No. 548

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August 1993

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Kubo, Yuji, "Scale Economies, Regional Externalities, and the Possibility of Uneven Regional Development" (University of Tsukuba)

ABSTRACT

This paper presents a model of regional development which attempts to explain differing patterns of growth of two regions. The model is an extension of Krugman's model of uneven development, but it incorporates not only scale economies within each region but also regional externalities across the regions. Depending on relative magnitudes of net scale economies of the two regions, the model entails different regional development patterns: uneven development, stable or joint development, or a mix of the two. The novel feature of the present model is that different regional development patterns can be explained within the same analytical framework.

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1. Introduction

In his insightful paper published in the Journal of Development Economics, Paul Krugman (1981) developed a model of trade and growth in which manufacturing sectors of two regions (called North and South) are shown to have a tendency to grow unevenly, leading eventually to a state of the world where one of the regions becomes more industrialized than the other, with the possibility that the lagging region become completely de-industrialized. Krugman presents this model as theoretical support for the doctrine of "uneven development," an argument by radical economists such as Paul Baran (1957), Gunder Frank (1967), and Immanuel Wallerstein (1974) that the current international economic system contains an inherent tendency for international inequality to increase. In fact, Krugman (1981) applies the results of his model to explain the decline of the Indian textiles industry during the 18th century in the wake of competition from foreign producers. A similar explanation of the same phenomenon, the de-industrialization of the Indian textiles industry, was attempted by Dutt (1992), who used an extension of the Krugman model [Dutt(1986)] which incorporates, instead of increasing returns to scale, learning by doing and domestic spinoff effects to explain the possibility of uneven economic development.

The Krugman model of uneven development, though intended to provide a theoretical explanation for the differential growth of the developed and developing countries, has considerable relevance to the relative development of two regions in a particular country. In certain cases, we observe two regions growing together, with one region's growth spreading the beneficial effects of agglomeration economies to the other region and vice versa. In other cases, we observe two closely located regions competing with each other, resulting in an expansion of one region and the relative stagnation of the other region. The Krugman model of uneven development appears to have relevance in providing a possible explanation for the latter case,[1)] but what can we say about the former possibility? What can be the reasons behind these differing patterns of regional development? And, is it possible to explain uneven and "even" regional development within the same analytical framework?

The purpose of the present paper is to develop a model of regional growth which accounts for such differential growth of two related regions. In doing so, we shall extend the Krugman model of uneven development to include special features that are characteristic of regional economies. Specifically, we shall start from a framework similar to that of Krugman (1981), in which there exist two regions both having two sectors, agriculture and manufacturing. The agricultural sector produces an agricultural good using labor inputs and constant returns to scale technology. The manufacturing sector produces a composite manufactured good using Leontief-type technology. The manufacturing technology is characterized by scale economies which arise from agglomeration economies in each region, so that an accumulation of capital in a region reduces the unit capital and labor requirements of that region's manufacturing production. We also postulate regional external effects, through which capital accumulation in one region spreads the benefits of regional agglomeration to the other region, in the form of knowledge spillovers and other benefits. Based on such a framework, we wish to explore the patterns of relative growth of two regions in the presence of scale economies and regional externalities.

The plan of the paper is as follows: In Section 2, the model of development of two regions is presented, and in Section 3, the dynamic properties of the model is analyzed. The conditions that bring forth different patterns of regional growth are examined in this section. In Section 4, the differing patterns of regional development are examined based on phase diagrams and the differences are explained by the relative strength of scale economies and regional externalities. Finally, there is a brief conclusion in Section 5.

2. The Model

We consider a regional economy consisting of two regions. Let us call them A and B. For simplicity, we shall assume that the two regions are endowed with the same amount of labor, $\bar{L}$:

$$L_A = L_B = \bar{L} \tag{1}$$

For the purpose of this study, we shall assume that labor is not mobile between the two regions but commodities are traded freely between the regions.

Each region has two sectors, agriculture and manufacturing. The manufacturing sector produces a composite manufactured good using labor and capital. The manufacturing technology is of fixed-coefficient type, but there is increasing returns to scale in production, in the sense that an accumulation of capital results in reduction of capital and labor coefficients. In addition, we assume that there are regional externalities emanating from capital accumulation in each region, which spills over from one region to the other and improves production efficiency. Specifically, we assume that the regional external economies result in a reduction in capital and labor coefficients of the affected region. We shall assume simple forms of such intraregional and interregional effects in production technology, and assume that the capital and labor coefficients in the two regions are given by

$$k_A = a/(K_A^{\alpha} K_B^{\lambda}), \quad \ell_A = b/(K_A^{\alpha} K_B^{\lambda}),$$
$$k_B = a/(K_B^{\beta} K_A^{\mu}), \quad \ell_B = b/(K_B^{\beta} K_A^{\mu}), \tag{2}$$

where the subscripts denote regions A and B, k and ℓ denote capital and labor coefficients, α and β the degrees of regional scale economies, and λ and μ the degrees of regional external effects. We assume that

$$0 < \alpha,\ \beta < 1, \quad 0 < \lambda,\ \mu < 1, \text{ and } 0 < a,\ b$$

The fact that the same a and b apply to regions A and B means that the two regions are exposed to the same basic technology. Also, we have assumed neutrality in the scale economies and regional externalities, in the sense that

$$k_A/\ell_A = a/b = \text{const.}, \text{ and } k_B/\ell_B = a/b = \text{const.}$$

However, we have allowed for the differences in the strength of scale economies and regional external economies among the two regions.

Given the technological coefficients in (2), the manufacturing production in the two regions are given by

$$M_A = K_A/k_A = a^{-1} K_A^{1+\alpha} K_B^{\lambda},$$

$$M_B = K_B/k_B = a^{-1} K_B^{1+\beta} K_A^{\mu} \tag{3}$$

The agricultural sector is assumed to be the residual claimant of labor. This sector produces an agricultural commodity using labor alone, under constant returns technology. We shall choose the unit of measurement so that one unit of labor produces one unit of agricultural product. Because of free trade of commodities between the two regions, this specification can be applied to both regions. Thus, we can write

$$A_A = \bar{L} - \ell_A M_A,$$
$$A_B = \bar{L} - \ell_B M_B, \tag{4}$$

where A denotes agricultural output. This specification implies that the wage rate is unity in the agricultural commodity; that is,

$$w = 1 \;, \quad \text{in agricultural good.}$$

Since the agricultural commodity is taken as numeraire, let p_M denote the price of the manufactured good in terms of the agricultural good. The equilibrium in the manufactured-good market requires that the demand and supply be equal. We shall assume that a constant fraction γ of the wage income in each region is spent on the consumption of manufactured goods and the rest on agricultural goods. That is, a total of $2\gamma\bar{L}$ is spent on manufactured goods. Then, the equilibrium condition in the manufactured-good market is given by

$$p_M (M_A + M_B) = 2\gamma\bar{L} \tag{6}$$

This, in view of (3), gives the price of manufactured good as

$$p_M = 2a\gamma\bar{L}/[K_A^{1+\alpha} K_B^{\lambda} + K_B^{1+\beta} K_A^{\mu}] \tag{7}$$

The rate of profit relative to capital stock in each region is given by

$$\rho_A = (p_M M_A - \ell_A M_A)/K_A = p_M/k_A - b/a$$

$$\rho_B = (p_M M_B - \ell_B M_B)/K_B = p_M/k_B - b/a \qquad (8)$$

We assume that profit incomes and only profit incomes are reinvested in the respective sectors to increase capital stock. Then the rate of capital accumulation in each region can be described as

$$\dot{K}_A/K_A = \rho_A = p_M/k_A - b/a = 2\gamma\bar{L}/[K_A + (k_A/k_B)K_B] - b/a$$
$$\dot{K}_B/K_B = \rho_B = p_M/k_B - b/a = 2\gamma\bar{L}/[K_B + (k_B/k_A)K_A] - b/a. \qquad (9)$$

Note that

$$k_A/k_B = K_A^{\mu-\alpha} K_B^{\beta-\lambda}.$$

Hence, the two region's growth equations can be expressed as

$$\dot{K}_A/K_A = 2\gamma\bar{L}/[K_A + K_B^{1+\beta-\lambda} K_A^{\mu-\alpha}] - b/a$$
$$\dot{K}_B/K_B = 2\gamma\bar{L}/[K_B + K_A^{1+\alpha-\mu} K_B^{\lambda-\beta}] - b/a. \qquad (10)$$

The dynamic properties of the development of the two regions are fully described by these two growth equations.

3. Properties of the Growth Equations

The long-run equilibrium of the economy described by (10) is attained when $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$. As we can see from (10), the dynamic equations are expressed as functions of K_A and K_B. Hence, our first task is to find out how the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves look in the (K_A, K_B) plane.

First, consider the $\dot{K}_A/K_A = 0$ curve. In view of (10), $\dot{K}_A/K_A = 0$ is equivalent to

$$g_A(K_A, K_B) \equiv 2\gamma\bar{L}/[K_A + K_B^{1+\beta-\lambda} K_A^{\mu-\alpha}] - b/a = 0, \qquad (11)$$

which can be solved for $K_B^{1+\beta-\lambda}$ as

$$K_B^{1+\beta-\lambda} = (2a\gamma\bar{L}/b - K_A)\, K_A^{\alpha-\mu} \qquad (12)$$

The shape of this curve depends on the sign of $\alpha - \mu$. The following properties can be easily verified:

Property 1: The $\dot{K}_A/K_A = 0$ curve has the following properties:

(i) If $\alpha > \mu$, the $\dot{K}_A/K_A = 0$ curve passes through (0, 0) and $(0, 2a\gamma\bar{L}/b)$ in the (K_B, K_A) plane, and is upward-sloping for the values of K_A between 0 and $(\frac{\alpha-\mu}{1+\alpha-\mu})(\frac{2a\gamma\bar{L}}{b})$, and downward sloping for the values of K_A between $(\frac{\alpha-\mu}{1+\alpha-\mu})(\frac{2a\gamma\bar{L}}{b})$ and $\frac{2a\gamma\bar{L}}{b}$.

(ii) If $\alpha < \mu$, the $\dot{K}_A/K_A = 0$ curve passes through $(0, 2a\gamma\bar{L}/b)$ in the (K_B, K_A) plane, and is downward-sloping and approaches the horizontal (K_B) axis as K_A approaches 0.

(iii) $\dot{K}_A/K_A > 0$ to the left of this curve and $\dot{K}_A/K_A < 0$ to the right of this curve.

Next, consider the $\dot{K}_B/K_B = 0$ curve. From (10), $\dot{K}_B/K_B = 0$ is equivalent to

$$g_B(K_A, K_B) \equiv 2\gamma\bar{L}/[K_B + K_A^{1+\alpha-\mu}\, K_B^{\lambda-\alpha}] - b/a = 0, \qquad (13)$$

which can be solved for $K_A^{1+\alpha-\mu}$ as

$$K_A^{1+\alpha-\mu} = (2a\gamma\bar{L}/b - K_B)\, K_B^{\beta-\lambda} \qquad (14)$$

In the same way as above, we can obtain the following:

Property 2: The $\dot{K}_B/K_B = 0$ curve has the following properties:

(i) If $\beta > \lambda$, the $\dot{K}_B/K_B = 0$ curve passes through (0, 0) and

$(2a\gamma\bar{L}/b,\ 0)$ in the $(K_B,\ K_A)$ plane, and is upward-sloping for the values of K_B between 0 and $(\frac{\beta-\lambda}{1+\beta-\lambda})(\frac{2a\gamma\bar{L}}{b})$, and downward-sloping for the values of K_B between $(\frac{\beta-\lambda}{1+\beta-\lambda})(\frac{2a\gamma\bar{L}}{b})$ and $\frac{2a\gamma\bar{L}}{b}$.

(ii) If $\beta < \lambda$, the $\dot{K}_B/K_B = 0$ curve passes through $(2a\gamma\bar{L}/b,\ 0)$ in the $(K_B,\ K_A)$ plane, and is downward-sloping and approaches the vertical (K_A) axis as K_B approaches 0.

(iii) $\dot{K}_B/K_B > 0$ below this curve and $\dot{K}_B/K_B < 0$ above this curve.

In Figure 1, the $\dot{K}_A/K_A = 0$ curve and $\dot{K}_B/K_B = 0$ curves are shown for the case where $\alpha > \mu$ and $\beta > \lambda$. Figure 2 corresponds to the case where $\alpha < \mu$ and $\beta < \lambda$. In both figures, the two curves are drawn to have a unique intersection. In fact, this is true in these two cases. By equating (11) and (13), we can obtain the relationship between K_A and K_B at the intersection of the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves. This relationship is expressed as [2)]

$$K_A = K_B^{(\beta-\lambda)/(\alpha-\mu)} \qquad (15)$$

That is, the intersection of the two curves, if it exists, lies on this curve. For the purpose of the present analysis, we shall assume that $\beta \neq \lambda$ and $\alpha \neq \mu$.[3)] Substituting (15) into (11) and rearranging, we obtain

$$K_B^{(\beta-\lambda)/(\alpha-\mu)} + K_B = 2a\gamma\bar{L}/b. \qquad (16)$$

If $(\beta-\lambda)/(\alpha-\mu) > 0$, then the left-hand side of (16) ranges from 0 to ∞, and there is a unique K_B which satisfies (16). This value is larger, the larger the value of $2a\gamma\bar{L}/b$ and the smaller the value of $(\beta-\lambda)/(\alpha-\mu)$. (16) can alternatively be written as

$$K_A + K_B = 2a\gamma\bar{L}/b. \qquad (17)$$

Hence, the intersection of the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves lies on the line segment connecting $(2a\gamma\bar{L}/b,\ 0)$ and $(0,\ 2a\gamma\bar{L}/b)$.

If $(\beta-\lambda)/(\alpha-\mu) < 0$, then the left-hand side of (16) is the sum of the 45° line and a monotone transformation of a rectangular hyperbola, which approaches ∞ as K_B approaches 0 or ∞ and has a minimum at

$$K_B = \left(-\frac{\alpha-\mu}{\beta-\lambda}\right)^{(\alpha-\mu)/[(\beta-\lambda)-(\alpha-\mu)]} \tag{18}$$

The minimum value can be calculated as

$$\left(\frac{\alpha-\mu+\lambda-\beta}{\alpha-\mu}\right)\left(-\frac{\alpha-\mu}{\beta-\lambda}\right)^{(\alpha-\mu)/(\mu-\alpha+\beta-\lambda)} .$$

If this value is less than $2a\gamma\bar{L}/b$, then (16) has two solutions, so that the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves have two intersections in the $(K_B,\ K_A)$ plane. Thus, we have proved the following property:

<u>Property 3</u>:

(i) If $\alpha > \mu$ and $\beta > \lambda$, or if $\alpha < \mu$ and $\beta < \lambda$, then the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves have a unique intersection $(\hat{K}_A,\ \hat{K}_B)$, which lies on the line segment $K_A + K_B = 2a\gamma\bar{L}/b$. The larger the value of $(\beta-\lambda)/(\alpha-\mu)$, the smaller the value of $\hat{K}_B$ and the larger the value of $\hat{K}_A$.

(ii) If $(\beta-\lambda)/(\alpha-\mu) < 0$, the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves have two intersections if and only if

$$2a\gamma\bar{L}/b > \left(\frac{\alpha-\mu+\lambda-\beta}{\alpha-\mu}\right)\left(-\frac{\alpha-\mu}{\beta-\lambda}\right)^{(\alpha-\mu)/(\mu-\alpha+\beta-\lambda)} \tag{19}$$

If equality holds, there is one intersection (tangency). Otherwise, the two curves do not intersect.

Note that, although Property 3 (ii) specifies the conditions under which the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves have only one or no intersection when $(\beta-\lambda)/(\alpha-\mu) < 0$, the possibility of such an occurrence is very small. The reason is that the minimum value given by the right-hand side of (19) is very small. As we can see, the left-hand side of (16) takes a value of 2 when K_B is 1, so that the minimum value is less than or at most equal to 2. For this reason, when $(\beta-\lambda)/(\alpha-\mu) < 0$, we shall only consider the case where the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves have exactly two intersections.

4. The Growth of the Regions

The dynamic growth of the manufacturing sectors of the two regions are shown in Figures 1-3. Each case is distinguished by the relative strength of scale economies and regional external effects. In particular, the differences between the scale economy index and the regional externality index, namely, $(\alpha-\mu)$ and $(\beta-\lambda)$, play an important role in determining the various growth patterns. These differences indicate the benefit of capital accumulation in one region less the regional externalities it exerts on the other region. The latter effect benefits the other region by reducing costs and increasing profits, and enhances a better growth prospect for that region, resulting in a relative disadvantage for the region exerting that external effect. Therefore, this difference signifies the net benefit to each region of the capital accumulation in the own region. We shall refer to $(\alpha-\mu)$ and $(\beta-\lambda)$ as net scale economies if positive; if negative, we shall call $(\mu-\alpha)$ and $(\lambda-\beta)$ net regional externalities. A number of different growth patterns emerge depending on the signs and relative magnitudes of these net effects.

Case 1: Uneven Regional Development ($\alpha > \mu$, $\beta > \lambda$)

When the scale economies in each region are stronger than the regional externalities it exerts on the other region, the growth trajectories can be derived as in Figure 1. In this case, there is uneven development of the two regions. The stationary state C is a saddle point, and any path starting from an arbitrary initial point tends to approach either point A, where only Region A becomes industrialized and Region B becomes de-industrialized, or point B where only Region B is industrialized and Region A becomes de-industrialized. If the available labor in Region A or B is completely absorbed in industry before point A or B is reached, the industrializing region will completely specialize in manufacturing, and the other region may become partially industrialized. In any case, the regional development is such that there is a certain point on any growth path after which the manufacturing sector of one region continuously grows and that of the other region continuously contracts, until there is one industrially-advanced region and one industrially lagging region. Which region will eventually grow and which region eventually contract is determined by the threshold growth paths, shown by the dotted arrows, which approach the stationary point C. If the initial point is above the threshold paths, Region A will eventually grow, and if it is below the threshold paths, then Region B will eventually grow. The location of point C is determined by the value of $(\beta-\lambda)/(\alpha-\mu)$. If this value is larger, that is, if net scale economies (domestic scale economies less regional externalities it exerts) of Region B is greater than that of Region A, then the stationary point C and the threshold paths tend to be located closer to point A, and the possibility of eventual expansion of Region B increases. If this value is smaller, the opposite possibility increases.

What is the mechanism behind this uneven development? Suppose initially the two manufacturing sectors are of similar size. If capital expands in, say, Region A, it generates strong scale economies in Region A but small regional externalities to Region B. Hence, production costs decline more in Region A than in Region B. Now the increase in capital and increase in production efficiency result in an increase in commodity supply, which brings forth a fall in the commodity price. This will work to reduce profits. The region which had a larger reduction in production costs may still experience an increase in the profit rate, thus increasing the rate of capital accumulation. The region which had a small reduction in costs may experience a fall in the profit rate and hence a fall in the rate of capital accumulation. Thus, the region which receives larger benefits from the initial capital accumulation will tend to expand faster than the other region.

Case 2: Stable Regional Development ($\alpha < \mu$, $\beta < \lambda$)

When the scale economies in each region are weaker than the regional externalities it exerts on the other region, the growth trajectories are given as in Figure 2. In this case, the regional development is a stable one, and the manufacturing sectors of the two regions approach the stationary point C, where they both attain certain stable sizes. The relative size of the two regions depends on the values of μ-α and λ-β. If $\mu-\alpha = \lambda-\beta$, then the two regions attain an identical size. If $\lambda-\beta$ is larger than $\mu-\alpha$, that is, if Region A receives larger net regional externalities from Region B than does Region B from Region A, the stationary point C will locate closer to point A, and Region A will achieve a larger equilibrium size than Region B. If $\mu-\alpha$ is larger than $\lambda-\beta$, that is, if Region B receives larger net regional externalities, then Region B will achieve a larger long-run equilibrium size. Thus, in this stable regional development, the region which receives larger net regional externalities from the other region tends to achieve a larger stationary size.

The mechanism of stable regional development can be explained in a similar manner to that of uneven development. Suppose the manufacturing sector of one region is larger than the other initially. An increase in capital stock in the large region generates small domestic scale economies but exerts strong externalities to the other region. This will reduce production costs more in the smaller region than in the larger region. The increase in capital and production efficiency will increase commodity supply and reduce the commodity price. This reduction in price will reduce the profit rate of the larger region more than that of the smaller region. Hence, the rate of capital accumulation in the larger region will slow down and that of the smaller region will increase, bringing about an equalizing trend in the relative size of the two regions.

Case 3: Mixed (Stable and Uneven) Regional Development ($\alpha > \mu$, $\beta < \lambda$)

As stated in Property 3, there are two intersections of the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves in this case if the necessary condition (19) is satisfied. The growth trajectories are shown in Figure 3. In this case, there are three stationary points, but only two of them, C and B, are stable, and D is unstable (a saddle point). If the economy starts from an initial point where Region A is very small and Region B is very large, the economy may eventually lead to B where only Region B is industrialized. However, if the economy starts from more balanced initial sizes, or a larger size of Region A, the regional development is more likely to lead to point C, where the two regions achieve certain stable sizes. In the stable equilibrium, the region which receives stronger net scale economies and net regional externalities tend to achieve a larger equilibrium size. Which long-run equilibrium is reached depends on whether the economy will start from an initial point above or below the threshold growth paths, shown by dotted arrows, that lead to point D.

The opposite of the present case, where $\alpha < \mu$ and $\beta > \lambda$, also leads to a mixed regional development. In this case, Region B, being the region that receives lager net scale economies and net regional externalities, will achieve a larger stationary size at the stable long-run equilibrium. The analysis of this case is analogous to the above.

As we have observed, in the present model, the patterns of regional industrial development hinge crucially on the relative magnitudes of scale economies and regional externalities between the two regions. The stronger the domestic scale economies, the stronger the possibility that that region expands its industrial production. On the other hand, if the regional externalities are stronger than the domestic scale economies, the two regions tend to develop jointly, achieving certain stable sizes. The results from the present analysis may provide a useful basis to explain the differing patterns of regional development among adjacent regions, which we observe in reality.

5. Conclusion

In this paper, we have developed a model of regional development in which economies of scale in the manufacturing sector of each region and externalities across regions interact to determine the patterns of development of adjacent regions. The model is an extension of Krugman's (1981) model of uneven development, but the resultant patterns of regional development entail not only uneven regional development but also stable development, and a mixture of stable and uneven development. Specifically, the following patterns of regional development are identified:

1) If the extent of regional externalities is weaker than the scale economies within each region, then the pattern of regional industrial development is uneven. That is, the regional growth starting from an arbitrary initial point tends to lead to de-industrialization of one of the regions and complete specialization in industry by the other region, unless the labor supply precludes complete specialization of the industrializing region.
2) If the extent of regional externalities is stronger than the local scale economies, the regional development is stable. Any path starting from an arbitrary point will approach a point where the manufacturing sectors of two regions attain certain stable sizes.
3) If the extent of regional externalities is stronger than the local scale economies in one region and weaker in the other region, the regional development is likely to have both uneven and stable features. There is a threshold path which separates the two patterns. Trajectories which start from points on one side of this path will lead to stable regional development, while those starting

from the other side will lead to uneven regional development.

In reality, there are cases where adjacent regions grow together, and also there are cases where one region's growth tends to stagnate the growth of adjacent regions. The novel feature of the present analysis is that it provides a formal explanation of these different patterns of regional development within the same theoretical framework.

Notes

* The author wishes to thank Yoshihiko Otani and Joseph Sicilian for helpful comments and suggestions. However, the author alone is responsible for any remaining errors and shortcomings.

1) Kubo (1986) also offers an explanation for such an uneven development in the case of urban and rural sectors, based on scale economies and market interactions through the labor market.

2) Equating (11) and (13), we obtain

$$K_A + K_B^{1+\alpha-\mu} K_A^{\mu-\alpha} = K_B + K_A^{1+\alpha-\mu} K_B^{\lambda-\alpha}$$

which can be rewritten as

$$(K_A^{1+\alpha-\mu} + K_B^{1+\alpha-\lambda}) K_A^{\mu-\alpha} = (K_B^{1+\alpha-\lambda} + K_A^{1+\alpha-\mu}) K_B^{\lambda-\alpha}$$

Hence,

$$K_A^{\mu-\alpha} = K_B^{\lambda-\alpha}$$

3) When both $\alpha = \mu$ and $\beta = \lambda$ hold, the $\dot{K}_A/K_A = 0$ and $\dot{K}_B/K_B = 0$ curves coincide, given by the downward-sloping 45° line connecting A and B. In this case, all the points on this line are stationary points, and any trajectory starting from an arbitrary initial point will tend toward a point on the line. If $\alpha = \mu$ or $\beta = \lambda$ but not both, the phase diagrams of Figures 1 - 3 must be slightly modified, but the basic patterns of regional growth coincide with one of the three cases depicted in those figures.

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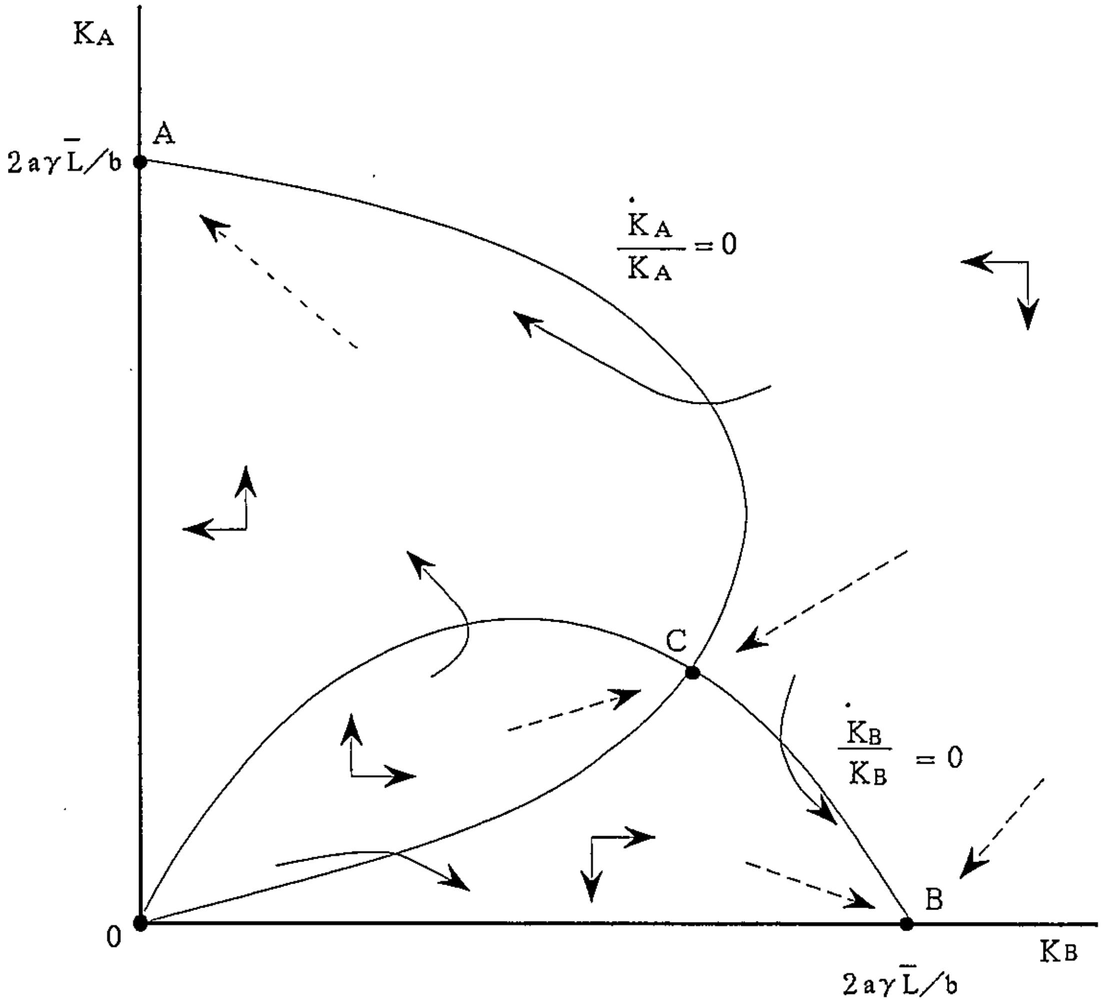

Figure 1 : Uneven Regional Development

($\alpha > \mu$ and $\beta > \lambda$)

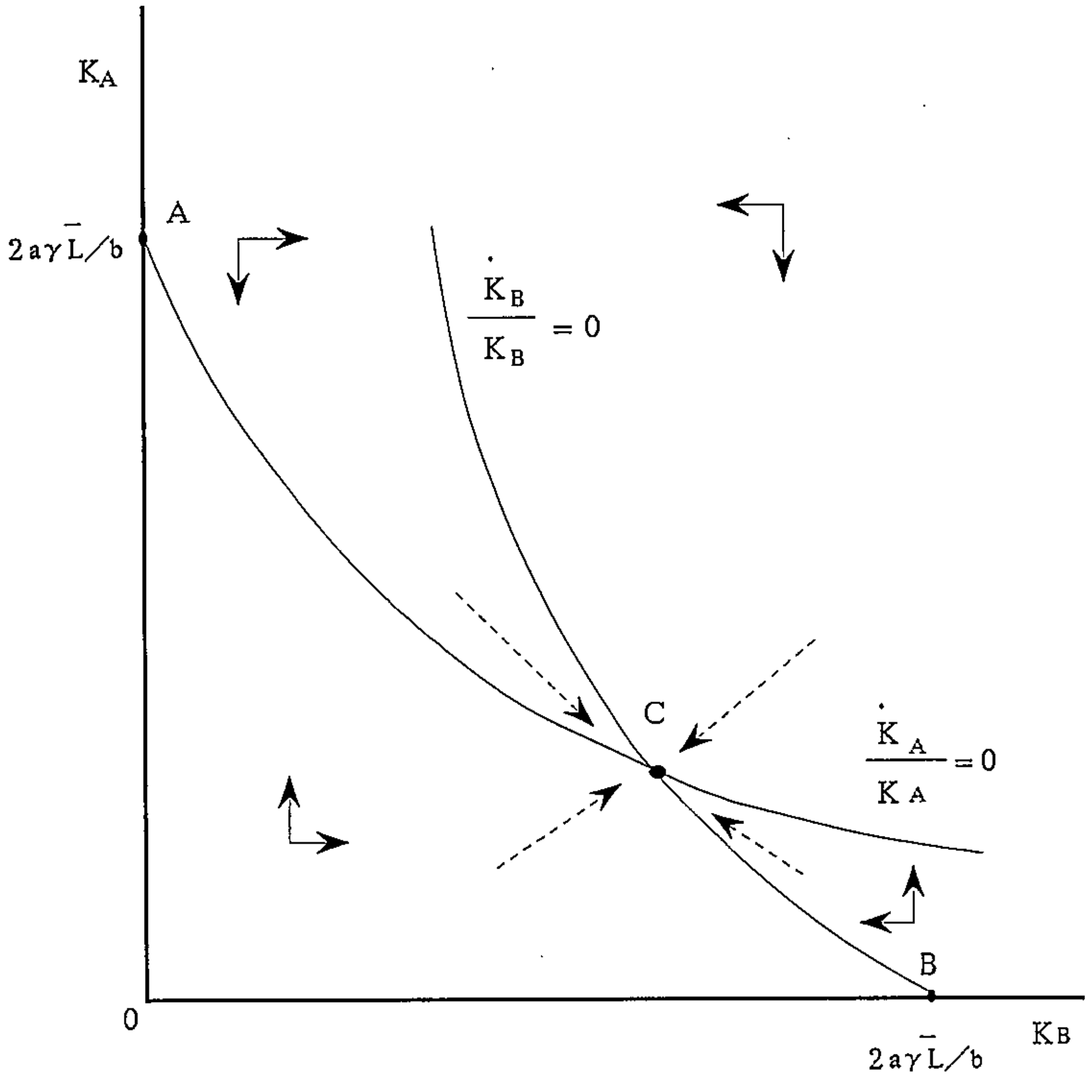

Figure 2 : Stable Regional Development

$(\alpha < \mu$ and $\beta < \lambda)$

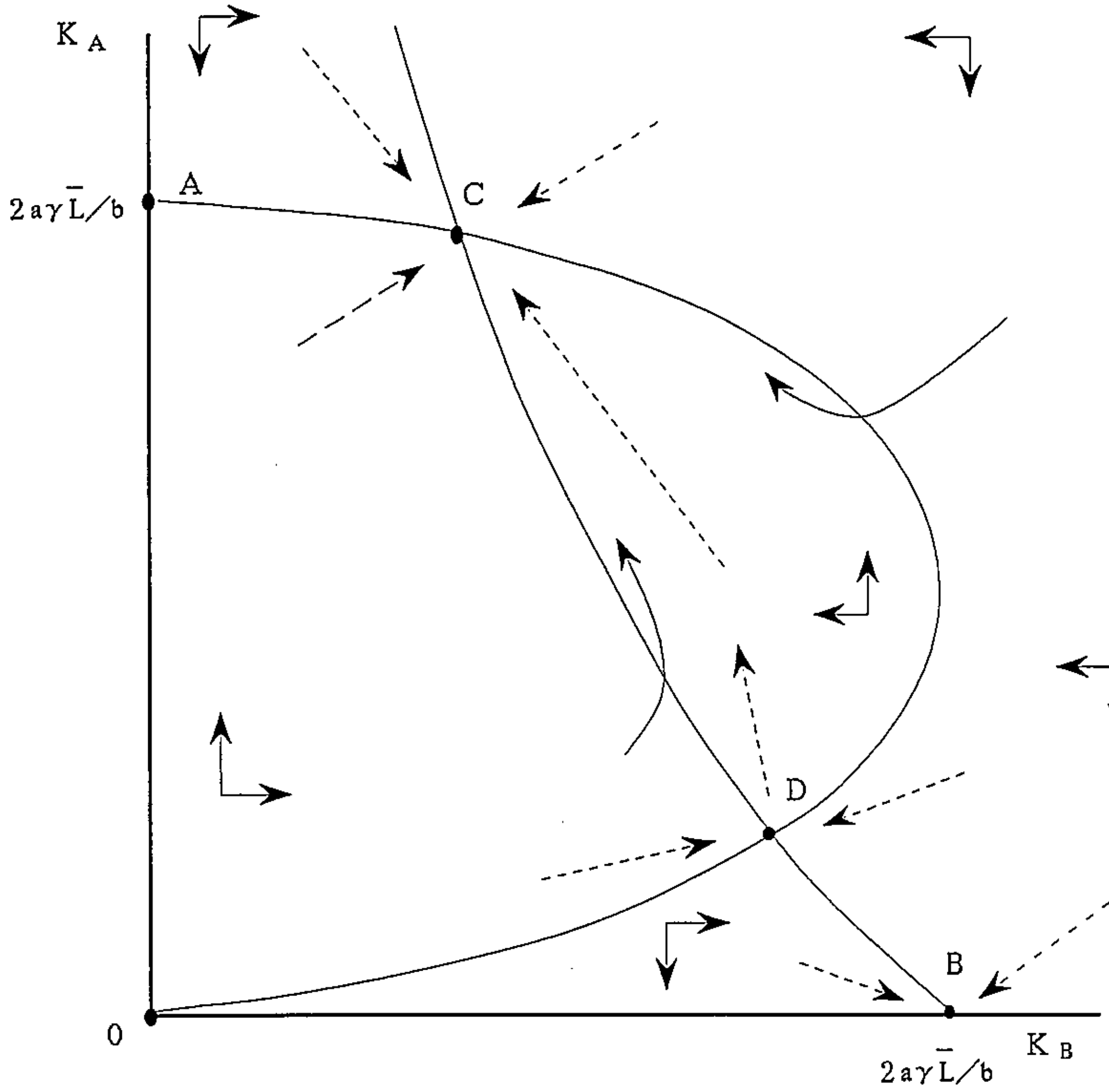

Figure 3 : Mixed Regional Development

($\alpha > \mu$ and $\beta < \lambda$)