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**Economic Integration, Location of Industries, and Frontier Regions: Evidence from Cambodia**

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**Abstract**

We examine changes in the location of economic activity in Cambodia between 1998 and 2008 in terms of employment growth. During this period, Cambodia joined ASEAN and increased trade with neighboring countries. Drawing on the predictions of the new economic geography, we focus on frontier regions such as border regions and international port cities. We examine the changing state of manufacturing in Cambodia from its initial concentration in Greater Phnom Penh to its growth in the frontier regions. The results suggest that economic integration and concomitant trade linkages may lead to the industrial development of frontier regions as well as the metropolitan areas in Cambodia.

**Keywords:** Economic integration, Trade liberalization, Frontier regions, Cambodia

**JEL classification:** F15, F16, R12

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# Economic Integration, Location of Industries, and Frontier Regions: Evidence from Cambodia

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## 1. Introduction

Trade policy affects the geographical location of industries. For example, when a country adopts isolationism or erects high trade barriers, metropolitan areas are a preferable location for industries, since that is where most of their local customers and input suppliers are located. However, once a country opens up to trade, the optimal location may change. If an industry is highly export-oriented and has a high dependency on imported inputs, the advantage of being located close to local customers and suppliers will be diminished substantially. Thus, instead of large cities, the industry may prefer locations where they can save on the transportation costs of importing intermediate inputs from international markets and exporting their products back to them. In this respect, frontier regions such as border regions and port cities may gain location advantages.

There is some empirical evidence of this from Mexico and Europe. After Mexico renounced its policy of import substitution and began trade liberalization in the mid-1980s, it became a manufacturing base for many firms that import parts and components from the United States and export final products back to it. As a result, manufacturing activities in Mexico relocated from Mexico City to the northern regions near the Mexico-US border. In Europe, where economic interactions between Central and Eastern European countries (CEECs) and Western European countries had been restricted prior to the collapse of the iron curtain in 1989, free trade agreements between the European Union and individual CEECs were enacted in the early 1990s. Since then, the economies of the CEECs have become increasingly integrated into EU economies. Simultaneously, manufacturing activities in CEECs have gravitated towards the border regions, particularly those bordering core EU member countries.

As in North America and Europe, less developed Southeast Asian countries, namely Cambodia, Laos, Myanmar, and Vietnam, have been integrated into the

greater Southeast Asian economy since their accession to Association of Southeast Asian Nations (ASEAN) and the WTO. We can expect that the location of the industries in these countries has also changed considerably as a result of this. However, unlike in the cases of North America and Europe, rigorous analytical work has not yet been conducted in these countries, owing to the paucity of data. The purpose of this study is to fill in this knowledge gap and to examine the impact of economic integration on industry location in less developed Southeast Asia, with a particular focus on Cambodia.

Cambodia's geography is well suited for an analysis on industry location. Phnom Penh, the capital city of Cambodia, is located in the middle of the country. Bordering countries include Laos, Vietnam, and Thailand, with all of which Cambodia could forge a complementary relationship. In addition, there is an international port at Sihanoukville. As discussed above, economic integration is likely to attract industries to frontier regions. It is thus preferable that metropolitan areas be geographically separated from these areas in order to test the hypothesis.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature, both theoretical and empirical, on the impact of economic integration on industry location. Section 3 takes a brief look at the development of the Cambodian economy after the country's civil war in the context of regional integration. Section 4 explores the structure of regional economies using employment data. Section 5 provides an empirical model to examine the location of industries and reports the estimation results. The paper concludes in Section 6.

## 2. New Economic Geography Models

There are two contrasting views regarding the influence of economic integration. Krugman and Livas Elizondo (1996) argue that economic integration will disperse industry activities from the agglomerated area and

lead to the development of frontier regions where they can access the international market at a lower cost. Their theory was inspired by empirical studies on North America, especially a series of studies conducted by Hanson. On the other hand, there is another group of economists who argue that economic integration in Europe has increased the regional concentration of economic activities. The models of both groups are based on the new economic geography (NEG), but have yielded different conclusions because of their different assumptions and specifications. In the following section, we will review the relevant NEG models and empirical works.

## 2.1. Spatial dispersion models

After the World War II, Mexico adopted an import-substitution industrial policy. In 1985, however, it joined the (GATT) and started opening its economy to international trade. Since then, economic integration with the United States has proceeded rapidly. This integration was aided by Mexico's accession to the North American Free Trade Agreement (NAFTA) in 1994. Hanson wrote a series of papers about the impact of economic integration on both Mexico and the United States. In his earlier works, Hanson (1994, 1996a, 1996b) developed a model of regional production networks based on localization economy. This model assumes that an industry has two production stages: a composite input production stage, which has location-specific external economies; and an assembly stage, which has constant returns to scale. By agglomerating in an industry center, the first-stage activities could enjoy external economies. However, agglomeration in the industry center inevitably drives up wages and land rents, thus pushing second-stage activities to outlying regions.

During the period of import substitution in Mexico, Mexico City was an industry center with firms engaged in both stages of production, while labor-intensive assembly activities were dispersed throughout the country.

After opening up to international trade, however, a production network was formed between the United States and Mexico. In this new setting, the United States specializes in the first-stage activities while Mexico specializes in the second-stage activities in factories in the northern border region. Note that the northern border region has a geographic advantage over internal regions in access to the United States. Using this evidence, Hanson conjectures that international trade liberalization has significantly affected industry location inside the country and has conducted empirical studies using regional data. A series of his studies (Hanson 1996a, 1996b, 1997, 1998) clearly indicate that integration with the US economy has significantly increased manufacturing wages and employment in the northern border region.

In line with Hanson's empirical works on North America, Krugman and Livas Elizondo (1996) developed a formal NEG model to explore how economic integration affects internal economic geography. They demonstrate that declining international trade costs are likely to weaken agglomeration (or centripetal) forces, while leaving intact dispersion (or centrifugal) forces, such as congestion costs caused by longer commuting distance or higher land rent.

In the Krugman and Livas Elizondo model, the concentration of population and industry raises local wages because firms can afford to pay higher wages if they have good access to a large local market ("backward linkage"). The concentration of population and industry also lowers consumer prices because almost all goods can be made available in the local market without incurring transport costs ("forward linkage"). These two effects—backward and forward linkages—raise real wages in the core region and form centripetal forces that sustain the core-periphery structure.

However, as observed in Mexico, when trade liberalization or economic integration occurs, lowering international trade cost incentivizes the typical manufacturer to sell to export markets and to rely on imported inputs. It thus strengthens linkages with overseas markets while weakening links with the

domestic market. Consequently, there would be little advantage to a location near an agglomerated area while the disadvantage of higher congestion costs would still be a consideration. In the context of economic geography, this would weaken the centripetal forces vis-à-vis the centrifugal forces, thus leading to the breakup of the core-periphery structure.

## 2.2. Spatial concentration models

Monfort and Nicolini (2000) and Paluzie (2001) have extended Krugman's core-periphery model (Krugman 1991). However, since their model specifications, especially those for the centrifugal force, are different from those of the Krugman and Livas Elizondo model, their study leads to different conclusions. As in the basic core-periphery model, the centrifugal force in their models is given by the pull of an agricultural population tied to the land (i.e., the pull of dispersed rural markets). Lowering international transport cost, which occurs as a result of trade liberalization or economic integration, leads to the concentration of economic activities within a country.<sup>1</sup>

Crozet and Koenig Soubeyran (2004) have further extended the core-periphery model by introducing spatial heterogeneity into the model. They first demonstrate that trade liberalization is most likely to result in a spatially concentrated domestic industrial sector. This occurs because, although international trade liberalization weakens both the agglomeration forces (i.e., backward and forward linkages) and the dispersion forces (i.e., the need for domestic firms to locate away from domestic competitors), the dispersion forces are more significantly affected than the agglomeration forces. Second, by allowing international transport costs to differ and assuming that one region

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<sup>1</sup> According to Paluzie (2001), the Krugman and Livas Elizond model, in which congesting cost is the centrifugal force, is better suited for an urban model that tries to explain the emergence of giant cities like Mexico City. On the other hand, adhering to the basic core-periphery model appears more appropriate for analyzing the consequence of economic integration in Europe. A stylized fact in Europe is that economic integration has led to increased regional disparities within a country.



has distinctly lower transport costs to the foreign market than another, as in the case of the frontier regions, Crozet and Koenig Soubeyran demonstrate that if competition pressure from the international market is not too strong, trade liberalization fosters spatial concentration in the region that has advantages in access to the foreign market. Moreover, using evidence from Romania, it has been shown that access to the European Union (EU) market and proximity to the coast are critical in determining the rate of urban growth. In a similar vein, Resmini (2003a, 2003b) demonstrates that proximity to the EU border has stimulated a catching up process for the peripheral regions in Eastern and Central European countries. Regions bordering the EU also have better prospects for growth in employment than internal regions.

As shown above, there are conflicting views about the influence of international trade liberalization on internal geography.<sup>2</sup> However, both views indicate that frontier regions, such as border regions and port cities, would gain location advantages over internal regions due to low-cost access to the foreign market. It is therefore quite important to investigate whether such a phenomenon could be observed in a newly integrated economy such as Cambodia.

### 3. The Cambodian Economy in the Context of Regional Integration

After experiencing a violent regime in the 1970s and a socialist economy in the 1980s, the Cambodian government decided to pursue economic reform, replacing the centrally planning economy with a more open market system. In particular, the Cambodian economy has made significant progress in liberalizing its economy and has strengthened its economic relationships with neighboring countries. In this section, we describe the advancement in trade

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<sup>2</sup> In addition to the models introduced above, there are eclectic models based on the Krugman and Livas Elizondo model (Alonso-Villar 1999, 2001; Mansori 2003). These models can lead to different conclusions – either spatial dispersion or concentration – by introducing different assumptions into the models.

agreements and infrastructure which affect trade and transport costs, the geographic variations of regional economies, and the position of foreign trade.

### 3.1. Free trade agreements and infrastructure development

Cambodia joined ASEAN in 1999. Initially the ASEAN market did not hold much significance because the Cambodian economy was overwhelmingly dependent on garment exports to the US and EU markets, owing to the General System of Preferences offered by developed countries. The importance of Cambodia's membership in ASEAN increased as Cambodia entered into binding agreements to liberalize intra-regional trade under the ASEAN Free Trade Area: Cambodia is committed to reducing tariff lines in the Inclusion List (IL) below 5% by 2010 and remaining tariff lines by 2017.<sup>3</sup> Moreover, ASEAN has concluded free trade agreements with China, Japan, Korea, Australia, New Zealand, and India. These agreements have expanded the free trade area for ASEAN across the entire East Asian region.<sup>4</sup>

Other barriers to trade included poor transport infrastructure. Cambodian infrastructure was largely destroyed during the country's long period of conflict. Cambodia has received substantial bilateral and multilateral assistance from international donors, which has contributed significantly to Cambodia's rehabilitation and the development of its infrastructure. Among infrastructure sectors, roads and ports are particularly important.<sup>5</sup>

#### (1) Road infrastructure

The main roads were constructed between the 1920s to 1960s. Then, since the mid-2000s, more roads have been paved than ever before. By 2009, 99.1% (2,117

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<sup>3</sup> In 2003, ASEAN leaders agreed to establish the ASEAN Economic Community (AEC) as an end goal of economic integration. Under the AEC, Cambodia, along with other member countries, is expected to eliminate or reduce trade barriers, including non-tariff barriers.

<sup>4</sup> In 2004, Cambodia also joined the WTO.

<sup>5</sup> See Hatsukano, Kuroiwa, and Tsubota (2012) for further descriptions on the development of infrastructure.

km) of the main national roads and 30.2% (3,146 km) of the secondary national roads were paved.

As we discuss later, the main corridors are strategically important to attracting industries. In particular, the Southern Economic Corridor, which connects Poipet (a Cambodia-Thailand border town), Phnom Penh (the capital), and Bavet (a Cambodia-Vietnam border town), is crucially important in deepening integration with neighboring economies.

## (2) Port

Cambodia's main international seaport is located in Sihanoukville. The original pier was constructed in 1960. It was rehabilitated in 2009 and possesses a container terminal that is 400 m long and 10 m deep. Most goods passing through the port are carried to/from international markets via Singapore.<sup>6</sup>

## 3.2. Economic geography of Cambodia

Traditionally, two areas have led industrialization in Cambodia: the Greater Phnom Penh area and Sihanoukville. In addition, the advancement of regional integration and the construction of special economic zones (SEZs) appears to have brought about changes in the border regions, in particular Poi Pet and Bavet. We will briefly describe such geographical features in this section.

### (1) Greater Phnom Penh

This region is the political, economic, and cultural center of the country.

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<sup>6</sup> Another important port is located in Phnom Penh, along the Tonle Sap River. Most cargo passing through this port is carried to/from international markets via Ho Chi Minh City in Vietnam. In 2008, the Phnom Penh Port handled 47,507 TEU, while the Sihanoukville Port handled 258,775 TEU. In this study, only the impact of the latter port was examined in the econometric analysis because (1) the volume of cargo handled at the latter port is significantly larger than the former port, and (2) it is technically difficult to separate the impact of the Phnom Penh Port on the location of industry activities in Phnom Penh City from those of other agglomeration forces.

Compared with other parts of the country, Phnom Penh and the surrounding areas are better prepared for industrial development in almost all aspects, including market size, supporting industries, labor force, and infrastructure. Therefore, many large-scale factories, especially in the garment and textile industries, have been located in the Phnom Penh and Kandal provinces since the early 1990s. Although Phnom Penh is not close to international borders or sea ports and is thus not necessarily an ideal location for export-processing industry, investors continue to be attracted to this region.

#### (2) Sihanoukville

Sihanoukville is a good location for export-processing industries. Footwear and garment products made in Phnom Penh and Sihanoukville are exported through the Sihanoukville port to the US and EU markets via Singapore.

#### (3) Border regions

Regional integration and road infrastructure development has increased the location advantages of the border regions. In particular, Poipet and Bavet, which border Thailand and Vietnam, respectively, are well-connected to neighboring countries through the Southern Economic Corridor. The advantage of the border regions is also given by the fact that they can use the efficient infrastructure services of bordering countries, particularly electricity, transportation and logistics.

### 3.3. Trade linkages

= Tables 1 and 2 =

Tables 1 and 2 indicate that the value of Cambodia's trade increased rapidly after trade liberalization. Cambodia is highly dependent on exports to

developed countries (i.e., the United States, the European Union, and Japan), because these provide lucrative markets for final products such as wearing apparel and footwear.<sup>7</sup> However, Cambodia was still highly dependent on imports from East Asia and especially Northeast Asia (excluding Japan) and bordering Southeast Asian countries.<sup>8</sup> Among the three bordering countries, Vietnam gained importance as a supplier of materials for Cambodia, narrowing the gap with Thailand. Vietnam and Thailand's shares of Cambodia's imports in 2008 (1998) were 10.6% (6.5%) and 15.8% (15.6%), respectively, while Laos's share was negligible.

As is often pointed out, production networks have been the driving force behind regional integration in East Asia. In East Asia, industries that were previously based in more advanced economies have extended their production networks into less developed economies to take advantage of low wages, preferential tariffs, government tax breaks, and liberal trade and investment regimes. Since Cambodia opened up trade, it has been actively involved in regional production networks in East Asia, centered on wearing apparel and footwear exports to the US and EU markets. At the same time, it is heavily dependent on imported materials from neighboring East Asian countries. As a result, it is expected that proximity to international markets has become an important factor in determining the location of industries.

#### 4. Regional Structure

In this section, we focus on the location of industry in terms of manufacturing

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<sup>7</sup> Cambodia's trade structure is skewed, particularly in exports. Wearing apparel and footwear combined accounted for 71.3% of Cambodia's exports in 2008. These were directed to major markets in developed countries, such as the US, the EU, and Canada.

<sup>8</sup> Cambodia's import items consist primarily of materials for the wearing apparel industry such knitted or crocheted fabric and synthetic staple fibers. These are imported mostly from China, Hong Kong, Taiwan, Malaysia, Korea, and Vietnam. Across all industries, the import shares of Northeast Asia and the three bordering countries were respectively 47.9% and 26.5%, while the export share of the developed countries in 2008 was 63.3% (Tables 1 and 2).

employment.<sup>9</sup> Cambodia experienced high employment growth during the period of 1998-2008. During this period, total employment increased by a factor of 1.44, from 4,822,864 to 6,934,891. Manufacturing employment grew more rapidly than total employment, increasing by a factor of 2.86 from 150,259 to 430,105.

= Figure 1 =

Figure 1 shows the relative share of manufacturing employment by district in 1998 and 2008. Figure 1 indicates the districts in which manufacturing activities are more densely concentrated. First, there is an area of manufacturing concentration in and around the Greater Phnom Penh area. Comparing figures for 1998 and 2008, it is clear that the share of manufacturing employment in the Greater Phnom Penh area has increased significantly.<sup>10</sup> Moreover, manufacturing activities have spread out from Phnom Penh to the surrounding suburbs, while other economic activities, including services, have become more prominent in Phnom Penh (Hatsukano, Kuroiwa, and Tsubota 2012).

Second, the port region of Sihanoukville and the northwestern and southwestern regions bordering Thailand and Vietnam have also experienced a certain level of concentration. In particular, the Ou Chrov district in Banteay Meanchey province, which contains the Poi Pet border post, has increased manufacturing employment 7.23-fold from 1998 to 2008. Similarly, the Chantrea district in Svay Rieng province, which contains the Bavet border post, has increased 9.66 times. In the international port province, the Mittapheap district in Sihanoukville province has increased 2.89-fold. As observed above, districts located in frontier regions have increased their employment significantly. In

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<sup>9</sup> Our definition of manufacturing does not include mining and related extraction industries.

<sup>10</sup> For the aggregated data of manufacturing employment by province, see the Appendix. The highest growth is in the Kampong Speu province, located on the outskirts of the Greater Phnom Penh area.

terms of employment share, however, the districts in rural provinces have relatively low shares of manufacturing employment compared to those in the Greater Phnom Penh area, although the districts mentioned above showed higher employment growth.

In contrast, manufacturing activities in regions sharing borders with Laos have remained stagnant. Similarly, many other inland areas, which are for the most part rural and agriculture-based, lost manufacturing employment share between 1998 and 2008<sup>11</sup>. We can see a significant increase in the number of unshaded or lightly shaded districts outside the metropolitan and frontier regions. Siem Reap, which is a tourist destination famous for Angkor Wat, was among the few districts which have increased or retained a relatively high share of manufacturing employment.

= Figure 2 =

To examine changes in the overall distribution of manufacturing activities, two Lorenz curves are drawn in Figure 2. We note that these Lorenz curves indicate the cumulative distribution of employment share in 1998 and 2008. As the curve shifts outward from 1998 to 2008, we can conclude that manufacturing activities have become more geographically concentrated. Regions with more dense manufacturing activities tended to grow faster while the remaining regions remained relatively stagnant.

## 5. Econometric Analysis

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<sup>11</sup> Most of Cambodia's rural areas remain underdeveloped. Northeastern provinces (such as Ratanak Kiri, Mondul Kiri, Kratie and Stung Treng) are relatively mountainous and host few industries. They have high potential to attract agro-industry, mining, and eco-tourism industries. Northwestern provinces (such as Banteay Meanchey (except Poi Pet area), Oddor Meanchey and Preah Vihear) are also mountainous and have small populations and weak industrial bases.

## 5.1. Econometric model

Using employment data from the population census, we consider what factors account for regional adjustment to trade liberalization. As discussed in the previous sections, the reduction of trade costs—which is advanced by trade liberalization and economic integration—is likely to affect industry location by enhancing the accessibility of the frontier regions to external markets. In particular, manufacturing firms that are closely involved in international production networks are likely to respond to such changes. Following the empirical framework set up by Hanson (1998) and Resmini (2003a, 2003b), our analysis of dynamic employment growth in agglomeration economies examines two hypotheses (i) that the initial concentration of industry activity may have external effects (i.e., agglomeration economies) and enhance manufacturing employment growth; and (ii) that improvements in accessibility to international markets may lead to manufacturing employment growth especially in frontier regions. In particular, by making several specifications for frontier region dummy variables, we examine the second hypothesis with regard to the effects seen in frontier regions. We may call the effects of frontier regions on employment growth “frontier region effects”.

The regional labor demand function is assumed to be expressed in a linear function as

$$E_{rt} = a_{rt} + \beta W_{rt} + \gamma X_{rt} + \varepsilon_{rt} \quad (1)$$

where  $W_{rt}$  is the input price vector at time  $t$  in region  $r$ ,  $X_r$  is a vector of



regional characteristic variables, and  $\varepsilon_{rt}$  is an independent and identically distributed shock that has mean zero and constant variance.

We further assume that the growth of employment share between time  $t$  (=1998) and time  $T$  (=2008) can be expressed as a function of the initial conditions of the explanatory variables. Considering the factors relevant to industry location in Cambodia, we assume that the growth of employment share can be expressed as

$$\ln\left(\frac{E_{rT}/E_T}{E_{rt}/E_t}\right) = \alpha + \beta_1 \ln\left(\frac{W_{rt}}{W_t}\right) + \beta_2 \text{Density}_{rt} + \gamma \ln\left(\frac{\text{Dist}_r}{\sum_{r=1}^R \omega_{rt} \text{Dist}_r}\right) + \sum_{i=1}^2 \delta_i \text{Road}_r^i + \sum_{j=1}^4 \theta_j \text{Frontier}_r^j + \varepsilon_{rt}. \quad (2)$$

The first term on the right-hand side is the wage in district  $r$  ( $W_{rt}$ ) relative to the national wage ( $W_t$ ). Population density is used as a proxy for land prices. To avoid simultaneity, all the time-varying explanatory variables are values for the initial year 1998.

The regional characteristic variables include accessibility to markets such as distance to the capital district (i.e., Phnom Penh) and international markets. Note that the distance to the capital district is represented by the distance of the district in question to the capital ( $\text{Dist}_r$ ) relative to the weighted-average distance to the capital ( $\sum_{r=1}^R \omega_{rt} \text{Dist}_r$ ).

To account for regional characteristics, we have introduced several dummy variables. *National Road* takes a value of one if a national road passes through the district in question. There are two types of national roads. The first type is the main national road system. These roads are represented by

single-digit numbers. The second type is the secondary national road system, where roads are represented by double-digit numbers.

*Frontier district* takes a value of one if the district in question shares a national border with Thailand, Laos, or Vietnam, or is located in the coastal area (there thus are four types of frontier districts). Among frontier districts, districts with border posts or international seaports may have an additional advantage over other frontier districts in terms of accessibility to international markets, and thus are separated from the other frontier districts by adding dummy variables for *Border Posts*, which takes a value of one if the district in question has a border post.

## 5.2. Estimation results

For this empirical analysis, we restrict our data to samples that are available for both 1998 and 2008. Table 3 shows the number of frontier districts in Cambodia. Five districts are dropped, since a census was not conducted in these districts. Four of these districts border Thailand. The border post in Preah Vihear is also excluded from our dataset due to a territorial dispute between Cambodia and Thailand. Summary statistics are provided in Table 4.

Estimation results are given in Table 5. The signs of wage, population density, distance to the capital, and national roads are in line with our expectations. Higher wages are not favored by manufacturing companies. Similarly, a higher population density, which reflects higher land rents, is not

favorable. On the other hand, the sign of the variable representing proximity to the capital (Phnom Penh) is significantly negative, suggesting that closer distance to the metropolitan area positively affects industry location. This result is in line with the significant agglomeration economies and lock-in effects found in the metropolitan area. The national road dummy variables are both positive. This result indicates that efficient transport infrastructure enhances market connectivity and thus contributes to industry development. It should be noted, however, that the single-digit main national roads are less statistically significant than the double-digit secondary national roads and the coefficients are smaller (in Equation (1)-(5)). All of these variables are significant under various model specifications. We may therefore conclude that the estimation results of these variables are robust.

Equation (1) demonstrates that the frontier region effect is significantly positive. Being located in the frontier districts significantly enhances manufacturing employment growth. To examine the sphere of influence of the frontier region effect, a dummy variable for adjoining districts is added in Equation (2). This dummy variable takes a value of one if the district in question adjoins frontier districts. In Equation (2), the sign of the adjoining district dummy variable is negative, and neither the frontier district nor the adjoining district dummy variable is significant. These results suggest that the sphere of influence of the frontier region effect is geographically limited.

To disentangle the frontier region effect as verified in Equation (1), the

frontier districts are separated into four types of districts according to their neighboring countries or international ports, as in Equation (3). Equation (3) demonstrates that the signs of the dummy variables for frontier districts bordering Thailand and Vietnam are both significant and positive, while those for Laos and the sea are insignificant and negative. These results suggest that there is systematic variation in frontier districts. As expected, frontier districts closer to larger markets such as Thailand and Vietnam exhibit positive effects, while those bordering smaller markets such as Laos demonstrate negligible effects. Moreover, while the coastal area is expected to have an advantage in terms of accessibility to international markets, such potential is not sufficient to show positive employment growth effects when all coastal areas are treated together as a single district.<sup>12</sup>

Next, we narrow the definition of frontier regions and regard only those districts with border posts as frontier regions. While frontier regions adjoin national borders, it does not mean that there is direct connectivity to the foreign market. Without border posts, official trade is not allowed to be conducted across borders (although smuggling may be rampant, given the weak border control in Cambodia). Equation (4) indicates that districts with border posts to Thailand and the Shihanoukville international port show significantly positive employment growth effects. Variables for Vietnam and Laos, on the other hand, show positive but insignificant effects. Estimation results may therefore vary

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<sup>12</sup> Instead of seacoast districts, a dummy variable for international port exhibits positive and highly significant results as shown in Table 6.

depending on the definition of frontier regions.

When controlling for both effects, we obtain a different result, as shown in Equation (5). Frontier district dummy variables are significantly positive for Thailand and Vietnam, while the dummy variables for border posts are significant for the only Sihanoukville international port. Because all districts with border posts are part of the frontier districts, border post effects are additional effects obtained after controlling for frontier region effects. Moreover, it is worth noting that all districts with border posts are endowed with national roads. Therefore, even if the border posts effects are not significant, the districts with border posts may still have high potential to attract industry, owing to both the national road and frontier region effects.

These results suggest that (i) for the frontier districts bordering Thailand and Vietnam, the frontier region effects are more dominant than the border post effects; (ii) for the coastal districts, the frontier region effects are not significant, and it is only the border post effects at Sihanoukville international port that have significantly raised manufacturing employment growth; and (iii) for the frontier districts bordering Laos, neither the frontier region effects nor border post effects are significant, reflecting weak trade links between Cambodia and Laos.

For the robustness check, we change the method of measuring the border post effects. The sphere of influence of the border post effects is measured by examining the significance of the dummy variables which are

defined by the direct distance from the nearest border post. Equations (1)-(3) in Table 6 indicate that positive border post effects are seen only within 20 km from the border post. For the 35km and 35-50km distance dummy variables, none of the border post effects are significant. When we include the frontier district dummy variables as in Equations (4)-(6), the border post effects are still positive within 20km, but they are no longer significant. Dummy variables for frontier districts to Thailand and Vietnam are significantly positive but border post effects are not significant after controlling for frontier region effects.

## 6. Conclusion

Our analysis of dynamic employment growth in agglomeration economies examined two hypotheses: (i) that the initial concentration of industry activities in the metropolitan area may enhance manufacturing employment growth; and (ii) that improvements in accessibility to international markets may lead to manufacturing employment growth, especially in frontier regions. We find that proximity to the capital is the primary factor determining manufacturing employment growth. This is quite natural, given the agglomeration economies in the capital region. On the other hand, frontier region effects are significantly positive in the districts bordering Thailand and Vietnam. After controlling for frontier region effects, we find that border post effects are significant only in the Sihanoukville international port. When visiting border districts in Cambodia, one notices that border districts connected by highways to neighboring

countries are thriving due to casinos and other tourist attractions. We find that districts bordering large countries or endowed with international ports are thriving in manufacturing as well, owing to prominent market accessibility.

It should also be noted that the frontier regions are endowed with relatively cheap labor and land, while districts with border posts are also endowed with national roads. It is therefore possible that the frontier regions—in particular districts with border posts—are attracting manufacturing industry and experiencing higher employment growth. However, because frontier region and border post effects are still minimal, the sphere of influence of these effects is geographically limited.

From our analysis on manufacturing employment growth, it appears that industry development in Cambodia is becoming multipolar. However, contrary to the predictions of Krugman and Livas Elizondo (1996), agglomeration economies in the Greater Phnom Penh area are still strong and have induced rapid manufacturing employment growth. One possible reason for this phenomenon is that frontier region effects are still relatively weak when compared with agglomeration forces in the metropolitan area. Also possible is that, unlike Mexico City, the development of agglomeration economies in the Greater Phnom Penh area are still in the early stages, so there remains room for further development.

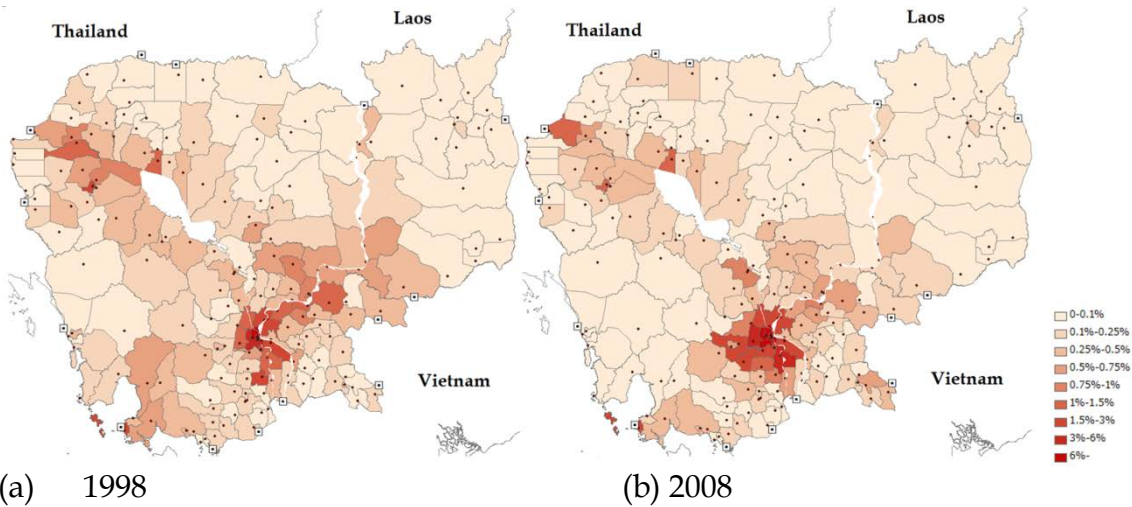
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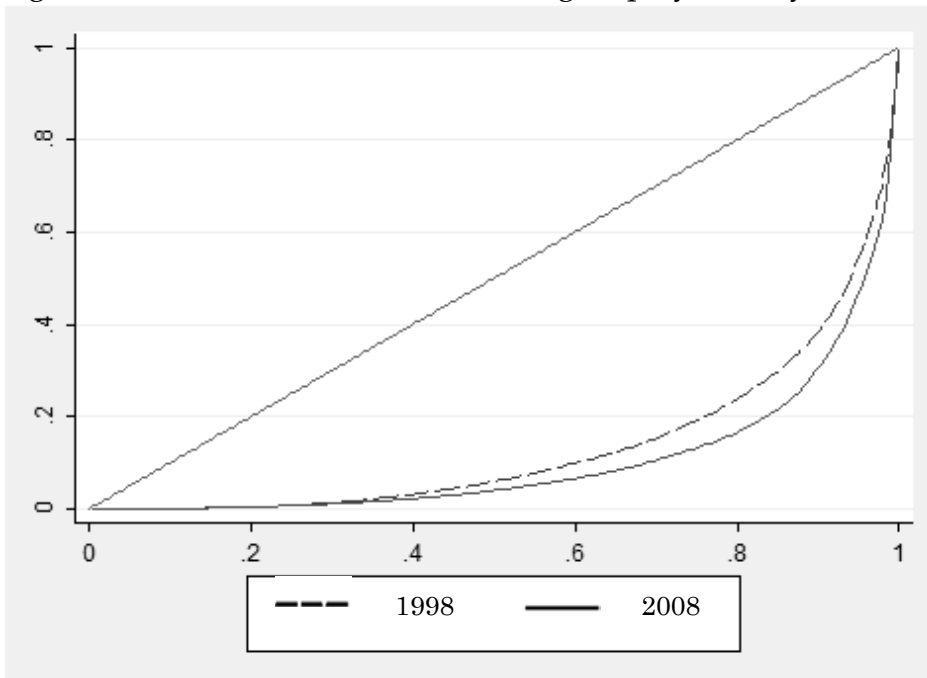
Figure 1 Employment Share of the Manufacturing Sector by Province



Source: Authors' calculation based on the General Population Census of Cambodia (1998, 2008), National Institute of Statistics with map data from the Geographical Department, Ministry of Land Management, Urban Planning and Construction

Note: Square symbols (□) on the map indicate locations of border gates.

Figure 2. Lorenz curve of manufacturing employment by District



Source: Author's calculation based on the General Population Census of Cambodia (1998, 2008), National Institute of Statistics

Table 1. Total Imports from 2000 to 2008

(unit: USD millions)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Neighboring countries*	318 (22)	330 (22)	337 (20)	354 (20)	400 (19)	473 (19)	687 (23)	862 (24)	1107 (25)
Other ASEAN countries	245 (17)	256 (17)	262 (16)	298 (17)	303 (15)	318 (12)	339 (11)	384 (11)	528 (12)
Northeast Asian countries**	628 (44)	699 (46)	854 (51)	909 (51)	1094 (53)	1317 (52)	1593 (53)	1889 (53)	2120 (49)
Developed countries	187 (13)	181 (12)	170 (10)	167 (9)	208 (10)	364 (14)	277 (9)	321 (9)	431 (10)
ROW	61 (4)	41 (3)	45 (3)	51 (3)	59 (3)	79 (3)	92 (3)	100 (3)	174 (4)
Total	1438	1507	1668	1779	2064	2551	2988	3556	4360

Source: The General Department of Customs and Excise of Cambodia

\* Thailand, Laos, and Vietnam

\*\* China, Hong Kong, Korea, and Taiwan.

\*\*\* Values in parentheses indicate the share in each year.

Table 2. Total Exports from 2000 to 2008

(unit: USD millions)	2000	2001	2002	2003	2004	2005	2006	2007	2008
Neighboring countries*	46 (3)	30 (2)	43 (2)	52 (2)	60 (2)	62 (2)	91 (3)	98 (3)	185 (4)
Other ASEAN countries	31 (2)	43 (3)	52 (3)	50 (2)	23 (1)	81 (3)	150 (4)	143 (4)	130 (3)
Northeast Asian countries**	301 (22)	231 (15)	452 (24)	360 (17)	657 (23)	563 (19)	567 (16)	486 (14)	867 (20)
Developed countries	996 (72)	1170 (78)	1343 (70)	1574 (74)	1930 (69)	2167 (72)	2587 (73)	2588 (73)	2763 (63)
ROW	14 (1)	25 (2)	33 (2)	82 (4)	127 (5)	145 (5)	172 (5)	215 (6)	418 (10)
Total	1388	1499	1923	2118	2797	3018	3567	3530	4363

Source: The General Department of Customs and Excise of Cambodia

\* Thailand, Laos, and Vietnam

\*\* China, Hong Kong, Korea, and Taiwan.

\*\*\* Values in parentheses indicate the share in each year.

Table 3. Number of Frontier Regions

	Thailand	Vietnam	Laos	Sea	Total	
Border post	5	7	1	1	14	
Frontiers	17(4)	29	7	12	61(4)	
Distance from border post	20km	8(1)	9	0	2	19(1)
	20-35km	4	17	0	1	22
	35-50km	3(1)	16	4	0	23(1)

Source: Author's calculation based on the General Population Census of Cambodia (1998, 2008), National Institute of Statistics

Notes:

\* Values in parentheses indicate the number of districts that are dropped from the estimation since they were not covered by the census in 1998 due to safety concerns. There are five such districts in total.

\*\* There is a border post at Preah Vihear, but it is not counted as a border post in our analysis since there is an ongoing border dispute involving army forces.

Table 4. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	obs
Growth of regional employment share in manufacturing	3.35	5.25	0.06	42.27	180
Relative wage	1.01	0.62	0.50	3.18	180
Relative population density	1.03	5.44	0.001	58.60	180
Weighted distance from capital	2.18	1.46	0.16	5.08	180

Source: Author's calculation based on the General Population Census of Cambodia (1998, 2008), National Institute of Statistics

Table 5. Estimation Results (1)

Dependent variable: log of employment share growth					
	(1)	(2)	(3)	(4)	(5)
Wage	-0.665*** [0.179]	-0.657*** [0.177]	-0.480** [0.210]	-0.674*** [0.181]	-0.523** [0.214]
Population density	-6.960*** [2.240]	-6.874*** [2.235]	-8.157*** [2.456]	-6.688*** [2.232]	-8.123*** [2.492]
Weighted distance to capital (Phnom Penh)	-0.307*** [0.0729]	-0.286*** [0.0703]	-0.330*** [0.0726]	-0.287*** [0.0745]	-0.337*** [0.0736]
National Road: single digit	0.225* [0.122]	0.207* [0.121]	0.268** [0.124]	0.184 [0.121]	0.235* [0.125]
National Road: double digit	0.409*** [0.124]	0.407*** [0.123]	0.375*** [0.130]	0.408*** [0.130]	0.410*** [0.134]
Frontier district	0.312** [0.145]	0.216 [0.145]			
Adjoining frontier districts		-0.195 [0.144]			
Frontier district Thailand			0.732** [0.287]		0.679* [0.400]
Frontier district Vietnam			0.404*** [0.154]		0.442** [0.183]
Frontier district Laos			-0.0665 [0.297]		-0.0789 [0.344]
Seacoast district			-0.189 [0.304]		-0.298 [0.298]
Border Post (Thailand)				0.613*** [0.215]	0.134 [0.419]
Border Post (Vietnam)				0.207 [0.244]	-0.108 [0.308]
Border Post (Laos)				0.172 [0.162]	0.247 [0.339]
International Port				1.552*** [0.293]	1.730*** [0.299]
Observations	180	180	180	180	180
Adjusted R-squared	0.229	0.231	0.247	0.219	0.248

Notes: \*\*\*, \*\*, and \* respectively indicate 1%, 5%, and 10% levels of statistical significance. Standard errors are in brackets.

Table 6. Estimation Results (2)

Dependent variable: log of employment share growth						
	(1)	(2)	(3)	(4)	(5)	(6)
Wage	-0.639*** [0.171]	-0.635*** [0.172]	-0.643*** [0.175]	-0.482** [0.210]	-0.483** [0.210]	-0.510** [0.215]
Population density	-6.833*** [2.200]	-6.804*** [2.202]	-6.783*** [2.200]	-8.203*** [2.463]	-8.209*** [2.478]	-8.191*** [2.471]
Weighted Distance to Capital (Phnom Penh)	-0.289*** [0.0712]	-0.292*** [0.0709]	-0.289*** [0.0708]	-0.335*** [0.0729]	-0.335*** [0.0732]	-0.334*** [0.0729]
National Road: Single digit	0.224* [0.121]	0.229* [0.122]	0.235* [0.122]	0.266** [0.123]	0.265** [0.124]	0.275** [0.123]
National Road: Double digit	0.392*** [0.124]	0.390*** [0.123]	0.390*** [0.123]	0.375*** [0.130]	0.376*** [0.131]	0.380*** [0.131]
Less than 20km from border post	0.518** [0.203]	0.541*** [0.206]	0.522** [0.209]	0.345 [0.235]	0.336 [0.241]	0.269 [0.250]
20-35 km from border post		0.157 [0.199]	0.136 [0.203]		-0.0217 [0.199]	-0.089 [0.208]
35-50 km from border post			-0.124 [0.156]			-0.213 [0.152]
Frontier district to Thailand				0.589** [0.289]	0.596** [0.282]	0.622** [0.280]
Frontier district to Vietnam				0.330* [0.167]	0.340* [0.182]	0.399** [0.189]
Frontier district to Laos				-0.0243 [0.310]	-0.0277 [0.312]	0.0406 [0.288]
Seacoast district				-0.305 [0.289]	-0.298 [0.283]	-0.246 [0.293]
Observations	180	180	180	180	180	180
Adjusted R-squared	0.234	0.233	0.23	0.252	0.248	0.248

Notes: \*\*\*, \*\*, and \* respectively indicate 1%, 5%, and 10% levels of statistical significance. Standard errors are in brackets.

## Appendix: Manufacturing Employment by Province

	Employment			Share	
	1998	2008	Growth	1998	2008
Banteay Meanchey	4815	12468	2.59	3.2%	2.9%
Battambang	8131	11923	1.47	5.4%	2.8%
Kampong Cham	15224	24240	1.59	10.1%	5.6%
Kampong Chhnang	2538	9020	3.55	1.7%	2.1%
Kampong Speu	2110	28810	13.65	1.4%	6.7%
Kampong Thom	2959	4696	1.59	2.0%	1.1%
Kampot	2321	4809	2.07	1.5%	1.1%
Kandal	22944	105129	4.58	15.3%	24.4%
Koh Kong	2737	1298	0.47	1.8%	0.3%
Kratie	3400	3332	0.98	2.3%	0.8%
Mondul Kiri	123	473	3.85	0.1%	0.1%
Phnom Penh	59291	167264	2.82	39.5%	38.9%
Preah Vihear	427	814	1.91	0.3%	0.2%
Prey Veng	4154	8429	2.03	2.8%	2.0%
Pursat	2621	2726	1.04	1.7%	0.6%
Ratanak Kiri	443	976	2.20	0.3%	0.2%
Siemreap	3880	9813	2.53	2.6%	2.3%
Sihanoukville	4175	8880	2.13	2.8%	2.1%
Stung Treng	649	837	1.29	0.4%	0.2%
Svay Rieng	1361	7656	5.63	0.9%	1.8%
Takeo	5163	14100	2.73	3.4%	3.3%
Oddar Meanchey	267	1432	5.36	0.2%	0.3%
Kep	97	298	3.07	0.1%	0.1%
Pailin	379	682	1.80	0.3%	0.2%
<b>Total</b>	<b>150209</b>	<b>430105</b>	<b>2.86</b>		

Source: Author's calculation based on the General Population the Census of Cambodia (1998, 2008), National Institute of Statistics