REGIONAL DEMOECONOMIC GROWTH

A Survey of Theories and Empirical Models

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Preface

This paper is a first draft of a chapter of the author's doctoral dissertation on regional demoeconomic growth to be submitted to Northwestern University in the field of Urban Systems Engineering and Policy Planning. It therefore should not be cited or quoted without the author's permission.

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Summary

This paper is a survey of recent economic research concerning the spatial allocation of demoeconomic growth--that is the change in the location of jobs and people--within a nation. It critically examines existing theories as well as empirical evidence derived from these theories or from more pragmatic studies.

The main conclusion is that, to date, theories and empirical models have contributed very little to the explanation of the role of firms and households in shaping the spatial pattern of demoeconomic growth. Too often framed in independent and incomplete terms, past research efforts have led to inconsistent results, and therefore have never been useful for policy application. Particularly striking is their inadequate treatment of the temporal and spatial dimensions of regional development.

On the one hand, attention has been focused on a specific *time* horizon, either the long run (export-base and labor supply approaches) or the short run (simultaneous-equation models of urban growth built in the last decade or behavioral models of regional labor markets having microeconomic foundations). These approaches hardly brought insights into the identification of the sources of regional demoeconomic growth, a problem which presents a rather complex time structure.

On the other hand, past regional studies, either theoretical or empirical, have generally ignored *space*, except those that have examined the behavior of firms and household in rather independent terms. Additional exceptions are some recent verbal explanations of regional growth (e.g., Richardson 1973). This paper thus includes a review of studies concerned with the determinants of the expansion and relocation of firms as well as with the determinants of the migration of households.

Finally, the spatial allocation of demoeconomic growth is a very complex problem that cannot be studied within the partial frameworks proposed in past economic studies. The diversity and complexity of intervening elements call for a larger approach: the systems analysis approach.

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Regional Demoeconomic Growth: A Survey of Theories and Empirical Models

INTRODUCTION

In developed societies, local areas can present quite different behaviors within the same country: some regions decline economically and lose population at the same time that others experience a higher than average development which is sometimes accompanied by rapid population growth. A comprehensive explanation of this differential evolution is currently beyond our reach because few insights into the mechanisms causing and shaping the spatial pattern of demoeconomic growth within a country have been obtained to date: the identification of the sources of regional development remains a subject of controversy.

Summarizing the various positions taken in the debate, Hirsch (1973) has typified two polar approaches: the industry-initiated and the household-initiated theories of regional development. However, they are more commonly known as the export-base and labor supply theories respectively. The first one, which dates back to an earlier stage of economics (see Lane 1966), suggests that

> Industry decides where future growth will take place and that in making such decisions firms are relatively insensitive to the locational choices and preferences of households. (Miron, 1977, p. 1)

The alternative approach, first developed by Borts and Stein (1964), argues that

> It is the locational behavior and preference of households which through their roles as consumers of goods and services and as suppliers of labor, determine the evolving spatial pattern of growth and development within a nation. (Miron, 1977, p. 1)

Clearly, in the real world, the two paths of causation that these two polar theories underline are not mutually exclusive

but are coexistent. In the last decade, several empirical models were developed taking into account the simultaneous nature of the locational choices and preferences of firms and households. However, these models tend to focus on the short-run dynamics of regional labor markets by emphasizing the processes by which firms and workers make their respective decisions. In doing so, they overlook the problem of growth initiation by firms and households by concentrating on the capability of firms and workers to speed up or slow down regional development. Clearly, this suggests that future research ought to be redirected to permit a better understanding of the forces which cause and shape the spatial pattern of demoeconomic growth.

The purpose of the present report is to help initiate and direct such a research effort by providing guidelines, drawn from a review of theories and models recently proposed. Part One, critically examines the traditional approaches to regional development, as well as the aggregative models mentioned above.

Part Two focuses on those research efforts that have emphasized the clearing mechanisms of regional labor markets. It includes a brief survey of the determinants of labor force participation but especially evaluates the potential offered by the behavioral approach recently advocated to overcome the failure of the macroeconomic approach explained in Part One.

Part Three reviews theoretical and empirical studies which have focused on partial or independent behavioral aspects of firms and households in the spatial dimension. Attention is focused on the impact of distance, location and agglomeration economies on regional development, a subject hardly ever considered in the aggregative theories and models reviewed in Part One. The determinants of firms' expansion and relocation as well as the determinants of the migration of households are also examined. The spatial dimension, has however, been included in recent theories of regional demoeconomic growth proposed by Richardson (1973) and von Böventer (1975), whose contributions are also evaluated.

Our survey concludes with the narrow perspective taken by economists to deal with regional demoeconomic growth and advocates a broader approach of the problem through the application of systems analysis methods.

Before turning to Part One, we must note that the reference to regional development or demoeconomic growth, used throughout this paper, is a misnomer. The argument developed in this report also applies to the case of regional decline. Indeed, the use of the word change, rather than growth (or decline), would, have been more appropriate.

Additionally, we must point out that we do not discuss the spatial unit to which regional demoeconomic growth applies, i.e., how an area is defined. The problem is deliberately ignored for two main reasons. First, there is substantial literature on the topic, some of which gives a fairly satisfactory answer. Second, in most instances, past research has dealt indifferently with regions--understood in a political or economic sense--or with metropolitan areas.

PART I. AGGREGATIVE EXPLANATIONS OF REGIONAL DEMOECOMIC GROWTH

An assessment of the contribution of economists in providing aggregative explanations of regional development or economic growth must be considered first. Certainly, the best index measuring such development is growth in per capita income, defined by comparing an economic term (income growth) and a demographic term (population growth). However, the knowledge of the evolution of such an index is not as telling with regard to the area's development as the knowledge of the evolution of both the economic and demographic terms which define it: the per capita income growth concept gives insights into only the relative--but not the absolute--evolution of income and population growth.

The initial purpose of this paper is to discuss how economists explain the evolution of income and population growth at the

regional level and more specifically their interaction. However, the economists' explanations rarely use income growth as an economic growth measure. The paucity of income data at the level of small areas and the larger availability of data on the labor input, have led to a more common--but less precise--reliance on employment growth. Another reason for the choice of employment as an economic measure is perhaps the similarity of the measurement units for employment and population. Thus, a large part of past theories and models of regional development have focused on the growth and interaction of employment and population. Little consideration has been given to income, and whenever this variable has been included, it has been used on a per capita basis as a proxy for the wage level.

Hence, the overriding emphasis of past explanations of regional demoeconomic growth is the labor market. But these explanations are largely influenced by a nation's economic theories with little regard for the spatial dimension of the problem. Therefore, available theories of regional development deal primarily with either the demand side (influenced by Keynesian economics), or the supply side (influenced by neoclassical economics). These polar theories, emphasizing the role of firms and workers respectively, in shaping the spatial pattern of demoeconomic growth in developed countries, are examined and contrasted in section 1.1.

The views of labor migration implied by these alternative theories favor job opportunities (demand explanation) or relative wages (supply explanation), as the key determinant. The job opportunity and wage differentials hypotheses are examined and contrasted in section 1.2.

In reality, the two polar explanations of regional growth are not exclusive of each other but rather are complementary: the demand and supply sides affect each other through the clearing mechanisms of the labor market. In the late sixties and early seventies this observation led several researchers to construct mixed demand-supply oriented models of regional demoeconomic growth,

based on a simultaneous-equation formulation. These models, which have been devised with reference to metropolitan growth in North America, are critically examined in section 1.3.

1.1 Alternative Theories of Regional Demoeconomic Growth

Historically, the first explanation of regional demoeconomic growth put forth was the export-base theory inherited from Keynesian economics. The alternative explanation (labor supply approach) was proposed much later, soon after the interest of national economists shifted from Keynesian economics to neo-classical economics and growth models. Broadly speaking, these two explanations retain the main features of their background: on the one hand, the export-base theory supposes that an area's growth is only limited by its factor demand and is not constrained by input factors assumed to be perfectly elastic; on the other hand, the alternative approach assumes that an area's growth only arises from the growth of its input factors.

The Demand-oriented Explanation

In this first approach to regional development, it is assumed that an area's economic growth is induced by factor demand and thus depends on exogenous expenditures in the Keynesian sense. However, regional economists have primarily focused on exports as being the only source of autonomous spending. The roles of other types of expenditures such as government spending and investment have not been investigated as extensively (a few considerations concerning these expenditures will be given later on)*. This restriction in scope has led to the development of the well known export-base theory.

A Brief Description of the Export-base Theory

In general terms, the export-base analysis assumes that a regional economy operates on two scales:

*Note that regional demand, the other type of final demand is accounted for endogenously within this explanation.

a) either transactions take place internally and are carried out on a 'non-basic' scale, i.e., they involve the recycling of money already in the regional economy, or

b) transactions involve the export of goods or services that are purchased by an outsider, i.e., they require the importation of money from outside the considered area. They are called 'basic' activities because the money that they bring into the regional economy supposedly leads to the growth and expansion of economic activity within the area.

From this dichotomy, the conceptual basis of the export-base theory is defined by assuming that the part of income, derived from the production of basic (export) goods which is spent regionally, determines the amount of income which is available for the production of non-basic (regional) goods. Then, to the extent that in both basic and dependent sectors there is a close relationship between income and employment*, the export-base theory asserts that the amount of employment in the basic sector (E_b) determines the area's total employment (E_t)

$$E_t = \mu + \gamma E_b \quad . \tag{1}$$

What is the rationale for asserting that this relationship between the basic and the dependent sectors exists? Lane (1966) contends that "there is no body of a priori analysis from which this conclusion (relationship) can be rigorously drawn". Nevertheless, it is possible to imagine a plausible set of assumptions which could underlie this explanation of regional growth.

Assume an area can, through any increase of the wage rate, attract a very large flow of immigrant workers, i.e., the area

*Note that the substitution of employment terms for income terms in the exposition of the export-base concept is not necessary (see Bolton, 1966, for a good exposition in income terms), but is generally required in order to apply the theory to real situations because of data considerations.

has a largely elastic labor supply. As a consequence of an increase in export demand, workers inmigrate and tend to place an increased demand on the regional sector. Now, assume that

a) the regional sector's output is not constrained by factor supplies and requires labor inputs in proportion to its output, and that

b) each type of worker, resident and inmigrant, has the same demand function for the regional sector output.

If one assumes a constant activity rate in the area's population, employment in the local sector E_s is then linked to the region's total population P by

$$E_s = \alpha + \beta P \quad . \tag{2}$$

Assume further, that the export and local sectors pay the same wage; then any increase (decrease) in each sector's demand leads to the migration of workers into (out of) the area and the following relationship linking P and E_t can be reasonably postulated:

$$P = a + b E_t \quad . \tag{3}$$

Combining (2), (3) and the identity

$$E_t = E_b + E_s \quad , \tag{4}$$

we obtain precisely equation (1) above, i.e.

$$E_t = \mu + \gamma E_b \quad , \tag{1}$$

in which μ and γ (referred to as the marginal export-base multiplier) are combinations of the coefficients of (2) and (3):

$$\mu = \frac{\alpha + \beta a}{1 - \beta b} \quad ; \quad \gamma = \frac{1}{1 - \beta b} \quad . \tag{5}$$

Thus, the export-base theory is a demand-oriented one in which growth is generated by exogenous export demand through a scheme similar to the Keynesian multiplier: total employment is some multiple of basic employment.

It follows that, in this explanation of regional growth, an area's employment is determined by external conditions which fix the amount of basic employment. Moreover, it is independent of factor supplies: the necessary increases in labor and capital inputs are always forthcoming with no consideration given to factor market conditions in general. Demand for labor (and capital) is thus exogenous and rather inelastic to prices and wages.

In the short run, an increase in the demand for basic commodities in an area (illustrated by the rightward shift of the demand curve from D_1 to D_2 in Figure 1) induces a rise in the wage rate (from W to W´) if all labor demands are met by the available local labor surplus. But, as new workers enter the area, in response to increased employment opportunities, a rightward shift in the labor supply curve from S_1 to S_2 occurs, thus leaving unchanged the level of employment. This in turn, causes a lowering of the wage rate from W´ to W´´. However, owing to the high elasticity of the labor supply, the changes W´´ - W in the wage rates are expected to be small.

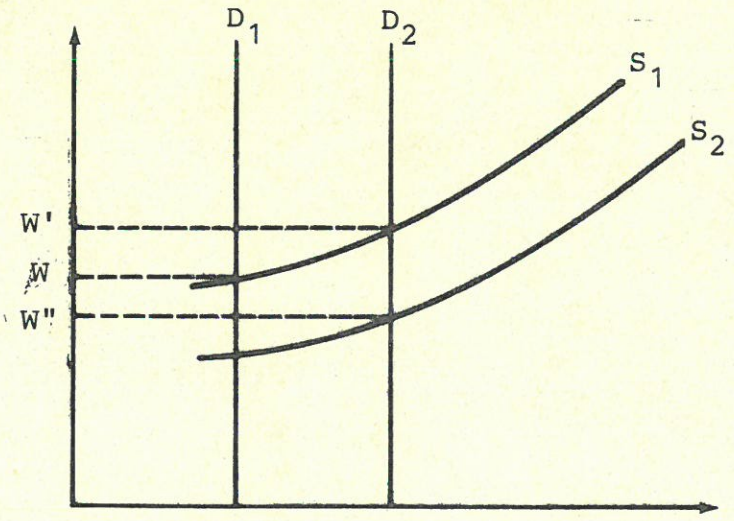

Figure 1. The export-base theory.

Therefore, in the long run, because of perfectly elastic labor supply curves, the movement of workers occurs due to regional differences in job opportunities: this movement is from regions of relatively small size and low employment growth to those of relatively large size and high employment growth.

Thus, the export-base theory leads to a long-term equilibrium representation in which the supply of labor has no meaningful effect: "there is no role for unknown market dynamics because migration implicitly brings the market into continuous equilibrium". (Miron, 1975, p. 13). Since the rising returns generated by the growth of external receipts lead to an automatic increase in an area's supply of labor, a shortage or surplus of labor does not have any effect on regional growth.

Indeed, the same criticism applies to capital, which leads Richardson (1973) to raise yet another objection concerning the direction of capital flows. He contends that, in most instances, since an increase in an area's gross export tends to induce more growth, fast-growing areas tend to export capital. He argues:

> We would normally expect fast-growing regions to import rather than to export capital, i.e., to run import surpluses. For a fast-growing region to be a net exporter of capital (the typical export-base case), it is probably necessary for the region in question to have such a high savings rate that it can both finance fast internal growth and export capital to other regions. (Richardson, 1973, p. 17)

Empirical Verification of the Export-base Theory

A preliminary step in verifying the export-base theory consists of identifying and measuring the parts of each economic sector whose output are sold within and outside the considered region. However, such a separation cannot be generally implemented from commonly available data and must be carried out using special surveys or secondary data.

As a consequence, the findings of any study aiming at verifying or using the export-base theory are not independent of the method chosen to estimate the export-base sector. This unfortunately leads to a questioning of the validity of any practical

application of the theory, making its evaluation and use very troublesome. Nevertheless, if one is willing to ignore this practical consideration, it is possible to evaluate the theory by testing its main proposition regarding the relationship between export employment (E_b) and total employment (E_t) embodied in equation (1).

Note that in testing this relationship, the use of total employment as a dependent variable tends to yield a spurious measure of correlation between E_b and E_t due to the inclusion of the independent variable as part of the dependent variable (Weiss and Gooding, 1968; Moody and Puffer, 1970). Thus it is preferable to test the validity of the export-base theory by plotting E_s (local employment) against E_b. The two are linked by the following relationship, obtained by subtracting E_b from each side of (1)

$$E_s = \mu + (\gamma - 1)E_b \quad . \tag{6}$$

Several past studies have attempted to fit (1) or (6) to actual data relating to urban areas over various periods of time, using ordinary least squares (OLS) estimation. Among those researchers who reported positive findings concerning the validity of the theory, Hildebrand and Mace Jr. (1950) found a high correlation between dependent and export employment in Los Angeles County during a span of 37 peace time months in the 1940's. Thompson (1959), in a study of Lincoln, Nebraska, calculated an export employment multiplier which apparently confirms the validity of the theory (although he did not present a correlation coefficient). Sasaki (1963) found a high correlation between the relationship between export employment and total employment changes in Hawaii, using annual data from 1945 to 1955. In a study of Portsmouth, Weiss and Gooding (1968) estimated from annual data over the period 1955-1964, three differential employment multipliers relating to three different classifications of export employment. They obtained relatively high coefficients

of determination, over .90 using total employment as a dependent variable and .78 using non-basic employment.

In contrast to this, some other studies have reported negative findings concerning the validity of the export-base theory. The often cited employment multiplier study of Wichita (Federal Reserve Bank of Kansas City, 1952), showed a low correlation between export and local employments. Moody and Puffer (1970), using monthly employment data for San Diego from January 1949 to December 1966, obtained a similarly low correlation (R^2 = .14). In a study of nine metropolitan areas in the district on the Federal Reserve Bank of St. Louis, Luttrell and Gray (1970), found that "growth in the export-base sector did not create multiple employment expansion".

In summary, there appears to be unconvincing empirical evidence in verifying the validity of the export-base that one can attribute, for a large part, to the difficulties in measuring the export-base sector. However, Moody and Puffer (1970) contend that this could also be the result of the delayed reactions of employers of the local sector, to changes in basic employment. They present two adjustment process models to provide tests for various hypotheses concerning the relationship between E_s and E_b. Their results eventually suggest that the export-base theory might still be verified but that there would be an extremely slow adjustment to equilibrium.

A Brief Evaluation of the Export-base Theory

To summarize, the main characteristic of the export-base approach to regional growth is the lack of consideration of labor supply conditions. By focusing on a demand explanation of regional growth stressing the role of exports as the unique motivating force of development, it ignores the internal mechanisms at work in an area's economy. Regional growth is generated outside the area by an unknown mechanism determining interregional demand for commodities, and, in particular, the level of exports for the area. The resulting growth of the area's exports then

determines the growth of local employment through the multiplier mechanism imbedded in the theory. Consequently, employment change only arises from the action of firms reacting to external demand. Workers are reduced to a passive role in shaping development: they respond to changes in job opportunities, but do not influence them in any circumstance.

In short, "(Any area) exists at the whim of exogenously defined variables and has no means, for example, of enabling its own growth." (Miron, 1975). Thus the export-base approach "based on a series of relatively harsh assumptions" (Conroy, 1975), appears as a very naive framework holding little promise for dealing with a regional area's demoeconomic growth (or decline).

The Supply-oriented Explanation

Borts and Stein (1964) have presented the first supply-oriented explanation of interregional development in which output growth can come from sources related to capital and labor resources. Their discussion of this supply-oriented explanation consists of two phases: an initial model (Borts, 1960) which was based on the evaluation of the economic consequences of simple regional increases in the quantity of these resources, was later contradicted by empirical testing; it was subsequently replaced by a modified model allowing for the reallocation of these resources (in particular, labor supply shifts).

Description and Statistical Test of Borts's Theory of Regional Growth

Borts (1960) divides the economy into two or more regions in which identical production processes of the same single output take place, with no economies of scale, in a full employment situation. In addition, labor and capital inputs are homogenous units and capital consists of reinvested units of output. Then, if pure competition prevails in each region, Borts demonstrates analytically, that the ratio of capital to labor determines the wage level. This result is based on the assumption that firms equate the value of the marginal product with its price of

capital: the labor-capital ratio determines the marginal physical product of labor and, with the price of the uniquely processed product, determines the equilibrium wage which is equal to the value of the marginal product of labor.

In this model, factor proportions play such a dominant role that patterns of growth are generated by initial disparities in resource endowment. Those regions with a high capital-labor ratio experience relatively high marginal products of labor (wage rates) while those with lower capital-labor ratios experience the opposite. Thus, in a free market, producers would tend to move to low-wage areas which would cause these areas to experience a faster growth than high-wage areas. On the other hand, if the regional wage differentials were large enough, labor would also tend to move: workers would move from low-wage areas to high-wage areas. It follows that high-wage (low-wage) regions would tend to lose (gain) capital, and experience an increase (decrease) in labor, which would cause a decrease (increase) in the wage level. Eventually, capital and labor movements would produce an equalization of the prices of resource endowment, i.e., real wages and the prices of capital across regions.

Empirical testing has contradicted the two main predictions of the above theory, i.e., capital does not grow at a higher rate in the low-wage areas and the average wage does not grow at a higher rate in the low-wage areas. Examining 48 US States during three periods (1919-20, 1929-48, and 1948-53), Borts and Stein (1964) found that capital grew at a faster rate in the high-wage areas in the first and third period. In addition, using contingency tables to classify these states according to initial wage level and wage growth, they obtained chi-square statistics showing a strong divergence among wages during the first period, a strong convergence during the second period and no clear cut pattern for the third.

According to Borts and Stein, the failure of the empirical test of the theory could be attributed to interstate differences

in industrial composition,* as well as to the larger capital formation in housing and services due to the large population increases in the high-wage areas. The last argument led Borts and Stein to develop a modified theory.

Description and Statistical Test of Borts's and Stein's Theory of Regional Growth

To account for the failure of their empirical test of the Borts model, Borts and Stein divided the economy of a state into two main sectors: an export sector providing products that are sold outside and a home sector providing local services (housing, schools, highways, etc.). First, they concentrated on the growth in export (manufacturing) employment using a framework in which the labor supply function appeared as a generator of regional growth differences. And, second, they examined the repercussions on the service sector.

In formalizing the growth in manufacturing employment, Borts and Stein added to the assumptions of Borts's model several hypotheses concerning the price of capital available to each industry within the manufacturing sector and the price of its product (Borts and Stein, 1964, p. 78). They then demonstrated that in the long run the labor-capital ratio would be the same for all manufacturing firms of a given industry, regardless of regional location, and that each firm would pay the same wage. Since the long-term equilibrium wage is predetermined, the labor supply function determines the quantity of labor that is forthcoming and employed in each state. In other words,

> Interstate differences in rates of growth of employment in (the) manufacturing industry, *from one long-run equilibrium to another*, arise solely from interstate differences in the growth of the labor-supply function.

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*Recently, Lande and Gordon (1977) have attempted to re-evaluate Borts's model by disaggregating to the two-digit SIC industry level and also by looking for agglomeration industries. Their results show, by sector, the strengths of neoclassical and agglomerative influences in explaining long-term behavior and help determine which one, the convergent or the divergent wage rate tendency, is dominating the overall economy.

What, then, are the factors influencing the local labor-supply function? Borts and Stein indicate three important determinants of this function: the proportion of the area's workers outside manufacturing, the rate of growth of the labor force due to natural increase within the local population, and the net inmigration of workers from other regions.

Borts and Stein (1964, p. 82-84) argue that the ratio of manufacturing to total state employment can be taken as a proxy for the first two determinants, while the per capita net in-migration rate of the population aged 15 to 64 can adequately represent the third influence. It then follows that

a) the rate of growth in manufacturing employment will be higher in states with a relatively low percentage of employment in that sector,

b) the rate of net inmigration is positively correlated to the manufacturing employment growth.

Empirical testing of manufacturing data for the US, between 1919 and 1953 confirms the two above propositions about inter-state differences in growth rates. Regressing growth in manufacturing employment on both variables, Borts and Stein found a negative correlation with the manufacturing employment ratio and a positive correlation with the net migration rate. Moreover, in spite of a low coefficient determination, the coefficients of these independent variables were shown to be significant (they exceed their standard errors by more than threefold).

On the other hand, the regional wage rate, which in theory has impacts of similar magnitude and opposite direction on manufacturing employment growth is not expected to be correlated to the rate of manufacturing employment growth. Actually, when replacing migration by the level of production worker annual earnings in manufacturing, Borts and Stein found that the manufacturing employment ratio was negatively and significantly correlated while the effect of the earnings level was positive and not significant.

The approach to regional growth put forth by Borts and Stein is a supply-oriented one, in which growth is generated in the manufacturing sector by labor supply shifts due to inmigration. In this sector, wage rates have little influence on the employment level as indicated by the results of Borts and Stein's regression analysis. Indeed the wage rate determined by external conditions in the manufacturing sector is necessarily the one which prevails in the service (regional) sector.

Note that a model similar to the one suggested by Borts and Stein has been proposed by Chambers and Gordon (1966), who have reversed the role of the manufacturing (export) and service sectors. In their model, the wage rate is not determined in the export sector, but in the alternative sector. In other words, the demand for labor here is highly elastic in the regional sector and any change in labor demand causes an employment shift toward the regional sector without alteration of the wage rate.

The high elasticity of the labor demand curve, thus characterizing the supply-oriented approach to regional development (in the short run), can be illustrated as follows with reference to the Borts and Stein model. An increase in the demand for export goods in a given area--illustrated by the rightward shift of the demand curve from D_1 to D_2 on Figure 2--induces a rise in the wage rate (from W to W´) as labor is attracted from the service sector to the export sector, or from the outside. But, as new workers enter the export sector in response to increased employment opportunities, a rightward shift in the labor supply curve of this sector, from S_1 to S_2, leaving the level of labor supply unchanged, causes a lowering of the wage rate from W´ to W´´. However, owing to the higher elasticity of labor demand, the changes W´´ - W in wage rates are expected to be small.

According to Borts and Stein, the short-term mechanism just described explains the failure of the test using Borts's model:

a) the greater rate of growth of capital in high-wage areas during two of the three periods, may be accounted by the growth of capital in the service sector due to the influx of migrants, and

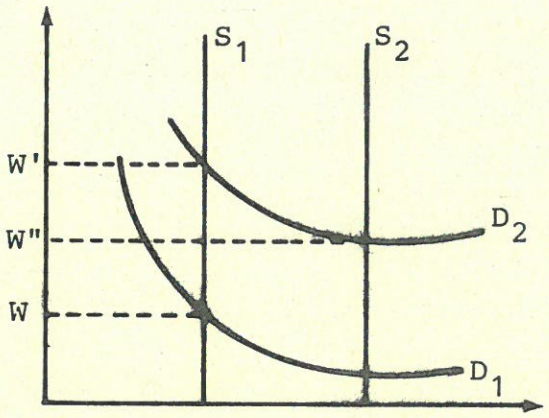

Figure 2. The labor-supply approach.

b) the ensuing growth in the demand in this sector may have produced greater growth of the wage and the greater growth of capital in the high-wage regions.

However, in the long run, as changes in the wage rates occur due to the development process, Borts's conclusions predicting the convergence of interregional wage rates remain valid.

In brief, Borts and Stein's modified model separates regional economies into two main sectors, which allows one to account for the fact that they are not operating at their long-term equilibrium positions and thus, to demonstrate the possibility of a convergence or divergence of wage rates (or per capita incomes).

As a digression note that there is a theoretical strand of literature which predicts regional per capita income divergence, rather than convergence. It owes most to Myrdal (1957) who claims that the "play of forces in the market normally tends to increase, rather than to decrease the inequalities between regions". His argument is based on very simple circular and causation principles that have been laid out in very loose terms.

> Market forces lead to the clustering of increasing return activities in certain areas of the economy. Regardless of the intitial location advantage, this build-up becomes self-sustaining because of increasing internal and external economies at these centers of

agglomeration. The limited advantages of backward regions (such as cheap labor) are insufficient to offset these agglomeration advantages.

Although it was recently translated into a formal model (Kaldor, 1970), this theory of cumulative causation does not seem a promising way of examining local development since some traditionally backward regions (e.g. Appalachia in the US) currently appear to be experiencing a strong revival.

Recent Evidence on the Validity of the Labor Supply Approach

Indeed, most of the empirical research concerning the labor supply approach to regional demoeconomic growth has consisted of various tests of the long-term equalization of interregional wage rates, or in a broader way, of interregional per capita incomes. For example, two analytical volumes on this problem, published in 1960 (Perloff, et al.; Kuznets, et al.), provided detailed empirical evidence of the convergence tendencies in regional per capita incomes in the US. In other instances, the opposite conclusion has been obtained (Borts, 1960). In all fairness, this focus on the convergence or divergence of interregional wage rates or per capita income is useful only to the extent that it enables one to understand the relationship between disequilibrium and growth in various limited time and space settings.

As far as general explanation of regional development is concerned, the studies that have attempted to explain the persistent disequilibrium of interregional wage rates of per capita incomes seem to be more interesting than those that add new empirical evidence of their convergence or divergence in particular conditions.

Two main supply-side explanations of long run differential wages can be put forward: the first relates to workers who may be induced to migrate by other incentives than wage differentials

and the second involves the attraction of different industry mixes.*

On the one hand, the motivations of workers to shift locales might be due to the fact that higher wages are required in certain areas because of systematic cost of living differences connected with higher commuting costs (in large cities) or higher heating and transportation costs (in colder areas). Also the existence of amenities in some areas or the availability of friends and family ties might persuade some workers to live and work in areas offering lower wages. Richardson (1973), also mentions the possibility of sluggish response to wage differentials and, at the other extreme, the existence of risk-prone migrants whose rationale is evasive.

On the other hand, Goldfarb and Yezer (1976) emphasize the existence of a compensating or equalizing differential argument based on various industry mixes as being one of the oldest explanations for wage differentials:

> If industries vary in their nonpecuniary returns to work, then different areas have different wage levels in the long run to balance these nonpecuniary features..... Along similar lines, if occupational structure varies by industry, then average wages may differ from area to area because of differences in human capital per worker.

There are a few empirical studies of regional growth, based on labor supply that have not concentrated on the role of wages or per capita income. Among these is a recent paper by Glickman and McHone (1977), which presents a cross-section analysis of the growth of urban cities in Japan. The authors have tested the influence of the components of change of labor supply on

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*Indeed, the mechanisms of wage formulation in local areas are influenced by demand factors as well. Among demand factors, foreign to the labor-supply approach, which influence wage differentials are (a) the feasibility for larger firms to pay higher wages for labor in the long run because other locational costs advantages may offset these higher labor costs, (b) the existence of protected market positions for some firms and (c) the existence of institutional factors (see Goldfarb and Yezer, 1976).

employment growth of the three main economic sectors (primary, secondary, and tertiary). Their regressions in double logarithm form include four independent variables: an index indicating the net shift of employment between each sector and all other sectors, a net migration variable, a variable representing changes in labor force participation, and a city size variable representing all excluded variables, (two stage-least-squares estimators were used to avoid simultaneity problems). They found that employment in the three sectors was primarily responsive to the net migration of the labor force (elasticities for the three sectors are respectively 1.01, 1.06 and 0.79) and secondly to an intracity sectoral shift variable, especially in the case of the primary sector: the elasticity obtained is roughly four times as high as in the case of the other two sectors. The coefficients of change in the labor force participation, however, were not significant at the usual level of confidence (especially in the secondary sector).

A Brief Evaluation of the Labor Supply Approach

To summarize, the approach to regional growth developed by Borts and Stein is characterized by an emphasis on input factors, primarily labor. It accords an active role to workers in shaping spatial growth and decline through their impact on employment in the export and service sectors. In each industry, a pool of available workers resulting from shifts of labor between sectors or areas (or voluntary changes in labor force participation) determines the level of industry specific employment. Firms are thus given a rather passive role since they produce in response to external demand the maximum output that available input allows: no constraint is placed on construction.

As with the export-base theory, the labor supply approach appears to be an insufficient framework to deal with an area's demographic growth.

Demand-oriented and Supply-oriented Approaches Constrasted

The two most popular views of regional growth as seen above are two polar theories which focus on limited aspects of an area's economy: its export demand and its labor supply and demand. We note also that these aspects themselves are characterized by opposite assumptions. Export demand is perfectly inelastic in the export-base theory and highly elastic in the Borts and Stein theory. For the labor factor, the export-base theory requires:

a) perfectly inelastic demand for labor in export industries,

b) highly elastic labor supply

while the alternative theory calls for:

a) highly elastic demand for labor in export industries,

b) perfectly inelastic labor supply.

The role of capital in both theories is not so clear cut. In the export-base theory, high levels of savings are required in rapidly growing regions in order to generate the needed capital by the export demand and the additional capital to be exported (as was seen in Richardson's argument). In the neoclassical approach of Borts, capital is perfectly mobile between regions in quest of higher rates of return.* This assumption remains in the Borts and Stein approach which, however, acknowledges labor supply as the main supply factor of regional growth. In both export-base and labor supply theories, the role of capital is thus somewhat secondary. Firms and wokrers are seen as the principal economic actors promoting development. The export-base theory stresses

*As emphasized by Romans (1965), this assumes that the interregional capital market is a perfectly competitive market for a homogenous good. However, there are considerable objections which make this assumption unrealistic (Richardson, 1973, Chap. 4). For one thing, most of the existing capital stock is immobile; seoond, a substantial proportion of interregional capital flows take place within existing corporations; and third, such capital flows are associated with the criteria extension or relocation of plants: "in effect, this means that to this extent it is not a question of the spatial mobility of capital but of interregional location theory". Consequently, capital does not move in response to differentials in the rate of return.

the role of firms in initiating regional growth from an external demand pressure and enhancing this growth by attracting migrants responding to job opportunities. The labor supply approach emphasizes the role of workers in initiating regional growth in the locale to which they move in response to economic (or non-economic) incentives. In other words, the main difference between the two theories concerns the path of causation between employment growth and migration which goes in opposite directions. A possible reconciliation of these theories containing virtually no overlapping elements is discussed in section 1.3.

Nevertheless, there exists a factor of commonality between these two approaches; the aforementioned secondary role given to capital (although capital is as important as labor in the long run of the Borts and Stein approach). Consequently, there is no allowance for endogenous regional growth: regional growth is imported through export demand and migration respectively. In other words, is this treatment in agreement with reality? Might endogenous regional growth not occur?

Strong empirical support for the hypothesis of endogenous regional growth has been provided by Ghali (1973). Firstly, in a paper coauthored with Renaud (Ghali and Renaud, 1971), he demonstrated that, in an open region (Hawaii), local investment--except for hotel construction--was determined by regional variables. Secondly, for the period 1963-69, Ghali (1973) shows the dominant role of regional investment on exports in the short run:

> the changes in the investment variable have about 35 percent more influence on the changes in the growth of income than do changes in the export variable. (Ghali, 1973, p. 292-293)

However, in the longer run, allowing for the dynamic role of the variables included in the model, the exports and investment growth rates reverse the impression given by the relative roles by comparing the short-term effects:

> by the 18th year the contribution of a substantial 10 percent annual growth in exports on the rate of growth income is about twice as big as that of a sustained 10 percent annual growth in investment. (Ghali, 1973, p. 295)

It follows that investment possibilities must be considered in order to explain the forces that shape the regional pattern of demoeconomic growth. In fact, this consideration is not in contradiction with the theories examined above since dynamic regionally endogenous investment functions could be added to supplement the analysis. This is especially possible in the supply-oriented approach, even if Borts and Stein stress the preponderant role of the labor factor in keeping a regional economy's growth away for this long-term equilibrium trajectory. Economic growth can be described by income change in terms of the changes in factor inputs (changes in labor supply, investment). Theories of regional development, recently proposed by Richardson (1973) and von Böventer (1975) illustrate such an approach. (They are examined in part Three of this paper because they introduce the spatial dimension of the problem which has been neglected in the above research.) However, the ability of such theories to provide accurate insights into the mechanisms of regional development is seriously limited by the lack of regional data on capital and investment.

1.2 Economic Explanations of the Migration Component of Labor Supply Growth

The polar theories of regional development examined in the first section view the response of labor migration to changes in economic factors in a different way. In the export-base theory, the amount of labor migration is determined by the number of job opportunities offered by firms in various areas within a nation. By contrast, in the labor supply approach, the amount of labor migration results from the self-determined mobility of workers depending, to a large extent, on inter-area wage (or income) differentials.

From the point of view of labor migration, the two alternative explanations of regional development reduce to the competitive hypotheses traditionally considered in the migration literature: the job opportunity versus the wage differential hypotheses. Because of the relevance of labor migration to the problem

of regional development, a critical review is presented next describing migration studies that have attempted to test the validity of the above hypotheses. Let us underline the peculiar character of these migration studies which have to be distinguished from the more frequent studies of place-to-place migration examined in Part Three, which stress spatial factors (intervening obstacles between origin and destination). Here the accent is on the explanation of total migration flows relating to a given area regardless of the origin or destination of the individual moves. In addition note that the migration data used by the studies cited below, rarely relate to the labor force or the working age population, but more commonly refer to the total population, for which migration data are more readily available. Indeed, the use of latter type of data can be expected to blur the true response of labor migration to changes in economic incentives as certain segments of the total population (college students, military personel, etc.) move for predominantly non-economic reasons.

The Job Opportunity Hypothesis Versus the Wage Differentials Hypothesis

Empirical evidence concerning these two competitive hypotheses comes from econometric studies that have examined the economic determinants of total migration flows relating to various types of areal units. Initially, in the 1960s, these studies focused on net rather than gross migration flows and led to mixed results about the validity of either hypothesis.

On the one hand, the findings obtained by some researchers tended to favor the wage differentials hypothesis. For example, Fuchs (1962) obtained the result that the net cumulative migration into a US state of persons still living in 1950* responded more to relative wage levels than to the comparative growth of

*This variable was computed as follows: "all persons living in the state, born in other states, minus all persons born in the state living in other states, divided by the population of the state in 1950". (Fuchs, 1961, p. 115)

manufacturing employments. He obtained a coefficient of partial correlation between population migration and relative wage levels equal to +.71 in the absence of a significant relation between comparative growth of manufacturing and wage levels. In fact, the comparative growth of manufacturing employment was moderately correlated with migration, but the relation was not as strong as between migration and wage levels or between migration and climate.

Sommers and Suits (1973) who have analyzed more specific net inter-state migration rates for both the periods 1950-60 and 1960-70, showed that, for both whites and non-whites, income provided a significant inducement to migration. By contrast, unemployment rates, used as proxies for job opportunities were significant in explaining only 1960-70 white migration.

On the other hand, studies which have made extensive use of the "prospective unemployment" concept to define job opportunities have found little correlation between wage differentials and migration. According to Blanco (1963, 1964), it is the comparison of the change in total employment with the number of entries into the labor force which is relevant to induce net migration. Rather than have two separate variables, one for the change in labor demand and one for the change in labor supply, she combines the two into a unique variable:

> prospective unemployment or, the annual rate of change in unemployment which would be expected to occur if workers were not able to migrate between states. (Blanco, 1964, p. 221)

This variable, she claims, accounts for 85 percent of the variations in US net inter-state migration between 1950 and 1957. Among the other variables, only changes in the location of federal military personnel is significant, accounting for another percent of the variation between regions. Thus, wage rates are not found to be significant. Mazek (1969), using a similar concept, was led to similar conclusions since his income variable did not turn out to be significant in contrast to his prospective unemployment variable.

Lowry (1966), has used a model virtually identical to Blanco's in spite of the separation of the elements contained in the prospective unemployment concept:

$$M_i = a_o + a_1\, dP_i + a_2\, dQ_i + a_3\, dA_i + a_4\, dE_i + a_5\, dI_i \qquad (7)$$

in which the following variables are defined for each SMSA as a rate of per thousand 1950 population:

M_i = net population change attributable to migration

dP_i = net change in the number of residents 15-64 years of age in the absence of migration

dQ_i = net change in civilian nonagricultural employment

dA_i = net change in the number of Armed Forces personnel

dE_i = net change in the number of school enrollees 14-29 years of age.

The following variable is expressed as a percentage of the 1950 median income:

dI_i = change in median family income.

Only the first two explanatory variables turn out to be significant (at the .001 level of significance): natural increase of the working age population discourages net migration while employment growth encourages it. Moreover, when the net migration variable is redefined to include only migrants of employable age, the coefficient of the Armed Forces personnel variable becomes significant (at the .001 level of confidence) as well as the income growth variable (only at the .05 level of confidence).

More recently, Glickman and McHone (1977), in a study of net migration of labor force for Japanese cities over the period 1965-70, have shown the significance (with the expected sign) of the coefficients of three variables intended to indicate labor demand conditions. Their results indicate that high unemployment rates deter net migration while high wages and labor force participation rates induce net inmigration.

Indeed, the contrasting findings obtained above do not confirm either the job opportunity hypothesis or the wage (income) differential hypothesis. We suggest that such a result merely reflects the differences in the specification of the regression models used to test the alternative hypotheses. In particular, wage or income variables appear as levels in some cases (Fuchs, Mazek) or as changes in those levels in other cases (Lowry). Perhaps, the question of knowing which of the two theories prevails does not have and does not need to have an answer, as suggested by Raimon's findings (1962). He showed that US interstate net migration between 1950-58 was highly correlated, not only with differentials earnings* (R^2 = .86), but also with differentials in job vacancies (measured by employment change) (R^2 = .89). However, there was evidence of a functional relationship between the two explanatory variables as a .72 correlation was found between earnings and employment change. Raimon concluded that the two hypotheses led to essentially the same results. He also added, without much justification, that "because the wage difference model incorporates the job vacancy model, goes beyond it and says more, it may be regarded as the more useful" (Raimon, 1962, p. 438).

More recently, the impact of changes in economic opportunities on migration was reexamined in the context of gross flows studies.

Economic Determinants of Gross Migration Flows

The traditional theories of regional demoeconomic growth conceptualize migration as an equilibrating process from areas with low job opportunities and/or low wages to areas with high job opportunities and/or high wages. Thus, in a given area, outmigration flows should be negatively correlated and inmigration flows, positively correlated with regional earnings and job opportunities.

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*Note the contradiction of this result with Blanco's findings that wages were not significant in explaining US interstate net migration flows for the same period.

From an empirical standpoint, studies of gross migration flows tend to support the contention that such economic variables as employment changes or wage rates positively affect inmigration. However, these studies do not agree on the validity of the symmetric and thus, negative response of outmigration to these very same factors, although there seems to exist a larger consensus for the prevalence of a somewhat weak interaction.

Studies of Outmigration Flows

Since Lowry (1966), in the context of a place-to-place migration study, and Lansing and Mueller (1967), as a conclusion of a microsurvey of households, first suggested the nonresponsiveness of outmigration to changes in regional economic factors, a large number of studies (see Part Three) have confirmed it. In contrast to this, studies of gross migration flows have, surprisingly, obtained results substantiating the existence of an interaction, the most notable exception being the evidence provided by Morrison and Relles (1975).

Iden and Richter (1971), showed that the average number of unemployed had a positive and significant impact on the number of outmigrants from standard economic areas (SEA's) of a low-income region. However, they found that per capita income was negatively but insignificantly correlated with outmigration.

In a similar way, Miller (1973a), found no significant impact of family income on outmigration rates from US States (the sign of the coefficient of this variable was even positive). However, when controlling for differential propensities to migrate, he was able to display the existence of a negative and significant correlation between outmigration and family income. When the control variable was the percentage of those born out of state, the family income then had the expected sign and was almost significant. Moreover, when an inmigration rate was used as an additional control variable, the family income term became significant.

Finally, by inserting employment growth as an explanatory variable, Miller was able to increase the explanatory power of his regression model from $R^2 = .68$ to $R^2 = .79$. Both the coefficients of the employment growth rate and family income variables then appeared highly significant with the expected negative sign. However, the variable controlling for the state of birth did not appear significant anymore. It is worthwhile to note that the significance of the family income variable appeared only when the employment measure was computed from data of the Bureau of Labor Statistics which exclude the military, the self-employed and the agricultural workers.

In another paper, Miller (1973b), narrowed down the analysis to those born in the state and found that their outmigration was highly related to economic conditions. Again, the most significant determinant was the employment growth rate variable (which had a negative and significant coefficient). Family income also had a negative and significant coefficient, if the equation included some control for educational levels. Additionally, in contrast to total outmigration, this restricted outmigration type was positively and significantly affected by unemployment rates.

Recently, several researchers have taken advantage of migration data provided by the Office of Business and Economics (OBE) of the US Department of Labor to analyze the influence of economic conditions on outmigration flows. OBE keeps a one percent data file of all workers covered by Social Security benefits (Social Security Administration's Continuous Work History Sample). Because, for each person in the sample, information on location of successive employments is recorded, a special treatment of the file permits estimating gross out- and inmigration flows relating to any sufficiently large area and for any desired time interval. (For a description of the CWHS file, see Hirschberg, 1975). Using such data for 84 SMSAs (Standard Metropolitan Statistical Areas) from five regions--South East, South Central, South West, Midwest and Great Lakes--for the period 1960-65, Pursell (1972)

showed that male labor outmigration was negatively and significantly affected by job opportunities (proxied by employment change) and wages (proxied by average hourly earnings in manufacturing).

Renshaw (1974) was not convinced by these findings. He pointed out that Pursell was only one step removed from estimating an identity. Nevertheless, he contended that the negative association between outmigration and employment change could not be attributed solely to the effects of testing a quasi-identity.

As a justification, Renshaw has presented some results which tend to confirm that changing employment opportunities affect outmigration. Arguing that a five-year period is too long to study the relationship between outmigration and employment change, he performed a cross-section analysis of yearly data--also obtained from the Social Security Administration's data file--concerning 224 US metropolitan areas. Two of the tests reported by Renshaw estimated the following equations:

$$OM = a + b\ \Delta EMP \quad . \tag{8}$$

$$OM - \overline{OM} = a' + b'\ (\Delta EMP - \overline{\Delta EMP}) \quad . \tag{9}$$

in which

OM and ΔEMP are annual outmigration and employment change.

$\overline{OM}$ and $\overline{\Delta EMP}$ are three- or five-year averages of outmigration and employment change.

Whereas testing equation (8) over the whole period 1960-65 led to a positive and highly significant coefficient b, its testing for each single year during that period very often yielded negative (although generally not significantly negative) coefficients b'. "Therefore, estimates of equation (8) did not support the Pursell finding of a strong negative relationship between outmigration and employment growth." (Renshaw, 1974, p. 147). Tests of equation (9) however, led to negative and highly significant coefficents b' of the employment change term and Renshaw

concluded that outmigration from an area tends to be discouraged during periods when employment change rises above the average.*

This finding was strongly challenged by Morrison and Relles (1975), who also performed cross-section analyses of yearly data covering the period 1960-65, but based on 85 of the 98 metropolitan areas of 250,000 or more in 1960. Using variables measured in a way different from Renshaw's, they did not obtain a systematic relationship between employment change and outmigration rate. Unfortunately, Morrison and Relles do not report the results of a simple regression analysis between the measures of outmigration and employment change and therefore we are unable to compare theirs with Renshaw's results. Moreover, in all their tests, the employment change measure is used as an independent variable along with additional variables accounting for the presence in an area of highly migratory groups. The results obtained by Morrison and Relles showed that much of the cross-sectional variations of outmigration rates were the reflection of the differential presence of mobile population segments: "outmigration rates vary according to the proportion of an area's residents who are chronic movers, persons who arrive but then depart soon thereafter". (Morrison and Relles, 1975)

Studies of Inmigration Flows

Unlike the case for outmigration, the association between inmigration and economic conditions has been firmly established: the findings of the studies reviewed below show that the demand for labor, gauged by regional differentials in the level of wage rates and the availability of jobs attracts inmigrants to economically healthy regions.

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*Estimates of (8) and (9) were also obtained by disaggregate groups and showed the existence of a much stronger association between outmigration and employment change for males than for females. Thus, "although a negative relationship between outmigration and employment change can be isolated for the total employment group, the Pursell relationships are probably stronger because he restricted the analysis to male migration." (Renshaw, 1974, pp. 148-149)

Miller (1973c), observing that certain of the less prosperous states derive a significant fraction of their immigration from returnees, claimed that "the true effect of economic conditions on immigration to less prosperous states is concealed by the inclusion of these return migrations in the total inmigration" and recommended to divide migrants into return and non-return migrants.

Miller found that between 1955 and 1960, Americans returned to their state of birth because of the availability of jobs (proxied by employment change) rather than because of a high level of earnings (proxied by family income).* This result is also true in the case of non-return migration: employment change alone explains 60 percent of the variances, while the effect of family income, significant only when no adjustment for college attendance is provided, is relatively weak.

As in the case of outmigration flows, data from the Social Security Administration's data file on inmigration flows have been used to test interaction with economic conditions. A strong correlation between inmigration and employment change has been shown by Pursell (1972) and Renshaw (1974) as well as by Morrison and Relles (1975) who have used the two following independent variables: a variable reflecting the "pull" of newly created jobs (the change in the logarithm of non-agricultural employment) and a variable reflecting the "pull" of jobs being vacated by outmigrants (a two year average of the logarithm of the outmigration rate). In particular, the cross-section analyses undertaken by the last two studies showed the existence of a positive and significant impact of employment change on inmigration to the largest US SMSAs during the period 1960-65. In addition, Renshaw, who unlike

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*This conclusion was obtained from a regression in which the dependent variable was defined as the ratio of return migrants to those born in the state but residing elsewhere in 1955. The rate of change of employment had the expected positive sign and was strongly significant ($t > 5$), while the family income variable also had the expected positive sign but was insignificant. Also, the unemployment rate proved to be insignificant.

Morrison and Relles, reported a significant correlation between outmigration and employment change, pointed out that the positive relationship between inmigration and employment change is much stronger than the negative relationship obtained between outmigration and employment change. Before turning to the relationship between in- and outmigration flows, note that there are, however, studies displaying a more moderate association between inmigration and economic conditions. For example, Iden and Richter (1971), showed the existence of a positive but not significant correlation between per capita income and migration into SEAs of a low-income region. In a study of migration flows into Indiana SMSAs, Bonello et al. (1973), found that nonagricultural employment change had a positive and significant impact on inmigration. However, their other economic variables did not perform quite successfully: their wage variable (manufacturing earnings) was not found significant, while their unemployment rate had a significant coefficient with the wrong sign! In addition, income appeared to play no significant role except in the case of non-whites. This dichotomy in the significance of some economic characteristics between whites and non-whites also appears in a study of migration to central cities by Pack (1973). She shows that the percentage change in family income is positive for both races and significant in the case of non-whites only. Unemployment rates appear as a significant deterrent to inmigration in the case of whites only.

Relationship Between In- and Outmigration Flows

In brief, whereas net migration studies indicate that labor migration is responsive to economic factors such as job opportunities and/or wages, gross migration studies suggest an asymmetry in the response of the directional components of migration: regional economic forces strongly affect inmigration but have a much smaller impact, if any, on outmigration.

Important here is the observation that the substantiation of the latter impact, when it was shown significant (Miller, 1973a),

required the control of outmigration rates for differential propensities to move. Thus, Miller's findings corroborate Morrison and Relles's claim that past migration strongly determines the present propensity to move. All in all, it appears that migration is a self-generating process. Areas that have experienced high inmigration contain a pool of highly mobile individuals which can produce high levels of outmigration.

A typical illustration of this proposition is given by Morrison and Relles (1975), who point out that, during the early 1960s, more than one-third of the migrants coming to San Jose, California, had departed within the next year. In other words, "where favorable economic conditions formed a high rate of inflow, then, the flow-through of chronic migrants makes the prevailing rate of outflow high also" (Morrison and Relles, p. 38).

As a digression, note that as documented by Vanderkamp (1971), a large part of those who outmigrate within a short period of their arrival are prone to return to the place they came from.* Indeed, the return migration thus defined is not similar to the return migration dealt with by Miller (1973c), and which involved a return to the place-of-birth. It is likely that its economic determinants may differ in some important ways. It could be that migration patterns involving a move shortly followed by a return move do not correspond to the economist's model of rational behavior. Unfortunately, data commonly available do not make it possible to test this hypothesis.

In summary, we observe that the above empirical studies suggest the existence of a direct relationship between the directional components of migration, contrasting with the inverse relationship implied by the conceptualization of labor migration as an equilibrating system.

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*The hypothesis of a self-generating migration process and the observation of return migration flows are hardly new in the analysis of migration as they were already made a long time ago: "Each main current of migration produces a compensating counter-current". (Ravenstein, 1885)

If out- and inmigration flows were responsive in the same magnitude to the economic forces that normally increase the arrival rate and decrease the departure rate, one would obtain a significantly negative relationship when performing a simple correlation of these gross flows. However, since the empirical evidence reported above indicates the existence of an asymmetry between these flows, one would rather expect the simple correlation of the directional components of migration to yield a perhaps negative but certainly not significant interaction between them. In fact, migration studies which have examined this problem have exhibited the existence of a positive and significant correlation between total out and inmigration flows (Hollingsworth, 1968, Gleave and Cordey-Hayes, 1977). This result has, moreover, been shown to persist when out and inmigration flows were divided into sex and occupation groups (Miller, 1967; Stone, 1971).

Some scholars (Lansing and Mueller, 1967), have contended that the positive association might just well be the reflection of regional differences in migration rates. This argument has been strongly challenged by Morgan (1974). She tested again the relationship between relative measures of out- and inmigration of employed persons for US metropolitan areas previously examined by Miller and Stone but stratified metropolitan areas into four groups corresponding the four US Census regions. Her results show, that except for the North Central region (for which the coefficients of correlation between inmigration and outmigration are significant for employed persons disaggregated into specific color, sex and major occupation group components), there is a lack of relationship between gross out- and inmigration flows in the Northern region and especially in the Western region.

Another hypothesis proposed to explain the positive relationship between out- and inmigration rates is that it follows from the length of the period over which migration is recorded (generally five years). Again, Morgan (1974), rejects this hypothesis as her results do not show a lower correlation between the two flows if migration is measured over a one-year period than over

a five-year period. In fact, the most plausible explanation of the positive correlation between in- and outmigration is to be found in the existence of a dynamic mover pool, with a high propensity to migrate.

In accordance with the results derived by Morrison and Relles (1975), and others, an area's inmigration rate is determined by (a) changes in economic conditions and (b) its outmigration rate. If I and O the in- and outmigration rates respectively and $\frac{\Delta A}{A}$ is the variable indicating the relative change in economic conditions, then:

$$I = a_1 + a_2 \frac{\Delta A}{A} + a_3 O \quad , \tag{10}$$

in which $a_2 > 0$ and $0 < a_3 < 1$.*

On the other hand, the outmigration rate is expected to be more or less influenced by changes in regional economic conditions in accordance with the researchers' findings cited above. Thus, if P is the proportion of the population under a certain age (used as an index of propensity to migrate), then

$$O = b_1 + b_2 \frac{\Delta A}{A} + b_3 P \quad . \tag{11}$$

in which b_3 is positive, the sign of b_2 is not necessarily negative but $|b_2| < a_2$.

Due to the existence of a dynamic mover pool consisting of relatively young people with high propensity to migration, it seems reasonable to suppose that (Rogers, 1976)

$$P = c_1 + c_2 I \quad . \tag{12}$$

in which $c_2 > 0$

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*The inequality $a_3 < 1$ simply comes from the fact that a larger outmigration implies a smaller net migration.

Combining (10) through (12), yields the following relationship linking out- and inmigration rates:

$$O = \alpha + \beta I \quad , \tag{13}$$

in which:

$$\alpha = \frac{b_1 + b_2 c_1 - \frac{b_2 a_1}{a_2}}{1 + \frac{b_2 a_3}{a_2}} \quad ; \quad \beta = \frac{b_3 c_2 + \frac{b_2}{a_2}}{1 + \frac{b_2 a_3}{a_2}} \quad .$$

It is clear that, whatever the sign of a_2, the restrictive inequalities on the regression coefficients of (10) through (12) make the denominator of the coefficient β of I in (13) positive. Then, the nature of the correlation between out- and inmigration rates depend on the sign of the numerator of β, $(b_3 c_2 + \frac{b_2}{a_2})$.

Since

$$\frac{|b_2|}{a_2} < 1 \quad , \; b_3 c_2 + \frac{b_2}{a_2} > b_3 c_2 - 1 \quad .$$

By combining (11) and (12) it is easy to see that $b_3 c_2$ is less than one because, everything else being equal, a large inmigration implies a larger net migration: consequently $\beta > 0$.

The conclusion is here, that regardless of the significance of the impact of economic conditions on outmigration (however restricted to be of a lesser magnitude that their impact on inmigration), there exists a positive relationship between in- and outmigration rates. Returning to the expression of β, it appears that the presence of $b_3 c_2$ in the numerator, due to the existence of a dynamic mover pool, accounts for this result.

Thus, we have shown that the positive relationship between the gross directional components of migration is not necessarily the consequence of a non-responsiveness of outmigration rates to economic forces. It stems from the presence, of a pool of chronic movers who respond independently from regional economic forces.

Additional support for this explanation has been offered by Gleave and Cordey-Hayes (1977), from the results of a simulation effort. Their starting point is that migration must be examined in the context of a behavioral and dynamic context focusing on the time-path of individual migrants. In particular, they point out the dependence of the decision to migrate on the previous migration history of the individual. Then, using the axiom of cumulative inertia found in the sociologists' approach to migration (McGinnis, 1968)* they suppose that the probability of remaining in any state increases as a monotonic function of prior residence in that state.**

Moreover, Gleave and Cordey-Hayes contend that such an axiom is not exclusive of the economic explanation of migration examined

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*The validity of this axiom can be justified in various ways. One rationale is that "residence in the same place fosters ever increasing social ties and as such, operates as an inertia factor which may effectively raise the social and psychological costs of migration, that is, accumulated residence seems to generate inertia." (Shaw, 1975). Another justification relates to employment and promotion prospects as it is reasonable to suggest that, after a move, the potential offered to an efficient employee becomes apparent very quickly and that his chances of an employee's promotion tend to decline as his stay in any one position increases (Gleave and Cordey-Hayes, 1977).

**The existence of duration-of-stay effects, substantiated by Taeuber (1961), Morrison (1967), Land (1969), is generally presented as a direct consequence of the cumulative inertia hypothesis of which it constitutes an empirical support. However, the recent theoretical work undertaken by Gingsberg (1973), McFarland (1970), and Spilerman (1972), suggests that the empirical evidence just cited does not really prove the existence of cumulative inertia. Following that line, Clark and Huff (1977) obtained results which emphasize that "even when cumulative inertia exists it is a very weak influence on the probability of migrating and that duration of stay since the last move is an inadequate measure of residence history effects".

above and that the two are rather complementary. For their justification, they build a dynamic simulation model combining the principle of cumulative inertia with a differential attractiveness mechanism preserving the role of economic locational determinants in allocating migrants (for a description see Cordey-Hayes and Gleave, 1974).

The outcome of such a model is characterized by the emergence in each region of a pool of movers and the retention of other more stable segments of the population. Moreover, the more mobile groups tend to congregate in attractive areas which have high out- as well as high in-migration rates, shown to remain positively correlated over time.

To summarize, aggregate economic studies point to the responsiveness of labor migration to economic forces, although they also indicate the existence of an asymmetry between its directional components. Outmigration seems to be primarily determined by personal characteristics based on the principle of cumulative inertia, while inmigration appears to be the consequence of economic attractiveness. Indeed, this interpretation does not provide an adequate picture of the relationship between labor migration and economic forces since migration is also a cause of economic growth as emphasized by Borts and Stein (1964). As a result, the empirical relationships explaining migration in terms of employment (income) change by the single-equation econometric models examined above suffer from a simultaneous bias. This bias can be prevented by building and testing simultaneous-equation models of regional demoeconomic growth.

1.3 Simultaneous-equation Models of Regional Demoeconomic Growth (Mixed Demand-supply Approach)

The empirical evidence examined in the above sections has not provided any clearly favorable evidence concerning either of the two polar theories of regional development, i.e., those emphasizing the demand and the supply sides respectively. Indeed, such a result is hardly surprising since demand and supply conditions cannot evolve independently of each other over a long

period of time without generating disequilibria. Demand and supply sides affect each other: the decisions of firms regarding employment and wages affect workers' response in terms of migration levels, whereas the decision of workers regarding shifts in their places of work affect the firms' decisions concerning expansion or relocation.

The realization of this interaction between firms and workers (Burns, 1964), led some researchers to envision mixed demand-supply approaches to regional growth based on simultaneous-equation models. Built in the last decade, the mixed demand-supply models of regional development initially emphasized the interaction between an area's indicator for economic change and a corresponding indicator for demographic change. Later Greenwood (1973a, 1975b) enlarged the scope of these models by proposing a model (a) accounting for interactions between income change, employment change and labor force change and (b) allowing for various disaggregations of the employment and labor force variables.

Early Simultaneous-equation Models

Early simultaneous-equation models were built by Okun (1968), who studied interaction between income change and net migration of total population in the US states; Muth (1971), who examined the interaction between employment change and labor force growth in US cities; and Olvey (1972), who dealt with the interaction of employment change and population growth in major US SMSAs.

Okun's Model

Okun (1968), proposed a three-equation system to model the interaction between per capita service income and population growth for US states. The three equations, set up in a linear form explain the variations across states of the net migration

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*Note that all these models have been tested using estimation methods compatible with the simultaneous nature of these models (two- or three-stage least squares estimators have been displayed for all these models).

rate (M), the absolute change in service income per capita (Z), and the percentage point change between 1940 and 1950 in the percent of the labor force engaged in agriculture (ΔL) respectively.

Empirical regression results concerning the corresponding equations appear in Table 1, in which all coefficients are significant (at the 5 percent significance level) except those of ΔL. The net migration equation shows that states with relatively high service income per capita tend to attract migrants (as the coefficient of S, service income per capita is positive). Additionally "states which grow comparatively slowly in absolute increase in service income per capita, tend to attract migrants" (because of the significant negative relationship between M and Z). Okun points out that this rather puzzling difference can be almost certainly attributed to the high correlation between S and Z.

The second equation shows that net migration promotes service income growth per capita and is significantly affected by the social composition of the state (of which C is an index). The growth in the agricultural labor force (found to affect insignificantly net migration and change in service income per capita) is explained in the third equation by variations across states of levels in service income per capita and fertility (of which B is an index).

Table 1. Okun's Model of Income and Population Change--US States--Period 1940-1950.

Source: Okun (1968, p. 305)*

$M = -493 + 1.855\ S - 31.5\ \Delta L - 1.55\ Z$ $\quad\quad (0.669)\ \ (17.5)\quad\ (0.695)$	$R^2 = .46$
$Z = 698 + 152\ C + 3.50\ M - 8.94\ \Delta L$ $\quad\quad (24.9)\ \ (0.532)\ \ (6.63)$	$R^2 = .82$
$\Delta L = -4.67 + 0.010\ S - 19.3\ B$ $\quad\quad\quad\quad (0.003)\quad\ (6.25)$	$R^2 = .72$

*The coefficients between parentheses are standard errors.

The main findings of Okun's model is that, in the forties, interstate migration was a force for widening interstate differences in service income per capita.

Muth's Model

Muth (1971), introduced employment change into the picture but reduced income to an exogenous role. He proposed a two-equation system, set up in a double logarithmic form, explaining demoeconomic growth for a cross sectional sample of US urbanized areas during the period 1950-1960. These two equations have employment change and net-migration of labor force between 1950 and 1960 as their dependent variables (Table 2).

Muth argues that employment change and net inmigration are interdependent and that each variable is partly determined by the other as well by additional variables (including family income used as a proxy for wages).

The most important result obtained by Muth is that the effect of employment expansion on labor force change in excess of natural increase (i.e. net migration of labor force), is of the same magnitude as the reverse effect of net migration on employment change. However, on the basis of a higher value for the coefficient α_{11} of the net migration variable in the employment change equation than for the coefficient α_{21} of the employment change variable in the net migration equation ($\alpha_1 = .998$ and $\alpha_{21} = .819$), Muth concluded that the effect of net migration on employment growth was somewhat stronger than the reverse effect. Thus he claimed that his results supported the Borts and Stein theory rather than the demand (or export-base) theory.

Mazek and Chang (1972) strongly challenged the validity of this conclusion on several grounds:

1) First, they point out that Muth has not directly estimated supply and demand elasticities and has limited himself to provide some indirect evidence in order to justify the infinite elasticity of the supply curve which constitutes the foundation of the Borts and Stein

Table 2. Muth's model of employment and labor force changes.*

Source: Muth (1971)

a) employment change equation:

$$\log \frac{E_{60}}{E_{50}} = \alpha_{10} + \alpha_{11} \log \left[1 + \frac{M_{60}}{L_{50}}\right]^{+} + \alpha_{12} \log \left[1 + \frac{N_{60}}{L_{50}}\right]^{+}$$

$$+ \alpha_{13} \log \frac{y_{60}}{y_{50}}^{+} + \alpha_{14} \log \left[1 + \frac{\Delta MP}{L_{50}}\right] + \alpha_{15} \log P_{50}$$

$$+ \alpha_{16} S_{50} \ .$$

b) net-migration equation:

$$\log \left(1 + \frac{M_{60}}{L_{50}}\right) = \alpha_{20} + \alpha_{21} \log \frac{E_{60}}{E_{50}}^{+}$$

$$+ \alpha_{22} \log \left(1 + \frac{N_{60}}{L_{50}}\right)^{+} + \alpha_{23} \log \left(1 + \frac{\Delta MP}{L_{50}}\right)^{+}$$

$$+ \alpha_{24} \log U_{50}^{+} + \alpha_{25} \log y_{50} + \alpha_{26} X_1 + \alpha_{27} X_2 \ .$$

in which

E = total civilian employment

M = net inmigration over the decade 1950-1960

L = total civilian labor force

N = natural increase of labor force over the decade

y = median family income

ΔMP = the change in military personnel

P = the proportion of employment in the manufacturing sector

S = the area's population

U = the unemployment rate

X_1 = regional dummy (1 if city located in the South, 0 otherwise)

X_2 = regional dummy (1 if city located in the West, 0 otherwise)

and 50 and 60 subscripts refer to 1950 and 1960.

*Only variables accompanied by a + sign are statistically significant.

hypothesis. Thus according to Mazek and Chang, Muth's model is inconclusive in supporting any regional theory: "His (Muth), paper supports neither the BLM (export-base) nor the BS (Borts and Stein) approaches". (p. 133)

2) Second, Mazek and Chang indicate that the use of 10 year rather than annual data diminishes the prospects of uncovering the simultaneous bias between migration and employment growth offered by the two polar theories. For example, in the short run, the migrant labor supply may grow faster in a region than the number of employed migrants, contributing to an increase in unemployment. However, in the long run, the unsuccessful job seekers will drop out of the labor force or move out of the region: "long-term net inmigration and employment change tend to approximate proportionately more closely than their short run counterparts". (p. 136)

3) Finally, Mazek and Chang strongly attack the specification of the structural employment equation which they view as a quasi-identity: according to them, this is the most serious criticism to be addressed to Muth's model.

Also, note that the required data for labor force migration were obtained by using the cohort-survival technique and national labor force participation rates. From an empirical point of view, this is unsatisfactory and contributes to even more doubt the validity of Muth's results.

In addition, as observed by Miron (1975, p. 41) "the growth in jobs and inmigrants feed on one another completely simultaneously". In other words, there is little explanation of how urban growth occurs in spite of the presence of a proxy for export demand in the employment change equation and an autonomous migration term (net increase in armed forces) in the net migration equation. Actually, Muth's model does not focus on the cause of regional development but examines how firms and workers react to each other. Thus, from the above finding that migration

affects employment growth no more than employment grow affecting migration, it appears inappropriate, as Muth does, to conclude the preponderance of the Borts and Stein theory.

Olvey's Model

An extension of Muth's model has been studied by Olvey (1972). He proposed a model in which the employment side was divided into two sectors (manufacturing and services), and net inmigration was broken down into its gross components. In addition, a money variable (wage rate), still exogenously considered, was given more importance than the income variable in Muth's model.

The model, displayed in Table 3, consists of eight equations: five structural equations and three identities. The structural equations explain the growth in both types of employment and the three gross migration flows. Population growth appears to be the main contributor to employment growth in both sectors in accordance with Borts and Stein's theory. No export demand is explicitly introduced in the manufacturing employment equation but growth in manufacturing employment stimulates growth in service employment as in the export-base theory. The wage level also affects the employment growth in both sectors while median family income influences growth in service employment (additional demand effect).

On the demographic side, unlike Muth who dealt with labor force, Olvey uses population and thus does not allow for differentials in labor force participation among regions: there is no role for labor market dynamics in his model. All the migration flows are influenced by the prevailing wage level and a climate variable. Total employment growth affects the two types of inmigration flows but not outmigration. In addition, a prospective unemployment variable defined as the excess of labor supply growth over the employment growth that would occur in case there would be no outmigration (see first identity defined by equation 6 in Table 3) is found to significantly influence gross outmigration.

Table 3. Olvey's model of regional growth.*

Source: Olvey (1972, p. 153)

(1) 5 STRUCTURAL EQUATIONS	Explanatory Variables	
Dependent variables	Endogenous	Predetermined
1. Growth in manufacturing (y_1)	Net population growth (q_2)+	Wage level+, industrial composition index, climate
2. Growth in service employment (y_2)	Manufacturing employment growth (y_1)+ Net population growth (q_2)	Median family income+, wage level
3. Short-distance inmigration (y_3)	Total employment growth (q_3)+	Wage level+, median family income in contiguous areas+, climate and population+
4. Long-distance inmigration (y_4)	Total employment growth (q_3)+	Wage level+, climate+
5. Gross outmigration (y_5)	Prospective unemployment (q_1)+	Wage level+, climate

(2) 3 IDENTITIES

6. Prospective unemployment (q_1) = No-migrant population growth** (x_1) + Inmigration ($y_3 + y_4$) - Employment growth ($y_1 + y_2$)

7. Net population growth (q_2) = No-migrant population growth (x_1) + Inmigration ($y_3 + y_4$) - Outmigration (y_5)

8. Growth in total employment (q_3) = Growth in manufacturing employment (y_1) + Growth in service employment (y_2)

*Note that the + sign accompanying some of the variables of the model indicates that these variables are significant. All variables are deflated by the area's population in the initial year.

**No-migrant population growth in an exogenous variable describing population increase which would have occurred during 1955 to 1960, assuming no migration.

In all fairness, such a variable appears to be a broad estimate of the impetus to outmigration implied by employment growth, inmigration and natural increase and does not preclude the validity of a strong response of outmigration to local labor market conditions. For example, Greenwood argues that:

> in the context of a simultaneous-equation model of migration, it seems clear that prospective unemployment would grossly exaggerate the actual amount of unemployment that would exist in the absence of migration. The lack of migration would tend to aggravate unemployment and to provide significant downward pressure on the wage rate. (Greenwood, 1973a, p. 97)

Because Olvey's model presents a simple interaction of population and employment growth (see Figure 3), it allows for the calculation of elasticities comparable to the α_{11} and α_{21} coefficients of Muth's model. It turns out that Olvey's numerical values* result in a finding opposite to Muth's: the impact of employment growth on population growth is greater than the reverse impact.

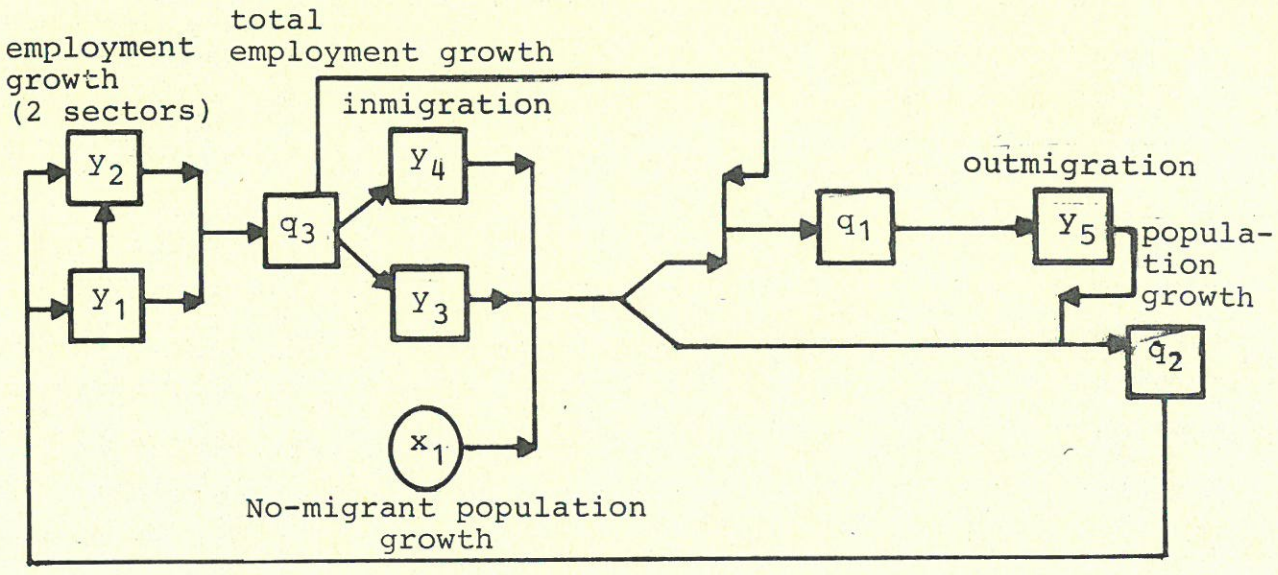

Figure 3. The structure of Olvey's model.

(The meaning of all variables is the same as in Table 3.)

*Using a US average value for the employment/population ratio leads to elasticities comparable to α_{11} and α_{12} equal to .51 and .64 respectively.

Kalindaga (1974), has attempted to reconcile the apparently inconsistent findings of Muth and Olvey, using modified versions of their models in order to make them more comparable. He concludes that Olvey's model fails to provide adequate results because of an inappropriate impact of labor supply growth on employment growth: there exists no separation of the natural increase component from the migration component. Finally, Kalindaga endorses Muth's view that migration and employment growth affect each other to almost the same extent and that migration has a stronger influence on employment growth than employment growth has on migration:

> at the present stage of development of US cities, supply factors appear to dominate demand factors in influencing differentials in growth among cities. As cities have grown, the relative importance of internal markets has increased and the relative importance of exports declined. For given levels of demand, supply factors have become an essential determinant of output and employment. (Kalindaga, 1974)

Again such a conclusion is valid to the extent that one is willing to refute the criticisms raised by Mazek and Chang (1972) on the basis of Muth's model.

Greenwood's Models of Urban Growth and Migration

Greenwood (1973), proposed a model of urban economic growth and migration that improved Olvey's model by treating unemployment and median income of persons (a proxy for wage rate) endogenously. It consisted of seven equations shown in Table 4: five structural equations and two identities and was estimated, using three-stage least squares estimation, for the cross-section of the 100 largest SMSAs in the continental US in 1960, i.e. SMSAs with populations in excess of 250,000 in that year.

Employment change, the dependent variable in equation 4, Table 4, is affected by the various components-of-change of the labor force taken separately (outmigration, inmigration and natural increase): outmigration reduces employment change while inmigration and natural increase promotes it, however only the two migration variables are significant at the 5 percent level.

Table 4. Greenwood's model of urban growth and migration.

Source: Greenwood (1973a, p. 92)

A - VARIABLES*

Endogenous Variables		Exogenous Variables	
IM	inmigration of people in the labor force	AGE60	median age of the 1960 population
OM	outmigration of people in the labor force	CLF50	1950 civilian labor force
NATINC	natural increase of the labor force	EDU50	median number of years of school by persons 25+
ΔCLF	civilian labor force change	INC50	median 1949 income of persons residing in SMSA in 1950
ΔEMP	employment change	UNR50	1950 unemployment rate
ΔINC	income change	ΔEDU	change in educational level
ΔUNEMP	unemployment change	ΔGOVT	change in local government expenditures
		DEW & DNS	regional dummies

B - EQUATIONS

1) Five Structural Equations

1. $OM = f_1\,(IM,\ \overset{-}{\Delta INC},\ \Delta EMP,\ \Delta UNEMP,\ \overset{--}{INC50},\ \overset{++}{UNR50},\ \overset{++}{CLF50},\ \overset{++}{EDU50},\ \overset{--}{AGE60})$

2. $IM = f_2\,(\overset{++}{OM},\ \overset{++}{\Delta INC},\ \overset{++}{\Delta EMP},\ \Delta UNEMP,\ INC50,\ \overset{--}{UNR50},\ \overset{++}{CLF50})$

3. $\Delta INC = f_3\,(OM,\ \overset{++}{IM},\ \overset{++}{\Delta EDU},\ \Delta GOVT,\ \overset{++}{DEW},\ DNS)$

4. $\Delta EMP = f_4\,(\overset{--}{OM},\ \overset{++}{IM},\ NATINC,\ INC50,\ \overset{+}{\Delta EDU},\ \Delta GOVT,\ \overset{++}{DEW},\ \overset{++}{DNS})$

5. $\Delta UNEMP = f_5\,(\overset{--}{OM},\ \overset{++}{IM},\ \overset{++}{NATINC},\ DEW,\ \overset{++}{DNS})$

2) Two Identities

6. $\Delta CLF = g_1\,(\Delta EMP,\ \Delta UNEMP)$

7. $NATINC = g_2\,(\Delta CLF,\ OM,\ IM)$

$\overset{++}{(--)}$ denotes a positive (negative) correlation significant at the 5 percent level of significance.

$\overset{+}{(-)}$ denotes a positive (negative) correlation significant at the 10 percent level of significance.

*Variables representing a change in stock variable (like ΔEMP) are measured by a logarithm of the ratio between the initial and final values of the variable (in 1950/1960). Other variables are simply measured by the logarithm of their absolute value.

Outmigration, the dependent variable in equation 1, Table 4, is negatively affected by income change--whose coefficient is significant at the 5 percent level--and various exogenous variables whose coefficients all have the expected sign and are significant.* On the other hand, inmigration, the dependent variable in equation 2, Table 4, is positively affected by outmigration, income change, employment change, which are moreover, significant in all instances and negatively by unemployment change which is, however, not significant.

The two migration variables appear as explanatory variables of income change along with three exogenous variables. As stated by Greenwood (1973a),

> there is no strong a priori reason to suggest that the signs on the out- and inmigration variables in the income change equation should be positive, negative or zero..... There appears to be no a priori reason to suppose that the demand labor shift associated with migration will dominate the labor-supply shift, that the supply shift will dominate over the demand shift, or that the shifts will not offset on another..... (Greenwood, 1973a, p. 98)

The signs of the migration variables, thus regarded as an empirical matter, appear to be positive and significant for the inmigration variable, negative but insignificant for the outmigration variable.

Finally, no definite impact of the various components of change of the labor force on unemployment change (equation 5, Table 4) is expected: thus inmigration and natural increase significantly increases unemployment change whereas outmigration diminishes it significantly.

Again, this model shows that employment growth influences migration and migration in turn influences employment growth. However, it is not possible any longer to compare the relative strengths of the two ways of causation as in Muth's and Olvey's models, due to the more sophisticated structure of Greenwood's model (Figure 4).

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*Unemployment change and inmigration have the positive expected sign whereas employment change picks up a positive unexpected sign. All the corresponding coefficients are not significant.

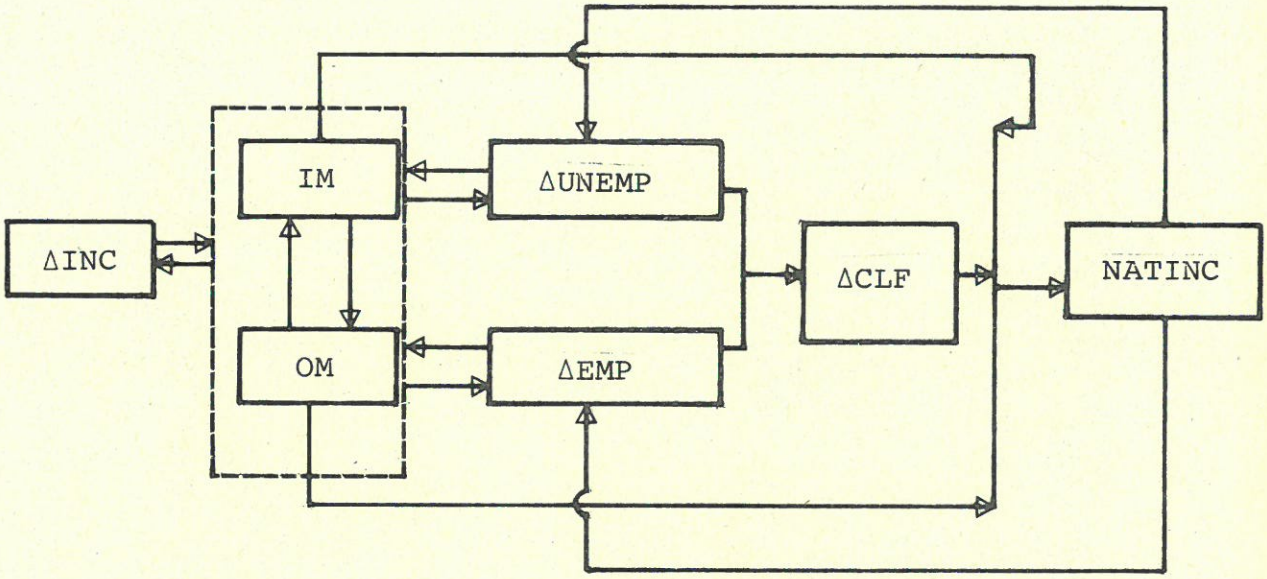

Figure 4. The internal structure of Greenwood's model.
(The meaning of the symbols have been given in Table 4.)

The main contribution of Greenwood's model appears to be the treatment of labor surplus (although it does not turn out to be significant in the migration equations) and the endogenous determination of income change (although it is affected by and only affects in- and outmigration flows as shown in Figure 4).

In a following paper (Greenwood, 1975b), the above model was extended to include three types of employment and two types of migration: employment change was disaggregated into component changes in manufacturing employment, government employment and other non-manufacturing employment; and gross migration flows were decomposed into flows out of or into other SMSAs and non-metropolitan areas. Moreover, the extended model was tested for two different time periods, 1950-1960 and 1960-1970.

Concerning the impact of migration on employment growth, it appears that higher rates of inmigration resulted in significantly greater rates of growth for each employment category. The coefficient of the inmigration variable was positive and significant for the three types of employment in both periods, the only

exception being government employment between 1960-1970. However, in contrast to the conclusions of his first model, Greenwood found a significant impact of outmigration on employment growth: during 1965-1970 outmigration significantly deterred employment growth.*

On the other hand, employment change was found to be a significant inducement to inmigration and, surprisingly a significant deterrent to outmigration. In the second period, this statement only holds true for migration into and out of metropolitan areas. Moreover, little evidence was found that in- and outmigration flows are significantly affected by levels of change in income during both periods: greater income growth significantly encouraged only inmigration from non-metropolitan areas during the second period. This again contradicts the findings of the earlier model. In addition, the influence of the levels of and changes in unemployment on migration flows was found to lead to different conclusions according to the fitting periods.

> In the 1960-1970 model neither the unemployment growth nor the unemployment rate variable appears significantly in any migration equation, and five of eight coefficients have unanticipated signs. However, for the earlier decade (unemployment change) has the expected sign and is significant in each migration equation, and (the 1950 unemployment rate) has the expected sign and is significant for both non-metropolitan migration equations. (Greenwood, 1975b, p. 894)

Both out- and inmigration were shown to have a significant impact on unemployment change, a negative effect on outmigration and a positive impact on inmigration thus confirming the results of the earlier model. However, these variables were found to have no significant influence on income change. Moreover, since the income level variable appears to be negative and significant in the income change equation, Greenwood's findings appear to hold no support for the view that regional income differentials are narrowed through interregional migration.

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*We note that change in manufacturing employment is a positive but not significant factor of change in non-manufacturing employment, which allows Greenwood to conclude the failure of the export-base theory for cities in advanced stage of development.

Mixed Demand-supply Models: A Brief Evaluation

The most striking feature of the mixed demand-supply models to regional demoeconomic growth is its empirical orientation: "there has been virtually no treatment of the theoretical basis for such a model" (Miron, 1977, p. 2). However, in spite of structural differences in the choice of the variables and the specification of their relationships, these models appear quite simplistic and similar in their attempt to disentangle the linkage between economic growth and migration. On the one hand, they present one or several regression equation(s) explaining the economic growth variable(s) in terms of the migration variable(s); on the other, they all include regression equations between the same variables representing the opposite path of causation.

Mixed demand-supply models of regional development, however, have neglected to identify the sources of growth, i.e. whether firms or workers, or both, induce growth. Instead, these models have concentrated on the short-term process by which entrepreneurs and workers form their expectations;

> ...these are really the models of the short-run dynamics of the urban labor market where entrepreneurs try to anticipate the change in labor supply and migrants in turn to anticipate the number of new jobs to be created. (Miron, 1975, p. 41)

In other words, the emphasis of the simultaneous-equation models of regional development is one consistent with the problem of removing the simultaneous bias affecting the impact of changes in economic forces on labor migration. One can obtain indications concerning the nature of this bias by comparing the three-stage least squares estimations of Olvey's and Greenwood's models (which account for the simultaneity problem) to the corresponding ordinary least squares estimations. In fact, the difference between the two types of estimators is minimal in the case of Olvey's model; the removal of the simultaneous bias leads to only an increase in the values of the impact of employment growth on migration. In Greenwood's case, (his first model)

a more dramatic change is observed. The three-stage least squares estimation causes the coefficient of employment change in the outmigration equation (which is negative and significant in the case of the ordinary least squares estimation) to be positive and not significant. Apparently, such a finding may suggest that it is the existence of a simultaneous bias that creates the strong response of outmigration to changes in economic factors as observed by some of the migration studies reviewed in section 1.2. Unfortunately, the conclusion is not confirmed by the second model presented by Greenwood which displays a negative and significant impact of employment change on outmigration in the case of the three-stage least squares estimation.

To summarize, in spite of their orientation, the mixed demand-supply models of regional development have not provided any clear explanations of the degree to which firms or workers contribute to enhance or slow down the development process in the short run. The evidence displayed by Muth, Olvey and Kalindaga concerning the two paths of causation between employment growth and migration may well be a result of the use of five-year or ten-year time frames for these studies (see criticism by Mazek and Chang).

Conclusion to Part 1

Overall, past aggregative explanations have contributed very little to the understanding of the forces which cause and shape the spatial pattern of regional demoeconomic growth. Theories and models have generally focused on the labor factor, examining the relationship between labor demand, viewed as an input index, and labor supply. Two polar explanations of regional development have been put forth: one stresses the leading role of labor demand which determines labor supply (export-base theory), the other emphasizes the opposite parth of causation between the two (labor supply approach). The empirical research of the last decade has not determined which one of the two explanations prevails in reality. Most studies, focusing on partial analysis, have either attempted to prove or disprove the validity of each theory while the more global studies, based on simultaneous-equation models have demonstrated the coexistence of the two

alternative explanations without producing any definite evidence favoring either one.

Labor migration which is both the cause and effect of economic forces has, in most instances, been examined as the result of the influence of these economic forces. Overall job opportunities and/or wage differentials have been shown to affect labor migration, with a much larger impact on inmigration flows than on outmigration flows. More precise statements could not be substantiated since the variations in the specification of the empirical models used often led to differing and sometimes inconsistent results. A typical example of this is the controversy concerning the response of outmigration flows to changes in economic incentives and the related question concerning observed positive correlation between out- and inmigration flows. Accounting for differential propensities to migrate on the basis of duration-of-stay effects (principle of cumulative inertia) brought insights into the debate. However, no economic rationale underlying these effects was really provided.

In summary, there exists to date no overall explanation of the migration process emphasizing its interaction with economic development. Two important reasons contributing to this are

a) the absence of a spatial dimension--whose role is examined in part 3, and

b) the rather crude treatment of the clearing mechanisms of regional labor markets.

The latter point is the subject of the next part.

PART 2. REGIONAL LABOR MARKETS AND THEIR ROLE IN REGIONAL DEMOGRAPHIC GROWTH

Part One has emphasized the preponderant role of the labor factor in the traditional theories of regional demoeconomic growth. Unfortunately, the explanations provided by past theories and

models have been essentially framed in independent and static terms. Consequently, progress in the understanding of the role of labor in regional development requires the availability of an integrated and perhaps more dynamic framework dealing with the interplay between the location of firms and households.

The second part of this paper examines the studies which have recently aimed at such a purpose. Section 2.1 reviews aggregative approaches to regional labor markets. It stresses the importance of separating the role of households as suppliers of labor and consumers and thus examines the determinants of labor force participation at the regional level. Section 2.2 reviews the behavioral models of job search and creation which have been proposed to comprehend the working mechanisms of regional labor markets. Finally section 2.3 examines the problem concerning the transition of these behavioral models to empirically testable models of regional demoeconomic growth.

2.1 Aggregative Approaches to Regional Labor Markets

The time horizon considered is an important characteristic of the pattern of regional demoeconomic growth discussed in Part One. Miron (1975, p. 7) clearly summarizes this problem when he argues that it is likely that

> ....short run changes may accumulate to produce behavior which in the long run does not approximate the demand or supply-oriented model.

A clear understanding of how and why regional development occurs requires the availability of a theory or an explanatory model integrating both short-term and long-term aspects. A first step in that direction was suggested by Anderson (1976), whose untested model proposed an endogenous wage determination involving the role of both firms and households.

Anderson's Model

The model proposed by Anderson (1976), is a model of regional wage determination synthesizing demand conditions and supply constraints. His model attempts to provide a general description

of the relationship between employment and labor force growth--subsuming the particular cases of the export-base and labor supply theories--in which regional wages are determined by the interaction of labor demand and supply.

We provide below an exposition of Anderson's model that ignores--without any restriction to the generality of the model--a third sector (investment) considered in the original formation. The first two equations describe labor demand in the two sectors of the regional economy: export and residentiary. In the first sector, labor demand is determined by the regional money wage rate w and exogenous factors denoted by λ (mainly referring to markets outside the area)

$$L_x^d = L_x^d (w,\lambda) \quad . \tag{14}$$

In the second sector, labor demand is determined by the money wage rate w, the labor force L employed in the area, and a set of exogenous parameters K

$$L_r^d = L_r^d (w,L,K) \quad . \tag{15}$$

This leads to a combined demand for labor:

$$L^d = L_x^d + L_r^d \tag{16}$$

which is to be met by a supply function

$$L^s = L^s (w) \tag{17}$$

such as

$$\frac{\partial L^s}{\partial w} > 0 \quad .$$

This leads to an equilibrium money wage w^+ satisfying:

$$L^s(w^+) = L_x^d (w^+,\lambda) + L_r^d (w^+,L,K,) = L \quad . \tag{18}$$

This equilibrium is a stable one because of the above assumptions concerning the demand and supply curves and the additional hypothesis that

$$\frac{\partial L_r^d}{\partial L} < 1$$

(i.e., additional wage income produced by an addition to local employment is spent only partly on locally produced goods). It follows that:

a) under conditions of excess demand, local employment L is supply-determined:

$$L = L^s(w) \text{ and } L^d(w,L,\lambda,K) > L^s(w) \tag{19}$$

such that a wage increase leads to a decrease on excess demand as indicated by differentiating the above inequality:

$$\frac{\partial L^d}{\partial w} - \left(\frac{\partial L^d}{\partial L} - 1\right)\frac{\partial L^s}{\partial L} < 0 \quad . \tag{20}$$

b) Conversely, under conditions of excess supply, local employment L is demand-determined:

$$L = L^d(w) \text{ and } L^s(w) > L^d(w,L,\lambda,K) \quad . \tag{21}$$

such that a wage fall yields a reduction in excess supply as indicated by differentiating the above inequality:

$$\frac{\partial L^s}{\partial w} - \frac{\frac{\partial L^d}{\partial w}}{1 - \frac{\partial L^d}{\partial L}} > 0 \quad . \tag{22}$$

An increase in any of the parameters K or λ from an initial position of equilibrium leads to excess demand for labor in the regional market. For example, an increase in λ (or K) corresponding to a rightward shift in demand curves for exports (or regional factors) produces a shift of the demand schedule toward the right (see Figure 5). In this case equation (20) applies and if labor demand is not perfectly elastic, the wage rate increases as employment rises. This initial shift in demand for labor (and thus employment) and this increase in wage rate are further magnified by an additional demand for labor via the impact of an additional demand occurring in the regional factor. The demand curve then reaches the schedule D_2, producing a new equilibrium in which the employment level and wage rate are L' and W' respectively. However, the additional effect due to the wage increase is absent if the supply of labor is perfectly inelastic with respect to changes in the wage rate.

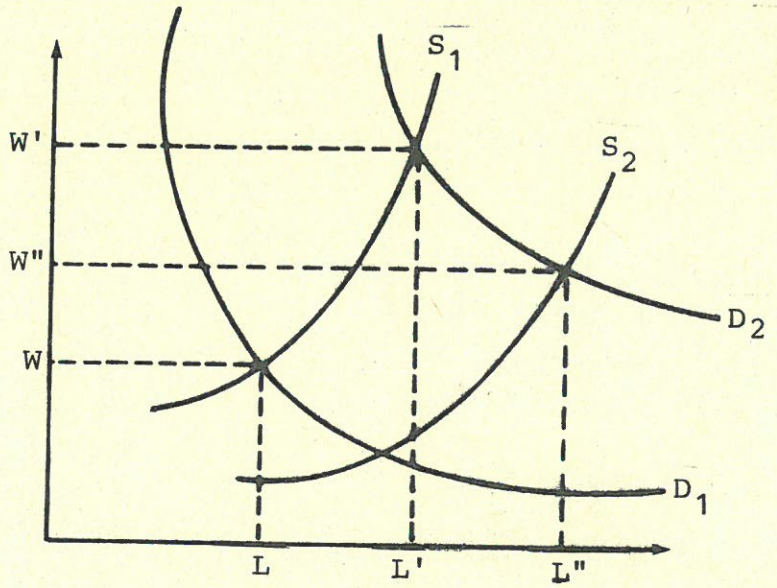

Figure 5. The mixed demand-supply approach to regional growth.

The increase in the wage rate and the employment opportunities induces inmigration, creating a shift from S_1 to S_2. The increase labor supply increases the level of employment to L'' and decreases the wage rate to its equilibrium level, w''.

In this general description of the relationship between labor force and employment growth, firms and workers are considered but are assigned mutually excluding roles. Employment growth is generated in the export sector and is regulated by the availability of labor:

> the process of regional expansion can be fruitfully described as a pattern of interaction between demand for production factors and their augmentable regional supplies. Price formation in factor markets serves as the first pivot in the approach. Demand conditions (stressed in export-base (...) models) acts as necessary conditions for regional growth by creating tight factor (labor) markets while the supply constraints act as sufficient conditions that respond through migration processes to levels of regional factor price. (Anderson, 1976, p. 223)

In brief, the mixed demand-supply approach of Anderson possesses characteristics of both the theoretical approaches of section 1.1 and the empirical models of section 1.3. On the one hand, it stresses the growth-inducing role of firms (as in the export-base theory); and on the other hand, it describes the short-term dynamics of regional development; firms in the local sector try to anticipate change in labor supply and migrants in the workforce try to anticipate the number of new jobs created. Still workers are denied any role in generating regional development in spite of the recent assertions that migration of workers, as well as of non-workers, is important in causing regional growth (see for example Hirsch, 1973, chapter 9; Richardson, 1973, chapter 4).

Moreover, the role of non-workers in regional development is not negligible since they may generate a large demand effect (college students, military personnel and retirees). Under these conditions, the sole consideration of labor supply on the demographic side is insufficient.

Population and Labor Supply Considerations

Existing theories and models of regional development examine how demographic growth relates to the economic growth process,

but, in most instances, the role of demographic factors is not adequately treated. Typically, labor supply is chosen as the main demographic index (only Olvey (1972) used population rather than labor force to describe demographic growth) and it is divided into terms reflecting natural increase and net migration of labor force. However, these two terms have little meaningful content especially within the five-year or ten-year time frame of the mixed models reviewed in section 1.3: the reason being that in such a period of observation individuals are likely to have a different labor force status in the final year than in the initial year. For example, in Greenwood's models (1973a, 1975b), the labor force migration flows include individuals who are in the labor force at the end of the observation period, regardless of their initial labor force status. The models do not include migrants who were in the labor force at the beginning of the observation period and dropped out later on. Consequently, the natural increase term in Greenwood's model appears as a combination of the changes in the working age population due to migration as well as to the aging of the regional population and the changes in labor force participation.

To be meaningful, the change in labor supply must be divided into easily interpretable components. As shown below, this can be done by using a population variable along with the labor force variable.

Let LF denote the labor supply and POPF the working age population in a given regional labor market. These are linked by the following identity stemming from the concept of labor force participation rate (LFPR):

$$LF = POPF * LFPR \quad . \tag{21}$$

POPF varies over time as a consequence of the aging process (hence the natural increase term NATF) and the net inmigration (NMIGF) of potential workers into the regional area:

$$POPF = POPF_{-1} + NATF + NMIGF \quad . \tag{22}$$

It follows, from (21) and (22), that the increase of regional labor supply is the combined result of three effects (natural increase, net migration of potential workers, and change in labor force participation):

$$\frac{\Delta LF}{LF} = \frac{NATF}{POPF} + \frac{NMIGF}{POPF} + \frac{\Delta LFPR}{LRPR} \qquad (23)$$

Intuitive arguments show that the decomposition of labor force change as indicated by (23) can provide a better understanding of the mechanisms of regional growth. First of all, natural increase for the working age population is not responsive to current economic conditions. It merely reflects the impact of the age structure of the regional population through the entrance into the labor market by young people and the retirement (or death) of older workers. Then only the last two terms of the right-hand side of (23) are responsible for growth. But, all else being equal, inmigration of working age population implies a larger decrease in per capita income than a change in the labor force participation rate of residents. And also:

a) For a given rate of employment expansion in a given area, differing responses to economic incentives regarding migration lead to differing growths of the area population: the more rapid population growth, the slower the rate of growth of income and the slower the area development.

b) The growth rate of per capita income is likely to be higher if employment expansion is met by the region's residents previously out of the labor force rather than by outsiders. For any given rate of employment expansion in a given area, differing responses of the resident potential labor supply leads to different growths of per capita income: all else being equal, the higher the labor force participation rate, the higher the rate of growth of income and the faster the area development.

In fact, the inclusion of a population variable along with the labor force variable is further justified by the existence of households not headed by a member of the civilian labor force whose location shifts may strongly affect their origin area and, to a greater degree, their destination area: clearly the concentration of college students, military personnel, elderly, etc. in some areas has an impact on the growth of these areas through demand effects. In other words, the distinction between population and labor force, at least in theory, accounts for the separate demand and supply impacts of households on regional employment growth.

More fundamentally, the above considerations suggest the possibility of household-initiated growth through either demand or supply effects:

a) exogenous migration of households outside the labor market generates demand incentives to regional development, and

b) exogenous changes in labor force participation (for example due to evolution of attitudes towards work) create supply incentives to regional development.

Additionally, it appears that individuals belonging to the labor force may be induced to relocate by non-economic incentives. Earlier in this paper, when dealing with the persistent differentials prevailing across regional wages, we mentioned several non-economic factors (amenities of living in a particular area, friends and family ties, and risk-bearing migrants) that induce autonomous streams of migration among workers also leading to a growth-inducing migration.

To summarize, households, like firms, have a growth-inducing role: it results from migration and changes in labor force participation, induced by non-economic motivations. Consequently, in order to understand how firms and households shape regional development, it is now necessary to develop theories and models accounting for this growth-inducing role of households.

Labor Force Participation at the Regional Level

This paper has proposed the thesis that the role of labor force participation in regional demoeconomic growth has been overlooked. Nevertheless, some indications concerning the variations of labor force participation, at the regional level, in response to economic forces can be found in the literature; although there have been a few studies concerned with regional labor force participation per se, the bulk of the evidence comes from the general studies of labor force participation based on cross-sectional data for regions.

After a brief review of economic theories of labor participation, we present here the highlights of the general and the regional studies on LFP immediately relevant to the objectives of this review.

The Economic Foundations of Labor Force Participation

Existing theories of labor force participation consists of two main strands: one built upon the empirical evidence linking labor force participation and unemployment, whereas the alternative theory is developed within the framework of classical economics and extended by neoclassical economists.

Traditionally, the explanation of labor force participation has focused on the short-run impact of labor markets' tightness, generally proxied by unemployment rates. Two competing hypotheses regarding the response of labor force to changes in economic activity over the business cycle have been postulated. According to the first view--the "discouraged worker" hypothesis--there is a direct relationship between level of economic activity and size: high unemployment rates limit employment opportunities and discourage entrance into the labor force of individuals who otherwise might seek jobs. Alternatively, an inverse relationship between level of economic activity and labor force size can be postulated--the "additional worker" hypothesis: when slack develops and leads some household heads to lose their jobs, other household members enter the labor market in order to bolster family

income. Clearly, the two alternative hypotheses are plausible and are likely to occur simultaneously and the question is then one of knowing which one is predominant.

Indeed, the impact of labor market tightness on labor force participation provides limited insights into the working mechanisms of labor supply. This is because economic and non-economic factors are likely to influence the decision of an individual to enter into or withdraw from the labor market.

The classical theory of labor force participation emphasizes the role of wages within a framework built on a trade-off between leisure and work. This role was also stressed in an extension built by Mincer (1965) paralleling the standard economic theory of consumption. As for the consumption of a commodity, labor force participation is affected both by changes in its relative price ("substitution effect") and by changes in income ("income effect"). These two effects are seen as substitutes for the "discouraged worker effect" and "additional worker effect" respectively, when wages are modified to account for the probability of obtaining a job (expected wages). It is on the basis of such labor supply models that Mincer has been able to resolve the apparent contradiction between i) the rising over time of labor force participation rates of female workers, as their incomes have increased and ii) the fact that the participation rates of married women at a moment of time are inversely related to the incomes of their husbands (Parnes, 1970, p. 5). But, although the consumer utility framework has its own merits, it appears that "Mincer tries too hard to force explanatory variables into a very limited number of traditional, price theory boxes" (Bowen and Finegan, 1966) and that the probability of obtaining a job must be investigated separately.

Instead, Bowen and Finegan (1965, 1969) propose theoretical foundations for labor supply analysis derived from the neoclassical utility maximization model of consumer behavior.

The starting point here, is that the household is the basic decision-making unit since the labor status of the members of

the members of any household are not independent. In addition, the decisions concerning labor force status are assumed to depend on a larger set of decisions concerning the allocation of time by each member of the household. Thus, the task of the household is to determine the number of hours each member is to devote to work and to other activities. In accordance with the neoclassical principles of the human capital theory, proposed by the Chicago school, the household seeks to maximize its utility function--expressed in terms of satisfaction derived from the consumption of goods and services and the pursuit of other activities--subject to its budget constraint. The consideration of this constraint reflects the fact that, ceteris paribus, a rich household may well value an incremental hour of work quite differently from a poor household. Besides three broad classes of variables influence the maximization process (Bowen and Finegan, 1969, p. 16-18): tastes, expected market earning rates and expected non-market earning rates.

Concerning tastes, it is likely that the household's labor force decisions strongly depend on

a) how it values successive units of monetary income compared with successive units of other activities, and

b) how it feels about the particular working tasks performed by individual members.

Expected market earning rates have a priori two effects on labor force participation which counteract each other so that the overall impact of this variable could be either positive or negative. On the one hand, an increase in real wages may induce an increase in labor force participation as a consequence of the increase in the opportunity cost of non-participation; and on the other hand, this real wage increase may have a negative impact by inducing secondary workers in the household to drop out of the labor force.

Indeed, variables other than the average wage rate influence the market earning rates. They reflect either general job

prospects such as the unemployment rate or "group" and personal job prospects (age, sex, health, education, color, etc.).

Finally, the non-labor income, having a pure wealth effect, tends to discourage entry into the labor force and therefore, has a negative effect on labor force participation.

Empirical Substantiation of the Determinants of Regional Labor Force Participation

For a long time, most of the empirical literature on labor force participation was devoted to either proving or disproving the two alternative hypotheses concerning the impact of job slack on labor force participation rates. With the development of the neoclassical model, a large emphasis has been placed on the substantiation of the factors identified above. Parnes (1970) provides a synthesis of the findings in a review paper whose highlights, completed by more recent findings, appear in Appendix 1.

The majority of the empirical studies have been based on cross-sectional data for various types of regions. They are relevant to the present discussion since they substantiate the relationship between unemployment rates and labor force participation.

Because labor force data are not available at the micro level (i.e. household), testing a model of labor force participation requires a macroeconomic setting. The decision to work strongly depends on personal factors, and therefore, most of the empirical analysis has been performed for groups of people with similar characteristics i.e., age, sex, color, and marital status. Among the main conclusions are the following.

a) The most consistent impact is job slack (unemployment rate): since a negative relationship is common for all age groups of both sexes, the "discouraged" worker effect. The relationship is stronger in the case of the secondary workforce (women). There is some evidence (Corry and Roberts, 1970 and 1974), that the relationship for men begins to operate when unemployment rates become high.

b) Labor earnings have generally a positive impact on labor force participation except for young men 16 to 24 years of age.

c) Marital status for both men and women, is of prime importance in the decision to join the labor force: it is the most powerful single predictor of labor force participation rates. In the case of women, marital status also affects the strength of the correlation with labor earnings.

d) A region's interindustry composition affects the level of labor force participation (Barth, 1967; Bowen and Finegan, 1969; Baer, 1972). Berg and Dalton (1975) indicate that, generally speaking, the labor force in the service sector is more responsive to economic conditions than in the goods sector which is characterized by more rigid institutional arrangements. In addition, it appears that the higher the percentage of employment in the service sector, the higher the labor force participation. This evidence is brought by Warren and Gilroy (1976) within a simultaneous-equation model built in response to Thompson and Black (1975), who assumed the path of causation between the two variables to be the other way around.

Unfortunately, very little analysis on a given region has been performed in the past due to the lack of age/sex population data for regional areas on a time series basis. An exception to this is an analysis of Hawaii's labor force participation rates by Renaud and Duc-Tu Pham (1975). Their main finding is that the use of the neoclassical model does not support the hypothesis that labor force participation rates are jointly determined by wages and unemployment rates (measured separately for each age-sex cohort of the population). The level of unemployment is not a significant factor in the determination of the supply of labor in Hawii.

Renaud and Duc-Tu Pham, using a simple model in which only a wage rate and a time trend appear as independent variables, show that the wage rate variable is highly significant for all cohorts of primary and secondary workers. A look at the supply-wage elasticity across age groups for each sex shows that it increases steadily from .151 for males 10 to 24, to .235 for males 45 to 64, indicating that the "substitution" effect dominates over the "income" effect and that its significance increases with age ... In the case of females for whom the wage elasticity is indeed higher than for men, it decreases continuously from .662 for females 14 to 29, to .420 for females 45 to 64.

Finally, Renaud and Duc-Tu Pham attribute the poor explanation of the "discouraged worker hypothesis" to the fact that, at the regional level, this hypothesis "may translate itself into a change in migration levels rather than a downward adjustment of labor force participation rates". The basis for this contention is yet another study by the same authors (Renaud and Duc-Tu Pham, 1973), who show the significant impact of the unemployment rate on net inmigration of the Hawaiian population.

Conversely, migration has been claimed to affect regional labor force participation. For example Mincer (1965), has shown that the relationship between unemployment levels and participation rates found in cross-sectional data may be biased upward by the effects of migration, since migration, a selective process, may involve disproportionately large numbers of labor force members. Bowen and Finegan (1969), introduced a measure of net migration to test 1960 labor force participation rates of four male age groups and married women. They obtained no significant impact of this measure because unemployment rates offered little correlation to their migration measure. This finding was confirmed for a later period--1970--in the case of married women (Gery, 1975).

The nonresponsiveness of labor force participation rates to migration differentials is strongly challenged by Baer (1972, p. 635) who points out that

> BF (Bowen and Finegan) inexplicably regress the labor force patterns of men in each of the three central age groups on the net migration rates of men aged 30 to 45 years in lieu of relating age-specific net migration rates to corresponding age specific LFPR

Baer's results support the view that net migration is a prime determinant of male labor force participation. The regression coefficient of the net migration variables is positive and significant in the case of males 20-24 and 25-34 (highly mobile age groups), negative and highly significant for those aged 45 to 54 and 65+ (as a consequence of the growing impact of retirement and slackening work activity for men in higher ages). By contrast, no significant relationship was found for males 14-19 and 35-44 years of age.

Leaving aside the impact of wages and unemployment rates, we may conclude that in a region, labor force participation is strongly affected by the industry-mix and varies with the demographic characteristics of the population, which themselves may depend on the net inmigration to the region. From our above review, we see that the level of regional participation rates results from the clearing of the regional demand for and supply of labor, in which migration seems to intervene.

2.2 Behavioral Models of Job Search and Creation

The limitations of the conventional neoclassical theory of decisions by firms and households have recently led economists to pay a great deal of attention to the microeconomic foundations of macroeconomic theories concerning labor markets.

Neoclassical Economics of Labor Supply and Unemployment

Little of the theoretical research devoted to the microeconomics of labor markets has attempted to provide a behavioral view of the clearing mechanisms of labor markets. Owing to the general difficulty of simultaneously dealing with the demand and supply sides, most researchers have emphasized one side or the other rather than giving them equal treatment.

On the one hand, some economists have attempted to make neoclassical theory consistent with Keynesian models of employment and with post-Keynesian models of inflation. They developed a path from the fall of aggregate demand to the fall of output and employment, deriving Phillips relationships emphasizing the role of the demand side (see various papers in Phelps, ed., 1970). On the other hand, following the suggestion that unemployed resources may be productive (Stigler, 1962), other researchers have developed analyses directed at workers' job searching strategy (McCall, 1970; Salop, 1973; Hartley/Revankar, 1974). The demand aspects have, however, been integrated with the supply (workers) aspects into a complete market model in some instances (Mortensen, 1970).

Note that the dominant characteristics of these studies are the prevalence of uncertainty and costly information that permits the departure from conventional neoclassical economics in which perfect information is postulated. In view of the objectives of this paper, the main drawback of these studies lies in the fact that they have adopted a level of analysis that does not facilitate the study of movement of firms and workers among alternative labor markets. Models emphasizing the demand side, have a market clearing occurring at the level of the firm considered as a wage-maker (especially in Mortensen's model). Models focusing on the supply side (job search models), generally deal with closed labor markets. An exception to this is a model which introduces migration as an endogenous component of the job search process (David, 1974).

David's Model of Job Search and Migration

Next, we describe and criticize the David model; a summarized formal statement of this model appears in Appendix 2 for easy reference.

David considers an individual located in some regional labor market of a multimarket economy who observes the other labor markets where he might seek employment to increase his welfare. The

objective of this individual is to optimally choose the labor market and to determine how hard this search should be.

The behavioral process of the migration-job search strategy imagined by David can be described as follows. If the individual who resides and works in a given locale, say the i^{th} locale, decides to work in another labor market, say the j^{th} locale, he is supposed to first quit his present job, then to move to the j^{th} locale where he looks full time for a job; and whenever, after having sampled a fixed number of firms, he accepts a job, this job is assumed to be permanent. Thus the migration behavior considered here is not the integral part of a continuous, lifetime program of job search, but constitutes the first phase of a job search process involving three static phases 1) a phase of migration, 2) a phase of random job search at the place of destination, and 3) the acceptance of the permanent tenure of a job. The rationale for such a simplistic and static separation of the migration-job search behavior is that David's model is a single-period model so as to simplify the mathematical apparatus.

An important assumption made by David, is that the prospective migrant does not know beforehand all the individual job offers that might come up in each of the labor markets that he observes. However, he is aware of the probability distribution of wage offers in each market: more exactly, he knows the average $[\mu_j = E(w_j)]$ and the variance of σ_j^2 of this distribution in each locale j of the multisystem market. Moreover, at the chosen specific destination, the prospective migrant seeks a job by collecting a fixed set n, of random wage offers, and chooses the highest.

The individual's preference structure is based on axioms giving rise to a utility index whose only argument is terminal wealth.* Additionally, it is supposed that

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*The individual's terminating wealth is his initial wealth, *less* his direct migration and search costs, *less* costs incurred in quitting the i^{th} locale, *plus* the increment in wealth due to the change of labor market (i.e. the increment in the present value of his earning streams obtained by virtue of his relocation).

1) the individual cannot spend more than a certain fraction of his initial wealth on searching for a job: this budget restriction pertains only to pecuniary costs due to migration and search activities. These two types of outlays are functions of the distance to the destination market and the number of wage offers collected, respectively.

2) There exists a trade-off between distance and opportunities: for a given distance D_{ij} of the destination market, there exists a value of the wage offer variance beyond which the prospective migrant is not willing to sample the destination market; in other words, the further the destination market, the smaller the risk he is ready to take to obtain a higher offer.

Based on this behavioral process, David is then able to depict the individual's objective as a maximum utility problem with respect to his choice of a migration-job search strategy, subject to the above financial limitations and topographical constraints. The solution of this utility maximization problem provides the necessary information for the prospective migrant to decide to move:* The determination of the j^{th} labor market in which to locate (given by an optimal value $D_{ij}+$) and the level of sampling in that market (obtained as an optimal value n+ of the wage offers). To be sure, relocation occurs if and only if, the solution of the programming problem providing the best migration-job search plan leads to an improvement of the individual's original welfare position.

We now turn to the evaluation of the model just described. In brief, the migration-job search behavioral process envisioned by David appears to be restricted and can be summarized as follows:

No search occurs without prior unemployment thus eliminating part-time search.* No local market search occurs

*The necessity of quitting a job and searching full time for another job appears a standard procedure in the job search literature. An exception is found in Mortensen's model (1970), in which the probability of making a contact with a firm is smaller if the worker is employed than it is when the worker is not.

> without physical presence thus disregarding other sampling methods. Finally, no change of location is permitted without corresponding migration, thus eliminating long-distance search travel. (Miron, 1977, p. 9)

This restriction is the price to be paid for making the decision to migrate and how long to optimally search essential features for studying labor migration.

David's model contains other explicit and implicit assumptions. Perhaps, the most questionable assumption of the model, one which represents a radical departure from usual job search models, is the migrant's strategy of collecting offers. Like McCall (1970), most researchers assume sequential strategies in which the job seeker decides to "take it or to leave it" after each wage offer, by comparing his relative cost of finding an additional offer with the expected gain from that new offer:

> Faced with (an) uncertain environment, the individual calculates a subjective wage-offer probability distribution for the entire market from his expectations of wage rates and vacancies and then samples the firms randomly, stopping his search and accepting employment when he is offered a position at a wage at least as great as the "acceptance wage" which he calculated from the wage-offer distribution. This "acceptance wage" has the property that the marginal cost of further search equals (exceeds) the marginal benefit. (Salop, 1973, p. 191)

In spite of the non-sequential sampling strategy, David's model is based on the job seeker's expectations concerning the wage-offer distributions, as are most job search models (Mortensen, 1970; McCall, 1970; Salop, 1973). However, the reliance on the wage distribution is even heavier than in other models since the optimal solution of David's model requires the knowledge of not only the average market wage, but also the wage offer dispersion.*

The reality of this source of uncertainty has been questioned by Parsons (1973) who, in a study of quit rates, finds that

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*In the usual models, only the probability that turns up a wage offer higher than "the reservation rate" is required.

workers are broadly aware of average market wages,* but might not know of other parameters of the wage offer distributions. More fundamentally, Miron (1977), claims that the informational requirements regarding the wage offer distribution, is in any case, too excessive on the migrant's part to be realistic. Following Todaro (1969), he argues that the prime source of uncertainty underlying labor migration is more simply the uncertainty of job finding alone. The validity of such a type of uncertainty which is perhaps in agreement with today's experience, remains to be ascertained through empirical testing. Note that along this line, Hartley/Revankar (1974), have proposed behavioral job search model in which uncertainty is due to existence of unemployment.

Another important deficiency of David's model is its assumption that workers are not able to distinguish between firms ex-ante, which causes workers to sample firms randomly rather than in a systematic fashion. Salop (1973, p. 191) contends that:

> In fact, individuals are able to distinguish among firms ex-ante, and they sample firms in a systematic fashion rather than just sampling the job market in general.

It is clear that the acceptance procedure of David's model does not create favorable conditions for incorporating a systematic sampling of firms.

However, David's model does present interesting features including the cost of job search, the treatment of distance to alternative labor markets and the implicit consideration of unemployment duration.

In evaluating the cost of job search, David's model includes not only the direct costs of moving and job searching, but also

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*The view that workers know average market wages has also been challenged by Alchian (1970), who claims that they are victims of a "wage illusion" by which they accept a certain wage rate without knowing its magnitude relatively to other wages.

the psychic costs incurred in changing locations as well as the cost of foregone earnings due to work interruption. More fundamentally, David's treatment of this aspect of job search behavior links search costs to wealth. Under such conditions, given imperfect capital markets, an individual, with greater personal wealth or non market income, may spend more on investments in job search. The explicit linkage of search costs to wealth appear to be a "must" if one accepts the evidence displayed by Stephenson (1976), for white and black youths.

When discussing distance to alternative markets, David introduces a trade-off between distance and opportunities through a topographical constraint: he assumes that an individual considers a maximum boundary of wage offers within his reach defined as a function of the distance to an alternative labor market. The effect of this constraint is "to ensure that for a migrant constrained by the boundary function....the marginal cost of access to wage offer dispersion....is continuously increasing in every direction, from any arbitrarily chosen point of departure within the system."

Finally, duration of employment is implicitly introduced through the requirement of a set of wage offers which indicates how long the job seeker must look for a job. The optimal size of this set of wage offers is a trade-off between the gains procured by the possibility of a better wage offer in the future and the foregone earnings lost by waiting unemployed for that probable wage offer. This treatment of the relation of unemployment duration and job acceptance is certainly more sophisticated in the present model than in usual job search models, but it is only possible because of the peculiar assumption of job offer collection proposed by David. By contrast, the models based on the reservation approach realistically suggest an impact of unemployment duration on job acceptance through a decrease of the "reservation wage" overtime unemployed. See Stephenson (1976), for a list of the important factors affecting the fall in the "reservation wage".

As a whole, David's model is a simplified and misleading representation of the actual migration-job search strategy. Nevertheless, its merit is that it is the only behavioral model of its kind and it suggests priorities for future modeling of the migration-job search process.

Models of Job Creation

The development of a regional labor market requires not only a supply side (job search submodel), but also a demand side (job creation submodel). A typical model of job creation was proposed by Mortensen (1970) who, by treating the supply aspect in an implicit manner, has provided the first integrated labor market model.

Description and Evaluation of Mortensen's Model

According to Mortensen, a firm's hiring behavior is the result of a maximization process. That allows the firm to choose an optimal time path for its wage offers based on expectations concerning future average wages $[\bar{w}(t)]$ and future unemployment levels $[u(t)]$ in the regional market.

More specifically, if

a) the firm produces an input $Q_i(t)$ at time t, using a quantity $N_i(t)$ of labor as the only input, $[Q_i(t) = h_i(N_i(t)]$, and if

b) it is free to set its own wage $w_i(t)$, it follows that the firm must maximize its discounted flow of net revenues

$$\sum_t \frac{P_i \; h_i \; [N_i(t)] - w_i(t) \; N_i(t)}{(1 + r)^t}$$

(where P_i is the output price and r the rate of discount).

Job seekers enter the picture through a supply function $N_i(t)$ assuming that they are attracted by higher wages and that

their number depends on the aggregate number of unemployed

$$\frac{dN_i(t)}{N_i(t)} = f\left(\frac{w_i(t)}{\bar{w}(t)}\ ,\ U(t)\right) \qquad (24)$$

This model has been sharply criticized by Miron (1977). First, he sees in Mortensen's model a long-run model of the firm constrained by its short-run labor supply: the firm faces neither demand constraints, nor other input (capital) constraints. Second, as in the case of David's model of job search, Miron is extremely critical of the emphasis on wage dispersion. Third, noticing that Mortensen's model is based on the hypothesis of a single labor market in which the aggregate labor supply is growing at a constant rate (which permits one to call Mortensen's model a complete model of labor dynamics), he points out that the consideration of a multimarket model is necessary to introduce more reality into the picture: "it is at this point that integration of job search and job creation models will occur" (Miron, 1977) to permit the development of a complete model of labor dynamics.

A Description and Evaluation of Miron's Model

Miron has proposed a model of job creation which eliminates the main criticisms he found in Mortensen's work. It is a short-term model in which the firm faces an additional constraint on capital. With regard to labor supply, "the firm is seen to view changes on its own part as ineffective in altering its labor supply": a maximum labor supply $L_i(t)$ is available to the firm at a fixed wage rate. In addition, the level of labor supply--which cannot exceed $L_i(t)$--is determined by a process placing emphasis on the fact that searchers sample firms for job vacancies (instead of being determined by a constant growth rate as in Mortensen's model).

For Miron, the unemployment rate does not determine directly the firm's labor supply as in Mortensen's model. Instead, the

flow of "acceptable" jobs applicants and the actual level of employment--both variables lagged one period--lead to the firm's expected labor force derived from:

$$\hat{L}_i(t) = [1 - \hat{\gamma}_i(t)]\, N_i^{\Delta}(t-1) + \hat{E}_i(t) \quad . \tag{25}$$

in which $\hat{L}_i(t)$ is the expected labor supply at time t

$N_i^{\Delta}(t-1)$ is the actual employment at time $(t-1)$, (depending on whether the firm is capital-constrained or labor-constrained)

$\hat{E}_i(t)$ is the expected number of acceptable applicants in period t

$\hat{\gamma}_i(t)$ is the expected quit rate in period t

If the firm has static expectations about the quit rate and the number of acceptable applicants

$$\hat{\gamma}_i(t) = \gamma_i(t-1) \text{ and } \hat{E}_i(t) = E_i(t-1) \quad , \tag{26}$$

then the expected labor force is:

$$\hat{L}_i(t) = [1 - \gamma_i(t-1)]\, N_i^{\Delta}(t-1) + E_i(t-1) \quad . \tag{27}$$

This value differs from the actual one:

$$L_i(t) = [1 - \gamma_i(t)]\, N_i^{\Delta}(t-1) + E_i(t) \quad . \tag{28}$$

as a consequence of the discrepancy between expectations and realizations concerning the quit rate and the flow of acceptable applicants.

On the one hand, the main merit of the above model is to present a more realistic picture of a firm's hiring process based on quit rates and applications. Unfortunately, this picture is incomplete since it only begins with the specification of the number of acceptable applications, simply assumed to be proportional to the number of applicants.

On the other hand, the main fault of this model is the fact that the role of wages in the moving procedure is neglected. Scattered evidence throughout this paper suggests that the wage differential is an important variable affecting both the demand and supply sides of labor markets in North America and is therefore in contradiction to Miron's de-emphasis of the wage role.

Finally, we note that Miron's analysis still focuses on a single market instead of a multimarket. No integration with a job search model is proposed, although Miron hints that such an integration ought to be performed at the aggregate level (see section 2.3), the development of a micro multimarket model of job search and creation remains needed to shed light on the clearing mechanisms of local (regional) labor markets.

2.3 Towards Empirically Testable Models of Regional Demoeconomic Growth

The purpose of this section is to examine the feasibility of developing empirical models of regional demoeconomic growth, ideally permitting the identification of the sources of growth--in the light of the above discussion. Indeed, the state-of-the-art, suggests that such an aim can only be reached with the construction of aggregative models of regional labor markets. This is illustrated further by the examination of the aggregative scheme proposed by Miron (1977), and of the recent contribution of Gleave and Cordey-Hayes (1977), who see labor migration as a spatial extension of labor market dynamics. We will begin with the short-term emphasis of the research efforts just cited (in the same manner as the simultaneous-equation models of section 1.3) and thus their resulting incomplete treatment of the problem of growth source identification. A personal elaboration on the latter point is presented toward the end of this section.

Miron's Aggregative Model of a Local Labor Market

Miron (1977), contends that empirical aggregative models of regional demoeconomic growth ought to and could be developed from behavioral models of labor markets. He argues that David's

model of job search and his revised version of the job creation model, proposed by Mortensen (1970), provide a theoretical basis for the labor supply and demand equations, respectively, of a typical empirical urban model.

More specifically, Miron suggests, through intuitive reasoning, that David's model of an individual's migration could be aggregated for all individuals to produce a model of migration based on the following equation:

$$M(t) = \alpha_0 + \alpha_1[N(t-1) - L(t-1)], \qquad \alpha_1 > 0 \qquad (29)$$

in which M(t) is the aggregate flow of net inmigrants into a local labor market and $N(t-1) - L(t-1)$ the net excess of job openings over labor supply (i.e. the net level of job vacancies) in the previous period.*

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*Note the contrast in the treatment of job creation between Miron's approach and the traditional approaches examined in Part 1. Let us recall that the job openings in the export-base theory are determined by exports so that:

$$N(t) = \Psi X(t) \qquad (30)$$

in which X(t) is the GNP of the national economy and Ψ a proportion of export to regional-oriented sectors. The corresponding equation in the labor supply approach would be:

$$N(t) - N(t-1) = \eta_0[L(t) - L(t-1)] \quad . \qquad (31)$$

According to Miron, the job hiring process as seen by Mortensen (1970), would be consistent with the following equation:

$$N(t) - N(t-1) = \eta_1 U(t-1) \qquad (32)$$

in which $U(t-1)$ is the regional level of unemployment at time $(t-1)$, i.e. $[U(t-1) = L(t-1) - N(t-1)]$ and η_1 reflects the intensity of search by job seekers and the distribution of wage offers among firms.

On the other hand, supposing that there is a fixed number of firms in a given regional labor market, Miron indicates that his demand side model can be aggregated from the firm to the regional market level. This yields:

$$N(t) = \bar{\alpha}(t)\ L(t) \quad . \tag{33}$$

$$\hat{L}(t) = [1 - \bar{\gamma}(t - 1)]\ N^{\Delta}(t - 1) + E(t - 1) \quad . \tag{34}$$

$$E(t - 1) = \bar{\beta}(t)\ A(t - 1) \quad . \tag{35}$$

in which

$N(t)$ is total labor demand

$\hat{L}(t)$ is the total expected labor supply

$E(t)$ is the total flow of acceptable applicants

$A(t)$ is the total flow of applicants.

The model is completed by the following identities:

$$L(t - 1) = (1 + g)\ L(t - 2) + M(t - 1) \quad . \tag{36}$$

in which g is a rate of natural increase for the labor force

$$L(t - 1) = [1 - \bar{\gamma}(t - 1)]\ N^{\Delta}(t - 2) + E(t - 1) \quad . \tag{37}*$$

and:

$$N^{\Delta}(t) = \min\ [N(t), L(t)] \quad . \tag{38}$$

---

*The comparison of the last two equations (36) and (37) yields the quit rate as a residual variable!

This leads to a simple linear system of regional labor markets consisting of 7 equations (29) and (33) through (38) and determining as many variables, [L(t), $\hat{L}$(t), N(t), N^{Δ}(t), M(t), E(t - 1), and $\bar{Y}$(t - 1)].

Indeed, this system is incomplete since it does not specify the flow of job applications A(t) and does not provide any indications concerning the relationship linking M(t) and A(t).

In addition, this system can be criticized on the following grounds.

a) It deals with a single market. The spatial dimension of labor migration and thus the multimarket aspects of job search have been eliminated by aggregating migration flows over destinations and origins in the migration equation (29) and by leaving the variable representing the flow of applications unspecified.

b) The emphasis is on workers rather than on people, thus reducing the importance of exogenous (non-economic) migration of laborers (included in the α_0 constant of the migration equation) and ruling out the influence of the autonomous migration of non labor force members.

c) The migration equation (29) does not represent a macro expression of the migration process described by David. When considering the importance accorded by David to both ends of a migratory move, the inclusion of gross flow variables for total outmigration and inmigration would be a necessary minimum. In addition, these equations would allow for independent variables characteristic of not only the regional labor market to which they relate, but also the rest of the country (grouping the set of all origins and alternative destinations).

d) The employment equation does not include any direct demand term or any variable representing the health of the national economy. This is a result of disregarding the demand constraints in the behavioral model initially proposed by Miron.

It may be concluded that, because of Miron's exaggerated effort to give a fair treatment to the role of households (workers) in regional development, no leading role is left to firms which are seen to answer to expectations made by workers.

Overall, the aggregative model proposed by Miron appears as a short-term (dynamic) model of regional demoeconomic growth that appears to be a slightly sophisticated version of the short-term variant of Borts and Stein's (1964) labor-supply approach.

Towards a Dynamic Model of Regional Labor Markets

The need for a dynamic model of regional labor markets advocated by Miron (1977), has also been stressed in a recent monograph by Gleave and Cordey-Hayes (1977). They proposed a largely verbal explanation of the interface of the demographic and economic sectors in a multiregional economy, as a first step in determining the forces which cause and shape the growth and decline of regions.

An Overview of Gleave and Cordey-Hayes's Contribution

Within a framework emphasizing labor migration as a spatial extension of regional labor market turnover, Gleave and Cordey-Hayes develop a theory on the clearing of regional labor markets, which involves the characterization of relationships between migration, job vacancies, unemployment and labor market turnover.

Their starting point is the common observation that there exists a positive relationship between the two directional components of migration. As we mentioned in section 1.2, such an association was attributed by Gleave and Cordey-Hayes to the juxtaposition of the concept of a dynamic mover pool and a differential attraction process. The simulation of a model including these characteristics effectively led to a positive association between in- and outmigration. In addition, it showed that a majority of migrants move from economic strength to strength, in contrast to traditional economic thinking which see the typical

migrant as a person pushed by the poor opportunities in a weak region. This finding led Gleave and Cordey-Hayes to claim that migration is not a strong mechanism between unbalances in the supply and demand for labor regions.

In a further development of their work (Gleave and Cordey-Hayes, 1977, Chapter 6) they give plausible theoretical support to their differential attraction process and more generally to the role of migration in a regional labor market. Although they also think of labor migration as the consequence of employment opportunities available on regional labor markets, Gleave and Cordey-Hayes, in a major innovation, contend that migration flows are not related to only the increment in regional employments. According to them, migration flows occur because of various changes in the labor status of workers during the period considered:

> Little emphasis is given here to the growth of economic activity per se; our main interest focuses on the mutual adjustment between the above [economic and demographic] sectors or on the dynamic interaction between people and jobs. The creation of job vacancies due to the continual musical chairs type of movements between jobs is found to be an important concept for the analysis of migration and further more these vacancies produced by the turnover of jobs (being approximately 10 million per annum in the UK) considerably outnumber the vacancies created by employment growth per se (being approximately 0.5 million per annum).

Thus, out- and inmigration rates--which need to be separated for Gleave and Cordey-Hayes's prospective--are to be tied to the relative turnover flow rather than to employment change:

$$o = o\ (\frac{F}{L}) \quad , \qquad i = i\ (\frac{F}{L}) \quad . \tag{39}$$

in which o and i are the out- and inmigration rates respectively;

F the turnover flow

L the total labor force.

Gleave and Cordey-Hayes further hypothesize that the relative turnover flow is a direct function of the quit rate and that the

latter is determined by vacancies and unemployment rates simultaneously:

$$\frac{F}{L} = f(q) \quad \text{and} \quad q = q(V,u) \tag{40}$$

in which

q is the quit rate

V is the job vacancy rate

u is the unemployment rate.

The authors, justify the correlation between turnover flow and quit rate--expected to be positive through intuition, and at the same time provide some evidence of the relationship linking q,V, and u with reference to a case study of firms in Birmingham and Glasgow for the period 1959 to 1968. The results indicate that high vacancies and low unemployment induce voluntary quits, a finding consistent with the view that employees have a risk-free opportunity to change their jobs if such an economic climate prevails.

It follows that q and therefore o and i are directly functions of the ratio $\frac{V}{u}$. A confirmation of the latter was obtained by Gleave and Cordey-Hayes when they regressed out- and inmigration rates against regional vacancy-unemployment ratios, for five British regions during the 1961 to 1966 period: the correlation was positive and significant at the 95% level of confidence in both cases (at the 99% level of confidence in the case of the inmigration rate).

> This matching of abilities and tastes to jobs can be regarded as a learning process in which movers are acquiring new skills and gaining information not only of the local labor market but also of a more extensive one. That is, conditions that favor local labor market turnover are also those that induce occupational mobility and give a better knowledge of spatially more extensive labor markets. (Gleave and Cordey-Hayes, 1977, p. 32-33)

In other words, migration is seen here as part of a large mobility process involving occupational mobility as well.

To summarize, Gleave and Cordey-Hayes provide an alternative to the standard economic theory which is monocausal and static. Their theory based upon heterogeneous labor regarding differential mobility of individuals and knowledge/information of the opportunities within and outside the region considered leads to a complex stochastic process involving many interactions in which the key variables are the dynamic concepts of job vacancy and turnover. A similar treatment can also be found in Curry and McKinnon (1974).

Complementary Perspectives

In brief, there is a growing tendency among some economists to reject the view of migration as a simple consequence and/or cause of employment change. Their premise is that migration ought to be considered as a spatial extension of regional labor markets. Unfortunately, the main theories and models of the labor market recently developed, (Miron, 1977; Gleave and Cordey-Hayes, 1977), are incomplete. Both of these contributions which recognize the existency of various feedback mechanisms between employment and labor supply are not capable of describing some of these linkages, in particular the one showing the role that migration plays between regions. Because of this, these labor market models concentrate on one region and are shown to strongly rely on concepts whose determinants are not discussed, e.g., job applications (Miron) and job turnover (Gleave and Cordey-Hayes).

It is clear however, that the latter contribution is richer. It places migration within a realistic framework involving total vancancies instead of the traditional increment on employment change or Blanco's (1963, 1964) prospective unemployment variable which reappears in Miron's aggregate model. The next step is then to relate job applications to turnover through a linkage involving vacancies and quit rates in a multidimensional system. This linkage ought to describe the geographical mobility process put aside in the contributions discussed above at the same time it deals with occupational mobility. By the specification of such a linkage, a clear picture of how migration affects regional development should appear.

To summarize, some regional economists advocate the need to develop a conceptual framework describing the interaction of regional demoeconomic variables within a nation in order to provide a comprehensive understanding of how regions grow or decline. Their focus, as in standard economic theory, is on migration as a potential regulator. However, their explanations do not dwell on macro mechanisms involving regional levels of wage rates, unemployment rates, or employment growth rates but expand a behavioral approach of the dynamics of relations between all jobs (not the incremental number of jobs) and all workers (not the prospective migrants). It is clear that the pursuit of a research thrust in this direction will provide insights into variations in regional growth patterns.

We contend however, that the insights thus obtained will be limited to the short run and will not provide a full picture of the interregional allocation of demoeconomic growth. The understanding gained will concern the respective expectations formed by firms and households but will not shed light on the sources of growth whose identification implies a rather long-term orientation.

Firm-initiated Versus Household-initiated Growth Controversy

As mentioned above, our position regarding the relative roles of firms and households in regional development is that a clear distinction should be made according to time horizon. This contention can be illustrated with the help of a simple illustrative model of regional demoeconomic growth summarized in Table 5. Three equations describing an area's employment change, net migration of population and change in labor force participation (equations (1) through (3)) are considered in this model to which national growth appears as an input. The growth process thus modeled is then a partial consequence of the influence of national growth on both firms and households. However, it also appears to be initiated by firms in response to export demand and by people who can move for non-economic reasons or can withdraw from or join the labor force for exogenous reasons.

Table 5. A simple illustrative model of regional demoeconomic growth.

$$1.\quad \log\left(1 + \frac{\Delta E}{E}\right) = \alpha_0 + \alpha_1 \log\left(1 + \frac{\Delta EXP}{EXP}\right) + \alpha_2 \log\left(1 + \frac{M - M_o}{P}\right) + \alpha_3 \log\left(1 + \frac{M_o}{P}\right) + \alpha_4 \log\left(1 + \frac{\Delta LFPR}{LFPR}\right) + \alpha_5 \log\left(1 + \frac{\Delta A}{A}\right)$$

$$2.\quad \log\left(1 + \frac{M - M_o}{P}\right) = \beta_0 + \beta_1 \log\left(1 + \frac{\Delta E}{E}\right) + \beta_2 \log\left(1 + \frac{\Delta A}{A}\right)$$

$$3.\quad \log\left(1 + \frac{\Delta LFPR}{LFPR}\right) = \gamma_0 + \gamma_1 \log\left(1 + \frac{\Delta B}{B}\right) + \gamma_2 \log\left(1 + \frac{\Delta E}{E}\right) + \gamma_3 \log\left(1 + \frac{M - M_o}{P}\right) + \gamma_4 \log\left(1 + \frac{M_o}{P}\right)$$

Endogenous variables:

$\frac{\Delta E}{E}$ relative change in total employment

$\frac{M - M_o}{P}$ employment-related net-migration rate

$\frac{\Delta LFPR}{LFPR}$ relative change in labor force participation

Exogenous variables:

$\frac{\Delta EXP}{EXP}$ relative change in export demand

$\frac{M_o}{P}$ autonomous net-migration rate

$\frac{\Delta B}{B}$ relative change in non-economic variables affecting LFPR

$\frac{\Delta A}{A}$ relative change in national economic conditions

$$\frac{\Delta E}{E} = \frac{\alpha_1 \frac{\Delta EXP}{EXP} + [(\alpha_2 + \alpha_4 + \gamma_3)\beta_2 + \alpha_5] \frac{\Delta A}{A} + (\alpha_3 + \alpha_4\gamma_4) \frac{M_o}{P} + \alpha_4\gamma_1 \frac{\Delta B}{B}}{1 - [\alpha_2 + \alpha_4(\gamma_3 + \frac{\gamma_2}{\beta_1})]\beta_1} \qquad (41)$$

The equation (41) which presents a first approximation of the reduced form of the model, allows us to determine the relative contribution of firms and households to the generation of regional growth (in terms of employment growth) with the help of the following ratio

$$r_L = \frac{\text{contributions of firms}}{\text{contributions of households}} = \frac{\alpha_1 \frac{\Delta EXP}{EXP}}{(\alpha_3 + \alpha_4\gamma_4)\frac{M_o}{P} + \alpha_4\gamma_1 \frac{\Delta B}{B}} \qquad (42)$$

This ratio r_L depends not only on the elasticities of the dependent variables with regard to the three exogenous variables other than natural economic conditions, but also on the relative increase of various exogenous factors.

The preponderance of the role of firms or households in the generation of regional demoeconomic growth will depend on the magnitude of r_L with respect to the value 1. Although it is expected that the value of r_L will vary over space and time, a measure of this ratio will provide a first approximation of the contribution of firms and households in generating growth.

Equation (41) also permits one to evaluate the relative contribution of firms and households in speeding up or slowing down the course of regional development. We thus define the following ratio

$$r_s = \frac{\text{contributions of firms}}{\text{contributions of households}} = \frac{\beta_1}{\alpha_2 + \alpha_4 (\gamma_3 + \frac{\gamma_2}{\beta_1})} \quad .* \qquad (43)$$

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*Note that if the labor force participation rate is left out, $\alpha_4 = 0$ and $r_s = \frac{\beta_1}{\alpha_2}$; we then find back the criterion used by Muth (1971) to compare the relative migration and employment growth.

The preponderance of the role of firms and households in the short term will depend on the magnitude of r_s with respect to the value 1. The value of r_s obtained in each particular case--varying with space and time--will not be indicative of the way firms and households generate growth but will only display the relative part played by both these agents in the acceleration or deceleration of the long-term growth (decline) path.

With the help of the above illustrative model, we have shown the existence of two types of forces intervening in the process of regional development. One set of these forces, the driving forces, generates the growth and thus the long-term orientation of the system. They include the exogenous demand placed on firms and the autonomous migration and changes in labor force participation of households. The other set of forces, the facilitating forces, which modify the growth path implied by the driving forces, reflects the respective expectations of firms and households and thus the short term orientation of the system (business-cycle). They include the impact of population growth on regional development as a demand factor (consumption of local products) and a supply factor (households as suppliers of labor), the impact of regional development on out- and inmigration flows, and labor force participation.

It is hoped that such a classification has helped in clarifying the controversy relating to the role of firms and households in regional demoeconomic growth.

PART 3. THE ROLE OF THE SPATIAL DIMENSION IN REGIONAL DEMO-ECONOMIC GROWTH

The conventional theories and models of regional growth examined in Parts One and Two appear to have provided very little insight into the actual process of regional development which could be of practical value to policymakers. As argued above, one reason for this is the cursory treatment of spatial dimension in these theories and models.

As observed by Richardson (1973), there have been some regional economists who have urged the importance of spatial elements in the analysis of regional growth. For example Friedmann (1966) has stressed center-periphery models and development corridors, Boudeville (1966) gave a spatial dimension to the growth-pole theory and von Böventer (1970) focused on agglomeration economies and hinterland effects as offsetting forces influencing the size and spacing of cities and regions. Unfortunately, the theories developed by these researchers have been very general in nature, and fall short of giving useful insights into the process of regional development.

However, a step toward a better understanding of regional demoeconomic growth involving the role of spatial patterns has been provided by recent applied and theoretical research efforts. These include an empirical growth model for the Northeast Megalopolis (Putman, 1970, 1975); a major project undertaken at the Urban Institute, Washington D.C. and examining the determinants of employment growth and migration in US metropolitan areas (Alperovich et. al. 1975a, 1975b); and theoretical analyses introducing spatial elements into a macroeconomic view of regional demoeconomic growth (Richardson, 1973; von Böventer, 1975).

This part, devoted to the role of space in regional development, critically reviews the partial regional studies that have emphasized the influence of sizes, distances, structures or locational qualities. Section 3.1, dealing with firms, discusses the determinants of an area's employment growth whereas section 3.2, focusing on households, consists of a discussion of the determinants of migration; in both cases, the accent is placed on the impact of spatial factors. Finally, section 3.3 examines the recent theoretical contributions of Richardson and von Böventer and assesses the feasibility of developing extended theories and models of regional development.

Before turning to section 3.1, it is worth mentioning that the concept of region considered so far, has not been clearly defined. The theories and models of the two previous sections

were applicable to various regions such as metropolitan areas or states, which were viewed as spaceless. However, the additional consideration of space has given rise to the concept of a functional economic area (Fox and Kumar, 1965). This concept, still the most popular today, is not discussed here, since most of the analyses relevant here relate either to metropolitan areas or states.

3.1 The Determinants of Regional Employment Growth

Traditional regional demoeconomic growth theories present a simple explanation of the evolution of regional employment that depends on the variations of a unique variable. The growth in external demand (demand for export products) in the export-base theory or the growth of the labor force in the Borts and Stein approach determines employment growth.

As many other factors enter the picture, a more thorough treatment of employment change is needed. This will be made clear with the examination of two empirical studies concerning the determinants of an area's employment growth.

Putman's Model of Employment Growth

A good discussion of the determinants of employment growth has been provided by Putman (1970, 1975), in two successive versions of an interregional growth model for the Northeast Megalopolis. In the second version (INTRA-II), Putman (1975), following Hoover (1948), defines three types of factors which influence an area's relative advantage: procurement, processing and distribution.

The procurement factors are those variables which determine the costs of inputs necessary to the production process. They include a measure of access to goods consumed as intermediate inputs and two measures of externalities (agglomeration and scale economies).

The processing factors are those variables which describe the costs of the factors of production. They include a measure of

labor availability, a measure of labor cost, a measure of labor surplus or deficit, and a measure of site cost.

The distribution factors are those variables which affect the selling and distribution of outputs. They include two measures of market potential describing the access to other suppliers and to final demand.

The various measures are defined, in each of the 131 counties of the Northeast Megalopolis, at the industry level except for the last two processing factors common to all of the 11 industrial sectors considered. They are generally constructed from employment data, whereas the conductance term reflecting the spatial dimension in the various accessibility measures is an adequate transportation cost.

Perhaps, the main reproach that one can address to this framework is that the Northern Megalopolis appears as a closed system thus ruling out the possibility of relations between its peripherical counties with regions outside the Megalopolis.

An additional criticism concerns the theoretical orientation chosen by Putman for the testing of his model. He assumes that a county's change in sectoral employment is directly affected by the change-in-markets variables (i.e. distribution factors). The procurement and processing variables are defined as facilitating variables that amplify or alternate the response of sectoral employment changes to the causal change-in-markets variables.

The model was estimated using a stepwise multiple linear regression producing ordinary least squares regression coefficients. The results obtained were rather disappointing. The change-in-markets variables displaying a strong positive correlation with employment change appeared to be the only ones whose coefficients in the full model indicated strong conclusions, especially for the change in the measure of accessibility to other suppliers. Putman argues that his findings can be explained by the fact that "the level of aggregation used in the analysis may well be too great to expect to see much response to procurement and processing

factors". By contrast, we think that his deceptive results are no more than the consequence of some of the hypotheses embodied in his model and criticized above.

The Urban Institute's Model of Intermetropolitan Job Shifts

Recently, researchers of the Urban Institute completed a large project centered around the determinants of demoeconomic growth in US metropolitan areas. This project originated with the examination of the agglomeration of economic activities (Bergsmann, et al. 1972, 1975). Three basic questions were addressed concerning: a) methods of identifying industrial complexes or activity clusters, b) the relation of economic structure to the growth rate and to other characteristics of cities, and c) the role of non-manufacturing industries in producing agglomerations. In brief, the results obtained have provided a description of clusters rather than an explanation of their existence and why they tend to concentrate in particular kinds of cities. The project was continued with an analysis of the determinants of employment growth in metropolitan areas by industry (Alperovich, et al. 1975b), critically examined below, as well as an analysis of intermetropolitan migration (Alperovich, et al. 1977) a review of which appears in section 3.2.

The study of the determinants of metropolitan employment growth represents a major contribution to the field of regional growth. It is the first empirical study of the determinants of regional employment growth which does not limit itself to the consideration of partial determinants emphasizing either the supply or the demand side.

The perspective used in the econometric model built by Alperovich, et al. is similar to the one used by Putman but the economic factors used here are less numerous and more simply defined than in Putman. They consist of input variables, goods and services purchased from other industries and labor, output variables (sales to other industries, and externalities or agglomeration economies). Capital expenditures are omitted from the model

because "The cost of capital varies very little among US metropolitan areas." (Alperovich, et al. 1975b, p. 835). The spatial dimension is introduced in the treatment of purchases from and sales to other industries, whereas the analysis takes account of the interrelationships between firms and their customers and suppliers located within the same city, as well as those located elsewhere.

The general issue addressed by the model concerns the relative importance of the factors determining the growth of a given industry: "In particular, how important are input costs, access to markets and externalities?" A special emphasis is put on the labor factor in view of the controversy concerning the relationship between migration and employment gorwth examined earlier in section 1.3. Specifically, Alperovich, et al. present a test of the hypothesis that local differences in the case of attracting labor may affect local rates of employment growth.

Description of the Model

Another innovation of the model is to suppose that the process of job shifts is not characterized by the attainment of an equilibrium. Alperovich, et al. define it as the outcome of a growth system in which there exists an adjustment process from the actual to a desired level of employment.

For each industry considered, this can be expressed as follows:

$$\begin{pmatrix}\text{observed}\\ \text{employment}\\ \text{change}\end{pmatrix} = \begin{pmatrix}\text{adjustment}\\ \text{rate}\end{pmatrix} \left(\begin{pmatrix}\text{desired}\\ \text{employment}\end{pmatrix} - \begin{pmatrix}\text{actual}\\ \text{employment}\end{pmatrix} \right) \tag{46}$$

The desired level of employment of an industry in a place is hypothesized to be a function of the profitability of the industry in that place. Profitability, in its turn, depends on input costs, revenues and externalities which are described by seven factors: demand, both local (i.e. in the same city) and in nearby places; supply of important inputs, both local and

nearby places (at most three supplying industries are included, following the idea that only a few inputs are critical in location decisions); wage rates; and localization and urbanization economies.

Product demand and input supply in nearby places are treated in a similar fashion: "the relevant measure both of input availability and product demand in a nearby city is the amount (negative and positive, respectively) of effective excess demand--that is, local demand minus local supply--for the commodity in that city."* In addition, "to keep the variables down to a manageable number, we use geographical potentials to summarize the net effect on a given city of the values of effective excess demand in other cities." (Alperovich, et al. 1975b, p. 838).

Note that an average local wage rate, specific rates not being readily available, instead of local industry is used to reflect the variation in labor costs among industries.

Localization and urbanization economies are described by initial-year values of local employment in the same industry and local population.

The desired demand function for labor (desired employment) is written as a linear sum of all the above characteristics, i.e.

$$E^*_{ik} = a_{k0} + a_{k1} D_{ik} + a_{k2} V(D^{ex}_{ik}) + \sum_{s \in s} a_{k3S} I_{iks}$$

$$+ \sum_{s \in s} a_{k4S} V(D^{ex}_{iks}) + a_{k5} W_i + a_{k6} \log E^0_{ik}$$

$$+ a_{k7} \log P^0_i + a_{k8} (\log P^0_i)^2 \qquad (45)$$

*The components of excess demand are measured from local employment data to which are applied adequate national input-output coefficients and national labor output coefficients.

where:

E^{*}_{ik} = desired employment in industry k of region i

D_{ik} = local demand for products in industry k

$V(D^{ex}_{ik})$ = nearby demand for products of industry k

I_{iks} = local purchases of industry k from industry s

$V(D^{ex}_{iks})$ = purchases of industry k from nearby industry s

W_i = local average wage

E^{0}_{ik} = initial-year level of local employment

P^{0}_{i} = initial-year level of local population

S = the set of industries that are important suppliers to industry k.

The adjustment factor is treated differently owing to the type of change observed. When there is contraction, it is held that the adjustment factor does not depend on labor market conditions and is constant across cities. When there is expansion, however, this factor is supposed to be a function of unemployment rate, net natural increase and net migration of the labor force.

Empirical Results

Basic data in each of 311 SMSAs were available on 480 sectors at the four-digit level (for the period 1965-1970), but they were clustered into 40 categories for the operation of the model. The test of the model revealed that the adjustment function did not perform as expected. The introduction of a multiplicative factor, representing the ease of attracting labor (before hiring and outmigration) and defined as the gross inmigration rate plus

the initial unemployment rate did not yield a better performance. Thus, Alperovich, et al. moved to a full adjustment model (adjustment function set equal to unity) in which the ease of attracting labor was included as an argument of the employment function (the measure of labor attraction being introduced into the linear sum of explanatory characteristics instead of being a multiplicative factor). The results of this full-adjustment model show that access to markets, both local and nearby, has the most important influence on metropolitan economic growth. Ranking next in importance are localization economies and access to purchased inputs. Regarding the ease of attracting labor, Alperovich, et al. found no support for the idea that population (labor force) growth induces employment growth. They argued that:

> The findings of other researchers that something like the inmigration and growth in the labor force seems to induce growth in employment were all for highly aggregate employment: either all sectors, or at least all manufacturing sectors. Our failure to confirm the hypothesis applies to smaller parts of the total employment change in the places of question. New employment growth does induce inmigration and net population growth. The findings that inmigration and population growth, in turn appear as significant variables in a regression for total employment growth is therefore, not very startling and may reflect the association that is known to exist but not a causal relationship. (Alperovich, et al. 1975b, p. 885)

To summarize, the above empirical study of employment change finds virtually no support for the role of labor migration in regional development as suggested by Borts and Stein (1964). On the contrary, it stresses the major influence of demand and the importance of geographical considerations, intra- as well as interregional.

Perhaps the greatest criticism that one can address to the above research effort is that it considers employment as a continuous variable whereas it is in fact a discrete variable determined by the various events that can affect an individual firm: creation, demise, relocation and expansion.

Towards a Microanalysis of Employment Growth

Little is known yet about the decision of individual firms concerning the aforementioned events. In fact because of the extension of the export-base theory to a spatial context, Lowry (1964) views the location of export employment (manufacturing essentially) as the principal determinant of the location patterns of population and population-serving activities. Most of the relevant research has been concerned with manufacturing firms in metropolitan areas.

Composition of the Change in an Area's Number of Establishments and Level of Employment

Within a given time period four main types of events other than immobility, characterize an establishment located in a given region: creation, demise, relocation within the region and migration (out of or into the region). It is clear that the importance of the employment change relating to these events differs from one area to the next. In fact, little data readily available allows one to assess the composition of the change in an area's number of establishments and level of employment. A few studies however, present and analyze specially tabulated data. James Jr. and Hughes (1973), for example, indicate that, during the two-year period 1967-8, 283 manufacturing establishments employing 20 persons or more, relocated with the state of New Jersey; 57 moved into New Jersey from other states; 262 new firms were formed; and 189 establishments went out of business.

However, the inmigration of establishments, the smallest of the various events considered, becomes preponderant if these events are viewed in terms of employment change. Inmigrant firms accounted for an increase of 4179 employees (out of a total of 6178) against 743 for the net increase of the firms newly created or dismissed and 1256 for the net change incurred by immobile and relocating firms.

Looking at a smaller level of aggregation (counties of New Jersey), James Jr. and Hughes found that two-thirds of the establishments relocating within the state stayed within their original

county and that the largest establishments, unlike the smallest, generally moved between counties. Observing in addition, a substantial degree of cross-migration, they concluded that the impact of relocation on activity levels is the main factor responsible for modification of the manufacturing structure.

Perhaps, these results are not illustrative of the pattern of change in other states or other types of regions. Nevertheless, they do suggest the two following points.

1) Establishment growth dominates the process of employment location change: the popular concern with relocation is misplaced. Relocation is clearly not the most powerful process altering the distribution of employment. (James Jr. and Hughes, 1973, p. 412)

2) Because of location inertia induced by the long useful lives of immobilized capital, "the most powerful force influencing the location of manufacturing activity is the stock of manufacturing structures." (James Jr. and Hughes, 1973, p. 405)

From there, the next step is to determine the factors which explain the behavior of firms with respect to the various events distinguished above. In the past, most of the relevant research on this subject consisted of qualitative analyses examining the information obtained from interviews conducted with establishments. An exception to this is the multivariate analysis undertaken by Struyk and James Jr. (1975), and summarized in Struyk (1976). Among the main results obtained by this study are the following.

a) External economies, including localization economies, were significant in determining the location of manufacturing employment across sub-areas, especially in the case of employment associated with new establishments.

b) The functional specialization of establishments is a very important determinant of location.

c) The destination of movers and the location of new firms demonstrated much more definite spatial patterns than other activities.

More quantitative evidence concerning relocation of firms within an area is available (for a review see Molle, 1977) but definitely little study concerning interregional migration of establishments--perhaps the most important compositional element of employment change as suggested by James Jr. and Hughes (1973)--has been undertaken so far. To our knowledge, Sant (1975), is the only one to have examined this subject in depth in a study of interregional moves in Great Britain. His study presents two dimensions: temporal and spatial. First, he performed a time series analysis of such industrial moves between 1945 and 1971 and found, that a large part of the variance (36 percent) was explained by changes in regional policies and that labor availability (unemployment) was significant but only explained a small part of the variance of the dependent variable. Second, he performed a cross-sectional analysis covering a large number of British regions over four different periods between 1945 and 1971 and attempted to explain the number of departures (outmigrant establishments) and arrivals (inmigrant establishments) from the locational qualities of the regions involved.

The findings obtained by Sant show that outmigration is mainly determined by factors indicating a lack of space (employment density, percentage of the region having an urban status) or describing the industrial composition of the region. Labor supply has also a significant impact: unlike unemployment, female activity rates and to a lesser degree, male and female earnings contribute to the explanation of the number of firms moving out. By contrast, inmigration is mainly affected by regional incentives (new town programs) and the proximity of main sources of movement. In addition, there is a positive influence of labor availability (total number of unemployed) and a negative influence of land availability and costs (urban employment density).

Overall, Sant's study confirms the relatively small importance of labor supply in determining the interregional migration of firms and stresses the importance of local spatial considerations in attracting relocating firms.

To summarize, the compositional change of a region's level of employment suggests the need for a more detailed treatment of the determinants of employment growth. This calls for a separation of the employment expansion or decline of immobile firms from the employment changes caused by other alterations in industrial establishments. In the latter case, a behavioral approach along the lines of the microanalysis proposed by Miron (1977) is called for.

3.2 The Determinants of Place-to-place Migration

Regardless of the path of causation between employment change and migration, an area's growth potential depends on its capacity to attract labor from elsewhere and to retain its own labor supply. In connection with this problem, the review of the economic studies of total migration flows undertaken in Part One, concluded that labor is generally responsive to economic forces, migrating from low-wage and opportunity regions to high-wage and opportunity regions. It indicated, however, that owing to the existence of a more or less important pool of chronic movers in each local labor market, there appears to be an asymmetry between outmigration and inmigration. Consequently, economic policies intended to increase an area's growth potential should best be devoted to the attraction of inmigrants rather than to the retention of potential outmigrants.

Such a policy implication is acceptable to the extent that the underlying models are correct. However, the models used in these studies present a fundamental shortcoming stemming from their failure to incorporate an essential element of the logic of the migration process: the fact that migration is a process in which the fundamental unit is a move which takes place between two places. A better understanding of migration would certainly be obtained if more attention was paid to the spatial pattern of this process, i.e., if the emphasis is placed on place-to-place flows rather than on the total flows out of or into a given area (which ignore the "other end" of moves).

Fortunately, over the years, numerous contributions have brought insights into the spatial pattern of labor mobility* and the factors influencing the magnitude of labor migration. Valuable syntheses of the accumulated knowledge on the subject have been undertaken recently (Greenwood, 1975a and Shaw, 1975). Thus, rather than to attempt yet another appraisal of the findings of past studies, we present here a review of the determinants of place-to-place migration, borrowing heavily from these two scholars. Highlights of their reviews completed by new evidence produced since the publication of these syntheses are summarized here. However, before presenting this summary, it appears worthwhile to present complementary perspectives on the theoretical background of these studies as well as on their econometric specification.

Theoretical Background and Econometric Specification

Place-to-place migration studies stem from two main theoretical strands: the neo-classical economics of maximization of utility and the empirically derived "push-pull" theory.

Migration and Neoclassical Economics of Maximation of Utility

The migration process has been seen by neoclassic economists in either macroeconomic or microeconomic terms. First, from a macroeconomic point of view, a reconsideration of the migration process, one removing some of the unrealistic assumptions underlying the classical theory of labor mobility, has been presented by Gallaway, et al. (1967). There is no need to re-examine the classical theory of labor mobility dealt with in Part One. It is sufficient to recall that, under the usual assumptions of classical economics (including one of no movement costs), the

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*So far, there has been very little research concerning the migration pattern of individuals who are not connected to the labor force, such as students or the elderly. Some examples are the contributions of Groat (1964) and Greenwood (1973b) who have examined interstate migration of college students, and Barsby and Cox (1972), who have dealt with interstate migration of the elderly (in the US in all cases).

shifts of labor from low-wage regions to high-wage regions eventually yield an equilibrium at which wage rates are equalized over all regions and no labor surplus exists. Gallaway, et al. showed that this result remains true if there exist movement costs. Workers adjust their offered wage to whatever amount is necessary to compensate these costs; this leads to an adjusted (shadow) wage rate determined for each of the various potential destinations. Workers, therefore, are going to migrate from the low (adjusted) wage regions to high (adjusted) wage regions until an equilibrium is reached. Indeed, further removals of other unrealistic assumptions of the classical theory of labor mobility are possible but would not modify the above reasoning and its final result. This, in fact, would lead to a simple macro conceptualization of the microeconomic approach developed by the Chicago school in the early sixties (Schultz, 1961 and Becker, 1964) as an offshoot of the human capital theory.

According to the human capital theory, the decision to migrate is viewed within a cost-benefit framework as a form of investment. An individual decides whether or not to move by balancing the benefits (increases in the present value of the net earnings stream following a migratory move) and losses (pecuniary and non-pecuniary costs associated with such a move). Sjaastad (1962), the first to apply the notion of investment in human capital to the decision to migrate, detailed and discussed the most important variables which are known to influence costs and returns generated by a prospective move.

Later, Brennan (1965), gave complementary perspectives on this approach by interrelating the significance of variables such as income, occupation and age, and the probability of finding a job. He suggested that these classes of individuals characterized by the longest time horizons, the smallest amount of mobile assets or the smaller number of dependents should be expected to respond first to a given interregional difference in

occupation-specific wages weighted by probability of employment.* That gross migration flows tend to be the greatest among young persons reflects the intersection of those three conditions. Migration thus involves a search for better economic well-being.

The "Push-pull" Theory

Alternatively, some economists have attempted to derive theories of migration from empirical observations of the phenomenon. They recognize the existence of two kinds of pressure believed to cause the process of migration: "push" and "pull" factors.

The "push" factors are those conditions which may induce somebody to leave. They may include a large number of factors, but among the most widely recognized are unemployment, low wages and, more generally, poor living conditions. The "pull" factors are those conditions which may attract people to a particular place. They generally include employment, income, educational opportunities, better living conditions etc. One interesting aspect of this approach is that it recognizes that migration may occur despite the fact that the migrants may only be able to find petty jobs rather than remunerative employment in desirable sectors. That is to say the people may be simply attracted by amenities, "bright lights" of the cities, favorable climate, etc. This means a departure from economic rationality but the analysis still remains a subset of the generalized economic appproach.

Additionally, the "push-pull" analysis permits a fusion with an intervening opportunities model (Stouffer, 1940, 1969) or a gravity model in which population (or labor force) variables replace the masses of the physical counterpart model. The spatial dimension of migration is thus explicitly introduced in the picture through the consideration of intervening obstacles.

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*This important modification of the simple wage differential approach by accounting for the probability of being unemployed in the destination region is generally improperly attributed to Todaro (1969), who, unlike Brennan, has tested an empirical model of rural-urban migration in developing countries along this line.

From Economic Theories to Regression Models

To summarize, the alternative theories of migration stress the existence of three different types of factors.

1) Differentials exist in the values of variables between areas of origin and destination. The classical theory emphasizes the role of wage differentials, the neoclassical theory adds differentials in various indicators of economic opportunities, and the "push-pull" analysis allows for the consideration of differentials in the vast array of variables, not necessarily economic.

2) Intervening obstacles appear either as various types of costs in the neoclassical theory or as distance (or intervening opportunities) in the "push-pull" analysis.

3) Personal factors are especially seen by the human capital theory.

The importance of the third type of factors in the decision to migrate has also been seen by the proponents of the theory of selectivity first stressed by Kuznets, et al (1960). According to them, at the root of the impact of population redistribution on economic growth is the selectivity of migrants who represent the more productive sector of the labor market.

This classification of the factors which enter the decision to migrate conforms to the theory of migration proposed by Lee (1966), and will be used later to present the empirical evidence concerning the determinants of place-to-place migration.

Finally, it is remarkable that the alternative theories of migration use the same or similar determinants. The only difference between the alternative theories appears to be one of relative emphasis on the various types of factors.

In these conditions, it is not surprising that, regardless of their theoretical inclination, empirical studies have taken a similar form to substantiate the importance of the factors that their theoretical underpinnings see as influencing the

decision to migrate. Virtually all studies dealing with place-to-place migration have used a common tool multiple regression analysis, in which the same explanatory variables have been used over and over. More specifically, the students of migration have used, with however minor variants, the following regression model explaining the variations of destination-specific out- (or net) migration rates:

$$\frac{M_{ij}}{P_i} = f(P_i, P_j, E_i, E_j, d_{ij}, A_i) \qquad (46)$$

in which

M_{ij} is the gross (or net) migration flow from region i to region j.

P_i and P_j are the populations of regions i and j respectively.

E_i and E_j are the set of economic and non-economic characteristics relating the origin i and destination j respectively.

d_{ij} is the distance between reigons i and j.

A_i is the personal characteristics of the population of the i^{th} region.

Note that E_i and E_j are generally used as separate explanatory variables in lieu of the differential $(E_i - E_j)$ or relative (E_i/E_j) variables.

The ability of such a tool to provide meaningful insights into the process of migration has been challenged by numerous students of migration (see, for example, Todaro, 1976). The discussion of the limitations offered by the multiple regression model is not directly relevant to the purpose of this paper and we will not deal with that subject. However, it is of prime interest to point out the existence of these limitations which perhaps account for the rather contradictory findings obtained by the empirical studies of place-to-place migration.

Empirical Studies: A Survey of the Findings

As mentioned above, our review of the findings of empirical studies is organized in three parts that roughly correspond to the three types of influencing factors considered by Lee (1966). We start with a review of the results concerning the conditions prevailing at the origin and destination.

Conditions Prevailing at the Origin and Destination

The economic factors whose role has been analyzed frequently in empirical studies of place-to-place migration are earnings and unemployment.

Earnings: In brief, empirical studies have produced a very mixed substantiation of the role of differentials in attainable earnings in the decision to migrate. On the one hand, some studies have provided a strong support for the role of differential earnings in interregional migration in North America. For example, Greenwood and Sweetland (1972) showed that inter-SMSAs migration flows are negatively influenced by the origin's per capita income and positively affected by the destination's per capita income (the relationship is significant in both cases). Chetwynd Jr. and Richter (1971) obtained an identical finding in the case of inter-SEAs migration in a low-income region in the United States. Additionally, Courchene (1970), in a study of interprovincial migration in Canada, Gallaway, et al., (1967), as well as Kau and Sirmans (1977), in studies of interstate migration in the US, showed the significance of relative per capita incomes in generating place-to-place migration.

Further evidence concerning the positive and significant per capita incomes or wages of the destination region can be found in the case of interprovincial Canadian migration (Laber and Chase, 1971), interstate US migration (Sjaastad, 1960; Greenwood, 1969; Greenwood and Gormely, 1971; Kohn, et al. 1973;

Wadycki, 1974), interregional Swedish migration (Gallway, et al. 1973),* or interregional Italian migration (Salvatore, 1977). Income change of the destination region was however, not found to be positively and significantly associated with place-to-place migration (Sjaastad, 1960; Kohn, et al. 1973).

On the other hand, other empirical studies have found little support for the influence of differential incomes on wages: neither the origin's wage rate, nor the destination's wage rate turned out to be significant in explaining interregional migration in Germany (Vedder, et al. 1970), or inter SEAs migration in California (Rogers, 1968). In addition Tarver and McLeod (1973) showed that per capita income of the origin state was not significant in explaining the interstate migration in the US while Lowry (1966) found a nonsignificant impact of the destination hourly manufacturing wage.

As suggested above, the different specifications of the testable models used by migration students certainly account for the above contrasting evidence concerning the role of earnings in interregional migration. However, Fabricant (1970), argues that the aggregative relationships typically used may obscure the fact that short-distance moves are not as much responsive to earnings (income) differentials as long-distance moves.

Unemployment: According to the "push-pull" theory, unemployment is a variable of major influence in the decision to migrate: increasing levels of unemployment stimulate outmigration and deter inmigration. On the one hand, a high unemployment rate generates fears of possible unemployment and induces individuals having such fears as well as those unemployed to look

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*These studies only tested the importance of destination factors in generating migration by studying the destination-specific migration flows out of given regions. Note that in the case of Greenwood (1969), the per capita income variable appeared to be significant only when a migration stock variable was included in the equation.

for better prospects in other areas. On the other hand, a high unemployment rate offers little prospect to the potential in-migrant to quickly find a job.

Again, the empirical literature provides some mixed evidence concerning the role of unemployment rates. Some studies have concluded that interregional migration can be largely attributed to unemployment differentials (Vanderkamp, 1968; Courchene, 1970, both in the case of Canadian interprovincial migration, and in the case of Italian interregional migration Salvatore, 1977). An opposite conclusion was obtained by Gallaway, et al. (1967) in the case of interstate migration in the US while numerous studies obtained incorrect or insignificant coefficients concerning the unemployment rate of the origin region (Lowry, 1966), the destination region (Greenwood, 1969; Chetwynd Jr. and Richter, 1971), or both (Rogers, 1968). A negative and significant impact of the destination unemployment variable has however been evidenced by Greenwood when adding a migration stock term to his regression.

Greenwood (1975a) argues that the failure of unemployment rates to appear generally significant is perhaps due to a simultaneous-equation bias. Note, however, that his simultaneous-equation models (1973a, 1975b) which we examined in section 1.3, led to significant unemployment variables influencing migration into and out of SMSAs for the period 1950-60 only. They were insignificant for the next decade.

The importance of job opportunities in affecting the decision to migrate has also been claimed by researchers (Lowry, 1966; Rogers, 1968; Greenwood, 1969; Chetwynd Jr. and Richter, 1971 etc.) who have used gravity-type formulations to describe place-to-place migration flows. They have interpreted the size of the population (or labor force) of the destination region which almost always turned out to be significant as a proxy for job opportunities.

Other Economic Incentives: Among other economic variables, government expenditures (Greenwood, 1969) and government transfers (Courchene, 1970), also affect place-to-place migration.

Their role has, however, been much more substantiated in the case of total migration out or into a given region (Sommers and Suits, 1973; Pack, 1973; or Cebula, 1974).

All in all, the above findings concerning the impact of economic determinants on migration indicate a mixed response of potential migrants to economic factors.

Is this finding surprising? The answer to this question must be negative. The guiding premise of the neoclassical economic theory assuming that man is economically rational (thereby subjugating noneconomic considerations to secondary status) does not hold in the real world. This is attested by the results of three US surveys summarized in Table 6, indicating that economic motives account for approximately 50 to 60 percent of the decision to migrate. However, one student of migration notes that:

> ...although it is inadequate to think of the movement people exclusively in economic terms (i.e. calculating costs and returns), economic motivations do appear to be a major causative factor in the migration process. This generalization holds true especially when we examine movements of those of labor force ages. (Shaw, 1975, p. 57)

Table 6. Reasons given for migrating: three US surveys.

Source: Shaw (1975, p. 58)

A. Current Population Survey US August 1945 to October 1946		B. Bureau of Labor Statistics US March 1963		C. Survey Research Center 1962: Lansing and Mueller (1967)	
Reason Given	%	Reason Given	%	Reason Given	%
Work related	63.1	Work related	49.5	Purely Economic	58.0
Take a job	49.9	Take a job	29.5	Economic and noneconomic	14.0
Look for work	13.2	Look for work	11.9	Noneconomic	23.0
Housing problems	15.0	Job Transfer	8.1	No reason	5.0
Change in marital status	3.5	Marriage and family	14.6		
Health	2.7	Other	35.3		
Other	14.2				
(Primary migrants i.e. family heads aged 18-64 years.)		(Males aged 18-64 years)		(Family heads)	

Regardless of the strength of the impact of economic factors on place-to-place migration flows, the studies reviewed above indicate that the economic factors at the destination have a larger impact than the economic factors at the origin. First, the coefficients of the variables relating to the destination turn out to have generally a larger magnitude and to be significant more often than the corresponding coefficients pertaining to the origin region. Indeed, this latter result confirms the asymmetry between total out- and inmigration flows observed in section 1.2. But the response of migration flows to economic forces as seen in this section appears to be much weaker than the one obtained by the aforementioned studies of total out- and inmigration flows.

Non-economic Characteristics: Few non-economic considerations have been given much attention in explaining migration. Attention has been given only to climatic conditions (Greenwood, 1969; Greenwood and Gormely, 1971; Alonso, 1973; Kau and Sirmans, 1977). It was generally found that the average temperature of the destination region has a positive and significant impact on place-to-place migration. Greenwood (1969), who found a high correlation between temperature differentials and migrant stock, especially when a migrant stock was included as an explanatory variable, argued that climatic conditions might be very influential in the long run.

On the other hand, some scholars have claimed to have shown the deterrent effect of congestion vis-a-vis migration as they observed a generally negative and significant impact on a population density variable (Gallaway, et al. 1973, in the case of interregional congestion in Sweden; and Gallaway, et al. 1972, in the case of migration out of Appalachian states).

Urbanization variables, popular in regression models of migration in developing countries, were seldom tried. In the case of interstate migration in the US Greenwood (1969), could not substantiate any significant influence by these variables.

By contrast, Kau and Sirmans (1977) showed a negative impact of urbanization on the origin and a positive impact of urbanization on the destination.

Intervening Obstacles and Spatial Aspects of the Decision to Migrate

The second type of factors which affect the decision to migrate refers to those determinants that Lee (1966) introduces under intervening obstacles set between all origins and destinations. Among them, we can distinguish those factors that:

a) directly affect the cost side of the decision to migrate (transportation costs and opportunity costs of moving), or

b) are related to the difficulty (psychic costs) or uncertainty (information costs) of undertaking a move, or

c) represent opportunities available to prospective migrants in alternative regions.

In practice, all these factors are seen to depend more or less on the distance between origin and destination, traditionally used as a proxy for these factors.

Clearly transportation costs directly depend on distance. The opportunity costs of moving consist of the earnings foregone while unemployed during a move. Obviously they increase with unemployment duration, i.e. with the time necessary to change places and thus are primarily affected by the distance of migratory moves.

Concerning psychic costs, Schwartz (1973) suggests that they can be measured by the transportation costs of the visits to the place of origin necessary "to negate the agony of departure of family and friends". Accordingly, these costs are expected to increase with distance.

Regarding information costs, Nelson (1959) points out that, the presence of family and friends constitutes an important

source of information for those left behind who seek places offering less uncertainty. It induces the latter to join them rather than to move to a perhaps more favorable place on which they have little information. Presumably, potential migrants with such family-and-friend ties move on the average a longer distance than those who do not have such links providing them with information on alternative places.

Finally, distance can also be interpreted as a proxy for the net benefits that a potential migrant would have received had he moved to one of the alternative destinations offering equal or better opportunities than the destination actually chosen. Clearly, these opportunities are related to the "intervening opportunities" concept developed by Stouffer (1940, 1960). He argues that "the number of people going to a distance form a point directly proportional to the number of opportunities on or within that circle (circle whose diameter links origin and destination)" (Stouffer, 1960, p. 1). These opportunities are regarded as intervening. The longer the distance of a move, the longer is the diameter of a circle just defined and the larger the number of intervening opportunities.

Actually, empirical studies have shown that distance is a serious (and perhaps the single most important) deterrent to migration: migration distance elasticities have been found to vary from -.70 (Greenwood, 1969) to -1.50 (Sjaastad, 1962). Then the problem is one of determining the extent to which each of the three types of factors enumerated above accounts for the high significance of the distance variable.

Following Lansing and Mueller (1967), who observed that 45 percent of moves made between 1962 and 1963 in connection with non-job transfers involve a total (direct) cost of less than $50.00, Greenwood (1975a) concluded that benefits associated with migration need not be particularly high to offset the direct expenditures required to move. Hence direct transportation costs (as well as earnings foregone during the period required to migrate) do not seem to be an appreciable deterrent to migration.

If for the time being we disregard the role of intervening opportunities, distance appears as a significant deterrent to migration in its capacity to capture psychic and information costs which cannot be easily measured directly.

From various experiments, Schwartz (1973) concludes that the distance effect is the result of informational costs but his conclusion remains dubious in view of the difficulties raised by his distinction between psychic and informational aspects.* Greenwood (1969), would perhaps agree with Schwartz's conclusions. He shows in a study of interstate migration in the US--including distance, income, schooling, unemployment, urbanization and temperature as explanatory variables--that distance, the most significant variable, ranks only fifth when a migration stock, a proxy accounting for information provided by family and friends, is included.

In addition, a recent study by Kau and Sirmans (1977), provides some evidence regarding uncertainty due to information opportunities according to migrant types. It indicated that the influence of distance and migrant stock variables is greater on new migrants (those leaving their state of birth presumably for the first time) than on repeat migrants.

The role of intervening opportunities has generally been considered within the context of the model proposed by Stouffer, who sees it as a substitute for the classical gravity model. An exception to this can be found in a study by Wadycki (1974), who includes for each explanatory factor a variable relating to the region of destination as well as a variable describing the best (alternative) value of the factor within the radius of a given move. His results show that the omission of these

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*Note that Kau and Sirmans (1977), argue that the information aspects of place-to-place migration are not totally represented by the distance variable but are also present in the magnitude of the origin and destination variables: "The coefficients at the origin tend to have a greater absolute size than the destination coefficients. This reflects the dominant influence of information cost and uncertainty". (Kau and Sirmans, 1977, p. 94)

factors for the best alternative opportunities causes a bias in the distance elasticity: the migration distance elasticity for interstate migration in the US is equal to -.89 in the traditional model against 1.39 in the model including alternative opportunities.

Personal Characteristics of Migrants

In accord with the human capital theory and the selectivity theory, empirical studies of place-to-place migration--as well as other types of migration analyses--have found that a number of personal characteristics exert important influences on the individual's decision to migrate. Among the most often cited are age, level of education, race and occupation. Their role is discussed in Appendix 3.

The Urban Institute's Model of Intermetropolitan Migration

A recent innovation in the appraisal of factors affecting interregional migration has been carried out in an analysis undertaken within the Urban Institute's project mentioned above (Alperovich, et al. 1977).

The starting point of this work consists of the observations that past migration models have been largely misspecified and have resulted in the contradictory results shown above. On the one hand, econometric studies of total migration flows (see sections 1.2 and 1.3), have ignored the effect of space altogether, thus ruling out the possible effects of attractiveness of and distances to all cities in the system.* On the other hand, econometric studies of place-to-place migrations have introduced the

*A few studies of total migration flows have allowed for a partial consideration of spatial elements. A good example is provided by Glickman and McHone (1977) who, in a study of intercity migration in Japan, include two indices of potential interaction (one with Tokyo, one with the nearest city). The interpretation of the coefficients associated with these two variables imply that "the greater the potential for interaction with the nearest city, the lower the rate of net migration to the city and the greater the potential for interaction with Tokyo, the greater the rate of inmigration to the city". (p. 177)

spatial dimension into the picture but have unanimously used explanatory variables relating to only the origin and the actual destination of migrants. There has been virtually no allowance for the impact of the attractiveness of and distance to other cities, considered as possibile destinations for potential migrants.*

This led Alperovich and co-workers to contend that in order to be meaningful, a migration model should "represent the essential interdependencies stemming from interactions among present residents and prospective migrants in a system of cities". Thus, they developed a model including a set of equations for gross migration flows consistent with a set of initial equations for place-to-place migration which account for the comparison of all possible destinations. Actually, the emphasis on an area's total flows is required by the ultimate purpose of the project aiming at the simultaneous determination of employment shifts and migration flows in US metropolitan areas.

Description of the Model

The basic hypothesis underlying the model is that the determinants of place-to-place flows can be divided into two groups.

- One group of variables relates to the comparison of the present location and the chosen destination (as in the place-to-place migration studies reviewed above). They consist of the population sizes and characteristic attributes of the origin and the destination, as well as of an interrelational term linking origin and destination (distance d_{ij}). The third type of usual determinants, demographic characteristics of the population of origin, whose influence is mentioned in the initial formulation

*Let us recall the exception offered by Wadycki (1974) who additionally accounts for this problem in an implicit manner explaining the destination-specific percentages of an area's total outmigration rather than its destination-specific outmigration rates (A similar treatment was used earlier by Greenwood, 1969).

of the model (Alperovich, et al. 1975a), is not included here because the test of the model is implemented on the total outmigration flows consistent with the place-to-place migration hypothesis.

- The other group contains variables involved in a comparison of the alternative possible destinations but only includes the effects of populations and distances. In other words, there is a reduced treatment of the notion of competing destinations since the comparison of possible destinations involves a limited set of variables (sizes and distances) which does not even include their attractive attributes.

More specifically, their migration hypothesis has the general form

$$\frac{M_{ij}}{P_i} = g_j(D_i, P) f(U_i, V_j) \quad , \tag{47}$$

in which M_{ij} = migration flow from region i to region j

P_i = population of region i

D_i = the vector of distances from i to all other cities

P = the vector of populations of all cities in the system

U_i and V_j = the attributes of the origin and destination respectively.

The move-comparison function $g_{ij}(\cdot)$ is expressed with the help of the notion of population potential:

$$g_{ij}(\cdot) = \frac{P_j \exp(-\theta D_{ij})}{\sum_{k=1}^{n} P_k \exp(-\theta D_{ij})} \quad , \tag{48}$$

while the factor $f(\cdot)$ is expressed as a linear function of the various attributes X_{sj} (constituting V_j) and X_{si} (contained in U_i)

$$f(\cdot) = \mu_0 + \sum_{s=1}^{\ell} \mu_s X_{sj} + \sum_{s=1}^{\ell} \gamma_s X_{si} \quad . \tag{49}$$

A careful aggregation of the place-to-place migration flows leads to the derivation of the following inmigration equation. [For a full derivation of this equation, the reader is referred to the original article (Alperovich, et al. 1977, p. 138).]

$$\frac{IM_j}{P_j V_j} = \mu_0 + \sum_{s=1}^{\ell} \mu_s X_{sj} + \sum_{s=1}^{\ell} \gamma_s RX_{sj} \quad , \tag{50}$$

in which

$$V_j = \sum_i g_{ij}(\cdot) \quad , \tag{51}$$

and

$$RX_{sj} = \frac{1}{V_j} \sum_{i=j}^{n} \frac{P_i \exp(-\theta D_{ij})}{\sum_{k=1}^{n} P_k \exp(-\theta D_{ik})} X_{si} \quad . \tag{52}$$

Equation (50) expresses that per capita inmigration to region j, expressed by unit of V_j, is a linear function of the attributes of place j and of a weighted average of the attributes of all other places contained in the j - "R potentials" expressed in (52).

Empirical Results

Indeed, due to the multicollinearity between the R-potentials which have rather small variances, a direct testing of the above inmigration equation (using 1965-70 data for 284 metropolitan

areas) did not yield satisfactory regression coefficients, specially in the case of the constant term and the coefficients of the R-potentials. To overcome this problem, Alperovich, et al. have conducted several experiments based on alternative prior restrictions imposed on the parameters.

Their experiments, not discussed here, consisted, for each type of explanatory factor used in (50), of substituting a unique variable $X_{sj} - k\,XR_{sj}$ for the separate variables X_{sj} and RX_{sj} and to find the optimal value of the ratio $k = \gamma_s/\mu_g$ assumed to be the same for each factor. Eventually, this led to findings which in some cases appear to contradict some of the few tangible results established by past studies of migration.

First, Alperovich, et al. found that differences in economic conditions (unemployment rate, rate of growth in employment and the wage rate) account for a large share of the variance in in-migration rates across cities although migrants respond to at least two non-economic attributes of the cities to which they move: mild climate, city size.*

Second, "although the evidence remains stronger for the role of economic pull than for economic push, the results strongly suggest that the push factors are as great an influence on migrations behavior as the pull factors" (p. 142). However, the difficulty in understanding the few explanations furnished by the authors concerning their series of experiments does not allow us to evaluate the extent to which this latter finding can be attributed to the restrictions imposed on the model.

Third, the relative importance of their wage rate and unemployment rate variables in the decision to migration suggest that

> intermetropolitan migrants in the US attach much more importance to wages, relative to unemployment rates... This result is consistent with the observation that many migrants already have jobs, so that unemployment exerts only a small negative influence on migration. (p. 143)

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*The results obtained by Alperovich, et al. concerning city sizes suggest that, in fact, migration rates are quite insensitive to city size up to a certain level beyond which it appears to be a significant deterrent to migration.

In addition, the inclusion of past inmigration shows that a great deal of the variance in intercity migration can be explained by the pattern of past migration, a finding corroborating earlier results obtained by Greenwood (1969) and others.

To conclude, the Urban Institute's model of migration based on various innovations in model specification in order to integrate the importance of spatial elements (mostly sizes and distances) displays impressive evidence concerning the role of economic forces on both in- and outmigration flows. In this respect, the findings obtained sharply contrast with those obtained by the common studies of place-to-place migration and appear to agree rather with the results obtained by the studies of total migration flows which have ignored the spatial dimension.

It seems however, that the above results must be accepted with caution since the Urban Institute model is also misspecified: only the effects of sizes and distances have been considered to affect the comparison of the chosen destination with alternative possibilities.

Finally, in view of the scope of the overall Urban Institute project, it is regrettable that no effective linkage was made between the employment shift model (examined in section 3.1) and the above migration model: such a linkage would have allowed a simultaneous-equation determination of metropolitan employment shifts and migration similar to that of the models examined in section 1.3, but presenting in addition a spatial dimension.

3.3 Extended Theories and Models of Regional Demoeconomic Growth

The main conclusion of the previous two sections thus appears to be the possibility of giving a spatial dimension to the process of regional demoeconomic growth in order to reduce the noticeable gap between a realistic explanation of this process and the explanations provided by the theories and models examined in the first two parts. Richardson (1973) was the first to illustrate such a possibility by presenting a model of regional demoeconomic growth integrating spatial relationships within a macroeconomic framework.

Richardson's and von Böventer's Models

The model suggested by Richardson (1973, Chapter 8) is a formalized summary statement of verbal theories. Its main characteristic is the stress of not only factor endowments and relative scarcities, but also of spatial agglomeration economies and locational preferences. It attempts to explain the growth of a particular region within a national economy.

Description of Richardson's Model

The model contains five equations (see Table 7). These include a definitional growth equation describing the regional growth rate of income in terms of three components: capital stock growth, labor supply growth and technical progress, three equations describing the variations of each of these three components, and a functional equation defining an index of locational preferences of households supposed to affect labor supply growth.

The definitional growth equation (first equation in Table 7) is the familiar neoclassical growth equation in which Richardson allows for the possibility of increasing returns to scale as implied by the existence of agglomeration economies.

The capital stock growth equation (second equation in Table 7) indicates that, the income growth rate, the size of the capital stock and the rate of return on capital have a positive impact on capital stock growth. The spatial dimension is introduced through the consideration of regional characteristics consisting of an agglomeration factor and a coefficient of variation in capital stock per unit of area in the urban centers of the region. In addition, a linkage between the region and the rest of the nation is introduced by considering a capital return differential between the region and the nation rather than a regional rate of return of capital.

The labor supply function (third equation in Table 7) shows that labor supply growth is affected by the rate of natural increase of population, the rate of inmigration supposed to depend

Table 7. The specification of Richardson's model.

Source: Richardson (1973), Chapter 8.

Dependent Variables	Independent Variables	Comments
Growth rate of income (y) $y = [ak + (1 - a)l]^{\alpha} + t$	Growth rate of capital (k) Growth rate of labor (l) Rate of technical progress (t)	a and (1 - a) are the income shares of capital and labor respectively. α reflects the type of returns to scales.
Growth rate of capital (k)	Agglomeration factor (A) Growth rate of income (y) Capital stock (K) Index of spatial distribution of past investments (V) Capital return differential between region and nation $(R - \bar{R})$	
Growth rate of labor (l)	Rate of natural increase of population (n) Agglomeration factor (A) Average locational preferences $(\bar{P})$ Wage differential between regional nation $(w - \bar{w})$	
Average locational preferences $(\bar{P})$	Agglomeration factor (A) Reciprocal of the population potential of the region's leading city $(1/V_N)$ Average length of residence (I) Wage differential between region and nation $(w - \bar{w})$ Mobility costs between region and closest higher income region (TC)	
Technical progress (t)	Agglomeration factor (A) Rank of region's leading city in the national urban hierarchy (G_N) Degree of region's connections with the rest of the economy (P) National rate of technical progress $(\bar{t})$	

on agglomeration economies and wage differentials, and the rate of outmigration proxied by an index of average locational preferences measuring the retentive power of the region for its own residents.

Locational preferences for not moving (fourth equation in Table 7) are supposed to vary directly with agglomeration economies, length of residence in the region and inversely with distance from the region's leading metropolitan area. Two additional explanatory variables, the wage differential between the region and the nation and transportation costs to the closest higher income region, are used to reflect the influence of sacrificed income gains and the costs of moving.

The final equation describing technical progress (fifth equation in Table 7) indicates the importance of agglomeration economies and capital embodiment in determining the rate and spatial incidence of technical progress. Additionally, the effect of the spatial diffusion of technical progress is considered with the help of a variable measuring the ranking of the major metropolitan area located in the region within the nation's hierarchy and a term representing the fraction of national technical progress that might be absorbed into the region as determined by the strength of the region's communication channels with the rest of the economy (Richardson, 1973, p. 214).

Such a model thus stresses the role of agglomeration economies which appear in all the equations under various forms: the coefficient α measuring returns to scale is the definitional equation, the agglomeration factor A used in all equations except the first one, the population potential influencing locational preferences, and the rank of the region's major metropolitan area. These agglomeration economies unbalance the interregional and intraregional growth tendencies which reinforce or counterbalance effects of the importance of capital and labor wage differentials in neoclassical analyses.

The effect of distance is also taken into account: interregional distance affects locational preferences through the

population potential measure and the transportation cost variable as well as the diffusion of technical progress over time; intra-regional distance effects appear via the agglomeration factor A, which Richardson crudely defines as a function of the size and spatial distribution of the region's urban centers.

Finally, the five equations of the model can be easily combined in a reduced form equation (see Richardson, 1973, p.214) in which the regional rate of income growth appears to be explained by twelve variables representing features prominent in neoclassical models (capital yield and wage differential variables) but also spatial features of regional development (i.e. agglomeration economies, locational preferences, and rank of the region's major metropolitan area in the national hierarchy).

Description of von Böventer's Model

This model of regional growth was formulated as a logical consequence of von Böventer's (1975) reactions to Richardson's model to which he addresses three major criticisms.

1) The model applies to a particular stage of regional development, a take-off period or a period of accelerated growth characterized by a concentration process through agglomerating factors and diffusion of technical and organizational knowledge over space.

2) It relates to an unspecified regional level: "what holds for small economic areas may not hold for larger ones, even if the national importance of the regional center is taken into account" (von Böventer, 1975, p. 13).

3) It still contains neoclassical price effects (wage rate differentials and capital return differentials) which, according to von Böventer should not be listed as explanatory variables of regional growth. His argument is that the chain of causation runs from innovations and market sizes to price and return differentials:

"above all during take-off periods and during periods characterized by increasing concentration of economic activities, the agglomeration factor is a much more significant variable than factor differentials are" (von Böventer, 1975, p. 13). Based on these criticisms he proposes an extended model

a) allowing for possible changes in the size and magnitude of important parameters according to sizes and phases of development,

b) considering two types of regions, and

c) focusing on the sizes, distances and structures.

Like Richardson's model, this model is designed to explain the growth rate of income for each region and subregion. However, in opposition to Richardson, the latter variable is determined not only by factor augmentations and the rate of technological change, but also by structural elements (the region's industry structure as well as its spatial structure to the extent that it gives rise to interregional economies) and by the growth rate of demand for the region's products.

Indeed, the consideration of this growth rate brings back into the picture a demand-oriented view of regional growth completely neglected by Richardson. Among the determinants of this growth, the following factors are of particular importance: the growth rate of national demand, the region's geographical location, its interregional agglomeration economies (or connectivity) with the rest of the economy and again its industry structure. The pull exerted by the central subregion is also considered.

Von Böventer's model includes an additional equation that shows the growth rate of labor force as influenced by the national rate of growth of labor force and the variables having a bearing on migration rates, namely locational qualities. There is no equation for capital growth and technological change; their influences are taken care of in the income growth equations through the national growth rate which includes national measures of the

national growth rate of capital and technical progress. Thus only two structural equations are left, an income growth equation and a labor force growth equation which contain virtually the same variables due to numerous interdependencies.

Then, abstracting from special factors effective only at lower levels of aggregation, the regional income growth rate is determined by the contained influences of agglomeration factors, industry structure, locational qualities, the natural rate of growth of the labor force, the income growth rate of the national economy as well as that of major subregions. The corresponding equation is the reduced-form equation of the verbal structural model envisioned by von Böventer. It clearly shows the absence of income and price variables as determinants of growth in accordance with the aforementioned view that these variables are closely related to, but dependent upon agglomeration factors and structural factors.

Additionally, von Böventer (1975) discusses the specification of the variables included in this reduced-form equation. It defines three indices which have to do with externalities related to sizes and distances: two agglomeration factors summarizing the role of agglomeration economies at the intra- and intercity levels and two indicators of economic distances describing traffic connections and hinterlands.

The role of industry structure is taken care of through indices accounting for the growth effects of the industry structure, the employment shares of particular industries and employment shifts from low-productivity to higher-productivity industries.

Locational qualities are considered under three headings: quality of infrastructure, availability of open space for new construction, and cultural and climatic features.

Richardson's Empirical Study of Regional Growth

Neither of the reduced-form models proposed by Richardson and von Böventer have been tested by their authors due to data limitations.

Instead, Richardson (1974) chose to test broad theoretical hypotheses and to adopt stepwise regression procedures in order to evaluate the statistical association between growth rates and plausible independent variables selected on theoretical grounds though outside the framework of a formal model.

The first part of the empirical study undertaken by Richardson consists of seven multiple regressions each of which attributes the evolution of the gross state product of States within the US over the period 1955-64 to the changes in independent variables representing a particular theoretical hypothesis about regional growth.

Richardson's first two regression equations which attempt to assess the relationship between, on the one hand, regional growth, and on the other hand, economic characteristics (first equation) or demographic characteristics (second equation) indicates that migration has a very significant and positive impact on growth. Indeed this, as well as the negative and significant association between growth and unemployment, is hardly surprising, as seen in part One. More interesting is the finding of a strong negative relationship between growth rates and per capita income, a result which brings some support to the convergence hypothesis of state per capita incomes.

Richardson's third regression equation testing the impact of amenities on the growth of states has a high overall explanatory power showing the significance of climate (average monthly temperature in major cities), tourist, and recreation activities on regional growth. Air pollution and locational preferences (the latter represented by the percentage of people born in the state but living in other states) had the a priori signs, but were not found significant.

In contrast to the amenities equation, the fourth and fifth equations testing for the influence of agglomeration economies and business behavior respectively, turned out to be quite disappointing. The national urban hierarchy rank was significant with the wrong sign from the point of view of agglomeration theory,

a result that Richardson attributed to the fact that the more backward regions tend to grow faster. In contrast to this, the wage variable was not significant and unemployment was significant but with the wrong sign.

Finally, the sixth equation (labor market equation) indicated that growth is higher in states with an economic structure tilted away from manufacturing and agriculture whereas the seventh equation (policy variables equation) suggested that tourist expenditures and federal government spending significantly affect income growth.

The second part of Richardson's study attempts to select determinants of growth using a stepwise regression procedure presenting no constraint imposed by preconceived hypothesis. He thus finds that

a) more backward states grew faster in the period 1955-64,

b) differences in the spatial distribution of population and economic activities (SMSA share, population and income density, location preferences, migration attraction) are associated with variations in state growth rates,

c) the signs of a few variables (unemployment, business failures and pollution) suggest simultaneous determination with growth,

d) the influence of climate fades out when more independent variables are introduced, and

e) two key variables are the instrument variables pointed out earlier.

Further Theoretical Developments

In brief, the latest contributions to the development of a regional growth theory (Richardson, 1973; von Böventer, 1975; Alperovich, et al, 1975b, 1977; Anderson, 1977; Miron, 1977; Gleave and Cordey-Hayes, 1977) are very critical of the supply-side explanations of the sixties and earlier seventies based on neoclassical assumptions.

The reintroduction of demand (as stressed in the export-base theory) as a growth factor, is advocated by most of these authors. The most convincing support however appears in the paper by Alperovich, et al. (1975b) which shows the prominent role of access to markets in determining the metropolitan employment growth.

Indeed, the high significance of the access to markets variable used by Alperovich, et al. indicates the importance of demand but also that of geographical characteristics. As seen above, there has been a tendency toward greater consideration of the spatial dimension: sizes (agglomeration economies) distances, locational preferences, etc. (von Boventer, 1970, 1975; Richardson, 1974; Alperovich, et al. 1975b, 1977). However, other scholars have dealt more carefully with the temporal dimension of the problem (Miron, 1977 and Gleave and Cordey-Hayes, 1977) and have recommended studying the dynamics of local labor markets.

It is clear that a meaningful regional demoeconomic growth theory involves both space and time considerations. However, their simultaneous inclusion in a theory or model is always a problem since the consideration of spatial elements hinders a large consideration of temporal elements and vice versa. In fact, the trade-off between space and time is not so much a relevant problem. The real problem consists of the choice between a long-term theory (which largely considers space) and a short-term theory (which examines the dynamics of the problem).

A priori, the regional demoeconomic growth that one would like to establish is more interested in the long-term aspects of the problem, all the more so because the present survey tends to indicate the existence of a large locational inertia that characterizes firms as well as households. As justified earlier in section 1.2, the purpose of the theory sought is the identification of the sources of growth. This is a problem quite different from the one treated by the simultaneous-equation models of section 1.3 which focused on the short-term adaptive behavior of firms and households.

Thus, we find a need as well as a possibility of developing two related areas of research.

- One would be oriented toward the long term, for the purpose of identifying the sources of growth. While giving importance to the spatial dimension of the problem, it would need to be as aggregated as possible and make a larger use of cross-section data.
- The other area would be oriented toward the short term for the purpose of examining the respective expectations of firms and households. Because of the paramount importance the temporal dimension of the problem, it would need to be as disaggregated as possible and make a larger use of time-series data. The emphasis would be placed on the labor market and on the interaction of migration and urban labor market dynamics. The empirical research associated to this second research area falls within the demometric perspective recently advanced by Rogers (1976).

CONCLUSION

Since the early sixties economists, among other social scientists, have contributed a great deal to the creation and expansion of a "regional science". One of their main focuses has been the development of a theory of regional demoeconomic growth explaining the forces which cause and shape the spatial pattern of development in market economics.

Borts and Stein (1964) were the first to suggest an alternative to the perennial export-base theory inherited from Keynesian economics. Spurred on by the growing influence of neoclassical economics, their work provided a supply explanation of regional demoeconomic growth, apparently no more realistic than the demand explanation proposed by the export-base theory.

The next step was the building of simultaneous-equation models of urban growth (Muth, 1971; Greenwood, 1973a) showing

that the two polar views contained in the export-base and Borts and Stein theories were, in fact, simultaneously at work. Unfortunately, these models emphasizing the short-term behavior of an area's firms and households proved to address no real growth issues and to provide very little insight into the process of urban development.

In brief, the above contributions to the development of a regional demoeconomic theory were characterized by undesirable features such as the ignoring of the spatial element (impact of sizes, distances, structures and locational preferences) and the adoption of a micro-economic approach amphasizing the role of labor.

Thus, Richardson (1973) stressed the importance of spatial elements in the process of regional development and suggested a first approach to their consideration in a theory of regional decroeconomic growth. And later, Miron (1977) emphasized the importance of examining the micro-economic foundations of the behavior of firms and households to understand regional economic growth and migration. Unfortunately, these recent contributions to the regional growth problem have been more verbal than formal and have led to empirically testable models little different from those proposed in the past.

All in all, this review of the research concerning regional demoeconomic growth shows that, in the recent past, regional economists here failed in their efforts to provide a meaningful explanation of the forces that cause and shape the spatial pattern of development in market economics. No substantial progress has been made toward the identification of the sources of regional growth and the solvability of the controversy centered around the firm-initiated and the household-initiated growth.

From our investigations, it is tempting to conclude that the development of a regional demoeconomic theory is a utopia since so many factors, more than the optimum number that can be accounted for in a theory, appear to affect the spatial pattern of demo-economic growth. Nevertheless, our review shows hope for the

construction of a meaningful theory which might emerge from a slow-paced process involving the constant interaction of theoretical constructs and empirical studies. Already, some insights have been gained into the partial aspects of regional development. A better understanding of the determinants of employment growth and migration has been brought by numerous socioeconomic studies, among them the most prominent has been the Urban Institute's project of intermetropolitan job shifts and migration which has attempted to provide a better feeling for the role of space in the behavior of firms and households.

Indeed, a great deal more work concerning the determinants of employment growth and migration is needed before the findings can be put together to provide a meaningful theory of regional demoeconomic growth. A better explanation of economic (i.e. employment) growth requires a more thorough analysis of the role of firms by looking at an area's individual firms rather than to its total change in employment. Progress toward comprehending the role of households requires the examination of the migration pattern of an area's microgroups of people rather than of its total population and the labor force participation problem. In addition, more emphasis on the spatial and time scope of these roles is needed.

It is clear that all these aspects of regional development which need to be examined in the future are not independent and do affect each other. For example, the spatial and time aspects of migration are quite intricate and require, in theory, their simultaneous consideration in an analysis of migration. It is a well known fact that it is difficult to deal simultaneously with these aspects. Richardson (1973), however, made it clear that one should stress space at the expense of time.

Thus, to understand the forces that cause and shape the location pattern of economic agents, a more general framework of analysis is required, one which views the actions of these agents in the light of their interrelationships over time and space,

i.e. restores an equal balance between the roles assigned to firms and people. It is claimed that the application of the scientific approach known as the "systems approach" to interregional demoeconomic systems could provide such a framework.

The purpose of this approach is to provide a useful framework explaining the evolution of a problem in terms of the relevant factors with maximum efficiency.

In brief, since systems are made up of sets of components that work together for the overall objective of the whole, the systems approach means looking at each component part in terms of the role it plays in the overall system examined:

> A basic objective of the systems approach is to discover those components whose measure of performance are truly related to the measure of performance of the overall system. (Reif, 1973)

In brief, the use of the systems approach consists of the following steps:

1) definition of the larger system corresponding to the relevant problem (here the spatial pattern of economic development in market economies),

2) delineation of the subsystems of the larger system which could be examined separately to reduce the difficulty of the examination of the problem at hand, and

3) establishment of the mechanisms underlying the intra- and then the interrelationships of the subsystem.

By applying such a process, regional scientists should then delineate meaningful subproblems of the regional demoeconomic growth that could be tackled separately. Since the systems approach views individual operations of a subproblem only in the light of their implications for the whole system as a whole, the subproblems to be delineated probably will not coincide with the various aspects examined in the past.

Indeed, the effort that the adoption of such a framework places on regional scientists is tremendous but is appears as a compulsory passing point to develop a meaningful theory of regional demoeconomic growth.

It is also fair to say that the completion of the suggested systems approach supposes that two important prerequisites be fulfilled: the first one concerns the availability of data and the second problem relates to the possibility of improving the quality and performance of empirical models.

In the past, very little data for regions and local areas, especially on migration, have been available. However, rapid progress has been made towards the systematic collection of accurate data concerning a larger number of regional variables. A typical example is offered by the Continuous History Work Sample of Social Security Administration whose sampling basis has been increased from one percent to ten percent. Thus, it is now possible to obtain reliable and accurate migration data for small areas on a time-series basis. Clearly, the availability of such data should permit the testing of empirical models and thus facilitating the induction of a theory of regional demoeconomic growth.

Additionally, the implementation of the foreseen systems approach requires an improvement of the modeling ability of regional scientists. Such an improvement depends on the availability of better quantitative methods. To a large extent, however, it is a function of the time and financial resources that would be made available to regional economists for the purpose of fully comprehending the spatial pattern of economic development.

How feasible is a regional demoeconomic growth theory? The experience of other fields which have attempted to solve similar issues is not encouraging. In spite of the huge amounts of resources made available for the construction of land-use transportation models or models of economic development in less developed countries, little insight into the change of land use patterns or the understanding of the economic development process have been obtained so far. (See D. Lee, 1973, for a negative view of land-use modeling and Arthur and McNicoll, 1975, for a sharp criticism of the usefulness of economic development models).

We are, therefore, pessimistic about the feasibility of developing a comprehensive view of the regional development problem. An additional reason is that we presently witness a shift in the interest of regional economists from growth theory to resources: this is clearly illustrated by the changes in the curriculum of the regional science program of one of the most reputed American universities (University of Pennsylvania). However, such a pessimistic conclusion does not rule out the possibility of gaining some important insights into partial aspects of the problem, like the aforementioned relationship between migration and urban labor market dynamics whose functioning mechanisms are also relevant to other subdivisions of economics.

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APPENDIX 1

The Determinants of Labor Force Participation

The following is a brief summary of recent evidence on the determinants of labor force participation found in the socio-economic literature. The role of various explanatory variables is subsequently examined. No attempt is made to review separately the effect of economic conditions and the impact of the demographic or social characteristics of the working age population. In reality they are not independent since the relationship of economic factors and labor force participation appears to vary according to age, sex, and marital status.

Income

The relationship of earnings and labor force participation typifies the statement just made. In the case of males Bowen and Finegan (1969) observe a positive correlation for men 25 to 54 years of age while they obtain a negative correlation for men 16 to 24 years (high wages connote limited opportunities which discourage participation by young men). Such a result is broadly confirmed by Baer (1972). By contrast, Bowen and Finegan obtain a definite relationship for all women 14 to 64 years: the correlation is high for non-married women, higher for married women living with their husbands and even stronger for those without any children.*

The effect of other income on labor force participation varies substantially among demographic groups, being consistent and strong only in the case of married women (although it is overbalanced by the positive effect of the wife's own wage rate) (Bowen and Finegan, 1965)

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*For age 65 and older, the relationship is negative for men and insignificant for women. As Parnes (1970) puts is "the fact that wives are less likely to be in the labor force when their husbands are retired causes the general relationship between female earnings and female labor force participation to be blurred for that particular age group".

Unemployment

Using the unemployment rate as an indicator of economic activity, Bowen and Finegan (1969) show that, for virtually all the major demographic subgroups (the only exceptions are several categories of never-married women), unemployment is a deterrent to labor force participation, thus showing the preponderance of the "discouraged worker effect" over the "additional worker effect". Indeed, the strength of the negative relationship is less in the case of the primary labor force (prime age males) than in the case of the secondary workforce (young and older men, married women). These results agree with those obtained by Baer (1972)--in the case of males, and by Cain (1966) and to a lesser degree Mincer (1966)--for married women. However, they largely differ from those obtained by Barth (1967) who finds that the unemployment rate is significant only in the case of women 18 to 64 years.

Further understanding of how the linkage operates between unemployment rate and labor force participation has been provided by Corry and Roberts (1970, 1974) in two successive studies of regional activity rates in Great Britain using pooled data. In their first paper analyzing the variations of labor force participation over the period 1951-66, they found no statistically significant correlation with unemployment rate for males (with minor exceptions) and a statistically significant negative relationship for females. Their second paper in which they performed the same analysis for the extended period 1951-70 broadly confirmed the preceding finding for females but showed a negative impact of the unemployment rate in the case of males (the negative sign was derived on nine occasions out of ten and in four times was significant. According to Corry and Roberts, the contrast between the results of the two analyses can be attributed to the fact that, when unemployment becomes high, the negative relationship for men begins to operate as all men, the young and the elder especially, become more responsive to changes in economic conditions.

Since the relationship between unemployment and labor force participation has generally been studied in the context of cross

section analyses, it is possible to attribute the negative relationship that Bowen and Finegan, and others, have obtained to the effects on long-term structural differences, rather than to the short-run change in labor market tightness. Therefore, with Mincer (1966), who finds a strong correlation between unemployment rates in 1957 and 1964 in the same areas, one may conclude that "prolonged depressed employment conditions in an area tend to shrink the area's labor force rates".

The relationship between job slack and labor force participation has also been extensively examined in the context of a time series analysis (Dernburg and Strand, 1966; Tella, 1964). However, in those studies, the ratio of total employment to total population was used as an alternative to the unemployment rate. Another peculiarity presented by the Dernburg and Strand model was its innovative specification allowing the direct testing of the relative importance of the "discouraged worker effect" (supposed to be captured by the employment-population ratio) and the "additional worker effect" (measured by a ratio of unemployment compensation benefit exhaustions to population, with a two month lead). For virtually all age groups, Dernburg and Strand found significant coefficients for both proxies (with the expected positive signs) but obtained a much stronger "discouraged worker effect" agreeing with the conclusions of Bowen and Finegan.

The cross-sectional and time series analysis offer large differences with respect to the importance of the net discouragement effect. Consistently, cross-sectional elasticities are smaller than time-series elasticities. So that variations in labor force participation due to job slack appear stronger in the short run and less pronounced in the long run. However, this interpretation is dismissed by Bowen and Finegan who attribute the discrepancy to the difference in structural employment opportunities prevailing between the various cities included in their cross-section study.

Parker and Shaw (1968) have investigated the impact of income levels on the relationship between unemployment and labor force

participation by running regressions of mean LFPR for both sexes over a sample of census tracts classified into three income levels. They found that the coefficient of the unemployment variable decreases with income and concluded that "discouraged workers among males are more likely to be found in lower income areas and that the sensitivity to economic factors is relatively pervasive for low- and middle-income males" (p. 542). In contrast to this they found that the most discouraged workers among females are found at the higher income levels. Perhaps observing that the relationship is not significant for low-income groups, we can conclude with Mincer (1966) that this is the net result of an adjustment process meaning that additional workers are more likely to be found among low income families.

Additional demand and supply factors are sometimes used to reflect the specific employment prospects available to particular groups. Baer (1972) after Bowen and Finegan (1965, 1969) has an industry mix variable reflecting the relative demand for specific categories of employment (positive and significant for prime-age males and married women of all ages). Barth (1967) explains the variations of labor force participation among counties in Michigan mainly by the percentage of growth in manufacturing (significant for all male age groups), agriculture (significant for all male age groups except 18-24 and 25-44) or services (significant for all male groups except 18-24 and 65+).

Further evidence is offered by Berg and Dalton (1975) who showed that the workers of the goods and service sectors present marked differences in their labor market reactions. Generally speaking, the labor force in the service sector appears to be more responsive to both money wage and unemployment variables: a likely explanation lies in the existence of more rigid institutional arrangements in the goods sector which tends to creaste money illusion.

Race

Labor force participation rates have been traditionally higher among non-whites than whites. However, there appears to have been

a trend reversal in the case of males since white men are now enjoying higher labor force participation especially at both ends of the age continuum. Among women, the differential in favor of the non-white women remains except for young women (Parnes, 1970). As for migration, the problem here is one of knowing to what extent those differentials reflect pure color differences. Apparently when controlled for the influence of other factors (income, marital status, health etc.), the inter-color difference is reduced by more than half for men and disappears totally for non-married women (Bowen and Finegan, 1969). This residual sex difference might well be due to a) a lesser discrimination in the sectors in which women are traditionally employed (services) and b) to the stronger tradition of working among black women and c) the easier access to child care for married black women due to living arrangements.

Marital Status

Marital status strongly influences the labor force participation of women as well as of men: Bowen and Finegan conclude that this is the most powerful single predictor of labor force participation rates. In the case of men, the correlation between marital status and labor force participation is shown by Bowen and Finegan only after controlling for other characteristics. This result which imposes itself in the case of women is perhaps not so surprising in the case of men since married men join the labor force in greater numbers due to their traditional role of bread-earners or to the possession of a personal trait (being married) which makes them more desirable to firms.

Among women, there appears to be, after control for other traits, a ranking of labor force participation according to marital status (never married, divorced or separated, widows, women not living with husbands, married women without young children, married women with young children).

Education

There is considerable evidence that labor force participation rates are positively related to the level of educational attainment for most demographic subgroups. Bowen and Finegan, controlling for other factors (age, marital status, color, income) find a positive relationship of LFPRs with years of schooling for men 25 and over, married women 14 and over and non-married women 25 and over. These results are broadly confirmed by the evidence put forward by Barth (1967), in the case of women, and Cain (1966), in the case of married women.

Health

Health, or physical condition, is considered to be an important factor of labor force participation, although there has been little systematic evidence on the question due to lack of data. Exceptions to this are provided by Hill(1971) and Baer (1972). Baer, using the percentage of inmates in a given population as a proxy for areal ill health, finds a negative and significant relationship for most male age groups, especially in control age groups. Hill, using dummy variables to account for health differentials, shows that health has a significant and strong positive effect on time spent in the labor force.

Bowen and Finegan indicate the existence of a high correlation between health and education attainment attributable to the influence of health (for about a half on the basis of 1962 data) which makes it difficult to isolate the pure effect of education and to properly assess the impact of health.

Tastes

Parnes (1970, p. 30) notes that little attention has been given to tastes (a source of variation in the decision to work according to the neoclassical theory of labor force participation) although he cites two scholars who have reported a significant influence of the husband's attitude toward women's working.

APPENDIX 2

A Formal Statement of David's Model of Job Search and Migration

David (1974) considers an individual initially working in the i^{th} locale of a multi-market economy who might relocate to another market in order to increase his welfare. This objective is handled through the maximization of the individual's expected utility with respect to his choice of migration--job search program subject to financial limitations and to topographical constraints.

Expected Utility

Let Y_{ii} be the initial wealth of the worker, i.e. the present value of his earning streams in labor market i and Y_{ij} his terminal wealth following a move to the j^{th} labor market ($j \neq i$).

Since Y_{ij} depends on the maximum wage offer taken in j by the job seeker (the corresponding relation will be established later), it follows that this variable has a stochastic specification and that the maximization of the utility index $U(\cdot)$, of which Y_{ij} is the unique argument, requires the maximization of the individual's expected utility over the alternative destinations.

The prospective migrant does not know ex ante the individual job offers that may turn up in each locale but is aware of the average $\mu_j = E(w_j)$ and variance σ_j^2 of the distribution of wage offers in each locale j. Then, the first step in stating the individual's problem consists of expressing his expected utility $E[U(Y_{ij})]$ in terms of μ_j and σ_j^2. This is obtained first by deriving $E[U(Y_{ij})]$ in terms of the average $\bar{Y}_{ij} = E[Y_{ij}]$ and variance σ_y^2 of Y_{ij} and second by calculating $\bar{Y}_{ij}$ and σ_y^2 in terms of the known parameters of the wage offers' distribution in the j^{th} locale.

a) A specific approximation for $E[U(Y_{ij})]$

Replacing $U(Y_{ij})$ by its Taylor series expansion and dropping terms whose order is higher than two, David obtains the approximation:

$$E[U(Y_{ij})] \sim U(\bar{Y}_{ij}) + \frac{1}{2}\sigma_y^2 U''(\bar{Y}_{ij}) \quad ,$$

in which $U''(\bar{Y}_{ij})$ is the second derivative of $U(Y_{ij})$ for $Y_{ij} = \bar{Y}_{ij}$.

The utility placed by the individual in its terminal wealth is postulated to be given by:

$$U(Y_{ij}) = Y_{ij}^{v} \quad , \qquad 0 < v \leq 1 \quad .*$$

This leads to the following approximation of $E[U(Y_{ij})]$:

$$E[U(Y_{ij})] \sim \bar{Y}_{ij}^{v}\left[1 - \frac{v(v-1)}{2}\frac{\sigma_y^2}{\bar{Y}_{ij}}\right] \qquad \text{(A1)}$$

b) Relating $\bar{Y}_{ij}$ and σ_y^2 to the parameters of the wage offer distribution

David supposes that the prospective migrant allocates a certain proportion s of his wealth Y_{ii}** to investments in migration and local job search and that he incurs a net cost of P_{ij} in quitting the i^{th} labor market to search for a job in the j^{th} locale. Then, if Y_{ij} is the expected gain in wealth obtained by moving to the j^{th} locale, the terminal wealth of the job seeker is given by the following accounting relationship:

$$Y_{ij} = Y_{ii}(1 - s) - P_{ij} + Y_{ij} \quad . \qquad \text{(A2)}$$

David further decomposes Y_{ij} into two components, one showing the gain obtained from the relocation in the j^{th} labor market and the other showing the gain due to the job search in the destination market. These two gains are respectively equal to the

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*If $v = 1$, the individual is risk-neutral. If $0 < v < 1$, risk-aversion is implied.

**The initial wealth of the individual is the wealth that he would have by staying definitely in locale i (thus the symbol Y_{ii}).

present value of the difference between the average wages in the two locales and to the present value of the difference between the maximum wage offer in the j^{th} locale and the average wage in that locale.

$$Y_{jk} = R[w_{j,max} - \mu_j] + R[\mu_j - \mu_i] \quad ,$$

in which R is the present value of a dollar flow income over the worker's remaining work-life and reflects the discount rate and the individual's work-life horizon.

It follows that

$$E(Y_{ij}) = R[E(w_{j,max} - \mu_j] + R[\mu_j - \mu_i] \quad .$$

Supposing that the stochastic variable w_j is unbounded but follows a Gauss-distribution yields

$$E[w_{j,max}] = \mu_j + B\ \sigma_j\ n^{\beta} \qquad 0 < \beta < 1 \quad ,$$

in which n is the number of job offers collected. Then:

$$E(Y_{ij}) = R[B\ \sigma_j\ n^{\beta}] + R[\mu_i - \mu_j] \quad . \qquad \text{(A3)}$$

Since Y_0 and P_{ij} in (A2) are known, Y_{ij} has the same distribution as Y_{ij}. Therefore,

$$\sigma_Y^2 = \text{var}\ (Y_{ij}) = \text{var}\ [R(w_{j,max} - \mu_j)]$$

$$= R^2\Big(\text{var}\ [w_{j,max}]\Big) \quad . \qquad \text{(A4)}$$

Referring once more to the distribution of a normal variate leads David to posit

$$\text{var}\ [w_{j,max}] = A\ \sigma_j^2\ n^{-\alpha} \qquad \alpha > 0 \quad . \qquad \text{(A5)}$$

Financial Constraint and Cost Function

It is moreover hypothesized that the prospective migrant cannot allocate more than a fixed proportion $\bar{s}$ of its initial wealth to investments in migration and local job search:

$$s < \bar{s} \quad . \tag{A6}$$

The cost function sY_{ii} is supposed to be composed to two terms $c_1^j(n)$ and $C_2^j(D_{ij})$: $C_1^j(n)$ represents the total cost of job search activity required to collect n job offers in the destination market j and $C_2^j(D_{ij})$ represents the cost of relocating in the j^{th} labor market, located at a distance D_{ij} of the origin market i.

David assumes $C_1^j(n)$ to be linear function of the number of job offers n and $C_2^j(D_{ij})$ to be a linear function of the distance D_{ij}. Then, we have

$$sY_{ii} = w_j \, n + \tau_j \, D_{ij} \quad . \tag{A7}$$

Topographical Constraint:

Further, David assumes that, for a potential migrant located in the i^{th} labor market, there exists a boundary of maximum dispersion characterizing the local markets to which he can move:

$$\sigma_j \leq \hat{\sigma}_{ij} \quad , \tag{A8}$$

in which $\hat{\sigma}_{ij}$, the function delineating the boundary, is defined as

$$\hat{\sigma}_{ij} = \sigma_{max} - (\sigma_{max} - \sigma_i) \, e^{-\theta D_{ij}} \qquad \theta > 0 \quad . \tag{A9}$$

This function, clearly bounded from below at σ_i, is supposed to be bounded from above at σ_{max} (as David puts it, there is "some finite limit to the real or imagined level of disorder in local labor markets").

Setting up the utility-maximization problem

David finally depicts the potential migrant's problem as one of maximizing $E[U(Y_{ij})]$ subject to the financial and topographical constraints, (A6) and (A7) respectively. He also makes the additional assumption of equal prices over space, i.e.

$$\mu_j = \mu \quad ; \qquad w_j = w \quad \text{and} \quad \tau_j = \tau \quad , \qquad \forall_j \quad , \qquad \text{(A10)}$$

in order to facilitate the proof of the existence of a unique optional solution to this maximization problem.

Formally, the utility-maximization problem can be formulated as

$$\underline{\text{Maximize}}\ E[U(Y_{ij})] = \bar{Y}_{ij}^{v} \left[(1 - \frac{v(v-1)}{2} \frac{\sigma_y^2}{\bar{Y}_{ij}}) \right]$$

in which

$\bar{Y}_{ij} = Y_0 - w\,n - \tau\,D_{ij} - P_{ij} - R[B\ \sigma_j^2\ n^{\beta}]$ (obtained by combining (A2), (A3), (A7) and (A10))

and

$\sigma_y^2 = R^2[A\ \sigma_j^2\ n^{-\alpha}]$ (obtained by combining (A4) and (A5)

<u>subject to</u> the constraints

$w\,n + \tau\,D_{ij} \leq \bar{s}\,Y_{ii}$ (obtaining by combining (A6), (A7) and (A10))

and

$\sigma_j \leq \alpha_{max} - (\sigma_{max} - \sigma_i)\,e^{-\theta D_{ij}}$ (obtained by combining (A8) and (A9)).

Using Kuhn-Tucker-Lagrange conditions, David shows that this maximization problem admits one solution that provides an optimal choice of the destination region and an optimal level of "sampling" (i.e. the optimal number of wage offers needed before accepting the highes of them). Of course the migration-search plan must lead to an improvement of the job seeker's original welfare position. Indeed, if the optimal $E[U(Y^{*}_{ij})]$ is less than Y_{ii}, the job seeker is supposed to remain in the i^{th} locale. Unfortunately, the model cannot be analytically solved for the optimal solution is only tractable at the numerical level.

APPENDIX 3

The Role of Personal Factors in Migration

This Appendix presents a summary of the important influences exerted by personal factors on the individual's decision to migrate. Only the role of the most often cited factors--age, level of education, race and occupation--is examined next, although other personal characters can intervene: sex, marital status, fertility status, home ownership, etc. (see Shaw 1975, p. 30-31).

Note that the empirical evidence cited here does not necessarily come from regression analyses of place-to-place migration but very often relates to regression analyses of total migration flows or even to descriptive studies of migration flows.

Age

The dependence of the probability of migrating on age is wel documented in demographic literature. The existence of a very stable pattern of migration rates according to age has been substantiated over time (Long 1973) as well as over space (Rogers 1975).

It has been shown that persons in their late teens, twenties and early thirties, have a larger propensity to move than the other age groups since they are more readily disposed to look for new opportunities involving migration. The rationale for such a behavior, according to Gallaway (1969), is simply that the young have a longer expected working life over which, to realize the advantages of migrating and less restraints from place-of-residence social and economic ties.

After the peak observed in the 20-24 year age group, migration rates appear to vary inversely with age. However, they do not appear to taper off uniformly with age since there exists a

definite selection of migrants in the age group at which retirement commences.

Support for the influence of age on migration has also been shown by macrofunctional regression analyses of migration in which a variable describing the age composition of the origin population turns out to have a generally positive and significant coefficient. However, Bowles (1970), in one of the few studies which have attempted a micro functional estimation of migration, found that the age elasticity of migration seems to decrease with age.

Education

Migration is also highly selective with respect to education. To take the case of labor mobility, it makes sense that higher educational attainment procures an easier access to information in alternative places and thus a larger awareness of differential opportunities or amenities offered in alternative places (Landinsky 1967). Moreover, migrant responsiveness to economy differentials is likely to increase with education (Schwartz 1973), and education is also likely to reduce the importance of psychic costs due to tradition and family ties (Schwartz 1973).

Support for the importance of education selectivity may be found in many studies of United States migration (Thomas 1958, Folger and Nam 1967, Landinsky 1967, Bogue 1969, Greenwood 1969, Kottis 1972, Schwartz 1973, Kau and Sirmans 1977, etc.).

Race

Race differences in migration behavior has been well documented by demographers and confirmed by numerous socio-economic studies (Lansing/Mueller 1967, Persky and Kain 1970, Greenwood and Gormely 1971, etc.). In brief, these studies reveal that whites typically have higher mobility rates than non-whites.

In a study by Kohn, et al (1973), the per capita income earned in the destination turns out to be more often significant

income levels and high income growth than are their white counterparts.*

Additionally, Greenwood's paper lets appear other interesting results, not discussed here, concerning the impact of migration on employment growth as well as the interaction between the two race groups.

Occupation

Migration has also been shown to be selective of occupation. The rationale here rests on that, in a market economy, supply and demand for unskilled labor are generally met in local labor markets whereas supply and demand for skilled labor are expected not to match at such level and thus to extend from the local to the regional or the regional or the national level (Richmond 1969). The most convincing evidence regarding the occupational selectivity of migration can be found in Miller (1967) and Stone (1971).