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Zeitschrift für Nationalökonomie

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*Suggested Citation:* Siebert, Horst (1969) : Goal conflicts in regional growth policy!, Zeitschrift für Nationalökonomie, ISSN 0044-3158, Springer, Wien, Vol. 29, Iss. 1/2, pp. 19-28

This Version is available at:

<https://hdl.handle.net/10419/3548>

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## Goal Conflicts in Regional Growth Policy

By

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With 4 Figures

(Received September 16, 1968)

### 1. Introduction

The problem of regional growth being defined as the increase in the output of a spatial subsystem of a nation has attracted considerable interest in the last years<sup>1</sup>. In nearly all nations regional income differentials exist and it is the objective of governments to reduce these differences by developing the depressed areas within a nation. Also the problem of over-agglomeration demands solution. Finally, in underdeveloped countries, a strategy decision has to be made as to which region should be developed first in order to promote national growth. In all these cases, policy targets for regional and national growth exist.

The existence of different targets raises the question how these targets are interrelated. This problem is intensified by the present institutional setting in most countries with the policy targets being formulated and implemented by independent policy makers.

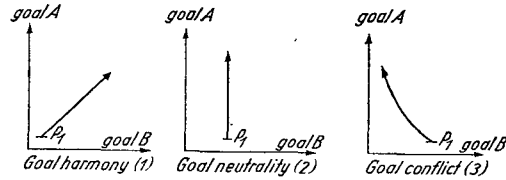
The relation between goals of economic policy may be harmonious, conflicting or neutral. A harmonious goal relation exists if the realization of a goal *A* leads to a better realization of another goal *B* (1). In the case of neutrality, policy measures to reach goal *A* will not affect the target value of *B* (2). Conflicting goals, however, indicate a situation in which the realization of goal *A* has a negative influence on the realization of goal *B* (3). Diagram (1) illustrates the three cases, with  $P_1$  denoting the initial policy situation.

Information on the slope and the shape of the goal relation curve is an important prerequisite for the analysis of economic policy and the solution of policy problems. If goals conflict, the policy maker may search for policy instruments which reduce the conflict between different objectives. Or he may have to reconsider his political priorities and may have to subordinate one goal under the other by means of a value judgment.

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<sup>1</sup> Compare W. Alonso and J. Friedman (eds.): *Regional Development and Planning*, Cambridge, Mass., 1964; L. E. Davin: *Economie régionale et croissance*, Paris 1964.

In the following a method is described which derives the goal relation curves (i) in the case of growth policies of different regions and (ii) in



the case of regional and national growth policies<sup>2</sup>. Both a geometrical and an algebraic construction of the goal relation curve are given.

## 2. Goal Relations between the Growth Policy of Different Regions: Geometrical Presentation

Let us suppose there are two regions, I and II, each of which is trying to maximize its output. Output in region I ( $O_I$ ) is a function of resources available in that region. These resources  $R_I$  may be internal factors of production representing labor supply, capital and technical knowledge originating in the region, or, they may be external factors of production being attracted from region II. The amount of factors of production available in the region including those attracted, will determine regional output:

$$O_I = f(R_I). \quad (1)$$

Output of region II depends on the amount of factors of production available there

$$O_{II} = g(R_{II}). \quad (2)$$

Total supply of factors of production in both regions is fixed at  $R$ . Thus we have

$$\bar{R} = R_I + R_{II}, \quad (3)$$

$R$  is completely mobile interregionally.

Let us assume that functions (1) and (2) are characterized by variable production coefficients<sup>3</sup>. For diagram (2) we also assume that technical knowledge is given and that both functions are of the form

$$f(0) = 0, \quad f' > 0, \quad f'' < 0. \quad (4)$$

<sup>2</sup> On the goals of regional policy compare W. R. Thompson: A Preface to Urban Economics, Baltimore 1967; Ch. Leven: Establishing Goals for Regional Economic Development, Journal of the American Institute of Planners 30 (1964), pp. 100–110.

<sup>3</sup> If the regional production functions are of the Leontief type, a programming formulation is appropriate.

Starting with these rather simplified assumptions we can derive the trade-off curve between output in both regions by making use of a four-quadrant diagram. On the north axis we plot output in region I ( $O_I$ ). The east axis measures output in II ( $O_{II}$ ). The west and the south axis show resources in I, namely  $R_I$ . As

$$R_{II} = \bar{R} - R_I, \tag{5}$$

the south axis also shows resources available in II, measured from  $R$  and increasing towards the origin.

In the second quadrant  $O_I = f(R_I)$  represents output as a function of resources in I, the curve indicating a given state of technical knowledge. Quadrant III is used to transfer  $R_I$  values from the west to the south

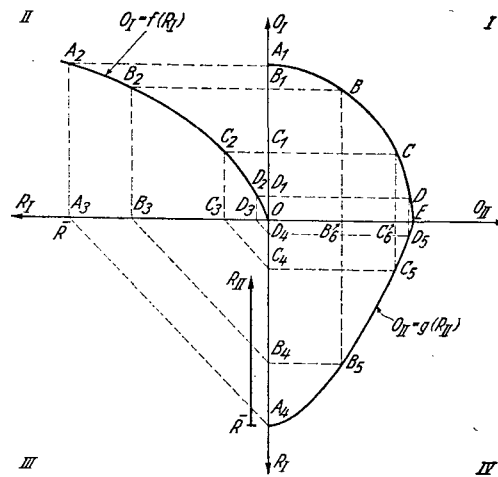


Diagram 2

axis. From Eq. (5) these values can also be reinterpreted as  $R_{II}$ . Quadrant IV shows the production function for output in region II. The curve in IV, as the one in II, reflects diminishing returns.

Total resources  $\bar{R}$  can be used either in one of the two regions alone or partly in both regions. If all of  $\bar{R}$  is used in region I,  $O A_3$  represents  $R_I$ ,  $R_{II}$  is zero.  $A_2$  represents the corresponding point on the production function and  $A_1$  is the first point on our goal relation curve, with  $O A_1$  output in region I and no output in region II. If all the resources are used in region II, then  $R_I = 0$  and  $R_{II}$  is represented by  $A_4 O$ . Output in II is  $O E$ ; there is no output in region I.

Normally, resources will be partly used in I and partly in II. These situations are represented by points  $B$ ,  $C$ ,  $D$ . Point  $B$  is constructed by starting from point  $B_3$ . Using  $O B_3$  of all available resources in I we get an output of  $B_3 B_2 = O B_1$  in I. Using  $O B_3 = O B_4$  of  $\bar{R}$  in I means that

of the given amount of resources, only  $A_3B_3 = A_4B_4$  is left for production in II. This leads to an output of  $B_4B_5 = OB_6$  in II. Points  $C$ ,  $D$  and all other points of the curve in quadrant I are constructed similarly.

The curve  $A_1BCDE$  represents the relation between the goals of increasing regional outputs. The slope of the curve depends on the form of the functions in quadrants II and IV. Under the assumption of diminishing marginal productivity the curve will be concave to the origin. The goal relation curve shows a trade-off case between the two regional goals. An increase in output in region I may only be reached by reducing output in II.

A shift of functions (1) and (2) may be thought of as representing a change in the state of regional technical knowledge. If region I is in a higher stage of development, region I is represented by a higher slope of its production function whereas the slope of region II, measured from the origin of its production function, would be lower. The trade-off curve will be based towards region I, showing a large output in I and a rather low output in region II.

The trade-off relation between the growth policies of different regions rests on the assumption that two regions are competing for a limited amount of resources and that region I can only attract these resources by withdrawing them from region II. There may, however, be cases when the withdrawal effect is insignificant. In a more than a two-regions-case, for instance, resources needed in region I may not be withdrawn only from region II, but also from all other regions thus lessening the withdrawal-effect on region II. At the same time, the expanding region may induce development in the other area through the following mechanisms:

(a) The expanding region I demands inputs and consumer goods from region II. This interaction via the interregional multiplier represents an incentive for increased production in II provided that resources can be made available which allow an increase in output.

(b) An increase in production in I may lead to internal economies. If these internal economies result in price reductions, conditions of production will be improved in region II if region II imports inputs from I.

(c) Arguments (a) and (b) can be presented in terms of pecuniary external economies. Both an increase in demand for goods of region II and a lowering of prices of I-goods will increase profits of firms in region II thus causing pecuniary external economies<sup>4</sup>. The intensity of the spill-over effect will depend on the interregional mobility<sup>5</sup> of these external pecuniary economies. If they are very mobile interregionally the intensity of the spill-over effect will be high and there are inducements for growth in region II. If, however, external economies are immobile interregionally the spill-over effect will be negligible.

<sup>4</sup> T. Scitovsky: Two Concepts of External Economies, *The Journal of Political Economy* *LXII* (1954), pp. 143–151.

<sup>5</sup> E. A. G. Robinson: *The Structure of the Competitive Industry*, rev. ed., London 1958, p. 124.

(d) Growth in region I may also cause negative pecuniary external economies in I by raising prices of factors of production. Thus the price of land will go up when the regional economy expands. Wages may also go up because of higher costs of living and increased demand for labor. In the case of land the negative pecuniary external economies resulting from a rise in the price of land will be immobile being restricted to the expanding region. In the case of rising labor costs part of the negative pecuniary external effects may affect other regions by withdrawing labor and raising wages there. Thus, the more immobile pecuniary external dis-economies will be interregionally, the more is the expanding economy affected negatively and the greater will be the growth incentives for the originally not expanding economy. We may think of all these factors as shifting the goal relation curve in favor of the originally non-expanding region.

In the following analysis, these spill-over effects are assumed to be negligible.

### 3. Goal Conflicts between Regional Growth Policies: Algebraic Analysis

Algebraically the trade-off curve is determined by calculating the solution set for the two regional production functions for alternative interregional distributions of the given amount of resources. The function that relates the corresponding elements of these two solution sets is the goal relation curve. Assuming simplified production functions we have

$$O_I = a R_I^\alpha, \quad (6)$$

where  $a$  is an efficiency coefficient representing a given state of technical knowledge and  $\alpha$  is the elasticity of production with respect to resources in I. For region II:

$$O_{II} = b R_{II}^\beta \quad (7)$$

(5) into (7):

$$O_{II} = b (\bar{R} - R_I)^\beta. \quad (8)$$

From (6):

$$R_I = \frac{1}{a^{1/\alpha}} O_I^{1/\alpha}, \quad (9)$$

(9) in (8):

$$y = O_{II} = b \left( \bar{R} - \frac{1}{a^{1/\alpha}} \cdot O_I^{1/\alpha} \right)^\beta. \quad (10)$$

Eq. (10) is the goal relation curve relating output of regions I and II. The curve depends on the efficiency coefficients, the elasticity of production in the two regions and total resources.

The first derivative  $y' = \frac{dO_{II}}{dO_I}$  is the rate of transformation between the two goals. If  $y' > 0$ , the goal relation curve has a positive slope. The

two goals are in harmony. If  $y' = 0$ , the two goals are completely independent from each other. If  $y' < 0$ , a trade-off situation prevails.

The first derivative is negative<sup>6</sup>. Consequently, a conflicting relationship exists between the growth goals of the two regions. Region I can only increase its output at the expense of region II and vice versa.

The second derivative  $y''$  indicates the shape of the trade-off curve, for positive  $O_I$  and  $O_{II}$ :

(a) If  $y'' < 0$ ,  $y'$  has a negative slope. As  $y' < 0$ ,  $y$  has a negative slope. Because of the negative slope of  $y'$ , the negative slope of  $y$  must decrease. The trade-off curve is concave to the origin.

(b) If  $y'' = 0$ ,  $y'$  has a slope of zero. As  $y' < 0$ ,  $y$  must be a straight line with a negative slope.

(c) If  $y'' > 0$ ,  $y'$  has a positive slope. As  $y' < 0$ ,  $y$  has a negative slope. Because of the positive slope of  $y'$ , the negative slope of  $y$  increases. The curve is convex to the origin.

For the second derivative  $y''$  we have<sup>7</sup>:

$$y'' \leq 0 : (1/a - 1) S \leq (\beta - 1) T, \quad (11)$$

where  $T$  and  $S$  are positive.

<sup>6</sup> The first derivative is:

$$y' = \frac{dO_{II}}{dO_I} = b \left( \bar{R} - \frac{1}{a^{1/a}} \cdot O_I^{1/a} \right)^{\beta-1} \cdot -\frac{1}{a^{1/a}} \cdot \frac{1}{a} O_I^{1/a-1}. \quad (1)$$

For all  $a, b > 1$  and  $\alpha, \beta > 0$  and  $O_I, O_{II} > 0$ :

$$y' < 0. \quad (2)$$

Proof: The right term of (1) is negative,  $y' < 0$ , if the left term is positive. The left term is negative, if

$$\bar{R} < \frac{1}{a^{1/a}} O_I^{1/a}. \quad (3)$$

From (6) in the text:

$$O_I \geq a \bar{R}^\alpha, \quad (4)$$

$$\bar{R} \geq \frac{1}{a^{1/a}} O_I^{1/a}, \quad (5)$$

(5) excludes (3). Thus, the first term cannot become negative.  $y'$  is negative.

<sup>7</sup> The second derivative is:

$$y'' = b (\beta - 1) \left( \bar{R} - \frac{1}{a^{1/a}} \cdot O_I^{1/a} \right)^{\beta-2} \cdot \left( \frac{1}{a^{1/a}} \cdot \frac{1}{a} \cdot O_I^{1/a-1} \right)^2 \cdot - (1/a - 1) \frac{b}{a^{1/a}} O_I^{1/a-2} \left( \bar{R} - \frac{1}{a^{1/a}} O_I^{1/a} \right)^{\beta-1}.$$

Defining one term as  $S$  and another as  $T$ , we have as a condition for (11):

$$y \geq 0 : S (1/a - 1) \geq (\beta - 1) T.$$

We have the following results:

(a) For increasing marginal productivities in the production activities:

$$a > 1 \text{ and } \beta > 1.$$

Then:

$$S(1/a - 1) > (\beta - 1)T. \tag{12}$$

Thus  $y'' > 0$ . This implies a convex trade-off curve.

(b) For constant marginal productivities,  $\alpha = 1$  and  $\beta = 1$ , we have  $y'' = 0$ . The trade-off curve is a straight line.

(c) For decreasing marginal productivities,  $\alpha < 1$  and  $\beta < 1$ :

$$S(1/a - 1) < (\beta - 1)T. \tag{13}$$

Then:

$$y'' < 0.$$

The trade-off curve is concave.

#### 4. Goal Relations between Regional and National Growth Policy

There is not only the possibility of a goal conflict between growth policies of different regions but also between regional and national growth goals. Using diagram (3) to determine maximum output in the system of both regions it can be shown that there is a goal conflict between maximizing output in a single region and maximizing output in a system of regions.

Total output of the two regions  $O_T$  is the sum of the two regional outputs.  $O_T$  can be derived from diagram (2) by adding up the vertical and the horizontal distance of a point on the trade-off curve from the north and the east axis. This method is used to construct curve  $ETA_1$  in diagram (3).

Total output is plotted on the north axis, output of I is shown on the  $x$ -axis. Curve  $ETA$  shows total output  $O_T$  as a function of output in region I. Curve  $EZ$  denotes the goal relation curve between the two regional outputs.

Point  $A_1$  in diagram (3) represents a situation in which all factors of production are used in region I,  $A_1$  in diagram (3) corresponds to  $A_1$  in diagram (2). For  $A_1$  total output of the system as a whole is identical to output in I, output of II being zero. Therefore section  $ZA_1$ , is equal to section  $OZ$ . Point  $E$  in diagram (2) represents a situation where all resources are used in II. It corresponds to point  $E$  in diagram (3). For  $E$ ,  $O_T$  is identical with  $O_{II}$ , as

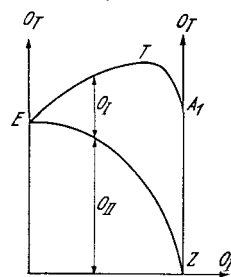


Diagram 3



$O_I = 0$ . Other points of the curve  $ETA_1$  are constructed by adding  $O_I$  and  $O_{II}$  from diagram (2).

Diagram (3) illustrates the relations between regional and national growth policy. Both relations of harmony and of conflict are shown. Starting at point  $E$  and increasing output of region I, will lead to an increase in total output. Thus, there is a harmonious relation between the two goals moving from  $E$  to  $T$ . The same is true if we try to increase output in region II, starting from  $A_1$ . Moving from  $A_1$  to  $T$ , both output of region II and of the two regions as a whole can be increased.

The relation of goals changes into one of conflict if we want to increase output of region I by moving beyond  $T$  towards  $A_1$ . This, however, is normally the goal of the planner in region I who wants to increase regional product in I not taking into consideration the situation in the other region and in the system as a whole. The same reasoning applies if the planner of region II wants to move beyond  $T$  towards  $E$ . By such a policy regional output in II will be increased, but total output will fall. In these cases, the goals of regional and national growth policy are conflicting.

Algebraically, total output  $O_T$  is equal to the sum of the two regional outputs:

$$O_T = O_I + O_{II} = a R_I^\alpha + b R_{II}^\beta. \quad (14)$$

Using (5) we have

$$O_T = a R_I^\alpha + b (\bar{R} - R_I)^\beta. \quad (15)$$

If  $R_{II}$  is substituted by  $O_I$  according to (6), Eq. (15) represents the goal relation curve between total output of the two regions and output in region I. Differentiating (15) with respect to  $R_I$  yields as a condition for maximum output of the two region system:

$$\frac{dO_T}{dR_I} = 0 : a \alpha R_I^{\alpha-1} = b \beta (\bar{R} - R_I)^{\beta-1}. \quad (16)$$

Condition (16) specifies that the maximum of total output is reached where the marginal productivities of resources are equal in both regions.

Marginal productivities can be represented by a tangent to the production functions. Equality of marginal productivities will be reached in a fourquadrant diagram when the tangents to the corresponding points of the two production functions in diagram (2) are vertical to each other. In diagram (2) there is only one point on the trade-off curve which allows the marginal productivities of additional resources in both regions to become equal, the point being situated between  $B$  and  $C$ . All other points of the trade-off curve involve situations in which the marginal productivities in both regions differ.

If the trade-off curve between regional growth policies is a straight line with a negative 45 degree slope total output of both regions will be

the same for all alternative allocations of resources in both regions. The marginal productivities are identical for all points of the transfer reaction curve and no single solution exists<sup>8</sup>.

In the case of a convex trade-off curve total output will be greatest if the region with the highest marginal productivity gets all the resources. Such a policy may, of course, conflict with other goals such as reducing interregional income differences.

The discussion of the goal relations of regional growth policy yields the following results:

(1) Growth policies of different regions are not compatible with each other if the spill-over effect of the expanding region is negligible and the withdrawal-effect caused by the expanding region is important.

(2) Growth policies at the regional and the national level may be in harmony or in conflict. A harmonious relation prevails if regional growth policy tries to increase regional output *and* if the marginal productivity is still below the marginal productivity in the other regions. A conflicting relation prevails if regional planners try to push regional output to a point where the marginal productivity in the region will be lower than in other regions. If the most important goal in the hierarchy of goals is to increase national output, regional output should only be increased to the point where the marginal productivities of factors of production in both regions are equal.

(3) The construction of the trade-off curve suggests a possible approach to influence the underlying factors that cause the conflicting situation. A very unfavorable trade-off curve for a region may be changed by increasing the coefficients of efficiency and also the elasticity of production through an increase in the state of technical knowledge and an improvement in organizational efficiency. If this approach is not possible only a value judgment can "solve" the conflict by establishing the priority of one objective over the other.

## 5. Preventing Diverging Interregional Income Differences

The goal system of regional growth policy includes more objectives than the ones mentioned so far and thus is much more complicated in reality. Only one of the many goals relevant for regional growth policy (including the noneconomic objectives of a society) will be mentioned here: the goal of preventing too extreme differences in income between regions. If this restriction is not introduced, the objective of a maximum output in the total economy may require in an extreme solution that all activities are concentrated in region I and that the output of region II becomes zero. A restraint may be introduced to prevent such an outcome.

<sup>8</sup> If the trade-off curve between regional growth policies is a straight line and has a slope  $b$  with  $0 < b < 1$  or  $1 < b < \infty$ , a corner solution will result as in the case of a convex trade-off curves.

This restriction may be stated in such a way that a minimum relation of regional outputs must be reached.

$$\frac{O_I}{O_{II}} > v_1, \quad \frac{O_{II}}{O_I} > v_2. \quad (17)$$

These restraints are shown in diagram (4) as two straight lines  $v_1$  and  $v_2$ .

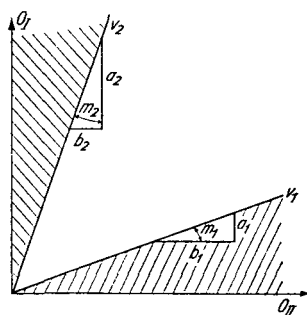


Diagram 4

The first restraint  $O_I/O_{II} > v_1$  excludes all solutions on and below the line  $v_1$ , because only points above line  $v_1$  satisfy condition (17). This restraint is measured by tangens  $m_1 = a_1/b_1$ . It protects region I from a relatively low income, compared to region II.

The second condition specifies that the relation between  $O_{II}$  and  $O_I$  must surpass a minimum value  $v_2$ . This restraint is measured by tangens  $m_2 = b_2/a_2$ , because in this case the relation between  $O_{II}$  and  $O_I$  is relevant. This constraint excludes all combinations of  $O_{II}$  and  $O_I$  which are below line  $v_2$ . Thus, it protects region II against a too low income in comparison with region I.

The restraints specified in diagram (4) conflict with the goal of a maximum total output in the two region system, if they become effective. Suppose that the optimum solution for the national economy consisting of two regions is represented by a point on the transformation curve which lies below  $v_1$ . If this restraint is realized through the use of policy instruments, the maximum total output cannot be reached. The opportunity cost of preventing too high differences in regional income can then be measured by the loss of total output  $O_T$  caused by the restraint.

Diagram (4) restricts the permissible solution of diagram (2) and it can be easily integrated into this diagram. Then diagrams (2), (3) and (4) represent a geometric picture of a simplified goal system of regional growth policy.

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