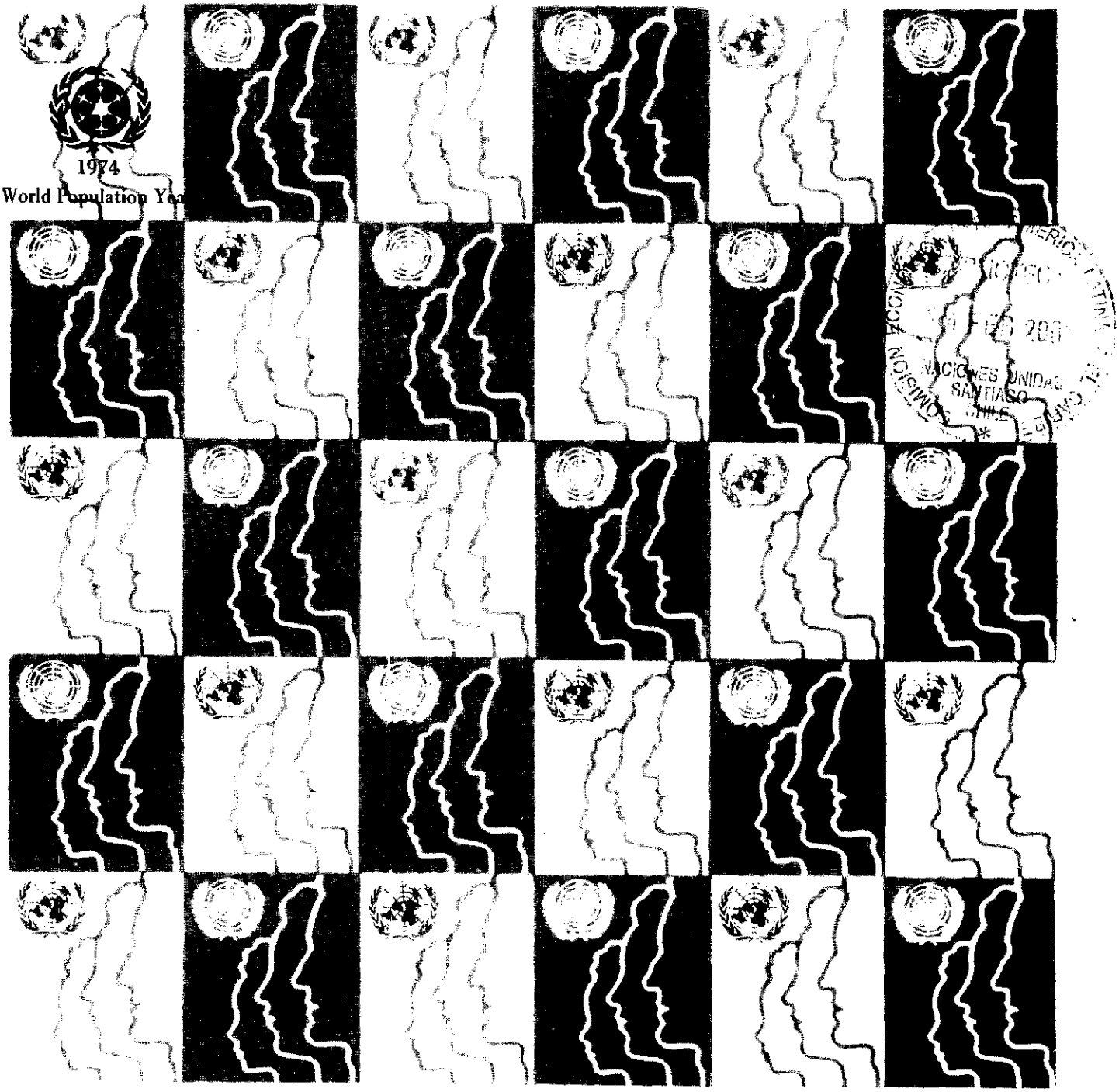
Stylianos Athanassiou

URBANIZATION AND INDUSTRIAL DEVELOPMENT IN LATIN AMERICAN COUNTRIES



Serie A, N° 125 Julio de 1974 Santiago de Chile

Centro Latinoamericano de Demografía celade

ERRATA

Page	Reference	It reads	It should read
44	In the linear equation 4*	2483.1	-2483.1
44	In the logarithmic equation 1* the standard error of estimate should appear		(0.1810)
46	Line 6	56 000	12 000
47	Line 19, in the formula of income elasticity	:	.
48	Line 14	10.65	10
48	Line 15	10.65	16.5
48	Line 18	10.31	13.1
56	Line 11	Colchagua	Aconcagua
56	Line 21	3981	4891
59	In the linear equation 3*	-	+
69	Line 3	10.23	12.3
91	Line 29, add Guatemala after Costa Rica		
[illegible]	Line [illegible]	[illegible]	[illegible]

CELADE

CENTRO LATINOAMERICANO DE DEMOGRAFIA

Distribución Interna

Stylianos Athanassiou

Serie A, N°125
Julio, 1974
150

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Acknowledgment

I would like to express my warm thanks to the Director of the Centre, Miss Carmen A. Miró and the Deputy Director of the Centre, Professor Juan Carlos Elizaga, both for their idea of the study of the problem in question as also for their contribution in the completion and presentation of the work. I particularly express my thanks to Professor Juan Carlos Elizaga for his guidance and his outlining of the general purposes of the study and his constructive remarks during the procedure of the work. Furthermore, I wish to thank to the colleagues Messrs, R. Mellon, J. Arévalo, J. Alberts, A. Fucaraccio, W. Pecht who participated in the conference of 31st October 1973, conducted by Professor J. Elizaga for their remarks, which were taken into consideration during the investigation of the problem under study. I also feel obligation to my assistant, Mr. Guillermo Mundt, who carried out the heavy task of collection and elaboration of the statistical data, and express my thanks to him. The calculations were carried out at the electronic computer of the Centre and, on this occasion, I express my thanks to the manager of the section, Mr. Santiago Vásquez and Mr. Juan José Calderón, who showed the greatest willingness to serve me. I extend my thanks to Mr. Carmelo Soria, Chief, Publication Department of the Centre, for his assistance and cooperation with the author, throughout the various stages of preparing the first draft for publication. Finally, many thanks are due to Mrs. Erica Wulff for typing up the first draft and to Miss Anita Esquivel for typing up the final text of the present work.

ABSTRACT

The present work is a contribution of the author to the investigation of the problem of urbanization and industrial development for the Latin American countries. As we mention in the determination of the problem under study, urbanization, which is a world phenomenon, and the industrialization of the country, are problems for each country to solve, targets of the economic plans and state policy. Furthermore, the development of these two magnitudes is an index of socio-economic growth of the country. What is the role of industrial development which, in its broader sense, means economic development, in urbanization? What are the economic-demographic factors which influence urbanization? Does the development of these two dimensions occur concurrently and to what degree? What are the consequences in the case of negative answers to the previous question? Are population redistributions expected between the Latin American countries? And what extension and what countries? Such questions and other similar questions arise during the analysis of the aforementioned problem.

The need to investigate this problem, as regards the influence of the industrial development on urbanization and the existing relationship between them, from the point of view of their development, became evident for the Latin American countries, where urbanization experienced a large extension in the last decade 1960-70, while these countries were in the stage of economic growth. Similar works have been undertaken for the European countries. Most correctly, therefore, did the Centre manifest the desire to realize such a study. Further to the answers which will be given to the above questions and from which those components will be able to exercise the policy indicated on urbanization and industrialization, the conclusions drawn can be probably used by other colleagues of this Centre who study subjects similar to the above, and also by the author during the study of the problem of economic growth by constructing an economic-demographic model. Finally, the comparative data regarding the degree of development of urbanization-industrialization among the Latin American countries will be useful for international comparisons.

INDEX

Index of Tables

Index of Charts and Diagrams

Charts

Diagrams

I. THE PROBLEM

1. In general

Since the end of World War II, and especially during the past two decades (1950-70), economic growth has become the main problem for solution of economic plans and state policy of all countries, regardless of their economic progress and their socio-economic standard of living. Economic growth, in its broader sense, means the maximization of socio-economic prosperity. As it is known, the main "dimension" of the degree of economic growth is the size of per capita income.[1/]

Furthermore, it is known that the rise in the level of economic development is mainly achieved by the development of the industrial sector of the economy, which has greater possibilities. It has been proved that there is a high degree of correlation between the per capita income and income from the industrial branch of the economy. Therefore, the increase of industrial production, both in the economically developed countries and in the less-developed ones, is a principal aim of the responsible state agencies. More specifically, in the less-developed countries,[2/] the whole problem of industrial development is of greater importance, and consists in the objective aim of all the efforts made by the state. This is obvious, because in these countries, the per capita income is at a low level, and industry is in the first stages of development. These countries desire the most rapidly possible

1/ This index, of course, must be supplemented with other economic magnitudes, such as the composition of consumption, income distribution, employment, productivity and education. This index of economic growth presents many difficulties as regards the statistical estimation of elements, referring both to the national income as also to the population, but has international acceptance.

2/ As a rule, less-developed countries have a per capita income of less than 25 per cent of the corresponding per capita income of the U.S.A. These countries, mainly Africa, Asia and Latin America, contain two-thirds of the world's population.

increase in per capita income, which is achieved, as aforementioned, mainly by the increase of industrial production and entry into the area of the economically developed countries.

Industrial development, as we shall see below, created the primary incentive for urbanization of the population. As it is known, urbanization of the population means, mainly, a movement of the agricultural labour force into the industrial sector of the economy. To this movement of the population, there also contributed, of course, the development of the tertiary sector of the economy, which is also the result of industrial development.[3/] Consequently, the urbanization of the population in each country, apart from certain exceptions, had an extent proportional to the degree of industrial development. On the basis of the above, we can say that the urbanization of the population is a function of industrialization.[4/]

Finally, if the movement of the agricultural labour force towards the industrial branch of the economy, is made to cover the employment opportunities created in the secondary production, then we can say that the urbanization of the population of the country takes place symmetrically with industrial development. This can be said in a general point of view, that the proportion of the urban population, particularly that employed in the secondary sector of the economy, consists of an indication of the economic growth of the country being effected.

2. Specification of the problem. Its purposes

In the previous section we said that, economic growth, speaking broadly, means industrial development which creates employment opportunities in accordance with its rate of growth. Furthermore, we accepted that industrialization of the country greatly influences the urbanization of the population

3/ There is a positive correlation of these two branches of the economy.

4/ Of course, urbanization is also attributable, apart from the industrial development realized, to other reasons. These reasons are social, cultural, etc. In addition to the above causes, the mechanization of the agricultural economy and the increase of agricultural productivity, contributed to the movement of the farmers towards the urban centres of the country, in search of employment, on account of the increase in unemployment in that sector of the economy.

of the country. In the general description of the problem under study, we also said that if urbanization covers the needs created in labour force in the secondary branch of the economy, then it can be said that the development of urbanization is symmetrical with industrial development. This can be said in general as follows: if the movement of the agricultural population towards the urban centres (urbanization) is proportional to the extent of the secondary production, then urbanization can be considered as an ideal kind of domestic mobility of the population, because it facilitates the industrialization of the country. Finally, we said that the symmetrical development of urbanization and industrialization can be considered as an index of economic growth of the country, and that the per capita income is used as a measure of the degree of socio-economic prosperity of the country, disregarding other characteristics, like social conditions, cultural patterns and so forth.

Based on these conclusions, we can determine the purposes of this work which, in general, are the following:

a) The analysis of the existing functional relationship between urbanization and industrialization. In other words, the estimation of the influence of the industrial development on the increase of the urban population of the country (or a geographical region).
b) The testing of the development of urbanization and industrialization from a symmetrical point of view.

More specifically:

The analysis of the functional relationship between urbanization and industrialization will refer to the case of Chile at the national level. Furthermore, we will investigate the aforementioned relationship from the point of view of the regional problem of the country.

The testing of the development of urbanization and industrialization will be realized for all the Latin American countries, at a national level and, in the case of Chile, this investigation will expand to the regional level.

3. Usefulness of the study. Its structure

The usefulness of the work, on the basis of the conclusions derived from the analysis of the whole problem of urbanization and industrialization, will consist of the following:

a) In the determination of the main economic factors which contribute to the population movements of the rural areas towards the urban centres and which factors, in the broader sense consist of an index of the industrial development of the country. Furthermore, in the exercise of the indicated policy on the basis of the degree of the influence of these factors on the urbanization of the country.

b) In the determination of the main factors (demographic and economic) prevailing in the regional problem of the country and the investigation of the correlation between these factors.

c) In the making of forecasts as regards the development of the urban population of the country, based on economic factors. The points of (a), (b) and (c) will refer to the case of Chile, as mentioned in the previous section.

d) In the determination of the countries of Latin America, where the development of urbanization is parallel to industrial development.

Finally,

e) In the investigation of the probable case of the anticipated population movements in the coming years in Latin American countries, based on their rate of growth and especially on the basis of the development of urbanization and industrialization.

The above will provide a general view of the problem of urbanization and industrial development in Latin American countries and the possibility of outlining the indicated policy, on this problem, at a national level by the responsible state agencies. Regarding the specific case of Chile, because of analysis of the problem at a regional level also, this policy can be expanded by region. This policy will mainly consist of the advancement of industrial development in those countries where urbanization preceded the country's industrialization and the acceleration of urbanization in those instances in which urbanization does not develop symmetrically with industrial development, with

the aim of achieving, in both the above mentioned cases, an equilibrium between urbanization and industrialization. In other words, the social and economic measures to be adopted by the state, will refer to the retardation or acceleration of the urbanization of the population of each Latin American country, according to the development already realized or anticipated in the secondary branch of the economy of each country, as also regional development in the case of Chile.

The work consists of six chapters. In the first chapter, we describe the problem to be investigated in its general and specific form, as well as the purposes and the usefulness of the study. In the second chapter, the hypotheses are given, the methodology to be applied for testing the hypotheses, as also the general economic aspects of the problem. Furthermore, we describe, on the one hand, the econometric model which will be applied for testing the relationship between industrial development and urbanization; on the other hand, the symmetry model from the point of view of its use and its broad interpretation. The analysis of the development of the urban population in Chile at a national and regional level is realized in the third chapter. This analysis will facilitate us in the investigation of the functional relationship between urbanization and industrialization. In the fourth part, the statistical results obtained from the investigation of the relationship between urbanization and industrial development, in the case of Chile, are presented. Furthermore, in this chapter we examine the regional problem of the country, by determining the main factors which prevail in it, and by investigating the existing relationship between regional economic development and urbanization. In the fifth chapter, we apply the symmetry model for Latin American countries. Moreover, the results obtained from the application of the aforementioned model are included in this chapter. Finally, in the last chapter (sixth chapter) a review of findings is made, and a summary of general conclusions is presented.

II. THEORETICAL CONSIDERATIONS. HYPOTHESES. METHODOLOGY. MODELS

1. General aspects for a theoretical consideration of the problem

Urbanization and the increase of the earth's population are the two most important trends which are ascertained in the Demographic Yearbook of the United Nations in the last decades. The urban population of most countries, economically developed and less-developed, was doubled during the period 1940-70. This very rapid growth of urbanization of the population on an international scale is the most revolutionary phenomenon of modern times. People nowadays prefer to live in the cities and especially in the metropolitan regions and the capitals of countries, where the largest population movements are realized.[5/]

The migrants of urban areas come mainly from the agricultural regions. Mechanization of agricultural work and the increase of productivity resulted in a large part of the agricultural labour force being underemployed. The results of this underemployment was the small increase in the farmer's income but also of the total national income. Furthermore, it is known that the output of the work of residents in the agricultural regions is not proportional to the effort made. It is estimated that returns from work in agricultural regions is less than half the returns from work in the industrial centres. A consequence of the employment conditions, the return for work and the income of the agricultural areas, is the movement of the population of these areas towards urban areas. Of course, employment and income can be considered the most important factors which drive the population from these areas, but not the only factors. Apart from the aforementioned main factors, other factors

5/ The population of Buenos Aires amounts to 8.3 million inhabitants, and represents 35.9 per cent of the total population of the country. Santiago de Chile has 2.7 million inhabitants (30.1 per cent of the total population of the country), while the population of Montevideo consists of 43.3 per cent of the total population of the country (1.2 million inhabitants), during the census year 1970.

have also contributed to the mobility of the agricultural population towards the industrial areas. These factors are social, political, cultural and demographic, the analysis of which is not included in the purposes of this study.[6/]

On the other hand, the secondary branch of the economy shows a rapid growth in all the economies. Its rate of growth follows an upwards trend. A result of the development of this branch is an increase in job opportunities, which means an increase of demand for labour force in secondary production as stated above, by the supply of agricultural labour force, which moves towards the industrial sector of the economy. Furthermore, industrial development causes a rapid increase of the per capita income of this sector of the economy. In fact, in the industrial centres, the per capita income is at a higher level than that of the agricultural sector, and its rate of growth is larger than the corresponding rate of growth of the agricultural income. Furthermore, as it is known, the high income results in formulation of high rates of wages. In general, it can be said that the size of the labour market in the urban centres, the high level of wages and the differentiation of social and cultural conditions between the rural and urban areas, are the basic causes attracting labour force from the rural areas to the urban areas. Finally, it must not be overlooked that the supply of labour hands to the secondary branch of the economy has increased not only industrial productivity, but also the national income of the country.

6/ Of course, the urbanization of the population of the country creates many problems, social, traffic, housing, atmosphere polution, etc. In spite of all of this, we aid as much as possible the entry of farmers to the industrial centres. This is because the economic growth of the country depends mainly on industrial development. Furthermore, it is known that the rate of growth of a country is determined, apart from other factors, as for instance per capita income which is considered the main dimension of economic development of a country, by the proportion of the rural population to the total population. In other words, the higher this proportion is the more economically underdevelopment is the country. Of the European countries the proportion of rural population to the total population has as follows: Austria (50 per cent), France (30 per cent), Greece (43 per cent), Netherlands (20 per cent), Sweden (22,2 per cent), Turkey (70 per cent), United Kingdom (22 per cent). In certain Latin American countries is as follows: Argentina (26,3 per cent), Chile (31,8 per cent), Venezuela (32,6 per cent), in the year 1960.

In conclusion, we can say, following what has been outlined above, that the urbanization of the population, which consists of a movement mainly of economically active population from rural regions to the industrial centres -which are the urban centres of a country- was caused by industrial development and the application of purely economic laws, as regards the return for work and employment conditions. Of course, the size of urbanization differs from one country to the other, and in many cases, is not proportional to industrial development, insofar, as has been stressed, the concentration of population in the metropolitan areas is also attributable to other reasons, not economic ones.

2. Basic hypotheses. Methodology

It was previously mentioned that the size of the labour market, particularly as regards labour demand in the secondary sector of the economy, continuously increases, because of the development of this sector. Furthermore, employment conditions in the industrial centres are better, in comparison with the rural regions, and nowadays are improving. Finally, the per capita income of the industrial sector is quite high, and its rate of growth is greater than the rate of growth of the agricultural income. We have conclusively accepted that the above situations prevailing in the secondary branch of the economy, as also the further anticipated improvements in these situations, are the main causes of attraction of the agricultural population to industrial production.

On the basis of the above, we can formulate the following hypothesis as regards urbanization and industrial development: that industrial development (cause) influences the evolution of urbanization (effect). In other words, the increase of urbanization of the population of a country is the result of the industrialization of the country. Furthermore, given this relationship, the question arises, what is the degree of influence of industrial development upon population movement towards the secondary sector of the economy. To test this hypothesis, regression techniques will be used and data time series (upon the observations of the years 1960-70). As a dependent variable,

Note: The terms "economically active population" and "labour force" are used with the same meaning in the present work.

internal migration towards the urban centres will be used, and as independent variables, certain factors which are considered as corresponding to the reasons of urbanization and refer as indices of the secondary sector of the economy, by means of which its development is determined. The factors are, i.e., the per capita income, the ratio of industrial wages to agricultural wages, the labour demand of the secondary branch of the economy, unemployment in the agricultural sector, etc.

As regards urbanization, we have accepted that, apart from the aforementioned reasons, it is attributable to other reasons also; social, cultural, political, etc. Consequently, it is natural that the development of the urbanization of each country does not proportionally follow industrial development. In many countries, urbanization precedes the industrialization of the country, and for this reason we have an enlargement of the tertiary sector of the economy of these countries. However, it is indispensable to know the situation already created, from this point of view of movement of the agricultural population towards the urban centres of the country, in relation to industrial development realized, that is, in which cases urbanization proceeds symmetrically with industrial development and to what degree is the development of these two magnitudes normal, with the aim of implementing the policy indicated.

On the basis of these thoughts, we can formulate the following hypothesis as regards the normal evolution of urbanization and industrial development: that the development of urbanization is symmetrical to industrialization, if the movement of the agricultural population to the urban centres (urbanization) covers the needs of the secondary production in labour force. If there is no coverage of the supply of labour force (urbanization) by the industrial sector, then the development of urbanization in this instance is called asymmetrical. In other words, this hypothesis can be stated as follows: if the supply of labour force is in balance with the demand for labour force in the second branch of the economy, then the urbanization can be considered to have developed symmetrically. In order to test the above hypothesis, the "symmetry model" will be applied, which refers to the indices of urbanization and industrialization and, more specifically, the model in question refers to the relationship of the ratio of these indices. The symmetry model was determined on an

international level and, consequently, the conclusions therefrom are generally accepted. Further details, as regards the manner of its construction, its broader importance from an economic and demographic point of view, as also its use, are provided in the relevant section on same.

Finally, the regional problem which appears in each country, is related to the problem under study. Therefore, in the case of Chile, we will try, a) to determine the main factors prevailing in it, as well as the existing correlation between them; b) to estimate the level of economic development of each geographical area based on per capita income, and the index of regional inequalities for the whole of the country.

3. Models used

3.1. Econometric model

3.1.1. In general

Models of different kinds are frequently used in economic analysis and as a tool in solving quantitative problems. Models may be described verbally, graphically and by means of mathematical functions and simple equations or simultaneous equations. Generally, equations describe the economic relationship which exists between economic variables. The exact formula of an equation-model corresponds to the original data and the development of the variable under study. Therefore, the mathematical form of a relationship should be based on economic and statistical criteria. By means of the models we calculate the statistical estimate of the parameters and, consequently, the interpretation of the determinants, with respect to their influence on the variable under study. From this point of view, the accuracy of a model -equation- is of great importance. The economic and statistical criteria will verify if the adopted model would be the appropriate one. On many occasions the impression is created that the unsatisfactory results are due to the fact that all the determinants have not been taken into consideration in a model. Of course, this claim may also be true, but this is mainly due to the fact that the mathematical form of the relationship is not the suitable one. Such a model is not indicated for expressing forecasts.

As it is known, the consideration of all factors influencing the variable under study, is not possible. This is either due to the technical difficulties, for instance, the nature of factors -qualitative factors- statistical material, measurements, etc. or due to ignorance of the factors. Therefore, these factors which are omitted in the relationships, are involved in the so-called unexplained part of the equation. From this point of view, the equations are called stochastic models, i.e. the functional relationships which have an explained part. This is the meaning of the residual term from an economic point of view. The stochastic models include some assumptions about the probable distribution of the disturbance term, e_t. They are the following, the mean to be zero, $E(e_t) = 0$ and the variance to be fixed, $V(e_t) = s_e^2$. And, it is also assumed that the random variable, e_t, is independently distributed with respect to explanatory variables as well as with respect to itself lagged. Moreover, explanatory variables are assumed to be distributed independently of each other. Finally, the facility with which the constants and coefficients of an equation may be calculated, the simplicity of the model and its a priori validity, the homoscedasticity of residuals, i.e. the same variance of the terms, consist of the points, from an economic point of view, which will contribute to the determination of the appropriate model.

3.1.2. Equations indicated

After the formulation of the functional relationships of urbanization and industrial development, which is realized in the next chapter, an attempt must be made to define the equations to be tried. The defining of the appropriate equations in each case, should be based on the economic theory, the statistical criteria mentioned in the previous section and the empirical data. Following the way of graphic presentation of the empirical data and the statistical criteria, we are led to the following two forms. The linear and the curvelinear -exponential- equations. These regression equations -models- explain the increase of urbanization during the sampling period 1960-70, by defining its changes due to the influence of the determinative factors taken. Furthermore, they provide a simplicity in their calculations and an easy interpretation of the results obtained from an economic point of view. In addition, the application of such models for purposes of prediction, in

short-time, is indicated, since the parameters of these equations have been estimated. Finally, the traditional method of the least squares is easy to be applied for the estimation of the parameters of the above equations.

3.2. Symmetry model

3.2.1. Description and use of the model

In section 2, it was said that the symmetry model refers to the relationship of the indices of "urbanization" and "industrialization". Therefore, in order to formulate this model, the calculation of the two aforementioned indices is necessary. The urbanization index refers to the proportion of the population which by definition, is characterized as "urban population", to the total population of the country.

That is

$$Z_{ij} = \frac{P_{a_{ij}}}{P_{o_{ij}}} 100 \qquad (1)$$

where:

$P_{a_{ij}}$: Urban population of a country or of a region

$P_{o_{ij}}$: Total population of a country or of a region

Z_{ij} : Index of urbanization of a country or of a region

i : Country $(i = 1, 2, 3 \ldots n)$

j : Region of a country $(j = 1, 2, 3 \ldots k)$

The industrialization index is the ratio of that part of the labour force which is employed in the secondary production, to the total economically active population of the country.

This index can be written as follows

$$I_{ij} = \frac{P^{s}_{e_{ij}}}{P_{e_{ij}}} 100 \qquad (2)$$

where:

$P^{s}_{e_{ij}}$: Economically active population employed in the industrial sector of a country or of a region

$P_{e_{ij}}$: Total economically active population of a country or of a region

I_{ij} : Index of industrialization of a country or of a region

ij : As in the relationship (1).

The ratio of these two indices, multiplied by 100, consists of the symmetry model. In other words, the symmetrical coefficient, as the symmetry model is called, can be presented as follows:

$$S_{ij} = \frac{I_{ij}}{Z_{ij}} 100 \qquad (3)$$

where:

I_{ij}, Z_{ij} : as in the relationships (2) and (3)

S_{ij} : symmetry model.

Thus, insofar as the relationship of the ratio of the two indices of industrialization and urbanization -symmetry model- approaches the limit of 100, this means that the urbanization of the population was absorbed by the secondary branch of the economy, that is, in other words, the urbanization was a consequence of the employment opportunities created in the secondary production. On the contrary, if the level of this index is low, then it can be said that the development of urbanization was asymmetrical, that is, it was not the result of needs for labour force created in the capitalistic sector of the economy. Finally, the limit of 100, of the symmetry model, is the point of equilibrium, in the sense that the possibilities for still further supply of labour have been exhausted. In general, we can say that the level of the symmetrical coeficient is a clear indication of the symmetry of the urbanization realized in relation to the industrial development of a country.

3.2.2. <u>The broader importance of the model</u>

It was previously mentioned that the point of equilibrium of the index-model is the limit of 100. In the economically developed countries this index is at the point of equilibrium, which means that the supply of labour force (urbanization) mainly from primary production, has been fully covered by the

secondary sector of the economy and, consequently, there are no possibilities for further increase in the supply of labour force (exhaustion of resources of labour force, such as the agricultural population).

In certain developed countries, this index has exceeded the limit of 100, a fact which can be interpreted to mean that the employment opportunities, which were created in the capitalistic sector of the economy, exceeded the limits of the potentiality of the domestic labour force to be employed. The problem is confronted by external migration from other countries, where there is a surplus of supply of labour force. This ascertainment is of great importance, particularly for developing countries which at the same time have an emigration problem, because they may confront scarcity of labour force in the coming years. Furthermore, this will reflect upon the rate of growth of the population of the "migratory" countries. In certain less-developed countries, the numerical limits of the symmetrical coefficient are less than 25 per cent. This means a delay in the development of secondary production in accordance with the development of urbanization.

Generally, the deviation of the numerical value of the symmetry model between developed and less-developed countries is reflected in two situations: a) in the developed countries, that urbanization was caused by the continuously increase of employment opportunities in the industrial sector and, b) in the less-developed countries, that the inflow of internal migrants in the urban areas of the country preceded the creation of needs for labour force in the industrial branch of the economy, resulting in an enlargement of the service sectors. In this last case, we have a form of unemployment in a large part of urban population which is called "invisible" unemployment. All the above situations in the developing countries create many difficulties in the rapid economic growth of the country. Finally, we must not forget that the movement of labour force from the tertiary sector to the secondary sector of the economy, for covering the demand for labour force, is more difficult than the movement of agricultural population to the industrial areas for the same purpose.

III. THE DEVELOPMENT OF URBANIZATION OF THE CHILEAN POPULATION DURING THE SAMPLE PERIOD 1952-70

1. Introduction

In the first chapter, during the determination of the problem under study, we said that internal population movements, which take place in each country, are a very recent phenomenon, for investigation by the researchers of social sciences. In this chapter, we will analyse the development of the urban population of Chile, during the two last decades 1950-70. This analysis has two main objectives. The first is to establish, through census data, the volume and direction of urbanization of the population of the country. This will show us the rôle of urbanization in the population increase of the already existing urban centres of the country, the creation of new such centres and the redistribution of urban and rural population by region. The second objective is to assess the degree of urbanization at a regional level. This will permit us to see the expected trends of urbanization in the coming years. Furthermore, to study the development of the main city of the country, for investigation of geographical poles of concentration of population of the country. The urbanization of the population is closely related to industrial development, both these factors consist of the problem under study. Therefore, the analysis of urbanization will facilitate us in the investigation of this problem. Finally, urbanization will possibly be a factor of the regional problem of the country and, consequently, the data as regards its development will be useful in this effort.

For the analysis of the development of urbanization of the population in the past years, we will use descriptive statistics, that is, by means of the indicated statiscical tables we will try to achieve the objectives of the present chapter.

2. Urbanization

2.1. Definitions. Characteristics

Before we mention the urban population of the country and its development up to the present, it is considered advisable to give the statistical concept of urban population. The meaning and statistical use of the concept of urban

population varies widely between countries, in two main aspects. The first aspect can be related to the administrative organization of the country, public services, industrial areas, etc., and the second aspect clearly has as criterion the variation on the minimum population.[7/]

In the case of Chile, as regards the determination of the urban population, it is rather the first aspect which is adopted.[8/]

2.2. The urban population

On the basis of the above adopted statistical aspect, the urban population in Chile, during the 1970 census, amounted to 6 660 thousand inhabitants and was 75.1 per cent of the total population, with a total of 517 urban centres. The development of the urban population of the country from 1952 up to the year of the most recent census (1970), is shown in the following Table 2.2.1. and in Chart 2.2.1.

Table 2.2.1.

DEVELOPMENT OF URBANIZATION IN CHILE DURING THE SAMPLE PERIOD 1952-1970

Year	Population (in thousands)				
	Urban	Percentage	Rural	Percentage	Total
1952	3 573	60.2	2 360	39.8	5 933
1960	5 028	68.2	2 346	31.8	7 374
1970	6 660	75.1	2 209	24.9	8 869

Source: Statistical Yearbooks, 1952, 1960 and 1970. National Statistical Institute, Santiago, Chile.

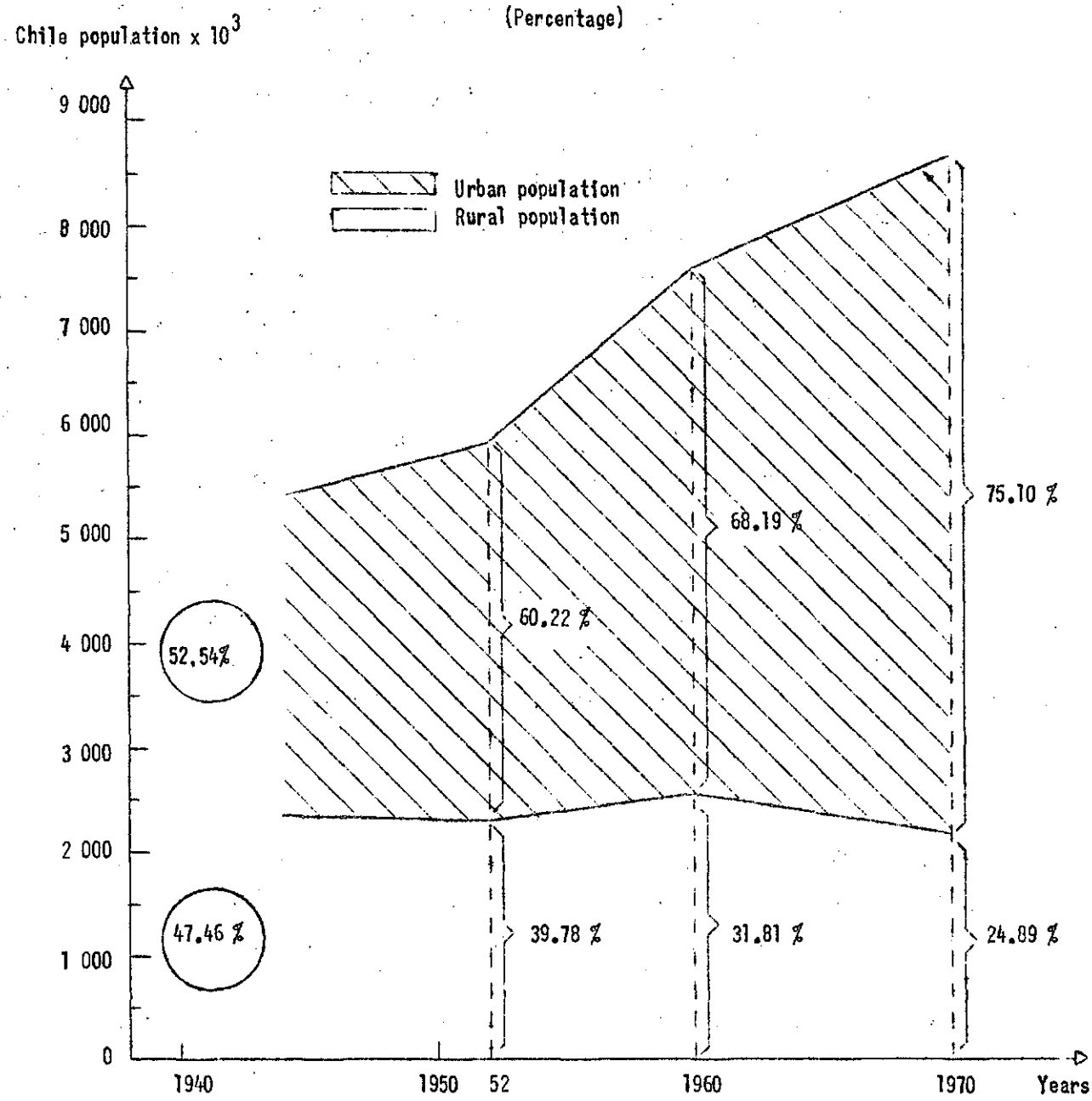
7/ The internationally accepted limit for the characterization of a population as urban, is 2 000 persons and over. This limit varies from country to country, according to the socio-economic development of the country, and the reason for this, is that in the determination of part of the population of a country as urban, there also enter socio-economic factors.

8/ The determination of the population centres, as urban, is made upon the basis of demographic and administrative elements, as also the existence in same of public services. Furthermore, certain industrial centres are characterized as urban regions (Servicio Nacional de Estadística y Censos, XII Censo General de Población, 1952, Santiago de Chile and III Censo de Población, 1960, Santiago de Chile).

Chart 2.2.1

THE DEVELOPMENT OF THE URBAN AND RURAL POPULATION
DURING THE SAMPLE PERIOD 1952 - 1970

(Percentage)



Sources: Dirección de Estadística y Censos, Censo General de Población (para 1940, 1952-1960), Dirección de Estadística y Censos, Santiago de Chile (1943, 1956, 1963). Dirección de Estadística y Censos, Entidades de Población (para 1970) (de Tarapacá a Magallanes), Santiago de Chile 1972

From the above table, it can be seen that the urbanization of the population, during the aforementioned period, experienced a considerable increase and formed, in 1970, three-quarters of the Chilean people. More specifically, the urban population, in the last census (1970), was increased by 86.4 per cent and 32.5 percent, in comparison with the years 1952 and 1960 respectively. A further increase is anticipated in the urban population in the coming years.

On the contrary, the population of the rural centres[9/] showed a considerable decrease during the surveyed period 1952-70. Thus, on the basis of the data of the 1970 census, the rural population of the country amounted to 2 209 thousand persons (24.9 per cent of the total population) compared with 2 360 thousand inhabitants (39.8 per cent) in the year 1952, showing a drop of 6 per cent approximately. As a consequence of the continuing increase of the urban population of the country, the development of the rural population will follow a downwards trend.

From the above, we can be led to the general conclusion that the population development in Chile is characterized by a considerable enlargement or urban population, probably attributable to the socio-economic growth of the country, in the sense of its transition from an agricultural to an industrial country.

2.3. Regional distribution of urban and rural population

The distribution of the urban and rural population of the country by province, during the last census (1970) is shown in Chart 2.3.1. This percentage distribution varies in each province.[10/] There are provinces whose near total (over 90 per cent) population is urban, as for example in the provinces of Tarapacá, Antofagasta, Valparaíso and Santiago. In the provinces of Atacama,

9/ Rural centres are characterized as those population centres which do not have public services and whose population mainly depends upon primary production (see sources of footnote 8).

10/ In Table 2 of Appendix I, we give the proportion of the urban and rural population of each province in the census years 1952 and 1960. Furthermore, in order to facilitate the reader of the present work, one of the letters of the Latin alphabet was given, to each province. (See table 2 of Appendix A).

Concepción and Magallanes, over 80 per cent of the population resides in urban areas, while in 16 of the 25 provinces of the country, the urban population is more than one half of the total population of the provinces.

In Table 2.3.1., we classify the provinces on the basis of the proportion of urban population to the total population of the country. From this table, it appears that the number of provinces whose urban population exceeds 90 per cent, was doubled during the period 1960-1970, and the urban population of these four provinces was 61.5 per cent of the total urban population of the country in the year 1970. Furthermore, the provinces whose urban population ranged from 70 to 90 per cent during the same as above census year, cover 11.3 per cent of the urban population of the country and the number of the provinces in question was reduced to three provinces in 1970, while the proportion of the urban population of the five provinces which are included in this size-class during the years of the previous censuses, 1952 and 1960, was 69.1 per cent and 24.7 per cent respectively. From this point of view we observe a drop of the proportion of the urban population, in this size-class (70-90 per cent), during the period 1952-60 eventhough the number of provinces was not changed.

In the medium size class (50 per cent to 70 per cent) we have a considerable increase in the number of provinces (from two provinces to nine provinces), during the period under examination, 1952-70, and the proportion of the urban population of these nine provinces was 15.8 per cent in the year 1970. The population of the provinces whose proportion of the urban population is more than 50 per cent is 7 184 thousand inhabitants, (81 per cent of the total population of the country). The same can be said from the point of view of the existence of a considerable number of provinces in the 40 per cent to 50 per cent size class in the year 1970, eventhough the urban population of these seven provinces covers only 9.9 per cent of the total urban population of the country. In this size class we have a duplication, both of the number of provinces as also percentage of the urban population in the semi-period 1952-60. Finally, the provinces whose urban population is less than 40 per cent of the total population, showed a decrease, both from the point of view of number of provinces as also from the point of view of proportion of urban population. The number of provinces decreased from fifteen provinces to two provinces, with

Table 2.3.1

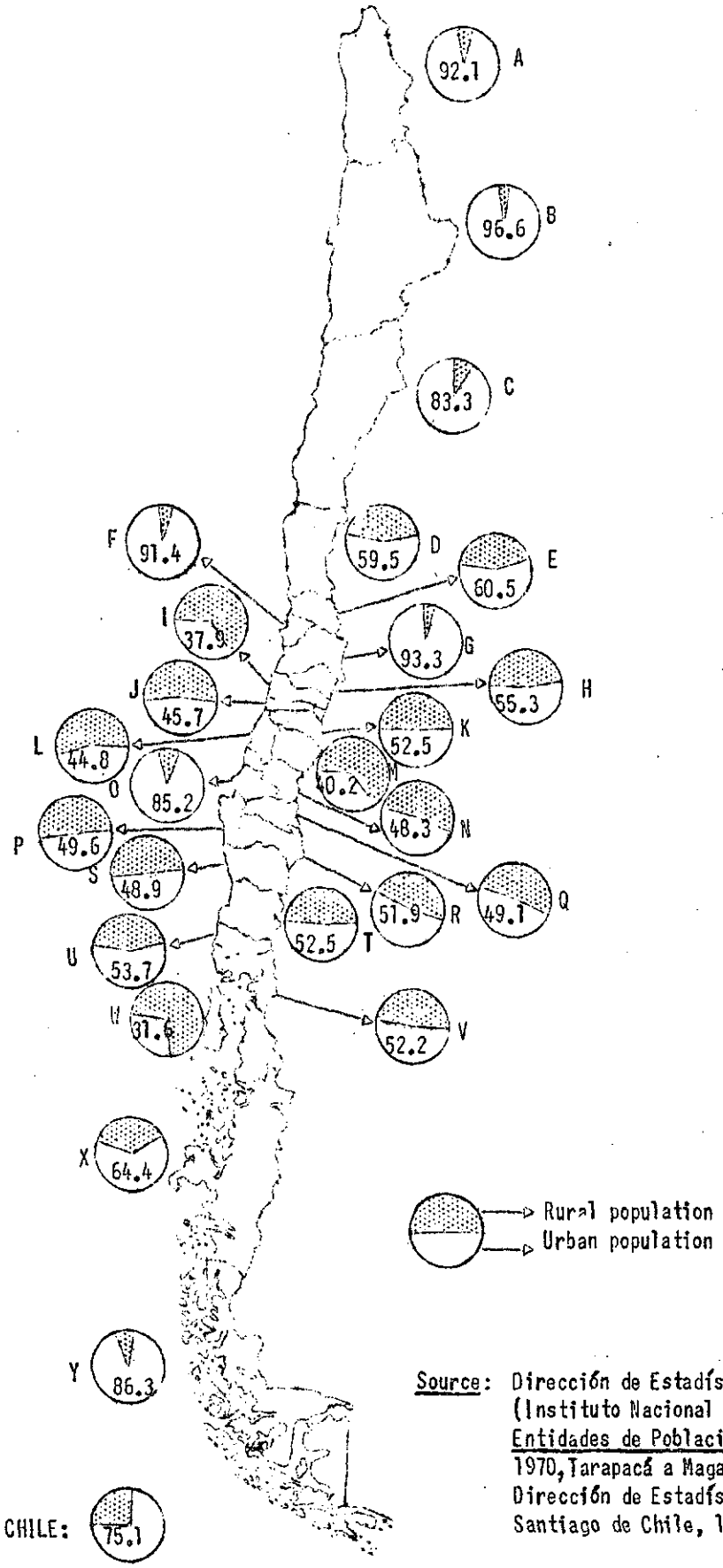
DISTRIBUTION OF THE PROVINCES OF THE COUNTRY BASED ON THE PROPORTION OF THEIR URBAN POPULATION DURING THE SAMPLE PERIOD, 1952-1970

Number of the class	Size classes	Number of provinces			Population			Percentage of urban population		
		1952	1960	1970	1952	1960	1970	1952	1960	1970
1	90 +	-	2	4	-	2 397 963	4 094 780	-	47.69	61.48
2	70-89.9	5	5	3	2 469 853	1 242 790	754 143	69.12	24.72	11.32
3	50-69.9	2	4	9	102 824	396 430	1 049 187	2.88	7.88	15.75
4	40-49.9	3	6	7	152 277	462 441	663 403	4.26	9.20	9.96
5	0-39.9	15	8	2	848 168	528 436	99 016	23.74	10.51	1.49
	Total	25	25	25	3 573 122	5 028 060	6 660 529	100.00	100.00	100.00
Population of the country					5 932 995	7 374 115	8 869 166	60.22	68.19	75.09

Sources: Dirección de Estadística y Censos, Censos de Población, Tomo I para 1952 y 1960. Dirección de Estadística y Censos, Santiago de Chile, 1959, 1969. Dirección de Estadística y Censos, Entidades de Población para 1970 (de Tarapacá y Magallanes). Dirección de Estadística y Censos, Santiago de Chile, 1972.

Chart 2.3.1.

REGIONAL DISTRIBUTION (PERCENTAGE) OF URBAN AND RURAL POPULATION IN 1970



Source: Dirección de Estadística y Censos, (Instituto Nacional de Estadística) Entidades de Población, 1970, Tarapacá a Magallanes. Dirección de Estadística y Censos Santiago de Chile, 1972.

the result that the urban population decreased by 88.3 per cent. This is of great importance, from the point of view of the internal population movements in Chile during the period under study (1952-70).

The increase of the urban population of the country in general, during the period 1952-70, the fact of the increase of the population of those provinces that can be considered as being pure urban areas,[11/] in conjunction with decrease of the number of provinces whose urban population is less than 40 per cent, leads us to the conclusion that, in addition to the movement of rural population to the large urban centres, we also have a movement of urban population of the regions with a small proportion of urban population, towards the large urban areas. This movement of the urban population is called urban-urban migration and it is of greater importance than the rural-urban migration. Furthermore the considerable increase (386.4 per cent) of the urban population, during the period 1952-70, in the provinces whose urban population is more or less by 10 per cent than half of their population, as also the increase of the number of these provinces, is a favourable point, from a demographic and economic viewpoint. This is because the population increase of provinces which cannot be considered as large urban areas of the country and whose urban population is half of the total population, presupposes economic and social development of the regions in question.

Finally, from attached Table 2, in Appendix I, we see that provinces showed an increase of their urban population, as also an increase in the proportion of urban population to rural population, during the period under examination 1952-70. In conclusion, we can say that the continuing trend of urbanization of the Chilean population, is followed by all the country's provinces.

As regards the development of the rural population, by province, it can be said that in certain provinces it followed an upwards trend, while in others the rural population decreased, during the period 1952-70. Thus, in sixteen provinces the rural population, probably on account of its movement towards the urban areas, showed a drop, whereas in the remaining nine provinces, it

11/ Pure urban areas are considered those areas whose urban population exceeds 90 per cent.

increased at a slow rate. Of course, the decrease of rural population in these sixteen provinces varies in each province, and does not exceed 12.5 per cent of their rural population.[12/]

In the following Table 2.3.2. we give the distribution of the provinces, on the basis of the percentage of decrease of the rural population, as also the provinces that showed an increase of their rural population in the period under study (1952-70).

Table 2.3.2

DISTRIBUTION OF PROVINCES BASED ON THE PERCENTAGE OF DECREASE OF THEIR RURAL POPULATION, DURING THE PERIOD 1952-1970

Number of the class	Size of class	Number[a/] of provinces	Population		Percentage of rural population	
			1952	1970	1952	1970
1	60 +	1	41 406	13 769	1.75	0.62
2	50-59.9	1	19 319	8 457	0.84	0.38
3	20-49.9	1	38 672	25 502	1.64	1.15
4	15-19.9	1	77 346	63 731	3.28	2.89
5	10-14.9	5	720 805	632 254	30.54	28.63
6	5- 9.9	2	315 714	291 842	13.38	13.21
7	0- 4.9	5	453 101	447 803	19.20	20.28
8	Increase of the rural population	9	693 010	725 279	29.37	32.84
	Total	25	2 359 873	2 208 637	100.00	100.00

Sources: Dirección de Estadística y Censos, XII Censo General de Población y I de Vivienda, Tomo I, Dirección de Estadística y Censos, Santiago de Chile, 1959.
Dirección de Estadística y Censos, Entidades de Población (de Tarapacá a Magallanes), Dirección de Estadística y Censos, Santiago de Chile, 1972.

a/ The number of provinces did not change as regards the classification of classes, during the census years 1952 and 1970.

12/ The rural population of the sixteen provinces amounted to 1 483 thousand persons in 1970.

Thus, from the above table, it appears that in one province the decrease of the rural population was considerably important, insofar, as it exceeded 60 per cent. This province was Tarapacá, and its rural population consists of 0.62 per cent of the total rural population of the country. The same can be said for the province of Antofagasta, where its rural population decreased by 55 per cent approximately. On the contrary, in the provinces of Maule, Ñuble, Concepción, Arauco and Bio-Bio, the drop in the rural population was negligible, less than 5 per cent, while the proportion of rural population of these provinces to total rural population of the country, remained virtually unchanged (20 per cent approximately) in the census years 1952 and 1970. Similarly unaltered remained the proportion of the rural population to total rural population, (13 per cent approximately), in the two provinces (Santiago and Llanquihue), belonging to the 5-10 per cent size-class, during the period 1952-1970. The provinces whose rural population was reduced from 10 per cent to 15 per cent are five (Coquimbo, Valparaíso, Malleco, Cautín and Valdivia) with a total rural population of 632 thousand persons, which was 28.6 per cent of the total rural population during the year 1970. Finally, there are two provinces, Aconcagua and Atacama, which showed a drop in rural population by 17.5 per cent and 34.1 per cent respectively, during the period between the two censuses in the years 1952 and 1970, and cover 4 per cent of the total rural population of the country.

As regards the provinces which showed an increase of the rural population, we have to mention the following: of the nine provinces, the provinces of Aysén and Magallanes experienced an increase of their rural population by 18.5 per cent, on an average, during the sample period 1952-70 while this increase (of rural population) in the provinces of Linares and Curicó, was more than 10 per cent. In the remaining five provinces, the increase of their rural population was less than 5 per cent and, consequently, can be considered insignificant.

As a conclusion, we can say that during the period under examination (1952-70) a redistribution took place of the urban and rural population in the country's provinces. This redistribution varies in each province. Generally, in all provinces, we had an increase of the urban population and in certain provinces this increase of urbanization was considerable. As a consequence of this fact, the decrease of the rural population of 16 provinces took place. Beyond

the decrease of rural population in these provinces, we had an increase of the rural population, if we compare the rural population of the census year 1952 to the remaining nine provinces (4.65 per cent). Probably, all these population changes are the consequences of the population movements and, specifically, the redistribution of the labour force of the country and of the areas of the country, from the point of view of rural and urban areas, due to the industrialization and, in general, the socio-economic growth of the country.

3. Degree of urbanization

3.1. In general

The great increase of the urban population of the country, its redistribution by region, during the sample period 1952-70, the increase anticipated in the coming years and the role of urbanization in the economic growth of the country, makes necessary the need to assess the degree of urbanization.[13/]

In the present work, by the degree of urbanization of the Chilean population, we will be facilitated in estimating the symmetry model at a national and regional level which, as we said previously, refers to the development of the urban population of the country and its industrialization. Furthermore, on the basis of the assessed degree of urbanization, in conjunction with the anticipated economic development of the country, we shall be able to indicate certain points regarding the policy on urbanization. Finally, the degree of urbanization and the rate of growth of the urban population of the country in a period of time, are basic elements of the investigation of regional economic problems of the country.

3.2. Evaluation of degree of urbanization

In Table 3.2.2, we refer to the already realized degree of urbanization and the rate of growth of urban population by region, during the period 1952-70. From this table, the increase in the degree of urbanization in all the

13/ The degree of urbanization is the proportion (percentage) of the urban population to the total population of the country. This relationship, refers to a specific point of time, and consequently it does not give the degree of development of the urban population of the country during a period of time. For this reason, the rate of growth is evaluated.

provinces of the country, during the three census years 1952, 1960 and 1970, is ascertained. In certain provinces, the degree of urbanization is extremely high.[14/] The degree of urbanization is between 17.97 per cent and 89.28 per cent in the year 1952, and between 31.58 per cent and 96.64 per cent in the last census (1970). From this point of view we observe an increase of both the lower and higher limits of urbanization. Finally, the degree of urbanization of the Chilean population, at a national level, followed an upwards trend during the aforementioned period (1952-70). Regarding the rate of growth of the urban population of the country, by province, we can say in the following Table 3.2.1.

Table 3.2.1

THE ANNUAL RATE OF GROWTH OF THE URBAN POPULATION OF THE COUNTRY DURING THE SAMPLE PERIOD 1952-70

Annual rate of growth 1952-70	Number of provinces	Urban population 1970	Percentage on the urban population
1-2	1	37 015	0.56
2-3	7	1 559 339	23.41
3-4	11	4 496 688	67.51
4-5	3	247 758	3.72
5+	3	319 729	4.80
Total	25	6 660 529	100.00

Sources: Dirección General de Estadística y Censos, Entidades de Población (de Tarapacá a Magallanes) para 1970. Dirección de Estadística y Censos, Santiago de Chile, 1972.

There are eleven provinces whose rate of growth of urban population of the country is between 3 and 4 per cent, and their population consists of 67.5 per cent of the total urban population of the country. In the provinces of Tarapacá, Atacama and Aysén, the rate of growth of the urban population exceeds

14/ For further details, as far as the number of provinces which have a great degree of urbanization in the aforementioned census years, see Table 3.2.2.

Table 3.2.2

THE DEGREE OF URBANIZATION OF THE CHILEAN POPULATION BY REGION, DURING THE SAMPLE PERIOD 1952-70

n/n	Province	Degree of urbanization			Annual rate of growth (percentage) of the urban population		
		1952	1960	1970	52-60	60-70	52-70
1.	Tarapacá	59.72	87.11	92.14	6.97	4.09	5.37
2.	Antofagasta	89.28	94.79	96.64	2.65	1.75	2.15
3.	Atacama	51.73	73.52	83.30	9.05	3.98	6.23
4.	Coquimbo	39.38	51.83	59.53	5.49	2.32	3.73
5.	Aconcagua	39.75	55.50	60.53	5.30	2.25	3.61
6.	Valparaíso	85.26	88.82	91.44	3.19	2.03	2.55
7.	Santiago	86.72	90.01	93.33	4.57	3.19	3.80
8.	O'Higgins	40.44	53.31	55.31	5.26	2.03	3.47
9.	Colchagua	26.16	32.69	37.91	4.38	2.10	3.11
10.	Curicó	37.27	40.98	45.71	3.28	1.90	2.52
11.	Talca	39.45	43.57	52.53	3.39	3.00	3.17
12.	Maule	36.69	39.84	44.76	2.27	1.53	1.86
13.	Linares	30.27	36.33	40.24	4.26	2.01	3.01
14.	Ñuble	34.99	39.62	48.31	3.15	2.68	2.89
15.	Concepción	76.12	81.70	85.18	4.27	2.21	3.12
16.	Arauco	28.63	35.71	49.61	5.42	4.27	4.78
17.	Bío-Bío	31.92	37.12	49.11	4.37	4.17	4.26
18.	Malleco	38.67	44.95	51.88	2.99	1.59	2.21
19.	Cautín	33.12	38.74	48.93	2.93	2.98	2.96
20.	Valdivia	37.03	43.94	52.53	3.51	2.46	2.93
21.	Osorno	40.45	46.12	53.68	3.61	2.59	3.04
22.	Llanquihue	32.28	41.96	52.19	5.53	3.89	4.62
23.	Chiloé	17.97	22.13	31.58	2.42	4.69	3.68
24.	Aysén	44.46	52.86	64.36	6.70	4.45	5.45
25.	Magallanes	81.37	82.98	86.30	3.79	2.37	3.01
	Chile	60.22	68.19	75.10	4.27	2.81	3.46

Sources: Dirección General de Estadística y Censos, Censos de población (1952-1960). Dirección de Estadística y Censos, Santiago de Chile, 1959, 1969.
Dirección General de Estadística y Censos, Entidades de Población (de Tarapacá a Magallanes) 1970. Dirección de Estadística y Censos, Santiago de Chile, 1972.

5 per cent. Similarly, the rate of growth (4-5 per cent) can be considered high in three provinces, those of Arauco, Bio-Bio and Llanquihue. The urban population of these six provinces consists of 4.30 per cent of the urban population of the country. on the average. Finally, in the size-class 2-3 per cent, there are seven provinces, and their population amounted to 1 560 thousand inhabitants in the year 1970. In general, we can say that great deviations by province are ascertained around the annual rate of growth of the urban population at the national level. The rate of growth of urban population of the country showed a drop in nearly all the provinces during the semi-period 1960-70, in certain of which this downwards trend was considerable as, for example, in the provinces of Atacama, Aconcagua, etc.

4. The urban areas

4.1. Urban and rural areas. Their regional distribution

In the second section, referring to the urban population, we ascertained that it was increased by 86.4 per cent during the past twenty years (1952-70). Furthermore, we were led to the conclusion that the increase of urban population came, mainly, from the movement of rural population to the urban areas and the movement of urban population of small urban centres to the metropolitan centres of the country -urban-urban migration. In addition to the aforementioned reasons, as far as the urbanization of Chilean population is concerned, the inclusion of rural regions in the urban areas caused a further increase of urban population of the country, as also the increase of urban areas.[15/]

The increase of urban areas, as was expected, caused their redistribution among the provinces of the country. Therefore, it is considered advisable to give a picture of the development of the number of urban and rural regions, as well as the redistribution of these regions effected in each province during the sample period 1952-70. Table 4.1.1. shows the number of urban and rural areas, and their distribution by province, during the census years 1952, 1960 and 1970. From the table, it appears that the number of urban centres in the

15/ The characterization of certain rural regions as urban centres was imposed by reasons of a socio-economic and administrative nature.

year 1960, amounted to 655, showing an increase by 83.5 per cent, compared with the 357 urban centres in 1952. In the last census (1970), the urban areas were 517, showing a decrease by 21.1 per cent, in comparison with the previous census year (1960). This reduction of the urban centres, in the last decade 1960-70, is mainly attributed to the unification of certain urban areas. Similar to the development of the number of urban centres, was the development in the number of rural regions. Thus, during the first decade (1952-60), the number of rural regions was increased by 14.4 per cent while during the semi-period 1960-70, it showed a decrease, in comparison with previous semi-period (1952-60), by 8.9 per cent. The decrease of the rural regions during the period 1960-70 is attributed, on the one hand to the inclusion of certain rural regions in the urban regions and, on the other hand, to the unification of certain rural regions. Finally, Table 4.1.1. shows the provinces where the number of urban and rural areas experienced an increase and a decrease during the census years under examination. Thus, of the 25 provinces of the country, 13 showed a decrease of urban areas between the years 1960-70 and, as a matter of fact, the reduction of urban areas in certain provinces was exceedingly important, such as for example, in the provinces of Santiago, Coquimbo, etc. Similarly, during the same period, nearly all the provinces showed a reduction of the number of rural regions, with the exception of 6 provinces which showed an increase of rural areas. These provinces are, Santiago, O'Higgins, Colchagua, Talca, Aysén and Magallanes.

In general, we can say that the increase and/or decrease of urban and rural areas varies in each province, during the two semi-periods 1952-60 and 1960-70. Furthermore, the decrease of the rural areas, for reasons which have been explained previously, can be considered an encouraging element, from the point of view of economic growth of the country and regional economic development. Finally, the decrease of the number of urban centres in certain provinces and in the country as a total, in the semi-period 1960-70, is not in contrast to the result obtained in Section 2, as far as the development of urban population in the same period in concerned, because this reduction of the urban centres came by the unification of certain small urban areas, a fact which can be also considered a favourable point in the whole effort of economic development of the country.

Table 4.1.1

DISTRIBUTION OF URBAN AND RURAL AREAS BY PROVINCES, DURING THE SAMPLE PERIOD 1952-1970

	Province	1952		1960		1970	
		Number of urban centres	Number of rural centres	Number of urban centres	Number of rural centres	Number of urban centres	Number of rural centres
1.	Tarapacá	8	621	16	739	13	530
2.	Antofagasta	14	458	24	365	16	283
3.	Atacama	11	860	28	863	18	823
4.	Coquimbo	17	1 919	63	2 368	34	1 913
5.	Aconcagua	13	523	38	533	30	534
6.	Valparaíso	21	617	46	767	42	722
7.	Santiago	42	1 618	113	1 668	54	1 964
8.	O'Higgins	23	719	44	787	32	879
9.	Colchagua	21	806	23	909	22	968
10.	Curicó	8	517	11	763	10	639
11.	Talca	10	1 073	17	1 096	14	1 428
12.	Maule	5	1 780	8	2 312	9	1 168
13.	Linares	13	1 324	12	1 554	12	1 503
14.	Ñuble	26	3 067	29	4 463	27	3 623
15.	Concepción	22	2 609	31	2 996	31	2 757
16.	Arauco	6	710	15	735	9	700
17.	Bio-Bio	10	2 915	9	3 144	12	2 819
18.	Malleco	16	2 046	17	2 241	19	1 838
19.	Cautín	25	4 462	36	4 225	38	3 968
20.	Valdivia	15	1 666	20	1 691	20	1 671
21.	Osorno	6	899	8	930	8	792
22.	Llanquihue	9	983	20	950	16	868
23.	Chiloé	10	597	14	847	15	742
24.	Aysén	3	209	9	758	11	977
25.	Magallanes	3	445	4	557	5	742
	Total	357	33 443	655	38 261	517	34 851

Sources: (Urban and rural centres)

i) Herrera, Ligia, Tendencias del poblamiento en Chile desde 1940 a 1960. Ed. por Departamento de Geografía de la Dirección de Estadística y Censos; Santiago de Chile, 1969.

ii) Servicio Nacional de Estadística y Censos, XII Censo General de Población y I de Vivienda. Tomo I (1952). Ed. por Dirección de Estadística y Censos, Santiago de Chile, 1956.

iii) Dirección de Estadística y Censos, XIII Censo de Población (1960). Serie A- Resumen del País. Ed. por Dirección de Estadística y Censos, Santiago de Chile, 1964.

iv) Dirección de Estadística y Censos, Entidades de Población (1960 y 1970) (desde Tarapacá a Magallanes). Ed. por Dirección de Estadística y Censos, Santiago de Chile, 1962 y 1973.

4.2. The size of urban areas

The examination of the increase and/or decrease of urban and rural population by province in two semi-periods 1952-60 and 1960-70, does not permit us make a full study of the development of the urban centres and the whole problem of urbanization of the country. Therefore, the classification of the urban centres into size-classes, with their urban population, will facilitate us in this effort. In Table 4.2.1, we give the development of the urban centres and their population during the period 1952-70, in various population size-classes. Thus, according to the national census of 1960, there were 655 urban areas, of which 454 areas or 69.3 per cent had less than 2 000 inhabitants. The proportion of such size class urban areas, during the years 1952 and 1970 was 55.7 per cent and 58.4 per cent respectively. Therefore, we have a decrease in the number of urban centres with a population of less than 2 000 inhabitants in 1970, in comparison with 1960, probably attributable, -as it has been mentioned- to the unification of certain urban regions. The percentage of the population of these urban areas (less than 2 000 inhabitants) to the total urban population of the country, was 5.3 per cent, on the average, during the three census years of the period 1952-70. The largest number of urban centres is observed in the 500 - 1 000 population group, while in the size class of more than 500 thousand inhabitants, there is an urban centre, the capital of the country, Santiago, whose population amounted to 2 700 thousand persons in 1970. Therefore, we see that in this country, Chile, there are no urban centres of over 500 thousand inhabitants, with the exception of the capital, of those which are usually characterized as "great" urban centres.

Finally, we observe a decrease of the population of urban centres, with a population smaller than 5 000 inhabitants, during the period 1960-70. The rate of decrease of the population is high (52.8 per cent) in the first population group of up to 500 inhabitants. Furthermore, the percentage of decrease of the population can also be considered significant in the two following size-classes, where it rose to 21.9 per cent and 15.1 per cent, during the same period 1960-70. In the fourth (2 000 - 5 000 inhabitants) and in the sixth (10 000 - 20 000 inhabitants) groups of inhabitants, the rate of decrease is small: 5.6 per cent and 6.9 per cent respectively. On the contrary, in the

development of the size-classes of less than 5 000 inhabitants, the development of the population in the groups of over 50 thousand inhabitants followed an upwards course, during the same as above period (1960-70). Thus, the rate of increase of the population in the 50-100 thousand and 100-500 thousand inhabitants groups, amounted to 48 per cent and 92.5 per cent respectively, while in the metropolitan area -over 500 thousand inhabitants- it amounted to 43.1 per cent. Of course, in the case of the size-class of less than 5 000 inhabitants, we have a decrease in the number of urban centres, between the years 1960 and 1970, although the decrease in question is more attributable to the unification of urban areas than to the subtraction of areas of the corresponding population groups. In the case of the size classes of over 50 thousand inhabitants, we have an increase in the number of urban areas and, consequently, there is serious justification for the increase of the population of these size classes.

All the above lead us to the following conclusions, regarding the increase of the urban population, particularly in the larger urban centres; a) that we have a movement of the population from the smaller population-size urban centres, to the larger urban centres of the country, and especially towards the metropolitan area of the capital, that is -in other words- we have an urban-urban migration and, b) a considerable increase of the population of Santiago, attributable to the movement of rural and urban population towards the capital. In this manner, we verify the trends observed in developing countries, of concentration of the population, both rural and urban, in the large urban centres of the country, and particularly in the capital.[16/]

The population decrease of the size-classes[17/] of less than 5 000 inhabitants in the semi-period 1960-1970 can be considered unfavourable from an economic point of view, and it could possibly raise obstacles to the regional

16/ On the basis of the data of Table 4.2.1, the urban population of the small urban centres, which moved towards the larger urban centres of the country, having over 50 thousand inhabitants, amounts to 121 thousand persons and consists of 7.7 per cent of the population increase of these urban centres during the period 1960-70.

17/ The population trend of the aforementioned size-classes (less than 5 000 inhabitants) was an increasing one during the previous semi-period 1952-60.

Table 4.2.1

DISTRIBUTION OF URBAN AREAS BY POPULATION SIZE-CLASSES: 1952, 1960 AND 1970

Number of the class	Class	Urban centres			Population			Absolute change		Relative change (Percentage)	
		1952	1960	1970	1952	1960	1970	1952-1960	1960-1970	1952-1960	1960-1970
1	0- 499	53	156	66	15 915	43 920	20 718	28 005	-23 202	176.00	-52.83
2	500- 999	60	163	122	45 191	120 097	93 683	74 906	-26 414	165.75	-21.99
3	1 000- 1 999	86	135	114	123 589	189 384	160 873	65 795	-28 511	53.24	-15.05
4	2 000- 4 999	66	96	91	206 494	301 742	284 834	95 248	-16 908	46.13	- 5.60
5	5 000- 9 999	39	41	55	274 518	280 104	374 314	5 586	94 210	2.03	33.63
6	10 000- 19 999	24	27	26	341 432	374 855	348 671	33 423	-26 184	9.79	- 6.99
7	20 000- 49 999	19	24	24	585 593	756 165	778 980	170 572	22 815	29.13	3.02
8	50 000- 99 999	7	9	12	451 361	591 701	875 955	140 340	284 254	31.09	48.04
9	100 000-499 999	2	3	6	350 706	516 410	993 883	165 704	477 928	47.25	92.46
10	500 000+	1	1	1	1 218 195	1 907 378	2 728 613	689 183	821 183	56.57	43.06
	Total	357	655	517	3 612 994	5 081 756	6 660 529	1 468 762	1579 171	40.65	31.07

Sources: (Urban Centres). i) Herrera, Ligia: Tendencias del poblamiento en Chile desde 1940 a 1960. Ed. por Departamento de Geografía de la Dirección de Estadística y Censos, Santiago de Chile, 1969.
ii) Dirección de Estadística y Censos, Entidades de Población (desde Tarapacá a Magallanes) para 1960 y 1970. Ed. por Dirección de Estadística y Censos, Santiago de Chile, 1963 y 1972.

Nota: Las cifras de población son de carácter preliminar, por esto difieren de las cifras censales. Sin embargo, estas diferencias son pequeñas. Las cifras preliminares son superiores a las definitivas en un 1.11 y 1.06 por ciento de la población urbana del país, en 1952 y 1960 respectivamente.

economic development in the future and, consequently, these areas should come in for particular attention, because the demographic development of an area is one of the fundamental prerequisites of its economic growth.

Finally, worthy of particular attention, as regards the population development of the above size-classes, is the intermediate size class (5 000 to 10 000 inhabitants) where there is an increase both of the number of the urban centres of this group, as also of the population, in both the periods under examination, 1952-60 and 1960-70. The population of this size class increased by 33.6 per cent, during the period 1960-70, while the increase of the population was 2.1 per cent during the previous decade (1952-60). The opposite can be said from the point of view of the two semi-periods (1952-60 and 1960-70), regarding the size-class 20 000 to 50 000 inhabitants, where the increase of the population amounted to 29.1 per cent during the first semi-period 1952-60, whereas during the period 1960-70 the population increase of this class was realized at very slow rate (3 per cent).

In conclusion, we can say, as regards the demographic development of the intermediate size-classes, that it can be considered satisfactory, and this is an encouraging point from the aspect of the economic growth of the various regions of the country. And this is because the population increase of urban centres, of a relatively small population size, mainly presupposes industrial development of the region. Furthermore, the economic development of such regions, as above, with manifest signs, not only of retaining their population, but also of increasing it, by the movement towards them or rural and even urban population, considerably limit astifilia, that is the movement of rural and urban population towards the metropolitan areas, such as -in this case- the area of Santiago. Regarding these urban areas, their population development in conjunction with the urbanization of the population of the country, we shall deal with them in detail in the next section.

4.3. The population development of the cities

The population growth and the rapid rate of urbanization in Chile, increased the population of the cities which, as is known, are considered as being nearly pure urban centres. This population increase, a result of the

movement of population from rural areas and urban centres with a small population, is greater in those cities which can be characterized as metropolitan areas, such as -for example- the country's capital, Santiago, or the largest port in the country, Valparaíso.

The cities are administrative centres of certain regions, because the main administrative services are concentrated in them. Furthermore, the cities are centres of economic, educational (Universities, Professional Schools, etc.), social and diplomatic services. Finally, many of the cities are centres of religious administration. It is, therefore, natural, that the cities form population poles and their demographic development, greater in comparison to the other centres, urban or rural, presents particular interest, in the analysis of the problem of urbanization and industrial development. On the other hand, this population concentration is an index of the urbanization of the country's population being realized, and the industrial development of these areas, in the sense of demand for labour force.

According to the census criteria (see Table 4.3.1), the cities[18/] with "urban characteristics" were 92, with a population of 3 008 thousand inhabitants, which was 50.7 per cent of the total population of the country in the year 1952. During the period 1952-70, and at the end of this period, the number of cities increased to 98 and their population showed an increase by 93.5 per cent and consists of 65.6 per cent of the total population of the country. This concentration of the population of the country in the cities, as also their demographic development, in the period under examination 1952-1970, is given in the table 4.3.1. Furthermore, the cities are also classified according to population size.

From this table, it can be seen that of the 98 cities, Santiago has a population of more than one million inhabitants. The speed of Santiago's growth, during the period 1952-70, can be considered high, although during the second semi-period 1960-70 the rate of growth experienced a slight drop. In the

18/ "Ciudad: Gran conglomerado continuo de viviendas, que posee todas las características urbanas en muy alto grado. Tienen este título las cabeceras de departamento y los centros urbanos que por disposición de la ley reciben tal denominación".

Table 4.3.1

THE POPULATION DEVELOPMENT BY SIZE OF CITY IN THE PERIOD 1952-70

Number of the class	Size of the city (in thousands)	Number of cities			Population (in thousands)			Annual rate of growth (percentage)	
		1952	1960	1970	1952	1960	1970	52-60	60-70
1	More than 1 000	1	1	1	1 218	1 907	2 729	5.77	3.65
2	150-500	1	1	3	219	253	611	1.82	9.22
3	100-150	1	2	3	132	264	384	9.04	3.83
4	50-100	7	9	12	451	591	876	3.43	4.01
5	30- 50	7	11	11	277	430	458	5.65	0.63
6	20- 30	8	11	11	201	280	277	4.25	-0.11
7	15- 20	8	9	3	143	154	129	0.93	-1.74
8	10- 15	10	13	14	121	156	167	3.23	0.69
9	Less than 10	49	32	35	246	222	190	-1.27	-1.54
Totals		92	89	98	3 008	4 257	5 821	4.28	3.18
Total Population					5 933	7 598	8 869		
Percentage of cities' population to total population					50.70	56.03	65.63		

Source: Dirección de Estadística y Censos, Entidades de Población (de Tarapacá a Magallanes) para 1952, 1960 y 1970. Dirección de Estadística y Censos. Santiago de Chile, 1955 - 1963 - 1972.

size-class of 150-500 thousand inhabitants, the cities with larger population, of course after the capital of the country, are included. The number of these cities was tripled in the period under study (1952-70). The fact of the increase of the number of cities and the high rate of growth of their population (9.22 per cent in the decade 1960-70) confirms the existing trend for concentration of the population in the larger cities of the country. The same can be said for the next two population size-classes. The number of cities in the fifth and sixth size-class was unchanged in the census years 1960 and 1970. We have a considerable decrease of the number of cities in the last size-class (less than 10 000 inhabitants) and, consequently, a decrease in their population.

In contrast to the decreasing trend of the aforementioned population group, in the 10-15 thousand inhabitant size-class, we have an increase in the number of cities. It is possible that this fact may reflect census reclassifications or, more probably, the inclusion of certain cities of less than 10 thousand inhabitants, on account of an increase of the population of the cities of this group. This, of course, does not reduce the importance of the fact that cities with a small population can develop demographically, which means that the internal migrants can move themselves to medium population size-class urban centres, instead of going towards large cities. As it is known, this demographic development of medium size-class cities, presupposes economic and social growth.

From the preceding analysis of the data of the table, we are led to the following conclusions:

a) An increase in the number of cities with a large population, with a corresponding decrease of the cities with a small population. This can be interpreted as a movement of the population of the cities with a small size population towards the large urban centres, verifying yet once more the trend for concentration of the population in the metropolitan areas of the country.

b) Cities with a small population can develop, as was the case in the size-class 10 to 15 thousand inhabitants.

c) The rate of growth of the capital of the country showed a drop during the second decade of the period 1952-70.

d) An increase in the total number of cities by 6 cities, while their population was increased by 93.5 per cent during the period under examination (1952-70).

We said previously that cities with a large population, (over 50 thousand inhabitants), show a demographic development. This event is made more specific by Table 4.3.2, which includes the main cities[19/] of the country with the

19/ As the population of the cities in Table 4.3.2, the total population of the area of the city was taken, without separation of the urban centres which consist of the city, from the rural centres of the area. This was done, because the percentage of urban centres of these areas is very small and, consequently, the cities can be considered pure urban centres.

characteristic of an upwards demographic evolution. Based on the data of Table 4.3.2, we see that the population of the cities of Santiago, Viña del Mar and Antofagasta was doubled during the period 1952-70, and the annual rate of growth of these three cities, although different in each decade, was 3.91 per cent, 4.21 per cent and 3.88 per cent respectively. The same can be said for the city of Temuco, where the annual rate of growth was 4.23 per cent.

The largest population increase occurred in the city of Arica, where the population increased by 363.16 per cent and the rate of growth was 8.51 per cent during the latest eighteen years (1952-70). The population increase of this city was perpendicular, if it be taken into account that the annual rate of growth was 0.5 per cent during the period 1930-52. We also have a considerable increase of population in the city of Talcahuano, where the population increased by 169.10 per cent. In this case, the annual rate of growth followed an upwards trend between the decades of the period 1952-70.[20/] On the contrary, the increase of the population of the city of Valparaíso can be considered small, within the period 1952-70, (14.61 per cent) and, as a matter of fact, during the decade 1960-70 we had a slight decrease of its population. Finally, from the aforementioned table it appears that the population of the 10 cities of the table which are surveyed, amounts to 3 993 thousand inhabitants, consists of 45.02 per cent of the total population of the country and experienced an increase by 92.90 per cent during the period under study 1952-70. As a conclusion, we can say that the demographic development of these cities, being different between each city, followed a different trend in two decades of the period examined, 1952-70 with an annual rate of growth of 3.65 per cent.

20/ In the cities of Temuco, Talca and Chillán we also have an upward trend of their rate of growth during both decades, 1952-60 and 1960-70.

Table 4.3.2

THE DEMOGRAPHIC DEVELOPMENT OF THE MAIN CITIES OF THE COUNTRY DURING THE SAMPLE PERIOD 1952-70

n/n	City	Population (in thousands)			Annual rate of growth (percentage)			Increase Absolute (in thousands)	Increase Relative (Percentage)
		1952	1960	1970	52-60	60-70	52-70	52-70	52-70
1	Santiago	1 350	1 907	2 729	4.32	3.58	3.91	1 379	102.15
2	Valparaíso	219	253	251	1.81	-0.10	0.75	31	14.61
3	Viña del Mar	85	116	182	3.79	4.55	4.21	97	114.12
4	Concepción	120	148	178	2.62	1.85	2.19	58	48.33
5	Talcahuano	55	84	148	5.29	5.73	5.53	93	169.09
6	Antofagasta	62	88	125	4.30	3.53	3.88	63	101.61
7	Temuco	52	72	110	4.21	4.25	4.23	59	111.54
8	Talca	55	68	94	2.67	3.25	2.99	39	70.91
9	Arica	19	43	88	10.34	7.05	8.51	69	363.16
10	Chillán	53	65	88	2.67	2.96	2.83	35	66.04
	Total	2 070	2 844	3 993	3.97	3.39	3.65	1 923	92.90
	Total population of Chile	5 933	7 374	8 869	2.72	1.85	2.23	2 936	49.49

Sources: Dirección de Estadística y Censos, Censos de Población (1952-1960). Dirección de Estadística y Censos, Santiago de Chile, 1959-1969. Dirección General de Estadística y Censos, Entidades de Población (de Tarapacá a Magallanes) para 1970. Dirección de Estadística y Censos, Santiago de Chile, 1972.

IV. URBANIZATION AND INDUSTRIAL DEVELOPMENT IN THE CASE OF CHILE

1. The influence of industrial development and urbanization

1.1. The functional relationships of urbanization

As a basic hypothesis, as regards the urbanization of the population of the country and industrial development, we accepted that the latter -industrial development- influences the development of urbanization. In other words the increase of urbanization is a function of the industrial development of the country. This can be written, in a mathematical form, as follows:

$$N_t^r = f\ (I_t) \qquad (1)$$

where:

N_t^r : urban population of a country, at time, t.

I_t : industrial development of a country, at time, t.

f : symbol of function.

t : time.

The functional relationship (1) expresses the influence of industrial development on urbanization. It was said, however, in the determination of the problem under study and its theoretical consideration that, apart from the aforementioned factor of industrialization, other factors also contribute to the increase of internal migration towards the urban areas and, particularly, to the movement of the agricultural labour force to the industrial centres of the country which are characterized as urban centres. These factors, on the basis of what we mentioned in the brief description of an econometric model and its statistical criteria in Chapter II, Section 3.1, are included in the unexplained part of the equation. As a consequence, relationship (1) can be written in the following form:

$$N_t^r = f\ (I_t) + e_t \qquad (2)$$

where:

N^r, I, f, t : as in relationship (1)

e : unexplained part of the relationship.

Furthermore, in the relevant chapter concerning hypotheses and methodology, we said that as independent variables in the functional relationship of urbanization, we will use the per capita income of the urban population, the demand for labour in the secondary branch of the economy, the wage of industry and unemployment in agricultural production.[21/] The reason for this is that the above factors are economic and demographic factors, whose investigation is included in the aims of the present work, and they correspond more with the causes of internal migration towards the industrial centres and can be considered, in a broad sense, as indices of the industrial development of the areas.

Based on the above, relationship (2) can be transformed and takes the following form, on the basis of the aforementioned determinative factors -causes- of the increase of urbanization of the population of the country:

$$N_t^r = f\ (Y_t^r/N_t^r) + e_t \qquad (3)$$

where:

N_t^r : urban population of a country, at time, t.

Y_t^r/N_t^r : per capita urban income, at time, t.

e_t : residual of the relationship.

21/ Of course, apart from the aforementioned determinative factors, there are other factors. These factors (e.g. communication - information, advertising over TV and radio, etc.) on account of their qualitative character, cannot be introduced as explanatory variables in the functional relationships of the urbanization of the population under study. Further to this, the influence of these qualitative factors on urbanization, is included in certain variables of a quantitative character, which are introduced in the equations to be tried. For instance, in the case of communication, advertising, etc., the factors cause the increase of demand for labour force in the secondary production, and, consequently, the influence of the demand for labour force. Finally, the existing difference between the per capita urban and agricultural income was taken as an explanatory variable of the development of the urban population, but the results obtained were almost similar to the equation (1) in the Section 1.2 at the present Chapter.

The functional relationship (3) expresses the influence of the changes of the urban per capita income on the size of the urban population of the country. Moreover, this relationship, by the elimination of the neutral part both of national income and total population of the country -agricultural income and rural population- corresponds more satisfactory to the hypothesis adopted regarding the relationship between urbanization and the per capita income of the urban areas.

Another important factor which influences urbanization and can be introduced as an explanatory variable in the functional relationship between the variable under study and economic and demographic factors, is the demand for labour force, in the secondary branch of the economy. Thus, in this case we will have:

$$N_t^r = f\ (D_t^w) + e_t \qquad (4)$$

where:

D_t^w : demand for labour force in the secondary production, at time t.

N_t^r : as in the relationship (1).

This relationship can be supplemented by the introduction, as an independent variable, of unemployment in the agricultural sector of the economy, which can also be considered a determinative factor of the variable under study. Thus, we will have:

$$N_t^r = f\ (D_t^w,\ U_t^a) + e_t \qquad (5)$$

where:

U_t^a : unemployment in the primary production of the economy at time, t.

D_t^w : as in the relationship (4).

Finally, the worker's wage in industry was said to be considered a factor for the movement of the agro-labour force to the industrial sector of the economy. Therefore, we can formulate the following functional relationship with the explanatory variable of the worker's wage.22/

22/ Apart from the labour wage in industry, W^w, as an explanatory variable in the above functional relationship, the existing difference between the industry wage and the agricultural wage was introduced. (Remark of Prof. J. Elizaga during the conference on 31st October 1973), however, the statistical results were not satisfactory. Similarly, in this same functional relationship, the ratio of the industrial wage and the agricultural wage was tested as an independent variable, but in this instance also we did not have better luck, as regards the statistical results obtained.

$$N_t^r = f\ (W_t^w) + e_t \qquad (6)$$

where:

W_t^w : labour wage in industry, at time, t.

After the formulation of the above six functional relationships of the urbanization of the population of the country, they are tested in indicated forms of equations, that is, linear and curvilinear form. The following tables include the models, i.e. they incorporate their mathematical forms, the parameter estimates with their standard errors in parenthesis, the determination coefficients (R^2) and the von Newman criterion. The comparison of the results to be obtained in these models, will allow us the selection of those models for the expression of forecasts. Furthermore, the elasticities, as far as the explanatory variables are concerned, are included in Section 1.4 of the present chapter. Finally, the sampling period (1961-70), from the point of view of the number of observations, can be considered satisfactory, because the changes of the exogenous variables during this period will be involved in the results of the statistical estimates.

1.3. The analysis of the statistical results obtained

In the Section 1.2, the best fitting regressions are given in linear and logarithmic form. These regression equations explain the change which the variable under study undergoes through the influence of the determinants taken during the sample period, 1960-71. These equations are numbered by a nominal number. The comparison of the results obtained, will allow the selection of those equations, for the expression of forecasts. A detailed analysis of the results obtained by the regression equations, on the basis of statistical criteria, is attempted hereunder.

The following are observed as statistical criteria of the equations tried:

a) The sign of the regression coefficients should correspond to the economic theory, on the basis of which the model was formulated. The sign of the the per capita income is positive in the equations, as was expected. Similarly, the sign of the demand for labour force, unemployment in the agricultural branch of the economy and the wages in secondary production is positive based on the

1.2. The best fitting regressions

1.2.1. The linear form

n/n	Model	Estimate of parameters	Percentage of N^r variance explained by regression (1)	$\bar{R}$ (2)	Von Newman K_2 (3)
1*	$N^r_t = a + b\ Y^r_t/N^r_t$	$N^r = -3856.6 + 3.509\ Y^r_t/N^r_t$ (0.417)	94.2	0.887	0.1820
2*	$N^r_t = a + b\ D^W_t$	$N^r = -1952.2 + 12.12\ D^W_t$ (1.53)	96.2	0.925	0.2307
3*	$N^r = a + b\ W^W$	$N^r = 549.2 + 56.83\ W^W$ (17.12)	88.7	0.786	0.8607
4*	$N^r = a + b\ D^W_t + c\ U^a$	$N^r = 2483.1 + 7.48\ D^W_t + 350.54\ U^a_t$ (1.11) (18.48)	99.9	0.999	0.2307

1.2.2. The logarithmic form

1*	$\text{Log}\ N^r_t = \text{Log}\ a + b\ \text{Log}\ Y^r_t/N^r_t$	$\text{Log}\ N^r_t = -1.9175 + 1.6513\ \text{Log}\ Y^r_t/N^r_t$	94.3	0.890	0.1820
2*	$\text{Log}\ N^r_t = \text{Log}\ a + b\ \text{Log}\ D^W_t$	$\text{Log}\ N^r_t = 0.0675 + 1.3175\ \text{Log}\ D^W_t$ (0.1741)	96.1	0.924	0.2307
3*	$\text{Log}\ N^r_t = \text{Log}\ a + b\ \text{Log}\ W^W$	$\text{Log}\ N^r_t = 1.9897 + 0.9024\ \text{Log}\ W^W_t$ (0.0110)	88.9	0.790	0.8607
4*	$\text{Log}\ N^r_t = \text{Log}\ a + b\ \text{Log}\ D^W_t + c\ \text{Log}\ U^a_t$	$\text{Log}\ N^r_t = 0.8469 + 0.8285\ \text{Log}\ D^W_t +$ (0.1212) $+ 0.5922\ \text{Log}\ U^a_t$ (0.0315)	99.9	0.999	0.2307

general hypothesis. In other words, the positive sign of the regression coefficients means that an increase of the determinative factor creates an increase of urbanization of the population of the country and, especially, an increase of the labour force in the secondary production, by moving the agricultural labour force towards the industrial centres of the country.

b) The coefficient of determination, R^2. This coefficient determines the percentage of the variance of the dependent variable explained by the independent variables. From column (1) of the econometric model tables, it is seen that the fitting regressions have explained a very high percentage of the total variance in the dependent variable. Of the 8 regression equations, 6 have explained more than 90 per cent of the variance of the regression, and the fit of the corresponding lines to the data observed must be considered very good. The average correlation coefficient is found to be about 0.90. In two cases -(2) and (4) equations in both forms- the correlation coefficient is greater than 0.95. The criterion "F of Snedecor" is taken into account on time series, for testing the statistical significance of the coefficient of determination, R^2, and it is investigated at a level of 5 per cent or less. From such a point of view, the regressions are considered statistically significant.

In conclusion, we can say that the coefficient of determination, as a measure of the good fit of empirical data, shows that the aforementioned regressions can be considered the best fitting ones. Moreover, we verify the probable existing correlation between the variable under study and independent variable of the functional relationships.

d) The standard error of estimate. The reliability of the statistical parameter estimates of an equation is judged by the standard error. In other words, the standard error is the measurement of the fit of the data of a regression equation formulated. The criterion of t-student is taken into consideration for testing of the statistical significance of the parameters estimates, at a level of 5 per cent or less. On the basis of this criterion, the regression coefficients of the equations tried are statistically significant.

e) Regression coefficients. They were included in the tables of the best fitting regressions. Each regression coefficient measures the change of the explained variable -urbanization- caused by the unique change of the

independent variable. Thus, the coefficient 3.509 on the per capita urban income in equation (1) of the linear form, means that if the per capita income rose by 100 escudos, the urban population would rise by 350 thousand persons approximately. In the linear equation (2), its coefficient shows that if the demand for labour force rises by 1 000 persons, the urbanization of the population would increase by 56 000 inhabitants approximately, and so on.

f) Autocorrelation: As regards the investigation of autocorrelation between the successive observations of the same time-series of the independent variables, von Newman's criterion was applied.[23/] The test of significance was made at the five per cent level. The calculated value, K_2, is less than the corresponding value of the table (K_1) and consequently, it is concluded that a positive autocorrelation exists.

Having analysed the results obtained, we come to the following conclusions:

i) The regression equations tested can be considered as those best fitting to the empirical data regarding the explanatory variables, as can be verified by the coefficient of determination, R^2.

ii) The forms of the equations can also be considered the appropriate ones, in accordance with the standard error of estimate.

iii) The signs of the regression coefficients were what was indicated by the economic theory.

Therefore, all the equations can be used for forecasts of the development of urbanizations in the coming years, and for this reason are marked by*.

23/ $K_2 = \frac{d^2}{s^2}$

where: d^2 : The average of the sum of the squares of the differences between the successive values of the variable,

$(X_{t+1} - X_t)^2$, $t = 1, 2 \ldots n$

s^2 : The variance of the sample.

1.4. Elasticities

1.4.1. The concept of elasticity

In a quantitative economic analysis, the existing relationship between two economic magnitudes is measured by the elasticity and, consequently, its investigation is deemed necessary in the present work.

Before proceeding with this, we represent its mathematical concept. A mathematical function has the property of elasticity. Thus, given a function f(x, y, z), its elasticity with respect to the variable, x, is defined as plus or minus its logarithmic derivative, with respect to x. We denote the elasticity by $e_x f$ according to the sign.

$$e_x f = \pm \frac{d \log f}{d \log x} = \pm \frac{x}{f} \frac{df}{dx} \qquad (1)$$

The elasticity with respect to income, demand etc., is briefly called income elasticity, demand elasticity, etc. Besides the sign, the elasticity consists of its amount. Finally, the elasticity is independent of measuring units of the variables.

1.4.2. Average and point elasticities

According to formula (1) of the preceding section, the income elasticity is defined as follows:

$$e_{Y^r/N^r} = \frac{dN^r}{d(Y^r/N^r)} : \frac{Y^r/N^r}{N^r}$$

where:

e_{Y^r/N^r} : income elasticity

Y^r/N^r, N^r : as in the list of variables

i.e. the income elasticity is equal to the product of the derivative of urbanization, with respect to the per capita urban income at a point of the curve, by the ratio $Y^r/N^r / N^r$

where:

Y^r/N^r and N^r are the per capita urban income and urbanization at that point.

This elasticity is called point elasticity. The average elasticity is derived by taking the average values of the variables, $Y^r/_{N^r}$ and N^r in the formula

$$\bar{e}_{Y^r/_{N^r}} = \frac{d\,N^r}{d(Y^r/_{N^r})} \cdot \frac{(\bar{Y^r}/_{N^r})}{\bar{N^r}}$$

and it refers to a period of time.

The elasticities, with respect to the explanatory variable of the logarithmic equations, are included in the following Table 1.4.2.2., while the elasticities of linear form estimated are included in Table 1.4.2.1.

The analysis of the elasticity is based on the sign and its amount. The sign shows the direction of the change of the variable under study -urbanization- caused by each explanatory variable, while the amount shows how much. From this point of view of sign, the elasticities coefficients drawn have the sign indicated by economic theory. Regarding the amount, the average income elasticity is 1.65 in the linear equation (1). That is, if the average income increases by 10.65 per cent the urbanization of the population will increase by 10.65 per cent. In the linear equations (2) and (4), the average demand for labour force elasticity is 1.3 and 0.81 respectively. This means that if the labour force of the secondary production increases by 10 per cent, the urban population will rise by 10.31 per cent and 8.10 per cent respectively. In the same manner, we can explain the meaning of the other explanatory variables. Finally, the elasticities of the linear equations are not constant at different points of the curve. These changes of elasticities during the sample period 1960-70 mean that the influence of each explanatory variable and urbanization was different at the various points -years- of this period of time.

In conclusion, we can say that income and the demand for labour force in the secondary branch of the economy (first and second equations) can be considered the most important determinative factor of the urbanization of the Chilean population. The wages for labour in secondary production and unemployment in agricultural production also influence the increase of the population of the urban centres, but at a lower level than the previous two main factors.

Table 1.4.2.1

ELASTICITIES WITH RESPECT TO THE EXPLANATORY VARIABLES OF THE LINEAR EQUATIONS TRIED

Number of equation	Variable	Average elasticity	Point elasticities										
			1960	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
1*	Per capita income, Y^r/N^r	1.65	1.74	1.74	-	1.69	-	1.70	-	1.59	-	1.52	-
2*	Demand for labour force, D^W	1.31	-	-	-	-	1.36	-	1.30	-	1.29	-	1.28
3*	Wages for workers, W^W	0.89	-	-	0.92	-	0.93	-	0.88	0.83	-	-	-
4*	Demand for labour force, D^W	0.81	-	-	-	-	0.84	-	0.80	-	0.79	-	0.79
4*	Unemployment, U^a	0.56	-	-	-	-	0.59	-	0.60	-	0.51	-	0.53

Table 1.4.2.2

ELASTICITIES WITH RESPECT TO THE EXPLANATORY VARIABLES OF THE LOGARITHMIC EQUATIONS TRIED

Number of equation	Variable	Average elasticity
1*	Per capita income, Y^r/N^r	1.65
2*	Demand for labour force, D^W	1.32
3*	Wage for workers, W^W	0.90
4*	Demand for labour force, D^W	0.83
4*	Unemployment, U^a	0.59

Similar remarks can also be expressed for the logarithmic form of the equations, as far as the elasticities are concerned.

1.5. Forecasts

1.5.1. Techniques. Period of forecasting. Assumptions

Forecasting is a more or less successful prediction of the future, on the basis of the observed regularities in the past, i.e., the inference from the past in the future. In Chapter III, we analysed the development of the urbanization of the Chilean population in the past, while in Section 1 at the present chapter, we determined the main economic factors which influence the increase of the urban population of the country and we selected the most appropriate regression equations for forecasts marked by *. In this section we will make forecasts as far as the development of urbanization in the projected period of time 1971-75. In other words, the dependent variable -urbanization- will be predicted on the basis of selected regression equations and certain assumptions as far as the determinative factors are concerned. This technique of forecasting, which is called forecasting by functional extrapolation, will be used in the present case. Furthermore, the projected period of time is five years approximately (1971-1975) and, consequently, we will make long-run forecasting. As regards the assumptions, they refer to the factors which influence urbanization. More specifically, these assumptions are the following:

a) The development of the explanatory variables, as this is presented in the respective tables, will indeed take place and their properties will remain unchanged.
b) The determinative factors defined during the sample period 1960-71 will continue exercising the same influence on the urbanization of the population of the country in the forecasting period.
c) New systematic factors affecting the variable under study will not appear during the projection period 1971-75.

It is known that the validity of the assumptions mainly depends on the "elongation" of the period of forecasts, while the accuracy of a forecast depends on the realisation of the assumptions adopted. In general, we can say that it is not easy to forecast accurately, because there are many difficulties,

however, the deviations between what is realized and what is evaluated by forecasting will facilitate the improvement of the models, by introducing new determinative factors, type of equation, period of forecasting, etc.

Finally, a comparison of the results obtained by this technique of forecasting and those drawn by CELADE will be realized hereunder.

Table 1.5.1.1

DEVELOPMENT OF DETERMINATIVE FACTORS
OF URBANIZATION IN 1975

n/n	Variable	Assumptions	Rate of growth 1971-75	Estimations 1975	
1	Y^r/N^r	Pessimistic (A)	1.6	3 108	in escudos
		Conservative (B)	2.0	3 157	in escudos
		Optimistic (C)	2.5	3 220	in escudos
2	D^w	Pessimistic (A)	2.0	794.7	in thousand persons
		Conservative (B)	2.5	810.4	in thousand persons
		Optimistic (C)	3.0	826.4	in thousand persons
3	W^w	Pessimistic (A)	2.0	103.7 a/	in thousand persons
		Conservative (B)	4.0	118.8	in thousand persons
		Optimistic (C)	6.0	135.8	in thousand persons
4	U^a	Pessimistic (A)	1.0	10.8	in thousand persons
		Conservative (B)	1.4	11.0	in thousand persons
		Optimistic (C)	1.8	11.2	in thousand persons

Note: The pessimistic assumption of the aforementioned variables corresponds to their rate of growth during the past period 1960-71.

a/ Base year 1962=100 and period of time 1968-75 for the rate of growth.

1.5.2. Evaluation of forecasts comparisons

In Table 1.5.2.1., we present the arithmetical results which refer to the increase of the urban population of the country in the year 1975. Furthermore, this table includes the number and the type of the equations tested, as

well as the three assumptions as regards the development of the determinative factors of the variable under study -urbanization- in the same year (1975).

Table 1.5.2.1

THE DEVELOPMENT OF THE URBANIZATION OF THE POPULATION OF THE COUNTRY IN THE YEAR 1975

Number of equation	Type of equation	Assumptions	Urban population (in thousands) 1975
1	Linear	A	7 049
		B	7 221
		C	7 442
2	Linear	A	7 680
		B	7 870
		C	8 064
3	Linear	B	7 301
		C	8 267
4	Linear	A	7 247
		B	7 435
		C	7 625
1	Logarithmic	A	7 074
		B	7 258
		C	7 500
2	Logarithmic	A	7 736
		B	7 938
		C	8 145
3	Logarithmic	B	7 278
		C	8 212
4	Logarithmic	A	7 273
		B	7 473
		C	7 676

Finally, we compare the results obtained, regarding the development of the urban population of the country in 1975, with the urban population forecasts in the same year (1975), made by the Latin American Demographic Centre (CELADE) 24/

24/ La proyección media para 1975, de que se dispone después del Censo de 1970, es para la población total (CELADE, Boletín Demográfico N°11, Santiago de Chile, enero 1973).
Para obtener la proyección de la población urbana para 1975, se aplicó el porcentaje de la población urbana, estimado por la Corporación de Fomento de la Producción (Perspectivas de Crecimiento de la Población Chilena 1970-1985, Corporación de Fomento de la Producción, publicación N°10-A 170. Santiago de Chile, 1970).

CELADE and equations applied	Assumption	Urban population (in thousands) 1975	Deviations	
			Absolute	Per cent
CELADE 1* equation linear	Conservative (B)	8 140	698	8.6
	Optimistic (C)	7 442		
CELADE 2* equation linear	Conservative (B)	8 140	76	0.9
	Optimistic (C)	8 064		
CELADE 3* equation linear	Conservative (B)	8 140	-127	-1.6
	Optimistic (C)	8 267		
CELADE 4* equation linear	Conservative (B)	8 140	515	6.3
	Optimistic (C)	7 625		
CELADE 1* equation logarithmic	Conservative (B)	8 140	640	7.9
	Optimistic (C)	7 500		
CELADE 2* equation logarithmic	Conservative (B)	8 140	- 5	-0.1
	Optimistic (C)	8 145		
CELADE 3* equation logarithmic	Conservative (B)	8 140	- 72	-0.9
	Optimistic (C)	8 212		
CELADE 4* equation logarithmic	Conservative (B)	8 140	464	5.7
	Optimistic (C)	7 676		

From the above data it appears that the use of the variable of demand for labour force in the secondary branch of the economy, as a determinative factor of the increase of the urban population of the country, has been the most successful. The same can be said for the other determinative factors. The relatively higher deviation between the forecasts of urban population made by CELADE and the models appears in the first equation which incorporates as an explanatory variable, the per capita income. This can be attributable to the non-continuous upwards trend of the national income in the period under study 1960-70. This fact does not reduce the meaning of the per capita income as regards its influence on the population movements of the rural areas towards the urban centres.[25/]

25/ The factor, per capita income in the case of increase of urban population of the metropolitan area of Santiago, gave very satisfactory results, verifying in this manner what we previously stated.

Consequently, on the basis of the above comparative results obtained by the Latin American Demographic Centre (CELADE) and the models of the present work, regarding the development of the urban population of the country in the year 1975, we can say that their deviations can be considered negligible. Therefore, the application of such models, from the point of view of making urban population forecasts, is indicated.

In the diagrams 1-4, we give the observed and estimated values of the urbanization of the Chilean population, their deviations in percentage and the influence of the explanatory variables on the variable under study of linear equations which, with their logarithmic ones, are used for forecasts.

2. Regional economic growth and urbanization

2.1. In general

In the first chapter, we said that the problem of economic growth appears more intense in less-developed countries. In these countries, the difference in income levels by geographical regions are, at times, great. As a rule, the more less-developed the economy of a country is, the greater is the inequality of development among the various regions of the country. The regional problem, as the inequality of income distribution among the different regions of a country is more broadly called, is of different intensity and form in each country, and is characterized by that factor which appears more intensively. These factors, apart from income, are employment, urbanization, industrialization, external emigration, etc. These factors are closely related between themselves, so that the appearance of one of them presupposes the existence of the others. The per capita income of the inhabitants of a region, is the measure for the estimation of the degree of economic growth of each geographical region. Furthermore, for the total of regions, as a measure of the existing differences, the index of regional inequalities, introduced by Williamson, can be applied. This index is a reliable criterion for the measurement of total differences during a period of time. Apart from the above comparative usefulness, this index can be utilised in comparisons between countries as regards existing inequalities among the regions of each country, but this use of the index is limited.

2.2. The regional problem in Chile

The regional problem in the case of Chile, appears in the following form: Large income differences exist between the provinces. The degree of industrial development differs considerably in each province. There are also differences in internal population movements. Hereunder, we realize an analysis of these "regional differences". Thus, as regards the income and from the data of the following Table 2.2.1., we can say that, in the provinces of O'Higgins and

Table 2.2.1

THE PER CAPITA INCOME BY PROVINCE DURING THE YEARS 1960 AND 1970, AT CONSTANT 1965 PRICES

n/n	Region	Per capita income (in Escudos)	
		1960	1970
1.	Tarapacá	2 192	3 064
2,	Antofagasta	4 130	5 983
3.	Atacama and Coquimbo	1 732	2 413
4.	Aconcagua and Valparaíso	2 214	2 391
5.	Santiago	2 312	2 984
6.	O'Higgins and Colchagua	1 903	2 247
7.	Curicó, Talca, Maule and Linares	1 265	1 560
8.	Ñuble, Concepción, Arauco, Bío-Bío and Malleco	1 418	1 697
9.	Cautín	961	1 092
10.	Valdivia and Osorno	1 382	1 614
11.	Llanquihue, Chiloé and Aysén	1 248	1 532
12.	Magallanes	3 832	4 758
	Chile	1 912	2 437

Sources: i) Oficina de Planificación Nacional (ODEPLAN). Unidad de Estadísticas Básicas e Indicadores Regionales. Producto Geográfico Bruto 1960-1970. (Cifras Provisorias). (Mimeo), Santiago de Chile, 1973.

ii) Instituto Nacional de Estadística, -Censo de Población 1960, Tomo A, Santiago de Chile, 1969.
-Censo de Población 1970. Muestra de Adelanto de Cifras Censales, Santiago de Chile, 1972.

Colchagua, the per capita income was nearly the same as the per capita income of the country (1 900 Escudos) in the year 1960, while the per capita income of the provinces of Antofagasta and Magallanes was double. Of the remaining 21 provinces, 4 provinces (Tarapacá, Aconcagua, Valparaíso and Santiago) had a per capita income larger than E°1 900, while the per capita income of the remaining 17 provinces was equal to E°1 300 on the average during the same year (1960). The per capita income of the country, in the year 1970, reached E°2 450, thus showing an increase by 27.5 per cent compared with the per capita income for the year 1960. The position of the provinces, in their distribution according to the per capita income, changed in the year 1970. Thus, in four provinces (Atacama, Coquimbo, Colchagua and Valparaíso) the per capita income did not differ from the per capita income at the national level (E°2 400). The per capita income of the provinces of Antofagasta and Magallanes was E°5 980 and E°4 758 respectively. In other words, the per capita income of these provinces continues being double the average income of the country, as in the year 1960. To these provinces, with a per capita income larger than E°2 450, can also be added the provinces of Tarapacá and Santiago. The smallest per capita income of the country is that of the province of Cautín (E°1 100), and the difference of the per capita income of this province from that of the per capita income of the country and the province of Antofagasta, which has the largest per capita income, amounts to E°1 343 and E°3 891 respectively. This ascertainment, as far as the differences of income levels concerned, is verified by the index of regional inequalities.[26/] The value of this index was calculated to be 38.0 in the year 1970 and it is characteristic of the differences existing between the provinces, as regards income, in the case of Chile. Of course, this index showed a slight improvement in comparison with 1960, which means that a reduction occurred in the income differences of geographical regions of the country.

26/ Index of regional inequalities

$$V_w = \frac{\sqrt{S_i (Y_i - \bar{Y})^2 \; f_i / n}}{\bar{Y}}$$

where: f_i : population of the geographic region, i
n : total population of the country
Y_i : per capita income of the region, i
$\bar{Y}$: per capita income of the country

Diagram 1: 1st. LINEAR EQUATION TESTED: OBSERVED AND ESTIMATED VALUES OF THE URBANIZATION OF THE POPULATION IN CHILE, THEIR DEVIATIONS IN PERCENTAGE AND THE INFLUENCE OF THE EXPLANATORY VARIABLES OF THE EQUATION

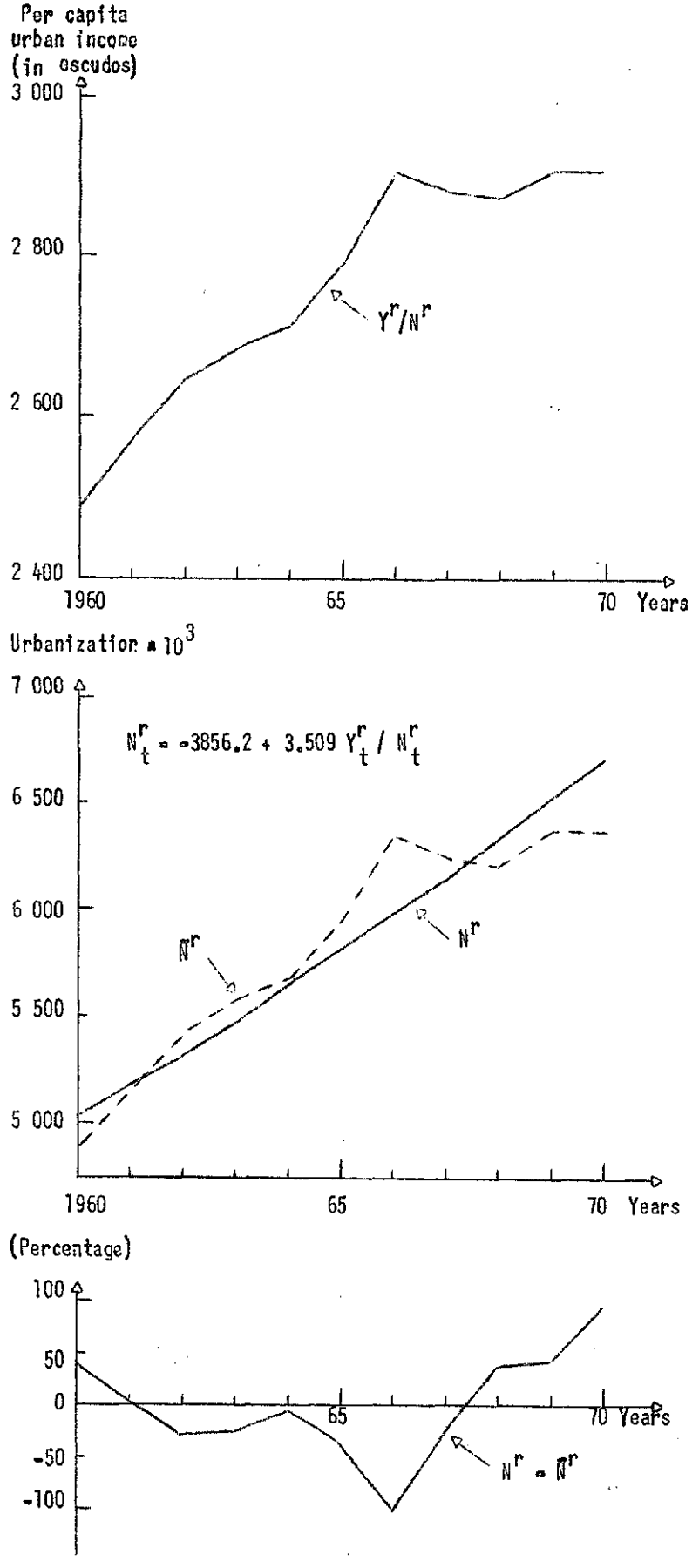


Diagram 2: 2nd. LINEAR EQUATION TESTED: OBSERVED AND ESTIMATED VALUES OF THE URBANIZATION OF THE POPULATION IN CHILE, THEIR DEVIATIONS IN PERCENTAGE AND THE INFLUENCE OF THE EXPLANATORY VARIABLES OF THE EQUATION

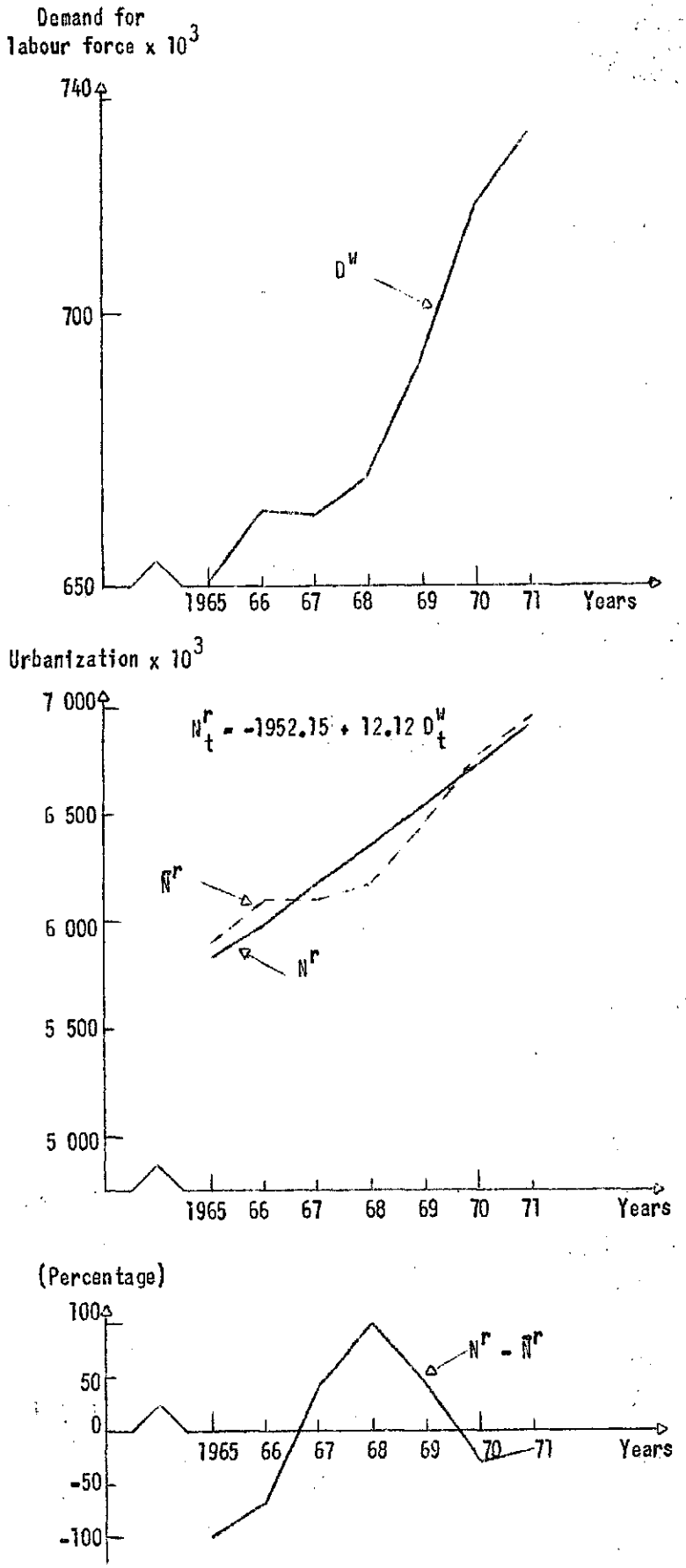
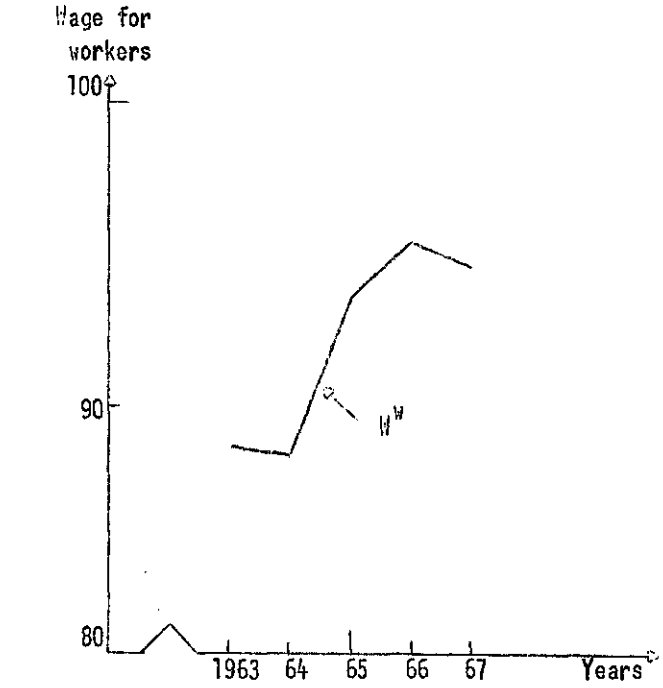
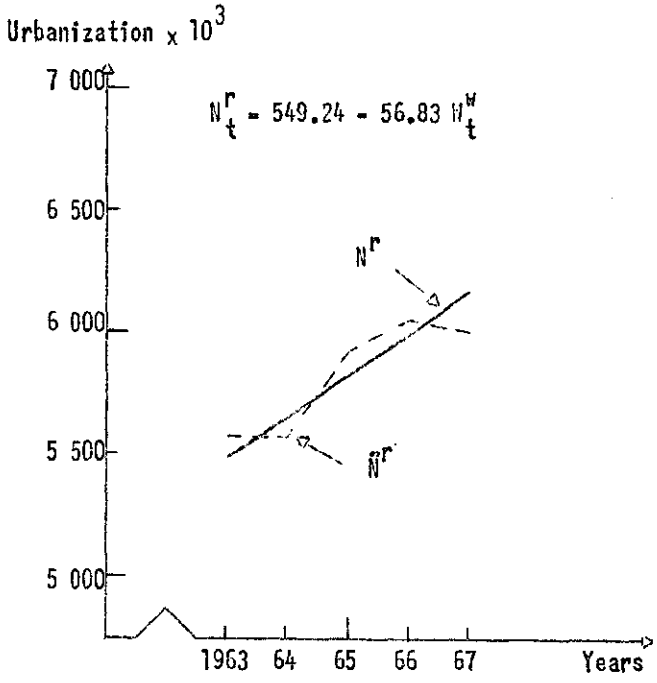


Diagram 3: 3rd. LINEAR EQUATION TESTED: OBSERVED AND ESTIMATED VALUES OF THE URBANIZATION OF THE POPULATION IN CHILE, THEIR DEVIATIONS IN PERCENTAGE AND THE INFLUENCE OF THE EXPLANATORY VARIABLES OF THE EQUATION





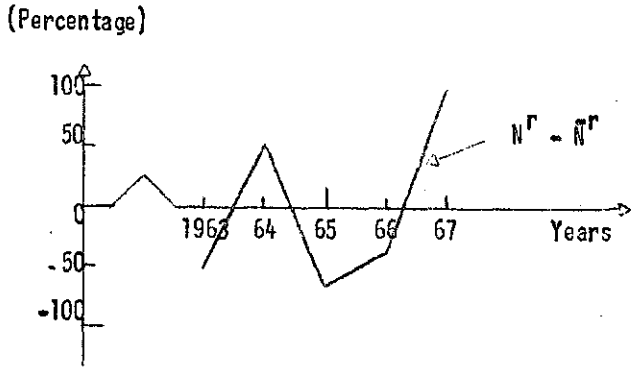
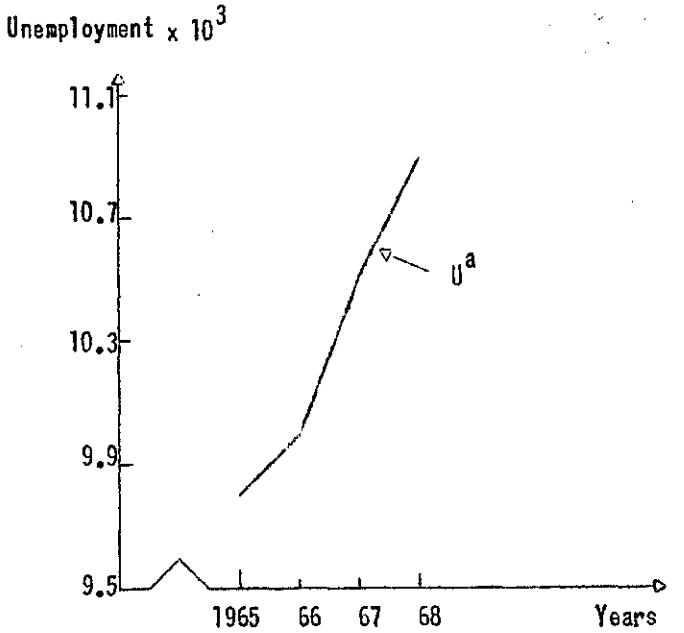
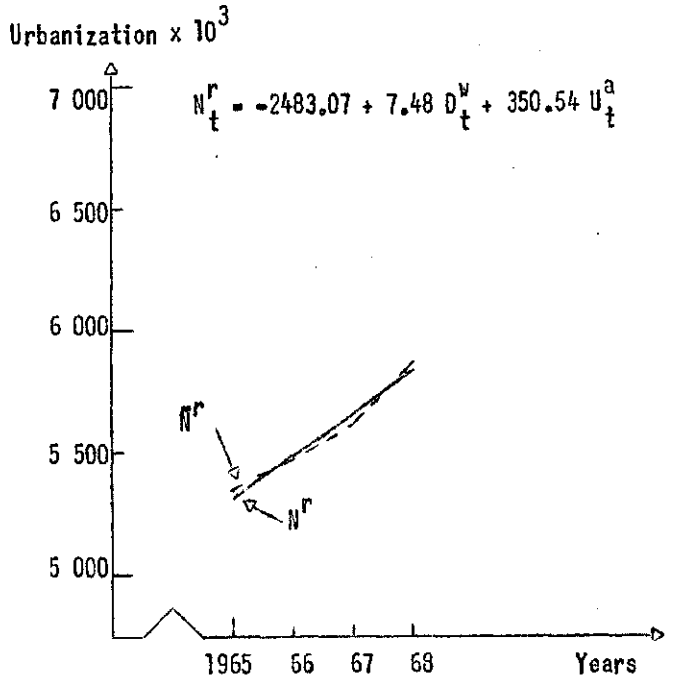
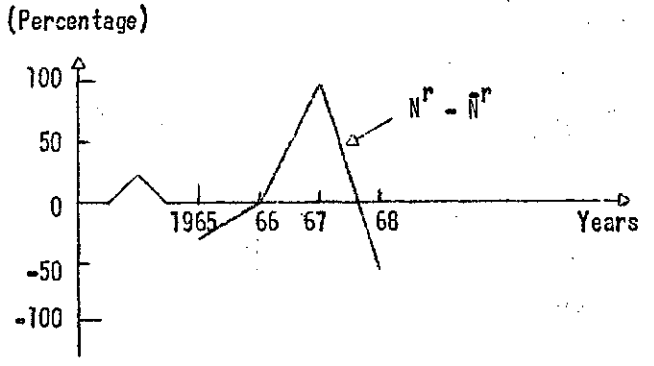


Diagram 4: 4th. LINEAR EQUATION TESTED: OBSERVED AND ESTIMATED VALUES OF THE URBANIZATION OF THE POPULATION IN CHILE, THEIR DEVIATIONS IN PERCENTAGE AND THE INFLUENCE OF THE EXPLANATORY VARIABLES OF THE EQUATION







As regards industrial development by region, we can also say that industrialization differs in each province. In certain provinces, the industrialization index can be considered as being at a satisfactory level, while in other provinces this index is at a low level. In greater detail, the industrialization index, on the basis of the data of Table 2.2.2., has as follows:

Table 2.2.2

THE INDEX OF INDUSTRIALIZATION BY PROVINCE DURING THE CENSUS YEARS 1952, 1960 AND 1970

n/n	Provinces	Index of Industrialization a/		
		1952	1960	1970
1.	Tarapacá	39.1	33.1	26.3
2.	Antofagasta	59.5	50.6	37.5
3.	Atacama and Coquimbo	35.5	34.8	32.8
4.	Aconcagua and Valparaíso	29.2	26.8	24.5
5.	Santiago	37.3	34.7	30.3
6.	O'Higgins and Colchagua	19.4	18.9	21.9
7.	Curicó, Talca, Maule and Linares	16.2	14.8	13.9
8.	Ñuble, Concepción, Arauco, Bío-Bío and Malleco	25.8	26.9	24.2
9.	Cautín	14.8	13.8	12.5
10.	Valdivia and Osorno	21.9	21.7	16.4
11.	Llanquihue, Chiloé and Aysén	14.4	17.0	12.9
12.	Magallanes	31.8	29.9	24.2
	Total	29.4	28.2	25.3

Sources: i) Dirección de Estadística y Censos, XII Censo de Población y Vivienda, 1952. Santiago de Chile, 1959.
ii) Dirección de Estadística y Censos, XIII Censo de Población, 1960. Santiago de Chile, 1969.
iii) Instituto Nacional de Estadística, XIV Censo de Población y Vivienda, 1970. Muestra de Adelanto de Cifras Censales, Santiago de Chile, 1972.

a/ Incluye Población Económicamente Activa en: Industria Manufacturera, Minas y Canteras, Construcción, Luz-gas-agua y servicios sanitarios. Más adelante, en el Capítulo V, Tabla 1.1, el índice de industrialización incluye solamente Industrias Manufactureras.

In the provinces of Antofagasta and Cautín, the industrialization index was 50.6 per cent and 13.8 per cent respectively, during the year 1960. We observe, therefore, that a considerable difference exists, amounting to 36.8 per cent, between the two industrialization indices of these two provinces which, as can be seen in the table, hold the extreme but opposite, positions, from the industrial development view. There are only six provinces (Tarapacá, Antofagasta, Atacama, Coquimbo, Santiago and Magallanes) whose index of industrialization is more than the index at the national level (28.2 per cent). Finally, in 10 provinces (O'Higgins, Colchagua, Curicó, Talca, Maule, Linares, Cautín, Llanquihue, Chiloé and Aysén) the index of industrialization is 16.1 per cent on the average and, consequently, it can be considered as being at a low level. The index of industrialization has not changed considerably in the years 1952 and 1960, while it showed a drop in the census year 1970, (25.3 per cent). In this year (1970), all the provinces (with the exception of the provinces of O'Higgins and Colchagua) experienced a decrease in the index of industrialization and in certain provinces, as for instance in the province of Antofagasta, this decrease of the index was considerable. As regards the existing differentiation of the number of provinces, from the point of view of industrialization, the situation, has not changed considerably since 1960. Thus there are also five provinces whose index of industrialization is more than 25.3 per cent, while in 10 provinces, mentioned above, this index was 15.3 per cent on the average.

Finally, as regards population movements and particularly the movements of the population to the urban centres, we can repeat in a summary the conclusions obtained during the analysis of the problem in the previous Chapter III, Section 3-4. These results are the following: a) The degree of urbanization of the population of the country can be considered high, and it differs in each province. The same can be said for the rate of growth of urban population by province; b) A redistribution took place of the urban and rural population in the country's provinces; c) The trend of concentration of population in the metropolitan areas.

In the following table, we give a general picture of the population outflows to the larger urban centres, on the basis of the 1970 census.

Table 2.2.3

THE POPULATION OUTFLOWS TOWARDS THE LARGER URBAN CENTRES IN THE YEAR 1970

n/n	Urban Centres	Internal migration	
		Absolute number (in thousands)	Percentage on the population of the province
1	Santiago	228	8.3
2	Concepción	37	7.0
3	Valparaíso	52	8.1
4	Antofagasta	28	13.0
5	Tarapacá	24	16.2
	Total	369	8.6

In conclusion, we can say that in the case of Chile there is a regional problem. The main factors prevailing in this problem are the unequal distribution of income, the low level of industrial development of the country and the differentiation of industrialization by region.[27/] Furthermore, the concentration of the population in the larger urban centres and in general the great rate of urbanization composes the regional problem of the country. Finally, the results obtained as regards the industrial development by region are in agreement with the conclusions drawn, as regards regional economic growth of the country on the basis of the per capita income. The reasons of these economic differences of the provinces of the country are the natural resources, such as i.e. in Antofagasta the mines, in Magallanes the oil, the concentration of industries in Santiago, the climate, historical reasons etc., whose investigation on the one hand is frequenly difficult and it needs much time; on the other hand, they are not included in the purposes of this study.

27/ To these factors there can be added the factors of wages in the secondary branch of the economy, unemployment in agricultural production, etc., the investigation of which was realized in the analysis of influence of industrial development and urbanization, (Section 1 of the present chapter).

2.3. The relationship of per capita income by region and the urbanization of metropolitan areas. The case of Santiago.

In the previous Chapter III, it was said that there is a concentration of the population in the larger urban centres and particularly in the metropolitan area of Santiago. Furthermore, it was ascertained in the analysis of development of urbanization in Chile, that the population outflows of the provinces mainly towards the capital of the country, Santiago, differ in each province. Finally, we were led to the conclusion that the differentiation of income by region is the main factor of such population movements. In other words, this last ascertainment indicates that there is a correlation between urbanization and the degree of regional economic development. The degree of the economic growth of each province can be determined by the per capita income of the inhabitants of the region, whilst as an index of the urbanization of an urban centre of the country, we will take the proportion of the population outflows of all provinces towards a certain urban area, in relation to their population. Here, we will examine the metropolitan area of Santiago.[28/] In the following Table 2.3.1, all the data regarding the investigation of the relationship between the per capita income by region and the urbanization of the metropolitan area of Santiago are included. The statistical data, as regards the internal migrants from each province to Santiago, were procured on the basis of the sample of the census in 1970.

The correlation coefficient of the two variables, per capita income by region and population outflows of the provinces towards the area of Santiago, on the basis of the above data, was calculated to be equal to minus 0.48.[29/] The size of the coefficient indicates that there is a correlation between the aforementioned variables. This correlation has the meaning of the influencing

28/ A similar analysis, as regards the population movements from various geographical areas towards the larger urban centres of the country, can be made for the areas of Antofagasta, Valparaíso, etc., and it is believed that the same conclusions can be obtained as in the case of Santiago.

29/ The same analysis was made in Sweden. The correlation coefficient was equal to minus 0.67. This means that the main reason which caused the population outflows of the regions towards the capital of the country, Stockholm, was the differentiation of income between the capital and the rest of the geographical areas of the country.

Table 2.3.1

THE POPULATION OUTFLOWS OF THE PROVINCES TOWARDS THE METROPOLITAN AREA OF SANTIAGO DURING THE PERIOD 1966-1970 AND THE PER CAPITA INCOME BY REGION IN 1970

n/n	Region	Population in 1970 (More than 5 years)	Population movements towards Santiago (More than 5 years)	Proportion of population movements to the total population of region	Per capita income
1.	Tarapacá	148 600	5 940	4.0	3 064
2.	Antofagasta	212 600	6 540	3.1	5 983
3.	Atacama and Coquimbo	408 900	14 120	3.5	2 413
4.	Aconcagua and Valparaíso	786 030	30 060	3.8	2 391
5.	O'Higgins and Colchagua	402 100	27 780	6.9	2 247
6.	Curicó, Talca, Maule and Linares	510 520	30 480	6.0	1.560
7.	Ñuble, Concepción, Arauco, Bío-Bío and Malleco	1 180 020	48 980	4.2	1 697
8.	Cautín	350 020	21 740	6.2	1 092
9.	Valdivia and Osorno	356 900	17 840	5.1	1 614
10.	Llanquihue, Chiloé and Aysén	294 500	7 100	2.4	1 532
11.	Magallanes	78 520	2 560	3.3	4 758
	Abroad	-	15 260	-	-
	Total	4 728 760	228 400	4.8	2 437

Sources: Centro Latinoamericano de Demografía (CELADE). Banco de Datos. Muestra del 5 por ciento. Censo de Chile, 1970.

of one variable by the other. Furthermore, the correlation of the two variables is negative, in the sense that the influence of the per capita income on the outflow of emigrants, from each geographical region, to Santiago, is inverse, that is, in other words, the smaller per capita income of the provinces causes an increase of the population movements towards the larger urban areas, as for

instance in the case of Santiago. This ascertainment is in agreement with the fundamental hypothesis of the influence of the level of per capita income on urbanization. In fact, as we observe from the data of Table 2.3.1., the largest outflow of internal migrants is realized in those geographical regions which have the smaller per capita income, and vice versa. Thus, the province of Cautín, with the smallest per capita income (1 092 Escudos) indicates a proportion of emigrants' outflow in relation to their population, amounting to 6.2 per cent, which can be considered high. Similarly, the provinces of Curicó, Talca, Maule and Linares, considered as being one geographical region, have a high degree of population outflow (6.0 per cent) towards the metropolitan area of Santiago, while the per capita income of these four provinces was 1 560 Escudos on the average, in the year 1970. The same can be said for the two groups of provinces, O'Higgins and Colchagua, as also Valdivia and Osorno, whose percentage of internal migrants was 6.9 per cent and 5.1 per cent respectively, while their per capita income is at a low level. On the contrary, the provinces of Antofagasta and Magallanes, which have the highest per capita income among the geographical areas of the country (E°6 000 and E°4 800 respectively), experienced a small population movement towards the capital of the country, which was 3.1 per cent and 3.3 per cent respectively in the same census year (1970). Following the above, we are led to the conclusion that among the main reasons which cause the movement of the population from various geographical areas -provinces- to the metropolitan area of Santiago is the income of each province. In other words, the low income of the residents of certain regions of the country is the reason for migration of part of the population of these regions to the capital of Santiago.

2.4. Factors influencing the population movements towards the metropolitan area of Santiago. Their statistical estimates

During the analysis of the development of urbanization in Chile, Chapter III, we ascertained that the greater part of the internal population movement goes to the metropolitan area of Santiago. In the previous section, we were led to the conclusion that there exists a correlation between the per capita income by region and the increase of the urban population of this area. Furthermore, we saw that the index of urbanization of the area of Santiago is at high level and the demand for labour force continuously increases. Thus, we

see that among the factors which caused the population concentration in the capital area of Santiago are also the economic factors and, consequently, the estimation of their influence on the urbanization of the population of the area is of great interest to the present work. Based on the general hypothesis, as regards the factors influencing the urbanization of the population and what we said previously, we will try to estimate here the influence of the two factors, the per capita income of the region of Santiago, Y^{r+s}/N^{r+s}, and the demand for labour force in the secondary branch of the economy, D^{w+s}, of this area, on the increase of the urban population of the metropolitan area of Santiago during the last decade 1960-70.

The best fitting regressions which are included in table 2.4.1, refer to the aforementioned determinative factors. Moreover, in this table, the criteria of the statistical reliability of the equations, i.e., the coefficient of determination, R^2, standard error, etc., are included.

From the analysis of the obtained statistical results of the above equations we see that:

i) The sign of the regression coefficients corresponds to the economic theory, and the coefficient of determination, R^2, is statistically significant in all equation.

ii) The standard error of estimate is statistically significant at a level of 5 per cent or less.

iii) The results as regards the criterion "F of Snedecor" for the testing of the coefficient, R^2 and the von Newman's criterion for the existing of autocorrelation can be considered satisfactory.

Therefore, the aforementioned regressions can be considered the appropriate ones for forecasting, on the basis of the said criteria, and they are marked by *.

Furthermore, regarding the average and point elasticities, with respect to the explanatory variables of the aforementioned equations, which are included in Table 2.4.2., we see that: the sign of the elasticities of the per capita income and of the demand for labour force is positive, as it is indicated by the economic theory, on the basis of which the hypothesis was formulated. Regarding the amount of the elasticities, the elasticity of the per capita income is

Table 2.4.1

THE BEST FITTING REGRESSIONS

n/n	Model	Estimate of parameters	Percentage of N^{r+s} variance explained by regression (1)	$\bar{R}$ (2)	Von Newman K_2 (3)
	a. The linear form				
1 *	$N_t^{r+s} = a + b\ Y_t^{r+s}/N_t^{r+s}$	$N_t^{r+s} = -591.72 + 1.117\ Y_t^{r+s}/N_t^{r+s}$ (0.179)	90.0	0.810	0.1495
2 *	$N_t^{r+s} = a + b\ D_t^{w+s}$	$N_t^{r+s} = 219.67 + 9.921\ D^{w+s}$ (0.882)	96.6	0.933	0.1799
	b. The logarithmic form				
1 *	$\text{Log } N_t^{r+s} = \text{Log } a + b \text{ Log } Y_t^{r+s}/N_t^{r+s}$	$\text{Log } N_t^{r+s} = -0.791016 + 1.21681 \text{ Log } Y_t^{r+s}/N_t^{r+s}$ (0.17844)	90.0	0.811	0.1495
2 *	$\text{Log } N_t^{r+s} = \text{Log } a + b \text{ Log } D_t^{w+s}$	$\text{Log } N_t^{r+s} = 1.25653 + 0.9069 \text{ Log } D_t^{w+s}$ (0.0852)	96.0	0.926	0.1799

Table 2.4.2

ELASTICITIES WITH RESPECT TO THE EXPLANATORY VARIABLES OF THE EQUATIONS TRIED

Number of equation	Variable	Type of equation	Average elasticities	Point elasticities 1960	1962	1964	1966	1968	1970
1	Per capita income of the area of Santiago	Linear Logarithmic	1.23 1.22	1.25	1.28	1.25	1.30	1.12	1.12
2	Demand for labour force of the area of Santiago	Linear Logarithmic	0.92 0.91	0.96	0.89	0.89	0.94	0.92	0.90

more than the one, a fact that means that, if the income rises by 10 per cent, the urbanization of the population of the area of Santiago will increase by 10.23 per cent. This elasticity is not constant in the whole period under study (1960-70). The higher value is in the year 1966 (1.30), and after this period of time it follows a downwards trend. As regards the elasticity of demand for labour force, it is 0.92 and its value changes during the period 1960-70. From the point of view of the sign and the amount of the elasticities, the factors, per capita income and demand for labour force, can be considered the most important economic factors influencing the urbanization of the population of the capital of Santiago, during the period 1960-70.

Finally for the development of the urbanization of the population of the metropolitan area of Santiago in the projected period, 1971-75, it is necessary to adopt:

i) The same basic assumptions as those mentioned in this chapter, Section 1.5.1., as regards the determinative factors of the urbanization of population, the appearance new ones, etc.

ii) Certain assumptions, as regards the expected development of two main economic factors of the increase of the population of the metropolitan area of Santiago, in the year 1975. These assumptions are included in the following table.

Table 2.4.3

ASSUMPTIONS AND THE DEVELOPMENT OF THE EXPLANATORY VARIABLES IN THE YEAR 1975

n/n	Variable	Assumptions		Rate of growth 1970-75	Estimations 1975	
1	Y^{r+s}/N^{r+s}	Pessimistic	(A)	2.5	3 455	in Escudos
		Conservative	(B)	3.5	3 627	in Escudos
		Optimistic	(C)	4.5	3 806	in Escudos
2	D^{w+s}	Pessimistic	(A)	3.0	320.9	in thousand persons
		Conservative	(B)	4.0	336.8	in thousand persons
		Optimistic	(C)	4.5	345.0	in thousand persons

Note: The pessimistic assumptions of the aforementioned variables correspond approximately to their rate of growth during the past period, 1960-70.

In Table 2.4.4., we give the development of the urban population of the metropolitan area of Santiago based on the equations tried, as well as the population projections of this area made by the Latin American Demographic Centre (CELADE), by commenting on the results obtained. Thus, the deviations as regards the forecasting of the development of the urban population of the area of Santiago in the year 1975, made by the models and by projections of CELADE, are not significant and, consequently, the results obtained by application of economic models for the estimation of the increase of the urban population of this area, can be considered satisfactory. This conclusion is in agreement with the general conclusion of Chapter IV, Section 1.5.2., as regards the possibility of consideration, apart from the demographic factors, of economic factors also for forecasts of the urban population of a country, or an area of the country.

Table 2.4.4

THE DEVELOPMENT OF THE POPULATION OF THE METROPOLITAN AREA OF SANTIAGO IN THE YEAR 1975

Number and type of equations	Population of the area of Santiago			Deviations	
	Assumption	By equations	by CELADE a/	Absolute	Per cent
1st. linear equation	C	3 660	3 831	171	4.5
1st. logarithmic equation	C	3 679	3 831	152	4.0
2nd. linear equation	C	3 642	3 831	189	4.9

a/ Urban population projections by CELADE are based on the manual "Perspectivas de Crecimiento de la Población Chilena 1970-1985". Publicación de la Corporación de Fomento de la Producción N°10 - A/70. Santiago de Chile, 1970.

In the diagrams 5 - 6, we give the graphical presentation of the linear equations tried, from the point of view of theoretical and observed values of the variable under study, their deviations and the influence of the determinative factors of the increase of urban population of the metropolitan area of Santiago.

Diagram 5: 1st. LINEAR EQUATION TESTED: OBSERVED AND ESTIMATED VALUES OF URBANIZATION OF THE POPULATION OF THE METROPOLITAN AREA OF SANTIAGO, THEIR DEVIATIONS IN PERCENTAGE AND THE INFLUENCE OF THE EXPLANATORY VARIABLES OF THE EQUATION

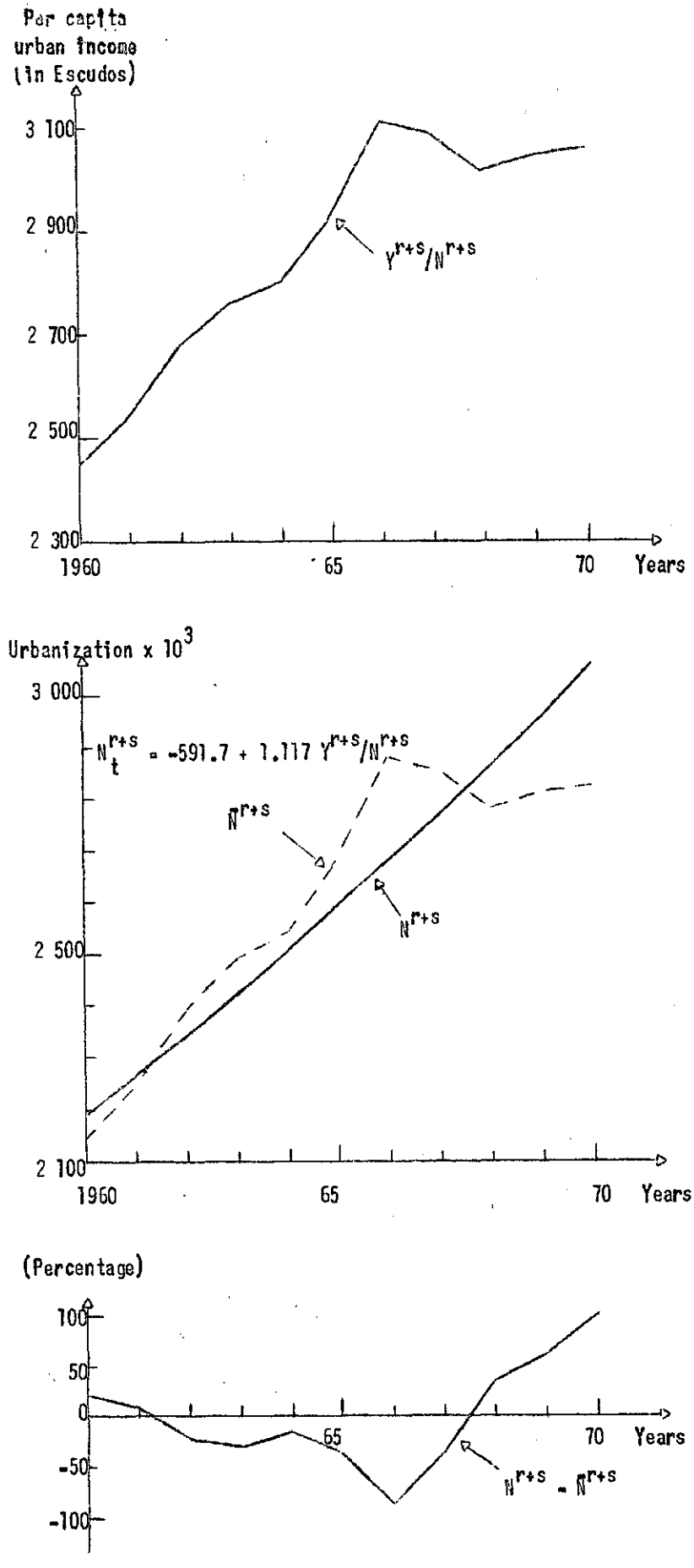
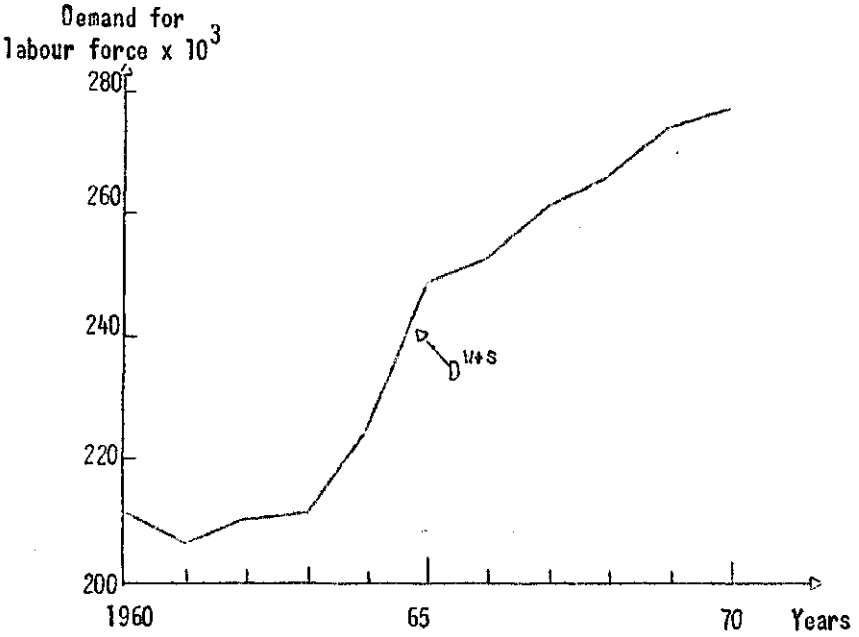
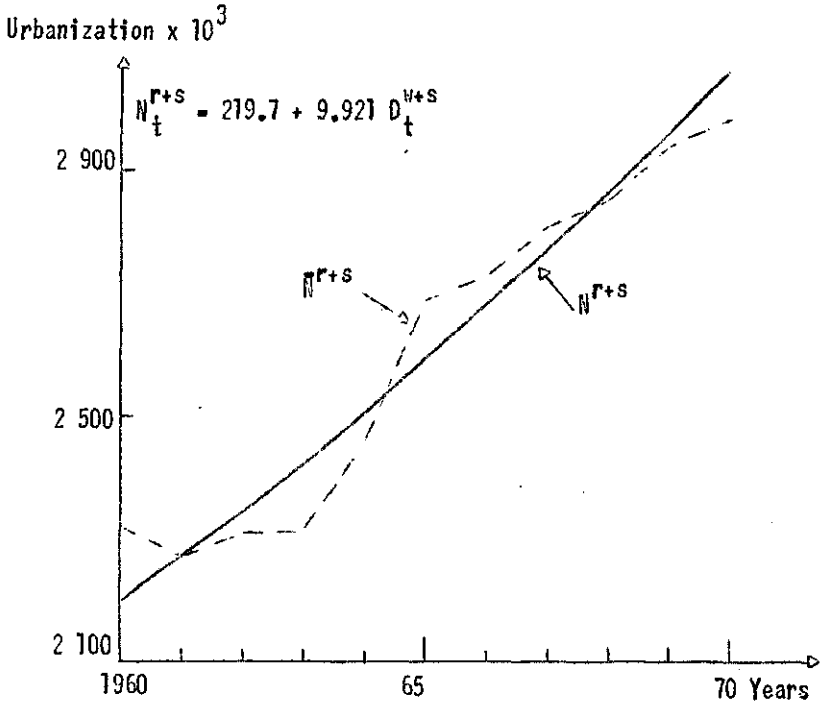
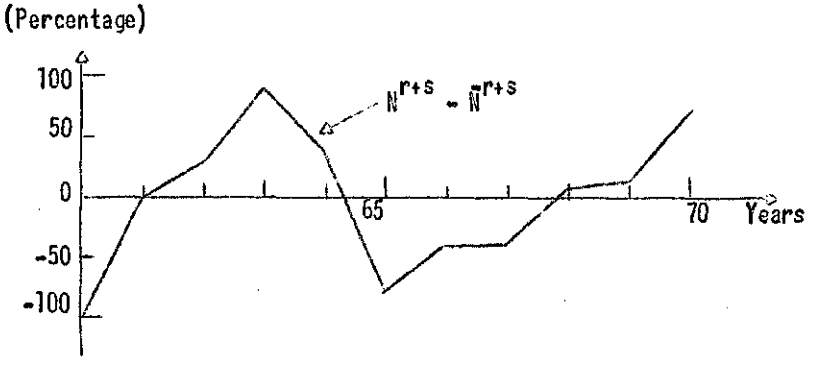


Diagram 6: 2nd. LINEAR EQUATION TESTED; OBSERVED AND ESTIMATED VALUES OF URBANIZATION OF THE POPULATION OF THE METROPOLITAN AREA OF SANTIAGO, THEIR DEVIATIONS IN PERCENTAGE AND THE INFLUENCE OF THE EXPLANATORY VARIABLES OF THE EQUATION







2.5. Regional differences and the theoretical consideration of the problem

In the theoretical consideration of the problem of urbanization and industrial development, Chapter II, Section 1, we said that the movement of the inhabitants of the rural areas to the urban centres was caused by the technological revolution, which occurred in agriculture, the result of which was the unemployment of the farmers, etc. Furthermore, the rapid development of the industrial sector of the economy, the increase in job opportunities in the urban centres, the higher wages, etc., were the incentives of attraction of the agro-labour force to the urban areas. Of course, to the aforementioned reasons there should be also added, the development of trade, and the cultural, social and political reasons which contributed to the population movements, without of course, overlooking the better living conditions, and the recreation etc., prevailing in the rapidly developing urban centres. Finally, we were led to the conclusion that the urbanization of the population of the country can be attributed to the application of purely economic laws. In the analysis of the regional problem in Chile we saw that the regional differences refer to the per capita income, the differentiation of industrialization, unemployment, etc. Moreover, we were led to the conclusion, during the study of the problem of concentration of the population in the metropolitan area of Santiago, Section 2.3 of the present chapter, that the higher per capita income of the area was the main reason of the population movement towards the aforementioned urban area.

Based on the above, we can say that the basic thoughts, as regards the whole problem under study, are in agreement with what we ascertained during the analysis of the regional problem in the case of Chile. All the conclusions as regards the creation of a regional problem of the country, verify the basic points of theoretical consideration of the problem. From this point of view, and beyond the statistical verification of the hypotheses which were adopted on the basis of the theoretical consideration of the problem in the case of Chile, both for the total urban population and the urban population of the capital area of Santiago, we can say that both theory and practice are in parallel in the case of the regional problem of the country.

V. RELATIONSHIP OF URBANIZATION AND INDUSTRIALIZATION IN LATIN AMERICAN COUNTRIES. APPLICATION OF THE SYMMETRY MODEL

1. Testing of urbanization of the Chilean population and industrialization at a national and regional level

In Chapter III, we undertook the analysis of the development of urbanization of the population of the country during the sample period 1952-70. This analysis extends to the regional level. The investigation, in this manner, of the mobility of the population of the country towards the urban centres, will facilitate us in the application of the symmetry model by province. Thus, on the basis of the data of the table 3.2.2. of Chapter III, Section 3.2., concerning the degree of urbanization of the population by province, and the data as regards the economically active population and, specifically, the population employed in the industrial sector,[30/] we formulate the indices of "urbanization" and "industrialization" at certain time-periods and specifically in the 1952, 1960 and 1970 census years. Furthermore, based on these indices we construct the symmetry model which, as we mentioned in the relevant chapter, consists of the ratio of these two indices, expressed in percentage. In the following table, the urbanization and industrialization indices are given at a national and regional level, Z_{ij}, I_{ij}, as also the ratio of their relationship, in percentage, which consists of the symmetry coefficient[31/] -model- S_{ij}.

From Table 1.1 the following can be seen. The numerical limits of the symmetry coefficient at the national level are less than half of 100, during the census years of the period 1952-70. This tells us, on the basis of what we have accepted as regards the interpretation of the symmetry model in Chapter II, Section 3.2, that the country, from this point of view, i.e. the development of the urbanization of its population and industrialization, belongs to the less-developed countries. More specifically, the estimation of the symmetry coefficient at the level of 21.2 per cent during the last

30/ See Table 3 of Appendix I.

31/ The grouping of certain provinces was imposed by the fact of the lack of statistical data, as regards the labour force according to the branch of economic activity, for the census year 1970. This, however, does not alter the importance of the conclusions drawn, as regards the application of the symmetry model at a regional level.

Table 1.1

THE SYMMETRY COEFFICIENT OF URBANIZATION OF THE POPULATION OF CHILE AND INDUSTRIALIZATION AT A REGIONAL LEVEL, DURING THE CENSUS YEARS OF THE SAMPLE PERIOD 1952-70

n/n	Country and by province	1952		1960		1970		Symmetry Coefficient S_{ij}		
		Index of urbanization Z_{ij}	Index of industrialization I_{ij}	Index of urbanization Z_{ij}	Index of industrialization I_{ij}	Index of urbanization Z_{ij}	Index of industrialization I_{ij}	1952	1960	1970
1.	Tarapacá	59.7	10.5	87.1	14.2	92.1	14.8	17.6	16.3	16.1
2.	Antofagasta	89.3	9.9	94.8	11.3	96.6	10.9	11.1	11.9	11.3
3.	Atacama and Coquimbo	42.3	10.2	57.8	9.6	66.9	6.7	24.1	16.6	10.0
4.	Aconcagua and Valparaíso	75.9	20.7	82.6	19.4	85.9	14.3	27.3	23.5	16.6
5.	Santiago	86.7	29.2	90.0	26.8	93.3	22.8	33.7	29.8	24.4
6.	O'Higgins and Colchagua	35.0	10.0	45.5	8.6	49.1	8.2	28.6	18.9	16.7
7.	Curicó, Talca, Maule and Linares	35.8	10.8	40.4	9.6	46.5	9.1	30.2	23.8	19.6
8.	Ñuble, Concepción, Arauco, Bío-Bío and Malleco	51.1	15.8	57.8	15.6	65.7	15.4	30.9	27.0	23.4
9.	Cautín	33.1	11.9	38.7	9.9	48.9	8.1	36.0	25.6	16.6
10.	Valdivia and Osorno	38.2	17.6	44.7	13.3	52.9	11.3	46.1	29.8	21.4
11.	Llanquihue Chiloé and Aysén	28.1	10.6	36.9	10.6	47.4	7.4	37.7	28.7	15.6
12.	Magallanes	81.4	15.7	83.0	11.9	86,3	10.4	19.3	14.3	12.1
	Chile	60.2	19.0	68.2	18.0	75.1	15.9	31.6	26.4	21.2

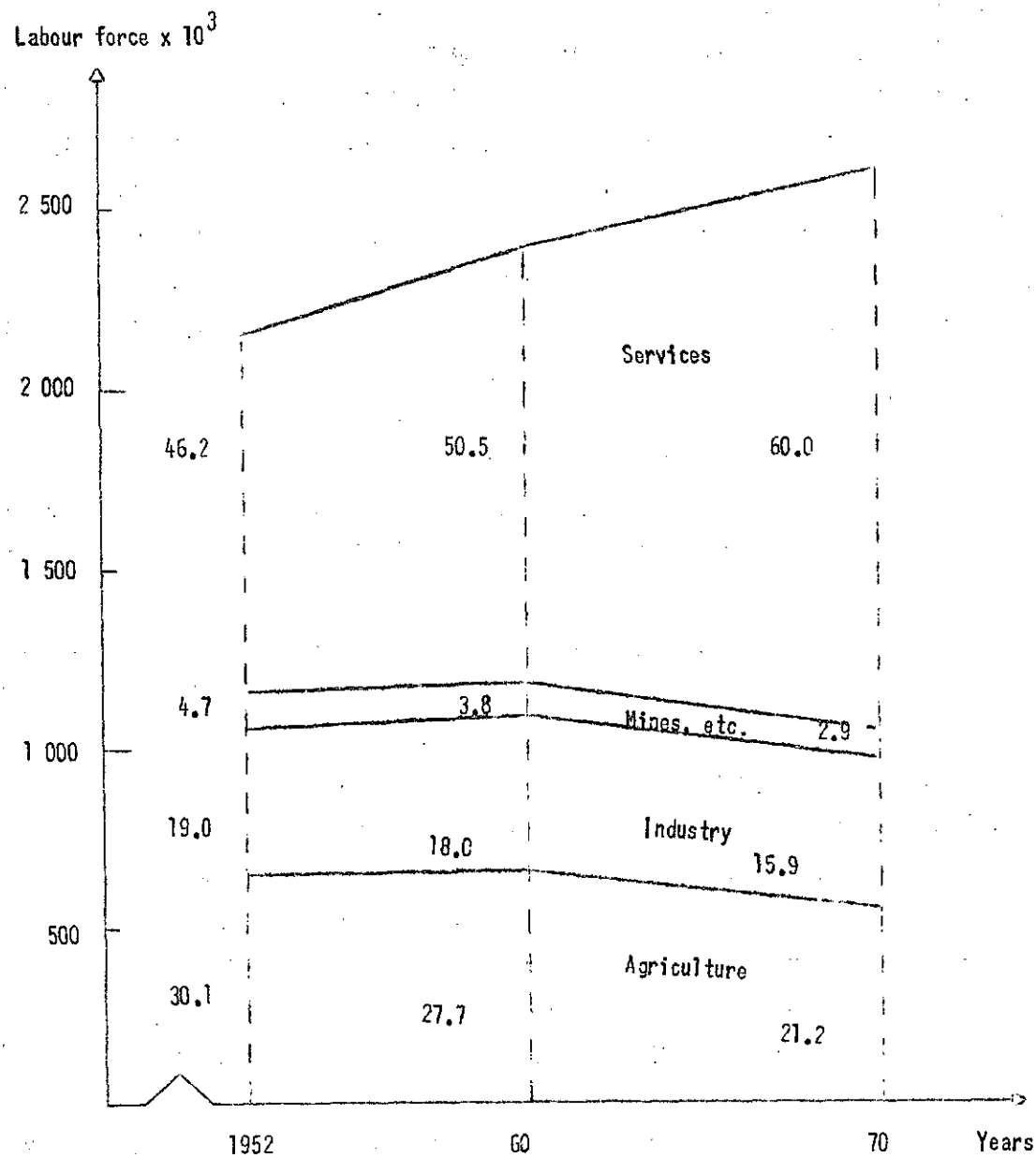
Sources: i) Dirección de Estadística y Censos. XII Censo General de Población y I de Vivienda 1952. Tomo Resumen del País, Santiago de Chile, 1959.
ii) Dirección de Estadística y Censos. XIII Censo de Población 1960. Tomo Resumen del País, Santiago de Chile, 1969.
iii) Instituto Nacional de Estadística (Ex-Dirección de Estadística y Censos). XIV Censo Nacional de Población y III de de Vivienda 1970. Muestra de Adelanto de Cifras Censales, Santiago de Chile, 1972.
Instituto Nacional de Estadística, Entidades de Población 1970 (Tarapacá a Magallanes). Santiago de Chile, 1972.

census years (1970), based on the indices of "urbanization" and "industrialization", means a delay in the secondary production and a asymmetrical enlargement in the urbanization of the population. Furthermore, the small development of the secondary branch of the economy, in conjunction with the large increase of the urban population, means an enlargement in the rest of the branches of the economy and, specifically, the sector of "services" i.e. the tertiary sector of the economy. Indeed, the tertiary sector of the economy, from the point of view of persons employed, increased by 56.9 per cent during the period 1952-70, while the secondary sector of the economy, from the same point of view, was increased by 1.6 per cent during the same as above period (1952-70).[32/] Finally, the symmetry coefficient in accordance with the urbanization index, shows that the urbanization of the population of the country realized, which during the year 1970 reached 75.1 per cent, was not only the result of the increase of employment of the industrial sector of the economy, but it was attributable to the other reasons mainly social and those of unemployment in the primary production, the lower per capita income of rural areas, etc.

As a conclusion, we can say that urbanization of the population in Chile does not correspond to industrial development, without of course, overlooking that a part of the urbanization realized is attributable to the industrialization of the country. The inflow of internal migrants to the urban centres, which in the case of Chile precedes the industrial development of the country, apart from the enlargement of the tertiary sector of the economy, covers unemployment, the so-called "invisible unemployment" of the population of the urban areas. This type of unemployment causes unfavourable consequences on the social and economic growth of the country. Finally, worthy of particular note, is the fact that it comes from the above table, as regards the development of the symmetry coefficient, that it followed a downwards trend during the sample period 1952-70. Thus, in the year 1952 it was 31.6 per cent and it fell to 26.4 per cent and to 21.2 per cent during the years 1960 and 1970 respectively.

32/ Chart 2 shows the development of the labour force by branch of economy, from the point of view of persons employed, during the period 1952-70. The above chart clearly shows the enlargement of the "services" branch of the economy.

Chart 2
THE DEVELOPMENT OF THE LABOUR FORCE IN CHILE BY BRANCH
OF ECONOMY IN THE SAMPLE PERIOD 1952 - 1970
(Percentage)



Sources: Dirección de Estadística y Censos, XII Censo General de población y I de Vivienda 1952. Santiago de Chile, 1959
Dirección de Estadística y Censos, XIII Censo de Población 1960. Santiago de Chile, 1969.
Instituto Nacional de Estadísticas, XIV Censo de Población y III de Vivienda. Muestra de Adelanto de Cifras Censales. Santiago de Chile, 1972.

This fact can be attributed, on the one hand to more rapid increase of the labour force than the corresponding increase of employment opportunities in the secondary branch of the economy and, on the other hand, to the decrease of employment in the aforementioned branch of the economy. Indeed, it was previously said that secondary production increased only by 1.6 per cent during the period 1952-70, while during the semi-period 1960-70 it was reduced, from the point of view of the number of employed, from 428.9 thousand persons in 1960, to 415.4 thousand persons in 1970, that is by 3.2 per cent.[33/] However, during the same semi-period (1960-70) the percentage of the urban population of the country, from 62.2 per cent in 1960 amounted to 75.1 per cent in the year 1970. These ascertainments verify the conclusion drawn previously, concerning the asymmetrical development of the urbanization and industrialization of the country. From the application of the symmetry model by region, the following were ascertained. The numerical limit of the symmetry coefficient, in all the provinces of the country, is less than half of 100, as same occurs at a national level. Therefore, the ascertainment at a national level as regards the asymmetrical evolution of urbanization and industrial development is also extended to a regional level. In other words, the general conclusion, in the case of the regional level can be interpreted as follows: that the urbanization of the provinces of Chile precedes their industrial development. In fact, in the province of Santiago, capital of the country, which shows the largest degree of urbanization of the population, which during 1970 was 93.3 per cent, the index of industrialization of this province during the same year (1970) was at the level of 22.8 per cent, that is four times smaller than the urbanization index, the same can be said for the provinces of Aconcagua and Valparaíso, where the index of urbanization during the last census year (1970) was 85.9 on the average, while the proportion of those employed in the secondary branch of the economy, in relation to the labour force of these provinces, was 14.3 per cent on the average. The region of Santiago, of course, shows the largest numerical limit of the symmetry coefficient (24.4 per cent) in comparison to

33/ The sector of the economy, mines, etc. from the point of view of labour force, showed also a drop during the period 1952-70. Thus, the number of employed in this sector of the economy decreased from 101.4 thousand persons in 1952 to 75.3 thousand persons in 1970 (25.7 per cent).

the other provinces of the country. This is because the majority of the industries are established in the capital of the country. After the province of Santiago, from the point of view of development of urbanization and industrialization, there follows the group of provinces of Ñuble, Concepción, Arauco, Bio-Bio and Malleco, whose symmetry coefficient in the year 1970 was 23.4 per cent on the average. There follow the provinces of Valdivia and Osorno, with a symmetry coefficient of 21.4 per cent, while in the remaining eighteen provinces, the coefficient is at low level.

Finally, the symmetry coefficient at a regional level, during the three census years of the period 1952-70, followed the same trend as at a national level, that is, a downwards trend for all the provinces. Furthermore, we can say that the same factors, as at a national level, caused the downwards trend of the symmetry coefficient in the same period (1952-70). Of course, the numerical value of the coefficient varies in each province and this is attributable to the differentiation of the urbanization and industrialization indices. We do not go into more detailed analysis of the results obtained from the application of the symmetry model by region, because both the conclusions drawn and also their causes, show a similarity with those for the country. We can, however, in the general conclusions, add the following as regards the urbanization of the population by province; that the provinces which have the largest numerical value of the symmetry coefficient, as for instance Santiago, etc. ceteris paribus, will be poles of attraction for the inhabitants of the rural regions, who desire to migrate to the urban areas of the country.

2. The development of urbanization and industrialization from the symmetrical point of view in the remaining Latin American countries at the national level. Their classification based on the model applied

The application of the symmetry model in Latin American countries allows us, in addition to the conclusions drawn for each country, to classify them into two main groups. This classification is based on the estimated numerical value of the symmetry coefficient, S_i. In the first group are included those countries where, during the last decade (1960-70) the development of the urbanization of their population and industrialization, from the point of view of the number of employed in the secondary branch of the economy, were not symmetrical. In other words, the degree of urbanization of these countries

was high during the past decade (1960-70), while the industrialization index did not experience any fundamental change during the census years 1960 and 1970. In the second group, the rest of the Latin American countries are included, whose characteristic is the fact that both the urbanization of their population as also industrial development, showed a normal development during the period under examination, 1960-70.

Of the eighteen countries of Latin America where the symmetry model was applied, eleven belong to the first group while the remaining seven belong to that group in which countries show symmetry as regards the development of urbanization and industrial development during the period surveyed (1960-70). In the Table 2.1 and in the Chart 2.1 we give the aforementioned classification of the countries, with their indices of urbanization and industrialization.[34/]

The countries of the second group are in a considerably advantageous position compared to the countries of the first group, as to the development of urbanization and industrialization, because the development of these two indices shows a certain symmetry, that is, urbanization does not precede industrial development. In the countries of the first group, we observe a large increase of the urban population, while industrial development follows a small upwards trend. This means that the development of the two magnitudes of urbanization and industrializations is asymmetrical. Furthermore, in certain countries, of both groups, we observe that the index of industrialization remained at the same level in the years 1960 and 1970. This, of course, does not mean that the labour force of the country, or the number of those employed in industry, remained unchanged between the two censuses. On the contrary, as same appears from the statistical data of the Table 3 of Appendix 1, in these countries, with an unchanging industrialization index, we have an increase in the labour force of the country in general and an increase in the number of employed in the secondary production, on account of the increase of the population of the countries and the industrial development taking place.

34/ Bolivia and Haití are not included in this table, because of the lack of adequate statistical data as regards the labour force in the secondary branch of the economy. The same can be said for the countries of Uruguay and Cuba, in the year 1970.

Table 2.1

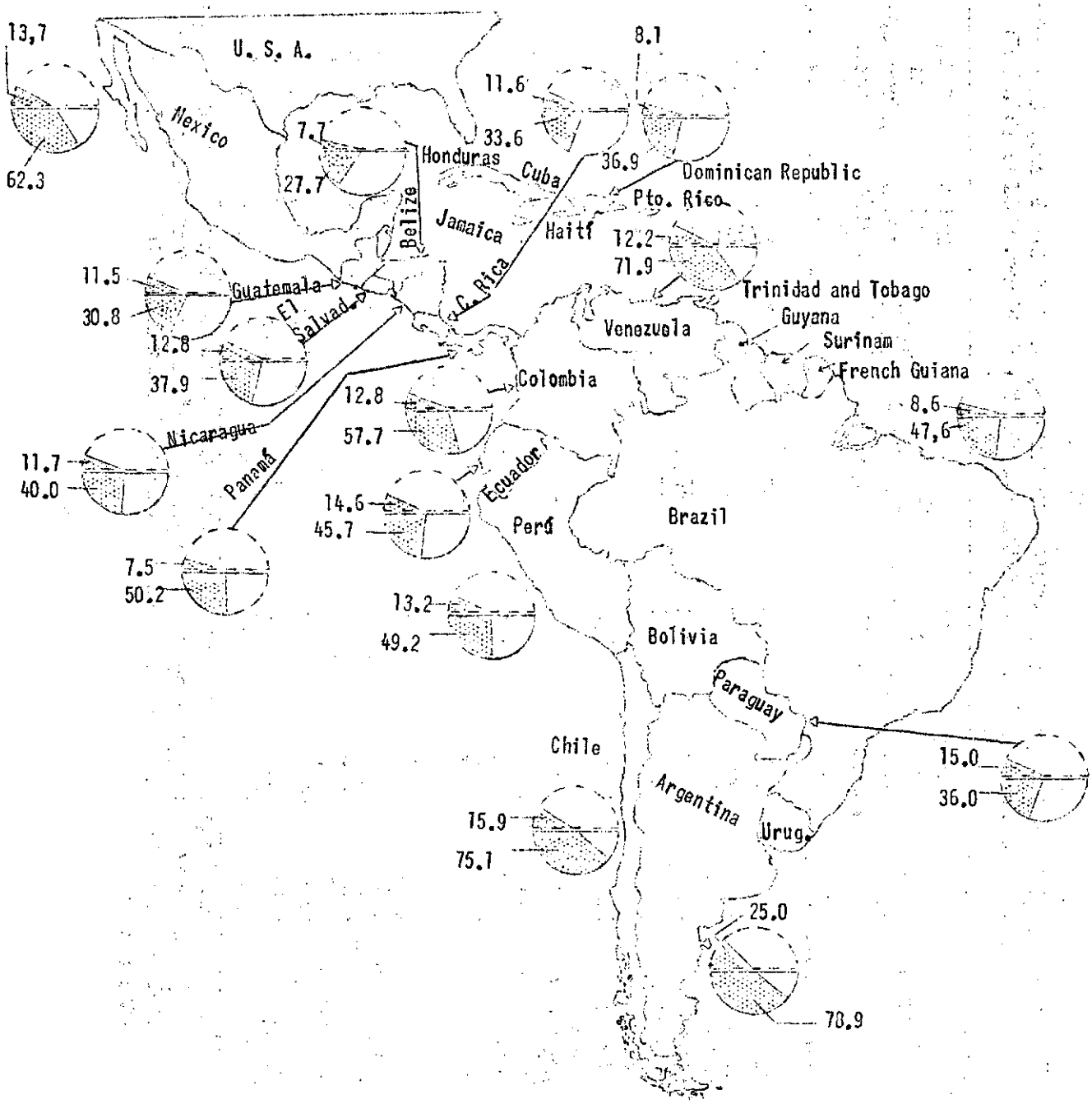
INDICES OF URBANIZATION AND INDUSTRIALIZATION, AS ALSO THEIR RATIO, IN VARIOUS LATIN AMERICAN COUNTRIES DURING THE CENSUS YEARS OF THE PERIOD 1960-1970

n/n	Country i	Census Year t	Index of urbanization Z_i	Index of industrialization I_i	Symmetry Coefficient S_i	Census Year t	Index of urbanization Z_i	Index of industrialization I_i	Symmetry Coefficient S_i
					A Group				
1.	Argentina	1960	73.7	25.0	33.9	1970	78.9	25.0	31.7
2.	Chile	1960	68.2	18.0	26.8	1970	75.1	15.9	21.2
3.	Colombia	1964	52.8	12.8	24.2	1970	57.7	12.8	22.2
4.	Ecuador	1962	36.0	14.6	40.6	1970	45.7	14.6	31.9
5.	Honduras	1961	23.2	7.7	33.2	1970	27.7	7.7	27.8
6.	Mexico	1960	50.7	13.7	27.0	1970	62.3	13.7	22.0
7.	Panama	1960	44.0	7.4	16.8	1970	50.2	7.5	14.9
8.	Dominican Republic	1960	30.3	8.1	26.7	1970	36.9	8.1	22.0
9.	Venezuela	1961	67.4	12.2	18.1	1970	71.9	12.2	17.0
10.	Uruguay	1963	32.2	21.2	25.8	-	-	-	-
11.	Cuba	1953	57.0	16.6	29.1	-	-	-	-
					B Group				
1.	Brazil	1960	46.3	8.6	18.6	1970	47.6	8.6	18.1
2.	Costa Rica	1963	34.5	11.6	33.6	1970	33.6	11.6	34.5
3.	El Salvador	1961	38.5	12.8	33.2	1970	37.9	12.8	33.8
4.	Guatemala	1964	34.0	11.5	33.8	1970	30.8	11.5	37.3
5.	Nicaragua	1960	40.0	11.7	29.3	1970	40.0	11.7	29.3
6.	Paraguay	1962	35.8	15.0	41.9	1970	36.0	15.0	41.7
7.	Peru	1961	47.4	13.2	27.8	1970	49.2	13.2	26.8

Sources: Programa de Intercambio ELAS/CELADE. Juan Carlos Lerda, Adolfo Aldunate. Distribución de la Población Económicamente activa en los países de América Latina, 1940-1960. Centro Latinoamericano de Demografía, Boletín Demográficos N°2 y 3. Proyecciones Población Urbana 1970.

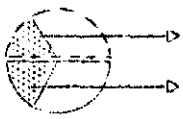
Chart 2.1

THE DEGREE OF INDUSTRIALIZATION AND URBANIZATION OF THE LATIN AMERICAN COUNTRIES IN THE YEAR 1970.
(Percentage)



Source: Based on the data of the Table 2.1

Note:



Index of industrialization: persons employed in the industrial sector of the economy to the total labour force of the country 180° = 100

Index of urbanization: urban population to the total population of the country 180° = 100

In general, we can say, for all the Latin American countries, on the basis of the numerical limits of the symmetry coefficient, S_i, which are less than half of 100, that the development of urbanization of their population and industrial development has not been symmetrical up to now. Based on the above general conclusion, it can be said that the countries of Latin America, from this point of view of development of urbanization and industrialization, can be considered as being less-developed countries and probably the socio-economic growth, from this point of view would follow an upwards trend in the countries of the second group for the coming years. Of course, the larger numerical value of the symmetry coefficient in certain countries of the second group of Table 2.1, as for instance Paraguay and Guatemala -their coefficient is 41.9 per cent and 33.8 per cent respectively- means the better development of urbanization of their population and industrialization, compared with the other countries of the same group, whose numerical value of the coefficient is at a lower level. However, the higher rate of the symmetry coefficient of the countries, even though these countries belong to the second group, is an index and not a proof of their socio-economic growth. The criterion of the economic growth of the country, as we mentioned in the previous chapters, is the per capita income and, consequently, the symmetry coefficient in the case of its higher value of certain countries, must be related with the main dimension of economic development -the per capita income- for the determination of the socio-economic level of the countries. Indeed, in the aforementioned countries, Paraguay and Guatemala, the per capita income amounted to US$ 149 and US$ 258 in the year 1960 -Table 4.2 of the present chapter- which is lower than the per capita income of certain countries which belong both to the second and the first group.[35/]

35/ For instance, the countries of Venezuela and Uruguay on the one hand, belong to that group of countries -first group of Table 2.1- whose development of the urbanization of their population was not symmetrical in the period under study (1960-70) and, on the other hand, their symmetry coefficient is at a lower level, 18.1 per cent and 25.8 per cent respectively in the year 1960, while the per capita income of these countries can be considered to be at higher level among the Latin American countries (US$ 859 and US$ 593 respectively in the same year, 1960).

Finally, from Table 2.1, it appears that there is deviation in the symmetry coefficient, S_i, among the various countries of Latin America. The deviation between the two extreme numerical values of the coefficient, 41.9 per cent (Paraguay) and 16.8 per cent (Panama) is 25.1 per cent in the year 1960. This deviation can be considered significant and shows the "gap" that there is in Latin American countries from this point of view of development of urbanization and industrialization.

In the Chart 2.2 we present graphically the position of each country, from the point of view of the symmetry coefficient, as also the direction of the development of this coefficient, in the period 1960-70, based on the classification of the countries in two groups and the data of Table 2.1.

3. Reliability of the model

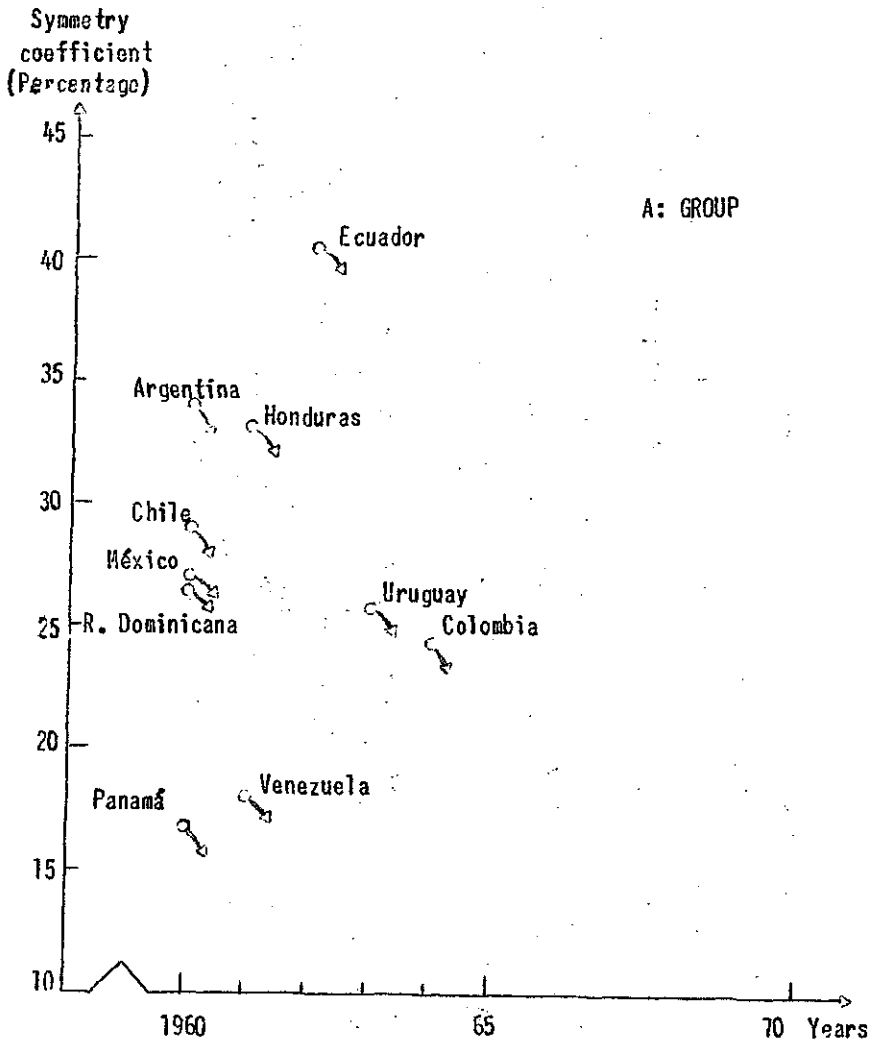
The reliability of the symmetry model is tested by the symmetry of the existing population distribution of each country. By the symmetry of population distribution, we mean that the development of the metropolitan areas[36/] must be in proportion to the development of the cities of small population size, of each country. Therefore, as a criterion of the normal population distribution we take the population size of each city, as also the existing relationship between cities of different population size. More specifically, for formulation of the aforementioned demographic criterion, we classify the cities of each country in accordance with their population size, as follows:

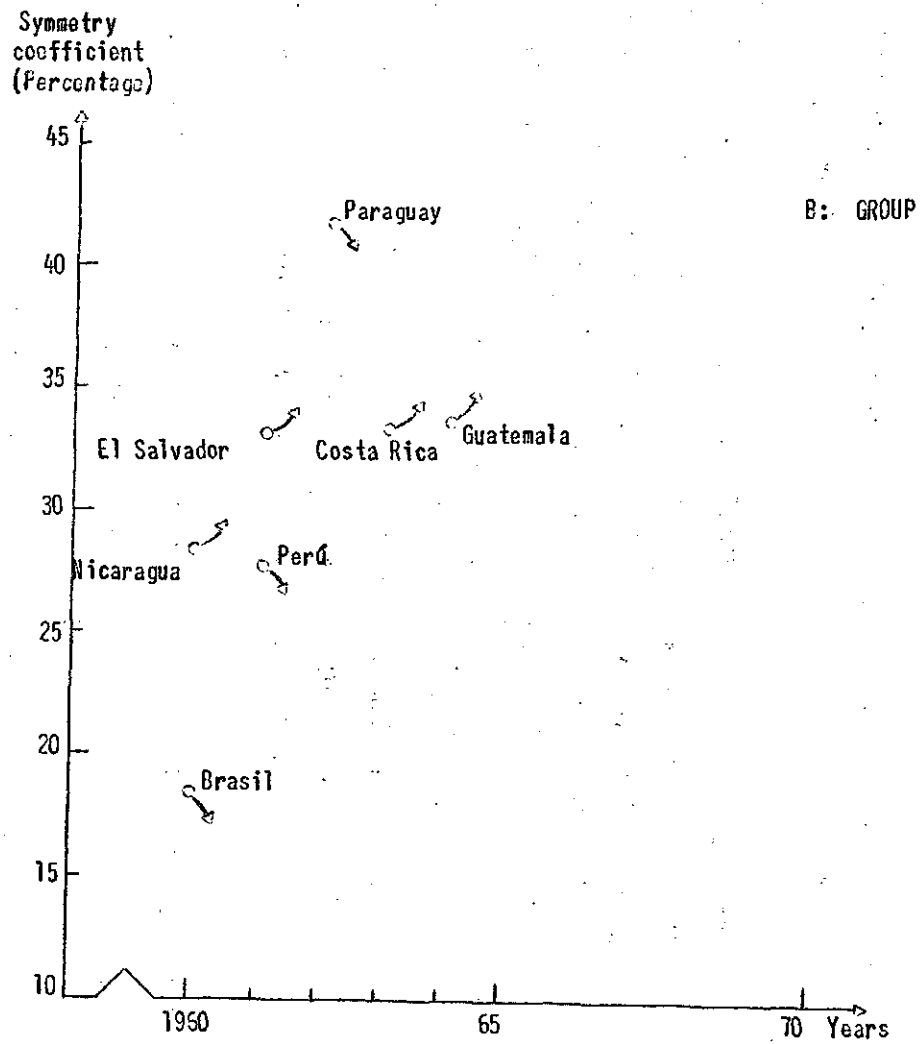
a) Cities of less than 20 000 inhabitants
b) Cities of 20 000 - 100 000 inhabitants
c) Cities of 100 000 - 500 000 inhabitants
d) Cities of more than 500 000 inhabitants

36/ The concept of a metropolitan area, according to an international classification, is defined as follows: "An area with 100 000 or more inhabitants, containing at least one city with 50 000 or more inhabitants and those administrative divisions contiguous to the city that meet certain requirements as to metropolitan character". (The World's Metropolitan Areas. Edited by International Urban Research, University of California, Berkeley, U.S.A.).

Chart 2.2

THE SYMMETRY COEFFICIENT OF URBANIZATION AND INDUSTRIAL DEVELOPMENT IN LATIN AMERICAN COUNTRIES, IN THE DECADE 1960 - 1970.





Source: Programa de Intercambio ELAS/CELADE. Lerda, Juan Carlos, Aldunate, Adolfo. Distribución de la población económicamente activa en los países de América Latina, 1940-1960.

Note: 1) The arrows indicate the development of the symmetry coefficient during the decade 1960-1970.
2) For the classification of the countries in A and B group, see table 2.1 of the present section.

Based on the above classification of the cities, the following indices, as regards the symmetrical population distribution of each country, have been accepted:

i) If the total sum of the population of the two first groups of cities (a and b) is approximately equal to the population sum of the last two groups of cities (c and d), the country is characterized by a symmetrical population distribution. The countries, furthermore, which have this characteristic, that is, a symmetrical population distribution, are the developed countries.

ii) The less-developed countries, are characterized by an asymmetric population distribution. In this case, it is observed that, the sum of the population of the two last groups of cities (c and d) is essentially larger than that of the first two groups of cities (a and b).

The aforementioned thoughts can be written in mathematical form as follows:

$a + b = c + d$ Symmetrical Population Distribution. Developed Countries

$c + d > a + b$ Asymmetrical Population Distribution. Less-developed Countries

where:

a : Population summation of cities less than 20 000 inhabitants

b : Population summation of cities 20 000 - 100 000 inhabitants

c : Population summation of cities 100 000 - 500 000 inhabitants

d : Population summation of cities more than 500 000 inhabitants

In the case of Chile, the symmetry coefficient was estimated at 26.8 per cent in the year 1960.[37/] On the basis of this numerical value of the symmetry coefficient and what we have accepted as regards its interpretation, we were

37/ The lack of statistical data as regards the number of cities according to population size, of the Latin American countries in the year 1970, with the exception of Chile, for the classification of the cities on the basis of the adopted criterion of reliability of the model, imposes on us the use of the data of the 1960 census, for all Latin American countries, to apply the aforementioned criterion. This, of course, does not alter the importance of the conclusions drawn.

led to the conclusion that the realized urbanization of the population of the country was asymmetrical, in relation to the achieved industrialization of the country and, the country, based on this ascertainment, belongs to the less-developed countries. The verification of the aforementioned result is achieved by the application of the criterion of reliability of the symmetry model which we described at the beginning of the present section. Thus, on the basis of the population data of 1960, which are given in the Table 4.3.1., of Chapter III, Section 4.3, the number of cities with less than 100 000 inhabitants, amounted to 85 cities with a total population of 1 833 thousand inhabitants.
The population of the cities of a population size of more than 100 000 inhabitants, amounted to 2 424 thousand persons during the same year (1960). Based on these data, it is seen that the population of the third and fourth population groups (c and d) is larger than the population sum of the first and second groups (a and b) by 590 thousand persons. The percentage increase in question is 32.2 per cent.[38/] Consequently, we can say, based on the inequality, $c+d > a+b$, that the population distribution in Chile is asymmetrical and the country belongs to the less-developed countries,[39/] as a conclusion drawn also during the application of the symmetry model.

Finally, the index of the population distribution of the country, which was estimated at 32.2 per cent, is in agreement with the calculated symmetry coefficient, 26.8 per cent, because the existing difference, 5.4 per cent can be considered very small. Therefore, the symmetry model becomes the most reliable statistical element for measuring the symmetrical development of urbanization of the population of the country and industrialization.

38/ The application of the criterion of reliability of the model, on the population data of the 1970 census, for the case of Chile also, leads us to the same conclusions as above. Thus, the population sum of the last two groups of cities (c and d = 3 722 thousand persons) is larger than the population sum of the first two groups of cities (a+b = 2 049 thousand persons) by 673 thousand persons, that is by 38.8 per cent.

39/ This criterion is an indication as regards the determination of the countries in less-developed and in developed countries. In this case, the per capita income must be taken into account for the classification of a country as a less-developed or a developed country.

The classification of the cities by population size, and in accordance with the requirements of the criterion of the model was made possible for certain Latin American countries, which are included in the following table.

Table 3.1

THE NUMBER OF CITIES BY POPULATION SIZE AND THEIR POPULATION FOR CERTAIN COUNTRIES OF LATIN AMERICA

n/n	Country	Census Year	Number of cities 20-100 thousand inhabitants	Population	Number of cities more than 100 000 inhabitants	Population
1.	Argentina	1960	51	2 039 334	12	9 512 665
2.	Bolivia	1950	5	272 402	1	321 073
3.	Brazil	1960	159	6 612 727	31	13 309 463
4.	Colombia	1964	35	1 591 020	12	4 802 612
5.	Costa Rica	1963	-	-	1	320 431
6.	Cuba	1963	21	869 400	5	2 211 400
7.	Chile	1960	31	1 353 424	4	2 423 788
8.	Ecuador	1962	11	385 058	2	865 550
9.	El Salvador	1961	5	187 053	1	255 744
10.	Guatemala	1964	3	92 269	1	572 937
11.	Haiti	1950	1	24 423	1	134 117
12.	Honduras	1961	2	83 495	1	134 075
13.	Mexico	1960	87	3 612 414	17	8 496 492
14.	Nicaragua	1963	4	118 371	1	234 580
15.	Panama	1960	2	32 522	1	273 440
16.	Paraguay	1962	-	-	1	309 660
17.	Peru	1961	27	995 313	4	1 827 672
18.	Dominican Republic	1960	6	198 720	1	369 980
19.	Uruguay	1963	14	456 232	1	1 159 085
20.	Venezuela	1961	31	1 304 261	5	2 256 892

Source: Centro Latinoamericano de Demografía (CELADE). Boletín Demográfico N°9, Santiago de Chile, diciembre de 1971.

From Table 3.1 it appears that in all the Latin American countries, the population of the cities of the second group (c and d) is larger than the population of the first group (a and b). This means that we have an unequal distribution of the population of the countries. Furthermore, the fact of the inequality of the population of the two groups indicates that the countries belong to the less-developed countries, because the relationship $c+d > a+b$ exists, In the case of Guatemala, the population difference of the two groups, a+b and c+d, is 152 thousand persons, that is, 36.4 per cent. This result is in agreement with the index of the symmetry model, which is at the level of 34.0 per cent approximately. Finally, from the data of the above table, the reader can be easily led to the relevant conclusions as regards the population distribution of each country, and their classification at the level of economic growth, on the basis of the criterion of reliability, by which, as we said previously, we can verify the obtained results for the application of the symmetry model.

4. International comparison based on the symmetry model. Conclusions drawn

In the present section, we provide the estimation of the symmetry coefficient of urbanization and industrialization, for certain countries which do not belong to the Southern hemisphere of America (Latin American countries). The symmetry coefficient was evaluated on the basis of the data of census years, or on the basis of the population projections in the period 1960-70. These countries are mainly European countries where the urbanization and industrialization indices differ in each country. In this manner, we wish to make comparisons of the data, as regards the increase of the urban population and the industrial development in the European countries, with those concerning the countries of Latin America, and to classify the countries as developed or less-developed countries, based on the numerical limit of the symmetry coefficient.

From the Table 4.1 in which are included sixteen countries with their indices of urbanization and industrialization, we are led to the following conclusions.[40/]

40/ The lack of statistical data as regards the economically active population by economic branch for the countries which are included in the table, in the year 1970, did not allow us the estimation of the industrialization index and, consequently, the symmetry coefficient of these countries, for the same year (1970).

Table 4.1

INDICES OF URBANIZATION AND INDUSTRIALIZATION, AS WELL AS THE SYMMETRY MODEL FOR CERTAIN COUNTRIES, DURING THE PERIOD 1960-70

n/n	Country i	Census Year t	Urbanization index Z_i	Industrialization index I_i	Symmetry model S_i
	North America				
1.	Canada	1961	69.6	22.9	32.9
2.	United States	1960	69.9	26.5	37.9
	Asia				
3.	Japan	1965	68.1	24.2	35.5
	Europe				
4.	Austria	1961	50.0	28.6	57.2
5.	Belgium	1961	66.4	34.6	52.1
6.	Denmark	1965	45.5	29.4	64.6
7.	France	1968	70.0	27.0	38.6
8.	Germany, Federal	1969 b/	38.4	37.9	98.7
9.	Greece	1961	43.3	13.4	30.9
10.	Netherlands	1960	80.0	29.9	37.4
11.	Norway	1960	32.1	25.5	79.4
12.	Sweden	1965	77.4	31.9	41.2
13.	Switzerland	1960	51.3	39.8	77.6
14.	United Kingdom a/	1966 b/	77.9	34.7	44.5
	Oceania				
15.	Australia	1966	83.3	27.0	32.4
16.	New Zealand	1966	68.3	26.6	38.9

Sources: i) United Nations, Demographic Yearbook, 1970.
ii) United Nations, Yearbook of Labour Statistics, 1970. International Labour Office, Geneva.
a/ Includes Scotland and Northern Ireland.
b/ Estimates.

In certain countries, the symmetry coefficient exceeds 75 per cent, or approaches the numerical limit of 100. These countries are characterized by a symmetrical development of urbanization of their population and their industrialization. In the case where, in certain countries, the symmetry coefficient approaches the limit of 100, this means, as we explained in the relevant chapter, that these countries require labour force to cover the needs mainly of the secondary branch of the economy, because of exhaustion of their domestic resources in manpower. These needs -as is known- are covered by the immigration of workers from other countries which have a surplus labour force. The countries which experienced a symmetry coefficient of more than 75 per cent, in the period 1960-70 are West Germany, Switzerland and Norway. Indeed, in these countries we had an inflow of workers from other countries, mainly Mediterranean countries where industrialization was at a lower level than in the aforementioned three countries and, consequently, they had a surplus of labour force, a problem of unemployment, etc. Of the sixteen countries surveyed, six countries show a symmetry coefficient of more than half of 100, and ten countries have a coefficient of less than 50 per cent.

In general we can say that the urbanization index of all the countries is at a high level, with the exception of W. Germany, Norway and Switzerland, where the development of the urbanization of their population and industrial development has been symmetrical in the period 1960-70. The numerical value of the symmetry coefficient in these countries approaches the optimum level and from this point of view, we can say that these countries will cover the needs in labour force by immigration.

Regarding the Latin American countries, and based on the symmetry coefficient, Table 2.1 of the present chapter, we ascertain the following: Of the eighteen countries surveyed, in the countries of Ecuador and Paraguay,[41/] the symmetry coefficient is more than 40 per cent, in the year 1960, and 1962 respectively, while there are five countries, Argentina, Honduras, Costa Rica and El Salvador where this coefficient is 33 per cent approximately. In the remaining eleven countries, the symmetry coefficients are at a level lower than 30 per cent. As a conclusion, on the basis of the symmetry coefficient which

41/ In these countries, Ecuador and Paraguay, the secondary sector of economy is mainly craftsmanship.

reflects only the development of the urbanization in conjunction with industrial development, we can say that all the countries of Latin America belong to the less-developed countries. Of course, as we said in the previous sections, the normal development of these two dimensions, urbanization and industrialization, is an index and not proof, of the economic growth of the country in general. The symmetry coefficient must be related with the per capita income, which is the main dimension of the degree of the economic growth of a country, for a determination of its social-economic level. To prove this fact, in the following Table 4.2., we give the per capita income of certain countries and the degree of urbanization of their population and industrial development.

Table 4.2

THE SYMMETRY COEFFICIENT AND THE PER CAPITA INCOME OF CERTAIN COUNTRIES DURING THE PERIOD 1960 - 1970

n/n	Country i	Census Year t	Symmetry coefficient S_i	Census Year t	Per capita income in market prices in US$
1.	United States	1960	37.9	1960	2 559
2.	Japan	1965	35.5	1970	1 658
3.	W. Germany	1969	98.7	1970	2 698
4.	Switzerland	1960	77.6	1960	1 429
5.	Norway	1960	79.4	1960	1 093
6.	Argentina	1960	33.3	1960	529
7.	Chile	1960	28.9	1960	245
8.	Guatemala	1960	33.8	1960	258
9.	Mexico	1960	27.6	1960	315
10,	Panama	1960	16.8	1960	349
11.	Paraguay	1962	41.9	1960	149
12.	Uruguay	1963	25.1	1960	593
13.	Venezuela	1961	18.1	1960	859

Sources: i) Symmetry coefficient: J.C. Lerda, A. Aldunate, Programa de Intercambio ELAS/CELADE, Distribución de la población económicamente activa en los países de América Latina, 1940-1960.
ii) Per capita income in market prices in US$ dollars: United Nations, Yearbook of National Accounts Statistics 1971, Vol. III.

From the above table, we see that in certain countries, as for instance W. Germany, Switzerland, etc., the main dimension of economic growth, which is the per capita income, is in agreement with the numerical value of the symmetry coefficient. In other countries, and particularly, in Latin American countries, the value of the index of urbanization and industrialization differs from their per capita income, a fact that means that in many cases, the value of the symmetry model is not in agreement with the main indicator of the economic growth of the countries.

5. Population movements anticipated in Latin American countries and probable redistribution of their labour force

In the previous section, we saw that in certain European countries, such as West Germany, Norway, etc., a scarcity of labour force was observed, particularly in the secondary branch of the economy, on account of exhaustion of the domestic resources in labour force. These countries economically developed, permitted the entry of workers from other European countries, to cover their needs in labour hands. The symmetry coefficient in these countries was formulated in numerical limits of more than 75 per cent. The "migratory" countries were the less-developed countries, where the numerical value of the symmetry coefficient was at a low level.

On the basis of the results obtained from the application of the symmetry model, in Latin American countries, such situations as those which appeared in the European countries, that is a scarcity of labour force, in the industrial sector of the economy, and coverage of these needs by immigration of workers from other countries, are not expected to take place in the coming years.[42/] This is because the increase of employment opportunities in the secondary production of the economy can be covered by domestic resources of manpower of each country. It was ascertained, in previous sections, that urbanization considerably precedes industrialization in all countries of Latin America and, consequently, there is a surplus of urban labour force which can cover the needs in

42/ International migration will probably take place between the Latin American countries for covering services needs in the coming years, as this happens in Argentina today.

labour force created in the industrial sector of the economy. Furthermore, there is a surplus of rural labour force, which can be transferred to the industrial areas of the country.

As a conclusion, on the basis of what we have mentioned above, we can say that in each Latin American country, under the present conditions, or a probable redistribution of the labour force by branch of economic activity on account of an increase of industrial development, the needs in labour force created in the secondary production, can be covered by the domestic resources in manpower for the coming years. Therefore, population movements (external migrations) between the countries of Latin America, on account of the created needs for labour force, and in general, of the economic growth of each country, are not anticipated for the coming years. The existing balance of their manpower will remain unchanged. Of course, a redistribution of the labour force, by branch of economic activity (agricultural, industrial, etc.) and by region, will take place in each Latin American country. This is because all the countries are at the stage of economic development and, as a consequence, the demands for labour force by branch of economy will be changing. The degree of redistribution, the period of time that a such redistribution of economically active population will take place, would depend on the rate of economic growth of each country. Such changes in the labour force of each country were noted in the past, 1952 - 1970, as one could ascertain from the investigation of the applied symmetry model and, particularly, from the development of the "urbanization" and "industrialization" indices, whose values changed during the census years of the sample period, 1952-70.

VI. FINDINGS AND CONCLUSIONS

1. A review of findings and conclusions

1.1. From the analysis of development of the urbanization of the Chilean population we ascertained that the urban population increased by 86.4 per cent during the sample period 1952-70 and the degree of urbanization amounted to 75.1 per cent in 1970, which can be considered high. Furthermore, we ascertained that a redistribution took place of the urban and rural population in the country's provinces. Finally, we were led to the conclusion, as regards the population movements that they took place from rural areas and small population size-urban centres towards the large urban areas and particularly to the capital of the country.

1.2. From the statistical investigation of the influence of the industrial development on the urbanization of the population, we evaluated that the main determinative factors of the increase of the urban population is the per capita income of the urban areas, the demand for labour force in the secondary branch of the economy, unemployment in agricultural production, and the wage of the industry. Based on these determinants, we made forescasts as regards the development of urbanization in the coming years and the results obtained were considered satisfactory.

1.3. As regards the regional problem in Chile, we ascertained that the main factors prevailing in it are the unequal distribution of income and the differentiation of industrial development by province. We were also led to the conclusion that there exists a correlation between the per capita income by province and the number of migrants towards the metropolitan area of Santiago. Furthermore, the main factors of increase of the population of Santiago, which is considered the largest urban centre of the country, is the higher level of per capita income and the demand for workers in the industry because, as we said in the relevant chapter, we have a concentration of many industrial units in this metropolitan area. Finally, we arrived at the conclusion that an equilibrium in the economic development of the province could possibly reduce the migration flow towards the capital of the country, because as it was proved, the movement of population in that direction is attributable, mainly, to economic reasons and secondarily, to other reasons, such as social, cultural, etc.

1.4. From the application of the symmetry model, in the case of Chile, and at a national level, the numerical value of this coefficient was equal to 21.2 per cent in the year 1970. Following this, we were led to the conclusion that the development of the urbanization and industrialization of the country is asymmetrical, that is, in other words, that urbanization precedes industrial development of the country and from this point of view the country can be considered as belonging to the less-developed countries. Furthermore, this coefficient in the period 1952-70 followed a downwards trend. The asymmetrical development of the urbanization of the population and industrialization, is observed in all the geographical regions, even though the symmetry coefficient varies in each province. The area of Santiago has the highest limit of this index. This is natural because of the fact that the majority of industries are established in this area and, as a consequence, the industrialization index is at a higher level than other areas.

1.5. From the estimation of the urbanization and industrialization indices, as also the symmetry coefficient for nineteen countries of Latin America, we were led to the following conclusions: i) in seven Latin American countries, urbanization and industrialization showed a symmetrical development, while in the remaining twelve the evolution of these two dimensions -urbanization and industrialization- was asymmetrical, as same was said in the case of Chile at a national and regional level. ii) The value of the symmetry coefficient in most of the Latin American countries is less than 50 per cent, a fact which shows that these countries are less-developed from the point of view of the development of the urbanization of their population and their industrialization. If the previously mentioned index is related with the main dimension of economic growth which, as we said, is the per capita income, then the fact is verified that these countries are economically less-developed as having a per capita income less than 1/4 of the per capita income of the United States.

1.6. From the application of the reliability criterion of the symmetry model, we ascertained the relationship existing between cities of various population sizes, both as regards the case of Chile, as also in certain other countries of Latin America. On the basis of the results achieved, from the application of the above criterion, we were led to the verification of the ascertainment which emerged from the application of the symmetry model. Finally, we accepted

that the symmetry model is the most reliable statistical technique for measuring symmetrical or asymmetrical development of urbanization and industrialization.

1.7. The lack of labour force, on account of exhaustion of the domestic manpower of the country, and the covering of these needs by external migration, events which took place in certain European countries, are not foreseen to appear in the Latin American countries for the coming years and this because, on the one hand there is a surplus of rural population and, on the other hand, the increase in labour force is much larger than the rate of growth of industrial development, whose rate, in certain countries of Latin America can be considered at a low level.

1.8. The comparison of the results obtained from the application of the symmetry model in the countries of Latin America and the European countries, has led us to certain conclusions as regards the degree of urbanization and the industrial development, whose repetition is not considered advisable.

1.9. Finally, all the ascertainments as regards the urbanization, the influence of industrial development on the urbanization of the population, regional problems, the relationship of urbanization and industrialization, are in agreement with what has been said during the theoretical consideration of the problem under study.

2. Epilogue

The econometric investigation of the problem of urbanization and industrial development for Latin American countries is the first effort to be made by the author of the present work, in the analysis of the general problem of urbanization and economic growth by constructing a model in which demographic and economic factors will be included. The estimation of the influence of the industrial development and urbanization, the correlation of the main factors prevailing in the regional problem and the degree of development of urbanization and industrialization, lead us to useful conclusions as regards the relationships existing between demographic and economic variables.

Today, in all the developed countries, an effort is made to relate all the factors, economic, demographic and social, which contribute to the increase of the national income. Furthermore, the economic and social structure of a

country mainly depends on the structure of its manpower. It is known that the age-composition of the population influences the age-composition of the labour force, productivity depends on the labour force, its structure, educational qualification, etc. Therefore, the correlation of all of these factors, in the frame of national accounts of the country will provide the data needed for allocation of the economic and human resources of a country for a rapid socio-economic growth.

Furthermore all the countries of Latin America are at the stage of economic development and prepare long-term economic plans and consequently, they have need of such data referring to the existing relationships between demographic and economic factors.

Finally, from the results obtained of the present work, we can say that the first effort of connecting demographic and economic factors can be considered successful.

APPENDIX A

A. List of variables used for urbanization of the population in Chile

1. N : Total population of a country (in thousands)
2. N^a : Rural population of a country (in thousands)
3. $N-N^a = N^r$: Urban population of a country (in thousands)
4. Y : Gross national income at constant 1965 prices and in million Escudos (E°)
5. Y^a : Agricultural income at constant 1965 prices and in million Escudos (E°)
6. $Y-Y^a = Y^r$: Urban income at constant 1965 prices and in million Escudos (E°)
7. Y^r/N^r : Per capita urban income at constant 1965 prices and in Escudos (E°)
8. U^a : Unemployment in the agricultural branch of the economy (in thousands)
9. D^w : Demand for labour force in secondary production (in thousands)
10. W^s : Wages in secondary branch of the economy (index: base year = 1962)
11. N^{r+s} : Urban population of the metropolitan area of Santiago (in thousands)
12. Y^{r+s}/N^{r+s} : Per capita urban income of the area of Santiago at constant 1965 prices and in Escudos
13. D^{w+s} : Demand for labour force in the secondary branch of the economy of the area of Santiago (in thousands)

B. List of variables used for the estimation of the symmetry model in Latin American countries

1. P_{oij} : Total population of a country or of a region (in thousands)
2. $P_{a_{ij}}$: Urban population of a country or of a region (in thousands)
3. $P_{c_{ij}}$: Rural population of a country or of a region (in thousands)
4. $Z_{ij} = \frac{P_{a_{ij}}}{P_{o_{ij}}} 100$: Index of urbanization of a country or of a region (in percentage)
5. $P_{e_{ij}}$: Total economically active population of a country or of a region (in thousands)
6. $P^s_{e_{ij}}$: Economically active population employed in secondary production of a country or of a region (in thousands)

7. $I_{ij} = \frac{P^s_{e_{ij}}}{P_{e_{ij}}} 100$: Index of industrialization of a country or of a region (in percentage)

8. $S_{ij} = \frac{I_{ij}}{Z_{ij}} 100$: Symmetry Model (in percentage)
Z_{ij} I_{ij} as in relationships 4 and 7.

i : refers to country

j : refers to province of a country.

Table 1

DATA OF VARIABLES USED IN FUNCTIONAL RELATIONSHIPS FOR URBANIZATION OF THE POPULATION IN CHILE, DURING THE SAMPLE PERIOD 1960-71

n/n	Year t	(1) N (in thousands)	(2) N^a (in thousands)	(3) $N-N^a=N^r$ (in thousands)	(4) Y (in million Escudos)	(5) Y^a (in million Escudos)	(6) $Y-Y^a=Y^r$ (in million Escudos)	(7) Y^r/N^r (in Escudos)	(8) U^a (in thousands)	(9) D^w (in thousands)	(10) W^w Index (1962=100)	(11) N^{r+s} (in thousands)	(12) Y^{r+s}/N^{r+s} (in Escudos)	(13) D^{w+s} (in thousands)
1	1960	7 374	2 346	5 028	14 099	1 580	12 519	2 489	-	-	-	2 194	2 448	221.5
2	1961	7 510	2 334	5 176	14 941	1 639	13 302	2 570	-	-	-	2 268	2 541	206.5
3	1962	7 649	2 320	5 329	15 698	1 598	14 100	2 646	-	-	-	2 344	2 675	210.2
4	1963	7 790	2 303	5 487	16 434	1 677	14 757	2 689	-	-	88.4	2 423	2 762	210.8
5	1964	7 934	2 285	5 649	17 096	1 769	15 327	2 713	-	-	88.1	2 505	2 801	225.2
6	1965	8 080	2 265	5 815	17 970	1 728	16 242	2 793	9.8	650.6	94.6	2 589	2 934	248.6
7	1966	8 229	2 242	5 987	19 280	1 867	17 413	2 909	10.0	663.9	96.8	2 677	3 107	252.5
8	1967	8 381	2 217	6 164	19 765	2 004	17 761	2 881	10.5	663.2	95.8	2 767	3 085	261.4
9	1968	8 535	2 189	6 346	20 241	2 037	18 204	2 869	10.9	670.3	92.2	2 860	3 014	265.5
10	1969	8 693	2 160	6 533	20 915	1 857	19 058	2 917	9.5	693.3	90.3	2 956	3 043	274.1
11	1970	8 853	2 127	6 726	21 572	1 949	19 623	2 917	10.2	719.8	-	3 056	3 054	276.8
12	1971	9 016	2 092	6 924	22 586	2 041	20 545	2 967	10.4	734.2	-	-	-	-

Sources: 1. XIV Censo Nacional de Población y III de Vivienda, 1970. Muestra de Adelanto de Cifras Censales. Instituto Nacional de Estadística. Santiago de Chile, 1972.
2. XIII Censo de Población, 1960. Instituto Nacional de Estadística, Santiago de Chile, 1969.
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4. Plan de Economía Nacional 1971-76. Antecedentes sobre el Desarrollo Chileno. Oficina de Planificación Nacional (ODEPLAN). Santiago de Chile, 1971.
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Notes: 1. For interpretation of the symbols of the variables used, see the corresponding list of variables.
2. Wages in the secondary branch of the economy deflacted by the index of consumption prices.
3. The urban population in 1970 differs from the urban population in the same year of Table 2.2.1., Chapter III. But the lack of statistical data regarding the urban population by province requires the using of both two figures.

Table 2

CHILE: THE DISTRIBUTION OF URBAN AND RURAL POPULATION BY PROVINCE DURING THE CENSUS YEARS 1952, 1960 AND 1970

n/n	Symbol of province	Province j	1952					1960					1970		
			P_{o_j}	P_{a_j}	Distribution (percentage)	P_{c_j}	Distribution (percentage)	P_{o_j}	P_{a_j}	Distribution (percentage)	P_{c_j}	Distribution (percentage)	P_{o_j}	P_{a_j}	P_{c_j}
1	A	Tarapaca	102 789	61 383	59.72	41 406	40.28	123 070	107 211	87.11	15 859	12.89	175 089	161 320	13 769
2	B	Antofagasta	184 824	165 005	89.28	19 819	10.72	215 219	203 997	94.79	11 222	5.21	251 555	243 098	8 457
3	C	Atacama	80 113	41 441	51.73	38 672	48.27	116 235	85 459	73.52	30 776	26.48	152 748	127 246	25 502
4	D	Coquimbo	262 169	103 230	39.38	158 939	60.62	308 991	160 148	51.83	148 843	48.17	339 403	202 043	137 360
5	E	Aconcagua	128 378	51 032	39.75	77 346	60.25	140 543	78 001	55.50	62 542	44.50	161 451	97 720	63 731
6	F	Valparaiso	498 254	424 799	85.26	73 455	14.74	617 510	548 481	88.82	69 029	11.18	735 162	672 210	62 952
7	G	Santiago	1 754 954	1 521 831	86.72	233 123	13.28	2 437 425	2 193 966	90.01	243 459	9.99	3 233 945	3 018 152	215 793
8	H	O'Higgins	224 593	90 827	40.44	133 766	59.56	259 470	138 315	53.31	121 155	46.69	306 460	169 491	136 969
9	I	Colchagua	139 531	36 501	26.16	103 030	73.84	158 509	51 823	32.69	106 686	67.31	168 580	63 915	104 665
10	J	Curico	89 432	33 332	37.27	56 100	62.73	105 802	43 359	40.98	62 443	59.02	114 737	52 448	62 289
11	K	Talca	173 693	68 515	39.45	105 178	60.55	206 154	89 822	43.57	116 332	56.43	230 885	121 275	109 610
12	L	Maule	72 181	26 486	36.69	45 695	63.31	79 736	31 768	39.84	47 968	60.16	82 700	37 015	45 685
13	M	Linares	146 257	44 270	30.27	101 987	69.73	171 350	62 257	36.33	109 093	63.67	189 053	76 077	112 976
14	N	Ñuble	251 342	87 941	34.99	163 401	65.01	285 639	113 159	39.62	172 480	60.38	306 220	147 944	158 276
15	O	Concepción	411 566	313 297	76.12	98 269	23.88	539 521	440 770	81.70	98 751	18.30	645 385	549 746	95 639
16	P	Arauco	72 289	20 699	28.63	51 590	71.37	89 460	31 947	35.71	57 513	64.29	98 664	48 947	49 717
17	Q	Bio-Bio	138 292	44 146	31.92	94 146	68.08	168 718	62 630	37.12	106 088	62.88	193 539	95 053	98 486
18	R	Malleco	159 419	61 647	38.67	97 772	61.33	174 300	78 350	44.95	95 950	55.05	176 963	91 814	85 149
19	S	Cautín	365 072	120 923	33.12	244 149	66.88	394 654	152 896	38.74	241 758	61.26	420 850	205 919	214 931
20	T	Valdivia	232 647	86 157	37.03	146 490	62.97	259 794	114 146	43.94	145 648	56.06	277 768	145 906	131 862
21	U	Osorno	123 059	49 773	40.45	73 286	59.55	144 005	66 417	46.12	77 588	53.88	160 237	86 017	74 220
22	V	Llanquihue	139 986	45 193	32.28	94 793	67.72	167 671	70 347	41.96	97 324	58.04	198 803	103 758	95 045
23	W	Chiloé	100 687	18 096	17.97	2 591	82.03	99 211	21 956	22.13	77 255	77.87	111 150	35 101	76 049
24	X	Aysén	26 262	11 677	44.46	14 585	55.54	37 770	19 966	52.86	17 804	47.14	48 423	31 163	17 260
25	Y	Magallanes	55 206	44 921	81.37	10 285	18.63	73 358	60 869	82.98	12 489	17.02	89 396	77 151	12 245
		Chile	5 932 995	3 573 122	60.22	2 359 873	39.78	7 374 115	5 028 060	68.19	2 346 055	31.81	8 869 166	6 660 529	2 208 637

Sources: Dirección de Estadísticas y Censos: "Censos de Población". Tomo: Resumen del País (para 1952 y 1960); Dirección de Estadística y Censos, Santiago de Chile, 1959 y 1969.
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Table 3

THE ECONOMICALLY ACTIVE POPULATION OF THE LATIN AMERICAN COUNTRIES IN THE CENSUS YEAR OF THE PERIOD 1950-70

n/n	Country i	Census year t	P_{e_i}	$P^s_{e_i}$	Census year t	P_{e_i}	$P^s_{e_i}$	Year[a/] t	P_{e_i}	$P^s_{e_i}$
1	Argentina	1947	6 447 631	-	1960	7 424 524	1 855 994	1970	9 177 000	2 294 082
2	Chile	1952	2 155 293	408 713	1960	2 388 667	428 862	1970	2 607 360	415 440
3	Colombia	1951	3 755 609	460 907	1964	5 134 125	655 961	1970	6 557 000	837 754
4	Ecuador	1950	1 205 269	233 292	1962	1 442 591	210 174	1970	1 895 000	276 087
5	Honduras	1950	647 393	-	1961	567 988	44 010	1970	799 000	61 910
6	Mexico	1950	8 272 093	372 542	1960	11 332 016	1 556 091	1970	15 966 000	2 192 423
7	Panama	1950	241 104	18 018	1960	299 386	22 079	1970	450 000	33 186
8	Republica Dominicana	1950	825 607	-	1960	820 710	66 850	1970	1 225 000	99 781
9	Venezuela	1950	1 555 828	167 726	1961	2 351 291	287 344	1970	3 372 000	412 082
10	Uruguay	-	-	-	1963	995 500	211 200	1970	1 111 000	235 703
11	Cuba	1953	1 972 266	327 208	-	-	-	1970	2 968 000	-
1	Brasil	1950	16 604 718	2 231 205	1960	22 651 263	2 005 775	1970	30 419 000	2 621 315
2	Costa Rica	1950	271 984	29 870	1963	395 273	45 332	1970	535 000	62 081
3	El Salvador	1950	653 409	74 424	1961	807 092	103 476	1970	1 081 000	138 594
4	Guatemala	1950	967 814	-	1964	1 317 140	149 460	1970	1 623 000	186 633
5	Nicaragua	1950	329 976	-	1963	474 960	55 631	1970	659 000	77 187
6	Paraguay	1950	437 344	-	1962	586 415	88 486	1970	784 000	117 979
7	Peru	-	-	-	1961	3 124 579	410 980	1970	4 285 000	563 610

Sources: 1) Programa de intercambio ELAS/CELADE. Distribución de la Población económicamente activa en los países de América Latina 1940-1960.

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a/ Estimations.

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