Market Potential and Regional Per Capita GRP Differentials: Application of the NEG Model to Indonesian Provinces

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Abstract

This study is conducted in order to examine the inter-provincial per capita GRP（Gross Regional Product）disparities in Indonesia under the NEG（New Economic Geography）framework. The coefficient of variation shows that the disparities are decreasing in the period of 1993-1997 and increasing in the period of 1998-2004. On the basis of the disparities trends, those two different periods are examined in our analysis. By utilizing wage equation which developed by Fujita, et al.（1999）we make use of panel data analysis in estimating the role of domestic market access, foreign market access, urbanization and human capital on inter-provincial per capita GRP. The findings suggest that domestic market access, foreign market access and human capital play important roles on inter-provincial per capita GRP disparities, while urbanization shows reverse role because of excess of urban labor.

Keywords: New economic geography, Regional income disparities, Panel, Indonesia
JEL codes: R11, R 13

1. Introduction

In the period from 1975 to 1993 Indonesia experienced the deceasing trend of inter-provincial per capita GRP disparities（Garcia and Soelistianingsih, 1998）. As we show later, this trend continues until 1997. After experiencing a decrease in inter-provincial per capita GRP disparities for several decades, from 1998 the trend is reversely increasing.

Nakamura（2008）outlined that the increasing trend of the disparities cannot be well explained by neoclassical growth theory, because of its restrictive assumption of constant returns to scale. By assuming of increasing returns to scale, new economic geography（NEG）can deal with the increasing of the disparities better. Thus, in this study NEG framework is

applied for examining the role of domestic market access, foreign market access, urbanization and human capital on the inter-provincial per capita GRP disparities in Indonesia.

Using the coefficient of variation, we present the trend of inter-provincial per capita GRP disparities in the period of 1993-2004. The inter-provincial per capita GRP disparities show the decreasing trend in the period of 1993-1997 and increasing trend from 1998 to 2004. On the basis of this finding, we examine the inter-provincial per capita GRP disparities analysis into those two periods. Detail explanation of inter-provincial disparities in Indonesia are provided in section 2.

Before examining the inter-provincial per capita GRP disparities, in section 3 we review the concept of NEG theory. We also provide the theoretical background which will be used as the framework of this study and its empirical applications.

In section 4 we review the empirical studies related to agglomeration and NEG, and construct the empirical model would be used in this study. This study can be considered as the subsequent study which is to enrich the empirical studies of inter-regional disparities and agglomeration in Indonesia, under NEG framework. Subsequently, we estimate the model using inter-provincial data. The results show that domestic market access, foreign market access and human capital have positive and significant impact on the inter-provincial per capita GRP. In contrast, urbanization has negative impact on inter-provincial per capita GRP.

The concluding remarks are provided in section 5. We deduce that in line with the theory, domestic market access and foreign market access and human capital play important roles on inter-provincial disparities. In contrast, urbanization plays the reverse role and potentially leads to the equalization on wages across provinces because of the excess of urban labor in Indonesia.

2. Indonesian Inter-provincial Disparities

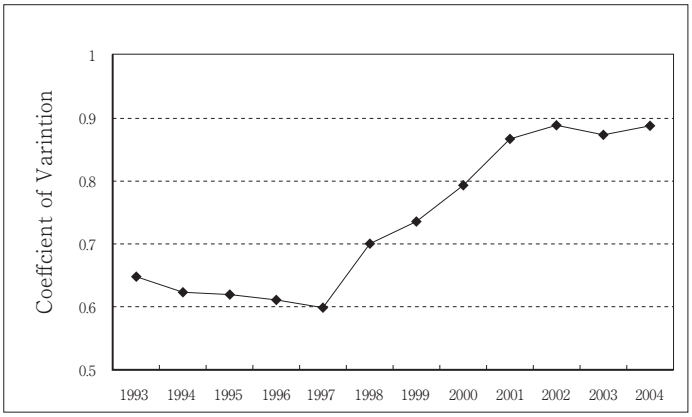
The coefficient of variation (CV) is the one of the basic tool that generally used for measuring disparities across economies. We use this disparities indicator in order to measure inter-provincial per capita GRP disparities in Indonesian. Figure 1 shows that in the period of 1993-1997 inter-provincial per capita GRP disparities is decreasing, while in the period of 1998-2004, inter-provincial per capita GRP disparities show the increasing trend. The results also show that the increasing pace is relatively faster in comparison to the decreasing pace in the period of 1993-1997.

As stated by Nakamura (2008), neoclassical growth theory does not well explain the expanding regional disparities because of its restrictive assumption, namely constant returns to scale. Neoclassical growth theory and traditional economic geography do not well answer the questions related to the expansion of inter-provincial disparities, such as why some regions which with relatively same geographical conditions could be very different as far as agglomeration is concerned, or why some regions with much geographical advantage failed growth faster than the less one. New Economic Geography (NEG), which supposes increasing returns to scale, can explain those problems.

According to Garcia and Soelistianingsih (1998), in the period of 1975-1993, Indonesia experienced the decreasing trend of inter-provincial disparities. It means after the experience of the decreasing of inter-provincial disparities, Indonesia is suffering from increasing inter-provincial disparities from 1998.

In the "new order" era under former President Soeharto administration (1967-1998), three development strategy known as "Trilogi Pembangunan Nasional" was enacted. The three development strategy is national stability, economic growth, and equalization of the distribution of development. Those are implemented in the five-year development planning abbreviated by REPELITA (Rencana Pembangunan Lima Tahun). The strategy was quite successful, marked by economic and political stability, unprecedented high and consistent of economic growth, and the decreasing trend of inter-provincial disparities in this period. The recent increasing trend of inter-provincial disparities seems to wipe off the development achievements by Soeharto administration, especially in terms of inter-provincial disparities.

Figure 1 Trend of Inter-provincial Disparities



note: real per capita GRP excludes oil and gas sector

3. NEG Approach

3.1 Concept of NEG

Although economic geography had been introduced since the early nineteenth century by von Thunen, most of the economists paid little attention to the importance of its spatial aspect. The main reason is due to the technical intractability (Fujita, Krugman, Venables, 1999, p.2). The monopolistic competition model developed by Dixit and Stiglitz's (1977) has become a bridge to deal with the notion, which initially explored by Krugman in his several seminal articles related to new trade theories and later new economic geography.

New trade theory is developed in order to explain the intra-industry trade and the phenomenon of the predominance trade flow by the large and developed countries which could not be explained by traditional trade theories. By assuming imperfect competition and economies of scale, this theory can reveal the competitive advantage enjoyed by the economies with the bigger local market or the better access to the wider market (Armstrong and Taylor, 2000) . The NEG which adopted the framework of new trade theories was firstly introduced by Krugman (1991). After Krugman's article, NEG has drawn lot attentions of regional scientists, and now grown into a mature body of economics literature (Ottaviano and Pinelli, 2006).

NEG models take the home market effects as the main focus and used it as the basis of explaining the geographical clustering and agglomeration. These models are no longer regarded market as given. Cumulative causation process will make the regions with bigger market size growth faster than the smaller ones. Once a region gets a head start and manufacturing begin to cluster, they will enjoy the home market effect. This process will draw the more labor to migrate in order to work in this region. This will stimulate the home market effect further and attract more firms to establish in this region (Fujita et al.1999).

There are three main sources of geographical agglomerations (centripetal forces) so called market size effects (backward-forward linkages), labor pooling, and knowledge spill over. In Fujita et al., they explained that firm takes advantages from being close to suppliers of intermediate input factors due to savings on transport costs (backward linkages) and to the market (forward linkages) due to increased demand. All of these effects will reduce trade cost, which finally will reduce the total cost and increase profit. The increasing profit of firms will make them have ability to pay higher wage to the labor. Thus, the role of market size effects will drive the geographical agglomeration and create the differences in wage, and further per

capita income across economies.

3.2 Basic Model of NEG

In this section we review the NEG model as a foundation of our investigation. On the basis of the seminal work of Fujita et al.（1999）, which is summarized by Redding and Venables（2004）, the simple NEG model is shown as follows.

The economy consists $i= 1,\ldots,R$ regions. First, we expose the demand side. If every consumer is assumed to have the same ***Cobb-Douglas*** taste for the two types of goods, then the utility is difined as

$$U=M^{\mu}A^{1-\mu},$$

where U is utility, M is a composite index of the consumption of manufactured goods, A is consumption of agricultural goods and μ is a constant representing the expenditure share of manufactured goods. The quantity index, M, is a sub utility function which is defined over a discrete of varieties of manufactured goods; m_v is the consumption of each variety and n is the number of varieties produced. By assuming that M is defined by a *CES* function, we get

$$M=\left[\sum\nolimits_1^n m_v^{\rho}\right]^{1/\rho},0< \rho <1,$$

where ρ is the parameter presenting the intensity of the preference for variety in manufactured goods. We can set $\sigma \equiv 1/(1-\rho)$ representing elasticity of substitution between any two varieties.

If Y is defined as income and p^A for agricultural good and p_v for each manufactured good, than

$$Y=P^AA+\sum\nolimits_1^n p_v m_v$$

The consumer problem is to minimize expenditure holding utility level constant:

$$\min \sum\nolimits_{v=1}^n p_v m_v \text{ s.t.} \left[\sum\nolimits_{v=1}^n m_v^{\rho}\right]^{1/\rho}=M$$

The first order condition to this expenditure minimization problem gives equality of marginal rates of substitution to price ratios

$$\frac{m_v^{\rho-1}}{m_s^{\rho-1}}=\frac{p_v}{p_s}$$

Substituting this equation into the constraint, we have the compensated demand function as

$$m_s = \frac{p_s^{1/(\rho-1)}}{\left[\sum_{v=1}^{n} p_v^{\rho/(\rho-1)}\right]^{1/\rho}} M .$$

From the above compensated demand function for the s^{th} variety of manufacturing product we can also derive an expression for the minimum cost of attaining M. Expenditure on the s^{th} variety is $p_s m_s$, as

$$\sum_{s=1}^{n} p_s m_s = \left[\sum_{v=1}^{n} p_v^{\rho/(\rho-1)}\right]^{(\rho-1)/\rho} M$$

Now we can define the terms multiplying M on the right-hand side of this expression as a price index. The composite price index of manufactured goods P is

$$P \equiv \left[\sum_{v=1}^{n} p_v^{\rho/(\rho-1)}\right]^{(\rho-1)/\rho} = \left[\sum_{v=1}^{n} p_v^{1-\sigma}\right]^{1/(1-\sigma)} .$$

If the prices of all manufactured goods produced in region i are the same and p_{ij} is the delivered price at region j of a typical variety produced in region i, then the price index at region j becomes

$$P_j = \sum_{i=1}^{R} n_i p_{ij}^{1-\sigma} \quad \frac{1}{1-\sigma}, \tag{1}$$

where P_j is t in region i, which is sold in region j.

With the same procedure, we can derive the CES quantity index of n_i varieties which available in the region j as

$$X_j = \sum_{i=1}^{R} \left(n_r x_y^{1-\sigma}\right)^{\frac{\sigma}{1-\sigma}}, \tag{2}$$

where x_{ij} is the consumption in region j of typical variety produced in region i.

When we define E_j as expenditure on X_j that is a fraction of income I_j, while $\sigma > 1$ is the own and as well as the cross price elasticity of demand; utility maximization then gives the demand in region j for a typical variety produced in region i as follows

$$x_{ij} = p_{ij}^{-\sigma} E_j P_j^{\sigma-1} \tag{3}$$

Turning to the supply side, each variety is produced by each firm under the assumptions of monopolistic competition and increasing returns to scale. The total production cost of a typical variety is define as

$$TC_i = P_i^{\alpha} w_i^{\beta} v_i^{\gamma} c_i (F + x_i),\ \alpha,\beta,\gamma > 0,\ \alpha + \beta + \gamma = 1 \tag{4}$$

where TC_i is total cost, P_i is the price of composite intermediate goods with input share α, w_i is the labor wage with the share β, v_i is the price of internationally mobile primary input with the share γ, c_i is marginal inputs, and $c_i F$ is fixed input.

There is a transportation cost which is defined as an iceberg transport cost, τ_{ij}. If , $\tau_{ij} > 1$, then $\tau_{ij} - 1$ measures the proportion of output lost in shipping to j from i. Hence,

$$x_i = \sum_{j=1}^{R} x_{ij} \tau_{ij}. \tag{5}$$

The profit is defined as [revenue − costs],

$$\pi_i = \sum_{j=1}^{R} p_{ij} x_{ij} / \tau_{ij} - P_i^{\alpha} r_i^{\beta} w_i^{\gamma} c_i (F + x_i) \tag{6}$$

Profit-maximization firms set a single f.o.b. price, p_i, thus price for sale in different region is $p_{ij} = \tau_{ij} p_i$, and the price, p_i, is derived from the standard CES mark-up pricing rule:

$$p_i = \frac{\sigma}{1-\sigma} P_i^{\alpha} r_i^{\beta} w_i^{\gamma} c_i,\ \ p_{ij} = \tau_{ij} p_i \tag{7}$$

Substituting the equations (7) into equation (6) :

$$\begin{aligned}
\pi_i &= \sum_{j}^{R} p_i x_i - P_i^{\alpha} r_i^{\beta} w_i^{\gamma} c_i (F + x_i) \\
&= \frac{\sigma}{\sigma - 1} P_i^{\alpha} r_i^{\beta} w_i^{\gamma} c_i \left[x_i - \frac{(\sigma - 1)}{\sigma} F - \frac{(\sigma - 1)}{\sigma} x_i \right] \\
&= p_i / \sigma \left[\sigma x_i - \sigma x_i + x_i - (\sigma - 1) F \right] \\
&= p_i / \sigma \left[x_i - (\sigma - 1) F \right].
\end{aligned}$$

Free entry implies that in equilibrium firms face break even, in which they operate at scale

$$\overline{x} = (\sigma - 1) F \tag{8}$$

The cost equation can be written as log linear function of its supplier access and market access

$$\begin{aligned}
(r_i^{\beta} w_i^{\gamma} c_i) &= p_i^{-\alpha\sigma} \sum_{j}^{R} E_j p_j^{\sigma - 1} \tau_{ij}^{1-\sigma} \\
&= \left[\sum_{j}^{R} n_i p_i^{1-\sigma} \tau_{ij}^{1-\sigma} \right]^{\frac{\alpha\sigma}{\sigma - 1}} \left[\sum_{j}^{R} E_i P_i^{\sigma - 1} \tau_{ij}^{1-\sigma} \right]
\end{aligned} \tag{9}$$

$$= SA_i^{\frac{\alpha\sigma}{\sigma-1}} MA_i$$

Using free entry condition (8) in region i, equation (9) can be written as

$$\overline{x}\left(\frac{\sigma}{\sigma-1} r_i^{\beta} w_i^{\gamma} c_i\right)^{\sigma} = SA_i^{\frac{\alpha\sigma}{\sigma-1}} MA_i \qquad (10)$$

where $SA_i = P_i^{1-\sigma} = \sum_{j=1}^{R} n_i p_i^{1-\sigma} \tau_{ji}^{1-\sigma}$ is the supplier access of region i, which inversely predicts a firm pays for intermediate inputs. And $MA_i = \sum_{j=1}^{R} E_j P_j^{\sigma-1} \tau_{ij}^{1-\sigma}$ is the market access of region i which is a measure of consumer proximity. Given a firm production costs, this measure can predict the quantity a firm sells.

Equation (10) shows the relationship between wage and supply access and market access. Putting other things equal, increasing of supply access and market access of region i lead to increasing of wage in that region.

We can derive supply access and market access in the equation (10) as follows. From aggregate value of exports equation, we can define market access and supplier access. Aggregate value of export from i to j can be defined as:

$$n_i p_i x_{ij} = n_i p_i (p_i \tau_{ij})^{-\sigma} E_j P_j^{\sigma-1} \tau_{ij}$$

Then, supply access (SA) and market access (MA) are

$$SA = n_i p_i^{1-\sigma} (\tau_{ij})^{1-\sigma}$$

and

$$MA = (\tau_{ij})^{1-\sigma} E_j P_j^{\sigma-1}$$

The cost equation can be written as log linear function of its supplier access and market access

$$(r_i^{\beta} w_i^{\gamma} c_i) = P_i^{-\alpha\sigma} \sum_j^R E_j P_j^{\sigma-1} \tau_{ij}^{1-\sigma}$$

$$= \left[\sum_j^R n_i p_i^{1-\sigma} \tau_{ij}^{1-\sigma}\right]^{\frac{\alpha\sigma}{\sigma-1}} \left[\sum_j^R E_i P_i^{\sigma-1} \tau_{ij}^{1-\sigma}\right]$$

$$= SA_i^{\frac{\alpha\sigma}{\sigma-1}} MA_i$$

3.3 Empirical Application of NEG

This section provides several empirical applications of NEG in the international and inter-regional scopes. Redding and Venables（2004）are taken for application in across countries data, Head and Mayer（2006）are taken for application across countries in Europe Union, and Ottaviano and Pinelli（2006）are taken in the inter-region in a country's scope. We also provide another approach which taken by Davis and Weinstein（2003）who integrated Heckscher-Ohlin model and the NEG framework for investigating the existence of market access in OECD countries.

All of the findings of those studies support the prediction of NEG that market access and supply access play important role on the variation of wages and per capita income across economies thus lead to the economic disparities across regions or countries. The summary of these studies are shown in Table 1.

Table 1 Representative Empirical Applications of NEG

Authors	Scope of Study	Estimation Method	Variable	Remarks
Davis and Weinstein (2003)	OECD Countries 1985	OLS	-Industrial output in 1985 in the three and four-digit levels are used as dependent variables. -Average demand over 1970-1975 are used as explanatory variables for capturing idiosyncratic component of demand. -The other explanatory variables are bilateral export-import, labor force by educational level and fuel data, all in 1985.	-They investigate home market effects from idiosyncratic demand on the pattern of production, based on Heckscher-Ohlin and NEG frameworks. -Average demand over 1970-1975 is used in order to avoid simultaneity problem. -They outline that the results support the prediction of new economic geography of the existence of market access for a broad segment of OECD manufacturing.
Redding and Venables (2004)	Across 110 countries, with various years data in 1992 - 1996.	OLS, IV	-GDP per capita is used as dependent variable in the main estimation. -Domestic market access, foreign market access, hydrocarbons per capita, arable land area per capita, number of minerals, fraction land in the geographical tropics, prevalence of malaria, risk of expropriation, socialist rule external war, OECD country, land lock and island countries, borders, domestic supplier access, foreign market access.	-They provide several stage of estimation. First, using bilateral trade data they construct market access and supply access and divided into domestic and foreign market and supply access. Second, they separately estimated market access and other control variables over per capita GDP, and supply access on manufacturing price index. Finally, market and supply access are estimated over per capita GDP. -They conclude that market access and supply access are significant, and quantitatively important in explaining per capita income variation across countries, even after controlling for a variety of other determinants of per capita income.

Head and Mayer (2006)	57 regions across countries in European Union 1985-2000	OLS, IV for robustness test	-Wage bill over the number of employees in the industry level is used as dependent variable. -Real market potential (RMP), human capital is used as explanatory variables. -Bilateral trade (export and import) data across countries, inter-regional distances, national borders and language commonality are used for calculation of RMP.	-Head and Mayer construct real market potential as weighted sum of importer fixed effect estimated in a bilateral trade equation, and supply index is used as weight instead of estimating separately. -They use the same method with Redding and Venables (2004), but in the main model they incorporated human capital. -Industrial data is used and the effect of RMP on wage is estimated separately by Industry. -The findings show that wages respond to market potential, and human capital affect the variation of regional wages.
Ottaviano and Pinelli (2006)	Finnish NUTS 4 regions 1977-1990 (before recession) and 1994-2002 (after recession)	OLS	-Taxable per capita income growth rate and primary per capita income growth rate as a proxy for wage, and population growth rate, house price growth rate all are used as dependent variables. -Taxable per capita income, density of population, house price, median age, nominal market potential, distance from main airports, distance from Russian borders, distance from ports, unemployment rate, share of manufacturing and construction, and lake covered land, all are in the log initial year form and used as explanatory variables.	-Market access and supply access are jointly measured as nominal market potential. -They conducted three group estimations to check the effects of market potential and other control variables on per capita income growth, population growth and house price growth. -They also incorporate labor mobility and land in their model. -They conclude that agglomeration of firms and workers hinder the productivity and amenity convergence across regions. -With or without labor mobility better market and supply access drive agglomeration in Finland. -The findings show that wages respond to market potential and human capital affect the variation of regional wages.

4. Application to Indonesian Regions

4.1 Agglomeration in Indonesia

As far as we know, there are few studies that examined inter-provincial disparities in Indonesian using new economic geography approach. One of them was conducted by Amiti and Cameron (2007). Interested in the manufacturing concentration in Indonesia that heavily concentrated in Java Island, they investigated the role of the three importance source of agglomeration namely input-output linkages, labor pooling and technological externalities. They used 11,361 firm level data spread in 210 districts. However, with the reason of little number of manufacturing firms, they drop 4 provinces, East Nusa Tenggara, Moluccas, Irian Jaya (Papua) and East Timor from their initial sample. From their study, they found that input-output linkages have a significant positive impact on manufacturing wages in Indonesia. However, although firms benefit from vertical linkages, the benefits are highly localized. They also found that labor pooling has a significant positive impact on wages, although smaller than input-output linkages. However, they noted that they were unable to detect the evidence of knowledge spillover.

Although they did not specifically utilize NEG model as the framework of their study, Sjoberg and Sjoholm (2004) have investigated the effect of trade liberalization and the geography of production in Indonesia. In lieu of a conclusion, they tried to list the source of the existence of powerful agglomeration in Indonesia. Although they found the strong agglomeration in Java and especially metropolitan Jakarta, however they outlined that agglomeration in metropolitan Jakarta is not merely a question about effect of linkages or market access, which typically thought of as driving forces of agglomeration, but this is also about accessibility and infrastructure. Since Jakarta is the main gate of Indonesian main gateway to the rest of the world. The other possible explanation of the rigid pattern of manufacturing concentration in Indonesia is the relaxed restriction of foreign ownership. FDI increased sharply with the number of foreign-owned establishments increasing more than 120 percent in the period of 1990-1996. However they tended to concentrate in the certain area. They also indicated the advantage of large supply skilled labor and supplier of inputs as the other reasons of manufacturing concentration.

However, there is an incompleteness of Sjoberg and Sjoholm (2004) since they did not try to make any econometrical estimation to support their findings. This study could be seen as a complement of their study, since we provide econometric estimation for proving whether or

not market access play substantial role in inter-provincial agglomeration in Indonesia.

4.2 Empirical Model

The questions raised in the previous section can be answered by the following illustration. Let us imagine two regions, Z_1 and Z_2, which are originally at the similar stage of development, and suddenly external shock affect region Z_1 positively but affect Z_2 negatively. According to neoclassical theory, through the convergence process, this gap will be closed by adjustment of income and movements of the labor force.

However, as explained by Eckey and Kosfeld（2004）, forward and backward linkages will potentially increase deviations from spatial equilibrium. Labor will move from region Z_2 to region Z_1, thus it lead to transfer purchasing power to region Z_1. It contributes to the extension of service sector. This will make region Z_1 more attractive and will accrue urbanization in this region. The urbanization means that the increase of consumers in the region Z_1 that will result in increasing the demand. Increasing of demand will be served by established firms. Firms can buy intermediate products cheaper thus they also can sell their product cheaper in this region relative to the region Z_2 since there is no transport cost. Consequently the real income in region Z_1 increase and in turn will attract more people to move to this region. More people means more consumers than lead to more firms in order to fulfill consumers need, that will lead to agglomeration. From the illustration, we can easily predict at the end region Z_1 will growth faster than Region Z_2 and lead to the disparities between the two regions.

As explained above, there are several essential factors which lead to agglomeration.

（1）Market access

（2）Supply access

（3）Trade cost

（4）Urbanization

Market access and supply access are the important notions, since larger market access and supply access will attract firms to agglomerate in order to serve their respective markets. Trade cost is the key element in the NEG framework. The cheaper trade cost will reduce total cost, increase profit, and encourage industrial agglomeration. This also makes firms pay higher wage for the labor and finally it lead to regional income disparities.

In the regional study where labor mobility is more plausible than in the case of across countries, the higher wage will potentially attract labor from lower income sectors or regions.

This suggests that the labor movement can lead to an increasing wage because of the increased demand, reduced cost, and increased profit. On the other hand abundant number of labor will hamper the increasing of wage. In this condition firms have flexibility to choose the labor that will be hired. With the same skills and experiences, firms tend to choose the labor who wants to be paid lower.

Based upon the theoretical model of NEG and the above explanation, the empirical model presenting regional wage differential is expressed as

$$w_{it} = f(MA_{it}, SA_{it} U_{it}, O_{it}) \tag{11}$$

where w_{it} is wage in region i it time t, $MAit$ is market access of region i in time t, $SAit$ is defined as supply access of region i in time t, U is urbanization in region i in time t, and Oit is the other control variables in region i in time t.

In this study, we use real per capita GRP instead of wage. Per capita GRP is different from wage per worker since GRP includes corporate income. However, due to data unavailability we apply per capita GRP as the proxy for wage per worker. The same approach is also taken by Redding and Venables (2004) and Ottaviano and Pinelli (2006).

For the same reasons as in Finland (Ottaviano and Pinelli, 2006), in regional level, it is difficult to separate the effect of market access and supply access across regions. Thus we use a joint measure market access and supply access in the estimation. However, not like in Ottaviano and Pinelli (2006) which just investigated domestic market access, in this study we try to incorporate foreign market access, as well. Thus, the domestic and foreign market access variables are defined as follows.

Domestic market access (DMA) variable is calculated as the sum of region j GRP divided by the distance (D) between region i and j, thus $DMA_i = \log\left(\sum_{j \neq i} GRP_j / D_{ij}\right)$. Precisely, this measure in traditional geographic literature is called market potential (Redding and Venables, 2004). This approach is called nominal market access (Head and Mayer, 2004) which resembles, for example, Au and Henderson (2006) who applied in the Chinese cities level. In line with the theory, we hypothesize this variable will affect per capita GRP positively.

Foreign market access (FMA) is the sum of the export and import of each region. Therefore it is defined as $FMAi = \log(\exp ort_i + import_i)$. In this measure, we use actual value of foreign trade instead of potential data. Head and Mayer (2006) extended the NEG model related to productivity and trade. They explain wage differentials by means of market potential

which is the export possibilities index of firms in a region or country. Frankle and Romer (1999) and Alcal'a and Ciccone (2004) investigate the relationship between per capita income and its growth with trade openness which is defined as the sum of export and import over GDP. Due to the unavailability of the disaggregate trade data between regions and countries, it is assumed that the trade is conducted between each region and a single exporting-importing partner country. Foreign market access is hypothesized to affect growth positively.

In Indonesia, there is abundant labor pooling in the rural areas (Sjoberg and Sjoholm, 2004). It is also appeared in Indonesian statistical year book that agricultural sector has the highest share of labor compared to the other sectors, which is around 40 percent (BPS, 2004) and evenly distributed across regions. The labor force leaves agricultural sector, moves into urban areas and enter the non-agricultural sector (urbanization). This process yields urban agglomeration. We try to capture the effect of urbanization, using the share of non-agricultural labor to the total population in each region. The urbanization is hypothesized to affect per capita GRP positively.

There are several other factors of agglomeration which are not explained by NEG theory (Amiti and Cameron, 2007, Head and Mayer 2006). In the estimation, we take into account human capital as control variable as did by Head and Mayer (2006). Some industries need certain skills or educational qualification. Thus they will tend to establish their firms in the regions with abundant qualified labor. That is the reason of incorporating human capital variable in the model.

The labor by educational attainment data is not available at the regional level. Thus we use the number of students enrolled in school at initial year as a proxy for human capital. The reason for using an initial value is that in the next subsequent years students will graduate and join the labor market. This potentially leads to an increase of human capital in the regions. Theoretically, regions with abundant human capital attract the firms. This yields agglomeration economies and then generates disparities across regions.

Due to a mandatory nine year education system in Indonesia, most variation among regions involves senior high school and university. We define the human capital variable as log of the number of students enrolled in senior high school and university at initial year. Students graduating high school and university are expected to have better skills in comparison to the labor that did not graduated high school and more. Thus, it is expected this variable will positively affect per capita GRP.

We also consider Java dummy in the estimation model. Java dummy is defined as the provinces located in Java Island. Previous regional studies in Indonesia showed Java region's superiority compared to other regions in Indonesia in terms of GRP as well as agglomeration of manufactures. Nazara, Sonis and Hewings (2000), found that the distribution of income in the period from 1975 to 1999, five regions in Java region account for more than 50 percent of total Indonesian income compared with the rest of the regions located in outer Java. They outlined that the regional economic disparities between the western and eastern part of Indonesia, Java and outer Java islands or other regional geographic divisions of economy has been long prominent issue in Indonesian regional development policy.

By the spatial distribution of manufacturing, based on the share of total manufacturing labor force and share of total manufacturing value added at the provincial level, Sjoberg and Sjohlom (2004) figured out that the geographic distribution of manufacturing in Indonesia is very unequal between Java and outer Java region. They found a high concentration of the manufacturing sector, with a strong domination of Java region. While, Amiti and Cameron (2007) outlined that 82% of formal-sector manufacturing output was produced in Java.

There is a possibility of endogeinity problem, since the higher per capita GRP can become the causes of better market and supply access instead of effects (Ottaviano and Pinelli, 2006). To avoid this problem, all of the explanatory variables are taken one-year lag.

On the basis of the above explanations, the estimation model is specified as

$$y_{it} = \alpha_1 + \alpha_2 DMA_{it-1} + \alpha_3 FMA_{it-1} + \alpha_4 UP_{it-1} + \alpha_5 HC_{i0} + \varepsilon_{it}, \quad (12)$$

where the subscript i refer to the region, while t refers to time.

yit	: log of per capita GRP at t
$DMA_{it\text{-}1}$	: log of domestic market access at t-1
$FMA_{it\text{-}1}$	: log of foreign market access at t-1
$UP_{it\text{-}1}$	: urban population at t-1
HC_{i0}	: log human capital at the initial year
ε_{it}	: error term

We estimate equation (12) using the method of panel data analysis. There are several benefits of using panel data approach compared to the other methods. Panel data estimation analysis has the merit of using information concerning cross-section and time-series analysis. Furthermore, the repeated cross-section of observations over time is better suited to study

the dynamic of changes like exports, imports, and GDP（Hsiao and Hsiao, 2006）. Davidson and MacKinnon（2004）outlined that panel data analysis can take heterogeneity of each cross-sectional unit explicitly into account by allowing for individual-specific effects. While Baltagi（2001）explained that panel data method has less collinearity among variables, more variability, degrees of freedom, and efficiency.

According to the trend of disparities, we divide the estimation in two periods, 1993-1997 and 1998-2004. This indicates the decreasing and increasing trend of inter-provincial disparities.

4.3 Data Description

In this study, provincial level data are used. The empirical analysis is based on 1993 to 2004 panel data. The data are mostly taken from The Indonesian Central Bureau of Statistics (Badan Pusat Statistik, BPS), and The Central Bank of Republic of Indonesia（Bank Indonesia, BI）databases.

We use Gross Regional Product（GRP）excluding oil and gas sector. The reason of using this data because most part of the value added in oil and gas sector is spilled over to national government, as well as foreign countries.

The data of exchange rates for converting the export and import values from US Dollar into Indonesian Rupiah are taken from Bank Indonesia databases. In order to get the real value, GRP, export, import have been deflated by the consumer price index（CPI）of each province.

We define variable of distance as the shortest length between capital cities of provinces. They are measured by Google earth software's facility. Urban population is defined as the share of non-agricultural population to total population in each province. This variable is used as a proxy of urbanization.

Due to a mandatory nine year education system in Indonesia, most variation among provinces involves senior high school and university. Thus we take the number of students enrolled in senior high school and university as the proxy of human capital variable.

There are changes in the number of Indonesian provinces. Indonesia had 27 provinces, before East Timor received independence and became a new country in 1997. Subsequently, based on Law no.27 of 2000 Banten, Bangka-Belitung, and Gorontalo became independent provinces. The three provinces were formerly part of West Java, South Sumatera and North Sulawesi, respectively. Since 2002, North Maluku and Riau Island became new provinces, where formerly each one was a part of Maluku and Riau provinces, respectively. While West Papua based on

Law no.45 of 1999 was created from the western part of Papua since February in 2003.

As East-Timor is currently not a part of Indonesia, this province is excluded as the unit of analysis. Some data of the new provinces are still reported together with their former provinces by BPS and BI, thus we consider them as part of their former provinces in the analysis. Therefore, the number of regions in this study is 26 provinces.

4.4 Results and Discussion

The estimation strategy consists of three stages. First, we examine the simple relationship between per capita GRP and each explanatory variable of per capita GRP. Second, we estimate the basic model which regresses per capita GRP on the domestic market access and the foreign market access variables. Third is the main estimation which is carried by incorporating human capital and urbanization in the basic model. Since most of the manufacturing output is produced in Java region (Sjoberg and Sjoholm (2004), Amiti and Cameron, 2007), we also try to capture if there is different effects of incorporating Java dummy into the estimation equation.

The estimation period is divided into the two periods; 1993-1997 and 1998-2004, and it is conducted by the panel data format. Starting from the period of 1993-1997, in the first stage we show the partial relationship between per capita GRP and each explanatory variable. Using the OLS estimation, we regress each explanatory variable on the per capita GRP variable. All explanatory variables except for human capital are taken one-year lag., all the variables except for urbanization, which takes the share of non agricultural labor to total population, are in the logarithmic form. The results are reported at the column of simple regression in Table 2.

The simple regression results show that domestic market access has positive effect on per capita GRP although insignificant. Foreign market access and human capital variables have positive effects on per capita GRP as expected and they are significant at the one percent level. In contrast to the hypothesis, the urbanization variable shows the negative sign but insignificant.

The effects of domestic market access and foreign market access on per capita GRP are examined at the second stage. The equation is estimated using panel analysis which is yielding 104 numbers of observations. The White test shows the rejection of the null hypothesis of homoscedasticity at the one percent level. Therefore, we use the White procedure for heteroscedasticity in order to correct the variance-covariance matrix. The Hausman test also rejects the fixed effects. Thus variances component (random effects) is considered. As

shown in the column of basic regression in Table 2, the domestic market access is positive but insignificant, while the foreign market access is positive and significant at the one percent level. The results show that the market access has positive effect on inter-provincial per capita GRP, and they suggest that provinces with better market access will have the higher per capita GRP, it will lead to inter-provincial GRP disparities.

After showing the estimation results, we try to explain the possible reasons behind the different estimated results between the model without Java dummy and with Java dummy. In the main estimation results, we first interpret without Java dummy model. Panel estimation has 104 numbers of observations. The White test rejects the null hypothesis of homoscedasticity at the one percent level. Thus, we use the White procedure for heteroscedasticity in order to correct the variance-covariance matrix. The Hausman test rejects the fixed effects in this estimation thus variances component（random effects）is considered. The results of the estimation are reported at the column of main estimation in Table 2. The domestic market access and the foreign market access are positive and significant at the one percent level. The human capital variable also shows the positive sign and significant at the one percent level. These results support the hypothesis that domestic market access, foreign market access and human capital have the positive effects on per capita GRP. In contrast, the urbanization variable shows the negative sign and significant at the one percent level.

In the equation with Java dummy, the white test rejects the null hypothesis of homoscedasticity at the one percent level. Thus, we conduct the same procedure as we did in the previous estimation without Java dummy. The Hausman test rejects fixed effect in this estimation, therefore variances component（random effects）is considered. The domestic market access becomes insignificant when Java dummy is incorporated, while the foreign market access is still positive sign and significant at the one percent level. The human capital variable shows the positive sign and significant at the one percent level. The urbanization variable still has negative sign and significant at the one percent level. Its magnitude of coefficient and t-statistic are also larger in comparison with the estimation without Java dummy.

One of reasons of the insignificant of domestic access market when Java dummy is incorporated is that many manufacturing firms in Java tend to export their product than to sale in the domestic market. As explained by Amiti and Cameron（2007）that around 82　% of manufacturing outputs are produced in Java. Most of the big manufacturing firms

are multinational companies or at least joint ownership. Those firms have higher share of output exported value compare to domestically owned firms (Sjoholm, 2003). He also outlined, manufacturing exports grew at 24% per annum between 1986 and 1997, and the share of manufacturing in total exports increased above 50% in the mid-1990s in comparison to 4% in 1980 (Sjoholm, 2003). In addition, Indrawati (2002) highlighted that import plays the substantial role in aggregate production. Since there is a strong correlation between raw materials and capital goods imports, manufactured exported and domestic manufacturing production. Thus the insignificant of domestic market access due to the export oriented manufacturing firms in Java region.

On the basis of NEG theory, the expansion of market size potentially increases the wage of labor. However, excess supply of population (or labor) will pull the real wages down. Au and Henderson (2006) give the empirical evidence of this phenomenon at the Chinese prefectural cities. Therefore, we suspect that Indonesia is experiencing the excess of urban labor.

In order to prove that urban labor has positive impact on wage in terms of the NEG theory and to verify that Indonesia is experiencing the excess labor, the relationship between per capita GRP and urban labor and its square is estimated. If the coefficient of urban labor variable shows the positive sign and the coefficient of its square shows the negative sign, the hypothesis that there is an inverted-U shape relationship between per capita GRP and the number of urban labor can be accepted. The urban labor first affects per capita GRP positively, but after reaching the peak it will affect per capita GRP negatively.

The results of OLS estimation show the coefficient of log urban labor is positive, which is 0.475 with the t-statistic (0.500), and the coefficient of the square of log urban labor is negative, which is -0.015 with the t-statistic (-0.440), as expected. Thus, we can deduce that Indonesia is experiencing the excess of urban labor.

Summarizing the results in this period, domestic market access and foreign market access and human capital are playing the important roles on inter-provincial per capita GRP disparities in Indonesia, while urbanization is playing the reverse role because of the excess of urban labor.

Table 2 Regression results, 1993-1997

Variable	*Per capita GRP*						
	Simple Regression				**Basic Regression**	**Main Regression**	
Constant	7.168*** (4.165)	8.172*** (19.152)	9.332*** (191.247)	8.018*** (17.490)	5.561 (2.924)	2.829 (1.441)	4.960* (1.947)
Domestic Market Access	0.079 (1.249)	–	–	–	0.125 (1.455)	0.191** (1.987)	0.125 (1.140)
Foreign Market Access		0.081*** (2.299)	–	–	0.046*** (2.601)	0.063*** (3.528)	0.062*** (3.508)
Urbanization	–	–	-0.360 (-1.163)	–	–	-1.467*** (-4.073)	-1.566*** (-4.365)
Human Capital	–	–	–	0.112*** (2.840)	–	0.138*** (2.848)	0.077*** (2.197)
Java Dummy	–	–	–	–	–	–	0.308 (1.505)
# of Obs.	104	104	104	130	104	104	104
R^2	0.015	0.067	0.013	0.059	0.078	0.237	0.250
Estimation	*OLS*	*OLS*	*OLS*	*OLS*	*Panel (Random Effects)*	*Panel (Random Effects)*	*Panel (Random Effects)*
Hausman test (Random vs. Fixed Effects)					3.808(0.149)	2.069(0.558)	3.539(0.316)

Note:
*, **, *** significant at 10%, 5%, and 1% level, respectively
t-statistic are in the parentheses

Now we discuss the results in the period of 1998-2004. In the first stage the partial relation between per capita GRP and each individual variable as we did for the previous period is shown. Using OLS estimation, each explanatory variable is estimated over per capita GRP variable. Except for human capital variable which takes the initial value, all explanatory variables are one-year lagged. Except for urbanization variable, which takes the share of non agricultural labor to total population, all the variables are in the logarithmic form. The results are reported in Table 3 in column simple regression.

The simple regression results show that domestic market access has positive effect on per capita GRP and significant at the five percent level. The foreign market access is also has positive effect although insignificant. The human capital variable has positive effect on per capita GRP as predicted and significant at the one percent level. In contrast to the hypothesis, the urbanization variable shows the negative effect but insignificant.

In the next stage, per capita GRP are regressed on domestic market access and foreign market access variables. The regression equation is estimated using panel analysis which is yielding 156 numbers of observations. The white test rejects the null hypothesis of homoscedasticity at the one percent level. Therefore, the White procedure for heteroscedasticity is applied in order to correct the variance-covariance matrix. The Hausman test rejects fixed effects, thus variances component (random effects) is considered. As shown by Table 3 in column basic regression, domestic market access is positive and significant at the five percent level, while foreign market access is positive but insignificant. As in the previous period, the results show that market access has positive effect on per capita GRP. However, it is different in comparison with the previous period, since in this period domestic market access plays more substantial role than foreign market access.

In the main estimation results without Java dummy, the Hausman test fails to reject the fixed effect in this estimation. Thus, within estimates (fixed effects) is considered. The estimation results are reported at the main regression column in Table 3. The results show that domestic market access has positive and significant on per capita GRP, as expected. Foreign market access has positive sign and significant at the one percent level. The human capital variable also shows the positive sign and significant at the one percent level as expected. As appeared in the previous period, in this period urbanization also shows the negative sign and significant at the one percent level.

The equation with Java dummy is also yielding 156 numbers of observations. As in the

period of 1993-1997, in this period we also consider applying random effects model. The results are reported at the main regression column in Table 3. The domestic market access shows the positive sign and significant at the five percent level as expected. The foreign market access has the positive sign and significant at the one percent level. The human capital variable also shows the positive sign and significant at the one percent level. Contrary to the hypothesis, the urbanization variable has negative effect on per capita GRP and significant at the one percent level.

There is an interesting result which in this period domestic market access keeps significant when we include Java dummy in the equation. The results indicate that exported-imported values of manufacturing output in Java region are still dominant in comparison with the domestic value. However, the domestic market access is increasing its role as well. The reasons behind the increasing role of domestic market access can be explained as follows. First is the Asian financial crisis in 1997-1998. As reported by several studies（e.g. Indrawati, 2002, Nasution, 2002）, Indonesia is the country that was strongly suffered from this crisis. The crisis collapsed many national banks, shook the economic and financial system, and changed the political landscape radically. For the reason of the economic and political instability many international traders cancelled their transaction with Indonesian partners and diverted to other countries. On the other hand, exporters and importers had difficulties to have credit export facilities and opening letter of credit（LC）as the financial payment in international trading, because of the tight money policy which highly increased the interest rates, and most of the international banks refused to make any deals with the national banks.

Second is the increasing competition with other countries, such as China and Vietnam. Recently, China and Vietnam show the powerful competition in international markets. China even becomes the most successful country in attracting FDI and in the international trade. Most of Indonesian exported manufacturing products are similar to the China and Vietnam. However because of the higher price reason, some of them cannot compete with the products of those countries in international markets. The above reasons, for some extent, imply that the domestic market access become more important for the manufacturing product from Java region. This conclusion is also supported by the estimation results. That is to say, as showed in the estimation results（Table 2 and 3）the coefficient of foreign market access in the period of 1998-2004 is smaller in comparison to the previous period 1993-1997 in the estimation with Java dummy. This also indicates that the role of foreign market access on explaining per capita

GDP is decreasing in the period of 1998-2004. Reversely the role of domestic market access is increasing.

As far as urbanization is concerned, the result in this period shows similarity to the results in the previous period, 1993-1997. Thus, the same estimation procedure as we did for the previous period is taken. The results of estimation show the coefficient of urban labor variable is positive which is 1.731 with the t-statistic (1.976) and significant at the five percent level. The coefficient of its square is -0.056 with the t-statistic (-1.827) and significant at the ten percent level. From these results we can deduce that the problem of the excess of urban labor still persists, even stronger in Indonesia.

Another interesting thing is that the role of domestic market access and foreign market access are increasing when human capital and urbanization variables are incorporated into the equations. This result suggests that human capital and urbanization amplify market access.

Table 3 Regression results, 1998-2004

Variable	*Per capita GRP*						
	Simple Regression				**Basic Regression**	**Main Regression**	
Constant	5.754*** (3.500)	9.385*** (20.198)	10.119*** (71.550)	7.879*** (16.942)	5.335*** (3.176)	–	3.106 (1.237)
Domestic Market Access	0.188** (2.577)	–	–	–	0.183** (2.505)	0.375*** (3.130)	0.199** (1.948)
Foreign Market Access	–	0.025 (1.308)	–	–	0.022 (1.176)	0.063*** (3.356)	0.056*** (3.122)
Urbanization	–	–	-0.265 (-0.960)	–	–	-1.707*** (-4.308)	-1.683*** (-5.312)
Human Capital	–	–	–	0.177*** (4.560)	–	0.252*** (4.308)	0.152*** (2.445)
Java Dummy	–	–		–	–	–	0.297 (1.541)
# of Obs.	156	156	156	182	156	156	156
R^2	0.038	0.011	0.001	0.104	0.050	0.324	0.210
Estimation	*OLS*	*OLS*	*OLS*	*OLS*	*Panel (Random Effects)*	*Panel (Fixed Effects)*	*Panel (Random Effects)*
Hausman test (Random vs. Fixed Effects)					0.926(0.626)	13.631(0.001)	19.848(0.000)

Note:
*, **, *** significant at 10%, 5%, and 1% level, respectively
t-statistic are in the parentheses
In the column main estimation without Java dummy, Hausman test shows significant of fixed effects. It is different in comparison to the period of 1993-1997. Financial crisis which hit Indonesia in this period and the implementation of decentralization might be the reasons behind this change.

5. Concluding remarks

Not like neoclassical growth theories which predicts that in the long run per capita income across regions in a country tend to converge to the common state of per capita income, the new economic geography theory posits that two regions with endowment similarities can show different performance in per capita income when agglomeration exists in the one region.

Using the new economic geography's framework we examine the inter-provincial disparities in Indonesia and find that in both period of study 1993-1997 and 1998-2004, domestic market access and foreign market access show the substantial effect on inter-provincial per capita GRP. These empirical results support new economic geography theory's prediction that market access leads to differences in per capita GRP and further increase the disparities across provinces. These results also support the previous study such as Amiti and Cameron (2007) who find that proximity to the market and supply access lead to the difference in wage in Indonesia.

The human capital variable also shows positive and significant on per capita GRP. The result suggests that the regions with abundant human capital tend to have higher per capita GRP. This study also finds that contrary to the theory, in Indonesian case urbanization hamper the increasing of inter-provincial per capita GRP, thus can lead to the equalizing on the inter-provincial disparities. This is because of the excess of urban labor in Indonesia. This study also finds out that human capital and urbanization amplify the market access.

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