Department of Economics

Undergraduate coursework evaluation form

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Module code	J31
Student's name *or* ID number	J6845
Tutor's name	IW

Coursework item number

Coursework item mark 72

Date 10/5

Key: Your coursework can be evaluated using *some* or *all* of the criteria below. In most cases a grade is returned which shows that the criterion has been met to a standard described as follows

A	☐ excellent	*equivalent to a mark of*	70 or more
B+	☐ good		60–69
B–	☐ satisfactory		50–59
C	☐ needs attention		40–49
D	☐ unsatisfactory		39 or less
NA	☐ not applicable		

Structure

Is there an introduction?	Yes ☑ No ☐ N
▪ if yes, does it usefully explain the argument?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Is the order of the argument clearly explained?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Does the coursework avoid significant gaps or omissions?	A ☐ B+ ☐ B– ☐ C ☐ D ☐ N
Does the coursework avoid significant irrelevant material?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Is there a conclusion?	Yes ☑ No ☐ N
▪ if yes, does it accurately reflect the argument?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Is the coursework of appropriate length?	Too short ☐ About right ☑ Too long ☐ N

Analysis

Is there appropriate use of	
▪ significant concepts?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
▪ analytical models?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
▪ quantitative techniques?	A ☐ B+ ☐ B– ☐ C ☐ D ☐ N
▪ graphs and diagrams?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Is relevant evidence used to test hypotheses?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Are explanations clear and complete?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N

Sources

Does the coursework demonstrate wide reading?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Does the coursework avoid undue reliance on lecture notes?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Are arguments, quotes, and facts properly referenced?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N
Are items listed in the bibliography used effectively?	A ☑ B+ ☐ B– ☐ C ☐ D ☐ N

Style and presentation

Does the coursework avoid	
▪ spelling mistakes?	Good ☐ Needs attention
▪ mistakes of grammar?	Good ☑ Needs attention
▪ overlong or unfocused paragraphs?	Good ☐ Needs attention
Is the coursework clearly legible?	Good ☑ Needs attention

For other comments please continue overleaf:

Other comments: general evaluation Excellent work
Structure Good
Analysis Very thorough discussion and good empirical work
Sources OK
Presentation Good on presentation of the data

A study of contemporary migratory movements in Brazil.

Abstract

The determinants of internal migratory movements are varied and complex. While much focus has been placed in the past on social, cultural and psychological factors, it was only in the last 30 years that economic variables have become of increasing concern. Using new developed literature and models of economic effects on migratory trends, in this study I propose to reconcile different theories of migration in order to encompass the full determinants of migration in Brazil's extensive and composite territories. I shall conduct a time-series cross-sectional panel analysis using annual data from 26 Brazilian states from 1987-1996.

Word Count : 5440

Contents

Introduction

The issue of rapidly expanding populations and agglomerations, particularly in large cities, has been recognized by leading development economists and international agencies.

Brazil, the largest country in South America, and the world's 5th largest nation has experienced substantial political and economic problems related to the influx of populations to Rio de Janeiro and São Paulo. The rich and influential suburbs of Rio are surrounded by *favelas* occupying hundreds of thousands of immigrants from other areas in Brazil.

The aim of this extended essay is to use various theories on migration to try and understand the movements of populations within the country. There are currently 26 states in Brazil (one of which was created in 1989 – Tocantins- and shall not be explored due to lack of sufficient data), and I propose to conduct a time series cross sectional panel analysis on the determinants of the migratory process.

The period of analysis will be from 1987 to 1996 using annually collected data from the Brazilian Institute for Statistics and Geography – IBGE. The author has currently collected the following data to be used in the regression:

1) Population by State
2) Birth rates and Death rates by State
3) Unemployment levels by State
4) Average Salary across States
5) Gini coefficient by Region
6) Number of Establishments teaching primary level education
7) Number of Hospitals by State
8) Road Network (in kms) within States

It is hoped that the current study will aid in the formulation of policies to combat the problems of migratory movements in terms of increasing inequality and unequal distribution of income and wealth within Brazil.

Part II - Country Characteristics

The Federative Republic of Brazil[1], is the world's fifth largest nation exceeded in size only by Canada, China, the United States and Russia. As well as covering an area of 3,286,487 square miles and approximately half of the total land mass of South America, Brazil is the world's ninth largest economy. It extends 2,965 miles north-south and 2,691 miles east-west.

2.1 - The people

Brazil has for long been the melting pot for people of all races and cultures. And even though social interactions have not always been without exploitation, the tolerance of the Portuguese Brazilians for other cultures and peoples has minimized conflicts within the country.

During the years of Portuguese rule, between the 16th and 19th centuries, the slave trade brought 3,000,000 to 4,000,000 black Africans to Brazil. However, unlike the indigenous Indians, the Africans rapidly adapted as laborers and domestics in the sugarcane industry and later in gold and diamond mines, around the area of Minas Gerais. Following the abolition of slavery in 1888, the black population migrated away from the regions where they had previously been employed as slaves to other areas within Brazil. Nevertheless even though the population became increasingly dispersed, a heavy concentration persisted in the Northeast[2].

The majority of the Brazilian population (55%) is constituted of European descendants mainly as a result of the perpetual arrival of the Portuguese. For the most part of the first three centuries of Brazilian occupation, virtually all the Europeans to migrate to Brazil arrived from Portugal. The Italians were the largest of the non-Portuguese immigrants setting up in São Paulo and in the state of Rio Grande do Sul. Given their cultural and religious similarity to that of the Portuguese, the Italian immigrants rapidly blended into the local way of life.

The ethnic mix of the contemporary Brazilian population was further enhanced by the immigration of Germans in the 19th century and by that of the Japanese in the early part of the 20th century. However, since these populations were of a significantly different cultural and ethnical background to that of the existing Mediterranean peoples, their assimilation was less rapid taking three generations to be fully incorporated.

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[1] See Appendix 1
[2] see Appendix 2

The following pie chart displays the proportion of people living in Brazil in 1989[3] according to their ethnicity or race. The White population mostly includes Portuguese, German, Italian, Spanish and Polish descendants. The black populations have their roots in Africa and the *Mulatos* are a mixture between the White, Black and Indian populations. Those referred to as others are mostly of Japanese and Middle Eastern descent.

Brazilian Race Charateristics, 1989
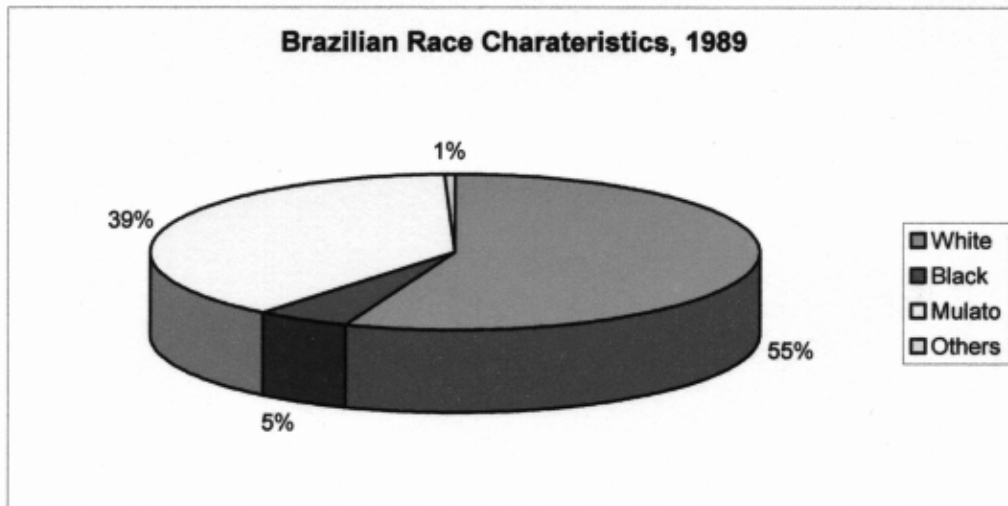

Source: IBGE

2.2 - Population Characteristics

As is common in many developing countries, the majority of the Brazilian population is young, though as the country is emerging the percentage of the population under 20 has declined to less than half of the total population between the 1970s and the 1980s, whilst the older age cohorts have begun to rise.

As the society has entered a period of modernization, there has been a move towards a lowering of the birth rate and a subsequent rise in the population's life expectancy. This suggests that Brazil has now entered an advanced period in the Demographic Transition Cycle, whereby there is a lowering both of the birth rate as well as the death rate leading to a more mature population. It is nevertheless interesting to note that there is a wide dispersion in the life expectancy rates between different regions of the country.[4]

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[3] IBGE

[4] The lowest life expectancy is that experienced in the Northeast with 51.57 years and the highest in the South (which is mostly inhabited by the German immigrants) with 67 years. The wide divergence between these regions is partly explained by the indigenous population characteristics and different weather conditions but more importantly by the higher levels of development (i.e. better access to health clinics) present in the South.

Life expectancy - Brazil and regions (1980)
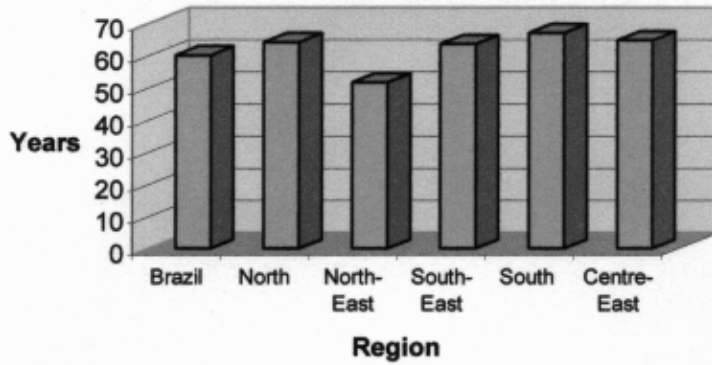
The following to two charts[5] show the projections of changes in the population size by sex and by different regions. As is easily verifiable by looking at the diagram below, the growth rates of both the female and male populations are relatively similar, suggesting that there is no need to weight their sumns in order to reach a population growth rate for the country[6].

Population growth trends (1980-2025)

Projected Population (000s) by region
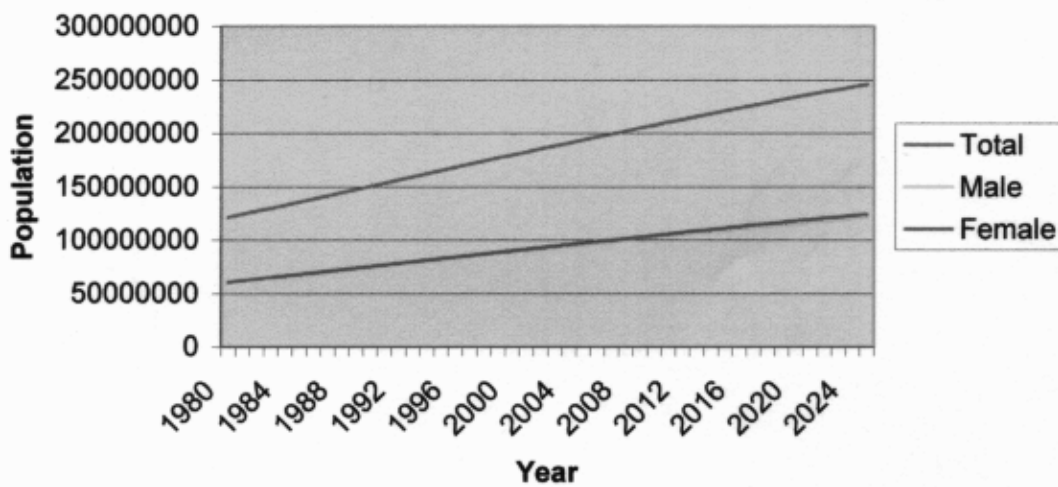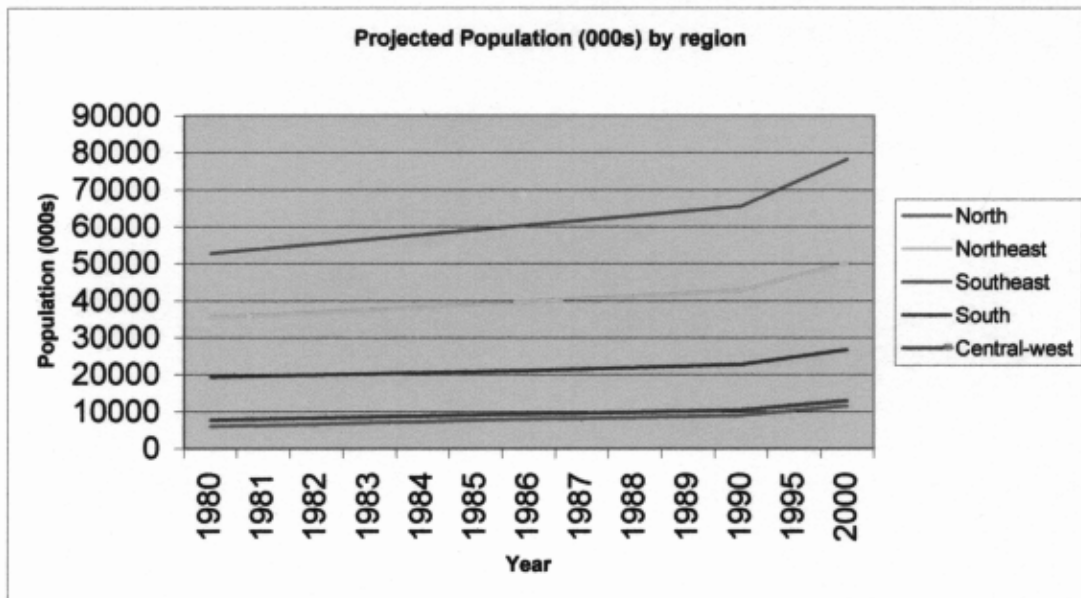
The relevance of this chapter for the remainder of the paper is that I believe it is important that the reader familiarizes him/herself with the surroundings of the country of interest. Brazil, being such a large nation makes it extremely difficult to efficiently distinguish the characteristics of her population. Nevertheless the currently available data has allowed me to draw a sketch of the underlying features of a multicultural developing society.

Part 3 – Theories of Migration

The act of migration is in the first place a natural instinct as opposed to a skill that has been learnt. As opposed to the millions of wild beast that migrate across continents in order to survive, the migration of human populations is by no means as simple. As we shall see migratory movements are underpinned by responses to institutionally set social and economic factors.

The topic of this research will address economic migrants – those moving in hope for a better life. In this section we will present two models of migration that have been extensively reproduced in the literature on the subject. What distinguishes this research from that analysed in the following theories, is that in the latter most are analysing the case of rural-urban migration. This paper does not as much focus on this issue but rather on the movement of populations between different regions. I shall thus adapt the proposed models and theories, when constructing a model to attempt to explain the determinants of migratory movements within Brazil.

3.1 - The Harris-Todaro Migration Model

Until the writings of Todaro, previous literature on migration had considered the transfer of labour to be a one-stage phenomenon whereby a worker moved from a low productivity rural job, directly into a higher productivity urban industrial job. Harris and Todaro (1970)[7] viewed this assertion as being over simplistic and not in line with observable data on developing countries. The fact that a worker could walk directly into a high productivity urban job suggests the existence of no unemployment in the urban sector. However, the empirical fact of chronic unemployment and underemployment throughout the Third World, leaves previous theories lacking in explanatory power.[8]

In the Harris-Todaro model, an emphasis is placed on migrants calculating the expected income in a certain period rather than the difference in income between the city and the countryside. The main characteristics distinguishing this key model are:

i) Migration is stirred chiefly by rational economic considerations whereby the entity weighs up the relative costs and benefits

ii) The underlying decision to migrate is dependent on "expected" rather than actual urban-rural real wage differentials[9]. The "expected" differential is calculated through the interaction of the urban wage and the probability of successfully obtaining a job in the urban sector[10]

In the Harris Todaro model there are two sectors: the urban industrial sector and the rural agricultural sector. The urban sector specialises in the production of a manufactured good, part of which is exported to the rural sector in exchange for agricultural goods. The rural sector has either the choice of using all its labour to produce agricultural goods for export, or it may wish to use part of its labour for export to the urban sector in return for wages.

The agricultural production function can be shown as:

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[7] Harris, J and Todaro, M (1970), "Migration, Unemployment and Development: A Two Sector Analysis", *American Economic Review*, 60
[8] Todaro, M (1969), "A Model of Labour Migration and Urban Unemployment in Less Developed Countries", *American Economic Review*, 59
[9] Todaro, M (1969), ibid, p140
[10] Thus the fact that the prevailing urban wage is significantly higher than the expected rural income is not the only factor influencing an individual's decision to migrate. If the probability of obtaining a modern sector job within the next year or two is very low, this must certainly influence the prospective migrant's choice as to whether or not he should leave the rural sector. As Todaro (1969) put it "a 70% urban real wage premium, for example, might be of little consequence to the prospective migrant if his chances of actually securing a job are, say, one in fifty."

$$X_a = q(N_a, \overline{L}, \overline{K}_a), \qquad q' > 0, q'' < 0 \,^{11}$$

where X_a is agricultural output, N_a is the rural labour used to produce this output, $\overline{L}$ is land and $\overline{K}_a$ is the capital stock (both of which are assumed to be fixed).

The manufacturing production function can be shown as:

$$X_m = f(N_m, \overline{K}_m), \qquad f' > 0, f'' < 0$$

where X_m is manufacturing output, N_m is urban labour used to produce this output and $\overline{K}_m$ is the capital which is assumed to be fixed.

The wage in the agricultural sector W_a is equal to the value of labour's marginal product in agriculture expressed in terms of the manufactured good:

$$W_a = P. q' \,^{12}$$

The wage in the manufacturing sector $\overline{W}_m$ is equal to the marginal product of labour in manufacturing (but strictly greater the institutionally set minimum wage). The expected urban wage is thus equal to the manufacturing wage adjusted for a share of the proportion of the total urban labour force N_u actually employed, $\dfrac{Nm}{Nu}$. Thus mathematically the expected urban wage is equal to:

$$W_u = \frac{\overline{W}m.Nm}{Nu}$$

In order that an equilibrium position occurs, the expected wage in the urban sector must be equal to that of the rural sector. At this point no further migration will occur. The labour market equilibrium under the Harris Todaro model is where:

$$W_a = W_u$$

The typical potential migrant to the urban sector will compare the long-run income he can expect to receive in that sector with that of the rural sector. The present value of the expected income stream if the individual moves to the urban is sector is:

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[11] the function is increasing at a diminishing rate following on from the law of diminishing returns

[12] $P = p\left(\dfrac{Xm}{Xa}\right)$ where p is the terms of trade of the agricultural good for the manufactured good

$$V_u = \int_0^T W u \, e^{-rt} \, dt - M$$

where T is the number of years remaining until the individual retires, r is his discount rate, and M are his out of pocket expenses of moving to the urban areas[13]. Migration is seen as a disequilibrium phenomenon and people migrate between different regions until expected incomes are equal, at which point equilibrium is re-established and there is no longer an incentive to migrate.

In many developing countries governments set an institutionally determined wage in the urban sector, which is higher than the equilibrium level. This leads to increased migration towards the cities since the expected wage in the urban sector rises. However, when the large influx of migrants arrive in the cities, the probability of getting a job is diminished (N_u rises) and the expected urban wage falls.

In extensions to their original model, Harris and Todaro added an informal urban sector to their analysis. The table[14] below briefly describes the characteristics of each individual sector.

Table 1: Characteristics of the Three-Sector Model		
Rural	**Urban Informal**	**Urban Formal**
low, flexible wages	low, flexible wages	high, downwardly rigid wages
full employment	underemployment	structurally limited number of jobs
job stability	job instability	job stability and advancement opportunities
no fringe benefits	no fringe benefits	fringe benefits

Todaro's critics such as Willis and Fields (1980)[15] have commented on various aspects of the model such as:

    i)   An inadequate elaboration of the relationship between the urban formal and informal sectors

    ii)   An implicit assumption that the labour of migrants is homogeneous

    iii)   There has not been sufficient empirical verification of the model's theoretical bases and the testing of its implications

Nevertheless the Harris-Todaro model, though perhaps somewhat simplistic, has added a great deal of value towards research in the area of migration.

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[13] for simplicity sake most authors consider the out of pocket costs to be negligible and thus ignore M

[14] Table extracted from Eaton, P (1992): "Rural-Urban Migration and Underemployment among Females in the Brazilian Northeast", Journal of Economic Issues, 26 (2)

[15] Willis, R and Fields, G (1980): "Comments on Todaro", *Population and Economic Change*, Chicago, NBER

3.2 - Lewis' theory of rural-urban migration under structural change

The Arthur Lewis 2 sector model of development which though rather simplistic in form, was an important starting point not only in terms of studies in migratory behaviour, but also in the advancement and formalisation of the study of development economics as a whole.[16]

In the Lewis framework, the underdeveloped economy consists of two sectors: the traditional, over populated rural agricultural sector characterised by zero marginal productivity of labour and a high productivity urban industrial sector. The existence of a pool of under utilised labour in the traditional sector was termed by Lewis as surplus labour. The labour was seen as a surplus in that it could be withdrawn from the agricultural sector and placed in the industrial sector without any loss of output in agriculture.

The following diagrams[17] aid in the explanation of the functionings of the model.
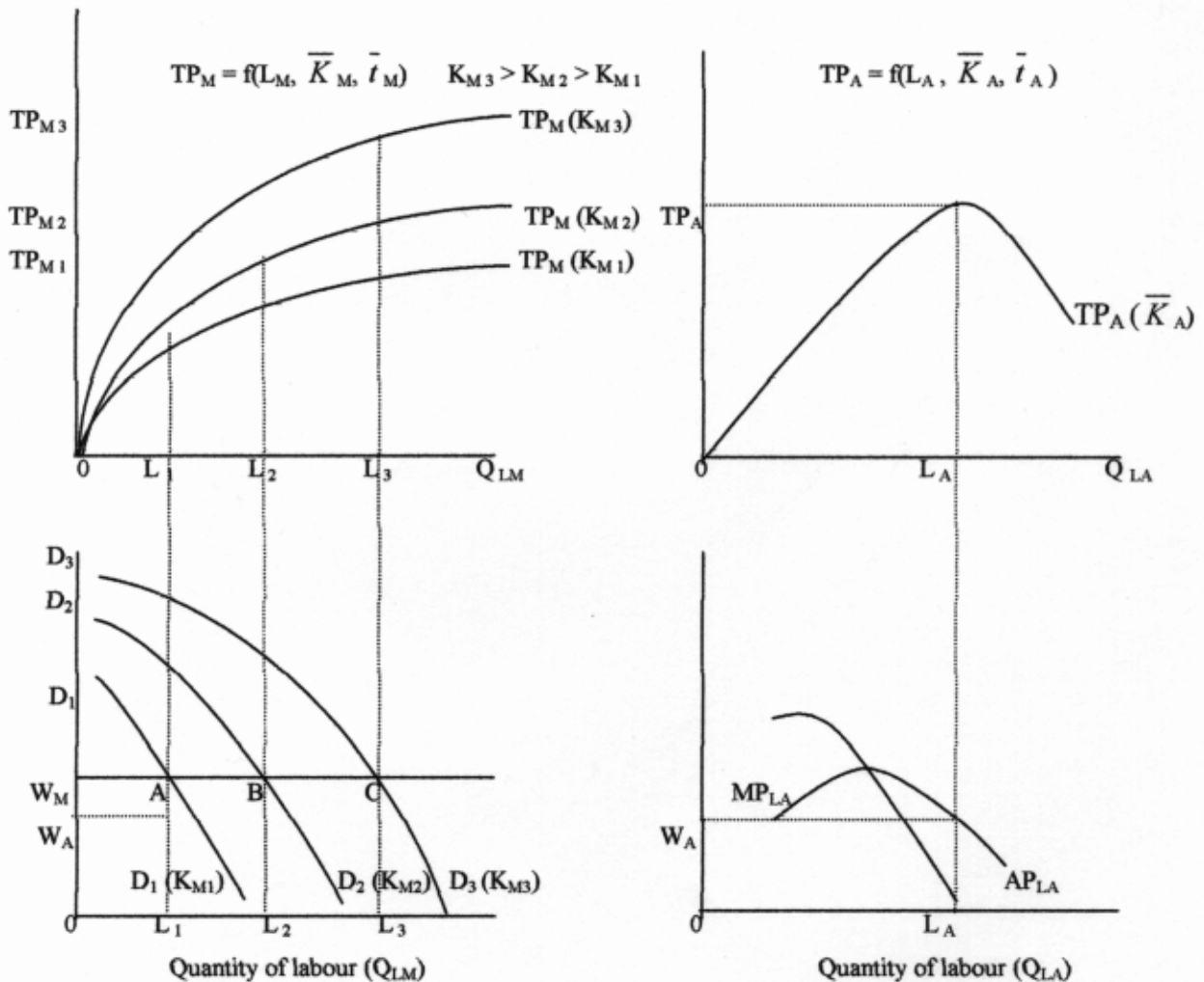
[16] Todaro, M (1997), op. cit.

[17] From Todaro, M (1997); *"Economic Development"*, England, Addison Wesley Longman

The two right hand side diagrams depict the traditional agricultural sector. The upper diagram shows how agricultural production varies with increases in labour inputs. In a typical agricultural economy Lewis assumed that production function is determined by changes in the amount of the only variable input, which is labour, given that the quantity of capital is fixed and the traditional technology does not change.

The upper left diagram depicts the production function of the modern industrial sector, where manufactured goods are a function of a variable amount of labour input, for a given amount of capital stock and technology.

W_A and W_M represent the wages in the agricultural and manufacturing sectors respectively. The differential in the wage between the agricultural and modern sectors was central to the Lewis model given that at the urban wage, supply of rural labour is assumed to be perfectly elastic. Thus employers in the urban sector can employ as many workers from the rural sector as they wish without increasing the wage. This condition implies a situation of profit maximisation by employers since they will hire labourers up till the point at which the marginal physical product is equal to the wage.

Let us assume that the economy is at the point whereby the total amount of output produced in the modern sector is TP_{M1} depicted by the area of the points $0D_1AL_1$. The share of the total output which is paid to the workers is thus equal to the area $0W_MAL_1$. The difference depicted by the area W_MAD_1 is considered as the total profits accrued by the capitalists. Due to the fact that Lewis assumes that all these profits are reinvested, the total capital stock will increase in the modern sector from K_{M1} to K_{M2}. This larger capital stock will lead to a larger product curve for the modern sector depicted by $TP_M(P_{M2})$. This extra product will need to be produced by more workers. Given that the employer can simply attract new workers from the agricultural sector without increasing the wage he will do so. There is thus an influx of migrants into the urban sector from the rural areas of the country[18].

The new equilibrium position can be identified at position B whereby L_2 workers are employed. This process of self-sustaining growth will continue up till the point where the marginal productivity of labour in the agricultural sector is not equal to zero – after this point the declining labour to land ratio will lead to lost food production in the agricultural sector. Beyond this point the urban sector can only draw on manpower from the agricultural sector by increasing the wage.

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[18] I often use the analogy of a water sledge in parks to look at this situation. When all the people have jumped into the sledge and are on their way to the pool, the attendant allows a further amount of people to follow.

The postulation that the marginal productivity of labour in the agricultural sector is equal to zero is on the whole false. Also the fact that entrepreneurs invest all their profits directly back into the firm are somewhat doubtful, and what seems to have occurred in many developing countries is the replacement of labour intensive production for capital intensive production and thus employment generating opportunities have been foregone.

Nevertheless, the Lewis model and the Harris-Todaro model, in particular, have provided economists with tools to build upon the structures of the migratory decision making process in developing countries.

Part 4 – Literature Review

I will now turn to a few areas relating to migration which have been debated and researched in recent years. Some have reached rather conclusive results whilst others have failed to add to our empirical knowledge on the subject. Most of this may be attributed to the lack of sufficient data on developing countries.

4.1 - The household and migration

The role of the family in the migratory process has been viewed by Mincer (1978)[19] where he assumes that net family gain rather than net personal gain will be the motivating migratory factor for households. Thus in a situation where moving to a particular destination involved a gain in earnings for one of the parties and a loss for the other, migration of the family would only occur if the absolute value of the gain was greater than the absolute value of the loss.

Developing on the household issue with respect to migration, Pratt and Zeckhauser (1987)[20] proposed the reduction of risk within the household as a determinant for migration. They put forward the idea that a family member might migrate in order to diversify the familial income-earning portfolio. By this they mean that if income away from home does not covary with that at home, then family's risk is lowered and there will be an incentive for a member of the family to migrate.

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[19] Mincer (1978)
[20] Pratt, J and Zeckhauser, R (1987): "Proper risk aversion", *Econometrica*, 55

Migration as a response to looking for a better life can be extended to include moves by parents motivated because of the advantage this may bequeath on their children and future generations. Developing further on this point, the issue of intergenerational altruism in motivating migration is one bearing considerable interest, leading to the reflection that migrant parents may consciously become impoverished as a result of moving, nevertheless consider migration since it will be positively reflected on future generations.

Tcha (1996)[21] tested the validity of this assumption on Korea and the United States finding that the regressions had high explanatory power, thereby suggesting that intergenerational altruism occurs.

4.2 - Unemployment and income differential effects on migration

In the Harris-Todaro framework, rural-urban migration is seen as a process of job search, where better paid jobs are assumed to exist in the urban sector. Migrants are attracted to the city due to the differential between urban and rural wage, but at the same time are discouraged from moving as unemployment in the urban sector rises.

Contrary to this belief, Herzog et al. (1993)[22] by including an unemployment dummy variable into a regression of individual migration outcomes, find that individuals that are already unemployed are more likely to migrate.

Yap (1976)[23] informs us that income differentials are an important determinant in decisions to migrate in Brazil. He finds that except for migrants from the East of Brazil, their incomes are at least 50 percent higher than rural non-migrants – a difference which exceeds the cost of living differences. The table[24] below shows Yap's results for predicted monthly incomes for white males by migration status.

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[21] Tcha, M (1996): "Altruism and migration: evidence from Korea and the United States", *Economic Development and Cultural Change*, 44, (pp859-878)

[22] Herzog, H; Schlottman, A and Boehm, T (1993): "Migration as a spatial job search: a survey of empirical findings", *Regional Studies*, 27, (pp327-340)

[23] Yap, L (1976): "Rural-Urban Migration and urban underemployment in Brazil", *Journal of Development Economics*, 3, (pp227-243)

[24] Yap, L (1976): "Rural-Urban Migration and urban underemployment in Brazil", *Journal of Development Economics*, 3, p235

Table 2: Predicted monthly incomes for white males, 20-29 years, without formal education, by migration status			
Migration Status	Region		
	Northeast	East	South
Recent (0-4) rural-urban migrant	3.8	3.1	5.1
Less recent (5+) rural-urban migrant	3.9	4.6	5.3
Rural nonmigrant	2.5	2.6	3.5

4.3 - Availability of amenities

Though casual observation would immediately imply that people seek areas which have the best availability of good schools, sanitation and services (e.g. electricity), we should be more interested in finding out how important these variables really are in influencing individual's decisions as to whether they should relocate or to stay.

Even though some studies such as that of Clark and Cosgrove (1991)[25] have tackled this issue for developing countries, there is currently no systematic evidence on this for developing countries. The fact that in most developing countries there is a severe lack of data over a time span has seriously constrained proposed studies.

Part 5 – The Model

In order to address the principal question of the determinants of migration in Brazil, I have used a mixed time-series cross-section panel of migration figures for 26 states from 1987-1996. The choice of variables was constrained by the availability of reliable data throughout the time span of the study.

In estimating the model I have tried to encompass the main factors influencing peoples decision to migrate. I have included in my model, therefore, an educational variable, a transport variable, an economic variable, a social variable and a health variable. All variables have been standardized as to give more accurate measures of regional effects.

All the data was gathered from the IBGE, from yearly publications.

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[25] Clark, D and Cosgrove, J (1991): "Amenities versus labour market opportunities: choosing the optimal distance to move", *Journal of Regional Science*, 31, (pp311-328)

5.1 - The dependent variable

The dependent variable in this model is net migration in each state for a period of 10 years. This availability of data allowed me to calculate net migration using the following equation.

$$NM_{ti} = Pop_{ti} - (Pop_{(t-1)i} - Death_{ti} + Birth_{ti})$$

Where Pop_{ti} is the population of state i at time t, and $Pop_{(t-1)i}$ is the population last period. Death and Birth refer to death and birth rates in state i at time t. The variable has been standardised dividing NM by the by the total population. I have assumed there is no international migration as figures are very limited and in most cases insignificant.

5.2 - The explanatory variables

Existing literature, economic theory and availability of suitable data have determined my subsequent choice of explanatory variables in the model. The best befitting variables appeared to be: expected wage, accessibility to health, accessibility to primary education, Gini coefficient this period and lagged by one period and transport variable. I will now look at each individual variable drawing attention to its particular relevance for appearing in the model.

Expected wage variable

The expected wage, used in the Harris-Todaro model, has been calculated as the average number of minimum salaries per household, multiplied by the probability of attaining a job[26]. This variable like in the Harris-Todaro model, examines the economic factors for a person migrating[27].

Gini Coefficient:

The Gini coefficient gives a shorthand summary of the relative degree of income inequality in a particular state. This allows us to measure possible social factors inducing people to migrate

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[26] The proxy for the probability of getting a job is given by $\dfrac{1}{Unemployment}$.

[27] If the expected wage in state i is larger than in state j, then a person is likely to migrate to increase their wealth and therefore living conditions There is an underlying assumption that agents are risk neutral. Were we to consider them to be risk averse, then migration would only occur at a premium to the expected wage.

or to stay in their state of birth. Kuznets (1966)[28] suggests that at primary levels of growth, inequality rises, whereas at later stages it will improve leading to an "inverse U" Kuznetz curve. The inclusion of this variable in the model is that I believe that people will move to areas where inequality is perceived to be lower.

Primary education variable

Primary education is given by the number of primary schools in a given state, divided by the total number of population. Ideally this standardization would have been concluded using the population in primary education age cohort, however this data is not available. I have used general population figures, therefore, which standardises this variable in likeliness to the dependent variable. The theory for including this variable is that parents are naturally concerned about their children's education and will seek better educational facilities and will move to areas with better access to education.

Health variable

Health is of importance to us all, and access to it determines where most of us choose to live, no matter if in developed or developing countries. In Brazil this is no different and hence its inclusion here. I have gathered information, like for education, on the number of health institutions (hospitals, clinics, etc.) standardised by the total population of that state. I believe that in terms of self-preservation, a characteristic that is positive on the majority of people, health accessibility is quite relevant for examining differences between countries and regions within a given country.

Transport variable

Unlike other Earth migrants, mainly of the animal population, humans depend on set routes for migration and transportation. The biggest method of transport is still roads and its extension and condition will effect whether we can move around a designated Region. Dividing the total number of kilometres of roads in each state by the total area of that state, I have reached a variable that hopefully will allow me to measure the effects of road access throughout a state, on net migration.

The final form of my model, taking into account all the above variables is as follows:

$$NM_t = \alpha + \beta_1 ExW_t + \beta_2 Educ1_t + \beta_3 Health_t + \beta_4 Roads_t + \beta_5 Gini_t + \beta_6 Gini_{t-1}$$

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[28] Kuznets, S. (1966), Modern Economic Growth, Yale University Press.

5.3 – Empirical results and analysis

Estimating the data sample by OLS the model produces the following results.

Variable	Coefficient	Std.Error	t-value	t-prob
Constant	-0.0012490	0.034317	-0.036	0.9710
Roads	-0.40413	0.082133	-4.920	0.0000
Gini	0.17471	0.080335	2.175	0.0306
Gini_1	0.18639	0.077690	2.399	0.0172
Educ1	8.3228	1.6944	4.912	0.0000
Health	26.500	9.7950	2.705	0.0073
ExW	0.0070157	0.0029273	2.397	0.0173

$R^2 = 0.203861$ $F(6, 251) = 10.712 [0.0000]$ $\sigma = 0.0149528$ DW $= 1.91$
RSS $= 0.05612026522$ for 7 variables and 258 observations

AR 1- 2F(2,249) =	7.3728 [0.0008] **
ARCH 1 F(1,249) =	0.00070622 [0.9788]
Normality Chi^2(2)=	699.48 [0.0000] **
Xi^2 F(11,239) =	1.1581 [0.3173]
Xi*Xj F(25,225) =	0.81288 [0.7237]
RESET F(1,250) =	3.1663 [0.0764]

The results of the regression are displayed above and display some interesting properties. At first glance we note that all the variables included are significant at the 5 percent level, except for the constant term. I shall now briefly analyse each variable individually.

The road network variable (Roads) is highly significant without a possibility of being rejected at any significance level. Theory would suggest that as a region becomes more accessible there is a higher scope for migratory movements. This is due to the reduction in transportation costs from one area to another and the fact that agglomeration effects will be enhanced by good locational indicators. Our model displays a negative coefficient suggesting that as the road network improves, there will be a reduction in migration. This can perhaps be explained by the fact that as areas are better served by road networks, individuals may commute to their places of work. Also, as roads are more readily available firms may wish to locate their operations in this area (due to a lowering of transportation costs) leading to a higher demand for labour and a smaller requirement for migration.

The coefficient displaying inequality in the region – the Gini – would normally be expected to be positive. This is due to the fact that as an area becomes increasingly equitable there will be more opportunities for wealth enhancement leading to an influx of foreign labour. The variable is significant and positive for both the current as well as the lagged period, informing us that individuals look at social infrastructure within the region across time.

Education can be viewed as a good proxy for individual's response to changing economic and political situations. The more educated an individual the more risks he/she will take and the more informed he/she will be. Migration has been previously shown to occur in response to information from prior migrants and family. It can be argued, therefore, that as an individual is more educated, especially with the means to read and write, that they will be able to react more responsively to situations. It can also be argued that parents seek a better education for their children and will thus forsake current consumption by migrating to other regions in order to improve the future perspectives of their offspring. Since our primary education is highly significant and positively correlated we can at least propose that individuals migrate for the latter reason exposed.

It can be safely assumed that people seek a better life and with it better health. Developing countries are often at a deficit when it comes to health provision. Provision is extremely expensive and governments find it very difficult to supply the funds (this can partly be pointed to the stringent structural adjustment policies implemented by the IMF and the World Bank). Nevertheless, good health provision is likely to induce the migration of individuals from external areas leading us to expect a positive coefficient. Fortunately our health variable is significant and positive.

Following the methodology of the Harris-Todaro model the coefficient on expected income should be positive. Even though the coefficient is quite small suggesting that the expected wage variable does not have a large impact on migration, it is positive and significant.

The coefficient of determination R^2 displays a relatively low value. It does not however signify that the model has low explanatory power since in panel data it is often ignored. I will thus not draw much attention to this result. More important is the F-test for significance of the model – this tests for the joint insignificance of the explanatory variables (e.g. $\beta_1 = \beta_2 \ldots = \beta_5 = 0$) – and since we can reject this test at any significance level, our model appears to be well specified.

The σ is the standard deviation of the residuals, where the latter refers to the portion of the dependent variable that is not explained by the regressors. The square of this value provides the variance of the residuals, which is assumed to be zero in the Classical Linear Regression assumptions. There is a need for the value of σ to be as small as possible – in the case of this model the value (0.0149528) causes no concern.

The Durbin Watson test for serial correlation in the error term is near 2 suggesting that there is no autocorrelation[29]. The AR test for first order autocorrelation tells us that the error terms are not serially correlated but the second order ARCH tests displays autocorrelation[30]. Nevertheless I would like to point out that the White's test and the Breusch Pagan test for heteroscedasticity both show that this is not present in the sample. Heteroscedasticity leads to similar problems as autocorrelation and is due to the fact that the variance of the error term is not constant across the sample.

The RESET test is testing for the functional form of the model (i.e. whether the model is in the correct form, log linear or linear for example). Our model does not show any problems in this area. Finally we look at the normality test which in our case is highly rejected. This would not allow us to perform t tests and F tests on the data but since we have 250 degrees of freedom we need not be worried about the normality assumption (i.e. the error terms are normally distributed).

Limitations of the model

Like any econometric or statistical model, the main limitations arise with the gathering of data. Polynomial estimation was used to gather information for states where more than two years of data were unavailable for any one variable. Another problem as has been mentioned, arose in the standardisation of certain variables. The education variable, for example, was standardised using the total population for state i at time t, where a more accurate measure would have been obtained if the data had been standardised using the relevant figure in the primary level age cohort. After careful analysis, the inclusion of fixed effect dummies was also deemed unnecessary, as the scope of the study was to view migration within the Brazilian territory as a whole, and not between individual states. Therefore, the fixed effect dummies would lead to the inclusion of irrelevant variables for this particular model.

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[29] Non-autocorrelation suggests that the error terms do not covary and are thus independent. A failure of this test would not lead to biased coefficients but they would be inefficient (i.e. we would accept irrelevant variables and reject relevant ones).

[30] At this point it is important to indicate that in the case of panel data, rejection of non-autocorrelation and homoscedasticity is not viewed as a problem. This is because panel data is a mixture of cross sectional data (where autocorrelation is not relevant) and time series data (where heteroscedasticity is not important).

Part 6 - Concluding Remarks

The problem of excess migration still remains a vital issue for policymakers in Brazil and many other developing countries. Large influxes into the cities create slums with thousands of inhabitants leading to social and political unrest. The analysis contained in this paper lends to the idea that migration can be explained by an amalgamation of social and economic variables. It is this mixture that provides influential signalling information for the migrant, prior to taking the decision to move.

Migrants often suffer from the illusion of a better life in cities or other regions of the country. This is due to lack of information about the particular areas they are migrating too. Often wages in the informal sector in urban areas are lower than the agricultural wage. Unemployment is also high and entry into the formal labour market difficult, due to low skill levels. If this kind of information reached the individual before a decision was made, then other policies to reduce migration flows could have increased efficiency. Domestically, a greater number of improved education and health facilities would also negatively effect migration figures. Relative income inequality is also a major policy area to be looked at. If this can be reduced then effective reduction of migration figures could then be achieved.

Although this paper is limited in content by its size restriction, I believe the main arguments on the migration debate in Brazil have been addressed. Overall, it seems that migration theory provides adequate analysis and solutions for this ongoing problem in developing countries.

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Appendix 1: The Regions of Brazil

Population Density - 1996

Inhabitants/km

- 1 to 2
- 2 to 10
- 10 to 50
- 50 to 100
- 100 to 12 881.4

Km

0   100   200