11	0.47	-0.62	3.07
Multi-plant	108	1.47	1.26	1.00	10.00
TFP	107	16,200,000.00	27,900,000.00	292,628.50	170,000,000.00

Table 2.2: Data Summary: Textiles

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	149	8.66	21.95	0.00	99.50
Output	149	327,000,000.00	691,000,000.00	1,253,725.00	3,810,000,000.00
Total Employment	149	280.15	579.67	11.00	5,180.00
Value Added per Worker	149	412,303.90	612,992.10	15,298.89	5,444,471.00
Skill per Worker	149	0.28	0.21	0.02	1.00
Capital per Worker	149	315,607.50	819,623.70	0.00	7,127,443.00
Age	149	17.85	12.33	1.00	61.00
Export	149	23.46	35.77	0.01	100.00
Foreign Owner	149	8.04	19.19	1.00	100.00
Computer	149	8.71	19.05	0.80	90.00
Vintage Capital	149	22.89	26.61	1.00	100.00
Average Wage	149	102,382.10	104,540.20	19,671.62	1,307,038.00
Sale Growth	147	0.04	0.27	-1.14	1.13
Multi-plant	149	1.15	0.57	1.00	6.00
TFP	149	6,152,724.00	9,580,953.00	178,165.70	63,200,000.00

Table 2.3: Data Summary: Garments

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	143	4.27	14.37	0.00	96.00
Output	143	150,000,000.00	346,000,000.00	323,270.30	3,290,000,000.00
Total Employment	143	244.32	320.82	8.00	1,824.00
Value Added per Worker	143	229,313.10	231,528.80	-19,628.20	1,706,697.00
Skill per Worker	143	0.28	0.25	0.03	1.00
Capital per Worker	143	46,887.54	69,524.21	0.00	438,804.10
Age	143	13.66	8.51	1.00	48.00
Export	143	41.30	44.84	0.01	100.00
Foreign Owner	143	6.81	17.36	1.00	100.00
Computer	142	7.31	14.53	1.00	80.00
Vintage Capital	143	34.12	30.76	1.00	100.00
Average Wage	143	88,686.84	40,977.87	6,876.63	315,555.60
Sale Growth	138	0.06	0.61	-3.85	3.44
Multi-plant	143	1.13	0.39	1.00	3.00
TFP	142	5,100,415.00	6,452,408.00	6,556.02	44,400,000.00

Table 2.4: Data Summary: Automobile Components

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	109	0.58	3.93	0.00	40.00
Output	109	895,000,000.00	1,920,000,000.00	1,893,722.00	16,100,000,000.00
Total Employment	109	278.63	347.47	13.00	1,774.00
Value Added per Worker	109	1,063,064.00	1,797,302.00	31,796.59	14,000,000.00
Skill per Worker	109	0.37	0.20	0.07	1.00
Capital per Worker	109	590,168.20	987,076.30	0.21	5,800,599.00
Age	109	15.50	8.80	3.00	48.00
Export	109	14.38	21.69	0.01	95.00
Foreign Owner	109	34.54	40.02	1.00	100.00
Computer	108	22.84	27.10	0.07	100.00
Vintage Capital	109	36.76	26.26	1.00	100.00
Average Wage	109	149,465.30	92,799.01	19,467.87	626,470.60
Sale Growth	109	0.03	0.28	-1.20	0.89
Multi-plant	109	1.35	0.76	1.00	4.00
TFP	109	39,100,000.00	68,500,000.00	249,000.00	399,000,000.00

Table 2.5: Data Summary: Electronic Components

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	65	1.43	11.16	0.00	90.00
Output	65	1,370,000,000.00	3,100,000,000.00	1,746,092.00	13,900,000,000.00
Total Employment	65	535.92	1,112.78	13.00	5,807.00
Value Added per Worker	65	640,258.80	662,620.50	14,929.88	3,213,701.00
Skill per Worker	65	0.38	0.26	0.05	1.00
Capital per Worker	65	211,682.90	282,783.20	0.00	1,615,160.00
Age	65	12.55	6.25	2.00	35.00
Export	65	37.44	43.49	0.01	100.00
Foreign Owner	65	38.12	42.90	0.01	100.00
Computer	65	28.57	31.56	1.00	100.00
Vintage Capital	65	53.32	122.95	1.00	999.00
Average Wage	65	147,318.30	98,523.52	14,794.25	656,171.60
Sale Growth	65	0.15	0.47	-0.54	2.68
Multi-plant	65	1.31	0.75	1.00	5.00
TFP	65	3,241,512.00	6,478,144.00	43,571.02	42,800,000.00

Table 2.6: Data Summary: Electrical Appliances

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	28	0.32	1.09	0.00	5.00
Output	28	796,000,000.00	1,980,000,000.00	5,899,339.00	9,120,000,000.00
Total Employment	28	283.96	544.97	10.00	2,603.00
Value Added per Worker	28	876,933.70	1,374,329.00	111,340.60	6,392,782.00
Skill per Worker	28	0.34	0.19	0.11	1.00
Capital per Worker	28	129,326.90	169,651.30	1,072.67	826,559.50
Age	28	14.71	9.12	1.00	39.00
Export	28	20.28	34.33	0.01	100.00
Foreign Owner	28	27.57	40.36	1.00	100.00
Computer	28	10.89	17.56	1.00	60.00
Vintage Capital	28	33.51	36.68	1.00	100.00
Average Wage	28	131,922.80	55,862.79	32,465.89	269,714.30
Sale Growth	27	-0.03	0.38	-1.45	0.76
Multi-plant	28	1.32	0.86	1.00	5.00
TFP	28	108,387.00	149,151.70	11,343.12	768,046.40

Table 2.7: Data Summary: Rubber and Plastics

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	258	3.39	12.02	0.00	80.00
Output	258	490,000,000.00	1,680,000,000.00	1,971,259.00	18,300,000,000.00
Total Employment	258	161.10	350.31	10.00	4,500.00
Value Added per Worker	258	598,143.80	1,302,432.00	-807,833.00	13,500,000.00
Skill per Worker	258	0.29	0.17	0.06	1.00
Capital per Worker	258	234,030.70	368,317.70	0.00	2,656,992.00
Age	258	15.18	8.86	1.00	49.00
Export	258	19.98	33.02	0.01	100.00
Foreign Owner	258	12.40	27.35	1.00	100.00
Computer	258	10.26	19.90	0.10	100.00
Vintage Capital	258	32.20	30.45	1.00	100.00
Average Wage	257	110,935.40	54,428.50	24,335.75	572,000.00
Sale Growth	257	0.14	0.34	-1.17	2.10
Multi-plant	258	1.16	0.68	1.00	10.00
TFP	256	111,958.10	264,453.40	2,808.93	3,204,679.00

Table 2.8: Data Summary: Furniture and Wood

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	100	4.84	14.28	0.00	90.00
Output	100	99,400,000.00	157,000,000.00	26,231.40	1,000,000,000.00
Total Employment	100	140.80	193.34	10.00	1,150.00
Value Added per Worker	100	383,475.00	741,603.80	-183,802.00	6,505,226.00
Skill per Worker	100	0.32	0.19	0.06	1.00
Capital per Worker	100	67,025.33	83,823.48	0.00	620,718.50
Age	100	13.92	8.01	1.00	38.00
Export	100	30.28	39.46	0.01	100.00
Foreign Owner	100	9.35	22.18	1.00	100.00
Computer	98	5.27	9.47	1.00	45.00
Vintage Capital	100	38.46	32.88	1.00	100.00
Average Wage	100	107,475.30	48,414.85	15,800.68	344,702.70
Sale Growth	97	0.06	0.25	-0.66	0.74
Multi-plant	100	1.18	0.72	1.00	7.00
TFP	96	281,449.80	441,083.10	20,916.56	4,007,921.00

Table 2.9: Data Summary: Machinery and Equipments

Variable	Obs	Mean	Std.Dev.	Min	Max
Immigrant/Native Workers	83	0.44	1.72	0.00	10.00
Output	83	257,000,000.00	763,000,000.00	796,034.80	4,360,000,000.00
Total Employment	83	139.28	374.10	12.00	2,922.00
Value Added per Worker	83	500,195.10	423,629.30	-30,255.10	2,905,115.00
Skill per Worker	83	0.47	0.24	0.10	1.00
Capital per Worker	83	167,698.20	219,345.40	363.91	1,398,967.00
Age	83	15.02	8.67	2.00	50.00
Export	83	20.68	32.59	0.01	100.00
Foreign Owner	83	14.18	28.97	1.00	100.00
Computer	81	13.88	22.14	0.20	100.00
Vintage Capital	83	32.18	29.31	1.00	100.00
Average Wage	83	151,284.30	73,730.29	17,311.47	601,462.00
Sale Growth	83	0.00	0.38	-2.02	0.97
Multi-plant	83	1.18	0.57	1.00	4.00
TFP	82	5,176,689.00	8,118,152.00	126,083.20	48,900,000.00

Table 3.1: Difference between Non-migrant Firms and Migrant-employing Firms: Food Processing

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	451	425	0.911
Output	691000000	702300000	0.974
Age	19	15	0.091*
Vintage Capital	35	45	0.143
Export	52	49	0.713
Foreign Owner	18	9	0.113
Multi-plant	1.63	1.19	0.079*
Computer	7	3	0.137
Value Added per Worker	758922	412429	0.227
Sale Growth	0.05	0.24	0.041**
TFP	17800000	13168300	0.416
Average Wage	121305	87933	0.081*
Skilled Average Wage	181857	155341	0.141
Unskilled Average Wage	75619	65591	0.359
Capital per Worker	344011	152349	0.244
Skill per Worker	0.35	0.28	0.138

Table 3.2: Difference between Non-migrant Firms and Migrant-employing Firms: Textiles

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	258	357	0.384
Output	371000000	178000000	0.154
Age	19	16	0.208
Vintage Capital	24	19	0.301
Export	23	27	0.604
Foreign Owner	9	6	0.469
Multi-plant	1.1	0.9	0.067*
Computer	11	3	0.029**
Value Added per Worker	461167	247033	0.073*
Sale Growth	0.01	0.1	0.084*
TFP	6207987	5985577	0.903
Average Wage	110433	78010	0.102
Skilled Average Wage	185009	153866	0.052*
Unskilled Average Wage	101851	62126	0.375
Capital per Worker	369487	133368	0.141
Skill per Worker	0.29	0.24	0.181

Table 3.3: Difference between Non-migrant Firms and Migrant-employing Firms: Garments

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	253	191	0.421
Output	157000000	106600000	0.548
Age	14	12	0.379
Vintage Capital	37	18	0.012**
Export	41	40	0.911
Foreign Owner	7	2	0.261
Multi-plant	1.15	1	0.092*
Computer	8	4	0.228
Value Added per Worker	230422	222494	0.888
Sale Growth	0.01	0.28	0.056*
TFP	5275013	4196491	0.465
Average Wage	88084	91830	0.689
Skilled Average Wage	165942	183296	0.438
Unskilled Average Wage	69136	70435	0.859
Capital per Worker	47787	41357	0.703
Skill per Worker	0.29	0.24	0.181

Table 3.4: Difference between Non-migrant Firms and Migrant-employing Firms: Automobile Components

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	275	334	0.688
Output	927000000	358000000	0.484
Age	16	13	0.368
Vintage Capital	37	41	0.691
Export	15	6	0.314
Foreign Owner	35	25	0.572
Multi-plant	1.36	1.22	0.606
Computer	22	10	0.188
Value Added per Worker	1093423	534041	0.46
Sale Growth	0.02	0.15	0.175
TFP	39800000	31437594	0.728
Average Wage	154519	93311	0.058*
Skilled Average Wage	256187	151627	0.029**
Unskilled Average Wage	107426	74703	0.288
Capital per Worker	604981	335886	0.519
Skill per Worker	0.37	0.25	0.166

Table 3.5: Difference between Non-migrant Firms and Migrant-employing Firms: Electronic Components

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	549	110	0.587
Output	1410000000	60000000	0.549
Age	13	12	0.919
Vintage Capital	39	22	0.342
Export	37	50	0.67
Foreign Owner	38	30	0.788
Multi-plant	1.29	1.67	0.399
Computer	29	17	0.532
Value Added per Worker	636833	748159	0.817
Sale Growth	0.14	0.49	0.212
TFP	3343405	1133783	0.568
Average Wage	145972	175270	0.619
Skilled Average Wage	267656	262014	0.961
Unskilled Average Wage	89453	70081	0.52
Capital per Worker	215695	85289	0.525
Skill per Worker	0.38	0.4	0.932

Table 3.6: Difference between Non-migrant Firms and Migrant-employing Firms: Electrical Appliances

Characteristics	Non-migrant firms	Migrant-employing firms	p-value
Total Employment	244	808	0.162
Output	485000000	4835000000	0.001***
Age	15	15	0.964
Vintage Capital	33	35	0.954
Export	16	80	0.008***
Foreign Owner	25	58	0.269
Multi-plant	1.32	1.31	0.98
Computer	10	18	0.490
Value Added per Worker	871583	946499	0.942
Sale Growth	-0.01	-0.19	0.449
TFP	104403	141586	0.691
Average Wage	124001	197953	0.027**
Skilled Average Wage	206469	394129	0.005***
Unskilled Average Wage	86850	61992	0.384
Capital per Worker	118038	276090	0.21
Skill per Worker	0.35	0.31	0.765

Table 3.7: Difference between Non-migrant Firms and Migrant-employingFirms: Rubber and Plastics

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	164	147	0.779
Output	491000000	488416615	0.993
Age	15	12	0.103
Vintage Capital	33	29	0.498
Export	18	29	0.047**
Foreign Owner	14	6	0.09*
Multi-plant	1.16	1.17	0.897
Computer	11	7	0.181
Value Added per Worker	616830	494307	0.59
Sale Growth	0.12	0.21	0.073*
TFP	107590	129093	0.602
Average Wage	113496	101080	0.139
Skilled Average Wage	219914	213693	0.805
Unskilled Average Wage	77412	69435	0.337
Capital per Worker	251188	137687	0.076*
Skill per Worker	0.29	0.29	0.949

Table 3.8: Difference between Non-migrant Firms and Migrant-employing Firms: Furniture and Wood

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	132	194	0.256
Output	93900000	130000000	0.413
Age	14	15	0.622
Vintage Capital	40	32	0.374
Export	27	50	0.034**
Foreign Owner	11	1	0.126
Multi-plant	1.06	1.68	0.000***
Computer	5	5	0.940
Value Added per Worker	381035	397303	0.938
Sale Growth	0.05	0.09	0.585
TFP	290615	241734	0.674
Average Wage	106246	112714	0.603
Skilled Average Wage	183750	187061	0.888
Unskilled Average Wage	75154	76899	0.841
Capital per Worker	68870	56575	0.603
Skill per Worker	0.32	0.28	0.433

Table 3.9: Difference between Non-migrant Firms and Migrant-employing Firms: Machinery and Equipments

Characteristics	Non-migrant Firms	Migrant-employing Firms	p-value
Total Employment	111	448	0.022**
Output	220000000	655000000	0.15
Age	15	12	0.386
Vintage Capital	30	51	0.069*
Export	21	18	0.83
Foreign Owner	13	29	0.163
Multi-plant	1.16	1.33	0.395
Computer	14	12	0.789
Value Added per Worker	506792	428573	0.643
Sale Growth	-0.02	0.25	0.044**
TFP	4857115	7769264	0.313
Average Wage	154940	121226	0.197
Skilled Average Wage	237674	160434	0.071*
Unskilled Average Wage	95819	86535	0.619
Capital per Worker	170022	142463	0.753
Skill per Worker	0.47	0.47	0.978

Table 5.1: The Decision to Employ Immigrants: Food Processing

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	32.79	0.269	0.386	0.409	0.258
	(60.46)	(0.353)	(0.469)	(0.483)	(0.395)
ln (Value Added per Worker)	57.09	0.419	0.609	0.646	0.409
	(93.80)	(0.546)	(0.729)	(0.752)	(0.615)
Skill per Worker	-57.82	-0.430	-0.691	-0.690	-0.552
	(83.83)	(0.399)	(0.664)	(0.674)	(0.586)
ln (Capital per Worker)	-8.194	-0.0704*	-0.0847	-0.0868	-0.0727*
	(6.313)	(0.0363)	(0.0528)	(0.0537)	(0.0437)
Age	-1.108	-0.00519	-0.00662	-0.00665	-0.00572
	(0.753)	(0.00408)	(0.00572)	(0.00576)	(0.00495)
Export	0.193	0.00174	0.00186	0.00198	0.00172
	(0.174)	(0.00132)	(0.00139)	(0.00144)	(0.00121)
Foreign Ownership	-0.803**	-0.00473***	-0.00685**	-0.00680**	-0.00591**
	(0.334)	(0.00135)	(0.00272)	(0.00266)	(0.00232)
Computer	-0.678	-0.00147	-0.00219	-0.00206	-0.00220
	(0.796)	(0.00288)	(0.00519)	(0.00521)	(0.00488)
Vintage Capital	0.0281	0.000456	0.000176	0.000178	3.50e-05
	(0.200)	(0.00155)	(0.00158)	(0.00161)	(0.00133)
ln (Wage)	-27.92*	-0.0696	-0.103	-0.111	-0.108
	(15.92)	(0.103)	(0.124)	(0.125)	(0.112)
Sale Growth	33.95***	0.232***	0.279**	0.280**	0.221**
	(12.31)	(0.0807)	(0.132)	(0.131)	(0.106)
Multi-plant	-17.97	-0.0531**	-0.107	-0.113	-0.0915
	(13.33)	(0.0224)	(0.0890)	(0.0931)	(0.0772)
ln (TFP)	-48.24	-0.398	-0.569	-0.606	-0.373
	(92.63)	(0.545)	(0.721)	(0.743)	(0.609)
Constant	319.3*	1.774			
	(176.7)	(1.136)			
Observations	106	106	106	106	106
R-squared		0.209			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.2: The Decision to Employ Immigrants: Textiles

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	-36.41**	-0.325***	-0.246	-0.276	-0.202
	(16.52)	(0.0970)	(0.176)	(0.186)	(0.141)
ln (Value Added per Worker)	-94.17***	-0.687***	-0.544*	-0.606*	-0.451*
	(28.25)	(0.176)	(0.309)	(0.325)	(0.249)
Skill per Worker	-2.139	0.0297	0.0167	0.0174	0.00757
	(23.24)	(0.179)	(0.178)	(0.190)	(0.158)
ln (Capital per Worker)	3.480	0.0301*	0.0257	0.0288	0.0231
	(2.811)	(0.0161)	(0.0218)	(0.0230)	(0.0197)
Age	-1.295***	-0.00345	-0.00368	-0.00422	-0.00277
	(0.469)	(0.00323)	(0.00328)	(0.00341)	(0.00292)
Export	-0.153	-0.000427	-0.000450	-0.000578	-0.000255
	(0.152)	(0.00125)	(0.00112)	(0.00116)	(0.00106)
Foreign Ownership	-0.0254	-0.000959	-0.00166	-0.00198	-0.00110
	(0.298)	(0.00126)	(0.00230)	(0.00247)	(0.00207)
Computer	-1.043*	-0.00330***	-0.00595*	-0.00626*	-0.00577*
	(0.595)	(0.00114)	(0.00343)	(0.00343)	(0.00332)
Vintage Capital	-0.00411	0.000128	1.96e-05	0.000200	3.50e-05
	(0.191)	(0.00146)	(0.00135)	(0.00139)	(0.00120)
ln (Wage)	-27.50*	-0.171	-0.208*	-0.219**	-0.191*
	(14.20)	(0.108)	(0.107)	(0.110)	(0.0998)
Sale Growth	32.60*	0.201	0.208*	0.225*	0.171*
	(17.83)	(0.149)	(0.126)	(0.128)	(0.0999)
Multi-plant	2.938	0.106**	0.0991	0.111	0.0702
	(7.593)	(0.0510)	(0.0756)	(0.0797)	(0.0642)
ln (TFP)	88.18***	0.661***	0.518*	0.576*	0.427*
	(28.37)	(0.175)	(0.309)	(0.325)	(0.248)
Constant	296.0*	2.022*			
	(151.7)	(1.133)			
Observations	146	146	146	146	146
R-squared		0.212			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.3: The Decision to Employ Immigrants: Garments

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	-57.50*	-0.182	-0.226*	-0.259*	-0.198*
	(29.56)	(0.142)	(0.124)	(0.135)	(0.105)
ln (Value Added per Worker)	-78.66*	-0.258	-0.278	-0.319	-0.241
	(44.76)	(0.248)	(0.193)	(0.209)	(0.164)
Skill per Worker	-27.71	0.00825	-0.109	-0.115	-0.0986
	(32.84)	(0.174)	(0.136)	(0.153)	(0.113)
ln (Capital per Worker)	6.344	0.0233	0.0190	0.0199	0.0173
	(4.868)	(0.0262)	(0.0197)	(0.0215)	(0.0163)
Age	-1.143	-0.00423	-0.00420	-0.00472	-0.00343
	(1.073)	(0.00342)	(0.00447)	(0.00483)	(0.00411)
Export	0.275	0.00148*	0.00142*	0.00163*	0.00110
	(0.195)	(0.000837)	(0.000831)	(0.000879)	(0.000757)
Foreign Ownership	-0.714	-0.00104	-0.00286	-0.00276	-0.00345
	(0.724)	(0.00132)	(0.00322)	(0.00308)	(0.00344)
Computer	-0.450	-0.00128	-0.00181	-0.00169	-0.00187
	(0.557)	(0.00210)	(0.00261)	(0.00249)	(0.00253)
Vintage Capital	-0.723**	-0.00305***	-0.00295**	-0.00331***	-0.00242**
	(0.293)	(0.00115)	(0.00121)	(0.00126)	(0.00107)
ln (Wage)	11.48	0.0425	0.0694	0.0798	0.0600
	(15.36)	(0.0590)	(0.0695)	(0.0734)	(0.0655)
Sale Growth	30.86**	0.140*	0.150**	0.159**	0.128**
	(15.03)	(0.0721)	(0.0621)	(0.0627)	(0.0516)
Multi-plant		-0.0670			
		(0.0466)			
ln (TFP)	72.26	0.218	0.273	0.314	0.234
	(44.34)	(0.244)	(0.192)	(0.207)	(0.162)
Constant	-58.50	0.372			
	(181.4)	(0.793)			
Observations	135	135	121	121	121
R-squared		0.144			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.4: The Decision to Employ Immigrants: Automobile Components

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	157.1	0.516*	0.122	0.0536	0.144
	(130.7)	(0.273)	(0.173)	(0.154)	(0.178)
ln (Value Added per Worker)	219.4	0.719*	0.173	0.0766	0.204
	(187.3)	(0.395)	(0.245)	(0.220)	(0.250)
Skill per Worker	-275.2	-0.610*	-0.207	-0.0925	-0.242
	(216.5)	(0.308)	(0.289)	(0.264)	(0.291)
ln (Capital per Worker)	-5.853	-0.0258	-0.00632	-0.00278	-0.00749
	(8.215)	(0.0219)	(0.00888)	(0.00785)	(0.00914)
Age	-0.00615	0.000417	8.10e-05	3.66e-05	6.28e-05
	(0.507)	(0.00255)	(0.000349)	(0.000179)	(0.000394)
Export	-0.0633	-0.000672	-2.67e-05	-1.42e-05	-2.38e-05
	(0.151)	(0.00103)	(0.000100)	(6.01e-05)	(0.000112)
Foreign Ownership	0.0339	0.000131	1.17e-05	7.84e-06	6.58e-06
	(0.0947)	(0.000796)	(6.53e-05)	(3.90e-05)	(6.96e-05)
Computer	0.149	0.000988	6.71e-05	2.83e-05	8.90e-05
	(0.108)	(0.00114)	(0.000126)	(9.14e-05)	(0.000149)
Vintage Capital	0.145	0.000622	5.02e-05	2.26e-05	5.63e-05
	(0.109)	(0.00130)	(0.000110)	(7.81e-05)	(0.000118)
ln (Wage)	-8.649	-0.162**	-0.00805	-0.00353	-0.00918
	(5.549)	(0.0731)	(0.0164)	(0.0123)	(0.0168)
Sale Growth	19.76	0.103	0.00989	0.00421	0.0121
	(13.61)	(0.0797)	(0.0167)	(0.0131)	(0.0181)
Multi-plant	-4.981	-0.0182	-0.00315	-0.00140	-0.00373
	(5.239)	(0.0267)	(0.00669)	(0.00485)	(0.00746)
ln (TFP)	-229.0	-0.730*	-0.176	-0.0776	-0.208
	(189.4)	(0.388)	(0.249)	(0.223)	(0.256)
Constant	312.5*	2.411**			
	(159.7)	(0.917)			
Observations	108	108	108	108	108
R-squared		0.148			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.5: The Decision to Employ Immigrants: Electronic Components and Electrical Appliances

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	8.305	0.0122	0.00619	0.00705	0.00530
	(16.34)	(0.0239)	(0.0123)	(0.0133)	(0.0121)
ln (Value Added per Worker)	20.27	0.0473	0.0225	0.0236	0.0226
	(19.87)	(0.0339)	(0.0180)	(0.0215)	(0.0174)
Skill per Worker	20.50	0.0427	0.0188	0.0246	0.0130
	(63.76)	(0.0861)	(0.0501)	(0.0543)	(0.0467)
ln (Capital per Worker)	1.331	-0.000702	-0.00120	-0.00165	-0.00109
	(12.78)	(0.0229)	(0.0117)	(0.0115)	(0.0125)
Age	-0.851	-0.00112	-0.000433	-0.000562	-0.000319
	(2.605)	(0.00359)	(0.00210)	(0.00225)	(0.00207)
Export	0.811*	0.00166	0.000631	0.000687	0.000609
	(0.461)	(0.00106)	(0.000479)	(0.000599)	(0.000446)
Foreign Ownership	-0.112	-0.000261	-0.000127	-0.000132	-9.89e-05
	(0.381)	(0.00100)	(0.000311)	(0.000342)	(0.000300)
Computer	-1.116	-0.000817	-0.000564	-0.000709	-0.000486
	(0.834)	(0.000975)	(0.000623)	(0.000666)	(0.000628)
Vintage Capital	-0.178	0.000390	-4.65e-06	-6.90e-05	5.69e-05
	(0.594)	(0.000959)	(0.000458)	(0.000478)	(0.000465)
ln (Wage)	-0.349	0.0390	0.0131	0.0126	0.0137
	(30.50)	(0.0475)	(0.0254)	(0.0271)	(0.0251)
Sale Growth	37.94	0.0197	0.0239	0.0282	0.0213
	(38.11)	(0.0789)	(0.0294)	(0.0317)	(0.0305)
Multi-plant	-0.688	-0.00426	-0.00298	-0.00293	-0.00308
	(13.57)	(0.0319)	(0.0109)	(0.0121)	(0.0105)
ln (TFP)	-9.121	-0.0378	-0.0110	-0.0113	-0.0109
	(9.024)	(0.0306)	(0.0103)	(0.0122)	(0.00970)
Constant	-279.7	-0.598			
	(409.6)	(0.630)			
Observations	91	91	91	91	91
R-squared		0.118			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.6: The Decision to Employ Immigrants: Rubber and Plastics

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	3.381	0.0285	0.0360	0.0336	0.0409
	(7.955)	(0.0547)	(0.0629)	(0.0657)	(0.0573)
ln (Value Added per Worker)	17.15	0.111	0.126	0.118	0.148
	(28.67)	(0.216)	(0.228)	(0.239)	(0.208)
Skill per Worker	-14.61	-0.0405	-0.0547	-0.0586	-0.0625
	(37.31)	(0.235)	(0.286)	(0.306)	(0.260)
ln (Capital per Worker)	-6.180	-0.0414	-0.0461	-0.0442	-0.0520
	(8.724)	(0.0635)	(0.0694)	(0.0726)	(0.0644)
Age	0.137	0.000497	0.000435	0.000463	0.000348
	(0.425)	(0.00378)	(0.00355)	(0.00362)	(0.00343)
Export	0.171*	0.00195**	0.00170**	0.00181**	0.00158**
	(0.0971)	(0.000973)	(0.000773)	(0.000815)	(0.000701)
Foreign Ownership	-0.211	-0.00125	-0.00144	-0.00150	-0.00142
	(0.141)	(0.000922)	(0.00115)	(0.00115)	(0.00112)
Computer	-0.338*	-0.00207*	-0.00257*	-0.00235	-0.00271*
	(0.183)	(0.00114)	(0.00155)	(0.00148)	(0.00148)
Vintage Capital	0.0559	0.000425	0.000557	0.000618	0.000504
	(0.120)	(0.000928)	(0.000970)	(0.00100)	(0.000923)
ln (Wage)	-9.042	-0.0822	-0.0835	-0.0890	-0.0815
	(8.663)	(0.0667)	(0.0711)	(0.0726)	(0.0687)
Sale Growth	22.04**	0.137	0.127*	0.132*	0.118*
	(9.299)	(0.0836)	(0.0754)	(0.0794)	(0.0665)
Multi-plant	-4.581	-0.0183	-0.0169	-0.0188	-0.0151
	(5.936)	(0.0310)	(0.0383)	(0.0416)	(0.0350)
ln (TFP)	-16.50	-0.104	-0.121	-0.115	-0.140
	(28.96)	(0.213)	(0.229)	(0.240)	(0.208)
Constant	98.62	1.234			
	(108.8)	(0.853)			
Observations	253	253	253	253	253
R-squared		0.061			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.7: The Decision to Employ Immigrants: Furniture and Wood

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	26.81	0.149	0	0	0
	(20.24)	(0.111)	(2.73e-09)	(0)	(0)
ln (Value Added per Worker)	32.13	0.234	0	0	0
	(47.89)	(0.281)	(4.60e-09)	(0)	(0)
Skill per Worker	14.23	-0.174	0	0	0
	(46.27)	(0.177)	(1.25e-10)	(0)	(0)
ln (Capital per Worker)	-17.61	-0.0891	-0	-0	0
	(12.41)	(0.0726)	(2.09e-09)	(0)	(0)
Age	-1.597	-0.000556	-0	-0	0
	(1.135)	(0.00576)	(8.23e-11)	(0)	(0)
Export	0.755***	0.00158	0	0**	0
	(0.247)	(0.00148)	(6.59e-11)	(0)	(0)
Foreign Ownership	-75.77***	-0.00383**	-0	-0	0
	(27.28)	(0.00152)	(4.88e-09)	(0)	(0)
Computer	-2.297***	-0.00232	-0	-0	0
	(0.834)	(0.00509)	(1.52e-10)	(0)	(0)
Vintage Capital	-0.717**	-0.00154	-0	-0**	0
	(0.272)	(0.00130)	(5.96e-11)	(0)	(0)
ln (Wage)	-8.325	-0.0239	0	0	0
	(14.12)	(0.0979)	(6.22e-10)	(0)	(0)
Sale Growth	31.62	0.208	0	0	0
	(27.86)	(0.154)	(3.26e-09)	(0)	(0)
Multi-plant	55.67***	0.176***	0	0***	0
	(17.66)	(0.0640)	(5.80e-09)	(0)	(0)
ln (TFP)	-45.75	-0.285	-0	-0	0
	(47.25)	(0.289)	(5.68e-09)	(0)	(0)
Constant	326.3*	1.180			
	(169.9)	(1.170)			
Observations	91	91	91	91	91
R-squared		0.260			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5.8: The Decision to Employ Immigrants: Machinery and Equipments

VARIABLES	Tobit	LP	Logit	Probit	Cloglog
ln (Employment)	-0.999	-0.106	-0.00910	-0.0213	-0.000893
	(11.79)	(0.170)	(0.114)	(0.133)	(0.106)
ln (Value Added per Worker)	-6.931	-0.278	-0.0807	-0.112	-0.0637
	(22.19)	(0.355)	(0.215)	(0.253)	(0.200)
Skill per Worker	-1.611	0.280	0.0314	0.0416	0.0295
	(17.29)	(0.376)	(0.169)	(0.200)	(0.155)
ln (Capital per Worker)	-1.247	-0.0155	-0.00915	-0.0104	-0.00791
	(1.841)	(0.0262)	(0.0205)	(0.0228)	(0.0200)
Age	-0.0364	-4.07e-05	7.56e-05	1.45e-05	0.000195
	(0.221)	(0.00415)	(0.00227)	(0.00253)	(0.00218)
Export	-0.0740	-0.000305	-0.000728	-0.000885	-0.000667
	(0.0837)	(0.00117)	(0.000844)	(0.000951)	(0.000793)
Foreign Ownership	0.0964	0.00128	0.000693	0.000836	0.000614
	(0.0734)	(0.00184)	(0.000746)	(0.000847)	(0.000681)
Computer	-0.0903	-0.00141	-0.000838	-0.00114	-0.000736
	(0.139)	(0.00128)	(0.00131)	(0.00146)	(0.00119)
Vintage Capital	0.0260	0.000671	0.000368	0.000392	0.000387
	(0.0568)	(0.00150)	(0.000614)	(0.000692)	(0.000580)
ln (Wage)	-1.123	-0.0737	-0.0226	-0.0219	-0.0259
	(4.959)	(0.0727)	(0.0494)	(0.0566)	(0.0478)
Sale Growth	14.54**	0.187	0.142*	0.163	0.133*
	(6.637)	(0.117)	(0.0843)	(0.102)	(0.0769)
Multi-plant	1.717	0.0343	0.00767	0.0113	0.00465
	(2.479)	(0.0746)	(0.0274)	(0.0305)	(0.0260)
ln (TFP)	7.546	0.294	0.0864	0.121	0.0684
	(22.09)	(0.366)	(0.216)	(0.254)	(0.200)
Constant	-3.135	0.590			
	(62.25)	(1.253)			
Observations	80	80	80	80	80
R-squared		0.147			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1