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IDS/WP 322

REGIONAL INEQUALITY AND DEVELOPMENT
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By

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In this paper the causes of regional inequality are discussed. Two main types of influences are identified. First, there are exogenous economic forces, which tend to concentrate production in certain regions. Second, there are endogenous forces, which are determined by the internal structure of the economy. The paper discusses the role of government in regional development and the impact of economic policies, which may be used to reduce regional inequality.

After a general discussion of these issues, a broad outline is given of an investigation into the regional inequality problem in Kenya. In this investigation the development of production and employment in the region and sector as well as the impact of government policy are discussed. SEPTEMBER 1977

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REGIONAL INEQUALITY AND DEVELOPMENT

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ABSTRACT

In this paper the causes of persistent or increasing regional inequality are discussed. Two main types of influences are identified. First, there are endogenous economic forces. It is pointed out that internal economies of scale tend to generate concentration of production, but from this we cannot draw any conclusions about where the agglomerations will be located. It is argued that input-output linkages among producers and the links between final demand and producers are determining locational choice. Secondly, there are the effects of economic policies, which may either counteract or reinforce the pattern of development generated by the endogenous economic forces.

After a general discussion of these issues a broad outline is given of an interregional input-output simulation model to be applied in Kenya. In this the development of production and employment by region and sector as well as migration will be simulated.

REGIONAL INEQUALITY AND DEVELOPMENTIntroduction

1. During the sixties the overall growth figures of most under-developed countries were good. Per capita incomes were rising faster than at any time before, and politicians as well as economists were content. In recent years, however, a number of studies have shown that the good aggregate performance was accompanied by growing inequalities among people and regions. Growth was in most cases concentrated to the small modern sector and to certain regions, while the majority of the population was left on a very low standard of living. This implies that the distribution of income did become more unequal.

Because of these insights there has been a growing criticism against development strategies aimed at maximizing growth without any consideration of the distributional consequences. The most important examples of attempts to define a new strategy are Chenery et al's "Redistribution with Growth" (1974), and ILO's "Employment, Growth, and Basic Needs" (1976). The latter draws upon experiences from the numerous country-studies made by the ILO (by e.g. the mission to Kenya, ILO, 1972). Both these works focus on the needs of the poor and outline economic policies aimed at improving their lot. To be able to reach the target groups planning and policies must be more disaggregated than what has been the case so far. In support of such a policy change there is need for research on the mechanisms that determine the distribution of income among sectors, regions and persons.

To be able to analyse the distributional consequences of growth, we need comprehensive models for integrated analysis of growth and distribution. In my study I will focus on one sub-problem of the general problem of distribution, that is the regional distribution of income. There is a growing awareness among policy makers in the Third World of the fact that large parts of their countries have been left more or less outside the process of development. This has led to an increasing concern for regional problems as can be seen e.g. in plan documents. Integration of all regions of a country in the process of development is one important prerequisite for a general equalization of incomes.

The purpose of my study is to analyse the process that determines the development of regional incomes and employment in Kenya. I will attempt to do three things; first to indicate how large the regional differences are, secondly to identify the factors that determine their development over time and to simulate this development, and thirdly to discuss how one can influence regional inequality by economic policy.

These tasks are difficult and the analysis that is developed obviously has weaknesses, particularly due to the scarcity of data. Still, I hope that it will make some contribution to the understanding of the development of regional inequality in underdeveloped countries. This work should be viewed as a contribution to an ongoing discussion, as we are still far from a satisfactory interregional analysis of development. In this introductory paper I will only present the general perspective of the study and give a broad outline of my approach. The more detailed description of the model and the results of the analysis will be presented in forthcoming papers.

2. A Disequalizing Development Pattern

It is a typical feature of growth in low income countries that it is combined with increasing inequality. Kuznets (1955, 1962), was the first one to advance the hypothesis that inequality first increases and then decreases with development. The reason for this is that growth in the early stages of development tends to be concentrated to the modern part of the economy, which then is small in terms of employment. In the preindustrial society where agriculture predominated there was little differentiation. With the introduction of capitalistic industries the degree of differentiation increases, and this causes an increase in inequality.

Kuznets' seminal contribution was followed by a number of studies dealing with this issue. Among the earlier ones can be mentioned Karvis (1960) and Oshima (1962). They present data that support Kuznets' hypothesis that early growth increases inequality, and they argue that changes in the economic structure causes the increase in inequality.

During the last few years the issue of distribution has really come in to focus, and a number of studies of the relation between the level of income and the degree of inequality have been presented. As there exists very little time series data on the distribution of income for underdeveloped countries, the studies that have been made are cross country studies. This of course means that the results should be interpreted with caution, but they still can be assumed to provide an approximation to development over time.

Adelman and Morris (1971, 1973) have made a cross section analysis of personal income distribution in 74 underdeveloped countries, and their analysis indicates that over a very long period of the modernization process inequality increases, unless there is efficient planning for equity.

Adelman and Morris find that with respect to the share of income accruing to the poorest 20% of households the most important explanatory factors are what they call dualism and various aspects of foreign trade and agricultural policy. They find (Adelman and Morris, 1971, p. 12) that "economic development is associated with increases in the share of the bottom 20 per cent only after relatively high levels of socio-economic development have been attained. At the early stages of the development process economic development works to the relative disadvantage of the lowest income groups".

Concentration of income tends to increase with dualism, and they also notice (Adelman and Morris, 1971, p. 21) that "once a sharply dualistic development pattern has been initiated, further economic growth actually reduces the share of the lowest 60 per cent. In the absence of government... intervention, dualistic growth therefore increases the concentration of income. The extent of cleavage of technology and life style thus exerts a profound effect upon income distribution, not only in itself, but also by influencing the way in which further development affects the distribution of income".

The data assembled by Adelman and Morris/^{are} used by Paukert (1973) to calculate how the Gini coefficient changes with the level of per capita income. He finds (p. 116) that "there is a sharp increase in inequality as one moves from countries in the lowest income group to those in the \$ 101 - 200 group, and a further but less pronounced increase as one moves on to the \$201 - 300 group. This group and the next (\$301-500) represent the peak of inequality.

Chenery and Syrquin (1975) have in their large cross-country study of development patterns analysed the development of inequality and also their results are in accordance with Kuznets' hypothesis. They locate the peak of inequality at a per capita income of about \$300. As there are a very large intercountry variation that is left unexplained they test a number of other explanatory variables. They add proxies for education, dualism and the size of the agricultural sector, and this notably improves the regression results. Still, their main conclusion (p. 63) is that when population growth is high and the modern sector is too small to absorb any substantial part of the labour force there is a marked tendency for inequality to increase.

In his thorough survey of the literature on distribution and development Cline (1975) cites evidence from Ahluwalia that seems to cast doubt on the hypothesis of the inverted U. In two later articles (1976a, 1976b) Ahluwalia, however, presents extensive results from his studies on inequality, which support the hypothesis. He cannot, however, find any evidence for the hypothesis that inequality is higher in fast growing countries than in slow growing countries at the same income level. As Ahluwalia's study (1976b) seems to be the most comprehensive that has been made so far, it should be worthwhile to sum up the results (the data that his study is based on are published in Jain (1975)).

Ahluwalia cautions the reader about the results, as they are the result of cross-section and not time-series studies. The results of the analysis should be regarded as "stylised facts", for which one should try to find a theoretical explanation. This kind of studies therefore only represents a starting point in our search for explanations and causal mechanisms.

First, Kuznets' hypothesis about the secular behaviour of inequality is supported by Ahluwalia's regressions. He furthermore identifies turning points for different income groups. The share of the top 20% increases up to \$364, after which the share of this group declines until \$291 and then improves, while the lowest 20% have to wait until per capita GNP has reached \$600. Ahluwalia's conclusion (p. 310) is that "the reversal of the 'deteriorating phase' of relative inequality begins fairly early, first for the middle income group, and much later for the lower income groups. It appears that if there is a 'trickle down' process, then it takes substantially longer to reach the bottom". The conclusion that the decline is most prolonged for the poorest groups further accentuates the need for a change of development strategy. The present rate of growth of per capita incomes are in most underdeveloped countries so low that it may take a century before the turning point is reached for them. Even if a relative decline not necessarily means that the absolute income level also decreases, it implies that the rate of improvement is slow.

Ahluwalia, like others who have analysed the relationship between per capita incomes and inequality, finds that the level of incomes only explains a limited part of the variation in the material. He therefore introduces other explanatory variables relating to intersectoral shifts in production, expansion of education and the demographic

transition. His conclusion is that these factors contribute considerably to the explanation of the improvement in the distribution, but that they do not explain the early deterioration. The share of agriculture is the only factor of those discussed that is associated with the deteriorating phase, but its effect is ambiguous. On the basis of Ahluwalia's study it is difficult to identify the processes that generates increasing inequality in the early stages of development.

All these studies of the distributional consequences of growth are exploratory. They do not investigate dynamic processes in historical context for any particular country, which should be done if one is to be able to identify the causal mechanisms. What is needed at present therefore is country studies, in which a more careful analysis of the dynamics of development can be made.

This is a very large task. I will here not try to deal with the entire problem of distribution, but I will analyse one important aspect of it, that is the regional distribution of income. The need to explicitly consider the depressed regions in a policy for redistribution has been stressed by e.g. Chenery et al (1974, p. 205). The hypothesis of the inverted 'U' has been claimed to be valid for the development of regional per capita incomes as well.

Myrdal (1957) first advanced the hypothesis that there is a general tendency towards increasing regional inequalities in underdeveloped countries, or - in his own terminology - for the backwash effects to outweigh the spread effects. Myrdal claims (p. 34) that in poor countries the free play of market forces tends to create regional inequalities and to widen those that already exist. (The same argument is advanced by e.g. Friedman, 1966, p. 18).

Myrdal argues that once an area within an underdeveloped economy has developed ahead of the others, the imbalance tends to perpetuate itself through a cumulative process. Industries and handicrafts in the backward areas tend to succumb to the increased competition from industries in the advanced areas. Capital migration tends to be perverse, that is capital moves out of areas where there is little capital per capita to areas where there is plenty. This may be due to higher profitability, to more developed capital markets, or to smaller risks within industrialized areas. Also labour migration tends to be perverse in so far as the most qualified individuals are the first to leave the backward areas. As the country develops the spread

effects may begin to assert themselves, but as long as the dual or disintegrated structure of the economy remains they will not be very effective.

Very few empirical studies of the relation between regional inequality and development have been made, even if a number of authors have analysed the persistent so called North-South problem, particularly in the United States. Williamson presented in 1965 the first cross-country study of regional inequality covering 24 nations (unfortunately including relatively few underdeveloped countries). This study remains the most comprehensive study of regional inequality.

Williamson arranges the countries according to income per capita and finds (p. 115) that "the relationship between level of development and degree of regional inequality is in the form of an inverted 'U', reaching a peak in the middle income class". Williamson also uses what little evidence there is to study the development of regional inequality over time in now developed nations such as USA and Sweden. He finds (p. 138) that the evidence "seems to be at least consistent with the result of the cross-section analysis".

The regional income inequality thus seems to follow the same pattern as personal income inequality, that is it increases as economic growth starts in an economy with very low incomes and then reaches a turning point, whereafter it decreases.

The reasons for the early increase in regional inequality advanced by Williamson are perverse capital and labour migration and a central government policy aimed at maximizing growth. He argues that eventually the economy will reach a turning-point as "the spread effects may begin to assert themselves from those islands of industrial growth as the economy fully integrates itself and commodity and factor markets become more efficient" (p. 107).

Another factor that is conducive to this is changes in the economic policy. Williamson feels that it may be more difficult to disregard large regional inequalities at the same time as the country has more resources to spend on regional policy. Recent experiences suggest that the increase in popular pressure for regional equalization comes very early and this creates tensions that may hinder national development and integration. In young nations "nation-building" is an overriding objective, and if this is to be successfully accomplished all parts of the country must have a share in the benefits of development.

Gilbert and Goodman (1976) has pointed out several inherent difficulties in Williamson's study, some of which also Williamson stressed. They particularly underline that the results are very sensitive to whether the major city is included with a rural area or is considered as a separate region. In spite of these difficulties Gilbert and Goodman agrees that there is at least a clear tendency towards convergence for developed countries. The divergence hypothesis, however, receives "only flimsy support" (p. 117) by the evidence advanced by Williamson.

They agree that Williamson's hypothesis has received some supporting evidence from studies of other measures of economic activity such as the provision of infrastructure, which appear to become more spatially concentrated during the process of growth in low income countries. Still, more recently published regional income data for 15 low income countries that they have been able to acquire do not show any marked tendency for regional income differentials to increase with rising per capita incomes. Tanzania and Kenya show the greatest regional income differentials in spite of the fact that their per capita incomes are among the lowest in the sample (p. 118). Obviously it is rather difficult to show clearly by cross-section analyses that regional inequality increases with development.

Still, for the type of growth experienced in African countries the hypothesis seems plausible. I therefore state the hypothesis that once an unequal pattern has been established there are very strong economic forces working to maintain or further aggravate the imbalance.

I will in section 3 of this paper point to the historical background to inequality in Africa. Section 4-7 I will discuss the factors that determine the pattern of regional growth at present.

3. The Colonial Background to Development in Africa

Adelman and Morris found that dualistic economic development tends to reduce the share of the poorest groups. Most African economies can be characterised as dualistic, that is they have a large (in terms of employment) and slow-growing traditional sector using simple production techniques, and a rapidly growing modern sector. In most African countries the major part of modern sector production is localized in one or a few regions, while semi-monetary or subsistence production dominates in the remaining regions. This explains a large part of regional differences in per capita income. These large differences among regions in sectoral structure makes it very difficult to solve the problem of regional inequality.

Almost all African countries have been under foreign domination and exposed to colonization by foreigners during much of the last hundred years. The colonists superimposed an alien pattern of living and an alien pattern of production on a predominantly agricultural, rural, and traditional economy. A biased structure of production was created by the colonists to serve the needs of the mother country and the settlers, and it has not changed drastically since the attainment of independence.

The urban and communication patterns that exist in African countries today were created by the settlers to serve their purposes, among which the most important one was to establish efficient export channels. The communication system therefore usually centres on some port. The location of railways and colonial administrative centres determined the urban pattern, which in turn is an important determinant of the spatial distribution of industrial activity. However, also in rural areas large differences emerged between settler agriculture and traditional agriculture, which is still reflected in large differences in the size of production units, methods of production, crops etc.

One of the causes of the concentration of production to certain "enclaves" was and still is the fact that large parts of the so called modern sector have very important relations with the industrialized countries. This is due to the fact that it often is those that provide the capital, the technical know-how, and the managerial skills that are used in this sector.

The point that I am trying to make in this section is that a large part of the present grave inequalities were originally caused by colonialism. I think one can safely claim that spatial differences in income were relatively small in pre-colonial society. This proposition is borne out by the fact that the income differences today are relatively small in countries, where foreign penetration has been limited e.g. Chad and Niger (see Adelman and Morris, 1973, p. 152, and Adelman, Morris and Robinson, 1976, p. 562). The colonial policy created a pattern with a few areas integrated into the monetary economy, while subsistence production continued to dominate in the rest of the country. The large spatial differences in income were thus built up over a long period of time and became firmly embedded in the economic structure.

4. Cumulative Causation and Agglomeration Economies

It has been argued by many that the market mechanism is inefficient in achieving an efficient allocation of resources in underdeveloped countries, where markets are far from perfect and where externalities abound. Still, in most of these countries the resource allocation is left to the market, which is complemented with more or less "development planning". It is the workings of these market economies that is the object of study here.

I have above pointed to evidence that indicates that growth in low income countries tends to increase or preserve interregional inequality. I will now try to identify the forces that generate this pattern of development. In the neo-classical models that have dominated regional growth theory, wage and capital yield differentials have been at the centre of the stage. According to analyses in this tradition the persistence of regional inequality is caused by lags in adjustment, which are due to the malfunctioning of the adjustment mechanisms (cfr. e.g. Borts and Stein, 1964, Siebert, 1969). The expectation is that the imperfections will disappear as the economy develops and factor as well as product markets become integrated. Then factor transfers are supposed to bring about equalization of wage and capital yields.

However, it should be pointed out that this tendency towards convergence historically has not occur until fairly high income levels have been reached. The economies that I am considering here are much below this level, wherefore I am interested in analysing the causes of divergence. For this purpose a neo-classical approach does not seem to be the best alternative and even apart from this the usefulness of neo-classical models for regional analysis in general has been questioned. Richardson (1973, p. 23) is very critical against the use of this kind of models for regional analysis, as he feels that many of the assumptions that they rest upon are not applicable at the regional level. He claims that "space is incompatible with perfect competition, complete certainty, marginal adjustments in prices, outputs and location, and the other background conditions of the neo-classical world". He argues that regional growth theory to be realistic must take into account the effects of agglomeration economies and distances among economic agents.

At least for analysis of regional growth in low income countries it seems to be more fruitful to turn to the tradition of "cumulative causation models", of which Myrdal (1957) was one of the earliest and

most influential proponents. His main thesis was that once some areas in an underdeveloped economy have developed ahead of the others, the divergent pattern becomes self-sustaining because of the increasing advantages of producing tin in the fast-growing regions. Myrdal argues (1957, p. 13) that changes in such an economy do not "call forth countervailing changes, but, instead, supporting changes which move the system in the same direction as the first changes but much further". The favourable spread effects from the growing region(s), such as the expansion of markets for the lagging regions, are less than the negative backwash effects, such as the disequilibrating flow of capital. This is contrary to the presumption of neo-classical theory. The advantages that the lagging regions may have, for example a lower wage level, are according to this view insufficient to offset the advantages of the developed regions.

Similar arguments concerning regional growth have been advanced by Kaldor (1970, p. 340), who writes that he is sure that the "principle of cumulative causation - which explains the unequal regional incidence of industrial development by endogenous factors resulting from the process of historical development rather than by exogenous differences in 'resource endowments' - is an essential one for the understanding of the diverse trends of development between different regions".

Kaldor's argument is in short outline the following. First he argues that the long-run growth rate of a region is determined by the growth of autonomous demand, and for a region the main part of autonomous demand originates outside the region. His theory therefore resembles the export-base theory to some extent. The growth of export demand then is a function of the competitive position of the region, which primarily is determined by the movement of efficiency wages (which depends on the movement of money wages in relation to productivity) within the region compared to its development in other regions. Finally, he includes the so called Verdoorn effect in his analysis. According to this productivity growth is (at least partly) dependent on the growth of output itself. Therefore fast growing regions can improve their competitive position and continuously grow faster than the lagging regions. It is the Verdoorn effect that makes the model a cumulative causation model.

Dixon and Thirlwall (1975) have attempted to formalize the model along the lines sketched here. They must, however, satisfy themselves with a partial equilibrium approach where each region is considered in

isolation from the others. Interregional relationships are considered only implicitly, as the Verdoorn effect can sustain high growth rates in one region once it has got a growth advantage, which makes it difficult for the other regions to compete.

In conclusion to their discussion of Kaldor's approach they note (p. 212) that "it is hard to apply Kaldor's model at the regional level without being able to identify regional exports and to estimate such crucial parameters as the price and income elasticities for exports, let alone the other parameters of the model".

Dixon and Thirlwall furthermore show that regional structure has important implications for regional growth in the model, a feature that Kaldor did not stress. They draw the conclusion that what the lagging regions need is to become more competitive and/or to change the industrial structure so that the regions get more industries producing goods with high income elasticities or with high Verdoorn coefficients attached to them.

There are many other authors that have had more or less worked out ideas about the process working towards increasing regional inequality. One example is John Friedman who emphasize center-periphery relations. He argues (1972) that the core regions dominate the periphery due to their higher capacity for innovative change. Another example is the discussion within the so called dependency school (Frank, 1967, Amin, 1970, Sunkel, 1973), where the problem of underdevelopment is discussed in terms of centre-periphery or metropole-satellite relations. The peripheral regions are linked to the center by an exploitative relationship. Development at the centre is dependent on the draining of the periphery of its surplus.

The main point in all of these analyses is that there are cumulative forces working against equalization. The factors suggested to cause this development can be given the common label agglomeration economies. The discussion has in most cases been in general terms, and few attempts have been made to give a more precise specification of what agglomeration economies really is. Therefore the concept has proved to be difficult to operationalize. Richardson (1973, p. 175) considers this problem to be "the most serious obstacle to progress in applied regional economics". What I am trying to do in this study is to identify the most important agglomeration forces and to operationalize them and use them in the analysis.

It is not possible to take all factors discussed under the heading of agglomeration economies into account. For example psychological, social and cultural factors may be important, but their influence is unclear and difficult to measure. Among "economic" forces that have been discussed one can distinguish between economies of scale that are internal to firms and external agglomeration economies.

First, let us consider internal economies of scale in production. Economies of scale are due to technical and administrative factors (for a discussion, see e.g. Silberston, 1972). As there exist economies of scale there are costs of decentralization, and therefore there is a tendency towards concentration to few production units. In a small, underdeveloped economy the markets for many products are so small that there may not even be room for one production unit that produces on a technically optimal scale. In many lines of production we therefore have a situation where there is only one or a few firms. Of course the importance of indivisibilities is greater the smaller the size of the country.

Therefore economies of scale influence investment decisions. Production costs in many branches are lower when investments are concentrated to few production units rather than divided between many units. Of course, on the other hand, the costs of transporting the products to the buyers works towards a decentralization provided demand is spread out. This is important mainly for goods with high transport requirements.

The empirical analyses of economies of scale that have been made usually deal with industries producing homogenous products. When one deals with more aggregate sectors each sector will contain a wide variety of products. In a sector like e.g. manufacturing there will be a large number of different types of products. Then even if there are scale advantages in the production of a specific product which would call for few production units, it will not for reasons of internal technical economies of scale be necessary to concentrate the production of the aggregate sector to one or a few locations.

What I am interested in here is precisely to analyse the tendency towards concentration to a few geographical areas of firms producing a variety of products, and it is not easy to say how productivity varies with scale in an aggregate sector. Westphal (1975, p. 258) states in his survey of planning with economies of scale that

at present there is "no satisfactory theoretical or empirical basis on which to aggregate over micro activities characterized by increasing returns. Consequently, there are no applied economy-wide planning models in which scale economies are specified for aggregate sector activities". As the analysis here will encompass the entire economy, it will not be possible to take internal economies of scale explicitly into account.

There are two broad groups of factors that cause regional inequality that will be emphasized, one relating to the economic system and the other relating to economic policy. I will place most emphasis on the first category which I believe include the basic determinants of the development of regional inequality. I there consider two kinds of factors, namely input-output linkages and interactions between final demand and producers. As the firms try to minimize communication costs within the pattern of interregional input-output and final demand linkages, there is economy in agglomeration. These factors will be discussed in the following section. The group of factors that is controlled by policy makers is the distribution of infrastructure and other aspects of economic policy. These will be dealt with in section 6.

5. Input-Output and Final Demand Linkages

While trying to specify the factors that should be included in an analysis of the development of regional incomes in underdeveloped countries, I will also briefly comment on some of the literature that is relevant to this issue.

In a market economy the critical factors in the pattern of regional growth are the location and output decisions of firms. Usually it is difficult for the government to influence the location decisions of private industries, even if there is a will to do so (which is not always the case). Private firms locate according to their own preferences, that is choose the location that is most profitable for the firm. I will here discuss the forces that determine this choice.

The idea that development implies structural change, and particularly that it is associated with divergent sectoral growth rates, was advanced already by Schumpeter (1911). This idea has then become central in the discussion of development theory starting with the classic articles by Rosenstein-Rodan (1943) and Lewis (1954, 1958).

Many theorists have since then analysed the course of structural transformation, but few have considered the spatial consequences of this transformation. The latter aspect is focussed here.

My first tenet is that input-output linkages strongly influence location decisions, and thereby the development of regional incomes. The degree of interdependence among producers is an important aspect of economic integration, and integration among sectors is also vital for the integration among regions. As long as there are few linkages among sectors the spread effects from the fast growing sectors will be small. The fast growing sectors tend to be concentrated to a few regions, and when there is little interdependence between these and the rest of the economy their growth will give very little stimulus to the lagging regions. Furthermore, the multiplier effects of production within the lagging regions also tend to be very small, as much of the small secondary effects that there are leak out to the more developed regions.

The importance of input-output linkages has in the development literature been stressed particularly by Perroux (1955) and Hirschman (1958). Perroux introduced the concept of growth pole, and pointed out (1955, p. 94) that "growth does not appear everywhere at the same time; it becomes manifest at points or poles of growth, with variable intensity; it spreads through different channels, with variable terminal effects on the whole of the economy". A similar type of argument was advanced by Hirschman (1958, p. 195), who contended that what a lagging region needs is "some ongoing and actively inducing economic activity of its own, in industry, agriculture, or services".

"In the wake of these early suggestions there has cropped up an extensive literature on "growth pole theory". The early formulation of a theory of polarized development by Perroux was abstract and it referred little to geographical space. By Boudeville (1966) and others it has been extended to include this dimension as well.

Industrial complexes are central in this analysis. By this concept is meant a cluster of activities with high propulsive strength, that is industries with high capacity to transmit growth impulses through backward as well as forward linkages to other industries. To qualify as a development pole a centre must have a propulsive industry that belongs to the category of "leading industry".

One thus tries to identify certain key industries within this school. This is the central aspect of the theory, but there are also other features. There is for example much stress laid on the role of cities or system of cities. In this context the importance of high-level amenities as well as a growth minded social structure is pointed out.

Still, I think one can say that much of the writings on growth pole theory is lacking in clarity. The general opinion of the writers in Hansen's (1972) anthology on the subject seems to be that the concept of growth pole is elusive and ambiguous. There are no criteria by which relevant centres can be identified (cfr also Alonso, 1968, p. 3). The theory cannot show why a certain pole first starts to grow at a certain location, nor what determines the spatial distribution of the induced growth effects.

It is argued by Hermansen (1972) that when the growth pole concept is applied to geographical space it has to rely on traditional theories of location, spatial organization, and external agglomeration as it in itself is not a theory of location. It has then been suggested that the theory should be viewed as a conditional theory explaining where growth may occur. "The more intricate problem of establishing necessary and sufficient conditions for growth is left unresolved" (Hermansen, 1972, p. 174). The predictive power of the theory thus seems to be weak. (Among the critics can be mentioned Blaug (1964, p. 560) who characterized the theory as "a slogan masquerading as a theory", and Richardson (1973, p. 86) who concludes from his discussion on the subject that the growth pole literature is confused).

Anyway, even if the theory lacks in clarity its stress of intersectoral linkages is commendable. This is a fundamental transmission mechanism of growth impulses in a market economy. My first main point therefore is that input-output linkages must be considered in the analysis of the development of interregional inequality.

The second main economic factor determining how growth impulses are transmitted is the interaction between final demand and production. Demand is the mediator of impulses from incomes to production. The localization of demand depends on the localization of incomes, but this in turn of course is determined by the localization of production. Accordingly it is important to consider the system in its entirety, that is as an interdependent system.

Economic development can be looked upon as the result of a continued process of interaction between demand increases and increases in supply (Kaldor, 1972). If a decentralized economic system is to be able to keep up self-sustained growth, the interaction between demand and supply impulses must function smoothly. In an underdeveloped economy there are many frictions and imperfections that hinder the smooth functioning of this process outside the most developed regions.

Both Richardson (1969, p. 343) and Kaldor (1970) emphasize the role of demand in the determination of regional growth. Of course there are supply restrictions on growth in an underdeveloped economy, but within these the growth of markets undoubtedly is an important determinant of the regional pattern of growth.

We thus have interdependence between production and final demand. The concentration of production leads to a concentration of demand, which then tends to perpetuate or accentuate the agglomerative tendencies and regional inequalities in income. For industries producing consumer goods above a certain level of sophistication and for industries producing investment goods a very large portion of the total market in most African economies is to be found in the main region/regions.

It should be borne in mind that it is not only the location of demand that is important. We also know that the demand elasticities differ, and that they are particularly low for agriculture which usually dominates in the lagging regions.

The location and pattern of final demand is the second main force I will consider when analysing the development of regional incomes. As can be seen I emphasize induced economic effects, while I neglect for example differences in natural resource endowment. In defence of this neglect I can point out that I am mainly interested in the growth differentials - rather than the causes of the existing differences. It is my belief that growth in most cases in the underdeveloped world today is determined by endogenous economic forces and not the availability of natural resources (except for example in regions where mining dominates). Of course the distribution of for example agriculture is determined by the availability of agricultural land, but I assume that the present size of the agricultural sector in different regions correctly reflect differences in agricultural potential. Provided there is no virgin agricultural land or land that for some reason could be radically transformed to yield definitely higher growth rates this assumption should be acceptable.

The rate of structural change is the central variable in the development process, and in this study it occupies the centre of the state. What I am trying to analyse is the differential impact of this change on different regions. The differences in the structure of production is the most important determinant of regional inequality. This pattern of development also has effects on the migration of people. This is the result of the totality of economic influences and policies, and if people move out of the lagging regions this will counteract the tendency of increasing regional inequality. Migration is, however, to a large extent caused by the economic forces, which are considered to be the driving force of the process. I therefore has concentrated my attention to the allocation of capital. I have in this section emphasized the role of input-output linkages and final demand in the transmission of growth impulses. There are, however, also a set of factors relevant to this analysis that are controlled by the policy makers. These will be considered briefly in the next section.

6. Regional Policy

The argument in the previous section was that in an under-developed economy endogenous economic forces determine the development of regional inequality. In recent years the ambitions as regards regional equity have been raised, and this is now often stated as one of the main policy objectives. A change of the development pattern in favour of the lagging regions implies an increase in the growth rates of the lagging regions relative to the more developed regions. To accomplish this one must find ways to influence the decisions on where to increase production.

In this section I will discuss the role of the government and the regional effects of economic policy. The policy is controlled by the government, and it can be used to change the pattern of development outlined in the previous section in the direction desired by the government.

I will briefly touch upon five aspects. I will consider the policy-makers and the institutional set-up and the restrictions that this places on policy choices. Secondly, I look at the role of infrastructure investments in regional policy. Thirdly, I discuss other economic policies directly aimed at supporting the development of specific regions. Fourthly, I briefly consider whether general national policies have a differential regional impact. Finally, I make some ^{comments} on migration.

The institutional problem has two sides. First, there is the possibility of lack of competence with the administrators or lack of resources to implement regional policy. It is a common observation that the planning machinery works better on plan formulation than on implementation. Often administrative capacity is a more pervasive constraint than lack of financial resources.

Furthermore, even if the resources and the administrative capacity needed for a regional policy exists, it is not self-evident that such a policy will be implemented. Influential pressure groups may work against shifting the distribution of public goods and the location of industry in the direction of the less developed regions.

There may be tribal interests that bias the allocation in favour of some regions. In Africa patron-client relationships often is the basis of politics, and politicians need to show results in their home areas to be able to retain their position. If power is unequally distributed among people from different regions or different tribes this makes it possible for the powerful groups to influence the regional distribution in favour of their own areas.

The type of government and the types of interests that are represented in it also places restrictions on what sort of policies that will be proposed. One would expect the elite to be reluctant to suggest reforms that would eventually undermine their position. In systems where the distribution of economic and political power coincide, this is a strong force against redistributive policy in general.

When considering various regional policies, e.g. infrastructure investment, there are two questions that should be answered. First, we must consider whether it is a viable regional policy and how it should be designed to give maximum effect. Secondly, we have the question whether the policy measure really will be implemented by policy makers. It might very well be the case that for example the distribution of infrastructure rather reflects the distribution of economic resources and political power. In the latter case the distribution of infrastructure may aggravate the inequalities created by the endogenous economic forces rather than to counteract them.

We can distinguish two types of infrastructure. One is localized entirely within the region and affects it directly. The other type is infrastructure that improves contacts with other parts of the country. The effects of the latter kind seems more difficult to predict, as there could be negative as well as positive effect associated with it. Competition

from other regions would increase.

The factor most commonly referred to in connection with regional development policy is the development of infrastructure. Hirschman (1958) pointed to the construction of social overhead capital as one way of inducing private investment, and also within the growth centre tradition one has emphasized the need to create a favourable investment climate in lagging regions through a build up of overhead capital. Investment in for example education and health facilities in themselves constitute a contribution to the welfare of the population, but in this context one usually only considers the induced effects on other investment. Investment in such amenities may increase worker productivity, but it may also simply make the location more attractive to people. Also Richardson (1973, p. 232-233) suggests that infrastructure investment is the best way for a government to create agglomeration economies, which he considers to be the prime determinant of growth.

Of special interest in infrastructure development is the communication system. In many African states (cfr e.g. Mabogunje, 1965, 1971 on Nigeria): economic integration and production in the periphery is hampered by the inadequacy of the transport system. The transport networks developed by the colonial powers were intended to connect the areas of primary production with the export harbours or to secure political control. "Export-orientated planning and imperially constituted frontiers have lead to transport systems throughout Africa, which are wierdly irrelevant to population patterns, potential market areas, and natural sites for the development of industrial-agricultural complexes" (Green, Seidman, 1968, p. 66). The transport networks were designed not to facilitate the flow of people, goods, or information between different parts of the present nations. Improvements of the communication systems therefore is an important pre-requisite for improved integration. This in turn would hopefully facilitate the spread of economic impulses outside the most developed areas, and make it possible for the peripheral regions to increase production for markets outside the region.

The next type of measures that I consider is regional policies other than infrastructure investment. These can be of many kinds and more or less far-reaching. First of course there is the possibility of using various taxes or subsidies to stimulate firms to behave in the manner desired by the government. It can also use various ad hoc measures such as special funds, minimum wage differentials among regions, investment credit allowances, and selective duty remission and tariff protection. The measures can be combined with direct negotiations with the firms, which can get certain benefits in return for the acceptance of a certain location.

Another possibility is to use demand policy. The easiest way of course is to change the allocation of the government's own demand in favour of the lagging regions. By transferring money to the poor it should also be possible to shift consumer demand towards the poorer regions. One might also promote exports of goods produced mainly in the lagging regions, if agriculture dominates in these, which usually is the case.

If stimulus or negotiations are not effective enough one can go a step further and use direct regulation. The problem is, however, that in a free market system the producer can choose to abstain from making the investment all together if he can't make it at the location of his choice.

There is also the possibility of a more direct interference with or involvement in production by the government. It can pursue a structural policy either as a coordinator of independent producers or in an owner capacity. The ultimate policy in this respect would of course be a fully planned economy, but then we have a different economic system from the one to which I originally restricted my analysis.

One aspect of structural change that is important is to strengthen relations between agriculture and the rest of the economy. By increasing the flows between agriculture and the rest of the economy the development of the rural areas would receive more stimulus. This would be one way of facilitating the spread of growth impulses to the lagging regions (cfr. e.g. Lefebvre, Datta-Chaudhuri, 1971).

The fourth aspect I consider here is the regional incidence of general economic policies. As there are large differences in economic structure among regions one should expect a differential regional impact of certain general policies even if they are not regionally differentiated. An obvious example is the import substitution policy which most underdeveloped countries has pursued, which has worked against agriculture (Little, Scitovsky, Scott, 1970). As agriculture dominates in the lagging regions this increases regional inequality.

Another example is agricultural policies supporting large scale agriculture rather than small scale agriculture. If these two types of agriculture is found in different regions this policy will have the same disequalizing effect. It is probably fair to say that no policies whatsoever effects all regions equally. This should always be born in mind by policy makers if they mean business with their professions about regional equalization.

Finally I shall say something about migration. The policy issue here then is whether this migration, which is going on all the time, should be encouraged by the government. The answer to this question hinges on the effects that the migration has on the delivering as well as the receiving regions. The fast growing slums in many urban centres in the Third World may be an indication that migration already exceed what it is possible to cope with. Still, one could argue that as people move they must believe that it is in their interest. Even if they end up in very sordid conditions, the situation might have been even worse where they came from. The question then is whether there are external diseconomies related to this type of moves that would justify restrictions on migration.

7. The Problem of Regional Inequality: A Summing up

First I have identified the regional problem as one part of the general problem of distribution. It has, however, also a further dimension. If the regional inequalities are allowed to grow this might lead to tensions between different parts of a country. It is desirable to integrate all parts of a country in the process of development to get a stable base for long run development.

Of course the policy objective of regional per capita income equalization is not an unproblematic one. Regional equalization does not necessarily imply reduced personal inequality or even a more efficient spatial organization of production. It is possible to create regional equalization and at the same time increase inequality within the regions. Some qualification of the objective certainly need to be made in this respect by policy makers, when choosing among the regional policy alternatives available.

I am here primarily interested in the pattern of regional development today and less in the forces that created the present situation. I consider two main types of influences. First there are the endogeneous economic forces. It was pointed out that economies of scale tend to generate concentration of production. Still, from this we cannot draw any conclusions about where this concentration will be located. Because of this and because of the problem of dealing with internal economies of scale for aggregate sectors I have to leave them out of the analysis.

Instead I emphasize the role of input-output linkages among producers and the links between final demand and producers in determining locational choice. I have suggested that these forces tend to increase or preserve regional inequality in a poorly integrated, low income country.

Secondly, I consider the effects of economic policy and whether they counteract or reinforce the pattern of development generated by the endogenous forces.

8. Choice of Approach

When studying the evolution of a society a systems view is desirable. The strength of economics is its capacity to deal with interdependence within a system, that is to take a comprehensive view of the inter-relations between different parts of the economy. The problem in relation to social change is that it is impossible to cover all relevant aspects of the social system in a consistent way.

One alternative then is to try to cover all aspects, even if the analysis breaks down into a large number of partial analyses, whose internal consistency cannot be checked effectively. Approaches of this kind are for example Myrdal's Asian Drama (1968) and the ILO-report (1972) on Kenya.

The other alternative is to retain some kind of equilibrium framework, within which checks of internal consistency are possible. This means that the scope of the study has to be somewhat more narrow. It may not be possible a priori to determine which of these approaches is to be preferred. To a certain extent it must be dependent on the purpose of the analysis, but as interregional and intersectoral interdependences are of fundamental importance, for the development of regional inequality some kind of equilibrium framework is necessary here.

We thus need a model that can explain the growth of regional production and employment, and within which the effects of policy changes can be analysed. The main factors that should be taken into account were identified earlier.

As the model is to be implemented empirically in an underdeveloped economy that has a limited data base, the scope for modelbuilding is restricted. Still, the ambition must be to use a comprehensive approach. Partial analyses are unsatisfactory in this case, as interdependences among sectors and regions are involved in a fundamental way. Aggregate models are not satisfactory as they

neglect the importance of differences among regions in economic structure. Therefore a disaggregated model must be used. To analyse the growth rates in regions with very different economic structure the advantages of a disaggregated model are obvious.

The model will be used to generate a time pattern of regional incomes. To be able to present valid conclusions some kind of equilibrium framework has to be used. In analyses within the structuralist school one has mainly used one or the other of two simple models, namely "a neo-classical model with particular structural relations added or some version of a linear Leontief input-output model, which exclude most forms of substitution" (Chenery, 1975, p 312). The first type of model underestimates the importance of specific rigidities, while the latter may exaggerate them. The last mentioned approach is, however, still better suited in a situation where rigidities and slow adaption are typical features of reality.

In spite of the linearity assumption and other restrictive features the input-output technique has considerable advantages. It is a disaggregated equilibrium model, which is what we are looking for. At the same time the tool is operational and flexible.

If one is interested in constructing a positive, dynamic model some recursive variant seems to be the best alternative. Dynamic applications of recursive models have been concentrated to three fields, namely simulation of economic history, simulation of policy alternatives, and projection and forecasting. It is the two latter uses that we are interested in here.

A recursive model, furthermore, has philosophically attractive features. It seems reasonable to assume that it is beyond the capacity of economic decision makers to optimize over extended time horizons, and that their optimization decisions for each period not necessarily are intertemporally optimal (Day, 1973). Therefore a recursive approach can be based on more realistic behavioural assumptions. Another advantage with a sequential equilibrium model is that it facilitates computation.

What must be done in the present data situation is to find ways to extract as much information as possible from the existing empirical material. The amount of detail has to be kept down, particularly as the spatial dimension is introduced.

The model that will be used here is a recursive variant of an interregional input-output model. This type of model has the advantage compared to other regional models that it is empirically applicable, but still disaggregative as well as general (Riefler, 1973). It also takes into consideration the fact that the growth rate of a region is very much dependent on what is happening outside the region.

In his very critical appendix on the use of traditional economic models in underdeveloped countries Myrdal (1968, p. 1966) specifies what kind of model would be desirable.

"A multisector model would be preferable to a one-sector model, but the number of sectors would depend on the information available. Given adequate information an input-output model of the Leontief type would be preferable to a Keynesian model. A model incorporating interregional flows would be preferable to a one-region model. A model envisaging both cumulative movements and stable equilibria would be more helpful than one assuming stable equilibria only; one that successfully quantified relevant variations in behavior, institutions, and attitudes would be better than one that assumed them to be constant and adapted or automatically adjusted; one that allowed for the passage of time and that differentiated between a sum of independent decisions and a joint collective decision would be better than a timeless, atomistic one".

The approach suggested in this paper meets quite a few of those demands.

9. The Structure of the Model

The model will be used to simulate the development of production and employment by region and sector in Kenya. The starting year for the simulation will be 1971, the last year from which we have an input-output table. To be able to concentrate on the regional aspects the amount of detail on other aspects of the economy will be kept down as much as possible.

What I am interested in is not "planning", but rather analysis. This type of analysis can furnish information on regional problems, but no precise answers. It brings out in quantitative form the structure of the economy, and it may thereby serve an important pedagogical purpose. Datta-Chaudhuri (1975) has pointed out that on the basis of such a model we can for example not make a detailed investment plan. What can be drawn from the analysis are broad conclusions on how different forces determine the pattern of regional development and in what direction policy makers should try to influence these. Locational planning must be more specific.

A forecasting or projection model does not give prediction of the future that will be exactly correct but it should be able to suggest the general direction of movement. On the basis of the best data we have available and on hypotheses about the critical relationships in the economy, the model generates production and employment projections for different sectors and regions of the economy. We get a basic scenario. Then we can within the model test the effects of changes /¹¹ certain key parameters and the effects of various policy changes. The advantages as far as the policy analysis is concerned is that we are able to quantify the effects, and to study them systematically within a consistent framework.

The model focuses on the monetary part of the economy, as it is the regional incidence of monetary production that is the main cause of regional inequalities in per capita incomes. In Kenya monetary production constitutes more than three quarters of GDP.

One might, however, then ask what relevance this analysis has for the small scale farmers that constitute the majority of the population.

In the model they are mainly regarded as a pool of labour, but it should be borne in mind that more than fifty per cent of the production of modern agriculture emanates with the small scale farmers. Many of them thus have one foot in the monetary economy.

From the study we also can see how fast they can be absorbed into modern employment, and also where this increase in employment will take place. The process of "filtering down" would be facilitated with a more dispersed pattern of production. The commercialization of subsistence agriculture and also the growth of other economic activities should be stimulated by a closer contact.

Furthermore, through the extended family system incomes are redistributed outside the group of wage earners within the modern sector. Already now different types of wage employment yields important extra incomes for small farmer households. Therefore it is important also for family members who are not involved in the modern sector that some member of the family gets a job. The chances for someone in an area to get a modern sector job is greater if production is located nearby. Therefore equalization among regions is important for families in the remote and poor areas, even if only one member of the family gets a modern sector job.

Another limitation that should be pointed out is that the type of analysis presented here does not take cyclical phenomena into account. Short-run problems and instruments are ignored. What is generated by the model is a non-cyclical development patterns with slowly changing or constant regional and sectoral growth rates. What I am trying to do is to give a reasonably accurate description of the long-run development pattern.

The size of regional differences in income and employment are primarily determined by the sectoral structure of production within the regions. This is given a central role in the model, which generates a growth pattern by region and sector. There are mainly three types of factors which determine where the production increases occur within this regional-sectoral production system. They are 1) the interrelationships among producers, 2) the links between producers and the market (final demand), and 3) the availability of various types of infrastructure and government policies. The first aspect will be described by the interregional input-output table. The second is described by the functions generating demand by sector and region. The third, however, still is a bit of a problem. One possibility is to let the development of infrastructure influence the allocation of demand.

The pattern and growth of demand is the driving force in the model. Endogenously the model determines production and employment by sector and province and migration.

The sectors in the analysis are-

1. Subsistence
2. Modern agriculture
3. Mining
4. Manufacturing
5. Construction
6. Electricity & Water
7. Commerce
8. Transport
9. Services.

In the first step the model equates supply and demand for these nine aggregate commodities. In the solution of production there then exists an equilibrium in the sense that there is no excess demand in the product market. This result is taken as an input in the following sub-models, in which no equilibrium is reached. The employment model does not clear the labour market, and the migration flows are also partial adjustments to regional differences.

Robinson (1976, p. 126) points out that such a distinction between equilibrium and disequilibrium model permits a "much more realistic modelling of dynamic processes".

This model shares with most economy-wide models the feature that it is formulated in real terms, and that it ignores price changes and financial aspects. The concentration is on the allocation of resources and structural change.

The simulation consists of five steps for each year:-

STEP 1: Determination of final demand by sector and region

STEP 2: Determination of production by region and sector by use of the interregional input-output model.

STEP 3: Determination of employment by region and sector.

STEP 4: Determination of population size by region.

STEP 5: Calculation of regional per capita income.

9.1 Estimation of Final Demand by Region and Sector (Step 1)

If there are r regions and i sectors, the interregional input-output matrix will be of size $r_i \times r_i$. (How to estimate the interregional input-output coefficients is discussed in another paper.)

To determine demand by region and sector we then have to estimate r_i items of each of private consumption, government consumption, total gross fixed capital investment, exports, and imports. This makes a total of $5r_i$ items. The estimation is complicated by the fact that consumption and investment demand in each regional sector is composed of the demand from each of the r regions.

Consecutive periods must be linked to each other so we get a recursive structure. As I solve the model in a sequential manner I must calculate demand on the basis of information from the previous period(s) as no information is at this stage known about the present period. I let final demand for private consumption be determined by income in the previous period. The growth of total investment is treated as a policy parameter assumed to be fixed by the government, but its distribution among sectors depend on the growth of production within various sectors during the previous period. An alternative way would be to make investment an endogenous variable, whose size would be determined by the availability of local savings and the inflow of foreign capital.

Demand for government consumption within each region can be assumed to be catered for by the government sector within that region. Export from Kenya can be considered to be exogenously determined and to grow at a constant rate. This is a common assumption (cfr e.g. Johansen 1974, p. 31). The growth of exports to a great extent is determined by what is happening abroad. It is beyond the scope of this study to go into this question.

I differentiate between intermediate imports and other imports. Intermediate imports are treated as non-competitive and are assumed to constitute a constant proportion of production, while imports for consumption and investment (competitive) are assumed to grow in line with consumption and investment demand. Also here one must introduce a one period lag to avoid simultaneity.

I then add the various categories of final demand and arrive at the sum of final demands directed to each regional sector.

1. $Z = FD - MC = C + I + G + E - MC$

Z - net final demand

FD - final demand

MC - competitive imports

C - private consumption

I - total gross fixed capital investment

G - government consumption

E - exports

9.2. Determination of Regional Production (Step 2)

When net final demand has been estimated in the manner described above for all sectors in all regions gross output can be calculated by

2. $Y = (I - A)^{-1}Z$

Y - gross output, which here also includes non-competitive imports, that is intermediate imports, as well as domestic intermediate inputs

A - interregional input-output coefficients (a_{ij}^{rs} 's)

I calculate value added (and regional income) from this by using value added coefficients for output, which can be derived from the input-output table.

The development of sectoral production is thus endogenously determined within the constraints given by aggregate investment and demand.

For illustrative purposes we will look at a two-region, two-sector case. Formula (2) then can be written

$$\begin{matrix}
 y_1^1 & 1 - a_{11}^{11} & - a_{12}^{11} & - a_{11}^{12} & - a_{12}^{12} & z_1^1 \\
 3. y_2^1 & - a_{21}^{11} & 1 - a_{22}^{11} & - a_{21}^{12} & - a_{22}^{12} & z_2^1 \\
 y_1^2 & - a_{11}^{21} & - a_{12}^{21} & 1 - a_{11}^{22} & - a_{12}^{22} & z_1^2 \\
 y_2^2 & - a_{21}^{21} & - a_{22}^{21} & - a_{21}^{22} & 1 - a_{22}^{22} & z_2^2
 \end{matrix}$$

y_i^r refers to gross output in sector i in region r , and a_{ij}^{rs} is the coefficient for deliveries from sector i in region r to sector j in region s .

Something should also be said about the possibility of solution. It is well known that to have a non-negative solution to the system the matrix $(Y) (1 - A)X = Z$ must satisfy the Hawkins-Simon condition. This condition is naturally met in a published input-output table and relation (4) has a unique, non-negative solution for any non-negative final demand.

As long as $C + I + G + E - MC$ is non-negative we will thus get a non-negative solution and the system is workable. Whether we will get a feasible growth path therefore depends on the development of Z . The stability of Z will depend on how the various demand components develop, which depend on how the demand functions are specified. This problem will be discussed in relation to the actual application, where these functions have been specified.

9.3 Determination of Employment by Region and Sector (Step 3)

Estimation of employment can be made by different methods depending on what kind of data one has access to. What is known at this stage of the simulation is output by sector and region. One alternative would be to use a production function approach, but this would meet with serious problems. First, there are no data on capital stock by region and the sectoral breakdown is incomplete. A distribution of the aggregate capital stock by sector and region would rest on very shaky foundations. Secondly, shifts in the production functions are of great importance, and there exist very little time series data that can be used to estimate shiftfactors.

As it is not feasible to use production functions I will instead use the simpler approach with labour productivity functions, that is relations of the form $y_i = F(t)L_i$, where y is output, L employment, and $F(t)$ a time function.

9.4 Determination of Population Size by Region (Step 4)

The growth of the population within a region is determined by two factors, namely the intrinsic rate of population growth and migration. For simplicity the first factor is taken as constant, but of course there is scope for improvements here. If the analysis were for a period of several decades it would be necessary. A little more should be said about migration. Numerous papers have been written on urban-rural migration (the best known are Todaro (1969), Harris and Todaro (1970)) and there is now widespread agreement that it to a large extent can be explained by economic factors. One often distinguishes two factors; the "push" from traditional agriculture, and the "pull" exerted by the high wages within modern urban employment as well as public capital such as education, health, services etc. In this model we deal with inter-regional migration, but I see no reason to suspect that this type of migration is determined by other types of factors.

The data that we get from previous steps are data on output and employment. The employment and income situation can then be taken as the determinant of migration.

9.5. Calculation of Per Capita Regional Incomes (Step 5)

This step is very simple if one only divides regional value added by regional population. One then obtains per capita regional incomes. Still, if one is interested in disposable income, (disregarding taxes) one must should try to include income transfers as well, and they often are of considerable importance.

9.6 Concluding Remark

There is a problem here as a great deficit in the balance of payments may make a realisation of the final demand impossible, unless investment is made endogenous as suggested as an alternative above. This can make necessary some kinds of economic adjustments, but that cannot be analysed within this model as it is outlined here. This model only generates a series of external balances, and as long as the deficits are not too large one can assume that they are covered by capital inflow.

1. Adelman, I. Morris, C. (1971), An Anatomy of Income Distribution Patterns in Developing Nations - A Summary of Findings, IBRD, mimeo.
2. Adelman, I. Morris, C. (1973), Economic Growth and Social Equity in Developing Countries, Stanford University Press, Stanford.
3. Adelman, I. Morris, C. Robinson, S. (1976), "Policies for Equitable Growth", World Development, vol. 4.
4. Ahluwalia, M.S. (1976a), "Income Distribution and Development: Some Stylised Facts", American Economic Review, vol. 66.
5. Ahluwalia, M.S. (1976b), "Inequality, Poverty, and Development" Journal of Development Economics, vol. 3.
6. Alonso, W. (1968), "Urban and Regional Imbalances in Economic Development", Economic Development and Cultural Change, vol. 17.
7. Amin, S. (1970) L'accumulation a l'echelle mondiale, Anthropos, Paris.
8. Blaug, M. (1964), "A Case of the Emperor's Clothes: Perroux's Theories of Economic Domination", Kyklos, vol. 17.
9. Blitzer, C.R. Clark, P.B. Taylor, L. (Eds.) (1975), Economy-Wide Models and Development Planning, Oxford University Press, London.
10. Borts, G.H. Stein, J.L. (1964) Economic Growth in a Free Market, New York.
11. Boudeville, J.R. (1966) Problems of Regional Economic Planning, Edinburgh University Press.
12. Chenery, H. (1975), "The Structuralist Approach to Development Policy", American Economic Review, vol. 65.
13. Chenery, H. et al (1974); Redistribution with Growth, Oxford University Press, London.
14. Chenery, H. Syrquin, M. (1975), Patterns of Development, 1950-1970, Oxford University Press, London.
15. Cline, W.R. (1975) "Distribution and Development: A Survey of Literature", Journal of Development Economics, vol. 1.
16. Datta-Chaudhuri, M. (1975), "Interindustry Planning Models for a Multi-regional Economy", in Blitzer, Clark, Taylor (Eds.).
17. Day, R.H. (1973), "Recursive Programming Models: A Brief Introduction", in Judge, Takayama (Eds.).
18. Dixon, R. Thirlwall, A.P. (1975), "A Model of Regional Growth Rate Differences on Kaldorian Lines", Oxford Economic Paper, vol. 27.
19. Frank, A.G. (1969) Capitalism and Underdevelopment in Latin America. Rev. ed. Modern Reader Paperbacks, New York.
20. Friedman, J. (1966), Regional Development Policy. A Case Study of Venezuela, MIT Press, Cambridge, Mass.

21. Friedman, J. (1972), "A Generalized Theory of Polarized Development", in Hansen (Ed.)
22. Gilbert, A. Goodman, D.E. (1976) "Regional Income Disparities and Economic Development: A Critique", in Gilbert, Goodman (Eds).
23. Gilbert, A. Goodman, D.E. (Eds) (1976), Development Planning and Spatial Structure, Wiley, New York.
24. Green, R.H. Seidman, A. (1968), Unity or Poverty. The Economics of Pan-Africanism, Penguin, Harmondsworth.
25. Hansen, N.M. (Ed) (1972), Growth Centres in Regional Economic Development, The Free Press, New York.
26. Harris, J.R. Todaro. M. (1970), "Migration, Unemployment, and Development", American Economic Review, vol. 60.
27. Hermansen, T. (1972) "Development Poles and Related Theories, Astnoptic View", in Hansen (Ed).
28. Hieschman, A.O. (1958), The Strategy of Economic Development, Yale University Press, New Haven.
29. ILO (1972) Employment, Incomes, and Equality. A Strategy for Increasing Productive Employment in Kenya, Geneva.
30. ILO (1976), Employment, Growth and Basic Needs, Geneva.
31. Jain, S. (1975), Size Distribution of Income, A Compilation of Data, The Johns Hopkins Press.
32. Johansen, L. (1974), A Multi-Sectoral Study of Economic Growth, 2nd ed, North-Holland, Amsterdam.
33. Judge, G.G. Takayama, T. (Eds) (1973), Studies in Economic Planning Over Space and Time, North-Holland, Amsterdam.
34. Kaldor, N. (1970), "The Case for Regional Policy", The Scottish Journal of Political Economy, vol. 17.
35. Kaldor, N. (1972), "The Irrelevance of Equilibrium Economics", Economic Journal, vol. 82.
36. Karvis, B. (1960), "International Differences in the Distribution of Income", Review of Economics and Statistics, vol. 42.
37. Kuznets, S. (1955) "Economic Growth and Income Inequality", American Economic Review, vol. 45.
38. Kuznets, S. (1962) 'Quantitative Aspects of the Growth of Nations VII, The Share and Structure of Consumption', Economic Development and Cultural Change, vol. 10.
39. Lefeber, L. Datta-Chaudhuri, M. (1971) Regional Development Experiences and Prospects in South and Southeast Asia, Mouton, Paris.
40. Lewis, W.A. (1954), "Economic Development with Unlimited Supplies of Labour", Manchester School of Economic and Social Studies, vol. 22.
41. Lewis, W.A. (1958), "Unlimited Labour: Further Notes", Manchester School of Social and Economic Studies, vol. 26.

42. Little, I. Scitovsky, T. Scott, M. (1970), Industry and Trade in Some Developing Countries, Oxford University Press, London.
43. Mabogunje, A. L. (1965), "Urbanization in Nigeria - A Constraint on Economic Development", Economic Development and Cultural Change, vol. 13.
44. Mabogunje, A.L. (1971), Growth Poles and Growth Centres in the Regional Development of Nigeria, UNRISD, Geneva.
45. McKee, D., Dean, D. Leahy, W.H. (1970) Regional Economics - Theory and Practice, The Free Press, New York.
46. Myrdal, G. (1957) Economic Theory and Underdeveloped Regions. Meuthen, London.
47. Myrdal, G. (1968) Asian Drama, Pantheon, New York.
48. Oshima, H. (1962) "The International Comparison of Size Distribution of Family Incomes with Special Reference to Asia", Review of Economics and Statistics, vol. 44.
49. Paukert, F. (1973) "Income Distribution at Different Levels of Development. A Survey of Evidence", International Labour Review.
50. Perroux, F. (1955), "Note on the Concept of Growth Pole", in McKee, Dean, Leahy (Eds).
51. Richardson, H.W. (1969), Regional Economics, Weidenfeld and Nicolson, London.
52. Richardson, H.W. (1973), Regional Growth Theory, McMillan, London.
53. Riefler, R. F. (1973), "Interregional Input-Output: A State of the Arts Survey", in Judge, Takayama (Eds).
54. Robinson, S. (1976), "Toward an Adequate Long-Run Model of Income Distribution and Economic Development", American Economic Review, vol. 66.
55. Rosenstein-Rodan, P.N. (1943), "Problems of Industrialization in Eastern and Southern Europe", Economic Journal. vol. 53.
56. Schumpeter, J. (1911), this edition 1969, The Theory of Economic Development, Oxford University Press, London.
57. Siebert, H. (1969), Regional Economic Growth: Theory and Policy, International Textbook C.O. Scranton, Pa.
58. Silberston, A. (1972), "Economics of Scale in Theory and Practice", Economic Journal, vol. 82.
59. Sunkel. O. (1973), "Transnational Capitalism and National Disintegration in Latin America", Social and Economic Studies, vol. 22.
60. Todaro, M. (1969), "A Model of Labour Migration and Urban Unemployment in Less Developed Countries", American Economic Review, vol. 59.
61. Westphal, L. (1975), "Planning with Economies of Scale" in Blitzer, Clark, Taylor (Eds).
62. Williamson, J.G. (1965), "Regional Inequality and the Process of National Development: A Description of Patterns", Economic Development and Cultural Change, vol. 13.

42. Little, I. (1970), Industry and Trade in Developing Countries, Oxford University Press, London.

43. Haborngje, A. L. (1983), "Industrialization in Nigeria - A Contribution to Economic Development", Economic Development and Cultural Change, vol. 34.

44. Haborngje, A. L. (1971), Growth Poles and Growth Centres in the Regional Development of Nigeria, UNRISD, Geneva.

45. McKee, D., Dean, D. Leahy, W. R. (1970) Regional Economics - Theory and Practice, The Free Press, New York.

46. Wrdal, G. (1957) Economic Theory and Underdeveloped Regions, Routledge, London.

47. Wrdal, G. (1968) Asian Drama, Pantheon, New York.

48. Goshal, H. (1982) "The International Comparison of Size Distribution of Family Income with Special Reference to Asia", Journal of Economics and Statistics, vol. 60.

49. Parkert, F. (1973) "Income Distribution at Different Levels of Development. A Survey of Evidence", International Labour Review.

50. Perroux, F. (1955), "Note on the Concept of Growth Pole", in McKee, Dean Leahy (Eds).

51. Richardson, R.W. (1969), Regional Economics, Weidenfeld and Nicolson, London.

52. Richardson, R.W. (1973), Regional Growth Theory, Weidenfeld, London.

53. Rietler, R. F. (1973), "Interregional Input-Output: A State of the Arts Survey", in Journal of Regional Science (Eds).

54. Robinson, E. (1970), "Toward an Adequate Long-Run Model of Income Distribution and Economic Development", American Economic Review, vol. 60.

55. Rosenstein-Rodan, P.M. (1943), "Problems of Industrialization in Eastern and Southern Europe", Economic Journal, vol. 53.

56. Schumpeter, J. (1911), this edition 1989, The Theory of Economic Development, Oxford University Press, London.

57. Siefert, H. (1982), Regional Economic Growth: Theory and Policy, International Textbook Co., Toronto, Pa.

58. Silberstein, J. (1977), "Economics of Scale in Theory and Practice", Economic Journal, vol. 87.

59. Sunkel, O. (1973), "International Capitalism and National Industrialization in Latin America", Journal of Economic Surveys, vol. 14.

60. Tobin, M. (1962), "A Model of Labor Market and Urban Growth: A Study in Less Developed Countries", American Economic Review, vol. 52.

61. Westphal, L. (1972), "Planning with Location of Scale", in Journal of Economic Theory (Eds).

62. Williamson, J.C. (1985), "Regional Growth and the Process of Industrial Development: A Survey of the Literature", Economic Journal, vol. 95.