Surplus unskilled labor trap in an open developing economy – the case of Vietnam

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Abstract

We propose a model that an open economy with surplus of unskilled labor will attract mostly labor-intensive industries and utilizes mainly unskilled labor. Economic growth induces wage increasing and firms respond either by upgrading technology to enhance productivity accordingly or moving business to low wage economies. If firms are moving out, unemployment increases then cause wage declining. As a result, the economy converges to a stationary point where wages are constant over time. In order to escape from this trap, government needs to help firms to upgrade technology in response to wage increase. As soon as firms shift from using unskilled labor with simple technology to skilled labor with more complicated technologies cost of moving out (fixed costs and costs of recruiting and training skilled labor) is higher than upgrading technology and stay. As result, jobs become more certain and there is more demand for skills.

Keeping firms inside the economy is a fundamental task for government to keep jobs for the economy. By using the unique firm-level panel data during the period of 2004-2011, efforts have been made to estimate the event of relocation and examine the determinants of firm relocation in Vietnam. We find the significant degree of variation across the manufacturing and services, and their corresponding intensity of technology and knowledge. Regarding the firm internal factors, large fixed assets and long-term investment is more likely to induce the low-tech manufacturing and less knowledge-intensive service firms to change their location, but not those in the medium-low-tech manufacturing. In terms of external factors, the impact of sectoral regional diversity on the relocation of firms through the external economies is only partially supported by the medium-low-tech and low-tech manufacturing and less knowledge-intensive service firms.

Keyword: relocation of firms, Vietnam, complementary log-log model, hazard model.

JEL:

1 Introduction

Lewis (1954), Ranis and Fei (1961) and Lewis (1972) develop a model significantly contributing to economic development theories for countries with unlimited supply of unskilled labor. Accordingly, surplus labor – labor with extremely low, even close to zero marginal productivity- will be drawn out to firms in industries. The abundance of unskilled labor gives firms easy access to minimal costs of labor. As soon as the surplus of unskilled labor in agricultural area is drained out, the wages in industry and agricultural sector increase and give these sectors motivation to upgrade technology and productivity to offset the increase in wage.

However, with surplus of unskilled labors firms would focus on developing labor-intensive industries, employing the low cost labor force to optimize profits. This discourages workers to enhance their skills for new technology. Elvin(1972) and Lin(1995) propose this argument to explain why industrial revolution did not originate in Chia but western countries. Under increasing costs of labor, firms either upgrade technology and employing high-skilled labor to increase productivity or moving out when productivity is lower than wage.

Zhu and Cai (2012), based on the Lewis economic growth model, indicate that China is experiencing the Lewis Turning period (LTP). The arrival of the LTP means that China needs to make serious policy efforts to transform its economic development pattern from labor- to capital and technology- intensive and to avoid the so-called "middle-income trap". The implementation of the policy package would significantly affect the growth rate of the urban resident wage, the income of rural residents, GDP growth rate, inflation, the economic structure and the mode of economic development and so on. Also, the higher wage of labor in China may lead to the labor-intensive industry transfer to other countries with cheaper labor costs like Vietnam. It means that, higher wage could induce firms to move out to other countries with cheap and abundance labor force.

De La Potterie and Lichtenberg (2001) examine econometrically whether foreign direct investment (FDI) transfers technology to host countries. Using Coe and Helpman's framework (1995), De La Potterie and Lichtenberg (2001) indicate that outward FDI flows to and imports flows from R&D-intensive countries are 'two simultaneous channels' to spill technology over, while inward FDI flows from R&D-intensive countries do not induce substantial technology transfers. De La Potterie and Lichtenberg (2001) explain that the latter invest in the host country

for the sake of exploiting ‘more fully their technology innovations’. In other words, foreign firms prefer to take full advantage of their current technology than to upgrade technology and spread it to the host countries. Thus, according to the explanation of De La Potterie and Lichtenberg (2001), foreign firms from R&D-intensive countries being faced with higher labor costs in the host country would prefer to move out to where they can continue to exploit existing technology.

In this paper we propose a model that an open economy with surplus of unskilled labor will attract mostly labor-intensive industries and utilizes mainly unskilled labor. Economic growth induces wage increasing. Firms respond either by upgrading technology to enhance productivity accordingly or moving business to low wage economies. If firms are moving out, unemployment increases then cause wage declining. As a result, the economy converges to a stationary point where wage are constant over time. In order to escape from this trap, government needs to help firms to upgrade technology in response to wage increase. As soon as firms shift from using unskilled labor with simple technology to skilled labor with more complicated technologies cost of moving out (fixed costs and costs of recruiting and training skilled labor) is higher than upgrading technology and stay. As result, jobs become more certain and there is more demand for skills.

In theory of location choice, we have three main streams including the location choice of start-up firms or FDI firms (Du, Lu, & Tao, 2008; Lipsey & Sjöholm, 2004; Manjón-Antolín & Arauzo-Carod, 2011); industrial re(location) and geographical relocation, which firms move to new location.The relocation of firms in the literature, however, is insufficiently investigated, especially in the developing countries. Recently, since the rich data in developed countries allows one to track the firm movements, the previous studies find that the firm location behaviors is influenced by firm-specific (internal), sector-specific (external), and region-specific factors (Brouwer, Mariotti, & Van Ommeren, 2004; Holl, 2004; Kronenberg, 2013; Li, Goetz, Partridge, & Fleming, 2016; Manjón-Antolín & Arauzo-Carod, 2011; Morkutė & Koster, 2016; Van Dijk & Pellenbarg, 2000).

We use the unique firm-level panel data during the period of 2004-2011 to examine the determinants of firm relocation in Vietnam. We find evidences in Vietnam to support our hypotheses; however the decisions of relocation are sector-dependent. The increase of average wage is positively related to the probability to relocate. Wages are really sensitive to firms'

decisions to relocate in Vietnam. Firms that are operating in the low-tech manufacturing and less knowledge-intensive service more likely to move even when they increase investment in fixed assets and other kinds of long-term investment. Those operating in the medium-low-tech manufacturing are less likely to move; however we do not find clear evidence of impact of long-term investments and enlargement of fixed assets on these firms' decision of relocation. We also find that the growth of firm size almost consistently stimulates the firms' propensity to change their location, as suggested by theories. When firms are large, growth rate of firm' size decline and they are less likely to relocate. The external factors that keep firms from relocating in general are: ages of firms and special concentration

1. Theoretical framework and hypotheses

For 30 years of opening market, external market and capital have helped Vietnam to escape from poverty and graduate to lower middle income economy. Some scholars have warned Vietnam about middle income trap, where the growth rate is stagnated (e.g. Ohno, 2009) and country will get stuck at middle income level. The reason for falling of middle income trap is attributed to lack of supporting industries and proactive industrial policy. However, in fact, most of developing countries have implemented industrial policies but the successful ones are quite rare. Furthermore, the conditions to have supporting industries are not clearly specified; the state is advised to proactively set up supporting industries without market conditions (demand and supply side). The evidences of State's failure in picking winners are abundant in literature.

In this study, we propose another mechanism of middle income trap for an open developing country. Since, firms in developing countries are mostly labor-intensive hence, When a firm faces with rising wage, it has two stages to decide: (i) first, it has to decide to stay in current location or to relocate to the alternative; (ii) if it decide to stay, it has to decide on upgrading technology to maximize profit.

At first stage:

We suppose that at point 1 wage rate in one country increase from w_0 to w_1 firms in this country have to make a decision whether to stay or move out to other location with lower wage. We also suppose that the remaining time of life of firm's product from point t on is T.

The additional cost that firm has to bear if choosing to stay is: $L*T*(w_1 - w_0)$ where L is labor in production.

If firm chooses to move, they will face replacement costs:

- Training new labor: $L*c$ where c is costs of training per worker

- Fixed costs of establishment in new location: F

- The difference of costs of transaction: $T*(C_t^f - C_t^h)$ where C_t^h *and* C_t^f are costs of transaction in current location and in new location each year. These costs depend on quality and

quantity of infrastructure, the availability of inputs, the legal environment, distance to main market, industrial agglomeration, population density, sectoral diverse districts…

The total replacement costs that a moving-out firm has to pay in the entire of remaining life cycle of product

$$F + L*c + T*(C_t^f - C_t^h)$$

Hence firm will choose to stay iff: $F + L*c + T*(C_t^f - C_t^h) > L*T*(w_1 - w_0)$

$$C_t^f - C_t^h > L*(w_1 - w_0 - \frac{c}{T}) - \frac{F}{T} \qquad (1)$$

If firm is operating in low-tech industry and uses mostly unskilled labor the training cost is trivial and can be assumed to be zero.

The inequality (1) can be rewritten as: $C_t^f - C_t^h > L*(w_1 - w_0) - \frac{F}{T}$ (2)

The inequality (2) implies:

- Other things equal, the large size of a firm (*L* is large) the lower probability a firm will stay as wage rising

- The lower transaction costs in current location in comparison with alternative, the higher probability that a firm will stay

- Fixed costs of establishment have positive effect on probability of firm's stay.

- Furthermore, for firms operating in medium or high-tech sector, they have to use more skilled labor, hence the cost of training labor of moving, *c*, is high and they have less incentive to move[1] (see equality 1).

- The remaining time of product's life cycle has negative impact on probability of firm's stay. The longer life of product, the more incentive for firm to relocate under pressure of higher wage. The remaining time of product's life cycle reduces the impact of fixed costs and training costs on probability to stay.

[1] Given that labour cost could be low in medium and high tech firms, the labor cost may have less impact on their decision to relocate

If one country is abundant in unskilled labor, it can specialize in unskilled-intensive industries and get grown. Note that, these industries are usually of long time of life cycle such as garment, footwear, processing of agricultural products,??…At Lewis's turning point the wage in industry and in agriculture will both increase. The higher wage may drive firms moving out the economy, hence unemployment increase and result in lower wage and lower economic growth. The economy fall into middle income trap.

In order to escape from the trap, country needs to make their business environment more competitive. Put it differently, they need to reduce the transaction costs in doing business their country. Improving infrastructure, broadening the pool of inputs, enhancing institution, encouraging industrial agglomeration, urbanization???

Second stage

Let's suppose that, there are N skilled workers and each one has *E/N* amount of skill in a representative firm. Without loss of generality we can assume that *E* is the total amount of skills used in the firm. The increasing *E* is equivalent to increasing number of skilled workers.

We suppose that firm has production function as follows:

$$Y = K^{\alpha} L^{1-\alpha} E^{\beta} \qquad (3)$$

K is capital, *L* is number of labor, and *E* is skill level use in production; $0 < \alpha < 1$, *and* $0 < \beta$. When firm increases *K* without increase *E*, the firm is just expanding production without upgrading technology; if firm increases *K* and raises skill level, the firm is upgrading technology.

The prices of *K*, *L* and skill *E* are *r*, *w*, and *h* respectively. The price of product is numeraire.

Assume that firm choose output level $\bar{q}$ and try to minimize costs of production:

$$\begin{aligned} &\underset{(K,L,E)}{Min}\ rK + wL + hE \\ &s.t.: \begin{cases} K^{\alpha} L^{1-\alpha} E^{\beta} \geq \bar{q} \\ K^{\alpha} L^{1-\alpha} E^{\beta} - rK - rL - hE \geq 0 \\ r, w, h > 0 \end{cases} \end{aligned} \qquad (4)$$

And we have Lagrangean conditions:

$$\underset{(K,L,E)}{Min}\{rK + wL + hE + \lambda(K^{\alpha}L^{1-\alpha}E^{\beta} - \bar{q})\}$$
$$s.t.: K^{\alpha}L^{1-\alpha}E^{\beta} - rK - wL - hE \geq 0,\ (r, w, h, \bar{q}) > 0 \qquad (5)$$

Applying FOC, it is easy to show that

$$E = \left[\frac{\bar{q}r^{\alpha}w^{1-\alpha}}{h}\right]^{\frac{1}{1+\beta}} \qquad (6)$$

$$K = \left[\frac{\bar{q}w^{1-\alpha}h^{\beta}}{r^{1+\beta-\alpha}}\right]^{\frac{1}{1+\beta}} \qquad (7)$$

$$L = \left[\frac{\bar{q}h^{\beta}r^{\alpha}}{w^{\beta+\alpha}}\right]^{\frac{1}{1+\beta}} \qquad (8)$$

$$1 \geq r^{\frac{\alpha}{1+\beta}}w^{\frac{1-\alpha}{1+\beta}}h^{\frac{\beta}{1+\beta}} \qquad (9)$$

Condition (9) to make sure that firm is making non-negative profit, firm has to decide move or upgrade technology if condition (9) is violated. If, the spillover of skill, β, is high firm is more likely to stay.

The equations (6) and (7) shows that, when firm faces rising wage they will choose to increase skill level and capital level, and decrease demand for labor. If wage is increasing too high to violate condition (9) firm has to either move or upgrade technology by increasing share of capital or α. In other words, under pressure of increasing wage firm will invest more for higher technology and skilled labor if they choose to stay and even change technology of production.

When the economy is abundant of unskilled labor, wage is low firm will choose technology of higher share of labor or $1-\alpha$ is much larger than α [2]. of and to maximize profit the demand for skill and capital are low too (eq. 6 and 7), firms tend to invest into unskilled labor-intensive industries and have low demand for upgrading technology and skill level. With increasing wage, firm is likely to move toward to more capital-intensive, or increases α.

[2] Note that the firm's profit is: $\bar{q}(1 - r^{\frac{\alpha}{1+\beta}}w^{\frac{1-\alpha}{1+\beta}}h^{\frac{\beta}{1+\beta}})$

Interestingly, the price for skill (or reward that firm has to pay for skilled worker) *h*, has positive impact on the demand for capital and labor, and negative impact on demand for skill. If the cost pay for skill that workers possessed is high, firm tends to reduce the level of skill they need and increase unskilled labor and capital.

Our model predict that increasing labor wage may either push the economy into middle income trap or encourage firms to invest more in capital and technology, then put the economy into new trajectory of development out of middle income trap.

2. Empirical review

The determinants of firm location and relocation are widely examined in the empirical literature. The early contribution can be credited to Ciccone (2002), who discusses in detail the agglomeration effects in US and Europe. In Country level, the agglomeration effects in US are strong and can explain over 50% of the variation on average of labor productivity across US states. They also found that human capital of labor force, regional infrastructure play minor role in explaining differences of labor productivity across US states, once the agglomeration effects are taken into account. Doubling employment density can increase labor productivity by 5% in US and 4,6% in European countries[3]. Agglomeration effects do not differ significantly across countries in Europe. In addition, one of the reasons for the changing in industry structure is likely that the externalities are strongly variable in the industries. Recently, de Bok and van Oort (2011) focus on the agglomeration economies, and show the new extension idea in the correlation between agglomeration economies and the firm relocation. Broadly speaking, the main results highlight that firm relocation probability is principally based on the firm's own characteristics such as its age, size and growth rate. Larger and older firms are less probably to relocate while firms with relatively high growth rates tend to relocate. The external factors (agglomeration, accessibility attributes) have much less impact on relocation probability of firms than those internal factors. Furthermore, de Bok and van Oort prove that firm relocation behavior is affected simultaneously by urbanization economies[4], localization economies[5] and proximity to transport infrastructures. Therein, the proximity to transport infrastructures is less important than urbanization economies and localization economies. In addition, the distance from firm's

[3] France, Spain, Germany, UK and Italy.
[4] General agglomeration of population and economic activities
[5] Sector-specific localization or inter-sectoral diversities

location to the essential sites, such as highways, train stations and especially the old locations appearsto play an important role. The distance from original locations also has strong effect on firm-relocating as the relocating firms try to maintain their reticulum of existing customers, suppliers and labor force. This factor plays an even more important role for the firms in the consumer services due to the nature dependence on the local customers.

According to Burger, Van Oort, and Raspe (2011), urbanization economies is more subservient to new establishment survival in the advanced services industry than localization economies, while region and sector conditions have a meaningful, but relatively limited impact on firms' survival and growth prospects. Common and popular policies purported to stimulate spatial service clusters may increase the survival chances of only the largest start-ups. Moreover, the larger urban areas have a more sound and distinct impact on new establishments. Therefore, the localized policy measures should be restricted to areas outside these largest economic agglomerations. The main limitation of this study is that it does not attempt to provide the evidence for the widespread hypothesis that large firms have more survival opportunities.

Another reports in agglomeration economies includes Artis, Miguelez, and Moreno (2012) and Ehrl (2013). The study of Michael, Rosina, Ernest finds that the agglomeration economies matter when explaining the variation in economic performance across the regions and has positive influence on productivity. Nevertheless, the impact of agglomeration economies is significantly lowered when model include variables of intangible assets, knowledge, human capital and entrepreneurial culture. In addition, the power of intangible assets is unaffected when externalities across regions are mentioned in the model. In the research of Ehrl (2013), based on the establishment- and employment-level data, the author proves that labor market pooling, input relations and knowledge spillovers, which are proxied by various variables, are all have some meaningful relationships with productivity[6]. The Jacob economies are not justified at county level but urbanization economies. The data confirms that a 10% increase of employment in a county results in a 0.2% TFP higher. The results are proved fairly solid to the variations in the range of the investigated industries.

[6] On average, plants in industries that have similar occupational structure to other in that county were more productive; similarly public investment in R&D, jobs changes among qualified workers help knowledges spillover and enhance productivity. The impact of input relations is discovered but insignificant.

Interesting recent studies include, among others, Amiti and Javorcik (2008), who suggest that accessing the customers and intermediate input suppliers appears as the main purpose of FDI inflow. The results illustrate that an increasing supplier access by on standard deviation corresponds to a 20% increase in entry of foreign firms, and an increasing in market access by one standard deviation is correspondent with an increase of 13% in the foreign entry. In contrast, an increase in production costs associates with a 2-4% reduction in entry of foreign firms. The analysis also indicates that the appearance of customers and suppliers in the entering province affects much more than the attendance of market and supplier access to the rest of China.

Moreover, the researches in the topic of the border effect[7] includes Requena and Llano (2010) and Laamanen, Simula, and Torstila (2012). Through the gravity model, Requena and Llano reveal that the intraregional Spanish trade is about 30 times higher than the interregional trade, and the intra-national Spanish trade exceeds the international trade around 10 times, taking into account the managing size, distance, adjacency and industry-specific characteristics. The enormousness of the international border has a narrow effect compared with the result in previous researches for Spain. The border effect varies across the industries. Magnitude of the internal border effect is significantly larger for trade in intermediate goods than for trade in final goods. In contrast, based on taxes and employment rates, Laamanen et al (2012)find that high taxes and a high employment rates are the factors leading to the increasing of the likelihood of HQ relocation. Otherwise, the central location and low taxes result in being the pull factors, which raise the attractiveness of an HQ relocation. In addition, the regional HQ has higher propensity of relocating. The trend of relocations of HQ is increasing, in line with global trend of increasing mobility of business activities. It's the most likely that a central location is also discovered to make a country more attractive, while the certain macroeconomic factors, such as wage levels and employment rate, receive some support. The international tax competition has an important role on HQ relocation decisions. They prove that at the average of corporate tax rate, an increase of tax by 1% leads to an increase of the chances of any particular HQ leaving the country by 6.8%.

As stressed in the firms location section, firstly, the regions having better quality of protection of intellectual property rights, lower level of government intervention in business

[7] "The home bias consumption and defined as how much more trade conducted within some region/province in a given country than with other region/province of the same country.

operation, lower level of government perversion and better contract enforcement are highly attractive to the U.S. multinational investment(Du et al., 2008). Secondly, DCM and CDM models used to study the industrial location (Arauzo-Carod, Liviano-Solis, & Manjón-Antolín, 2010) report that the explanation of variables in DCM provides documentation on how, *ceteris paribus*, variations in the explanatory variables affect the likelihood of choosing a particular territory. The factors, such as agglomeration economies, unemployment, education and better infrastructures appear to have a positive effect. The explanation of variables in CDM provides evidence of how ceteris paribus variations in the explanatory variables affect the average of new location. The factors such as agglomeration economies and market size tend to have a meaningful positive effect, while wages and taxes tend to act in the opposite way. However, estimating CDM in 2009 when examining the firm location and relocation (Arauzo-Carod et al., 2010)suggest that the location of new companies and the relocation of existent ones are controlled by different factors and the weight of common factors also varies between start-ups and relocation. They find evidence to prove that the locations and relocations are positively interrelated.

Ehrl (2014)suggests that the correlation between worker and quality of firm is positive in the entire economy. If qualities are observed in the production function, the wage of a given worker shows an inverted U-shape in the quality of employer.

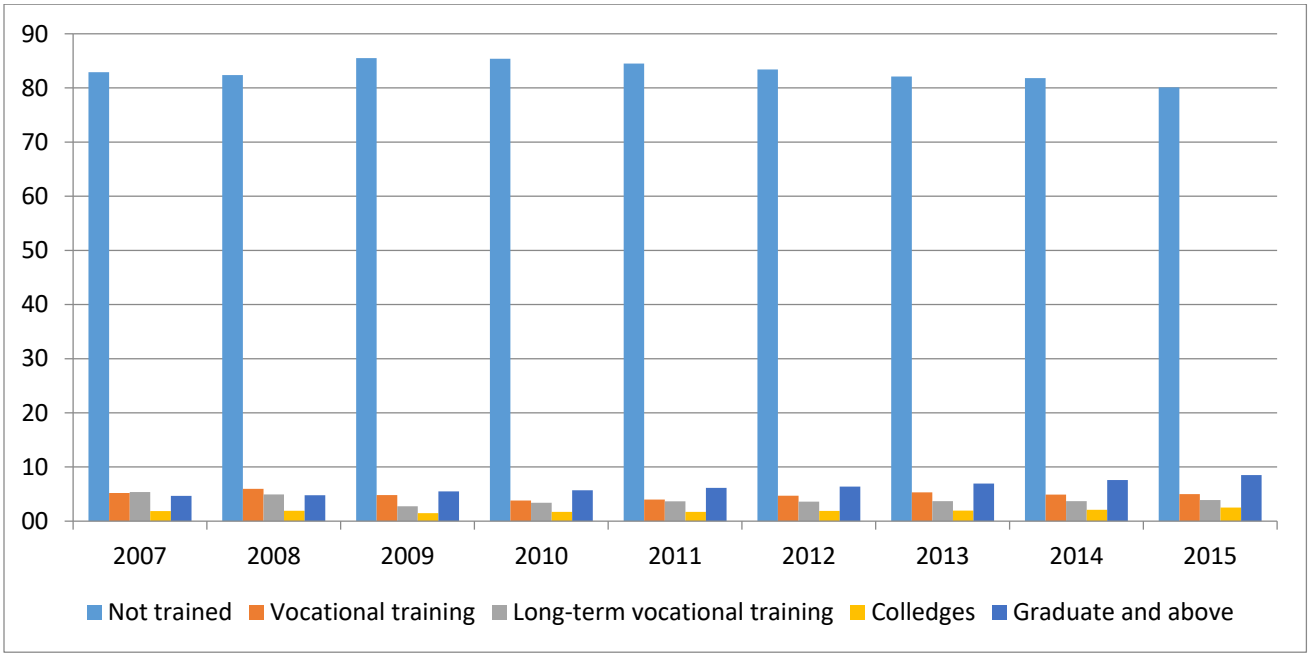
3. Case of Vietnam

In Vietnam, Newman, Rand, and Tarp (2013) analyze the industrial relocation called firm switchers, and highlight that the labor-intensive industries are switched out by firm to find the new opportunities, and respond to the changes in business environment. Additionally, firms with high productivity, are the switcher to reallocate the resources. On the other hand, Howard, Newman, and Tarp (2015) study a new industry agglomeration based on firms location, including province, district and commune levels, and find the prominent evidences of the effects of transportation costs, technology transfer, and labor market on the agglomeration processes. Following Kronenberg (2013) in Netherlands, in our paper, we measure the relocation of firms in Vietnam based on the movement of firm to new location in other district annually during the period of 2004 – 2011.

3.1. Overview of labor and firms

Vietnam is a country with abundant of unskilled labor. In the last 10 years, the economy have grown rather fast with average growth rate of more than 6 percent annually. However, the ratio of unskilled labor in working labor force is almost unchanged (Figure 1). Up to 2015, more than 80% of working labor force in Vietnam have not been trained yet.

Figure 1: Percentage of trained worker by qualification



Source: Calculate from General Statistics Office's Statistical yearbooks

This fact indicates that the demand for skilled labor in Vietnam is not much and firms tend to mostly exploit cheap unskilled labor and they have no demand to upgrade to higher technology and recruit more skilled labors.

We thus use the technology-intensity classification of OECD (2015) to categorize firms in manufacturing sector into high-tech and medium-high-tech manufacturing (HT-MT), medium-low-tech manufacturing (MLT), and low-tech manufacturing (LT), respectively. Table 1 shows that the numbers of firms that graduate from low-tech to higher tech in period-2005-2011 are almost trivial. These data to some extent confirms that most of firms in Vietnam still stay in low and medium technology industries, and very tiny number of firms can graduate.

Table 1: Number of firms in LT moving up MLT and HT-MHT

year	HT-MHT	MLT	LT	LT --> MLT	LT --> HT-MHT
2005	3,360	6,065	6,645	32	16
2006	3,542	6,948	6,690	71	28
2007	4,160	8,259	8,179	61	27
2008	5,017	10,352	9,994	32	21
2009	5,821	12,340	11,300	98	53
2010	6,019	13,408	11,067	130	68
2011	7,114	16,537	11,921	156	89

Source: Calculate from Enterprise Census from various years

These data are warning that Vietnam may fall into middle income trap as firms have no motivation to upgrade to higher technology and use more skilled labor. When Vietnam raises wage level some firms may move out and generate unemployment and some firms may choose to stay with upgrading technology. We use the following model to test whether these movements push economy into trap or upper level of development.

3.2 Data and methodology

Data

We use a unique firm-level panel data provided by General Statistics Office of Vietnam (GSO)in the period of 2004 – 2011 to investigate the firm relocation in Vietnam. The provincial statistics officers annually mail a questionnaire to all of the state-owned, FDI, and non-state-owned firms having more than 30 employees, and 15% of those having less than 30 employees. According to the regulation in Vietnam, the firms have to answer the questionnaires, and return them to provincial statistics offices. The data is not longitudinal. We use the firms' tax code to construct a panel data. The data provides rich information, including the accounting balance sheet, the address, employees, type of economic activities (NACE codes 8). Importantly, each firm has a tax code, which was issued by the provincial taxation offices when firm was established, and is a unique identification without changing over time, even if the firm relocates

[8] The economic activities of firms in Vietnam classified by the International Standard Industrial Classification of All Economic Activities (ISIC). We convert from it to NACE codes, which allows to easily divide up into high tech manufacturing and knowledge-intensive services.

to other districts or provinces in Vietnam. This is crucial point to determine whether a firm has relocated the current year from the previous year.

Empirical model

Dependent variable: relocation of firms

According to Weterings and Knoben (2013), the behavioral firms have replied to different distance relocations. In Vietnam, the government organization is decentralized as follows. The ministries are at the top tier located in Hanoi, the lower levels ordered by size of geographical areas are province/city, district, and commune/ward. The relocations in our paper are classified by district level because the amounts of located firms are sufficient for the analysis[9]. As shown in last column of Table 1, the relocation firms range from only 0.66 to 2.01 percent[10], indicating low mobility. According to Kronenberg (2013), the relocation of firms varies across different sectors. As in Tabble 1 we thus use the technology-intensity classification of OECD (2015) for the manufacturing and the knowledge intensity classification of EUROSTAT (2006) for the services. They are both based on NACE codes as noted in Table 2. Rows (1), (2), and (3) of Table 2 represent firms in manufacturing sectors divided up into high-tech and medium-high-tech manufacturing (HT-MT), medium-low-tech manufacturing (MLT), and low-tech manufacturing (LT), respectively. The rows from (4) to (7) of Table are firms in service sectors, containing the knowledge-intensive high-tech services (KIH), knowledge-intensive market services (KIM), knowledge-intensive financial services (KIF), and less knowledge-intensive services (LKI)[11], respectively. In general, the high-tech sectors in both manufacturing and services have relocated more than others. For instance, there are 2.89 percent of 2,698 firms and 1.38 percent of 5,722 firms acting in HT-MT in 2005 and 2010, respectively. These percentages of firms in Vietnam are relatively similar to those in advanced countries, such as Netherlands (Kronenberg, 2013; Weterings & Knoben, 2013), Portugal(Holl, 2004). As shown in Table 1, after the global crisis, the firms with relocation in Vietnam in 2009made up the largest share (2.01 percent) as indicated by the total row in Table 2.

[9] Our classification is the following Newman et al. (2013) they also applied at district level to estimate the switching industry of firms in Vietnam. Additionally, the distance among the provinces is long to decide to move the new location, and among the communes is the small area to classify.

[10] Because we do not identify whether the firms have relocated in 2004 (first year) and 2011 (last year) of dataset, thus, the observations of these years are dropped from dataset.

[11] Based on two-digit NACE codes, HT-MT are 24 and 29-35; MLT are 23 and 25-28; LT are 15-22 and 36-37; KIH are 64, 72, and 73; KIM are 61, 62, 70, 71, and 74; KIF are 65 – 67; and LKI are 50-52, 55, 60, and 63.

Table 2: Firm relocated by sector and year

	2005		2006		2007		2008		2009		2010	
	Relocation firms	N	Relocation firms	N	Relocation firms	N	Relocation firms	N	Relocation firms	N	Relocation firms	N
1	2.89	(2,698)	1.82	(3,128)	1.37	(3,735)	0.90	(4,682)	1.80	(5,510)	1.38	(5,722)
2	1.77	(4,799)	0.95	(6,126)	0.52	(7,316)	0.64	(9,497)	1.21	(11,239)	1.14	(12,766)
3	1.46	(5,471)	0.61	(6,054)	1.11	(7,419)	1.11	(9,360)	2.34	(10,607)	0.79	(10,514)
4	5.67	(653)	1.90	(1,685)	2.78	(2,229)	0.95	(3,577)	2.71	(5,059)	2.28	(4,866)
5	2.77	(4,513)	1.32	(8,619)	1.76	(11,712)	0.87	(18,186)	3.06	(24,415)	1.49	(30,569)
6	1.11	(902)	0.81	(1,352)	0.84	(1,195)	0.52	(1,340)	1.14	(1,486)	0.49	(1,833)
7	1.65	(26,492)	0.85	(46,870)	0.96	(55,412)	0.53	(74,006)	1.78	(91,364)	0.92	(112,459)
Total	1.87	(45,528)	0.96	(73,834)	1.10	(89,018)	0.66	(120,648)	2.01	(149,680)	1.07	(178,729)

Note: 1 - High-tech and medium-high-tech manufacturing; 2 - Medium-low-tech manufacturing; 3 - Low-tech manufacturing; 4 - Knowledge-intensive high-tech services; 5 - Knowledge-intensive market services; 6- Knowledge-intensive financial services; 7- Less knowledge-intensive services; Number of observations in parentheses

Independent variables

Table 2 presents the summary statistics for all explanatory variables in our models. At the beginning of analysis process, we carry out the multicollinearity check for all models[12], which does not violate this assumption with the low variance inflation factors (VIF). Next, we discuss the independent variables split into three groups, namely firm-specific, sector-specific, and region-specific groups.

Firm-specific characteristics

The various firm-specific characteristics affecting the likelihood to move have been investigated in the literature. For example, older firms may have set up the long-term trust-based relationships in their environment in current location. It can thus be expected that the age of firm (age)has the negative relationship with the firm's likelihood to relocate to other districts (Bruwer et al., 2004;Kronenberg, 2013). Firm size measured by the total numbers of firms' employees (lnFirmSize), have been concluded by many studies that large firms may be more costly to move than small firms (Van Dijk and Pellenbarg, 2000; Brouwer et al., 2004; Kronenberg, 2013; Weterings, 2014). However, it also depends on the specific sector as, for example, Kronenberg (2013) finds that in less knowledge-intensive sectors, the larger firms are more likely to relocate.

Firms experiencing the growth of employees (growth) may have to move to other premises (Brouwer et al., 2004; Kronenberg, 2013; Weterings, 2014), which might relocate to new opportunities. The average wage of employees (lnWage) may have an effect on the firm's likelihood to relocate. When it increases sharply, firms will paying higher wage for employees, which might trigger to move to save costs. This phenomenon goes quickly in less/low-tech firms using a large amount of workers (Kronenberg, 2013; Weterings, 2014).

The key variable in our paper is log of total fixed assets per total employees (lnFAE), we hypothesize when a firm invests more in fixed assets, and it may be less likely to relocate to another district. Moreover, firms operating in less/low-tech sectors are expected to have the propensity to move higher than those in other sectors because the entrepreneurs can be costly to move out the current locations.

[12] We only report the VIF of model with all sectors in Table 3.

Table 3: Descriptive statistics of independent variables

Variables	Description	Mean	SD	Min	Max	VIF*
lnFAE	Log of fixed assets per employees	4.356	1.568	-5.35	18.18	1.08
lnFirmSize	Log of total employees	2.357	1.266	0.00	11.38	1.47
growth	Growth of employees	1.075	1.618	0.00	717.00	1.01
lnWage	Log of employee wage per month	0.947	0.635	-8.32	9.72	1.70
herfindahl_e	Herfindahl index (ISIC 2 digits)	0.006	0.031	0.00	0.81	103
specialization	Log of number of employees in sector per number of employees in district	93.582	785.778	0.00	122394.25	2.88
lnWage_dist	Log of wage average of employees in district	0.879	0.377	-2.44	1.81	3.59
lnWage_sect	Log of wage average of employees in sector	0.876	0.322	-0.28	2.20	2.00
age	Age of firm	5.070	2.240	1.00	10.00	1.25
lnNOF	Log of number of firm in district	6.812	1.545	0.00	9.10	4.55
SOEs	State-owned enterprises	0.018	0.134	0.00	1.00	n.a.
NonSOEs	Non state-owned enterprises	0.944	0.230	0.00	1.00	3.44
FDI	FDI enterprises	0.038	0.191	0.00	1.00	3.06

Note: * The VIF is model running with all sectors, others will report if requested

Sector-specific and region-specific characteristics

Average wages in a specific sector (lnWage_sect) and average wages in a district (lnWage_dist) may be different from average wages in firm. In general, average wages in district have the same expected sign with average wage of employees affecting the likelihood to relocate to another district. On the other hand, the effects of average wage in sector may have opposite sign on the likelihood to firm relocation, which depend on firms acting in specific sector. Finally, we also include some variable as Herfindahl index using employment concentration (herfindahl_e), log of number of employees in sector per number of employees in district (specialization), log of number of firm in district (lnNOF) and ownership (SOEs, NonSOEs, and FDI).

Methodology

According to Van Dijk and Pellenbarg (2000) and Knoben and Oerlemans (2008), first, the limitation of studies using the micro-data to analysis the relocation of firm does not provide actual time to move via cross-sectional data, leading to potential bias in results. Using the panel data could partially solve these problems (Weterings & Knoben, 2013). Secondly, with cross-sectional data, Weterings and Knoben (2013)show that the relocation is a skewed distribution because we have a large number of non-relocated firms in comparison with relatively a few relocated firms. To solve this problem, Brouwer et al. (2004) proposeto usedata pooled several years. However, some information and measurements can be mismatched. With rare relocated firm event in panel data, therefore, an event history analysis is appropriate for our study (Jenkins, 1995, 2005; Long and Freese (2006); Vermunt & Moors, 2005; Weterings, 2014; Weterings & Knoben, 2013).

In our paper, the dependent variable is dummy, and defined by the relocation of a firm to different location in the year (t) compared with the previous year (t-1). However, the proportion of firms do not relocate is about 80 – 90 percent, thus, relocation event is rare. A model time-to-event data using discrete time duration model to estimate the likelihood of relocation is essential for this case (Jenkins, 1995, 2005). We thus consider the complementary log-log discrete time hazard model (cloglog) to estimate the event of relocation the most suitable in our case (see Jenkins, 1995 and Jenkins, 2005 for further technical details). In all models, we include the time dummy variables to control the shocks affecting the heteroscedasticity in the relocation per year. Moreover, we include the lag of time varying covariates in the model to reduce the

heterogeneitybecause the firm relocated in year i, depend on the past performance[13]. The general form of this function is

$$h(j, X) = 1- \exp([\exp(X'\beta + \gamma_j)] \quad (1)$$

Where h(j,X) is the hazard rate (rate of death) for a firm in interval j of a given X in interval j; X is a covariates matrix and $\gamma_j$which is the complementary log-log transformation of the baseline hazard and it captures the complement of the conditional probability of baseline hazard assessed at the finish of relocation in the interval and at the start of relocation in the interval.

3.3. Results and discussion

Results are presented in Table 3. We find that the determinants of firms' relocation decisions vary considerably across the sectors with different technological levels and knowledge intensity.

The probability for relocation increases with the average wage level for firms in most of the sectors, including the high- and medium-high tech manufacturing and most of knowledge-intensive services. Only the medium-low-tech manufacturing and knowledge-intensive financial service firms are not influenced by the firm-specific labour costs. This result might suggest cutting labor costs are paid special attention by the profit-optimizing firms, regardless of their technology/knowledge intensity, when choosing the location.

The sector-specific wage level tends to raise firms' likelihood of changing location in low-tech manufacturing, perhaps to save the labor costs as suggested by the theories. For firms in the high-tech and medium-high-tech manufacturing, and most of services, including less knowledge-intensive services which depend heavily on skilled labor, on the other hand, the propensity to relocate to other districts decreases with the own-sectoral average wage since the high wage level might correspond to the high quality of the workforce. Consequently, in order to retain these workers, and benefit from their high skills, firms are willing to pay such high salary, and thus are less likely to relocate.

The average wage in districts exclusively influences the likelihoodof theservice firms to relocate to other municipality, rather than of the manufacturing firms. The propensity to change the location decreases with the district-specific wage level in the knowledge-intensive financial services, but increase in others services. Potentially, in the former, the increase local demand caused by the high regional average salary is so significant that it could be sufficient to

[13] All variables related to price are constant prices in 2010

compensate for the rising labor costs. In the latter, however, it is not the case, and therefore, the profit-maximizing firms are pushed to move to other regions to save costs.

The low-tech manufacturing and less knowledge-intensive service firms having large fixed assets and long-term investment are less likely to relocate. This finding is consistent with prediction of our model. The higher fixed costs, the less probability to move. The relocation decisions of the medium-low-tech manufacturing firms, nevertheless, are positively associated with the firms' fixed costs. This phenomena may attribute to the remaining time of products' life cycle of those firms in medium-low-tech manufacturing are small. Moreover, no statistically effect is observed for firms in the high-tech and medium-high-tech manufacturing and knowledge-intensive services.

Across the sectors, the association between firm size and the relocation of firms are also fit with our model predictions: in the high-tech and medium-high-tech manufacturing, the knowledge-intensive high-tech services, the knowledge-intensive financial services and the less knowledge-intensive services the larger firms are more likely to relocate to other districts. For firms in knowledge-intensive market services, they usually started in location of pool of knowledges and good accessibility hence, increase firms size may not have impact on decision of relocation of firms.

Furthermore, firm size does not even statistically affect the relocation decisions of medium-low-tech and low-tech manufacturing firms. However, when we use the growth of rate of firm size instead of absolute value of firm size, almost all firms with higher growth rate consistently have higher probability to change their location, as suggested by theories. Only in the medium-low- and low-tech manufacturing, this positive effect of firm size growth on the firm relocation likelihood is not observed. The neutrality of firms' size in medium-low- and low-tech manufacturing on probability of relocation may attribute to fast improvement of infrastructure and business environment in Vietnam in period 2001-2011. It is noted that medium-low- and low-tech manufacturing firms benefits most from better infrastructure such as roads, ports, electricity,…

In most of the sectors, the older firms are less likely to relocate since older firms might have established the long term trust-based relations in the proximity as suggested by the institutional theory. Only for the medium-low-tech manufacturing firms, no statistically significant association between firm age and firm allocation decision is observed. The older

firms may face shorter life cycle of products and have no incentive to relocate. Firms in knowledge-intensive high-tech services are most sensitive to accessibility to pool of knowledges and human capital, hence may in process of converging to Hanoi and Ho Chi Minh city, the two biggest pool of knowledges and human capital. This prediction is also confirm by our study.

The ownership also matters in firm's relocation decision making. The non-SOE and FDI firms both are more likely to relocate than the SOE firms in the less knowledge-intensive services, but less likely in the high-tech and medium-high-tech manufacturing. Additionally, in the medium-low-tech and low-tech manufacturing and knowledge-intensive market services, the non-SOE firms is less likely to change the location than the SOEs.

The common proposition that firms located in the sectorally diverse districts can take the advantage of external economies by benefiting from the complementary services and inter-sectoral knowledge transfer, and therefore are less likely to relocate is only partially supported. On the one hand, the medium-low-tech and low-tech manufacturing and less knowledge-intensive service firms currently locating in the districts with the sectoral diversity are less likely to change their location. On the other hand, the sectoral diversity has positive effect on the relocation of the knowledge-intensive high-tech service firms.

The propensity to relocate appears to increase with the own-sector specialization of the districts that the high-tech and medium-tech manufacturing and knowledge-intensive high-tech service firms are currently located. For firms in other sectors, their decisions to relocate are even not affected by the firm agglomeration. These findings might suggest that the benefit from the agglomeration of firms in their own sector, in form of knowledge spillovers and worker transfer are not so prominent as to adequately offset the loss from the competition between these firms.

Table 13: Results of cloglog model for all sectors

Relocation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lnFAE	-0.020***	0.058	0.108***	-0.078**	-0.018	0.020	0.086	-0.045***
	(0.008)	(0.036)	(0.039)	(0.032)	(0.031)	(0.016)	(0.074)	(0.011)
lnFirmSize	0.040***	0.080*	0.051	0.009	0.110*	-0.055*	0.302***	0.055***
	(0.011)	(0.044)	(0.046)	(0.034)	(0.061)	(0.031)	(0.085)	(0.019)
growth	0.004***	0.013**	0.001	-0.054	0.080***	0.019**	0.187*	0.016***
	(0.001)	(0.006)	(0.010)	(0.065)	(0.028)	(0.009)	(0.101)	(0.006)
lnWage	0.330***	0.322***	-0.132	0.273***	0.233**	0.175***	-0.126	0.491***
	(0.023)	(0.102)	(0.099)	(0.093)	(0.094)	(0.048)	(0.191)	(0.038)
herfindahl_e	0.404	1.928	4.332***	6.268***	-2.047***	0.332	-4.894	2.456***
	(0.336)	(1.974)	(1.471)	(1.816)	(0.556)	(1.222)	(3.097)	(0.611)
lnSpecialization	0.011	0.371***	0.321***	0.006	0.180***	0.037	-0.120	0.015
	(0.011)	(0.061)	(0.060)	(0.041)	(0.041)	(0.032)	(0.149)	(0.025)
lnWage_dist	0.907***	-0.072	0.357	0.070	1.288***	2.811***	-1.176**	1.107***
	(0.065)	(0.309)	(0.284)	(0.194)	(0.387)	(0.191)	(0.592)	(0.093)
lnWage_sect	-0.123**	-1.976***	-0.396	1.216***	-0.438*	-1.841***	0.280	-0.310***
	(0.049)	(0.381)	(0.337)	(0.254)	(0.232)	(0.132)	(0.561)	(0.101)
lnNOF	0.094***	0.616***	0.516***	0.029	0.162	-0.043	0.413*	0.066**
	(0.017)	(0.094)	(0.088)	(0.056)	(0.107)	(0.050)	(0.229)	(0.031)
age	-0.051***	-0.140***	-0.046	-0.040*	0.058*	-0.034**	-0.173**	-0.048***
	(0.006)	(0.034)	(0.031)	(0.024)	(0.032)	(0.015)	(0.088)	(0.009)

SOEs (Reference group)								
Non-SOEs	-0.363***	-0.991***	-0.929***	-0.489*	-0.594	-0.718***	0.214	0.287*
	(0.073)	(0.207)	(0.235)	(0.265)	(0.375)	(0.174)	(0.443)	(0.155)
FDI	-0.027	-0.440**	-0.256	-0.128	-0.011	-0.223	0.102	0.630***
	(0.077)	(0.189)	(0.235)	(0.273)	(0.363)	(0.191)	(0.581)	(0.191)
_cons	-5.180***	-5.953***	-7.777***	-4.141***	-5.649***	-3.602***	-6.688***	-5.909***
	(0.154)	(0.778)	(0.762)	(0.593)	(0.851)	(0.409)	(2.020)	(0.272)
N	471426	18972	37683	37214	10006	57049	6514	260444
pseudo R^2								

Robust standard errors in parentheses; $^{*}p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$

Note: We have eight different models based on sectors classification. Model (1) is full sector, models from (2) to (8) are HT-MT, MLT, LT, KIH, KIM, KIF, and LKI respectively.

4. Conclusions

We build a model to predict the middle income trap for open, developing countries under the pressure of rising wage. The model also suggests factors that can be affected to help the economy escape out of this trap to go upper level of development.

The empirical review suggest that in order to keep firms in the economy under the pressure of rising wage, one economy could do to improve infrastructure, accessibility, knowledge spill-over, promoting urbanization and localization with inter-sectoral diversity.

We could not access to data of firms operated in Vietnam and now have moved to other countries to examine our model. Using the unique firm-level panel data during the period of 2004-2011, we examine the determinants of firm relocation in Vietnam. The potential factors are divided into three groups: (i) The firm-specific factors, including the fixed assets and long-term investments, the firm size, firm growth, average wage paying to the employees, firm age and ownership; (ii) the sector-specific factors, including sectoral concentration, own-sector average wage paying to the employees; and (iii) the regional-specific factors, including the regional-specific sectoral specialization, spatial concentration, and regional average wage paying to the employees. We find the significant degree of variation across the manufacturing and services, and their corresponding intensity of technology and knowledge.

The findings confirm that rising wage in general increase the probability of firms to move and the magnitude of the probability varies from sector to sector.

Regarding the firm internal factors, having large fixed assets and long-term investment is more likely to reduce the low-tech manufacturing and less knowledge-intensive service firms to change their location, but not those in the medium-low-tech manufacturing. This finding is consistent with prediction of our model. The higher fixed costs, the less probability to move. The relocation decisions of the medium-low-tech manufacturing firms, nevertheless, are positively associated with the firms' fixed costs. The remaining time of products' life cycle may play negative impact in this case as predicted by our model.

Firm size in terms of growth rate has negative impact on probability to relocate; the faster expanding firms the less likely firms relocate.

In most of the sectors, the older firms are less likely to relocate since older firms might have established the long term trust-based relations with others. The ownership also matters in firm's relocation decision making as the non-SOE and FDI firms both are more likely to relocate

than the SOE firms in the less knowledge-intensive services, but less likely in the high-tech and medium-high-tech manufacturing.

In terms of external factors, the impact of sectoral regional diversity on the relocation of firms through the external economies is only partially supported by the medium-low-tech and low-tech manufacturing and less knowledge-intensive service firms. The propensity to relocate appears to increase with the own-sector specialization of the districts that the high-tech and medium-tech manufacturing and knowledge-intensive high-tech service firms are currently located. The high-tech and medium-tech manufacturing and knowledge-intensive high-tech service firms tend to converge to specialized locations.

The neutrality of firms' size in medium-low- and low-tech manufacturing on probability of relocation may attribute to fast improvement of infrastructure and business environment in Vietnam in period 2001-2011. Reducing transaction costs through improvement infrastructure, business environment, accessibility to pools of inputs, knowledges,??? could be the best solution to keep firms in the economy.

References

Amiti, M., & Javorcik, B. S. (2008). Trade costs and location of foreign firms in China. *Journal of Development Economics, 85*(1), 129-149.

Arauzo-Carod, J. M., Liviano-Solis, D., & Manjón-Antolín, M. (2010). Empirical studies in industrial location: an assessment of their methods and results. *Journal of Regional Science, 50*(3), 685-711.

Artis, M. J., Miguelez, E., & Moreno, R. (2012). Agglomeration economies and regional intangible assets: an empirical investigation. *Journal of Economic Geography, 12*(6), 1167-1189.

Brouwer, A. E., Mariotti, I., & Van Ommeren, J. N. (2004). The firm relocation decision: An empirical investigation. *The Annals of Regional Science, 38*(2), 335-347.

Burger, M. J., Van Oort, F. G., & Raspe, O. (2011). Agglomeration and new establishment survival: A mixed hierarchical and cross-classified model *Drivers of Innovation, Entrepreneurship and Regional Dynamics* (pp. 45-63): Springer.

Ciccone, A. (2002). Agglomeration effects in Europe. *European Economic Review, 46*(2), 213-227.

de Bok, M., & van Oort, F. (2011). Agglomeration economies, accessibility and the spatial choice behavior of relocating firms. *Journal of Transport and Land Use, 4*(1), 5-24.

Du, J., Lu, Y., & Tao, Z. (2008). Economic institutions and FDI location choice: Evidence from US multinationals in China. *Journal of comparative Economics, 36*(3), 412-429.

Ehrl, P. (2013). Agglomeration economies with consistent productivity estimates. *Regional Science and Urban Economics, 43*(5), 751-763.

Ehrl, P. (2014). High-wage workers and high-productivity firms-a regional view on matching in Germany. *Working paper (No. 149)*.

EUROSTAT. (2006). Statistics in Focus 13/2006. *EUROSTAT, Luxembourg*.

Holl, A. (2004). Start-ups and relocations: Manufacturing plant location in Portugal. *Papers in Regional Science, 83*(4), 649-668.

Howard, E., Newman, C., & Tarp, F. (2015). Measuring industry coagglomeration and identifying the driving forces. *Journal of Economic Geography*, lbv037.

Jenkins, S. P. (1995). Easy estimation methods for discrete-time duration models. *Oxford bulletin of economics and statistics, 57*(1), 129-136.

Jenkins, S. P. (2005). *Survival analysis*.

Knoben, J., & Oerlemans, L. (2008). Ties that spatially bind? A relational account of the causes of spatial firm mobility. *Regional Studies, 42*(3), 385-400.

Kronenberg, K. (2013). Firm relocations in the Netherlands: Why do firms move, and where do they go? *Papers in Regional Science, 92*(4), 691-713.

Laamanen, T., Simula, T., & Torstila, S. (2012). Cross-border relocations of headquarters in Europe. *Journal of International Business Studies, 43*(2), 187-210.

Li, M., Goetz, S. J., Partridge, M., & Fleming, D. A. (2016). Location determinants of high-growth firms. *Entrepreneurship & Regional Development, 28*(1-2), 97-125.

Lipsey, R. E., & Sjöholm, F. (2004). Foreign direct investment, education and wages in Indonesian manufacturing. *Journal of Development Economics, 73*(1), 415-422.

Long, J. S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata*: Stata press.

Manjón-Antolín, M. C., & Arauzo-Carod, J.-M. (2011). Locations and relocations: determinants, modelling, and interrelations. *The Annals of Regional Science, 47*(1), 131-146.
Morkutė, G., & Koster, S. (2016). Human capital as a location factor: An empirical investigation of relocating firms and their labour force in the Netherlands. *Papers in Regional Science*.
Newman, C., Rand, J., & Tarp, F. (2013). Industry switching in developing countries. *The World Bank Economic Review, 27*(2), 357-388.
OECD. (2015). *Science, Technology, Industry Scoreboard 2015*: OECD.
Ohno K. (2009) Advoiding the Middle income Trap: Renovating Industrial Policy Formulation in Vietnam, *ASEAN Economic Bulletin*, Vol. 26, No. 1, pp. 25-43
Requena, F., & Llano, C. (2010). The border effects in Spain: an industry-level analysis. *Empirica, 37*(4), 455-476.
Van Dijk, J., & Pellenbarg, P. H. (2000). Firm relocation decisions in The Netherlands: An ordered logit approach. *Papers in Regional Science, 79*(2), 191-219.
Vermunt, J. K., & Moors, G. (2005). Event history analysis. In B. S. Everitt, & Howell, D. C. (Ed.), *Encyclopedia of Statistics in Behavioral science*: John Wiley & Sons Ltd.
Weterings, A. (2014). What makes firms leave the neighbourhood? *Urban Studies, 51*(8), 1613-1633.
Weterings, A., & Knoben, J. (2013). Footloose: An analysis of the drivers of firm relocations over different distances. *Papers in Regional Science, 92*(4), 791-809.

Brach, J., & Kappel, R. T. (2009). Global value chains, technology transfer and local firm upgrading in non-OECD countries.
De La Potterie, B. V. P., & Lichtenberg, F. (2001). Does foreign direct investment transfer technology across borders? *Review of Economics and Statistics, 83*(3), 490-497.
Elvin, M. (1972). *The High-level Equilibrium Trap: The Cause of the Decline of Invention in the Traditional Chinese Textile Industries*.in W. E. Willmott, Economic Organization in Chinese Society, (Stanford, Calif., Stanford University Press, 1972, ISBN 0-8047-0794-4) pp. 137–172.
Hornstein, A., & Krusell, P. (1996). Can technology improvements cause productivity slowdowns? *NBER Macroeconomics Annual 1996, Volume 11* (pp. 209-276): MIT press.
Lewis, W. A. (1954). Economic development with unlimited supplies of labour. *The manchester school, 22*(2), 139-191.
Lewis, W. A. (1972). Reflections on unlimited labour. In L. D. Marco (Ed.), *International economics and development* (pp. 75-96). New York: Academic Press.
Lin J. Yifu (1995) Why industrial Revolution did not Originate in China, Economic Development and Cultural Change, Vol. 43, No. 2, pp. 269-292
Lindic, M. (2015). How Do Trading Firms Upgrade Skills and Technology: A Theoretical Model. *Economic and Business Review, 17*(3), 347-369.
Ranis, G., & Fei, J. C. (1961). A theory of economic development. *The american economic review*, 533-565.
Zhu, A., & Cai, W. (2012). The Lewis turning point in China and its impacts on the world economy: AUGUR Working Paper.