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THE EFFECTS OF
INDIVIDUAL ATTRIBUTES AND CONTEXTUAL CHARACTERISTICS
ON HUMAN CAPITAL OUTCOMES, BRAZIL 1970

DISSERTATION

Presented in Partial Fulfillment of the Requirements
for the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Enid J. LaGesse, B.S.B.A., M.LHR

*****

The Ohio State University

1985

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To Robert M. and Lilia M.

Your unending patience made it easier to persevere
ACKNOWLEDGEMENTS

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CHAPTER I
INTRODUCTION

There is diversity in the development process among Third World countries, as evidenced by changes in the degree of modernization, industrialization and urbanization. This diversity is partially explained by Todaro's (1981: 70) definition of development:

"...major changes in social structures, popular attitudes, and national institutions, as well as the acceleration of economic growth... the reduction of inequality, and the eradication of absolute poverty."

As such, development takes place in a multidimensional fashion; it is both aided and impeded by the interwoven fabric of cultural, political, religious and socioeconomic structures.

This dissertation is concerned with the human capital aspects of development. In particular, it examines human capital theory in a spatial framework by assessing the relationship between individual attributes and place characteristics with individual educational attainment, income and amenities for Brazil, 1970. The following sections will discuss the conceptual framework, the study area and the plan of the dissertation.
Conceptual Framework

Human capital theory is concerned with maximizing societal and individual welfare through investments in human capital. Investments exemplify policy variables that can be operationalized. The paradigm hypothesizes that individuals, families and societies make investments in the form of education, (industrial) training, mobility and health to increase their productivity. They expect a return on their investment in the form of economic and non-economic benefits. The benefits are interrelated: societal policies regarding human capital investments affect the individual choices regarding human capital investments. Two expected benefits from human capital investments are increased income and improved quality of life.

The cornerstone of human capital theory is the investment in education, which is thought to have a direct relationship with overall well-being. Thus, at the societal level for example, a nation will decide to invest in building educational facilities (providing both the physical and human capital). These facilities may take the form of public or private institutions; industrial training may also be included. Where these facilities are located will impact the individual’s choice of whether or not she/he can invest in education. Alternatively, at the individual level, a person will decide to invest her/his time resources to take
advantage of educational opportunities. This personal investment is hypothesized to improve the individual’s skill level, thus improving the qualifications for higher paying jobs.

Once the individual has an education and an income, she/he can utilize amenities. This involves both the knowledge of how to use the amenity in question (e.g. how to use a flush toilet) and the ability to pay (e.g. to pay for plumbing).

However, because development varies from place to place, obtaining an education, finding a job commensurate with skills and/or the availability of amenities is sometimes impeded. In such instances, migration is a way to overcome these barriers. Accordingly, migration is considered a form of investment in human capital, and thus a partial determinant of individual differences in welfare.

Through migration, people actualize a capital gain or a capital loss. If the investment is a capital gain, the individuals benefit not only themselves but their families and society as a whole, as more productive resources; this is often measured in terms of income. If it is a capital loss, individuals can be subjected to undesirable social pathologies such as malnutrition, poverty, and crime; this is often measured by the quality of life.

The unevenness of development is also exemplified by the types of places to which individuals migrate. Some
places offer more educational opportunities, a greater variety of economic opportunities and numerous amenities. This may be illustrated by dual economy model (Lewis, Fei and Ranis, 1964) which hypothesizes that individuals migrate to jobs either in the traditional sector or the modern sector. The traditional sector is characterized by rural subsistence agriculture, low productivity, and surplus labor. The modern sector is characterized as urban, industrialized, highly productive, and capable of absorbing the surplus labor from the traditional sector. In general, this model suggests the movement from rural to urban and of the traditional sectors towards modernization.

The spatial theory which speaks to these "traditional versus modern" differences is the core-periphery work of John Friedmann (1966). The regional differences are the result of a "...dynamic center and a stagnating periphery (de Souza and Foust, 1979: 570)." The periphery, or traditional region, has few educational opportunities, limited income earning opportunities, and negligible amenities. In contrast the core, or modern region, has many educational opportunities, a variety of income earning opportunities and numerous amenities. This suggests that in the periphery there are fewer possibilities for individual human capital investments; often resulting from fewer societal investments.
This core-periphery phenomenon, as applied to the spread of development, takes place at the international and intranational level. At the international level we have North America and Western Europe as the core, with the Third World as the periphery. At the intranational level we have Friedmann's concept of four distinct regions: core, upward-transition, downward-transition, and resource-frontier regions. These regions are defined below.

"Core-regions are concentrated metropolitan economies with a high capacity for innovation and change... Upward-transition regions are peripheral to the core and suitable for resource exploitation and development... Downward-transition regions are stagnating or declining areas... Resource-frontier regions are peripheral areas of new settlement (de Souza and Faust, op cit.).""
National Modernization-Urbanization-Development Plans

Subject to Cultural, Religious, and Political Constraints

Brazil, 1970

FIGURE 1
which also influences individual well-being. Well-being is represented by a house. The foundation (of well-being) is schooling and the walls are made up of income and amenities. The circle inside the house represents the individual, whose age and gender are not changed by policy variables. The two-way arrows to and from the house indicate the interrelatedness of places and individual well-being; i.e., place affects well-being and the sum of overall well-being affects the characterization of a place. The door to the house represents choice; the way in which individuals can modify their well-being. Choice is influenced by the spread of new ideas, techniques, values, attitudes (i.e. innovation diffusion). National policy also influences the choices available, especially as regards investments in human capital.

The spatial development framework characterizes places in terms of their attractiveness, or not, to potential migrants. Attractiveness is a function of those characteristics which contribute to individual well-being; e.g. wage levels, amenities available, economic opportunities. Hypothetically, places with large pools of migrants are more attractive than those places with large pools of nonmigrants.

Another approach to viewing spatial development, which is incorporated in this dissertation, is to treat places as if they were located on a continuum. Places change, evolve,
and develop through the diffusion of innovations. For this study, the diffusion process is inferred by the contextual characteristics of different places, e.g. household amenities, and in the number of amenities the individual has.

"Household innovations are the use of durable consumer goods (refrigerators, television, automobiles, etc), installation of running water in dwellings...(Pederson, 1975: 7273)."

These innovations are often thought to also represent modernization.

Knowing that development's effects vary from place to place, this study will look at place differences in Brazil to determine common variances. This will demonstrate how national development plans can influence both the type of place (macro level) and individual choice (micro level). Or stated differently, individual choice of human capital investments is affected by place characteristics.

**Study Area**

Brazil, the largest country in South America, was chosen to assess the relationship between individual attributes and place characteristics with individual educational attainment, income and amenities because it is replete with a diversity of measurable geographic, demographic and socioeconomic characteristics. Based on qualitative experience, the changes from economic development are readily apparent in Brazil. Brazil underwent an "economic miracle"
from the mid-1960’s to the mid-1970’s. In addition it is one of the most rapidly developing and "urbanizing" countries in the world.

Core-periphery spatial development throughout Brazilian history has favored the core areas over the periphery. To wit, the "core-regions" first developed as coastal cities during colonial times. They continue to be the major ports of entry for trade; historically, export of primary commodities was the major form of trade. By the mid-nineteenth century, industrialization began in these coastal towns. Since the end of World War II, the "core-region" coastal area has also been emphasized by the booming tourism trade which boasts of the beauty of Brazil’s coastline. Today, Rio de Janeiro and Sao Paulo, represent two of the world’s largest "...concentrated metropolitan economies with a high capacity for innovation and change (de Souza and Faust, op cit.)." The economic life of Brazil continues to be dominated by the coastal cities, especially those located in the southern region.

"Upward-transition regions are peripheral to the core and suitable for resource exploitation and development (de Souza and Foust, op cit.)." In addition to the agricultural commodities for export, abundant mineral resources were also exploited. Gold was first discovered in the state of Minas Gerais in the seventeenth century. This was the start of
interior, i.e. periphery, development. One could hypothesize that the search for precious metals and the growth of mining towns were the impetus behind Brazilian urbanization. Even today, Minas Gerais is one of the major centers for precious stones in the world; Belo Horizonte, a major industrial city, is also located there.

"Downward-transition regions are stagnating or declining areas (de Souza and Foust, op. cit.)." The economic emphasis on a single commodity for export over time, has led to Brazil's "boom or bust" characterization; the "bust" periods have also contributed to the stagnation of many cities. By 1970, that stagnation was concentrated in the north and northeast regions of the country.

"Resource-frontier regions are peripheral areas of new settlement (de Souza and Foust, op.cit.)." Brazil's vast size, combined with a coastal orientation of development had left much of the frontier (non-resource-rich hinterlands) less developed. Moving the national capital, in 1960, from Rio de Janeiro (on the coast) to Brasilia (in the interior), was an attempt to encourage development of the interior regions. By 1970, the region surrounding Brasilia offered many economic opportunities in agriculture, forestry, and cattle raising.

The development of towns as the centres of economic life has led to concentrations of both physical and human capital. Over time, this has led to other spatial and
socioeconomic dichotomies: rural versus urban, North versus South, poor versus rich, and traditional versus modern economic sectors. These characteristics have evolved in a systematic manner and suggest that the individual can move from one place to another and thus influence her/his individual well-being.

Plan of Dissertation

The literature on human capital, discussed in Chapter II, is divided into two camps; that which seeks to maximize well-being by increasing income and that which seeks to maximize welfare by improving the quality of life. Both camps agree that investments in education are vital to improved welfare. Other factors that influence these outcomes are broadly classified as individual attributes and place effects. The individual attributes describe the demographic condition of the population while the place attributes delineate past policy practices and future policy needs. This study is unique in that it simultaneously examines the influence of individual attributes and place effects on three human capital outcomes—individual education, income and the quality of life.

Chapter III discusses the data, variables, research techniques and research design. An overview of Brazil (the study area) and its educational system is also presented.
The most informative data source for this type of study about Brazil, was the Public Use Sample from the 1970 Brazilian Census. The data contain cross-sectional information on both household and individuals, for 117 geographic areas. The data are manipulated in two key ways; first a factor analysis is performed to derive the contextual indices. These indices provide a more thorough description of commerce, industry, and technology that captures the diversity of areal economic development. They reflect the flow process mentioned earlier, i.e. that places can be viewed as if on a continuum, undergoing a constant process of changing, evolving and developing. These indices are expected to be dominant variables affecting human capital outcomes. Next, a subsample of single individuals, ages 21 to 64, with an income, is subjected to a multiple regression analysis to study the relationship between individual attributes and place effects with individual educational attainment, income and quality of life.

Chapter IV describes the average outcome for the total sample and various subgroups, to demonstrate in a crude fashion, how human capital outcomes vary by individual and place characteristics. Next, these differences are examined in a more refined fashion (viz., multiple regression analysis). The findings are arranged by total sample, and gender by migrant groups. These results highlight the importance of the contextual dimensions of a place in increasing
schooling, income and amenities. Concluding statements and policy implications are presented in Chapter V.

The next chapter reviews the relevant research on the application of human capital theory in the Third World.
CHAPTER II
REVIEW OF RELEVANT RESEARCH

The Third World provides ample evidence of "development ... as a multidimensional process... (Todaro, 1981: 70)". The various parts of the process are interrelated and do not progress at the same rate. For example, urban squalor and urban splendor coexist, like neighbors, in a community; high paying modern manufacturing establishments thrive amid low (or no) paying subsistence farms; malnourished and unkempt poor people beg for handouts and are ignored by the well-fed and stylish rich. In spite of this inherent unevenness, the overriding objective of the development process is economic growth.

To achieve this objective, help is solicited from national and international sources. This aid is often considered an investment benefitting both society and the individual. Of particular interest to this paper are the returns made, e.g. improved quality of life and increased income, on investments in human capital.

The following review discusses the relevant research on the application of human capital theory to economic growth in the Third World. First the theoretical framework is
discussed. Next, the application of human capital theory to economic growth is contrasted between the Western and Third Worlds. Sections three and four discuss factors that influence the returns on human capital investments. Section five summarizes what we know.

Theoretical Framework

Human capital theory, with its roots in economics, seeks to maximize societal and individual welfare through investments in human capital. The investments exemplify policy variables that can be operationalized. The benefits (i.e. returns on investment) are interrelated—the societal policies regarding human capital investments affect the individual choices regarding human capital investments.

For example, two major benefits are an improved quality of life and increased income. To achieve such outcomes the human capital paradigm emphasizes three key investment/policy variables: health, vocational or occupational training, and education. These policies are interdependent: an individual must first be healthy to take advantage of educational or training opportunities. Therefore, a societal investment in the provision of potable water and adequate sewage disposal greatly improves both the overall quality of life and individual health. A healthier person is better able to benefit from other human capital investments. She/he is also more productive. Theoretically, increased
productivity leads to economic growth (a societal benefit) and increased income (an individual benefit).

**Applied Human Capital Theory**

In the Western economies, investments in health, industrial training and education, resulted in overall growth, a rich quality of life and higher incomes. From a human capital perspective, the keystone of this success is an educational policy which stresses literacy, numeracy, skill acquisition, and the social values and attitudes necessary to modernize.

By contrast, Third World economies are characterized by slow (or no) growth, a poor quality of life and low incomes. This is attributed to poor health, limited economic opportunities and low educational attainment; a lack of investments in health, training and education. The policy orientation of the human capital paradigm offered the Third World a means to achieve economic growth, improve the quality of life and increase incomes. The following two sections will discuss the indicators of the quality of life and the factors that affect income.

**Factors that Affect the Quality of Life**

In this chapter quality of life refers to the average level of well-being in society. Morris (1979: 105) succinctly demonstrates its importance to development goals:
"...improvement in the quality of life is the ultimate justification of all development activity."

A better quality of life will also enhance the quality of human capital, in particular, the quality of the labor force. Studies done by the U.N., Morris (1979) and Adelman and Morris (1971) specifically discuss measures of societal well-being in the Third World.

**Level of living:** The quality of life is judged by the standard of living and in most of the Third World this is abysmally low. The low standard of living is accredited to (among other things) a lack of attention to basic needs. A definition that describes basic needs requirements at both the individual and societal level was adopted at the 1976 World Employment Conference (Morris, 1979: 20):

"Basic needs...include two elements. First, [at the individual level] they include certain minimum requirements of a family [or individual] for private consumption: adequate food, shelter and clothing, as well as certain household equipment and furniture. Second, they include essential services provided by [society] and for the community at large, such as safe drinking water, sanitation, public transport and health, educational and cultural facilities."

Attention to these basic needs raises the standard of living and thus improves the quality of life.

From a human capital standpoint, the satisfaction of basic needs can be measured by various policy variables which indicate the standard of living. As determined by a 1961 U.N. group, the most basic level of living is reflected
by: health, food consumption and nutrition, education, employment and conditions of work, housing, social security, recreation and human freedoms. These indicators are inclusive of the earlier definition of basic needs and satisfaction of them improves the quality of life. Both the PQLI and the indicators by Adelman and Morris (1971) incorporate one or more of these variables.

Physical Quality of Life Index (PQLI): Developed by Morris (1979), the PQLI, is composed of three indicators: infant mortality, life expectancy at age one and basic literacy.

"The three indicators can be thought of as measuring one form of human capital... [they] do capture distributive features in the social process (Morris, 1979: 33)."

These variables reflect the results of previous human capital investments in health and education (Morris, 1979: 32). More specifically, improved health conditions and increased educational opportunities should lower infant mortality, raise life expectancy after age one and increase basic literacy.

The indicators are weighted equally on a scale ranging from 0, the worst, to 100, the best. Studying 150 countries, Morris differentiates the PQLI by GNP, region, gender, rural and urban and historically. These categories are explained below.
GNP: Morris (1979: 62) concludes that

"...there is no automatic link between per capita GNP and even the barest elements of well-being... a system can be quite rich in what the GNP measures and still give its population inferior life chance."

He found that the PQLI values are clustered by country.

Region: Table 1 summarizes the PQLI and its component indicators by region (Third World only), for 1970. Although there are interregional differences, in ascending order they rank, Africa, Middle East, Asia and Latin America. For example, the PQLI for Latin America is above that for Africa, 71 versus 32 respectively.

Gender: Morris was able to determine gender specific PQLIs for almost half of the countries (N=73) from 1949 to 1972. Of these, 38 percent had female PQLIs lower than male PQLIs. In addition, the countries in which the female PQLI was at least three points lower than the male PQLI were in Asia and Africa. Overall, female literacy rates were lower than that of males while their infant mortality and life expectancy at age one was higher than males. He attributes the differences to the confounding "...genetic-biological characteristics and ...socio-cultural factors." The former factors lower female infant mortality and raise female life expectancy while the latter have the opposite effect. Table 2 summarizes the PQLIs and component indicators for Brazil by gender.
Table 1
Average per capita GNP, Component Indicators, by Region, 1970

<table>
<thead>
<tr>
<th>Region</th>
<th>Per Capita GNP ($)</th>
<th>PQLI</th>
<th>Life Expectancy at age one (years)</th>
<th>Infant Mortality (per 1000 births)</th>
<th>Literacy (%)</th>
</tr>
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<tbody>
<tr>
<td>Africa</td>
<td>368</td>
<td>32</td>
<td>53.1</td>
<td>152</td>
<td>23.7</td>
</tr>
<tr>
<td>Middle East</td>
<td>1351</td>
<td>49</td>
<td>60.2</td>
<td>120</td>
<td>40.7</td>
</tr>
<tr>
<td>Asia</td>
<td>455</td>
<td>58</td>
<td>60.7</td>
<td>87</td>
<td>52.6</td>
</tr>
<tr>
<td>Latin America</td>
<td>929</td>
<td>71</td>
<td>65.8</td>
<td>76</td>
<td>72.2</td>
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Source: Morris (1979: 68), Table 11.
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<th>Region</th>
<th>Per Capita GNP ($)</th>
<th>PQLI</th>
<th>Life Expectancy at age one (years)</th>
<th>Infant Mortality (per 1000 births)</th>
<th>Literacy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>912</td>
<td>66</td>
<td>66.0</td>
<td>96</td>
<td>66.2</td>
</tr>
<tr>
<td>Female</td>
<td>68</td>
<td></td>
<td>68.9</td>
<td>91</td>
<td>63.1</td>
</tr>
<tr>
<td>Male</td>
<td>64</td>
<td></td>
<td>63.1</td>
<td>101</td>
<td>69.4</td>
</tr>
</tbody>
</table>

Source: Norris (ibid: 68), Table II, Appendices A,B,C
Rural/urban: Only three Third World countries had rural/urban PQLI data: Ghana, Indonesia and Liberia. In all cases, the urban PQLI was better than the rural. These differences speak to the urban orientation of development policy. Even international assistance "...seems invariably to be more effective in urban areas than in the countryside (ibid: 92)."

Historical: Table 3 is a historical overview of the changes in the PQLI for selected Latin American countries. These changes reflect the distributive effects of previous investments in human capital to improve the quality of life.

Social, Political and Economic Indicators: Adelman and Morris (1971) used factor analysis to develop 41 indicators for 74 countries to describe the sociocultural, political and economic aspects, circa 1960. Of interest in this chapter are the sociocultural indicators, which subsume urbanization and industrialization, and economic indicators, which demonstrate the changes in economic structure and industrial institutions. The following section will discuss the various indicators and, where possible, specifically describe Brazil.

Education: the rate of improvement in human resources and literacy are used as surrogates for education. The rate of improvement is based on school enrollment ratios. They concluded that not only is there a positive
Table 3

Historical Overview of PQLI for Selected Latin American countries, Circa 1950 - 19670

<table>
<thead>
<tr>
<th>Country</th>
<th>1950</th>
<th>1960</th>
<th>1970</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>53</td>
<td>63</td>
<td>66</td>
</tr>
<tr>
<td>Colombia</td>
<td>47</td>
<td>66</td>
<td>71</td>
</tr>
<tr>
<td>Ecuador</td>
<td>48</td>
<td>60</td>
<td>68</td>
</tr>
<tr>
<td>Venezuela</td>
<td>58</td>
<td>69</td>
<td>79</td>
</tr>
<tr>
<td>Chile</td>
<td>62</td>
<td>65</td>
<td>77</td>
</tr>
<tr>
<td>Argentina</td>
<td>77</td>
<td>82</td>
<td>85</td>
</tr>
</tbody>
</table>

Source: Morris (ibid: 75), Table 13
association between the level of economic development and the rate of improvement but that secondary and higher education improve the quality of life. Brazil experienced a moderate rate of improvement in its human resources. Literacy is defined as the ability of the population fifteen years and older to read and write. It is

"...generally accepted that literacy is an essential economic asset in industrial urban occupations, facilitating the training of unskilled as well as skilled workers... (ibid: 36)".

In Brazil, 66.2 percent of the 1970 Brazilian adult population was literate, which is an improvement over the 1960 figure of 35-44 percent.

**Employment and conditions:** employment and conditions is characterized by the size of the traditional agricultural sector and the extent of dualism. Dualism is defined by Todaro (1981: 525) as

"the coexistence in one place of two situations or phenomena which are mutually exclusive to different groups in society..."

In the case of Brazil, this refers to the less educated who work in traditional, small scale agricultural sector and the well-educated who work in the modern, large scale industrial sector. Consequently those with more education work in the industrial sector. The more dualistic the society the greater the need for human capital investments.

As countries industrialize there is a corresponding shift of employment and population from rural agriculture to
urban industry. Urban industry requires more skilled workers than rural agriculture. Skilled workers infer a higher quality human capital. Brazil, circa 1960, was characterized as having "...from 25 to 54 percent of their population in traditional subsistence agriculture... (ibid: 22)"; i.e. moderately dualistic.

Urban/rural: As economies grow and industrialize, the percent of the population living in the urban area also increases. In Brazil, the shift in 1960 employment was accompanied by a population shift; between 20 and 30 percent of the total population resided in urban areas of 20,000 or more. Societal human capital investments are concentrated in the urban area. Consequently, more opportunities exist for individual human capital investments.

Summarily, at the national level the quality of life can be measured by the degree to which basic needs are satisfied, the PQLI, and various socioeconomic indicators. The quality of life varies by place characteristics such as region, degree of urbanness, and economic structure and by individual characteristics such as gender and literacy. But societal investments to improve the overall quality of life are not always gratis; sometimes the individual must have the ability to pay; income is the subject of the next section.
Factors that Influence Income

In the literature on individual income, the factors that have an influence can be divided into individual/societal attributes and place attributes. The attributes describe the population and economic structure. Individual traits include age, gender, education and migrant status. Place effects derive from the degree of urbanness or ruralness and industrial sector. Although each factor is discussed separately, it should be kept in mind that it is the interaction of the variables, in particular with education, that explains more of the variance in income than each factor alone. This interaction reflects the dominance of education as the keystone human capital (policy) variable and the interrelatedness of societal and individual human capital investments.

Individual/societal attributes

Education: There is general agreement in the empirical evidence regarding the relationship between education and income. First of all, education leads to increased income. In addition, at the individual and societal level, education has a positive relationship with modern attitudes, level of literacy and skill acquisition (Berry, 1980; Blaug, 1979; Chenery, et al., 1976; Colclough, 1982; Fields, 1980, 1983; Inkeles and Smith, 1974; Jallade, 1982; Psacharopolous, 1973, 1980; Todaro, 1981). The evidence indicates that
education is the single most important variable in explaining modern attitudes. Modern attitudes, increased literacy and skills are important in obtaining employment in the modern industrialized sector.

From the discussion on the quality of life we know that the overall levels of literacy have increased along with the occupational demand for higher level skills. Skill acquisition is evidenced by the shift in aggregate employment in both the industrial and occupational structure. For example, in Brazil, the concentration in employment shifted from the low skill, low paying agricultural sector to the high skill, high paying manufacturing sector. Jobs requiring more skill require more education (and more education represents a larger investment in individual human capital). The increased availability of education (society’s investment in human capital) and the individual’s increased level of educational attainment make it possible to take advantage of occupations in the modern sector (which require different attitudes and specialized skills than those in the traditional sector).

However, the availability of modern sector jobs did not keep pace with the burgeoning supply of applicants. To facilitate selection decisions, employers "screened" applicants on the basis of education. Education became a necessary credential to modern sector employment. This supports
the assumption about the socializing aspect of education. As Colelough (1982: 171) concisely explains:

"there is a correspondence between the values, attitudes and behaviour inculcated by the schools and the traits required by employers."

The screening hypothesis is another way of interpreting the relationship between education and income. For example, let us look at the income gaps between university and primary graduates. In Brazil (Ahluwalia, 1976), over the period 1960-1970, the income of primary school graduates increased by 14%, while that of university graduates increased by 52%. Under the screening hypothesis, this disparity, in the income of the two groups of graduates, reflects employer's preference for the more educated (and the willingness to pay them more) rather than skills required for the job. University graduates are usually employed in modern sector, higher paying jobs. Under human capital theory, this difference in incomes represents the higher return on the longer investment in schooling; more schooling is synonymous with more skills.

**Age:** theoretically, income tends to increase with age (Berry, 1980; Castro, 1978; Fields, 1983; Sahota, 1978). According to human capital theory, older individuals have more human capital than younger; i.e., they have accumulated a greater stock of human capital. This is true for more established societies. However, in a rapidly developing society such as Brazil, the highly educated younger workers
have higher incomes than the less educated older workers. This is not a function of age but of previous societal investments in education. The younger workers may have greater access to educational opportunities and more work experience in the higher paying occupations. Thus, it is the interaction between age, education and work experience that affects income. Berry (1980) found that age and education explain the majority of the variance in urban incomes.

**Gender:** females earn less than males (Boserup, 1970; Castro, 1978; Colclough, 1982; Fields, 1980 and 1983; Jalalade, 1982). This infers that the return on education for females is less than that of males. For Brazil, qualitative experience finds females do not encounter limited access to education as much as they encounter discriminating societal norms regarding income earning opportunities. Females in the urban area have higher incomes than those in the rural area, but less than their urban male counterparts (Boserup, 1970).

**Migrant status:** mobility (i.e. to be a migrant or not) is one of the investment variables in human capital theory. Todaro (1969 and 1976), a pioneer in applying human capital theory to migration and to the Third World, hypothesizes that individuals will migrate if the expected present value of future earnings at the destination is greater than those
at the origin. This expectation is feasible because of the concentration of higher paying jobs in the urban area. In a similar vein, urban migrants, on average, have higher incomes than rural migrants. The explanations for this are twofold: (1) the higher propensity to migrate and the better pay of the well-educated; (2) the urban orientation of rural education encourages out-migration; the process of education widens horizons by exposing individuals to a larger world new ideas, and new methods, many of which are not feasible in the rural area.

The next section discusses this urban bias by type of place and sector of employment.

Place attributes

Urban/Rural: residents in urban areas have higher incomes than those in rural places (Berry, 1980; Boserup, 1970; Castro, 1978; Fields, 1980, 1983; Jallade, 1982; Lipton, 1976; Todaro and Stillkind, 1981). This is a result of the concentration of higher paying modern sector jobs in urban areas. It also reflects the urban bias of societal investments in physical capital required for industrial jobs. Urban areas offer more educational opportunities, representing an urban bias in societal human capital investments.

Sectoral distribution: a traditional measure of economic growth is the gross domestic product (GDP), which
reflects changes in productivity. If we distribute this by economic sector, the implication is that the larger the share of GDP, the greater the productivity. For Brazil, in 1970, the traditional sector (agriculture and mining) was only 11 percent of GDP, while the modern sector (manufacturing, construction and utilities) was 37 percent. Consequently, the more workers employed in the more productive sectors the greater the probability of increased productivity and higher wages. According to the human capital model, higher wages represent the return on the additional investment in acquiring more specialized skills.

SUMMARY

This chapter has examined the human capital framework and its use in the Third World, particularly in Brazil. The cornerstone of this policy oriented theory is education; for which investments are made at both societal and individual levels. Two positive types of returns dominate the literature on investments in human capital--improved quality of life and increased income. Other factors that influence these outcomes can be broadly classified into individual attributes and place effects. The individual attributes describe the demographic condition of the populous while the place effects delineate past policy practices (and future policy needs).
The relationships between education, quality of life and income as affected by individual and place attributes are the focus of this dissertation. The definitions of the techniques and variables used in analyzing these relationships are discussed in the next chapter.
CHAPTER III
DATA, VARIABLES AND RESEARCH TECHNIQUES

Introduction

The previous chapter reviewed relevant research on applying human capital theory to Third World economic development. There is general agreement in the empirical evidence that investments in human capital contribute to an increased income and an improved quality of life. Implicit in those findings is the manner in which these returns are accomplished; either the individual increases income or the individual improves her/his quality of life. This is a rather unidimensional approach and conflicts with the multidimensionality of Third World development.

This chapter will discuss data, variables, and techniques that capture the diversity of economic development. Our approach, to studying income and quality of life, is from a human capital framework. Education, as the cornerstone of that theory, is hypothesized to be a dominant factor. Section one sets the stage for our empirical work by describing the Brazilian formal educational system.

The data used to analyze human capital outcomes in Brazil are from the Public Use Sample of the 1970 Brazilian
Census. These data include individual and household information for 117 geographic areas. Section two describes this dataset in greater detail.

By aggregating various characteristics of individuals and households by the 117 geographic areas, the contextual dimensions of each place are derived. Contextual in this chapter represents areal economic development. Section three discusses the derivation of contextual scales which are also hypothesized to influence human capital outcomes.

In addition to education and contextual features, the other factors hypothesized to influence income and the quality of life are gender, age, migrant status, and employment in the secondary sector. The research design that incorporates these factors is discussed in section four.

Study Area

Brazil occupies nearly one-half of the South American continent and offers a diversity of geographic, socio-economic and demographic characteristics. The total land area is 3,286,475 square miles, measuring 2,689 miles north to south and 2,264 miles east to west with a coastline of 4,603 miles. Fifty-nine percent of the land is considered highlands. The Brazilian lowlands supply fifteen percent of the planet's oxygen. By these statistics alone, Brazil is an important country. A country this size allows us to see the multifaceted dimensions of development.
Brazil's rapid growth from the mid-1960's to mid-1970's, often referred to as an "economic miracle", provides an excellent example of economic development—accumulation of human and physical capital, increased physical output, modern technology and significant structural change. The average annual growth rate ranged from 6 to 9 percent during that period. The population grew at an annual average rate of 2.8 percent during the same time, but the urban population alone grew 5.1 percent.

The rapid growth of urban areas in developing countries is a global phenomenon and Brazil is one of the most rapidly developing and "urbanizing". According to Katzman (1977: 151), between 1940 and 1970,

"...Brazil underwent an urban revolution that was compressed into half the time within which the United States made a similar transition."

The population numbered 93,139,107 in 1970; 50 percent were female and 39 percent lived in urban areas of 20,000 or more while 31 percent lived in cities of 100,000 or more. The urban population was more literate (defined as those individuals, 15 years and older, who can read and write) than the rural, 71 percent versus 29 percent. These results suggest greater human capital investments and opportunities were available in the urban areas. Given the human capital framework of this paper and its emphasis on education, the following discusses Brazil's formal educational system.
Brazilian Educational Structure

Historically, Brazil's first attempt at mass education was in 1823 (one year after her independence from Portugal) when free primary education was offered to males. By 1827, this offer was extended to females in the larger towns but due to resource and political constraints (and I suspect societal norms), was unachievable. The national planning body for Brazilian education, the Ministry of Education (MEC), was established in 1931. The 1946 Constitution guaranteed free primary education as a right of all citizens. In an attempt to increase the numbers of children receiving primary education, the government required four years of primary school in the urban areas and three years in the rural areas. By 1950, the beginning of Brazil's industrialization thrust, four years of basic education was to be offered everywhere. Due to increasing pressure from agencies giving foreign aid, the general education law (LDB) was amended in 1971, requiring eight years of primary education.

The precise date for the adoption of three levels of education is unclear. However, primary education is compulsory for ages seven through fourteen. Given Brazil's size and poverty, it is difficult for MEC to enforce attendance rules; consequently, the rural areas require only four years. Four years supposedly provides a basic education; completion at this point is either terminal or transitional. Often it is terminal if the student fails to pass the
entrance exam to the next phase. If it is transitional, the next three years cover supplementary subjects that aid in passing the entrance exam for secondary school. Due to the shortage of physical facilities, children often attend school only half a day (thus allowing more to attend). In spite of these physical capital shortages, primary school enrollment doubled between 1965 and 1975 (Haussman and Haar, 1978: 57,71,84). However, the retention rate was low; of 100 entering first grade, 41 entered second, 24 the fourth grade, 11 the eighth grade and 10 would complete.

Secondary education covers ages fifteen to nineteen, and is characterized as private, urban and expensive. It is divided into two cycles (phases); the first two years are to be career oriented and the courses are not applicable to university admittance. For example, primary school teachers are trained at this level. The second phase is oriented towards higher education, and offers two choices: classics or science. This is in keeping with tradition that the purpose of secondary education is to prepare students for the university entrance exam. Again we see the terminal or transitional aspects of completing one phase or both.

Nevertheless, secondary enrollment quadrupled between 1965 and 1975 (Haussman and Haar, ibid). According to the human capital framework, the more education the more literate (defined as the ability to read and write) the individual. Since these enrollment figures are so high, we
would assume a high degree of literacy. However, when we compare literacy to functional literacy, in 1970, the impact of the enrollment figures is lessened. Literacy is defined as those persons 15 years and older who can read and write; functional literacy refers to those persons 15 years and older who have studied five or more years. Table 4 shows that in 1970 a large percentage of that age group were literate; a larger percentage of males than females. But when functional literacy is the criterion, fewer people qualify and gender differences are diminished. This suggests that investments in education can easily be overstated based on the measure.

On one hand the large percentage increases in enrollment rates suggest a large investment in education at the individual and societal level. On the other hand, qualitative experience shows that functional literacy rates are low because retention rates are low. Table 5 depicts those individuals, 15 years of age and older, in absolute numbers and the percent of total, completing elementary and secondary education.

Table 5 says that of those individuals, 15 years and older, who complete elementary school, 21 percent complete the first cycle of secondary education; 17 percent of the females and 14 percent of the males complete the second cycle. Although not listed, of those who complete the first phase of secondary, 83 percent of females and 68 percent of
Table 4

Brazil, Literacy vs. functional literacy for population 15 years or older, by gender, 1970 (% total age group)

<table>
<thead>
<tr>
<th></th>
<th>Functional Literacy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>62.8%</td>
<td>21.1%</td>
</tr>
<tr>
<td>Males</td>
<td>69.1%</td>
<td>22.5%</td>
</tr>
</tbody>
</table>

Source: World Bank, Annex III: 120

Table 5

Elementary and Secondary Education completed
Population 15 years and older, by gender

<table>
<thead>
<tr>
<th></th>
<th>Elementary</th>
<th>Secondary</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First* (%)</td>
<td>Second* (%)</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>6163220</td>
<td>1289973 (21%)</td>
<td>1070674 (17%)</td>
</tr>
<tr>
<td>Males</td>
<td>6292014</td>
<td>1327805 (21%)</td>
<td>904321 (14%)</td>
</tr>
</tbody>
</table>

*First and Second refer to cycles

Source: Censo Demografico (1970: 38,39)
males complete the second phase. The retention rate for women is probably slightly higher because of their limited income earning opportunities which makes them appear more expendable (in the labor market), when compared to males.

The university level usually refers to individuals ages twenty to twenty-five. University education is heavily subsidized by the government and relatively inexpensive. Like secondary education, entrance depends upon passing an exam. According to Silva (1977), the Brazilian university structure evolved in three phases, marked by three laws.

The first phase began in 1931, with the passing of the Statues of Brazilian Universities. This established the overall structure, i.e., a university consisted of four faculties at the federal, state or private level: Law, Medicine, Engineering and Education, Sciences and Letters. The next phase came in 1953 with the Law of Guidelines and Fundamentals. With this law a minimum of five faculties were required with course divisions at the undergraduate, graduate and professional level. In 1968, the University Reform Laws required cooperation between the goals of economic development and university education. This objective was made more specific in 1974 when all graduate education had to be coordinated with national plans.

This brief history describes Brazil's investment in the formal education process. Theoretically education is the foundation on which all future human capital outcomes...
depend. Of interest to this chapter are three major outcomes: individual educational attainment, individual income and individual amenities.

**Overview of Income and Quality of Life**

Given such an investment in formal education, this chapter is concerned with the returns on such an expenditure. In the preceding section, we see that a national investment was made in formal education. Likewise, we expect corresponding improvements in income and quality of life.

Brazil had one of the highest GDPs in Latin America, in 1970. This agrees with the theory. It is not until we look at the distribution of income, by gender and class, that we begin to question the returns from education. A perusal of the 1970 Brazilian Census (op.cit., 93-112) shows that in general, more women than men have completed twelve years of education, until the monthly income reaches approximately CR$500 or more. At that point fewer women receive higher incomes than men, even with twelve years of education. By class, we find the richest five percent of the population received 27 percent of the national income in contrast to the poorest 20 percent which received only 5 percent. The class distribution and gender differences reflect different returns from investing in education. In light of these findings, a better understanding of the relationship between
education and income can be obtained by studying individual level data.

Education is also considered a vital part of the quality of life (defined as the general level of well-being). Participation in the educational system socializes the individual and dispenses knowledge about well-being. Physical well-being, as one indicator of the quality of life, is reflected in the number of household amenities. Owning these items reflects both the ability of the individual to pay and the general level of availability within the society (i.e., infrastructure development). Hypothetically, the greater the number of household amenities, the better the quality of life.

According to the Brazilian Census, housing structure is classified as either permanent or improvised. Within the permanent category, it is further divided into durable or rustic. Table 6 below describes the household amenities in permanent structures, for Brazil, 1970. On average household density is 5 people. In urban areas, there are only three amenities that more than fifty percent of the households have running water, electricity and radios. In the rural area, there is only one amenity, firewood stoves, that more than fifty percent of the households have. These percentages reflect an overall poorer quality of life for more than half the population, especially in the rural
Table 6

Percent Permanent Households having Amenities
Brazil, 1970

<table>
<thead>
<tr>
<th>Amenity</th>
<th>Total</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running water</td>
<td>33</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>Rudimentary sanitation</td>
<td>30</td>
<td>37</td>
<td>20</td>
</tr>
<tr>
<td>Firewood stoves</td>
<td>45</td>
<td>21</td>
<td>79</td>
</tr>
<tr>
<td>Electricity</td>
<td>48</td>
<td>76</td>
<td>8</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>26</td>
<td>42</td>
<td>3</td>
</tr>
<tr>
<td>Automobiles</td>
<td>9</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Televisions</td>
<td>24</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>Radios</td>
<td>59</td>
<td>72</td>
<td>40</td>
</tr>
</tbody>
</table>

Source: Censo Demografico, 1970: 240-253
areas. These findings suggest that the type of place where the individual lives is important to her/his quality of life. The data base used to study Brazil is described below.

Data Base

The study employs data from the Public Use Sample of the 1970 Brazilian Census that contains cross-sectional information on both households and individuals, gathered from the 'long form' of the Census (see Appendix A). This form was completed by 25 percent of Brazilian households in 1970 and the Public Use Sample represents one percent of those surveyed; a total of over 190,000 households and 910,000 individuals. For this chapter, the data are divided into the complete sample and a subsample. First, the complete sample is used to construct a contextual scale that characterizes the 117 geographic areas, both individually and at the household level. Second, the Research Design utilizes a subsample of individuals, drawn on specific criteria.

AREAL LEVEL VARIABLES

Explanation of Summary Characteristics of 117 Communities

The local unit of government is the 'municipio' which is comparable to a county in the United States. Each is composed of many districts. Given the small size, and for
reasons of confidentiality, the 1970 Public Use Sample summarizes the districts into 117 geographic communities, representing the diversity of Brazilian progress. The variables which describe these areas capture both the contextual aura and the multifaceted nature of development. The contextual characteristics which exemplify the demographic and economic structure are schooling, average age, percent male and female, resident indicator, current and type of previous residence, occupational status, sector of employment, individual income, population pressure, dependency ratio, household income, household rent and household amenities.

First, the characteristics (listed in the preceding paragraph) for individuals and households were aggregated for each of the 117 geographic areas. To uncover the contextual patterns of relationship among these variables, factor analysis was used. In this procedure, the characteristics are combined into common factors based upon their intercorrelation (Rummel, 1967). The contextual variables employed in the factor analysis are listed below along with the Census question (see Appendix A) to which they pertain.

Variables Pertaining to Individuals

Schooling. Question 17 asked respondents, ages 5 and older, which grade they successfully completed. Their responses translated into zero through seventeen years of schooling. Based on the total responding, age 5 or older,
with 0 through 17 years of schooling, the following four variables were calculated.

- Percentage with zero schooling: the respondent had no formal schooling. Forty two percent of the respondents had no schooling.

- Percentage with primary schooling: the respondent had completed between one and eight years of schooling. Fortyseven percent of the respondents had some primary schooling.

- Percentage with secondary schooling: the respondent had completed between nine and twelve years of schooling. Only nine percent of the respondents had completed some secondary schooling.

- Average years of schooling: The average years of completed schooling is 2.4; fifty-eight percent of the total sample had completed some formal schooling.

**Average age.** All respondents were asked their birthdate (Question 5) or presumed age (Question 6). The average age is 23 years.

**Percentage of total population that is female.** Question 2 asked all respondents their gender.
Resident indicator. Question 10 asked all respondents if they were born in the municipality where now residing. Those who answered yes are considered nonmigrants. Only those who answered no were asked questions 12 and 14. From the responses to questions 10, 12 and 14, four variables were calculated.

- Percentage of total population that are nonmigrants. A yes response to Question 10 indicates a nonmigrant; i.e., a person born in the municipality where currently residing. Sixtyeight percent of the sample are nonmigrants.

- Percentage of total population that are new migrants. Question 12 asked all respondents the length of time they resided in the current municipality. Those individuals residing there five or less years are classified as new migrants; a total of twelve percent of the sample.

- Percentage of total population that are old migrants. Question 12 asked all respondents the length of time they resided in the current municipality. Those individuals residing there six or more years are classified as old migrants; a total of twenty percent of the sample.
- Percent of migrants from previous urban residence. Question 14 asked migrants if their previous residence was urban or rural. Eightyseven percent of the respondents had previously resided in an urban area. This percentage is so large because a city is defined as 2,000 or greater inhabitants. Furthermore, qualitative experience shows a certain status to having lived in 'the city'; this fact would inflate the urban response.

**Average occupational status.** Question 23 asked persons ten or more years of age their occupation. These are ranked between 1 and 100, according to Treiman's (1977) prestige scale, with higher numbers associated with greater prestige. The average occupational status is 30; for this sample the range is from 8 to 82.

**Percent of population employed in each industry.** Question 24 asked persons ten or more years of age who had worked in the twelve months prior to the Census or who were looking for work, what branch of activity they were in. The industries were reclassified to give more meaning and facilitate data handling. Four variables were derived.

- Percentage employed in primary sector. On average, 43 percent are employed in agriculture, fishing and mining.
- Percentage employed in the **personal service** sector. On average 12 percent are employed in personal services.

- Percentage employed in **secondary** sector. On average 18 percent are employed in manufacturing, construction, and public utilities.

- Percentage employed in **tertiary** sector. On average 27 percent are employed in commerce, transportation and communication, social services, government, defense, banking and the liberal professions.

**Average individual monthly income.** Question 20 asked those persons 10 or more years of age their monthly income. Ranging from CR$1 to CR$9998, the average is CR$290 (in 1970, US$13.14).

**Population pressure.** The total population in a geographic area (see top of Census questionnaire, Appendix A,) divided by the total employed in that geographic area (Question 22).

**Dependency ratio.** The population less than or equal to 15 years of age (Question 5) plus those greater than or equal to 65 years of age, divided by those ages 16 to 64.

**Percentage of total population now residing in a rural place.** Determined by Census taker if place is urban or rural (see questionnaire in Appendix A, "situacao"). Forty-one percent of the total population resides in a rural
Variables Pertaining to Households

**Average household income.** Asked of persons 10 or more years of age; computed from household data using responses to Question 20. The average is CR$469 (US$21.25).

**Average household rent.** The average is CR$121 (US$5.48); computed on responses to Question 5 under "Caracteristicas do Domicilio", see questionnaire, Appendix A.

**Household amenities.** This is a scale ranging from 0 to 9 computed as the sum of yes responses to Questions 3, 7-14 under "Caracteristicas do Domicilio", see questionnaire, Appendix A. The average is 3.7, with a range of 2 to 6.2. The components are durable housing, public water and sanitation systems, electricity, type of stove, radio, refrigerator, television and automobile.

**Factor Analysis Results**

The above variables describing the 117 geographic areas were subjected to factor analysis using the Statistical Analysis System (SAS) with Varimax rotation. There were five factors with eigen-values greater than 1.0, the usual cutoff. These were reduced to two because of clarity of definition. The rotated factor loadings are listed in Table 7; the two factors account for 78 percent of the geographic variation in socioeconomic structure. Communalities (h2's)
Table 7

Rotated Factor Analysis for Geographic Areas
with Twenty-two Contextual Variables,
(Brazil, 1970)

<table>
<thead>
<tr>
<th>Areal Variables</th>
<th>Average</th>
<th>Standard Deviation</th>
<th>Rotated Factor Loadings</th>
<th>h²</th>
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Eigen-Value                          | 14.16131 | 2.94551 |
Percent of Variance Explained        | 64.4     | 13.4   |
Cumulative % of Variance Explained   | 64.4     | 77.8   |
are above .50 for all variables except population pressure.

Factor 1 accounts for 64 percent of the total variance and delineates a rural (variables with negative loading) to urban (variables with a positive loading) continuum. Factor 1 has a high negative correlation with the percentage of the population with zero schooling, percentage of nonmigrants, percentage employed in the primary sector, population pressure, dependency ratio, and percentage of the population residing in the rural area. These variables characterize rural areas. Those places with scores greater that -1.0 on Factor 1, for example, are clustered in the north and northeast region as listed in Table 8 and shown in Figure 1; the maximum negative score is -1.37 (geographic area 11, in the state of Maranhao, north region).

At the other end of the continuum, Factor 1 has a high positive correlation with the percentage of the population that has completed primary or secondary schooling; large percentage of young individuals in the population; large female population; percentage of long-time migrants; high occupational status; percentage of the population employed in personal services, secondary and tertiary sectors; average monthly income, both individual and household; average rent; and average number of amenities. These variables characterize the urban environment. Those places with scores greater than +2.0, on Factor 2, are clustered in the southeast region as listed in Table 8 and shown in Figure 2;
### Table 2

**Factor Scores for 117 Geographic Areas Brazil, 1970**

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SOURCE: SAS FACTOR ANALYSIS, VARIMAX ROTATION, FACTOR SCORES
FIGURE 2
the maximum positive score is +3.55 (geographic area 70, in the state of Guanabara, southeast region). Summarily the regional distribution of these extreme scores is north, northeast and central west 0, southeast 16 and south 1. Many of the major urban areas (e.g. capital cities) scored high on this factor; such as Sao Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Belem, Recife, Salvador, Vitoria, and Curitiba.

Factor 2 accounts for 13 percent of the total variance and delineates an economic change continuum. Factor 2 has a high negative correlation with the percentage of the population with primary schooling; percentage of new and old migrants; and the percentage employed in the secondary sector. Areas of rapid or growing economic change score negatively on this Factor. Again, those places with extreme negative scores, on Factor 2, are clustered in the southeast as listed in Table 8 and shown in Figure 2; the maximum score is -3.44 (geographic area 100, in the state of Parana, south region).

Factor 2 has high positive correlations with the percentage of the population with zero schooling; percent female; percent of nonmigrants; and the percentage of migrants whose previous residence was in an urban area. In contrast to the preceding paragraph, these characteristics represent areas of slow or no economic change. The places with extreme scores are clustered in the northeast as listed in
Table 8 and shown in Figure 2; the maximum score is 1.44 (geographic area 70, in the state of Guanabara, southeast region).

Figures 3 is and 4 graphically present the place scores for Factors 1 and 2, respectively; the vertical axis represents the range of scores while the geographic place is on the horizontal axis. Horizontal lines are drawn at +1 and -1 to mark off the greater deviations. Of the 117 geographic places, 73, or 62 percent, represent the extremes on the two continua. Figure 5 spatially presents the average factor score by region, using Brasilia (the capital of the country) as the center point. The north and northeast are characterized as rural with a low degree of economic change. The southeast is highly urban, with a high degree of economic change. The south and centralwest are rural areas with a high degree of economic change. This suggests that we have economic change going on in both urban and rural areas; and the various scores demonstrate a multifarious process. The southeast has been the center of development, historically, and thus has many urban centers. Qualitative experience corroborates the preceding findings; and also confirms that the south is well developed and expanding. The centralwest's development was a result of relocating the capital to Brasilia, in 1960 (the former capital was Rio de Janeiro, a coastal city). We know from
FIGURE 3

PLOT FACTOR1 BY PLACE
PLOT OF FACTOR1=PLACE SYMBOL IS VALUE OF PLACE
PLOT FACTOR2 BY PLACE

PLOT OF FACTOR2=PLACE  SYMBOL IS VALUE OF PLACE
AVERAGE FACTOR SCORES, BRAZIL, 1970

FIGURE 5
previous research that urban areas have high levels of educational attainment, income and amenities. We are hypothesizing that this is also true in areas experiencing a high degree of economic change. The following section will discuss the dependent and independent variables and methodology to be used to test this hypothesis.

**Research Design**

The rural to urban continuum and the economic change continuum represent two major types of contextual environment which influence the process of development; especially the aspects related to human capital. This section will describe the research design chosen to study the relationship between individual educational attainment, income, amenities (our three dependent variables), with individual attributes and the contextual setting in which they are found.

A total of 79,276 individuals were drawn from the one percent Public Use Sample, based on three criteria: age 21 to 64, with an income and single. Individuals ages 21 through 64 were chosen because they are likely to have completed their schooling and are more likely to be in the labor force. Since we wish to study how income is influenced by other individual and contextual characteristics and also how it influences other human capital returns, individuals with an income were chosen, as opposed to those with
no income. Single individuals were chosen to remove the confounding effects of marital status on females. Marriage tends to reduce the labor force attachment of women, resulting in decreased income. Mincer and Polachek (1974) found that single women earned 86% as much as single men while married women earned 66% as much as married men. In Brazil, cultural constraints may prohibit a married woman from working. For this study, we have eliminated this bias by limiting the sample to single individuals.

From the "Review of Relevant Research" the independent variables which are expected to influence education, income and amenities can be divided into two groups. First, we have individual characteristics: gender, age, and migrant status. Secondly, are the contextual characteristics: sector of employment and contextual environment. In this instance sector of employment is considered a characteristic of the place rather than of the individual based on the assumption that people tend to locate in places where there are greater opportunities to increase their income. As a consequence a place is desirable if it has industries that are hiring. This also assumes that skills are occupation-specific rather than industry-specific (i.e. a secretary in construction does not differ from a secretary in retailing). The contextual environment refers to two types of continua—rural to urban and low to high degree of economic change. Given the strong relationship which exists between these
individual and place characteristics, and the desirability of isolating the relationship between them (individual and place attributes) and individual educational attainment, individual income and individual amenities, the multiple regression technique was utilized.

As a research tool, multiple regression allows us to determine what proportion of the variance in education, income and amenities, is accounted for by (the independent variables) individual and place characteristics. In addition, it determines the relative importance of each independent variable. Unique to this study is the importance of the contextual milieu in the outcome of education, income and amenities, when other factors are held constant. The dependent and independent variables are described below. The Census question (see Appendix A) from which these variables were derived is noted.

**Dependent Variables**

The three dependent variables are educational attainment, individual income and individual amenities.

**SCHOOLING.** Question 17 asked respondents, ages 5 and older, which grade they successfully completed. Their responses translated into zero through seventeen years of schooling. Just as education is the cornerstone on which human capital theory rests, this variable is also expected to be the dominant variable in the income and amenities
equations.

**AVERAGE MONTHLY INCOME.** Question 20 asked those persons, 10 or more years of age, their monthly income; ranging from CR$1 to CR$9998 (1970, CR$1 = US$0.0453).

**HOUSEHOLD AMENITIES.** This is a scale ranging from 0 to 9 computed as the sum of yes responses to Questions 3, 7-14 under "Caracteristicas do Domicilio", see questionnaire, Appendix A. The average is 3.7, with a range of 2 to 6.2. The components are durable housing, water, public sanitation systems, electricity, type of stove, radio, refrigerator, television, and automobile.

**Independent Variables**

The five independent variables are gender, age, migrant indicator, sector of employment, rural to urban continuum and economic change continuum.

**GENDER.** Question 2 asks all individuals their sex; it is a dichotomous variable coded 1 for female and 0 for male.

**AGE.** Question 6 asks all individuals their age; it is a continuous variable ranging from 21 to 64 years.

**MIGRANT INDICATOR.** Question 10 asked all respondents if they were born in the municipality where now residing. Those who answered yes are considered nonmigrants. Question 12 asked the length of time residing in the current municipality and from this their migrant status was determined. This is a trichotomous variable coded 0 for nonmigrant, 1
for new migrant and 2 for old migrant. A new migrant is defined as an individual not born in the municipality where currently residing and having five or less years residency; an old migrant refers to the same criteria but has resided in the current place for six or more years.

SECTOR OF EMPLOYMENT. Question 24 asked persons 10 or more years of age, who had worked in the twelve months prior to the Census or who were looking for work, what branch of activity they were in. The industries are reclassified to give more meaning and facilitate data handling. The secondary sector was chosen because of its importance to economic development. Hence, this is a dichotomous variable indicating whether the individual is employed, coded 1, or not employed, coded 0, in manufacturing, construction or public utilities.

RURAL TO URBAN CONTINUUM. Derived from a factor analysis (described in the preceding section) places scoring positive have urban characteristics while those scoring negative have rural characteristics.

ECONOMIC CHANGE CONTINUUM. Derived from a factor analysis (described in the preceding section) places scoring positive have a low or slow degree of economic change while those scoring negative are rapidly changing or emerging centers.
SUMMARY

This chapter discussed the reasons for choosing the study area, Brazil. The country offers a diversity of geographic, socioeconomic and demographic characteristics, it has undergone an "urban revolution" and an "economic miracle". The highlights of the Brazilian educational system were also discussed. It is a three tier system—elementary, secondary and university. The formal educational system has received large investments (of both physical and human capital), at the individual and societal levels.

The data base used to study Brazil is the Public Use Sample, from the 1970 Brazilian Census. It provides disaggregated data on individuals and households. This is very useful in the construction of a contextual scale with which places can be scored. Using factor analysis, two types of contextual environments were derived. One is the rural to urban continuum, characterized by large percentages of the population with zero schooling and large primary sector employment in the rural area to large percentages of the population with secondary schooling and large manufacturing sector employment. The second is the economic change continuum. Areas of rapid economic change are characterized by large pools of new migrants and high percentages of secondary employment; contrasting this are those areas of slow economic change. These are characterized by large percentage of nonmigrants and females and large percentages of urban
The contextual variables are expected to have a major influence upon education, income and amenities. In the research design, a subsample of individuals is drawn on the following criteria: ages 21 to 64, with an income, and single. This group is most likely to have completed their education, participate in the labor force, have an income and acquired household amenities. Income and education are to be studied as both dependent and independent variables, both of which have an influence on amenities. Income and amenities represent returns on the investment in education.

Three dependent variables will be studied using the multiple regression technique: education, income and amenities. Theoretically, education has a direct relationship with income and amenities. The independent variables thought to influence these three human capital outcomes are gender, age, migrant indicator, sector of employment, rural to urban continuum and economic change continuum.

The next chapter will discuss the empirical results of the regression analysis.
CHAPTER IV
REGRESSION RESULTS

Introduction

The previous chapter discussed the data source, variables used in factor analysis and research design. Summarily, a factor analysis was performed to determine the contextual environment for each (117) Brazilian geographic areas. Next, the variables were described and the analytical technique explained. The individuals of interest numbered 79,276 and are broadly characterized as single, between the ages of 21 and 64 and having a monthly income.

This group of individuals was chosen because of our interest in applying a human capital framework to the relationship between educational attainment, income and amenities, with individual attributes and place characteristics. Based on the findings of previous research (see Chapter II) we expect differences by (individual attributes) gender, migrant status, and age. We hypothesize that place characteristics, i.e., sector of employment and contextual environment, are highly significant in these three relationships.
This chapter first presents the average education, monthly income and number of household amenities, for the sample and various subgroups. This provides a crude estimate of how individual and place characteristics contribute to differences in human capital outcomes, namely educational attainment, income and amenities. Next, a more refined method of arriving at these distinctions is multiple regression analysis. The second section discusses the equations, especially their recursive nature. Regression results are reported in the third section and the chapter closes with a summary of the major highlights.

Differences in Human Capital Outcomes on Average

This section presents the averages for three human capital outcomes; first, by differences in individual attributes and second, by differences in place characteristics. All results refer to Table 9.

Differences by Individual Characteristics

The total sample is composed of 79,276 individuals. As Table 9 shows, they have, on average, attained 3.8 years of schooling (out of a possible 17), an income of CR$244, and 4 household amenities (out of a possible 9). Forty-four percent of this group is female; sixty-eight percent were migrants. The average age was twenty-nine years; thirteen percent were employed in the secondary sector.
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Source: Amostra de 1% dos Registros do Censo Demografico de 1970, Brasil
Differences occur between females and males. On average the females had attained four years of schooling, had an income of CR$222 and almost five household amenities (4.7). Their average age was 30; sixtyeight percent were migrants. Only twelve percent were employed in the secondary sector. In contrast, males had attained less education, 3.7 years; more income, CR$255; and fewer household amenities, 3.9. The average age was twentyeight; sixtyeight percent were migrants; and twentytwo percent were employed in the secondary sector. These averages support earlier findings that females have less income even when they have more education than their male counterparts.

Migration is a way of changing human capital outcomes. The migrant group, on average, had 4.3 years of schooling; income of CR$280; and 4.6 household amenities. The average age was twentynine; fortythree percent were females; and twentythree percent were employed in the secondary sector. On average, it appears that migrants have more education, more income and more amenities than nonmigrants. The nonmigrants had an average of three years of schooling; income of CR$216, and four household amenities. Fortythree percent were females; the average age was twentyeight; and seventeen percent worked in the secondary sector.

Since the individual can mitigate human capital outcomes through migration but cannot affect gender attributes, we compare females and males by their migrant status rather
than comparing them by the gender. Female migrants, on average, had a little over four years of schooling, income of CR$239, and more than five household amenities. The average age for this group was thirty years; twelve percent worked in the secondary sector. This contrasts to the female nonmigrants who had an average income of CR$205, three and one-half years of schooling and four household amenities. The average age was twenty-nine and like their migrant counterparts, twelve percent worked in the secondary sector. For females, migration did have a positive effect on human capital outcomes, namely increasing in education, income and household amenities.

The male nonmigrant, had an average three years of schooling, income of CR$216, and 3.8 household amenities. The average age was twenty-seven; seventeen percent worked in the secondary sector. Male migrants, by contrast, had an average of four years of schooling, more than the nonmigrant group, income considerably higher than other migrant groups, CR$304, and 4 four household amenities. The average age was twenty-eight; twenty-nine percent worked in the industrial sector; the largest proportion so employed for any migrant category. This latter point suggests a partial explanation of the higher average income.
Differentiating Place Characteristics

Sixtyfive percent of the sample were currently residing in an urban area. Within this group the averages were: over five years of schooling; income of CR$299; and over five household amenities. Fortyeight percent were female; eightyone percent were migrants; and the average age was twentynine. Twentyseven percent of current urban dwellers were employed in the secondary sector. In stark contrast are those currently residing in the rural area, where the average educational attainment was a little over one year (1.4); the average income was CR$114 and the household amenities averaged 2. Thirtysix percent of this group were females and the average age was twentynine. Fortythree percent were migrants while only five percent were employed in the secondary sector. This strongly suggest that one's place of residence makes a difference in human capital outcomes. This supports our hypothesis that contextual characteristics make a difference in human capital outcomes.

The difference in averages, presented in Table 9, suggest that individual and place characteristics contribute to differences in education, income and amenities. The next section will discuss a more refined technique, multiple regression analysis, and the equations utilized to derive these distinctions.
Regression Analysis

Equations

We have chosen three equations to address the relationship between individual educational attainment, income and amenities with individual attributes and place characteristics. The three dependent variables are years of schooling, monthly income and household amenities.

These equations represent a highly recursive relationship; building one upon another. That is to say, education is hypothesized to be the base on which to build an increased income and both education and income are the basis for increased household amenities. To improve well being given the changing social norms, formal education is a prerequisite for higher paying jobs. And assuming that amenities are available, the individual has to have the income to purchase them.

The contextual environment in which the individual finds her/himself has a positive or negative impact on human capital outcomes. Those who reside in rural areas or places experiencing a decreasing level of economic growth have less education, income and amenities than those who reside in more urban places. For example, the rural area has a large percentage of persons in primary sector employment, which requires less education and pays less than secondary sector employment. In contrast, secondary sector employment tends
to be concentrated in areas with urban characteristics; the same is true of amenities.

Given this type of recursive relationship, individual educational attainment, income and amenities are a function of individual and contextual characteristics. The following paragraphs will discuss each equation and those factors expected to influence each dependent variable.

**Educational attainment.** Equation 1:

\[
\text{SCHOOLING} = f(\text{GENDER} - \text{AGE} + \text{MIGRANT STATUS} + \text{RUR/URB CONTINUUM} - \text{ECON/CHG CONTINUUM}).
\]

The dependent variable, educational attainment, is measured by years of schooling completed, and influenced by gender, age, migrant status and the contextual environment.

Gender (coded 1 for females, 0 for males) is expected to have a positive relationship with schooling, since on average, females have more education. Age is expected to have an inverse relationship with education because (of the changing social norm) the young have more opportunities to become educated than their elders. Migrants (coded 1 for migrants, 0 for nonmigrants), in general, are more educated; thus a positive sign is expected. Places that scored positively on the rural to urban continuum tended to be urban and offer more educational opportunities, consequently, the expected sign on this variable is positive. The characteristics and sheer numbers of the 117 places scoring negatively on the economic growth continuum suggest many places are
undergoing a increasing level of growth; thus an inverse relationship is expected.

**Income. Equation 2:**

\[
\text{MONTHLY INCOME} = f(+ \text{SCHOOLING} - \text{GENDER} - \text{AGE} + \text{MIGRANT STATUS} + \text{INDUSTRY} + \text{RUR/URB CONTINUUM} - \text{ECON/CHG CONTINUUM}).
\]

The dependent variable, individual income, is measured by average monthly income and influenced by education, gender, age, migrant status, industry of employment, and the contextual environment.

As the cornerstone of human capital theory, education plays a vital role in other human capital endeavors. To wit, education is expected to have a positive relationship with income, just as the findings of earlier empirical works (refer to Chapter 2). Education is seen as the means to employment in occupations and industries that pay more. Gender (coded 1 for females, 0 for males) is expected to have an inverse relationship with income because females earn less than males; and often they do not have equal access to the types of employment or industries that increase income. If we hypothesize that the young have more education and thus have the requisite skills for high paying jobs, then age is expected to have an inverse relationship with income. Migration is hypothesized to increase income (migrants coded 1, nonmigrants 0) so the sign is positive. Given the industrialization thrust of Brazil, those individuals employed in the secondary sector are expected to have higher incomes;
industry is expected to have a positive relationship. Urban areas have more higher paying jobs than rural areas, plus a large percentage of the population reside there; this suggests a positive relationship between the rural to urban continuum and income. Brazil's rapid development suggests many areas with a increasing level of economic growth which are hypothesized to have higher paying jobs consequently an inverse relationship is expected between income and the economic growth continuum.

Amenities. Equation 3:

\[
\text{AMENITIES} = f(\text{SCHOOLING} + \text{MONTHLY INCOME} + \text{GENDER} - \text{AGE} + \text{MIGRANT STATUS} + \text{INDUSTRY} + \text{RUR/URB CONTINUUM} - \text{ECON/CHG CONTINUUM}).
\]

The dependent variable, household amenities, is measured by the total number of amenities an individual has and is influenced by schooling, income, gender, age, industry, migrant status and the contextual environment.

Education is considered vital to amenities; a positive relationship is expected. In the same building block fashion, income is necessary to purchase amenities; a positive relationship is expected. Personal experience has shown that females tend to take advantage of as many amenities as income and availability will allow, thus a positive relationship is expected between gender and amenities. The young are hypothesized to have more knowledge about, and more income to purchase, amenities; an inverse relationship is expected. Since migrants are hypothesized to have more
education, thus might be more aware of the availability of amenities, a positive relationship is expected between amenities and migrant indicator. Those individuals employed in manufacturing are hypothesized to receive higher incomes, thus the expected relationship between industry and amenities is positive. The urban area has more amenities than the rural area; a positive relationship is expected between amenities and the rural-urban continuum. Areas undergoing a increasing level of growth are expected to be more modern and offer more amenities so the expected relationship is negative.

**Empirical Results**

This section presents the results of the regression analysis. We have hypothesized that education, income and amenities (dependent variables) are influenced by individual and contextual characteristics (independent variables). Since our findings by gender and migrant groups were so similar to previous research, those results are presented in Appendix B. The following first discusses the findings for the total sample for each equation. Next, the more unique results are put forth for each dependent variable by gender-migrant characteristics.

**Total Sample Findings.** Seventeen percent of the variance in individual education is accounted for by this equation and all variables are statistically significant, as
shown in Table 10. The signs are in the expected direction with the exception of migrant indicator, which becomes negative in the regression analysis. The urban context in which the individual finds herself/himself has a strong relationship (r-value of .37) with educational attainment; ranks second in relative importance (b-value of 1.54); is most important within the equation (Beta-value of .38); and contributes the most (t-value of 113.768) to our understanding of educational attainment, after controlling for other independent variables. Context is also reflected in age in that educational opportunities (more of which exist in urban areas) vary inversely with age (t-value -47.407).

Thirtyone percent of the variance in individual income is accounted for by this equation and all of the variables are statistically significant, as shown in Table 11. The signs are in the expected direction with the exception of age. Schooling and the rural to urban continuum have the strongest relationship with income (r-values of .51 and .32 respectively). In the multiple regression, gender ranks first in relative importance (b-value of -52.08); schooling is the most important variable within the equation (Beta-value of .48) and makes the largest contribution (t-value of 147.804) to our understanding of monthly income, after controlling for other independent variables.
Table 10
Zero Order Correlation, Multiple Regression Coefficients and T-Values For Years of Schooling and Independent Variables for Total Subsample

<table>
<thead>
<tr>
<th>YEARS OF SCHOOLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>INDEPENDENT VARIABLES</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Migrant Status</td>
</tr>
<tr>
<td>Rur/Urb Continuum</td>
</tr>
<tr>
<td>Econ/Chg Continuum</td>
</tr>
</tbody>
</table>

\* significant at the 1 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
### TABLE II

**ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES FOR MONTHLY INCOME AND INDEPENDENT VARIABLES FOR TOTAL SUBSAMPLE**

**MONTHLY INCOME**

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLES</th>
<th>Zero order r</th>
<th>b</th>
<th>Beta</th>
<th>T-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>---</td>
<td>-44.922</td>
<td>0.000</td>
<td>-12.056*</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.510</td>
<td>38.670</td>
<td>0.481</td>
<td>147.804*</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.046</td>
<td>-52.077</td>
<td>-0.076</td>
<td>-25.305*</td>
</tr>
<tr>
<td>Age</td>
<td>0.062</td>
<td>4.972</td>
<td>0.139</td>
<td>45.854*</td>
</tr>
<tr>
<td>Migrant Status</td>
<td>0.104</td>
<td>5.603</td>
<td>0.014</td>
<td>4.452*</td>
</tr>
<tr>
<td>Industry</td>
<td>0.101</td>
<td>41.943</td>
<td>0.048</td>
<td>15.833*</td>
</tr>
<tr>
<td>R/U Continuum</td>
<td>0.319</td>
<td>40.294</td>
<td>0.122</td>
<td>36.605*</td>
</tr>
<tr>
<td>Econ/Chg Continuum</td>
<td>-0.093</td>
<td>-11.557</td>
<td>-0.035</td>
<td>-11.065*</td>
</tr>
</tbody>
</table>

**F Value** 5008.249*

**R²** .3069

**N** 79173

* significant at the 1 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
The combined variables explain forty-three percent of the variance in household amenities and all are statistically significant with the exception of age and industry, as shown in Table 12. The signs are in the expected direction with the exception of age, which becomes negative under multiple regression. Education and the rural to urban continuum make the greatest difference in amenities (r-values of .53 and .52 respectively). The rural to urban continuum and gender have relative importance when the three equations are compared (b-values of .99 and .67 respectively); but within the equation the rural to urban continuum and education have equal importance (Beta-values of .37 each). The rural to urban continuum makes the greatest contribution (t-value of 119.854) to our understanding of household amenities, after controlling for other independent variables; schooling's contribution is also significant (t-value of 110.489).

Summarily, we find that the rural to urban continuum, after controlling for other independent variables, contributes the most to our understanding of educational attainment and amenities; while education does the same for monthly income. In order of their significance (t-values), years of schooling is increased by residing in an urban environment, youth, locating in areas undergoing a increasing level of growth, femaleness and a migrant.
**TABLE 12**

ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES
FOR AMENITIES AND INDEPENDENT VARIABLES FOR TOTAL SUBSAMPLE

<table>
<thead>
<tr>
<th>AMENITIES</th>
<th>INDEPENDENT VARIABLES</th>
<th>Zero order r</th>
<th>b</th>
<th>Beta</th>
<th>T-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Constant</td>
<td>---</td>
<td>2.814</td>
<td>0.000</td>
<td>100.484*</td>
</tr>
<tr>
<td></td>
<td>Schooling</td>
<td>0.530</td>
<td>0.245</td>
<td>0.368</td>
<td>110.489*</td>
</tr>
<tr>
<td></td>
<td>Monthly Income</td>
<td>0.329</td>
<td>0.000</td>
<td>0.018</td>
<td>5.706*</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>0.141</td>
<td>0.672</td>
<td>0.119</td>
<td>43.300*</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>-0.030</td>
<td>0.000</td>
<td>0.005</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Migrant Status</td>
<td>0.147</td>
<td>0.018</td>
<td>0.005</td>
<td>1.977**</td>
</tr>
<tr>
<td></td>
<td>Industry</td>
<td>0.094</td>
<td>0.016</td>
<td>0.002</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>R/U Continuum</td>
<td>0.524</td>
<td>0.999</td>
<td>0.368</td>
<td>119.854*</td>
</tr>
<tr>
<td></td>
<td>Econ/Chg Continuum</td>
<td>-0.133</td>
<td>-0.252</td>
<td>-0.092</td>
<td>-32.214*</td>
</tr>
</tbody>
</table>

**F Value** 7351.753*

**R²** .4263

**N** 79173

* significant at the 1 percent level
** significant at the 5 percent level
NS not significant

Source: Amostra de 1% dos Registros do Censo Demográfico de 1970
**Education by Gender-Migrant Characteristics.** The proportion of variance explained, in years of schooling for female migrants, is five percent, as shown in Table 13. All variables are statistically significant, with the exception of the economic growth continuum; signs are in the expected direction. Removing female migrants from the schooling equation reduces the proportion of variance explained by the rural to urban continuum (r-value of .16) suggesting a high concentration of female migrants in the urban area. The variance explained by age is not greatly affected (r-value of -.13) when we control by female migrant. The rural to urban continuum is not as important for female migrants (b-value of .68) when compared to other migrant groups. However, it is the most important variable in this equation (Beta-value of .17) and makes the most significant contribution (t-value of 20.271), after controlling for other independent variables, to our understanding of educational attainment.

Twentyfour percent of the variance is explained, in years of schooling for female nonmigrants, as shown in Table 13. All of the variables are statistically significant and the signs are in the expected direction. Removing female nonmigrants from the schooling equation increases the proportion of variance in years of schooling, explained by the rural to urban continuum (r-value -.18). Compared to other migrant groups, the rural to urban continuum is important.
### Table 13
Zero Order Correlations, Multiple Regression Coefficients and T-Values for Years of Schooling and Independent Variables

| Independent Variables | Female Migrants | | | | Female Nonmigrant | | | | Male Migrants | | | | Male Nonmigrant | | |
|------------------------|-----------------|-------------|-------------|-------------|-----------------|-------------|-------------|-------------|-----------------|-------------|-------------|-------------|-----------------|-------------|-------------|-------------|
|                        | Zero order r    | b           | Beta Value  | T- Value    | Zero order r    | b           | Beta Value  | T- Value    | Zero order r    | b           | Beta Value  | T- Value    | Zero order r    | b           | Beta Value  | T- Value    |
| Constant               | ---             | 5.870       | 0.000       | 51.423*     | ---             | 6.300       | 0.000       | 79.653*     | ---             | 5.679       | 0.000       | 78.229*     | ---             | 5.679       | 0.000       | 78.229*     |
| Age                    | -0.132          | -0.059 -0.142 | -17.062*     | -0.183      | -0.073 -0.178 | -29.226*     | -0.157      | -0.072 -0.153 | -28.890*     | -0.157      | -0.072 -0.153 | -28.890*     | -0.149      | -0.068 -0.150 | -27.016*     |
| Rur/Urb Continua       | 0.157           | 0.678 0.173 | 20.271*      | 0.443       | 1.847 0.418   | 66.274*      | 0.197       | 0.907 0.482   | 82.512*      | 0.205       | 0.944 0.472   | 86.512*      | 0.220       | 0.981 0.506   | 89.016*      |
| Econ/Chg Continua      | NS              | -0.101 -0.025 | -2.855*     | -0.221      | -0.499 -0.095 | -15.052*     | -0.101      | -0.025 -0.095 | -15.052*     | -0.101      | -0.025 -0.095 | -15.052*     | -0.101      | -0.025 -0.095 | -15.052*     |
| F Value                | 224.057*        |             |             |             | 2160.685*     |             |             |             |             |             |             |             |             |             |
| R²                     | 0.0457          |             |             |             | 0.239         |             |             |             |             |             |             |             |             |             |
| N                      | 14034           |             |             |             | 20648         |             |             |             |             |             |             |             |             |             |

* significant at the 1 percent level
NS not significant at the 10 percent level

Source: Amostra de 12 dos Registros do Censo Demográfico de 1970
for female nonmigrants (b-value of 1.85); also within this equation it is the most important variable (Beta-value .42). The rural to urban continuum makes the largest contribution to our understanding of years of schooling, after controlling for other independent variables (t-value of 66.274).

Twelve percent of the variance in years of schooling for male migrants is accounted for in this equation, and all variables are statistically significant, as shown in Table 13. All signs are in the expected direction with the exception of the economic growth continuum; this suggests that male migrants may be concentrated in areas with a decreasing level of economic growth. The rural to urban continuum has the strongest relationship with years of schooling (r-value of 0.32); is relatively important both between groups (b-value of 1.29) and within this equation (Beta-value of .32); and makes the greatest contribution (t-value of 44.307) to our understanding of educational attainment, after controlling for other independent variables.

Twentyeight percent of the variance in years of schooling for male nonmigrants is accounted for in this equation and all variables are statistically significant, as shown in Table 13. The rural to urban continuum has the strongest relationship with years of schooling (r-value of 0.49); is the most important variable for all groups (b-value of 2.03) and within this equation (Beta-value of 0.47); and makes the greatest contribution (t-value of
86.512) to our understanding of educational attainment, after controlling for other independent variables.

Summarily, these findings suggest that the rural to urban continuum is important in explaining years of schooling, irregardless of gender-migrant characteristics. For male nonmigrants, in particular, 24 percent of the variation in their years of schooling is explained by the rural to urban continuum. The same is true for female nonmigrants, where 19 percent of the variation in their years of schooling is explained. Although the economic growth continuum had a stronger relationship than age with years of schooling, for female and male nonmigrants, age consistently made a greater contribution to our understanding of years of schooling.

Income by Gender-Migrant Characteristics. The proportion of variance explained, in monthly income for female migrants, is 28 percent, as shown in Table 14. All variables are statistically significant, and signs are in the expected direction, with the exception of age. Removing female migrants from the monthly income equation reduces the proportion of variance explained by schooling (r-value of 0.47) and greatly reduces that for the rural to urban continuum (r-value of 0.17); this suggests a high concentration of female migrants, with an education, in the urban area. The variance explained by age is increased (r-value of 0.12) when we remove the influence of female migrants. Schooling
TABLE 14
ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES FOR MONTHLY INCOME AND INDEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLES</th>
<th>FEMALE MIGRANTS</th>
<th></th>
<th></th>
<th>FEMALE NONMIGRANT</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Zero order</strong></td>
<td><strong>T-</strong></td>
<td><strong>Zero order</strong></td>
<td><strong>T-</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>r</em></td>
<td><em>b</em></td>
<td>Beta</td>
<td>Value</td>
<td><em>r</em></td>
</tr>
<tr>
<td>Constant</td>
<td>---</td>
<td>126.307</td>
<td>0.000</td>
<td>-15.868*</td>
<td>---</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.474</td>
<td>35.086</td>
<td>0.484</td>
<td>65.903*</td>
<td>0.544</td>
</tr>
<tr>
<td>Age</td>
<td>0.120</td>
<td>5.825</td>
<td>0.193</td>
<td>26.363*</td>
<td>0.087</td>
</tr>
<tr>
<td>Industry</td>
<td>0.086</td>
<td>83.721</td>
<td>0.086</td>
<td>11.807*</td>
<td>0.062</td>
</tr>
<tr>
<td>Rur/Urb Continua</td>
<td>0.173</td>
<td>26.905</td>
<td>0.095</td>
<td>12.494*</td>
<td>0.423</td>
</tr>
<tr>
<td>Econ/Chg Continua</td>
<td>-0.031</td>
<td>-21.376</td>
<td>0.072</td>
<td>-9.561*</td>
<td>-0.170</td>
</tr>
<tr>
<td><strong>F Value</strong></td>
<td>1082.896*</td>
<td></td>
<td>2414.136*</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>.2785</td>
<td></td>
<td>.3689</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>14034</td>
<td></td>
<td>20651</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLES</th>
<th>MALE MIGRANTS</th>
<th></th>
<th></th>
<th>MALE NONMIGRANT</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Zero order</strong></td>
<td><strong>T-</strong></td>
<td><strong>Zero order</strong></td>
<td><strong>T-</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>r</em></td>
<td><em>b</em></td>
<td>Beta</td>
<td>Value</td>
<td><em>r</em></td>
</tr>
<tr>
<td>Constant</td>
<td>---</td>
<td>-83.922</td>
<td>0.000</td>
<td>-9.380*</td>
<td>---</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.544</td>
<td>47.304</td>
<td>0.525</td>
<td>81.989*</td>
<td>0.541</td>
</tr>
<tr>
<td>Age</td>
<td>0.061</td>
<td>5.614</td>
<td>0.127</td>
<td>20.996*</td>
<td>0.039</td>
</tr>
<tr>
<td>Industry</td>
<td>0.052</td>
<td>20.193</td>
<td>0.024</td>
<td>3.780*</td>
<td>0.122</td>
</tr>
<tr>
<td>Rur/Urb Continua</td>
<td>0.290</td>
<td>47.231</td>
<td>0.129</td>
<td>18.669*</td>
<td>0.397</td>
</tr>
<tr>
<td>Econ/Chg Continua</td>
<td>0.048</td>
<td>-10.339</td>
<td>-0.054</td>
<td>-8.658*</td>
<td>-0.165</td>
</tr>
<tr>
<td><strong>F Value</strong></td>
<td>1850.771*</td>
<td></td>
<td>2515.863*</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>.3294</td>
<td></td>
<td>.3292</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>18847</td>
<td></td>
<td>25634</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* significant at the 1 percent level
NS not significant at the 10 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
continues to have the strongest relationship with income. Among the monthly income equations, industry has the most relative importance for female migrants (b-value of 83.72). Within the equation, education is the most important (Beta-value of .48) and also makes the greatest contribution (t-value of 65.903) to our understanding, after controlling for other independent variables, of monthly income for female migrants.

Thiryseven percent of the variance is explained, in monthly income for female nonmigrants, as shown in Table 14. All of the variables are statistically significant and the signs are in the expected direction, with the exception of age. Removing female nonmigrants from the monthly income equation increases the proportion of variance explained by schooling (r-value .54), age (r-value .09), the rural to urban continuum (r-value .42) and the economic growth continuum (r-value -0.17). However, under multiple regression analysis, the three most important variables are rural to urban continuum (b-value 53.27), industry (b-value 36.78), and schooling (b-value 30.20). Within the equation the most important variables are schooling (Beta-value .49), rural to urban continuum (Beta-value .19), and age (Beta-value .18). In terms of significance of the contribution after accounting for other independent variables, education (t-value 76.480) is first followed by age (t-value 31.726) and the rural to urban continuum (t-value 30.370).
Thirtythree percent of the variance in monthly income for male migrants is accounted for in this equation, as shown in Table 14. All variables are statistically significant, and signs are in the expected direction, with the exception of age and the economic growth continuum. Removing male migrants from the monthly income equation increases the proportion of variance explained by schooling (r-value of 0.54) and that for industry (r-value 0.05), the rural to urban continuum (r-value of 0.29) and the economic growth continuum (r-value 0.05). Schooling continues to have the strongest relationship with income. Among the monthly income equations, schooling (b-value 47.30) and the rural to urban continuum (b-value 47.23) have the most relative importance for male migrants. Within the equation, education is the most important (Beta-value of 0.52) variable and also makes the greatest contribution (t-value of 81.989) to our understanding, after controlling for other independent variables, of monthly income for male migrants.

Thirtythree percent of the variance in monthly income for male nonmigrants is accounted for in this equation, as shown in Table 14. All of the variables are statistically significant and the signs are in the expected direction, with the exception of age. Removing male nonmigrants from the monthly income equation increases the proportion of variance explained by schooling (r-value .54), industry (r-value .12), the rural to urban continuum (r-value .40) and
the economic growth continuum (r-value -0.16). However, under multiple regression analysis, the two most important variables are the rural to urban continuum (b-value 55.37), and schooling (b-value 39.41). Within the equation the most important variable is schooling (Beta-value .48). Education makes the most significant contribution (t-value 79.050), after controlling for other independent variables.

Summarily, these findings suggest that schooling is important in explaining monthly income, irregardless of gender migrant characteristics. For female migrants, female nonmigrants, and male migrants, age is second in its contribution to our understanding of monthly income; for male nonmigrants the rural to urban continuum is second in importance.

Amenities by Gender-Migrant Characteristics. The proportion of variance explained, in amenities for female migrants, is 25 percent, as shown in Table 15. All variables are statistically significant, with the exception of monthly income and industry. For the zero order correlation, the signs are in the expected direction for all variables except the economic growth continuum; in the regression the exceptions are income and industry. Removing female migrants from the amenities equation reduces the proportion of variance explained by schooling (r-value of .28), income (r-value .16) and the rural to urban continuum (r-value of 0.45); this suggests a high concentration of female
TABLE 15
ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES
FOR AMENITIES AND INDEPENDENT VARIABLES

| INDEPENDENT VARIABLES | FEMALE MIGRANTS | | | | | FEMALE NONMIGRANT | | | |
| | zero order | T-Value | | | | zero order | T-Value | | |
| | r | b | Beta | Value | | r | b | Beta | Value |
| Constant | --- | 4.371 | 0.000 | 58.462* | --- | 3.100 | 0.000 | 62.080* |
| Schooling | 0.284 | 0.143 | 0.217 | 25.341* | 0.604 | 0.289 | 0.434 | 67.664* |
| Monthly Income | 0.164 | -0.000 | -0.009 | NS | 0.393 | -0.000 | -0.022 | -3.516* |
| Age | -0.025 | -0.007 | -0.025 | -3.311* | -0.055 | 0.009 | 0.035 | 6.687* |
| Industry | NS | -0.445 | -0.050 | -6.701* | 0.068 | 0.059 | 0.007 | NS |
| Rur/Urb Continuum | 0.447 | 1.129 | 0.436 | 56.016* | 0.583 | 0.108 | 0.367 | 63.160* |
| Econ/Chg Continuum | 0.060 | 0.158 | 0.058 | -7.550* | -0.307 | -0.411 | -0.117 | -22.755* |

| MALE MIGRANTS | | | | | | MALE NONMIGRANT | | | |
| | | | | | | | | |
| | zero order | T-Value | | | | zero order | T-Value | | |
| | r | b | Beta | Value | | r | b | Beta | Value |
| Constant | --- | 2.693 | 0.000 | 42.536* | --- | 2.745 | 0.000 | 64.723* |
| Schooling | 0.463 | 0.211 | 0.341 | 44.565* | 0.673 | 0.307 | 0.465 | 85.242* |
| Monthly Income | 0.339 | 0.001 | 0.073 | 9.781* | 0.448 | 0.000 | 0.054 | 10.546* |
| Age | -0.034 | 0.001 | 0.003 | NS | -0.083 | -0.002 | -0.007 | NS |
| Industry | 0.104 | 0.129 | 0.022 | 3.414* | 0.238 | 0.369 | 0.053 | 12.205* |
| Rur/Urb Continuum | 0.399 | 0.716 | 0.285 | 39.714* | 0.591 | 0.839 | 0.302 | 59.939* |
| Econ/Chg Continuum | 0.055 | -0.170 | -0.073 | -11.346* | -0.281 | -0.318 | -0.101 | -23.319* |

F Value | 789.354* | 3472.727* |
R² | .2524 | .5023 |
N | 14034 | 20651 |

* significant at the 1 percent level
NS not significant at the 10 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
migrants, with an education, in the urban area. The rural to urban continuum has the strongest relationship with amenities. Among the amenities equations, the rural to urban continuum has the most relative importance for female migrants (b-value of 1.13). Within the equation, the rural to urban continuum is the most important (Beta-value of .44) and also makes the greatest contribution (t-value of 56.016) to our understanding, after controlling for other independent variables, of amenities.

This equation explains fifty percent of the variance in number of household amenities for female nonmigrants, as shown in Table 15. All of the variables are statistically significant and the signs are in the expected direction. Removing female nonmigrants from the amenities equation increases the proportion of variance explained by schooling (r-value .60), monthly income (r-value .39), age (r-value -0.05), the rural to urban continuum (r-value .58) and the economic growth continuum (r-value -0.31). However, under multiple regression analysis, the most important variable is the rural to urban continuum (b-value 1.08). Within the equation the most important variables are schooling (Beta-value .43) and the rural to urban continuum (Beta-value 0.37). In terms of significance of the contribution after accounting for other independent variables, education (t-value 67.664) is first followed the rural to urban continuum (t-value 63.160).
Twentynine percent of the variance in number of household amenities for male migrants is accounted for in this equation, as shown in Table 15. All variables are statistically significant with the exception of age; signs are in the expected direction, with the exception of the economic growth continuum. Removing male migrants from the amenities equation reduces the proportion of variance explained by schooling (r-value of 0.46), the rural to urban continuum (r-value of 0.40) and the economic growth continuum (r-value 0.05); the proportion increases for monthly income (r-value of 0.34) and industry (r-value 0.10). Schooling continues to have the strongest relationship with income. Among the monthly income equations, the rural to urban continuum (b-value 0.71) has the most relative importance for male migrants. Within the equation, education is the most important (Beta-value of 0.34) variable and makes the greatest contribution (t-value 44.565) to our understanding of amenities; second is the rural to urban continuum (Beta-value 0.28, t-value 39.714).

Fifty-six percent of the variance in number of household amenities for male nonmigrants is accounted for in this equation, as shown in Table 15. All of the variables are statistically significant, with the exception of age; signs are in the expected direction. Removing male nonmigrants from the amenities equation increases the proportion of variance explained by schooling (r-value .67), monthly income
(r-value .45), industry (r-value .24), the rural to urban continuum (r-value .59) and the economic growth continuum (r-value -0.28). However, under multiple regression analysis, the four most important variables are rural to urban continuum (b-value .86), industry (b-value .31), economic growth continuum (b-value -.32) and schooling (b-value .31). Within the equation the most important variables are schooling (Beta-value .47) and the rural to urban continuum (Beta-value .30). Education (t-value 85.242), the rural to urban continuum (t-value 59.939) and the economic growth continuum (t-value -23.319) make the most significant contributions, after controlling for other independent variables, to our understanding of amenities for male nonmigrants.

Summarily, these findings suggest that schooling is the most important variable in explaining amenities for female nonmigrants, male migrants and male nonmigrants; the rural to urban continuum is most important for female migrants. For female nonmigrants, and male migrants, and male nonmigrants, the rural to urban continuum is next in importance.

**Summary**

This chapter discussed the average educational attainment, income and household amenities for the total sample
and various subgroups; differentiating by individual and place characteristics. Three equations were presented, for regression analysis, as representative of the recursive relationship between individual attributes and place characteristics with individual educational attainment, income, and amenities. The regression results were then discussed by total sample and gender-migrant characteristics. The summary of those results is reiterated below.

Overall, years of schooling are increased by the individual characteristics female, young, and a migrant; and by the place characteristics of residing in an urban context and in an area undergoing a increasing level of economic growth. Monthly income is increased by the individual characteristics of education, male, older, and a migrant; and by the place characteristics of secondary sector employment, residing in an urban area, and in areas undergoing a increasing level of economic growth. Amenities are increased by the individual characteristics of education, a monthly income, female, migrant; and place characteristics of residing in an urban context, living in areas undergoing a increasing level of economic growth.

For female migrants, years of schooling is increased by residing in an urban place that is undergoing a increasing level of economic growth, and being young. Income is increased by schooling, being older, in an urban place with increasing level of economic growth and employed in the
secondary sector. Amenities are increased by residing in an urban place with a increasing level of economic growth, schooling, being young.

Female nonmigrants increase their schooling by residing in urban areas undergoing a increasing level of economic growth, and young. Income is increased by schooling, being older and residing in urban areas with a increasing level of economic growth and employed in the secondary sector. The number of household amenities are increased by schooling, residing in an urban area, with a increasing level of economic growth, and being older.

Male migrants show an increase in schooling when they are young and reside in an urban context with a decreasing level of economic growth. Their monthly income increases with age, more schooling, residing in urban places that have a increasing level of economic growth, and are employed in the secondary sector. The number of household amenities increases with schooling, residing in urban places undergoing a increasing level of economic growth, more income and secondary sector employment.

Male nonmigrants can increase their schooling when they are younger, and reside in urban places with a increasing level of economic growth. Monthly income increases with schooling, age and residing in urban places experiencing a increasing level of economic growth. Household amenities increase with schooling, urban areas undergoing a increasing
level of economic growth, monthly income and employment in the secondary sector.

These findings support earlier research as regards the importance of individual characteristics and human capital outcomes. They add to that knowledge base by demonstrating the importance of the contextual dimensions of a place in increasing schooling, monthly income and household amenities. Those places with more urban characteristics increase all three outcomes. Educationally, being located in an urban area is most significant for male nonmigrants and least significant for female migrants. Urbanness to increase monthly income is most important for female nonmigrants and least important for female migrants. And an urban location to increase household amenities is most important for female migrants and least important for male migrants. In general, residing in places characterized by an increasing level of economic growth, tends to increase education, income and amenities. The exception to this for education is for male migrants. This characteristic is most important to increasing the income of female migrants, and least important to female nonmigrants; and most important to increasing amenities for female nonmigrants and least important to female migrants.

The next chapter will present concluding remarks and suggestions for further research.
CHAPTER V
GENERAL SUMMARY AND CONCLUSIONS

The focus of this dissertation is human capital aspects of Third World development. In particular, it examines human capital theory in a spatial framework by simultaneously assessing the influence of individual attributes and place characteristics on individual educational attainment, income, and amenities for Brazil, 1970. Introducing the spatial dimension to the study of human capital effects is a unique aspect of this dissertation.

Chapter II examines the human capital framework and its use in the Third World, particularly Brazil. The theory is concerned with maximizing societal and individual welfare through investments in human capital. The cornerstone of human capital theory is investment in education. Two positive types of returns dominate the literature on investments in human capital -- increased income and improved quality of life.

These benefits are interrelated in that societal policies regarding human capital investments affect the individual choices regarding human capital investments. At the societal level, for example, a nation will decide to invest
in building educational facilities (providing both the physical and human capital). Where these facilities are located impacts the individual’s choice of whether or not she/he can invest in education. Alternatively, at the individual level, a person may decide to invest her/his time resources to take advantage of educational opportunities. This personal investment is hypothesized to improve the individual’s skill level, thus improving qualifications for higher paying jobs. Once the individual has an education and income, she/he can acquire amenities, a proxy for quality of life.

However, the unevenness of development, i.e. how it varies from place to place, sometimes impedes finding a job commensurate with skills (and/or amenity availability). Migration is a way to overcome this barrier. Accordingly, migration is considered a form of investment in human capital, and thus a partial determinant of individual differences in welfare.

The unevenness of development is also exemplified by the types of places to which individuals migrate. Some places offer more educational opportunities, a greater variety of economic opportunities and amenities. This may be illustrated by the dual economy model (Lewis, Fei and Ranis, 1964) which hypothesizes that individuals migrate to jobs either in the traditional sector or the modern sector. The traditional sector is characterized by rural subsistence
agriculture, low productivity, and surplus labor. The modern sector is characterized as urban, industrialized, highly productive, and capable of absorbing the surplus labor from the traditional sector. More generally, the geographic component of movement from traditional sectors towards modernization is migration from rural to urban areas.

The spatial theory which speaks to the location of human capital investments is the core-periphery work of John Friedmann (1966). Throughout Brazilian history, this type of spatial development has favored the core areas over the periphery. The development of towns as the centres of economic life has led to concentrations of both physical and human capital.

Chapter III discusses the database, variables, research techniques, research design, and highlights the Brazilian educational system. The most informative data source for this study is the Public Use Sample of the 1970 Brazilian Census. This contains cross-sectional information on both households and individuals for 117 geographic areas. The data are manipulated in two key ways.

First, the data is aggregated to 117 places. Then a factor analysis is performed to derive the contextual indices which capture the diversity of areal economic development. Two types of contextual environments were derived: a rural to urban continuum and an economic growth continuum.
The rural to urban continuum is characterized by rural areas with large percentages of the population with zero schooling and large primary sector employment. In contrast is the urban environment which is characterized by large percentages of the population with secondary schooling and large manufacturing sector employment in the urban area. The economic growth continuum is characterized by areas of increasing economic growth containing large pools of new migrants and high percentages of secondary employment. Contrasting this are areas of decreasing economic growth characterized by large percentage of nonmigrants, females, and large percentages of urban migrants.

The second data manipulation is on a subsample of single individuals, ages 21 to 64, with an income. This group is most likely to have completed their education, participate in the labor force, have an income and acquired amenities. Three dependent variables are studied using the multiple regression technique: education, income, and amenities. The independent variables are gender, age, migrant/nonmigrant status, economic sector of employment, the rural to urban continuum and the economic growth continuum. The regression equations, discussed in greater detail below, are done in a recursive framework. That is to say, education is hypothesized to be the base on which to build an increased income and both education and income are the basis for increased household amenities. To improve
well-being given the changing social norms, formal education is a prerequisite for higher paying jobs. And assuming amenities are available, the individual has to have the income to purchase them. Thus income and education are studied as both dependent and independent variables, both of which have an influence on amenities. Income and amenities represent returns on the investment in education.

Chapter IV, first presents the average values for schooling income, and amenities for the total sample, male-female, migrant/nonmigrant, and by gender-migrant and type of place (urban/rural) subgroups. On average, the total sample attained an average of 3.8 years of schooling (out of a possible 17), had a monthly income of CR$244 and four household amenities (out of a possible nine). Differences occur between females and males. On average, females had more years of schooling, less income and more household income than males. We also find differences between migrants and nonmigrants since migration is a way of changing human capital outcomes. On average, migrants have more education, more income and more amenities than nonmigrants. For all gender-migrant subgroups, migration does have a positive effect on human capital outcomes, namely increasing education, income and household amenities. The difference in averages between rural and urban places suggests that individual and place characteristics contribute to differences in education income and amenities. These dif-
ferences are tested in a more refined manner using multiple regression analysis.

Three equations are used to address the relationship between individual educational attainment, income and amenities with individual attributes and place characteristics. Summarily, the relationships are as follows. First, educational attainment, measured by years of schooling completed, is related to gender, age, migrant status, rural to urban continuum and economic growth continuum. Second, monthly income is related to education, gender, age, migrant status, industry of employment, rural to urban continuum and economic growth continuum. Finally, household amenities, measured by the total number of amenities an individual has, is related to education, income, gender, age, migrant status, industry of employment, rural to urban continuum and economic growth continuum. These equations represent a highly recursive relationship, building one upon another.

Summarily for the total sample, in the education equation, our findings suggest the rural to urban continuum is the most important variable. This is partially a function of the urban orientation of development, i.e. urban areas offer greater educational facilities. Next in importance is age. Although age is not a policy variable, its importance may be explained by the large numbers of young people receiving an education, largely because of a greater societal emphasis on its attainment and increasing availability of
educational facilities. In the monthly income equation, the most important variables are schooling, age and the rural to urban continuum. In the amenities equation, schooling and the rural to urban continuum are of equal importance. Next in importance is gender.

The findings for the subgroups are similar to those for the total sample. In the education equation, the rural to urban continuum is the most important variable for all gender-migrant categories. The relative importance of the rural to urban continuum among gender-migrant groups suggests a large concentration of females in the urban area. In contrast, only male migrants show increased educational attainment in areas of decreased economic growth; suggesting that males may benefit from educational opportunities regardless of where they migrate while females benefit most from areas of increasing economic growth. Next in importance is age. This supports previous research which found that migrants tend to be younger.

In the monthly income equation, schooling is the most important variable across all gender-migrant subgroups. Next in importance for female nonmigrants, male migrants and male nonmigrants is the rural to urban continuum. For female migrants age is next in importance.

For the amenities equation, schooling is the most important variable for female nonmigrants, male migrants and male nonmigrants. Next in importance is the rural to urban
continuum. For female migrants the most important variable is the rural to urban continuum; schooling is next in importance.

It is clear, then, that place effects are of paramount importance in determining human capital acquisition and benefits there from. More generally, Figure 6 depicts the relationship between individual well-being and spatial development. Instead of using Friedmann's four regions, as was done in Figure 1/Chapter I, we adopt the areas defined by the two contextual continua from this study. This schema was derived from the conceptual framework developed in Chapter I, the literature reviewed in Chapter II and the results from the analysis in Chapters III and IV.

Given the interrelatedness between societal policy and individual choice, this schema takes into account that development's effects vary from place to place in Brazil. For illustration purposes we can characterize four types of places: rural with decreasing economic growth, rural with increasing economic growth, urban with decreasing economic growth and urban with increasing economic growth. The following describes how the human capital outcomes appear for an individual with identical characteristics to those in the sample. Rural places of decreasing economic growth are characterized by low levels of educational attainment, an average monthly income of less than CR$100 and less than two household amenities. Typically, such places are concentrated
Revised National Modernization-Urbanization-Development Plans

Subject to Cultural, Religious, and Political Constraints

Brazil, 1970

FIGURE 6
in the north and northeast regions. Rural areas of increasing economic growth have a slightly higher level of educational attainment, an average monthly income of CR$200 and approximately two household amenities. These places are concentrated in the southern and central west regions. Urban areas experiencing decreasing economic growth have the greatest level of educational attainment, the highest monthly income and numerous household amenities. These areas are concentrated in the southeast region; this is probably a function of the recent relocation of the capital at the time of the 1970 Census.

Implicit in the schema is the role of choice. Individuals may mitigate their human capital outcomes by staying (nonmigrants), or choosing to migrate to either rural or urban areas, places of increasing or decreasing economic growth, or any of the places in between. At the same time, governmental decisions on where to locate industry, the types of amenities to offer, the setting of wage (income) levels and what types of innovations to emphasize, affect individual choices.

Based on the findings in Chapter IV, the following policy implications were derived.

Policy Implications

Depicting places on a continuum clarifies the process of spatial development by showing how places change, evolve,
and develop through the diffusion of innovations. The contextual indices reflect past national policies regarding a variety of investments (both physical and human). In turn this has influenced the choices available for individuals.

Government policy regarding the location of educational facilities, economic opportunities and household amenities is crucial to individual human capital investments. Given the variance in human capital outcomes and the diversity of places indicated by the factor analysis in this study, development projects distributed over a wider area, i.e., "spread" along a continuum, would encourage numerous types of spatial development and increase the choices available for improved individual well-being.

If capital is predominantly invested only in those areas of increasing economic growth, the "polarization" effects will only be exacerbated. This can be countered by a greater emphasis on places in the middle. Historically, Brazil's economic development has contributed to the polarization of places. The dichotomy between rural and urban areas directly affects the level of educational attainment, income and amenities. This study suggests that more emphasis should be placed on the types of places between these two extremes. The utilization of contextual scales to further characterize places would improve the national planning body's ability to identify a broader range of areas to "develop" plus increase the choices for the
individual to improve her/his well-being.

The early identification of the contextual characteristics of a place can impact in and out migration. For example, areas of increasing economic growth could be marketed, just as Brasilia was. In addition, the identification of places of decreasing economic growth might stem the decline of places experiencing a low level of economic growth and might be more easily infused with needed capital if contextual evaluations were made. Our findings suggest these areas often have the necessary infrastructure for a variety of economic opportunities and offer numerous amenities.

The findings from this study, and the linking of spatial development with human capital, provide a foundation for future analysis of the contextual characteristics of a variety of places and their impacts on the individual. Such analysis can be applied at all levels: national, regional and local. In addition, such an interdisciplinary approach encourages a more "multidimensional" understanding of the subject. This can only improve the implementation of development plans and policies.
APPENDIX A

1970 BRAZILIAN CENSUS QUESTIONNAIRE
APPENDIX B

TABLES RELEVANT TO CHAPTER IV
TABLE 16
ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES
FOR YEARS OF SCHOOLING AND INDEPENDENT VARIABLES

| INDEPENDENT VARIABLES | FEMALES | | | MALES | | |
|-----------------------|---------|---------||---------|---------|---------|
|                       | r       | b       | Beta   | T-Value | r       | b       | Beta   | T-Value |
| Constant              | ---     | 6.019   | 0.000  | 89.961* | ---     | 5.496   | 0.000  | 90.598* |
| Age                   | -0.159  | -0.068  | -0.164 | -32.612*| -0.138  | -0.069  | -0.143 | -33.625*|
| Migrant Status        | 0.074   | -0.140  | -0.028 | -5.284* | 0.087   | 0.012   | NS     | NS*     |
| Rur/Urb Continuum     | 0.321   | 1.317   | 0.327  | 63.335* | 0.419   | 1.735   | 0.420  | 97.381* |
| Econ/Chg Continuum    | -0.128  | -0.429  | -0.097 | -18.543*| -0.073  | -0.241  | -0.062 | -13.638*|

F Value: 1425.78* 2784.557*

R²: 1412 .20

N: 34688 44484

* significant at the 1 percent level
NS not significant at the 10 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
### TABLE 17

**ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES FOR YEARS OF SCHOOLING AND INDEPENDENT VARIABLES**

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLES</th>
<th>Zero order r</th>
<th>b</th>
<th>Beta Value</th>
<th>T-Value</th>
<th>Zero order r</th>
<th>b</th>
<th>Beta Value</th>
<th>T-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>---</td>
<td>5.701</td>
<td>0.000</td>
<td>106.132*</td>
<td>---</td>
<td>5.682</td>
<td>0.000</td>
<td>73.822*</td>
</tr>
<tr>
<td>Gender</td>
<td>0.047</td>
<td>0.574</td>
<td>0.070</td>
<td>17.272*</td>
<td>0.032</td>
<td>0.161</td>
<td>0.018</td>
<td>3.420*</td>
</tr>
<tr>
<td>Age</td>
<td>-0.164</td>
<td>-0.073</td>
<td>-0.167</td>
<td>-41.356*</td>
<td>-0.122</td>
<td>-0.063</td>
<td>-0.140</td>
<td>-26.153*</td>
</tr>
<tr>
<td>Rur/Urb Continua</td>
<td>0.469</td>
<td>1.948</td>
<td>0.446</td>
<td>108.104*</td>
<td>0.387</td>
<td>1.009</td>
<td>0.255</td>
<td>45.825*</td>
</tr>
<tr>
<td>Econ/Chg Continua</td>
<td>-0.208</td>
<td>-0.466</td>
<td>-0.094</td>
<td>-22.590*</td>
<td>0.043</td>
<td>-0.015</td>
<td>NS</td>
<td>NS*</td>
</tr>
</tbody>
</table>

**F Value**

- Nonmigrants: 4056.394*
- Migrants: 729.950*

**R²**

- Nonmigrants: 0.0816
- Migrants: 0.0816

**N**

- Nonmigrants: 46286
- Migrants: 32682

* significant at the 1 percent level
NS not significant at the 10 percent level

Source: *Amostra de 1% dos Registros do Censo Demográfico de 1970*
TABLE 18

ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES
FOR MONTHLY INCOME AND INDEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLES</th>
<th>FEMALES</th>
<th></th>
<th></th>
<th>MALES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zero order</td>
<td>T-</td>
<td>Zero order</td>
<td>T-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>---</td>
<td>-78.821</td>
<td>0.000</td>
<td>-17.095*</td>
<td>---</td>
<td>-62.698</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.500</td>
<td>33.066</td>
<td>0.489</td>
<td>101.021*</td>
<td>0.548</td>
<td>43.460</td>
</tr>
<tr>
<td>Age</td>
<td>0.104</td>
<td>5.219</td>
<td>0.186</td>
<td>40.534*</td>
<td>0.052</td>
<td>4.933</td>
</tr>
<tr>
<td>Migrant Status</td>
<td>0.077</td>
<td>-5.627</td>
<td>-0.017</td>
<td>-3.495*</td>
<td>0.122</td>
<td>13.638</td>
</tr>
<tr>
<td>Industry</td>
<td>0.074</td>
<td>64.946</td>
<td>0.072</td>
<td>15.834*</td>
<td>0.101</td>
<td>7.524</td>
</tr>
<tr>
<td>Rur/Urb Continua</td>
<td>0.288</td>
<td>31.752</td>
<td>0.117</td>
<td>23.576*</td>
<td>0.376</td>
<td>49.078</td>
</tr>
<tr>
<td>Econ/Chg Continua</td>
<td>-0.100</td>
<td>-11.560</td>
<td>-0.038</td>
<td>-8.133*</td>
<td>-0.085</td>
<td>-13.606</td>
</tr>
</tbody>
</table>

F Value                  | 2542.610* |                   | 3770.245* |
R²                       | 0.3055    |                   | 0.3371    |
N                        | 34688     |                   | 44484     |

* significant at the 1 percent level
** significant at the 3 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
TABLE 19
ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES
FOR MONTHLY INCOME AND INDEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>INDEPENDENT VARIABLES</th>
<th>Zero order r</th>
<th>b</th>
<th>Beta Value</th>
<th>T-Value</th>
<th>Zero order r</th>
<th>b</th>
<th>Beta Value</th>
<th>T-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>---</td>
<td>-20.350</td>
<td>0.000</td>
<td>-4.564*</td>
<td>---</td>
<td>-66.010</td>
<td>0.000</td>
<td>-10.437*</td>
</tr>
<tr>
<td>Schooling</td>
<td>0.516</td>
<td>34.246</td>
<td>0.452</td>
<td>101.036*</td>
<td>0.504</td>
<td>42.374</td>
<td>0.503</td>
<td>104.265*</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.017</td>
<td>-30.174</td>
<td>-0.048</td>
<td>-12.394*</td>
<td>-0.085</td>
<td>-83.015</td>
<td>-0.113</td>
<td>-23.546*</td>
</tr>
<tr>
<td>Age</td>
<td>0.051</td>
<td>4.398</td>
<td>0.133</td>
<td>33.672*</td>
<td>0.071</td>
<td>5.641</td>
<td>0.149</td>
<td>31.501*</td>
</tr>
<tr>
<td>Industry</td>
<td>0.111</td>
<td>25.548</td>
<td>0.030</td>
<td>7.513*</td>
<td>0.077</td>
<td>49.765</td>
<td>0.058</td>
<td>11.974*</td>
</tr>
<tr>
<td>Rur/Urb Continuum</td>
<td>0.394</td>
<td>55.296</td>
<td>0.167</td>
<td>36.886*</td>
<td>0.228</td>
<td>37.657</td>
<td>0.113</td>
<td>21.992*</td>
</tr>
<tr>
<td>Econ/Chg Continuum</td>
<td>-0.166</td>
<td>-11.729</td>
<td>-0.031</td>
<td>-7.733*</td>
<td>0.013</td>
<td>-16.721</td>
<td>-0.052</td>
<td>-10.572*</td>
</tr>
</tbody>
</table>

F Value 3546.583* 2381.484*
R² .3150 .3030
N 46286 32882

* significant at the 1 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
TABLE 20

ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES
FOR AMENITIES AND INDEPENDENT VARIABLES

| INDEPENDENT VARIABLES | FEMALES | | | MALES | | |
|------------------------|---------|-----------------|---|-----------------|---|
|                        |         | T-Value         |   |                  |   |
|                        | r       | b               | Beta |                  |   |
| Constant               | ---     | 3.548           | 0.000 | 83.196*         | --- | 2.733           | 0.000 | 74.976*         |
| Schooling              | 0.474   | 0.228           | 0.337 | 66.341*         | 0.582 | 0.268           | 0.418 | 91.579*         |
| Monthly Income         | 0.275   | -0.000          | -0.029 | -5.954*         | 0.399 | 0.000           | 0.054 | 12.294*         |
| Age                    | -0.034  | 0.002           | 0.007 | NS*             | -0.059 | -0.001         | -0.003 | NS*             |
| Migrant Status         | 0.198   | 0.106           | 0.032 | 7.124*          | 0.106 | -0.078         | -0.025 | -6.419*         |
| Industry               | 0.033   | -0.207          | -0.023 | -5.451*         | 0.183 | 0.250           | 0.039 | 10.417*         |
| Rur/Urb Continuum      | 0.545   | 1.173           | 0.431 | 93.779*         | 0.504 | 0.798           | 0.301 | 71.388*         |
| Econ/Chg Continuum     | -0.182  | -0.297          | -0.099 | -22.652*        | -0.126 | -0.227         | -0.091 | -23.650*        |

F Value                 | 3440.678* |                           | 4845.660* |
R²                      | 0.4098    |                           | 0.4326   |
N                       | 34688     |                           | 44484   |

* significant at the 1 percent level
NS not significant at the 10 percent level

Source: Amostra de 1% dos Registros do Censo Demografico de 1970
### TABLE 21
ZERO ORDER CORRELATIONS, MULTIPLE REGRESSION COEFFICIENTS AND T-VALUES FOR AMENITIES AND INDEPENDENT VARIABLES

| INDEPENDENT VARIABLES | NONMIGRANTS | | | | MIGRANTS | | | |
|-----------------------|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                       | Zero order  | r | b | Beta | T-Value | Zero order  | r | b | Beta | T-Value |
| Schooling             | 0.641       | 0.295 | 0.444 | 108.633* | 0.379 | 0.174 | 0.266 | 47.823* |
| Monthly Income        | 0.410       | 0.000 | 0.030 | 7.726*   | 0.238 | 0.000 | 0.040 | 7.222   |
| Gender                | 0.087       | 0.402 | 0.073 | 22.724*  | 0.224 | 1.047 | 0.183 | 37.831*  |
| Age                   | -0.059      | 0.004 | 0.012 | 3.654*   | NS    | -0.003 | -0.011 | -2.266*  |
| Industry              | 0.163       | 0.234 | 0.034 | 10.212*  | NS    | -0.152 | -0.023 | -4.689*  |
| Rur/Urb Continuum     | 0.585       | 0.959 | 0.331 | 86.944*  | 0.434 | 0.938 | 0.361 | 69.912*  |
| Econ/Chg Continuum    | -0.284      | -0.356 | -0.108 | -32.380* | 0.087 | -0.167 | -0.066 | -13.522* |
| F Value               | 7514.655*   | | | | 2033.182* | | | |
| R²                    | 0.5320      | | | | 0.3021 | | | |
| N                     | 46286       | | | | 32882  | | | |

* significant at the 1 percent level
NS not significant at the 10 percent level

Source: Anostra de 1% dos Registros do Censo Demografico de 1970
LIST OF REFERENCES


