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AN EXPLORATORY ANALYSIS OF HOUSEHOLD INCOME INEQUALITY IN PERU

(1985/86)

A Research Paper presented by

Midori de Habich

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Members of the Examining Committee

Prof. R. Teekens
Prof. Ch.M. Cooper

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CONTENTS

INTRODUCTION

The importance of income distribution as an area of study within Economics, has changed enormously from the central position it had with the Classics to its relegation to the last chapter of the regular text book on Microeconomics. Today, basic questions about the relevance of income distribution -why study income distribution? what does it tell us?- are seldomly asked explicitly and frequently answered implicitly in a way which is neither illuminating nor consistent.

This I found to be the most disturbing issue when initiating this paper. The attempt to deal with it ultimately led to the elaboration of Chapter I, which contains a synthesis of the conceptual framework constructed by A. K. Sen throughout a series of articles and books.

The identification of development with welfare is the crucial starting point. From here the inquiry is directed towards determining the basis on which welfare should be assessed. The distinction of the notion of good from the notion of functioning of a person leads on one hand, to the association of welfare with capabilities, and on the other, to the formulation of a functional relationship between the entitlement to goods and the achievement of capabilities. As a next step, there is a inquiry into the diverse mechanisms of entitlement generation which ultimately leads to the identification of the determinants of each mechanism.

Although, it has been said that this is a case of 'new names for old ideas', I find that the process of rethinking these old ideas, in a rigorous manner, has led Sen to construct a consistent and, at the same time, flexible structure, which can be helpful at different levels.

At the foundational level, it provides questions of some basic issues about the nature of development and of income distribution. In some cases, it may provide debatable answers; we would certainly benefit from a vigorous debate on these matters which unfortunately has not taken place.

As a framework, it orders the different topics and areas of study, thus providing a basic structure for description. In this way, it is

possible to undertake descriptive studies in which the underlying concepts are explicit. It is my belief that this is major condition for the accumulation of knowledge -either by acceptance or by rejection-.

It is important to bear in mind that it is not a theory. Can it serve as the basis for the construction of theories? It is not my intention here to discuss the nature of the process by which theories are elaborated, but having a consistent framework as point of departure must certainly facilitate the synthesis of empirical studies and lead to the formulation of 'stylized facts'.

This paper obviously does not cope with all these dimensions. It is an attempt to initiate a descriptive exercise on income distribution within this framework. In this approach, the study of income distribution is a necessary but not sufficient element for the explanation of the quality of life of a certain community and therefore no direct welfare implications can be derived. This constitutes a major difference with similar studies in which the measurement of income distribution is understood to be a direct inquiry into living standards.

Chapter II deals with methodological issues in which conceptual aspects are translated to the operational level. A particular aspect is the definition of socio-economic groups according to the mechanisms by which entitlements are generated. Frequently, this definition is determined on empirical grounds rather than in connection with a conceptual base. Many studies deal with what Cohen (1984) calls 'quasi-groups' -for example disaggregations on the basis of age or education, -which do not provide insights regarding the social structure.

A particularly challenging aspect of this study was the handling of the National Household Survey on Measurement of Living Standards of Peru (1985-86). Due to the limitation of time, a full assessment of the quality of the data has not been possible and there is still much to do regarding the contrast of the results of this study with alternative sources of information.

Parallel to the lack of a comprehensive theory of income distribution for developing countries, there has been an important evolution

in the statistical methods concerning its measurement. Only some basic tools are used in this study: calculation of alternative inequality measures, estimation of a bivariate lognormal model and decomposition analysis. The first two are strictly descriptive devices in order to present the level of inequality at the national level and within and between the major socio-economic groups. The results are presented in Chapter III.

The methods of decomposition utilized aim to explore the sources of income and the attributes which have a greater incidence in income inequality. It is important to mention that the results presented in Chapter IV are not equivalent to the testing of causal relationships but precisely a previous descriptive stage towards their formulation.

Finally, the concluding section contains a synthesis of the main findings and, I am afraid to say, more questions than answers.

CHAPTER I

1. Foundational issues

A crucial issue in development economics is to characterize the very nature of the development process. The question of foundation is a difficult one to resolve, as it is not clear what should count as an adequate basis or on what grounds that adequacy should be assessed. It certainly surpasses the limits of the economic science into disciplines such as philosophy, and more specifically ethics. Nevertheless, the concern is far from being rhetoric, as it has direct implications both on the analytical and the prescriptive levels.

The history of development economics shows that the concept of development has undergone various redefinitions and with each the areas of inquiries and the policy recommendations have changed, sometimes radically. Initially, development was associated to the expansion in goods and services, i.e. it was directly related to economic growth. The experiences of various developing countries showed that this relationship was far from exact, and the focus was reoriented towards the distribution of economic growth, basically in terms of income distribution. With the economic crisis of the seventies and eighties that affected most of the developing countries, the emphasis changed to 'humanizing' adjustment policies, and ultimately a concern with the provision of basis needs.

In this way, the central issue shifted from the supply of goods and services to the structure of demand, and lately to the access of certain groups to basic goods and services. Although the move seems to be in the correct direction, implicitly these approaches identify well being with commodities; the final concern of development seems to be what people have, the goods they possess.

A different approach based on a reconsideration of this foundational issue has been proposed by A.K. Sen. In it, the essence of well being is associated with the notion of capabilities and the process of

development is seen seen as the expansion of people's capabilities. The exposition of the main features of this approach calls for the distinction of three notions: good, characteristics of a good and the functioning of a person. Using Sen's notation:(Sen [1985])

e_i = vector of commodities possessed by a person i

$c(.)$ = the function converting a commodity vector into a vector of characteristics of those commodities

$f_i(.)$ = an personal "utilization function" of i reflecting the conversion of the characteristics of the commodities into the functioning of person i

F_i = the set of utilization functions f_i, any one of which a person i can choose

E_i = the set of vectors of commodities over which person i can establish command

If the person chooses the utilization function $f_i(.)$ then with his or her commodity vector e_i, the achieved functions will be given by the vector b_i,

$$b_i = f_i\,(c\,(e_i)) \qquad (1)$$

The vector b represents person's functioning and well being can be seen as an evaluation of b as it indicates the type life the person is achieving. In a simplified example, consider the commodity vector to be composed of a certain amount of food, its characteristics being the potential of providing calories and proteins. Given a certain pattern of use, the food bundle will generate a certain ability to function without nutrition deficiency. It is at this level that the person's quality of life is to be assessed.

So far the analysis has been concentrated only on one utilization function $f_i(.)$ from the set F_i and a given commodity vector e_i from E_i. Taking into account that f_i and e_i are partly a matter of choice, the complete specification of the person's feasible functioning vectors are given by the set $Q_i(E_i)$,

$$Q_i(E_i) = [b_i | b_i = f_i(c(e_i)), \text{ for some } f_i(.) \in F_i \text{ and for some } e_i \in E_i] \quad (2)$$

$Q_i(E_i)$ represents the freedom that a person has in terms of the choice of functionings, given his personal features F_i (conversion of characteristics into functionings) and his command over commodities E_i (entitlements). Q_i can be called the "capabilities" of person i given those parameters. It reflects the various combinations of functionings he can achieve.

The commodity-based view of development, implies the reformulation of Eq. 1 in the following terms:

$$b_i = c(e_i) \quad (3)$$

Within this specification, the focus is on commodities as they are assumed to have a one-to-one relationship with well being. Ultimately, this view leads to value commodities as an end in themselves and therefore fails to acknowledge the variability that exists in the commodity requirements of well being achievements. In contrast, in the capability approach the possession of commodities is instrumentally and contingently valued only to the extent that it will help in the achievement of functionings. The actual relationship between commodities and functionings therefore has to be assessed. As Sen points out:

> "The conversion of commodities into functionings varies enormously with a number of parameters e.g. age, sex, health, social relations, class background, education ideology and a variety of other interrelated factors."(Sen [1984;pg.511])

Additionally, Sen's approach leads to a questioning of the utilitarianism on which the traditional welfare economics is based. The utility view assumes that happiness or desire-fulfillment is a guide to a person's well-being. Eq. 1 is transformed to:

$$u_i = h_i(f_i(c(e_i)) \qquad (4)$$

where $h_i(.)$ is the 'happiness function' of person i related to the functioning achieved by i.

Sen argues that this approach has two main limitations: it completely neglects the living conditions of the person, and it avoids any direct reference to the person's own valuation of his life. To the extent that, for example, deprived people can come to terms with their own poverty, the scale of utilities suppresses the considerations of the actual quality of life. Ultimately, traditional welfare economics can not provide an adequate framework for the analysis of issues such as poverty, inequity or starvation.

If development is accepted to be the expansion of capabilities, then the understanding of the process of development calls for the analysis of the process of economic growth and structural change through which capabilities can be expanded. To this purpose, Equation 2 can be seen as a synthetic representation, not of a theory or a particular hypothesis, but of a framework of analysis in which the main areas of concern are entitlements and the conversion of these entitlements into capabilities.

Having dealt with these foundational issues, it is now possible to turn to the characterization of the concept of entitlements at a greater level of detail.

2. The Entitlement Approach

As has been said, the capabilities of a person depends, among other things, on his entitlements, e.i. the set of all the bundles of commodities over which he can establish command. The ability of a person to do so will depend on his position in the economic class structure of a particular society and on the legal, political, economic and social characteristics of the society in question.

In an economy with private ownership and exchange in the form of trade and production, a person's entitlement can take two forms: ownership entitlement and exchange entitlement. In the first case, the very ownership of commodities assures command over them. But it is hardly ever the case that a person can live exclusively on what he owns; people engage in the exchange of their ownership bundles, thus generating exchange entitlements.

The exchange entitlements depend on the endowment vector and the exchange entitlement mapping, which represents the exchange possibilities, either through trade or production or a combination of both. Thus, different mechanisms of exchange entitlement generation can be characterized.

i) Pure trade entitlement

Consider the following notation,

X = set of all non-negative vectors of commodities

Y = set of all subsets of X

x = vector of commodities the person owns

z = vector of sales

y = vector of purchases

p = vector of prices

$$E(x) = \{((x-z)+y) \mid y,z \in X;\ z \leq x;\ f(y,z) \leq 0\} \qquad (5)$$

In this case, the exchange entitlement arises from the exchange of all the ownership bundle ($z=x$) or part of it ($z<x$) into commodities costing no more. It will depend on the trade possibilities represented by the 'net cost function' $f(y,z)$ which stands for the net cost of buying y and selling z.

In this way, the ownership entitlement is $(x-z)$, while the exchange entitlement is represented by y.

If the endowment vector is fully exchanged at fixed relative prices, the exchange entitlement set will be:

$$E(x) = \{y \mid y \in X;\ py \leq px\} \qquad (6)$$

The value of the E-mapping being the well-known 'budget set' of the traditional economic theory

Consider the case of a labourer whose main endowment is his 'labour force'. His exchange entitlement will depend on the quality of his resource and his trade possibilities. These do not only include his 'terms of trade', e.i. the relative price between the wage rate he faces and the prices of the goods he needs for his survival, but also the very possibility of trade in terms of his access to employment.

ii) Direct production and trade

Let,

s = vector of inputs the person owns

r = vector of purchased inputs

q = vector of outputs

$$E(x) = \{((x-s)+(q-z)+y) \mid r,s,z,y \in X;\ (s+z) \leq (x+q);\ (q \in \Psi(s+r);\ f(r+y,z) \leq 0\} \qquad (7)$$

Here, the person can not only use his ownership for trade or consumption but also for production. In this case it can be important to consider the different social or legal rules that determine the appropriation of the produce.

The production possibilities can be represented by $\Psi(s+r)$, while $f(r+y,z)$ stands for the trade possibilities.

In this case, the exchange entitlement is additionally composed of a production entitlement $(q-z)$, i.e. the retained production.

If no inputs are purchased $(r=0)$, then the only trade possibilities that affect the entitlement are $f(y,z)$ as in (5)

A peasant farmer that engages in production on the basis of his endowments of land and 'labour force', will have his exchange entitlements determined by the quality of his resources, the technological possibilities open to him, and his trade possibilities. Here again this last concept includes on one hand, the access he has to markets both in terms of buying (inputs and consumer goods) and selling (marketed output), and on the other hand, the relative price of his sales to the prices of his purchases.

iii) Own production entitlement

$$E(x) = \{(x-s)+q) | s \in X;\ s \leq x;\ q \in \Psi(s)\} \qquad (8)$$

This is the case in which there is production without trade, no inputs are purchased $(r=0)$ and no resources or outputs are sold $(z=0)$. Therefore the exchange entitlement will consist exclusively of production q.

Although this is a rare case, the own-production entitlement relation gives an idea of what a person can secure independently of the working of the rest of the economy.

iv) Non-exchange entitlements

$$E(x) = \{(x+e^{*}) | e^{*} \in X\} \qquad (9)$$

An additional case to consider are those entitlements which do not stem directly from the resources and exchange possibilities represented by e^*. These may take the form of claims against the state, e.g. social benefits, transfers or subsidized public services. It may be important also to consider non-public transfers, either from other individuals or from private institutions.

An important aspect of this approach is the complexity of the notion of entitlements, as it assumes the form of stock through the ownership entitlement and a form of flow in the exchange entitlement. The first can be identified with the notion of wealth; the second, apparently associates to the concept of income, but his requires some further elaboration.

Take for example, case i), the exchange entitlement implies a double exchange (unless we deal with a barter economy): an exchange of z into monetary income, and subsequently, the exchange of the latter into goods and services. The notion of exchange entitlement therefore includes the generation of the entitlement and the extent in which the entitlement gives rise to a commanding power over commodities.

It is mainly in the second aspect that the notion of exchange entitlement differs from the concept of monetary incomes. On one hand monetary income is a mean of buying things, it reflects a purchasing capacity, but if a certain good or service is not available in the market or is not an economic good, then an income increase does not exactly represent an increase in the command over that particular commodity, but over the goods that are available in the market.

On the other hand, even when considering market transactions, the commanding power of incomes depend on prices and as such it is necessary to look for some notion of real income. This brings in the consideration about the weights that are chosen. In the case of dealing with starvation situations, the command of food can be estimated by considering high weight for food in the budget of those in distress. However, if a distress situation is not being considered and the concern is with other goods and

services such as education or health, the notion of real income is more difficult to pin down. The expenditure on these services may be a small part of the budget so that the weight on the price index will not be considerable. Thus, a change in the price of these services probably will not be reflected in the real income, although a significant loss of command over these services may have occurred.

In the case of non-monetary incomes such as self-consumption or payment in kind, this distinction does not seem to be necessary as they represent entitlements to specific goods and services. However, if these payments in kind are registered in terms of imputed monetary income, as is usually done, then we fail to capture the difference in the analysis of the actual command over commodities.

The implications of the entitlement approach as an analytical tool are multiple. In the first place, it presupposes an initial consideration about the characteristic of a particular economic and social organization. It allows comparisons between economic systems,either in a particular point in time or from a historical perspective.

Secondly, it is strongly linked to the analysis of the class structure and the modes of production in the economy.(See Sen [1981;pg 170]) The entitlements would vary between persons according to their particular class position, i.e. their ownership situation, even considering the same E-mapping for all individuals. Conversely, for an identical ownership bundle, the entitlements of a person will differ from others depending on the modes of production and his position in terms of production relations. In this sense, the entitlement approach can be viewed as being structural in nature.

3. Areas of inquiry

As has been mentioned, the capability approach provides a structure of analysis in which distinct areas can be distinguished. Drawing a parallel with a map, a structure of this kind can serve to locate the position of a certain issue within a broad field and to guide the way in the

right direction. This section should be regarded as a attempt to point out different topics and hopefully, as an initial agenda for future research.

Roughly, it is possible to delimit three areas of inquiry. On the one hand, the analysis of capabilities (Q_i) as a direct inquiry into the welfare of a society. Accordingly, it is within the sphere of capabilities that poverty and inequality in well being should be asserted. There are many unsolved aspects in this field : the determination of the capabilities which should be considered essential, the construction of the relevant indicators and the elaboration of an index of basic capabilities, among the most important. Reviewing the debates around the determination of basic needs under a new light may prove to be useful, although not necessarily conclusive.

The analysis of entitlements (E_i) can be distinguished as another distinct area of inquiry, its importance resting on the role they play in the determination of capabilities. The understanding of the mechanisms by which entitlements are generated calls for the analysis of employment and the functioning of labour markets; production possibilities and restrictions; the role of the state in the provision of entitlement guarantees; survival strategies of deprived groups, just to mention the most outstanding.

In this context, the study of inequality undoubtedly deserves attention as it is the result of the operation of these forces; however it is important to keep in mind that the assessment of welfare inequality through entitlement inequality may in most of the cases lead to an incomplete picture.

Finally, the conversion of entitlements into capabilities (F_i) implies an inquiry into the nature of the functional relationship between both variables. On one hand, there is the question of the actual use of entitlements, which raises the issues of consumption patterns and the distribution of consumption within the household; and on the other hand, the transformation of those commodities into capabilities.

An important dimension to consider is the possibilities of substitution or the complementarity of goods and services in the achievement of capabilities. The relation between commodity bundles and capability bundles may be a many-one correspondence, with some capabilities being achievable by more than one bundle of goods and services (different combinations of food and health services may lead to the same level of nutrition) or the necessity of a combination of goods and services to produce an achievement of a certain capability (health services alone, without education may produce scarcely any result).

The capability approach has been applied by Sen in the analysis of starvation. In his studies, an entitlement shift explains the non-achievement of a basic capability, within the framework of partial equilibrium analysis. However, the approach is directed to the interdependencies that hold in a market economy, and this seems to suggest the use of general equilibrium theory.

But, the standard theory of general equilibrium can be unhelpful in analysing development issues because of non-equilibrium features and the lack of consideration of the actual institutions which prevail in underdeveloped economies. More important however, is the fact that the standard theory of general equilibrium tends to eliminate by assumption the problem of survival itself. As Koopman noted:

> "...they assume that each consumer can, if necessary, survive on the basis of the resources he holds and the direct use of his own labour, without engaging in exchange, and still have something to spare of some type of labour which is sure to meet with a positive price in any equilibrium" (cited by Sen[1984;pg 445])

In this way it is clear that any attempt to construct a model of general equilibrium within this framework,, if possible at all, must go very far in the reformulation of the standard theory.

4. Objective of the research paper

The several issues touched upon in the previous section certainly represent enormous challenges. This study is much more modest in its aims and should be viewed as an initial and exploratory attempt to deal with the distribution of incomes in Peru. Within the capability framework, this implies dealing with the area of entitlements, particularly regarding exchange entitlements. Even at the risk of being repetitive, it is important stress that in this context no welfare implications can be derived from the analysis of entitlements -let alone incomes-. This clearly implies a point of departure from the majority of similar studies in which income distribution is seen in itself as a measurement of the state of well being in a society.

It has already been pointed out that incomes can hardly represent such a complex notion as entilements. As was said, the concept of entitlement presupposes a double dimension: its generation and its commanding power; the most serious objections to the use of income concern this second aspect. In this sense, the use of incomes in this study does not presuppose a very serious drawback as the focus is on the generation of incomes

However a major limitation, even within this reduced scope, is the exclusion of public action in the provision of entitlements. The role of the state, the extent to which it guarantees entitlements and for whom, is of course a crucial issue, that would have to be considered in a latter stage in order to convey a more complete picture of how entitlements are generated in the society.

The first objective of the study is to document the state of income inequality in the peruvian economy. In order to extend the empirical usefulness of this exercise a lognormal model will be estimated and on that basis some of the possible uses of the results will be analysed. The second objective is to determine the contribution of the different income sources to overall inequality so as to indicate which mechanisms of income generation should principally be analysed to explain inequality in the

peruvian case. Finally, an tentative attempt will be made to investigate the explanatory factors of income inequality considering the different income generation mechanisms.

This study is be based on primary data from the National Household Survey of Living Standards -Encuesta Nacional de Hogares sobre Medicion de Niveles de Vida (ENNIV)- which was collected in Peru during 1985-86. This survey was financed by the World Bank and the Banco Central de Reserva del Peru (Central Reserve Bank of Peru) and implemented by the Instituto National de Estadistica (National Institute of Statistics). A systematic analysis of this data base has not yet been carried out.

CHAPTER II

1. Some Basic Definitions

a) Income concept

The ENNIV income definition refers to the flow of net receipts both in cash and in kind. This implies that direct taxes and costs of production have been excluded.

An important aspect concerns the period of measurement of incomes. The data source ENNIV provides two accounting periods: incomes in reference to the previous 7 days and incomes in reference to the last 12 months. Unfortunately the information available at the moment regarding the latter has proved to be incomplete; for this reason the income with reference to 7 days had to be chosen. This implies a strong limitation as it does not allow to take into account the seasonal nature of some incomes, specially concerning agricultural activities.

As in the case of entitlements, income can be generated through three major mechanisms: pure trade incomes, direct production and trade income and non-exchange income. Table 2.1. contains the different income sources that can be derived from this distinction and further breakdowns.

b) Recipient Unit

In the standard economic theory, it is individuals that own resources, trade and earn incomes. It is certainly true that certain resources are indissoluble associated to individuals, such is the case of the level of education which is important to determine the quality of labour. However, in other cases resources pertain to the household as a unit, specially when dealing with family farms and enterprises. This joint ownership of resources clearly leads to the fact that some incomes accrue directly to the household and not to the individual members within it.

TABLE 2.1
SOURCES OF INCOME

Mechanism	Main resource	Income source
Pure trade	Labour	Wages and salaries
	Capital/land	Property income
Direct production and trade	Labour	Income of self-employed professionals
	Labour and land/capital	Operating surplus
	Labour and land/capital	Self-consumption
Non-exchange		Transfers

A more fundamental reason however, to consider the household as the relevant recipient unit is that, in whatever form income is generated - individually or collectively- the household performs the role of pooling incomes of its different members together. This points out to what can be considered the double nature of the household as economic unit: on one hand, it appears as the unit in which income getting decisions are made, and on the other, performs the role of redistribution of those incomes within the family.

c) Socio-economic groups

The aggregation of households into socio-economic groups requires the specification of some criteria determined by the nature of the problem under study. If the interest is the distribution of income, the basic idea underlying the classification should be to convey an idea of the class structure of the society.

If the class position of a household depends on its ownership bundle, then the way to identify social groups should be based on the distinctions of endowments. Empirically this presents the problem of making an exhaustive listing of the ownership positions of each household. At the operational level, identifying the main entitlement of a household can be an alternative way to identify the resource on which it primarily depends for its living. On the basis of this distinction, Table 2.2 contains the categorization by socio-economic groups.

Due to the availability of the information, the occupational status of the household head will be used as a proxy for determining the main mechanism by which the household obtains its income. There is some evidence in the case of Peru that the head of the household is also the worker that generates the higher proportion of the household income.

TABLE 2.2
SOCIO-ECONOMIC GROUPS

Mechanism	Main resource	Socio-economic group
Pure trade	Labour	Wage labourer
		Blue collar
		White collar
		Domestic worker
		Unemployed
	Capital/land	Rentist
Direct production and trade	Labour	Self-employed professional
	Labour and land	Agricultural self-employed
		Unpaid family worker
	Labour and capital	Non-agricultural self-employed
		Unpaid family worker
Non-exchange		Non-active

2. Description of the source

The basic information for the sample frame of ENNIV is based on the National Census of 1981, actualized for 1984. The population is defined as the total of private dwellings and their occupants, with residence in urban and rural areas. Three departments were excluded, as they were under the state of emergency during the period of the survey. The greatest political unrest in the country has been concentrated in this area during the present decade.

This is an important limitation in the information as the excluded areas -Ayacucho, Apurimac and Huancavelica- together with Cusco and Puno have conformed was has been called the "Mancha India". It is this region that the highest degree of deprivation has traditionally been found. Inasmuch as the income levels of the excluded areas and their variability is similar to the other two departments considered, the bias of the information can result to be insignificant. However a underestimation of income inequality will occur if the income levels are lower in the excluded areas, and conversely if they are higher.

Additionally the sample excludes the following:

-Members of the armed forces, living in barracks, ships, etc.

-People living in collective dwellings (hotels, hospitals, asylums, religious cloisters, etc.)

Due to the socio-economic differences within the population, the political-administrative divisions were grouped into regions or "dominios". The aim of such an aggregation was to assure the homogeneity within dominios and the heterogeneity between dominios. The resulting regions are:

1. Lima Metropolitana
2. Northern coast
3. Central coast
4. Southern coast
5. Northern sierra
6. Central sierra
7. Southern sierra

8. High jungle
9. Low jungle

The sample is probabilistic, multi-stage and independent in each domain In urban areas and in rural areas of 500-2000 inhabitants a three stage stratified sampling technique was employed. In the remaining rural areas, the sample was a stratified two-stage sample.

Considering the costs, operational feasibility and the recommendation of international organisms, the sample size was determined at the level of 5000 dwellings. The final sample was adjusted to 5024, so as to distribute the field work.

The income of the household is derived from two types of income: those which correspond to the individual members and those pertaining to the household. In the first case, the survey covers principal and secondary occupations for each member. The income categories which have been considered are:

1. Dependent (Individual level)
   1.1 Main occupation
      1.1.1. Monetary
      1.1.2. In kind
   1.2. Secondary occupation
      1.2.1. Monetary
      1.2.2. In kind
2. Independent (Individual level)
   2.1. Main occupation
      2.1.2. Monetary net
   2.2. Secondary occupation
      2.2.1. Monetary net
   2.3. Other occupations
3. Self consumption (Household level)
4. Self provision (Household level)
   4.1. Food
   4.2. Non-food
5. Property income (Household level)
   5.1. Interest payments
   5.2. Dividends and distributed profits
   5.3. Rent from buildings, machinery or vehicles
   5.4. Imputed rent
6. Regular transfers (Household level)
   6.1. Retirement pension
   6.2. Alimony
   6.3. Transfers from private institutions
7. Extraordinary transfers (Household level)

Studies in other countries have shown that borrowing or dissaving can be fairly common phenomenon among low level income households in developing countries, unfortunately these sources have not been included in the definition of income.

A serious shortcoming of the income estimation of ENNIV is that the imputed values of payments in kind and own consumption have been recorded according to the valuation of the respondents, without any external checks. In the case of imputed rent there is a high percentage of non respondents.

3. Methodology

a) Income inequality measures

Several inequality measures have been developed on different grounds. A classical way to categorize them is to distinguish between positive and normative measures.

> "On the one hand there are measures that try to catch the extent of inequality in some objective sense, usually implying some statistical measure of relative variation of income, and on the other there are indices that try to measure inequality in some normative notion of social welfare so that a higher degree of inequality corresponds to a lower level of social welfare for a given total of income." (Sen [1973;pg.2]

This classification has been criticized in terms of the impossibility to dissociate the positive from the normative in the study of income inequality. Nevertheless, it touches upon a critical aspect in the study of income inequality within the entitlement approach. If the claim is that income inequality can not serve as an exclusive indicator of welfare, then the use of indices based directly on social welfare notions is clearly inconsistent with the framework. Therefore, in terms of this study normative indexes such as the Dalton or the Atkinson measures will be ruled out.

From the set of positive measures the Gini coefficient and Theil's entropy index will be utilized to assess income inequality. Both indices satisfy the properties of mean or scale independence (the index remains invariant if anyone's income is changed by the same proportion); population size independence (the index remains invariant if the number of people at each income level is changed by the same proportion) and the Pigou-Dalton condition (any transfer from the richer to the poorer person that does not reverse their relative ranks reduces the value of the index).

b) The bivariate lognormal model

Previous empirical evidence in the estimation of the bivariate lognormal model for the distribution of household size and income proposed by Kmietowitcz (1984) suggests its applicability in developing countries, and thus can provide a fairly consistent framework for the descriptive exercise. Additionally, the model presents some convenient properties that makes it very useful in applied work.

If it is assumed that total household income (Y) and household size (X) follow a bivariate lognormal distribution with parameters μ_y, μ_x, σ_y^2, σ_x^2, ρ_{yx}, it follows that:

-The marginal distributions of household income and size are univariate lognormal, with parameters μ_y , σ_y^2 and μ_x , σ_x^2 respectively.

-Similarly, the conditional distributions of household size and income are univariate lognormal, with parameters μ_y, μ_x, σ_y^2, σ_x^2, ρ_{yx}.

-The per capita household income (R) is also lognormally distributed with parameters μ_y, μ_x, σ_y^2, σ_x^2, ρ_{yx}.

When the parameters of the bivariate model are known the Gini coefficient of total household income can be easily calculated in the following terms:

$$G_y = 2 \int_{-\infty}^{\sigma_y/2} N(0,1)dz - 1$$

And the Gini coefficient for per capita household income can be obtained from:

$$G_R = 2 \int_{-\infty}^{\sigma_R/2} N(0,1)dz - 1$$

where $\sigma_R = (\sigma_y^2+\sigma_x^2-2\rho_{yx}\sigma_y\sigma_x)^{1/2}$.

Given a random sample of households, the method of maximum likelihood yields estimators of the parameters μ_y, μ_x, σ_y^2, σ_x^2, ρ_{yx} which are asymptotically unbiased and efficient.

The Gini coefficients can readily be calculated for a lognormal distribution and thus it is quite straightfoward to calculate and compare the Gini coefficient of the distribution of total household income and of the per capita household income. Additionally, this permits to establish the condition which has to be satisfied for the inequality of total household income to be higher to the inequality in percapita household income:

$$\rho_{yx} \geq \sigma_x/2\sigma_y$$

If once the model has been estimated, its fit to the data is significant, then it may prove to be useful in developing countries where material for the assessment of income distribution is usually not available for considerable periods. The following uses of the results can be stated:

a) If the parameters can be obtained externally it is possible to estimate the proportion or the number of households falling in a specified range of household size and income.

b) The model can also be used to specify fully the distribution of per capita household income when an observed distribution of the variable is not available, but the parameters can be obtained from other sources.

c) As the Gini coefficients G_y and G_R depend only on one and three of the five parameters, respectively, it would only necessary to obtain them externally to be able to assess the inequality in total and per capita household income.

c) Decomposition by source

The objective of the decomposition by source is to determine to what extent each income source contributes to the inequality of total income. For this purpose, it is desirable to have an inequality index which can be additively decomposable, i.e. that the sum of the contribution of the various sources add up to the total income inequality.

However, if the different income sources are correlated, two types of contributions will be obtained, those that correspond to each income source and those associated to the interaction between them. There are two alternative methods to deal with this. One approach is to introduce separate categories for each of the interaction effects, the other is to derive only one term corresponding to each source.

Consider Y_i^k as the income of individual i (i=1,...,n) from source k (k=1,...,K) and the variance as a measure of inequality.Then,

$$\sigma^2(Y) = \sum_k \sigma^2(Y^k) + \sum_{j \neq k} \sum_k \rho_{jk}\sigma(Y^j)\sigma(Y^k)$$

where ρ_{ij} is the correlation coefficient between Y^j and Y^k. The first term can be associated to the 'direct' effect of each income source, while the latter can be seen to represent the interaction affects.

However if the purpose is to have only one element corresponding to each source, it is necessary to determine how the interaction effects should be allocated between the individual factor contributions. This obviously

introduces some extent of arbitrarity and involves the reconsideration of the notion of contribution.

Shorrocks (1982) specifies general restrictions to be imposed on decomposition methods to this purpose and derives a unique and invariant decomposition rule in which the contribution of factor k is:

$$S_k = \text{cov}(Y^k, Y)$$

which can also be expressed in terms of its proportional contribution:

$$s_k = \frac{\text{cov}(Y^k, Y)}{\sigma^2(Y)}$$

This is called the 'natural' decomposition of the variance which is exactly the same as the 'natural' decomposition of the coefficient of variation. This last index is mean independent and therefore appropriate for the comparison of different groups of the population

It is important to point out that the decomposition rule assigns to factor k half the value of all the interaction terms involving factor k. This is to be kept in mind when interpreting the contributions in economic terms.

c. Decomposition by attribute

This decomposition method can be used to evaluate to which extend a certain attribute is associated to income inequality. This type of analysis does <u>not</u> provide an explanation of income inequality, but it can provide some insights for the generation of explanatory hypothesis.

If the population is divided into groups according to q attributes or characteristics (each individual belonging to one and only one partition), an inequality index is said to be additively decomposable if total inequality can be written as the sum of between-group and within-group inequality. This property allows the unambiguous measurement of the contribution of a particular grouping or variable to overall inequality.

Consider Y as the total income, n as the total population size, Y_i the total income of the i^{th} group and n_i the population size of the i^{th} group. The Theil entropy index T can be decomposed into two terms:

$$T = T_W + T_B$$

where the within-group component:

$$T_w = \sum_i [Y_i / Y] T_i$$

is a weighted average of within group i Theil's indices T_i, the weight being equal to the income shares Y_i/Y of the groups,

$$T_i = \sum_i (y_{ij}/Y_i) \log [(y_{ij}/Y_i)/(n_{ij}/n_i)]$$

and the between group component:

$$T_B = \sum_i (Y_i/Y) \log [(Y_i/Y)/(n_i/n)]$$

The between group contribution can be defined as the ratio of the between-group component T_B to the overall Theil T index and measures the part of the total of the total inequality which is "explained' by the q attributes (or variables) considered for the grouping. The within-group component defined as T_W/T, represents the portion of total inequality which is not "explained' by those attributes.

As a next stage, T_B can be decomposed in the following way:

$$T_B = T_1 + T_2 + \ldots + T_q + I^t$$

where T_k represents the inequality that would be observed if the population is divided only considering the attribute k

I^t is the summation of all the possible interactions between the q variables.

The decomposition method does not yield a unique ordering of the attributes according to the importance of their contribution to total inequality. From the different methods that have been proposed, the following two will be considered:

i) Classification according to the gross contribution or direct effect T_k which represents the direct effect of the variable on total inequality. The value of the gross contributions do not depend on the total number of variables considered in the decomposition.

ii) Classification according to the q order marginal contribution of each variable. For example the marginal contribution for the variable 1 would be defined as:

$$C_1 = T_{1,2,\ldots,q} - T_{2,\ldots,q}$$

C_k represents the contribution of a specific attribute holding all the other attributes constant, thus measuring the contribution that cannot be captured by any of the other variables. The value of a marginal contribution depends on the other variables considered in the decomposition analysis.

The relationship between T_k and C_k can be established thus:

$$C_k = T_k + I_k^t$$

where I_k^t represents all the interaction effects involving the attribute k.

CHAPTER III

1. Household Income Inequality in Peru

In the majority of underdeveloped countries, there is no single predominant distributional rule; income distribution is the outcome of diverse mechanisms that operate in different segments of the population. To characterize the social structure of a developing country through the notion of entitlements implies inquiring about the existence of these different distributive mechanisms and their relative importance within the economy. In the peruvian case 36 per cent of households are mainly associated to the mechanism of Pure Trade and therefore depend on the functioning of labour markets. On the other hand, Direct Production and Trade is the basic mechanism of income generation for 50 per cent of households who thereby depend on their production possibilities and the conditions in the market of goods and services. [1]

Table 3.1 shows that although there is a predominance of Pure Trade in urban areas, nevertheless 37 per cent of urban households are associated to Direct Production and Trade. In Lima, the capital of the country and its most important industrial centre, almost one third of household heads are self-employed. On the other hand, in rural areas 70 per cent of the households engage in production directly, specially linked to agriculture.

The diversity of the peruvian social structure suggests that some of the disaggregations that have been proposed for the analysis of income, such as the urban-rural dichotomy and the modern-traditional dualism, do not seem to be adequate in the peruvian case. The urban-rural distinction fails to capture the heterogeneity of urban households, while on the other hand, the dual modern-traditional distinction fails to convey the difference in the distributional mechanisms within the self-employed.

This indicates that in Peru modeling distributional aspects should take into account the following major socio-economic groups: the wage earners -blue and white collars-, the agricultural self-employed and the

TABLE 3.1 : SOCIAL STRUCTURE OF HOUSEHOLDS BY AREA AND REGION
(Percentage of households)

COLUMN PERCENTAGES:

MECHANISM Socio-economic Group	AREA		REGION				TOTAL
	Urban	Rural	Coast	Sierra	Jungle	Lima	
PURE TRADE	47.2	16.4	40.2	22.1	17.1	54.0	35.5
Blue Collar	22.1	13.4	25.5	13.2	10.0	23.8	18.8
White Collar	22.8	2.2	12.2	7.9	6.4	27.7	15.0
Domestic Worker	0.5	0.2	0.6	0.2	0.1	0.7	0.4
Unemployed	1.8	0.6	1.9	0.8	0.6	1.8	1.3
DIRECT PRODUCTION AND TRADE	37.0	70.3	44.6	62.9	73.0	29.7	49.6
Self-employed Professional	2.7	0.8	2.1	1.6	2.1	2.3	2.0
Agricultural Self-employed	3.2	60.2	13.3	45.6	50.2	0.5	24.9
Non agricultural Self-employed	30.4	7.8	28.9	14.3	19.6	26.2	21.8
Unpaid Family Worker	0.6	1.4	0.3	1.4	1.1	0.7	0.9
NON SPECIFIED	15.8	13.3	15.3	15.0	9.9	16.3	14.9
Non Active	15.0	12.8	14.8	13.7	9.6	15.8	14.1
Non Specified	0.8	0.6	0.5	1.3	0.4	0.5	0.7
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0

ROW PERCENTAGES:

MECHANISM Socio-economic Group	AREA		REGION				TOTAL
	Urban	Rural	Coast	Sierra	Jungle	Lima	
PURE TRADE	82.5	17.5	23.7	21.7	5.8	48.8	100.0
Blue Collar	73.0	27.0	28.5	24.5	6.4	40.6	100.0
White Collar	94.5	5.5	17.0	18.4	5.1	59.4	100.0
Domestic Worker	79.1	20.9	29.7	13.5	3.2	53.6	100.0
Unemployed	82.2	17.8	29.6	20.8	5.5	44.0	100.0
DIRECT PRODUCTION AND TRADE	46.2	53.8	18.8	44.3	17.6	19.2	100.0
Self-employed Professional	84.1	15.9	22.3	28.6	12.7	36.4	100.0
Agricultural Self-employed	8.0	92.0	11.2	64.0	24.2	0.6	100.0
Non agricultural Self-employed	86.4	13.6	27.7	23.0	10.7	38.6	100.0
Unpaid Family Worker	42.5	57.5	6.3	54.0	14.3	25.4	100.0
NON SPECIFIED	65.9	34.1	21.5	35.3	8.0	35.2	100.0
Non Active	65.7	34.3	21.9	34.0	8.1	36.0	100.0
Non Specified	70.0	30.0	14.1	60.1	6.0	19.8	100.0
TOTAL	62.0	38.0	21.0	34.9	12.0	32.1	100.0

Source : ENNIV 1985/86

non agricultural self-employed. These groups constitute 80 per cent of total households.

At the level of these major socio-economic groups, the agricultural self-employed households simultaneously present the lowest total household income level and the highest intra group inequality as shown in Table 3.2. Next in the income scale are the blue collar households with an income level 1.18 times higher and a lower income dispersion that the previous group. Non agricultural self-employed receive on average 80 per cent more income and show a more equal distribution than the agricultural self-employed. Finally, white collars present the highest income level (2.59 times higher than agricultural self-employed households).

Rural households receive on average less than half than urban households and their income being more dispersed. The sierra region appears as the poorest region as opposed to Lima, here again more inequality is associated to less incomes.

As has been frequently mentioned, the distribution of total household income does not provide a good indicator of inequality as a large household with a certain income level will be ranked in the same position as a small household with the same income level. It is therefore necessary to consider the number of people that depend on a household income, and evaluate income inequality with respect to per capita household income.

To investigate the pattern of association between household size and total household income and determine if there is significantly diverse demographic behavior between households belonging to different socio-economic groups, areas or regions, the following equation was estimated:

$$\ln m = b_0 + b_1 \ln y$$

where m = Household size
y = Total household income

The regression results shown in Table 3.3 indicate that there are substantial differences in the relationship between household size and

income among socio-economic groups.

The number of household members rises at a faster rate with the increase in income for blue collars as compared to white collars, similarly agricultural self employed tend to have larger households than non agricultural self employed. This is also the case for rural households in comparison to urban households, and for households in Lima as compared to households in the Sierra region. In general terms, there is a tendency for households of lower average income levels present a higher 'elasticity' in the relationship between household size and income.

Therefore, it is expected that these different patterns will give rise to diverse conclusions for different socio-economic groups, areas and regions when comparing total income and per capita income distributions.

Although positive relationships between household income and size have been established, it is difficult to predict if the degree of inequality will increase or decrease when the analysis moves from total household income to per capita household income. For the inequality in per capita household income to be smaller than the inequality in total household income, the covariance between total income and size must be sufficiently large.[2]

As shown in Table 3.2, both the Gini coefficient and the Theil T index increase at the national level when the analysis moves to the distribution of households according to their per capita income. This suggests that although household income increases with the number of members, i.e. positive correlation between income and size, households with low income tend to have more members which contribute with very little.

The agricultural self-employed continue to be the group that presents the lowest income and the highest inequality. All the other groups retain their relative positions regarding their income levels but the disparity ratios increase to 1.20, 1.84 and 2.80 for blue collars, non agricultural self employed and white collars respectively in comparison with agricultural self employed. The inequality indexes increase for all these

TABLE 3.3 : REGRESSION RESULTS (t-statistics in brackets)

	Intercept	Slope	R^2	F
SOCIO-ECONOMIC GROUP:				
Pure Trade	0.733 (157.9)	0.082 (178.7)	0.03	31944
Blue Collar	0.448 (64.23)	0.116 (162.9)	0.04	26566
White Collar	0.545 (73.5)	0.093 (132.9)	0.03	17681
Direct Production and Trade	-0.245 (-6.2)	0.159 (395.2)	0.08	156154
Agriculture Self-employed	-0.326 (-57.4)	0.199 (331.9)	0.12	110146
Non agriculture Self-employed	-0.329 (-52.6)	0.184 (295.9)	0.11	87588
AREA:				
Urban	0.188 (51.5)	0.130 (362.2)	0.06	131176
Rural	-0.435 (-92.4)	0.207 (413.3)	0.12	170817
REGION:				
Coast	0.299 (5.1)	0.158 (266.1)	0.09	70821
Sierra	-0.333 (-72.9)	0.192 (397.2)	0.12	157831
Jungle	0.163 (17.3)	0.139 (147.7)	0.05	21841
Lima	0.198 (36.5)	0.123 (236.1)	0.05	55722
TOTAL	0.127 (46.6)	0.140 (507.8)	0.07	257846

socio-economic groups, the highest increase being in the group of white collars. In this way, the analysis at the level of per capita income distribution yields a picture in which both inter and intra group inequality is higher.

Table 3.4 shows the location of socio-economic groups across quartiles in order to analyze their degree of homogeneity with regard to income. Both, Pure Trade and Direct Production and Trade associated households seem to be quite evenly spread out across the quartiles thereby turning out to be highly heterogeneous. Within Pure Trade, blue collars span through all the quartiles, while white collars tend to concentrate in the upper levels. Regarding Direct Production and Trade, agriculture self-employed are mostly located in the first two quartiles, while non agriculture self-employed seem to be participating in similar proportions in the four levels.

From the urban/rural perspective, there is clear pattern of concentration in the lowest quartile in rural areas and in the highest in urban areas. A similar tendency is found when a comparison is made between the Sierra region and Lima.

The heterogeneity of some of the socio-economic groups seems to indicate that there is no simple correspondence between an income strata and particular social groups. This can be further studied by examining the composition of the different quartiles.

On one hand, the first quartile is mainly composed of Agriculture self-employed households followed by blue collars and non agriculture self-employed. These results seem to contradict the idea that wage earners in Peru belong to the higher strata of the population. Similarly, although rural households are predominant in this quartile, as much as 36 percent belong to urban zones. At the regional level, it is fundamentally the sierra region that forms the quartile.

On the other hand, the highest quartile is composed of white collars and non-agriculture self-employed. There is a very high predominance of urban households and more than half of the households that belong to this strata reside in Lima.

Although no rigorous comparison to previous studies is possible at

TABLE 3.2: TOTAL ANNUAL HOUSEHOLD INCOME, ANNUAL PER CAPITA HOUSEHOLD INCOME AND INEQUALITY COEFFICIENTS

	TOTAL HOUSEHOLD INCOME			PER CAPITA HOUSEHOLD INCOME		
	INCOME (In Intis)	GINI	THEIL T	INCOME (In Intis)	GINI	THEIL T
PURE TRADE	38444	0.4960	0.4893	8701	0.5453	0.6540
Blue Collar	25881	0.4451	0.3544	5624	0.4756	0.4288
White Collar	56546	0.4662	0.4454	12997	0.5210	0.6107
Domestic Worker	20805	0.3356	0.1889	4103	0.3871	0.2547
Unemployed	17307	0.6320	0.7379	5174	0.7480	1.4728
DIRECT PRODUCTION AND TRADE	30368	0.5601	0.6568	6738	0.5778	0.7056
Self employed Professional	42602	0.5379	0.5150	12268	0.6070	0.7142
Agricultural Self-employed	21854	0.5487	0.6981	4649	0.5598	0.7127
Non agricultural Self-employed	39278	0.5337	0.5761	8573	0.5358	0.5891
Unpaid Family Worker	21673	0.4484	0.3452	7529	0.6817	1.1550
NON SPECIFIED	31563	0.5879	0.6724	8416	0.5897	0.6696
Non Active	32379	0.5842	0.6636	8608	0.5836	0.6570
Non Specified	14941	0.5870	0.6154	4509	0.6772	0.8575
AREA						
Urban	41797	0.5040	0.5007	9672	0.5387	0.6080
Rural	19723	0.5380	0.6849	4432	0.5526	0.6942
REGION						
Coast	32262	0.5354	0.5847	6587	0.5375	0.5895
Sierra	20928	0.5440	0.6478	4753	0.5513	0.6609
Jungle	31206	0.4887	0.4573	7256	0.5420	0.5704
Lima Metropolitan Area	48564	0.4993	0.4934	11742	0.5378	0.6165
TOTAL	33421	0.5441	0.5964	7684	0.5717	0.6865

Source : ENNIV 1985/86

this stage, these results could indicate a deterioration of blue collars and of urban areas in their relative position within the distribution of income. The lowest incomes are not only to be found among agricultural self-employed households and almost exclusively in rural areas as has traditionally been the case.

The heterogeneity in the composition of both the lower and the higher strata regarding the income generating mechanism, implies that the political and administrative difficulties for redistribution have increased; on one side, numerous policy instruments are required to affect a whole income class, and on the other, the potential for conflict is greater as a specific policy may benefit some and hurt others within the same strata.

2. The Bivariate Lognormal Model

Although the diverse measures of inequality presented above can provide a fairly good idea regarding the extent and the difference in inequality between groups, they do not provide a full characterization of of the income distribution. This can be attained by fitting the empirical information into a theoretical distribution function and thus obtaining through the estimation of the parameters information regarding the whole distribution.

In the present section a bivariate lognormal model for the distribution of household size and income has been be estimated due to its several convenient properties and the practical use that can be made of the results as described in Chapter II-3.

The results of the of the estimation of the marginal distributionsof total household income and size for the total level, the four main socio-economic groups, the urban and rural areas and the regions of Lima and Sierra, are shown in Tables 3.5 and 3.6 while the bivariate distributions are contained in Annex B.

An approximation to the 'goodness-of fit' can be achieved by a comparison between the predicted and the observed values. As a general

TABLE 3.4 : QUARTILES BY ANNUAL PER CAPITA HOUSEHOLD INCOME
(Percentage of households)

ROW PERCENTAGES:

	QUARTILES				TOTAL
	I	II	III	IV	
PURE TRADE	18.3	22.9	27.6	31.2	100.0
Blue Collar	25.5	29.4	24.7	20.4	100.0
White Collar	5.7	15.0	31.9	47.3	100.0
Domestic Worker	34.6	23.1	31.3	11.0	100.0
Unemployed	53.0	19.8	19.5	7.7	100.0
DIRECT PRODUCTION AND TRADE	29.7	27.1	23.8	19.4	100.0
Self-employed Professional	21.0	20.2	16.9	41.9	100.0
Agricultural Self-employed	41.4	29.5	18.9	10.1	100.0
Non agricultural Self-employed	16.5	25.3	30.1	28.1	100.0
Unpaid Family Worker	45.5	21.2	17.5	15.8	100.0
NON SPECIFIED	25.5	22.9	22.9	28.8	100.0
Non active	23.8	23.3	23.3	29.5	100.0
Non specified	58.1	13.5	13.8	14.6	100.0
AREA					
Urban	14.5	21.7	29.1	34.7	100.0
Rural	42.3	30.4	18.3	9.1	100.0
REGION					
Coast	26.1	26.3	27.2	20.3	100.0
Sierra	38.5	29.8	19.3	12.3	100.0
Jungle	23.7	27.9	24.9	23.4	100.0
Lima	10.1	17.8	29.7	42.4	100.0

COLUMN PERCENTAGES:

	QUARTILES				TOTAL
	I	II	III	IV	
PURE TRADE	26.1	32.6	39.4	44.4	35.5
Blue Collar	19.2	22.2	18.6	15.4	18.8
White Collar	3.5	9.0	19.2	28.5	15.0
Domestic Worker	.6	.4	.5	.2	0.4
Unemployed	2.8	1.1	1.0	.4	1.3
DIRECT PRODUCTION AND TRADE	59.0	53.9	47.2	38.6	49.6
Self-employed professional	1.7	1.6	1.4	3.4	2.0
Agriculture Self-employed	41.2	29.4	18.8	10.1	24.9
Non agriculture Self-employed	14.4	22.2	26.4	24.6	21.8
Unpaid Family Worker	1.6	.8	.6	.6	0.9
NON SPECIFIED	15.0	13.4	13.4	16.9	14.9
Non active	13.4	13.1	13.1	16.5	14.1
Non specified	1.6	.4	.4	.4	0.7
AREA					
Urban	35.9	53.9	72.2	86.2	62.0
Rural	64.1	46.1	27.8	13.8	38.0
REGION					
Coast	21.9	22.2	22.9	17.1	21.0
Sierra	53.7	41.6	27.0	17.2	34.9
Jungle	11.4	13.4	12.0	11.2	12.0
Lima	13.0	22.9	38.2	54.4	32.1
TOTAL	100.0	100.0	100.0	100.0	100.0

characteristic of the marginal distributions of income, there seems to be a tendency to overestimate the proportion of households at higher income levels (particularly to the left of the model interval), to underestimate the middle intervals and to overestimate again the number of households at high income levels (with exception of the last interval in which no value is predicted for any distribution).

The comparison between the observed and the predicted frequencies for the total sample and the group of blue collars indicates that the distributions are not correctly centered as the mode of the observed frequencies are found in the second income bracket while for the estimated frequencies they are located in the first bracket.

In the case of white collars, agricultural self employed and nonagricultural self-employed the estimated distributions are correctly centered in the third, first and second intervals, respectively. There seem to be however some truncation of the estimated distribution for white collars and non agricultural self employed, while the frequencies for the modal interval are overestimated for the agricultural self employed.

The estimation for urban and rural areas are also correctly centered but in both cases the proportion of households in this interval is overestimated, particularly in rural area.

Unfortunately, the estimation for Lima does not provide a correct modal interval, as it is for this region that regular income statistics are elaborated and thus was the main candidate for the application of the practical uses of the model.

The comparison between the predicted and observed frequencies for the marginal distribution of household size indicates that for all the disaggregations the predicted values for households with one member are particularly low while there is an overestimation for households with 7 members. (Table 3.6) These discrepancies may partly be due to the discrete nature of the variable household size, thus pointing out the need to investigate alternative theoretical distributions in a latter stage.

If these limitations are taken into account, a cautious use of the results of this model can be made. As explained in Chapter II-3, when information on income distribution is not periodically available, some

TABLE 3.5 : MARGINAL DISTRIBUTION OF HOUSEHOLDS BY TOTAL HOUSEHOLD INCOME
(Percentage of observed and predicted households)

Income Brackets[1]	Less than 10	10-20	20-30	30-40	4-=50	50-60	60-75	75-100	100-150	150-200	200-500	More than 500
TOTAL												
Observed %	24.7	25.5	16.3	10.3	6.5	4.7	3.8	3.5	2.6	1.2	0.7	0.3
Expected %	28.5	23.8	14.1	8.9	5.9	4.1	4.1	4.0	3.5	2.1	1.0	-
BLUE COLLARS												
Observed %	23.4	27.6	20.9	10.9	5.8	4.3	3.5	2.4	1.1	0.6	0.1	-
Expected %	27.6	27.5	15.8	9.4	5.8	3.8	3.5	3.0	2.2	1.0	0.3	-
WHITE COLLARS												
Observed %	5.7	14.4	17.1	16.5	12.6	8.5	7.7	8.2	4.9	2.2	1.6	0.7
Expected %	7.9	17.7	15.9	12.4	9.5	7.2	7.8	8.0	7.4	4.4	1.8	-
AGRICULTURAL SELF EMPLOYED												
Observed %	38.6	31.4	13.1	6.4	4.3	1.4	1.2	1.2	1.3	0.4	0.5	0.1
Expected %	41.4	26.8	12.7	6.8	4.0	2.5	2.2	1.8	1.3	0.5	0.1	-
NON AGRICULTURAL SELF EMPLOYED												
Observed %	17.8	25.8	17.6	10.8	6.5	6.8	4.7	4.3	2.6	1.4	1.4	0.3
Expected %	20.9	23.7	15.6	10.3	7.0	5.0	5.0	4.8	4.2	2.4	1.0	-
URBAN												
Observed %	15.0	20.6	18.5	13.3	8.3	6.8	5.7	5.1	3.7	1.7	0.9	0.4
Expected %	18.6	22.3	15.3	10.5	7.4	5.3	5.5	5.5	5.1	3.1	1.5	-
RURAL												
Observed %	40.4	33.3	12.7	5.5	3.4	1.3	0.8	0.9	0.7	0.4	0.5	0.1
Expected %	44.9	26.1	11.9	6.2	3.6	2.2	1.9	1.6	1.1	0.4	0.1	-
LIMA												
Observed %	10.9	17.7	18.8	14.1	9.0	8.3	6.5	5.8	4.9	2.2	1.2	0.4
Expected %	13.9	20.5	15.5	11.1	8.1	6.0	6.4	6.6	6.1	3.8	1.8	-
SIERRA												
Observed %	39.5	30.0	13.6	5.8	4.4	2.1	1.3	1.8	0.7	0.4	0.3	0.1
Expected %	43.6	24.9	11.9	6.5	3.9	2.5	2.3	2.0	1.5	0.7	0.2	-

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TABLE 3.6 : MARGINAL DISTRIBUTION OF HOUSEHOLDS BY HOUSEHOLD SIZE
(Percentage of observed and predicted households)

Household Size	1	2	3	4	5	6	7
TOTAL							
Observed %	5.7	8.1	12.6	15.8	17.2	13.6	26.9
Expected %	0.4	7.4	16.1	17.8	15.4	11.9	30.9
BLUE COLLARS							
Observed %	4.6	4.8	12.8	14.5	17.8	15.8	29.8
Expected %	0.2	5.0	13.7	17.3	16.0	13.0	34.8
WHITE COLLARS							
Observed %	3.0	5.1	12.2	23.7	19.7	14.6	21.7
Expected %	0.1	3.6	14.2	20.3	18.9	14.5	28.5
AGRICULTURAL SELF EMPLOYED							
Observed %	5.9	9.0	10.6	12.6	15.3	14.0	33.1
Expected %	0.4	6.7	14.8	16.9	15.1	12.0	34.1
NON AGRICULTURAL SELF EMPLOYED							
Observed %	5.6	7.6	12.3	15.3	19.3	12.8	27.0
Expected %	0.4	7.2	15.8	17.7	15.4	12.0	31.5
URBAN							
Observed %	5.1	7.1	13.3	17.7	18.1	13.5	25.2
Expected %	0.3	6.7	15.9	18.3	16.0	12.3	30.5
RURAL							
Observed %	6.8	9.6	11.5	12.6	15.9	13.9	29.8
Expected %	0.7	8.5	16.2	17.2	14.6	11.3	31.5
LIMA							
Observed %	5.5	7.7	15.9	18.0	17.0	13.4	22.6
Expected %	0.4	7.8	17.0	18.7	15.8	11.9	28.4
SIERRA							
Observed %	6.7	10.3	10.8	15.4	15.8	13.5	27.3
Expected %	0.7	8.8	16.9	17.7	14.8	11.3	29.8

inference is possible on the basis of the model when all or some of the parameters can be obtained externally. It is therefore, necessary to determine the feasibility of obtaining these external estimates.

On one hand, the parameters which are associated to household size, e.i. μ_x, σ_x and ρ_{xy} can be expected to be considerably stable as they are determined by demographic behaviors which tend to change over a long time span. This enables us to consider their estimates as constant in the short run.

On the other hand, the parameter μ_y depends on the household income (μ_Y) and the variance of household income (σ_Y^2):

$$\mu_y = \ln[\ \mu_Y\ /\ (C_Y^2 + 1)^{1/2}]$$

where $C_Y = \sigma_Y/\mu_Y$

While, σ_y^2 depends only on C_Y:

$$\sigma_y^2 = \ln\ (C_Y^2 + 1)$$

Usually it is possible to obtain information regarding total household income (μ_Y) from the regular statistics, however the main difficulty is to obtain external estimates for the variance of household income (σ_Y^2). In an attempt to overcome this lack of information, Kmietowicz and Webley suggest that if both parameters are strongly correlated, it is possible to estimate σ_Y^2 from the information about μ_Y.

Figures 1 to 9 in Appendix C, show the scatter diagrams of the two parameters and the results of the estimation of the linear equation:

$$\sigma_Y = b_0 + b_1 \mu_Y$$

The regressions were run at the departamental level, except in the case of Lima where the district level was considered.

Although, the correlation coefficients are mostly high showing a strong positive association between both variables, an inspection of the corresponding figures suggests that in most cases this is basically due to an 'outlier': Lima. Other levels of disaggregation were tried, basically according to the segments defined in the survey but this yielded unsatisfactory results due to the vast amount of observations.

NOTES TO CHAPTER III

1. The third broad category in Table 3.1 is mainly composed by the non active. This group includes the following:

	%
Student	2.4
Housekeeper	17.1
Retired	25.6
Rentist	2.2
Old aged	28.8
Ill	16.2
Other	7.7

Although the income obtained by these households can be traced down to be derived by a particular mechanism, this would imply looking at the occupation of the other members of the households. We have preffered to maintain a general criteria of classifying by the household head.

2. Taking y as household income, m for household size and z for per capita household income, $z = y/m$ and comparing the relative inequality in the two distributions with the variance of log-income measure: Anand (1983; pg.350)

$$\log z = \log y - \log m$$

$$\text{var}(\log z) = \text{var}(\log y) + \text{var}(\log m) - 2\,\text{cov}(\log y, \log m)$$

If $\text{cov}(\log y, \log m) < 1/2\ \text{var}(\log m)$

Then $\text{var}(\log z) > \text{var}(\log y)$

CHAPTER IV

1. Inequality Decomposition by Income Source

This section aims to analyze the composition of total household income by different sources and to study the contribution of these various components to overall income inequality. Total household income is considered as the sum of five components : wage income, self-employed income, self-consumption, rents and private transfers. It is important to bear in mind that the results should be carefully interpreted considering the existing underestimation particularly for rent incomes.

The shares of the various income sources shown in Table 4.1 indicates that at the national level 45 per cent of household income is generated from self-employed activities (self-employed income plus self-consumption) and 35 per cent is generated through wages or salaries.

Households whose main mechanism is Pure Trade generate at least two thirds of their income through wage income; nevertheless in the case of blue collars 22 per cent of the total income arises from self-employed activities. In contrast, households that are mainly involved in Direct Production and Trade obtain 77 per cent of their income from self-employment and only 9 per cent from through wage income.

The agricultural self-employed households present two interesting aspects. On one hand, the wage income share is quite low, 6 per cent[1] and on the other hand, for these households more than half their income is generated as self consumption. This indicates a high degree of independence of these households both from the labour and the goods markets quite contrary from a the general idea of progressive linkage. Here again no conclusive evidence can be provided regarding a reduction of market relationships without having made this information comparable to studies undertaken in previous periods.

TABLE 4.1 : COMPOSITION OF ANNUAL HOUSEHOLD INCOME BY SOURCE AND COEFFICIENT OF VARIATION
(In percentages)

MECHANISM Socio-economic Group	WAGE INCOME	SELF-EMP. INCOME	SELF-CONSUMPTION	RENT	PRIVATE TRANSFERS	TOTAL	COEFFICIENT OF VARIATION
PURE TRADE	67.6	9.3	7.8	8.2	7.1	100.0	1.70
Blue Collar	67.0	10.0	11.7	5.1	6.2	100.0	1.02
White Collar	69.1	8.9	5.4	9.8	6.8	100.0	1.64
Domestic Worker	62.3	18.3	4.9	6.0	8.5	100.0	0.64
Unemployed	26.1	5.9	16.1	19.6	32.3	100.0	1.42
DIRECT PRODUCTION AND TRADE	8.8	48.7	28.5	8.0	6.0	100.0	1.77
Self-employed Professional	16.8	48.2	10.1	16.5	8.4	100.0	1.21
Agricultural Self-employed	5.9	33.0	54.1	3.4	3.6	100.0	2.16
Non agricultural Self-employed	10.0	59.1	14.0	9.9	7.0	100.0	1.53
Unpaid Family Worker	4.7	33.7	33.0	10.8	17.8	100.0	0.94
NON SPECIFIED	25.3	10.5	12.5	18.5	33.2	100.0	1.63
Non Active	25.2	10.3	12.5	18.5	33.5	100.0	1.62
Non Specified	30.8	19.5	11.3	19.3	19.1	100.0	1.28
TOTAL	35.2	27.3	17.8	9.5	10.2	100.0	1.74
COEFFICIENT OF VARIATION	2.93	3.44	3.45	5.61	4.56	1.74	

Source : ENNIV 1985/86

Non agricultural self-employed households present a different pattern, a somewhat higher linkage with labour markets and a substantial dependence on trade of their production.

Additionally, Table 4.1 shows that the inequality for total income is substantially lower than for the different components taken individually, indicating that these different sources tend to counteract. Rent and private transfers show the greatest variability .

Table 4.2 contains the decomposition by sources of household income at the national level. The results of the 'natural decomposition of variance' (see Chapter III-3) are presented under the heading of Total Effects. Additionally the table includes the indirect effects or interactions between the different income sources as an extension of the method.

TABLE 4.2 : DECOMPOSITION OF TOTAL HOUSEHOLD INCOME BY SOURCE
(In percentages)

	Wage Income	Self Employed Income	Self Consump-tion	Rent	Private Transfers	Total
Total Effect (%)	42.7	26.8	13.4	10.6	6.5	100.0
Direct Effect (%)	41.0	25.3	13.8	6.3	5.3	91.7
Interaction Effects (%)	1.7	1.5	-0.4	4.3	1.2	8.3
Wage Income	-	-0.7	-0.9	2.3	1.0	
Self-employed income	-0.7	-	0.7	1.5	-0.2	
Self consumption	-0.9	0.7	-	-0.1	-0.2	
Rent	2.3	1.5	-0.1	-	0.5	
Transfers	1.0	-0.1	-0.2	0.5	-	
CS Ratio	1.21	0.98	0.75	1.12	0.64	

Source : ENNIV 1985/86

The significance of the sources are expected to bear some resemblance to their share in total income but inasmuch as the different sources are not identically correlated with total income, an indicator of their distributional influence can be obtained by the ratio of the total

contribution to the income share.[2] This proportion is presented in the Table as the Contribution-Share Ratio (CS Ratio)

The first conclusion that emerges is that wage income is the source with the highest contribution to household income inequality. Additionally, its contribution is higher than its relative share in total income as reflected in a CS Ratio greater than unity. The interaction effects between wage income and other sources on the whole increase its contribution to inequality.

The second highest contribution belongs to self-employed income, its total contribution being roughly the same as its income share. In contrast, rent incomes seem to contribute substantially to total income inequality presenting the highest CS Ratio. This is due to its unequal distribution among household as indicated by the coefficient of variation in the previous table. An important part of this influence is due to the interaction effects of rents with other sources, in particular with wage incomes.

The contributions of self-consumption and private transfers are lower than their respective income shares. In the case of self consumption the Direct Effect is higher than the Total Effect, thus indicating that its interaction with other sources -particularly wage income- decreases its contribution to inequality.

These results suggest that labour income inequality plays an important role in the explanation of household income inequality both through its direct effects and through its interactions with other income sources. It is important to bear in mind that 8 per cent of total inequality derives from indirect effects.

A disaggregated decomposition analysis is presented for wage earners, agricultural self-employed and non agricultural self-employed in order to study the differences in the inequality contribution of the various income sources.

Table 4.3 shows that for both blue and white collars the most important contribution comes from wage income as was expected. A difference however is that this income source accounts for 57 per cent of inequality

TABLE 4.3 : DECOMPOSITION OF TOTAL HOUSEHOLD INCOME OF WAGE EARNERS BY SOURCE
(In percentages)

	Wage Income	Self Employed Income	Self Consump-tion	Rent	Private Transfers	Total
BLUE COLLARS:						
Total Effect (%)	57.2	12.3	15.2	3.4	11.9	100.0
Direct Effect (%)	55.1	10.8	16.3	1.3	9.9	93.4
Interaction Effects (%)	2.1	1.5	-1.1	2.1	2.0	6.6
Wage Income	-	0.3	-1.4	1.2	0.2	
Self-employed income	0.3	-	0.8	0.5	-0.4	
Self consumption	-1.4	0.8	-	-0.1	-0.4	
Rent	1.2	0.5	-0.1	-	0.5	
Transfers	2.0	-0.1	-0.4	0.5	-	
CS Ratio	0.85	1.23	1.30	0.66	1.92	
WHITE COLLARS:						
Total Effect (%)	67.3	11.0	7.6	9.2	4.9	100.0
Direct Effect (%)	63.5	11.1	7.2	6.0	4.2	92.0
Interaction Effects (%)	3.8	-0.1	0.4	3.2	0.7	8.0
Wage Income	-	0.0	0.4	2.8	0.5	
Self-employed income	0.0	-	0.1	-0.1	-0.1	
Self consumption	0.4	0.0	-	0.2	-0.1	
Rent	2.8	-0.1	0.2	-	0.3	
Transfers	0.5	0.0	-0.1	0.3	-	
CS Ratio	0.97	1.24	1.40	0.94	0.72	

Source : ENNIV 1985/86

for blue collars while for white collars it accounts for 67 per cent. Income from self employment and self-consumption contribute together 28 per cent of total inequality in the case of blue collars while for white collars it contributes 18 per cent. In both cases, this source of income introduces a unequalizing effect which is more than proportional to its share.

Rents seem to introduce greater variability in the case of white collars. There is a relatively strong interaction effect particularly with wage incomes, indicating that high rents are associated to high wages. On the other hand, transfers account for 12 per cent of the inequality in the incomes of blue collars, in a magnitude which is quite larger than its share as indicated by the CS ratio of 1.9.

For agricultural self-employed the highest contributions come from self consumption and self employed income, which together account for 88 per cent of inequality within the group. For non agricultural self employed the contribution of these two sources is somewhat lower -73 percent-. This is mostly due to the high contribution of rents to the inequality of the latter group. As much of half of this contribution is due to the indirect effect of rents through self employed income.

Another strong interaction effect in the case of non agricultural self employed acts through the association of self employed income with the other sources particularly with wage income.

In summary, the decomposition of income inequality by sources presents different patterns according to socio-economic groups. For blue and white collars the most important source of inequality is wage income, nevertheless the impact of self-employed income is also to be considered in spite of its relatively low income share. For the first group, private transfers seem to have a considerable effect as well. For agricultural self-employed, self-consumption seems contribute to a great extend to inequality; while for non agricultural self-employed, self-employed income is most important. For both the latter, rent income seems to generate higher unequalizing effects.

It is interesting to note that the sole presentation of the total contribution of each source, may in some cases mean a substantial loss of

TABLE 4.4 : DECOMPOSITION OF TOTAL HOUSEHOLD INCOME OF SELF-EMPLOYED BY SOURCE
(In percentages)

	Wage Income	Self Employed Income	Self Consump-tion	Rent	Private Transfers	Total
AGRICULTURAL SELF EMPLOYED:						
Total Effect (%)	6.6	29.0	58.7	3.6	2.1	100.0
Direct Effect (%)	5.7	26.7	58.2	2.1	1.2	93.9
Interaction Effects (%)	0.9	2.3	0.5	1.5	0.9	6.1
Wage Income	-	0.2	0.2	0.1	0.4	
Self-employed income	0.2	-	0.4	1.4	0.1	
Self consumption	0.2	0.4	-	-0.2	0.1	
Rent	0.1	1.4	-0.2	-	0.2	
Transfers	0.4	0.3	0.1	0.2	-	
CS Ratio	1.12	0.88	1.09	1.06	0.58	
NON AGRICULTURAL SELF EMPLOYED:						
Total Effect	8.7	56.9	15.9	13.2	5.3	100.0
Direct Effect	4.1	47.9	13.5	8.0	4.5	78.0
Interaction Effects	4.6	9.0	2.4	5.2	0.8	22.0
Wage Income	-	3.2	0.0	0.9	0.4	
Self-employed income	3.2	-	1.9	4.0	0.3	
Self consumption	0.0	1.9	-	0.1	0.3	
Rent	0.9	4.0	0.1	-	0.3	
Transfers	0.4	-0.1	0.3	0.3	-	
CS Ratio	0.87	0.96	1.14	1.94	0.76	

Source : ENNIV 1985/86

information, as in the case of non agricultural self employed if the decomposition exercise is understood to be an exploratory method in order to provide the basis of the specification of behavioral relationships.

2. Inequality Decomposition by Attribute

In this section, the method of decomposition by attributes of the Theil T inequality index will be used in order to explore the determinant factors of income inequality within each of the socio-economic groups considered. (See Chapter II-3) When the aim is to explore a set of data rather than to test a particular hypothesis this technique proves to be useful, nevertheless it is important to keep in mind that it does not provide evidence about the direction of causality.

The variables considered for the decomposition by attribute, shown in Table 4.5, are reffered to 1) the quantity and quality of the main endowments, 2) the trade possibilities, 3) the production possibilities. (The classes considered for each group are detailed in Annex D)

In the case of wage earners, the variables regarding the main endowment try to reflect the quality of the labour force which is being exchanged. Three indicators are considered initially: age, education and sex. The trade possibilities are reflected by variables which refer to the general conditions of location -region and area- and to the specific characteristics of the enterprise which hires the labour force -sector, size and the existence of a worker's organization-.

In this way, the two basic hypothesis to explain inequality among wage earners are present in the analysis: the Human Capital hypothesis through the variables associated to the main endowment and the Labour Market Segmentation hypothesis through the variables that describe the trade possibilities. Although, this exercise is not equivalent to the testing of either hypothesis, it can provide evidence regarding the relative importance of demand and supply conditions.

The main endowments of agricultural self-employed households include land and capital, besides labour. The indicators concerning land

TABLE 4.5: VARIABLES FOR THE DECOMPOSITION BY ATTRIBUTE

Socio-economic group	Main endowments	Trade Possibilities	Production Possibilities
Wage Earners	Labour -Age -Sex -Education	-Region -Area -Sector of activity -Enterprise size -Trade union	-
Agricultural Self-employed	Labour -Age -Sex -Education Land -Size -Access to water Capital -Agricultural equipment	Region	Technical assistance Use of fertilizers
Non agricultural Self-employed	Labour -Age -Sex -Education Capital -Equipment	-Region -Area -Sector of activity	

endowment intend to reflect both its extension and its quality. This last aspect is approximated by the percentage of the land which is under irrigation. A better indicator would be to 'standarize' the extension of land according to its quality. This however would require a considerable amount of information which is external to the survey.

The amount of capital has been recorded on the basis of the self-valuation of agricultural equipment. This information was not cross checked in any way and unfortunately no indication about the age or characteristics of the equipment is given by the survey, therefore there is practically no possibility to complement this data.

The trade possibilities should basically measure the access to markets and the size of these markets; also this would need external information not contained in the survey and therefore was not included. A rough 'proxy' -region- has been used instead.

The third group of variables refer to the production possibilities which have been represented by the access to technical assistance and the use of pesticides.

Thus, it is possible to investigate the relative importance of three distinct aspects -possession of assets, market conditions and technological conditions- in the determination of inequality among the agricultural self-employed.

For non agricultural self-employed households, capital is also determined on the basis of self-valuation. It refers to the inventory of equipment of up to three enterprises and includes stocks of unsold production.

As in the case of agricultural self-employed, trade possibilities have been difficult to determine on the basis of the information contained in the survey. As an approximation, region and area have been used.

Different sectors of activity can be said to represent different production processes, for example the industrial sector typically requires more capital intensive techniques than the sector of commerce. It is in this sense that the sector of activity is included an an indicator of production possibilities. This is certainly a very unsuitable proxy by itself and is

complemented by the number of workers to give a clearer idea of the technology utilized.

For this group also, it is possible to determine the relative importance of endowment, trade and technological variables in the analysis of income inequality.

Besides exploring the relevance of certain variables or groups of variables, the method also indicates the existence of 'joint' effects of two or more variables through the interaction effects. A positive interaction effect indicates that some of the contribution of a variable is not captured if it is considered individually, because part of the influence occurs only when other variables are also included. It may be said that it reflects a certain complementarity between variables.

On the other hand, a negative interaction implies that the variables are statistically correlated and that part of the contribution of a certain variable may be including the effect of other variables on inequality.

In this exercise, only first-order interactions will be considered because they tend to have the largest magnitudes and particularly due to their analytical relevance.

a. Decomposition of the household income of wage earners

Due to computational limitations only seven variables could be considered simultanously. Table 4.6 shows the result which yielded the lowest proportion of within-group inequality from the different alternatives which were tried. The variable sex was excluded as it presented both the lowest gross and marginal contributions among the endowment variables (0.0013 and 0.0164 respectively). The remaining seven variables account for 78 per cent of total income inequality.

The inter-group inequality was decomposed into direct effects (T_j) and the interaction effects (I_j) (See Chapter II-3). The highest direct effects are those associated to the trade variables which concern the

TABLE 4.6 : DECOMPOSITION OF THE THEIL COEFFICIENT FOR BLUE COLLAR HOUSEHOLDS

TOTAL	0.3544	100.0%	
Within-group inequality	0.0792	22.3%	
Between-group inequality	0.2752	77.7%	
Decomposition of Between-group Inequality (C_j in brackets)			
I. Direct Effects:	0.1441	52.4%	
1. Endowments	0.0424	15.4%	(0.1489)
Age	0.0260	9.4%	(0.0863)
Education	0.0164	6.0%	(0.0442)
2. Trade - Location	0.0311	11.3%	(0.0517)
Region	0.0188	6.8%	(0.0301)
Area	0.0123	4.5%	(0.0149)
3. Trade - Enterprise	0.0706	25.7%	(0.1603)
Enterprise size	0.0431	15.7%	(0.0646)
Trade Union	0.0189	6.9%	(0.0197)
Sector of Activity	0.0086	3.1%	(0.0487)
II. Interactions [1]	0.1311	47.6%	
Age-Sector	0.0241	8.8%	
Age-Education	0.0169	6.1%	
Enterp. size-Trade Union	-0.0150	-5.5%	
Age-Region	0.0121	4.4%	
Education-Sector	0.0108	3.9%	
Age-Enterprise size	0.0098	3.6%	

1 Only the most important first-order interactions disaggregated .

characteristics of the enterprise, followed by the endowments variables. The attributes associated to location contribute only 11 per cent to total inter-group inequality, indicating that the partition of the households by area or region produces highly heterogeneous groups. The classification by marginal contributions (C_j shown in brackets in the table) yields the same ranking.

However, if the assesment is to be made of the contribution of individual variables, the two criteria produce different results. According to the gross contributions, the most important variable is the size of the enterprise, while education occupies the second place. This order is reversed when considering marginal contributions, due to the high positive interaction effects of age with other variables -particularly sector and education- as can be seen in the lower part of the table. This implies that some of the effects of age on income inequality would not be captured if it were considered alone.

It is interesting to note that the existence of trade unions does not seem to have the impact on inequality that is frequently argued and that has lead to the idea of the existence of an 'aristocracy' within the wage earners due to the power of their organizations. Moreover, the negative interaction of trade union with size, suggests that the impact of trade unions is partly due to the correlation between both variables.

The relatively low impact of education is a surprising result; the inclusion of an indicator of specific training, rather than of general schooling, should be tried to give a more precise indication of the impact of education, before concluding that education has little impact on inequality for this group.

In the case of white collars, the proportion of inter-group inequality that arises from the decomposition of the selected variables is 87 per cent as can be seen in Table 4.7. However, the high proportion of inequality captured by the variables act mainly through interaction effects (72 per cent).

The endowment variables seem to be by far the most important, followed by the enterprise related trade variables. Location variables, as

TABLE 4.7 : DECOMPOSITION OF THE THEIL COEFFICIENT
FOR WHITE COLLAR HOUSEHOLDS

TOTAL	0.4454	100.0%	
Within-group inequality	0.0575	12.9%	
Between-group inequality	0.3879	87.1%	
Decomposition of Between-group Inequality (C_j in brackets)			
I. Direct Effects:	0.1072	27.6%	
1. Endowments	0.0673	17.3%	(0.2407)
Age	0.0083	2.1%	(0.1096)
Education	0.0590	15.2%	(0.1103)
2. Trade - Location	0.0161	4.2%	(0.0519)
Region	0.0079	2.0%	(0.0466)
Area	0.0082	2.1%	(0.0014)
3. Trade - Enterprise	0.0706	6.1%	(0.1603)
Enterprise size	0.0066	1.7%	(0.0865)
Trade Union	0.0021	0.5%	(0.0105)
Sector of Activity	0.0151	3.9%	(0.0989)
II. Interactions [1]	0.2807	72.4%	
Age-Sector	0.0270	7.0%	
Enterp. size-Sector	0.0262	6.8%	
Area-Trade Union	0.0257	6.6%	
Area-Sector	0.0251	6.5%	
Education-Area	0.0247	6.4%	
Age-Enterprise size	0.0245	6.3%	

1 Only the most important first-order interactions disaggregated.

in the case of blue collars, do not seem to have a strong influence on inequality, that is to say, the spectrum of inequality reproduces itself within regions and areas.

However, considering the importance of the interaction effects mentioned above, a disaggregation of these according to the interaction between the three groups of variables and within each group can provide some additional information. As shown bellow, the interactions within the group of enterprise associated variables represent 26% of the between group inequality, thus indicating that the enterprise related variables have a substantial effect on inequality when taken together.

DECOMPOSITION OF THE INTERACTION EFFECTS FOR WHITE COLLARS

Interaction	I_j	I_j / T_B
Interactions within:		
1. Endowment (Age-Education)	0.0200	5.2%
2. Trade:Location (Region-Area)	0.0136	3.5%
3. Trade:Enterprise (Size-Trade Union-Sector)	0.1007	26.0%
Interactions between 1,2 and 3	0.1464	37.7%
Total interactions	0.2807	72.4%

At the level of individual variables, it is education which shows the largest direct and marginal contribution. According to the direct effects criteria, the sector of activity would be the next in importance followed by age. This order is reversed again due when considering marginal contributions, due to the high interactions associated to age.

In summary, these results seem to indicate that in the case of blue collars, even though there is a predominance of trade variables which can support the idea of labour market segmentation, endowment variables seem to

have a considerable impact through the indirect effects of age on other variables.

In the case of white collars, the effect of education is very significant while the impact of age manifests itself through indirect effects, producing in this way a predominance of endowment variables. Nevertheless, the interaction effects that take place within the trade variables regarding the characteristics of the enterprise also indicates some evidence in favor of the segmentation of the labour market. For both kinds of wage earners, the location variables seem to have small impact.

b) Decomposition of household income of agricultural self-employed

The 'explained' proportion of inequality in this case amounts to 70 per cent, out of which 89 per cent is due to direct effects. The endowment variables stand out as the most important, accounting for 61 per cent of the inter-group inequality according to the direct effects. The ranking of trade and production possibilities is not so clear as the two criteria give different orderings basically due to the high negative interaction of region with other variables.

The most outstanding direct contribution comes from agricultural equipment, nevertheless its importance diminishes to the third place when its marginal contribution is considered. The case of land is quite the opposite: it is third when the direct effects are considered but first according to the marginal criteria.

For the production possibilities, the contribution of technical assistance was investigated but its direct contribution was 5 per cent of the inter-group inequality, substantially lower than the contribution of use of pesticides. It is interesting to notice that this last variable has strong interaction effects with agricultural equipment, which could indicate that better technology is associated to better equipment.

For this group, the access to land and equipment seem to be crucial elements thus indicating that the endowment variables are more important than market or production conditions. It may be argued that the proxies for trade and production possibilities are few and inadequate and that this has

TABLE 4.8 : DECOMPOSITION OF THE THEIL COEFFICIENT
FOR AGRICULTURAL SELF-EMPLOYED HOUSEHOLDS

TOTAL	0.6981	100.0%	
Within-group inequality	0.2083	29.8%	
Between-group inequality	0.4898	70.2%	
Decomposition of Between-group Inequality (C_j in brackets)			
I. Direct Effects:	0.4360	89.0%	
1. Endowments	0.2957	60.4%	(0.3772)
Age	0.0485	9.9%	(0.0721)
Education	0.0493	10.1%	(0.0120)
Land	0.0719	14.7%	(0.0734)
Irrigation	0.0170	3.5%	(0.0368)
Agricultural Equipment	0.1090	22.3%	(0.0570)
2. Trade			
Region	0.0804	16.4%	(0.0187)
3. Production			
Use of Pesticides	0.0599	12.2%	(0.0274)
II. Interactions [1]	0.0538	11.0%	
Age-Education	0.0566	11.6%	
Capital-Region	-0.0485	-9.9%	
Capital-Pesticides	-0.0286	-5.8%	
Region-Pesticides	-0.0277	-5.7%	
Age-Irrigation	0.0252	5.1%	
Land-Irrigation	0.0224	4.6%	

1 Only the most important first-order interactions disaggregated.

biased the results in favor of the endowment variables. But if we consider on one hand that the direct contributions do not depend on the number of variables included in the analysis and on the other that we are already accounting for 70 per cent of total inequality, it may be deduced that the inclusion of more trade or production variables will probably not alter the general conclusions.

d) Decomposition of household income of non agricultural self-employed

In this case also the variables which have been included show a high association with inequality as 77 per cent is due to inter-group inequality.

By both criteria, the endowment variables are the most relevant followed by production possibilities. The direct effects of trade variables 'explain' only 9 per cent of the between-group income variation.

Capital is the most important variable as it accounts for more than one-fourth of the inter-group inequality. Its interaction effects tend to counteract and cancel as indicated by the similarity between the gross and the marginal contributions.

Once more, age presents high positive interaction effects which change its ranking from last according to the direct effect criteria to second in the marginal ranking. The opposite is true for enterprise size, which presents a strong correlation with capital.

It is worth mentioning that the low magnitude of the direct effects of the variable sector may be misleading as its importance greatly increases when its indirect effects are considered.

In conclusion, these results suggest that the access to capital is the main element which 'explains' income inequality within this group.

TABLE 4.9 : DECOMPOSITION OF THE THEIL COEFFICIENT
FOR NON AGRICULTURAL SELF-EMPLOYED HOUSEHOLDS

TOTAL	0.5761	100.0%	
Within-group inequality	0.1340	23.3%	
Between-group inequality	0.4421	76.7%	
Decomposition of Between-group Inequality (C_j in brackets)			
I. Direct Effects:	0.3054	69.1%	
1. Endowments	0.1655	37.4%	(0.2858)
Age	0.0197	4.5%	(0.1115)
Education	0.0302	6.8%	(0.0767)
Capital	0.1156	26.1%	(0.1160)
2. Trade	0.0379	8.6%	(0.0964)
Region	0.0217	4.9%	(0.0782)
Area	0.0162	3.7%	(0.0117
3. Production	0.1020	23.1%	(0.1479)
Sector	0.0039	0.9%	(0.0975)
Enterprise size	0.0981	22.2%	(0.0257)
II. Interactions [1]	0.1367	30.9%	
Capital-Enterp.size	-0.0468	-10.6%	
Age-Education	0.0274	6.2%	
Region-Sector	0.0144	3.3%	
Capital-Sector	0.0137	3.1%	
Age-Region	0.0130	2.9%	
Sector-Enterp.size	0.0129	2.9%	

1 Only the most important first-order interactions disaggregated.

NOTES TO CHAPTER IV

1. This proportion is probably underestimated as salaried employment for the members of these households are mostly seasonal which can not be captured by the income of the last seven days. Nevertheless, inasmuch as different areas, regions or even micro climates present different patterns of seasonality and as the survey was undertaken throughout 18 months, the degree of underestimation is not likely to be very considerable.

2. See Shorrocks (1983)

CONCLUSIONS

The social structure of the peruvian society, characterized by the notion of entitlements, suggests that after 40 years of industrialization the capitalist system has been incapable of securing the reproduction of the labour force as only one-third of the households depend on wages as their main source of income.

A more unexpected outcome however is the extent of isolation from the market of the households that generate their income outside capitalist relations of production as indicated by the fact that they derive almost 30 per cent of their incomes from self-consumption.

Additionally, there seems to be no evidence to support the argument of an important linkage of self-employed households to labour markets for wage income is barely 6 and 10 percent of the total household income, for agricultural and non agricultural self-employed households, respectively. On the contrary what has been found is that blue collars generate up to 20 per cent of their total income through self-employment.

Are these results determined by the economic crisis of the last decade or do they represent the outcome of a longer term tendency? This opens the question regarding the effects of the different periods of the industrialization process on the relative importance of the different entitlement mechanisms and ultimately to the assessment of the limits of the capitalist system in its capacity to secure the reproduction of the labour force in an extensive way.

The distributional outcome shows that there is simultaneously a high level of inequality at the global level, as well as within each of the socio-economic groups, particularly when the distribution of households according to their per capita distribution is considered.

This implies that each income strata is highly heterogeneous thus suggesting the political and administrative limitations of redistributive policies. Nevertheless, a future inquiry is necessary regarding further disaggregations within the agricultural and non agricultural self-employed

so as to obtain more homogenous groups. The decomposition by attributes provides some clues to this respect as indicated bellow.

At the level of the descriptive exercise, it is necessary to point out that more investigation regarding alternative theoretical distributions is needed. It is suspected that alternative distributions could on the whole provide better fits to the data than the bivariate lognormal model but also sacrifice some its simplicity and practical usefulness. An assesment of this trade-off is required.

The decomposition by attribute indicates that there is some evidence regarding the existence of labour market segmentation for wage earners, particularly in the case of blue collars. Supply conditions, particularly education plays an important role in the determination of inequality within white collars, while its importance for blue collars is considerably smaller.

In the case of self-employed households the exercise indicates that land and capital are attributes which 'explain' a large proportion of the inequality, thus suggesting that it is endowments and consequently production possibilities, more than trade or exchange conditions which determine the income differences.

On the basis of the decomposition analysis it is now necessary to try further breakdowns of self-employed households and determine the importance of the conditions of trade at a greater level of disaggregation.

BIBLIOGRAPHY

Aitchinson, J., Brown, J. A. C. (1966) The Lognormal Distribution Cambridge University Press, Cambridge.

Altimir O. and Pinera S. (1982) 'Analisis de descomposicion de las desigualdades de ingresos en America Latina' El Trimestre Economico XLIX(4): 813-60

Amat y Leon, C. (1986) La Familia como Unidad de Trabajo Centro de Investigacion (CIUP) Universidad del Pacifico, Lima

Anand, S. Inequality and Poverty in Malaysia : Measurement and decomposition Oxford University Press, Oxford

Barreiros, L., Kouwenaar, A., Teekens, R., Vos, R. (1987) Ecuador : Teoria y Diseno de Politicas para la Satisfaccion de las Necesidades Basicas Instituto de Estudios Sociales, La Haya.

Carbonetto, D., Carazo de Cabellos, M. I. (1986) Heterogeneidad Technologica y Desarrollo Economico : El Sector Informal Instituto Nacional de Planification-Fundacion Friedrich Ebert, Lima.

Cohen, S. I., Cornelisse, A., Teekens, R., Thorbecke, E. (1984) The Modelling of Socio-economic Planning Problems Gower, London

Cowel, F. A. (198) 'Multilevel Decomposition of Theil's Index of Inequality' Review of Income and Wealth 201-5

Fitzgerald, E. V. K. (1979) The Political Economy of Peru 1956-78 : Economic Development and the Reconstruction of Capital Cambridge University Press, Cambridge.

Ginneken, W. van (1980) Socio-economic Groups and Income Distribution In Mexico Croom Helm, London.

Kmietowiz, Z. W. (1984) 'The bivariate lognormal model for the distribution of household size and income' The Manchester School of Economics and Social Studies 2: 196-210

Kmietowiz, Z. W., Webley, P. (1975) 'Statistical Analysis of Income Distribution in the Central Province of Kenya' Eastern Africa Economic Review 7(2):1-25

Kouwenaar, A. (1986) A Basic Needs Model. A General Equilibrium Analysis with Special Reference to Ecuador

Kuznets, S. (1976) 'Demographic aspects of the size distribution of income: an exploratory essay' Economic Development and Cultural Change 25 : 1-94

Kuznets, S. (1978) 'Size and Age structure of family households: exploratory comparisons' Population and Development Review 4(2): 187-223

Lazear, E. P., Michael, R. T. (1980) 'Family Size and the Distribution of Real Per Capita Income' The American Economic Review 70(1) : 91-107

Paukert, F., Lecaillon, J., Morrisson, C., Germidis, D. (1984) Income Distribution and Economic Development : An Analytical Survey International Labour Office, Geneva.

Pereirinha, J. A. Inequalities, Household Income Distribution and Development in Portugal Ph. D. Thesis, Institute of Social Studies, The Hague

Sahota, G. S. (1978) "theories of personal income distribution:a survey' Journal of Economic Literature XVI, March: 1-55

Saith, A. (1983) 'Development and distribution: a critique of the cross country U-hypothesis' Journel of Development Economics 13: 367-82

Sen, A. K. (1975) Employment, Technology and Development Clarendon Press, Oxford.

Sen, A. K. (1977) 'Starvation and Exchange Entitlements : A General Approach and its Implications to the Great Bengali Famine' Cambridge Journal of Economics 1, 33-59

Sen, A. K. (1978) On Economic Inequality Clarendon Press, Oxford.

Sen, A. K. (1979) 'Utilitarianism and Welfarism' The Journal of Philosophy LXXVI-9 : 463-89

Sen, A. K. (1981) Poverty and Famines : An Essay in Entitlement and Deprivation Clarendon Press, Oxford.

Sen, A. K. (1982a) Choice, Welfare and Measurement Basil Blackwell, Oxford.

Sen, A. K. (1982b) 'Rights and Agency' Philosophy and Public Affairs 11 : 3-39

Sen, A. K. (1984) Resources, Value and Development Basil Blackwell, Oxford.

Sen, A. K. (1985) Commodities and Capabilities North-Holland, Amsterdam

Sen, A. K., Williams, B. (eds) (1982) Utilitarianism and Beyond Cambridge University Press, Cambridge

Shorrocks, A. F. (1980) ''The Class of Additively Decomposable Inequality Measures' Econometrica 48(3) : 613-25

Shorrocks, A. F. (1982) 'Inequality decomposition by factor components' Econometrica 50(1): 193-211

Shorrocks, A. F. (1983) 'The impact of income components on the distribution of family incomes' The Quarterly Journal of Economics May:311-26

Teekens, R. (1985) Mapping personal to household income distribution' The Hague: Institute of Social Studies, ISS-PREALC Working Paper 28

United Nations (1984) Handbook of Household Surveys Studies in Methods Series F no. 31, New York.

Webb, R. (1977) Government Policy and the Distribution of Income in Peru 1963-1973 Harvard University Press, Cambridge.

ANNEX A

TABLE A-1 : SOCIAL STRUCTURE BY AREA AND REGION

(Number of Households)

	A R E A		R E G I O N				TOTAL
	Urban	Rural	Coast	Sierra	Jungle	Lima	
DIRECT TRADE	965977	205491	277750	254134	67494	572090	******
Blue Collar	452017	167474	176364	152061	39377	251688	619491
White Collar	466803	27258	84207	91053	25242	293559	494061
Domestic Worker	11239	2974	4224	1923	455	7611	14213
Unemployed	35919	7784	12954	9097	2420	19232	43703
OWN PRODUC. & TRADE	755668	880189	307817	725093	288232	314715	******
Self-employ. Profs.	55843	10527	14799	18993	8434	24143	66370
Agricul. Self-empl.	65575	754514	91709	524835	198242	5303	820088
Non-agric. Self-em.	621669	98133	199449	165291	77317	277745	719802
Unpaid Family Work.	12581	17016	1859	15975	4238	7525	29597
NON SPECIFIED	323010	167101	105380	172904	39170	172657	490111
Non Active	306077	159837	101979	158362	37715	167858	465914
Non specified	16933	7264	3401	14542	1456	4799	24198
TOTAL	2044655	1252781	690947	1152131	394896	1059463	3297437

TABLE A-2: TOTAL ANNUAL HOUSEHOLD INCOME BY SOCIO-ECONOMIC GROUP, AREA AND REGION
(In Intis)

MECHANISM Socio-economic Group	TOTAL	AREA		REGION			
		Urban	Rural	Coast	Sierra	Jungle	Lima
PURE TRADE	38444	41994	21707	31611	27175	30360	47703
Blue Collar	25881	29010	17419	24462	19707	23940	30892
White Collar	56546	56866	51068	49975	41154	42365	64424
Domestic Worker	20805	22659	13388	15803	11169	21078	25790
Unemployed	17307	18050	13823	14730	14454	11351	21123
DIRECT PRODUCTION AND TRADE	30368	41910	20438	32468	20016	32578	50129
Self employed Professional	42602	48366	12390	30312	30076	62391	53375
Agricultural Self-employed	21854	36721	20557	29288	17719	27816	79028
Non agricultural Self-employed	39278	42142	21137	34144	26626	42262	49664
Unpaid Family Worker	21673	29156	16141	26730	14834	18419	36775
NON SPECIFIED	31563	40932	13429	33377	15470	22597	48573
Non Active	32379	42137	13715	34046	15776	23153	49212
Non Specified	14941	18357	6422	13318	11768	8190	26686
TOTAL	33421	41797	19723	32262	20928	31206	48564

TABLE A.3: ANNUAL PER CAPITA HOUSEHOLD INCOME BY SOCIO-ECONOMIC GROUP, AREA AND REGION
(In Intis)

MECHANISM Socio-economic Group	TOTAL	AREA		REGION				GINI
		Urban	Rural	Coast	Sierra	Jungle	Lima	
PURE TRADE	8701	9518	4849	6457	5843	7642	11180	
Blue Collar	5624	6334	3707	5157	4159	5668	6827	
White Collar	12997	13012	12738	9932	9006	11310	15259	
Domestic Worker	4103	4529	2398	2229	2011	4216	5619	
Unemployed	5174	5725	2588	2950	2922	2144	8103	
DIRECT PRODUCTION AND TRADE	6738	9381	4464	6397	4431	7442	11740	
Self employed Professional	12268	14029	3039	6393	6151	12121	20973	
Agricultural Self employed	4649	7932	4363	5558	3791	6118	18824	
Non agricultural Self employed	8573	9037	5630	6797	6366	10498	10625	
Unpaid Family Worker	7529	13554	3075	4799	3324	4082	19072	
NON SPECIFIED	8416	10828	3747	7482	4496	5224	13648	
Non Active	8608	11105	3830	7663	4629	5381	13708	
Non Specified	4509	5636	1698	2062	2892	1170	11610	
TOTAL	7684	9672	4432	6587	4753	7256	11742	

Source : ENNIV 1985/86

TABLE A-4: HOUSEHOLD SIZE

MECHANISM	SOCIO-ECONOMIC GROUP	TOTAL	AREA		REGION			
			Urban	Rural	Coast	Sierra	Jungle	Lima
Direct Trade		5.30	5.29	5.37	5.73	5.30	5.15	5.12
	Blue Collar	5.50	5.50	5.50	5.83	5.31	5.55	5.38
	White Collar	5.05	5.07	4.66	5.47	5.31	4.54	4.89
	Domestic Worker	6.10	6.29	5.37	7.13	5.03	5.00	5.86
	Unemployed	5.16	5.18	5.06	5.53	5.23	5.10	4.88
Own Production and Trade		5.33	5.30	5.35	5.60	5.18	5.51	5.23
	Self employed profession.	4.61	4.55	4.94	5.16	4.83	5.58	3.76
	Agriculture Self employ.	5.45	5.70	5.43	6.03	5.26	5.68	5.86
	Non agricul. Self employ.	5.24	5.33	4.70	5.43	4.99	5.00	5.32
	Unpaid Family Worker	5.59	5.04	6.00	6.08	4.99	6.83	6.05
Non specified		4.38	4.39	4.36	4.90	4.27	4.82	4.07
	Non active	4.34	4.37	4.28	4.85	4.20	4.74	4.08
	Non specified	5.05	4.63	6.02	6.56	5.02	7.00	3.45
TOTAL		5.18	5.15	5.23	5.55	5.07	5.38	4.98

ANNEX B

TABLE B-1 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR ALL HOUSEHOLDS
(O=Observed; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 2.9316
SIGMA(Y) = 1.1071
MU(S) = 1.5056
SIGMA(S) = 0.57454
RHO(Y,S) = 0.27105

BRACKETS (In 1000 Intis)	HOUSEHOLD SIZE 1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	111314	8508	115305	113454	111242	200118	119248	187481	115916	140353	95456	96038	139174	185623	807655	931576
10. - 20.	41034	3138	61930	59995	106370	133716	131848	147210	137397	124116	126150	93208	227260	217064	831990	778447
20. - 30.	15462	1223	38382	27546	68166	68656	77011	81975	111512	73518	68987	58009	152301	150585	531822	461510
30. - 40.	7373	583	10641	14563	41815	38961	52415	48996	54176	45721	50276	37245	120376	104017	337072	290086
40. - 50.	3035	315	14808	8490	21950	23928	38734	31262	34860	30040	38798	25055	59919	73970	212104	193059
50. - 60.	1347	185	10868	5308	18956	15586	33250	20989	28891	20643	20738	17543	38609	54178	152661	134433
60. - 75.	1964	158	4184	4803	17388	14683	25505	20370	19579	20498	15577	17744	40998	57347	125195	135602
75. - 100.	1905	123	397	4031	15607	12957	11959	18654	27931	19315	13526	17111	43922	58602	115246	130793
100. - 150.	2188	81	4249	2925	4927	10042	12413	15184	19478	16330	6796	14917	33477	55309	83529	114788
150. - 250.	1885	32	3054	1319	3588	4939	5114	7962	7052	8999	2632	8557	15021	35335	38346	67143
250. - 500.	0	8	579	414	1789	1753	6824	3101	5663	3771	3741	3807	6430	18727	25026	31582
500. and more	0	0	0	0	891	0	780	0	701	0	2828	0	3177	0	8377	0
TOTAL (In 1000)	188	14	264	243	413	525	515	583	563	503	446	389	880	1011	3269	3269

VALUE OF CHI2 = 2433601.75
NUMBER OF D.O.F. = 61

TABLE B-2 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR PURE TRADE HOUSEHOLDS
(O=Observed; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 3.1621
SIGMA(Y) = 1.0273
MU(S) = 1.5576
SIGMA(S) = 0.51622
RHO(Y,S) = 0.16557

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	20632	568	17231	16294	28988	42154	29671	48171	33721	40085	24729	29017	35950	57034	190923	233322
10. - 20.	16084	395	13963	13989	26180	41524	49226	52422	39720	47032	44544	36144	64319	79936	254036	271442
20. - 30.	3944	197	14591	7814	26355	24978	37207	33317	50019	31183	33567	24793	57712	58858	223395	181140
30. - 40.	2438	108	2305	4611	20982	15460	26715	21369	20291	20557	23770	16710	52917	41592	149419	120408
40. - 50.	0	64	4249	2894	10613	10049	20267	14259	15570	13999	17785	11567	29812	29838	98297	82670
50. - 60.	0	41	4000	1909	8741	6816	22670	9876	12557	9854	8144	8249	15164	21899	71277	58644
60. - 75.	521	37	1097	1814	8454	6656	12489	9845	8188	9980	9420	8463	18741	23123	58910	59917
75. - 100.	0	31	0	1609	7182	6110	6155	9271	16814	9588	6252	8262	18602	23413	55005	58285
100. - 150.	669	23	780	1244	2087	4943	3945	7761	11712	8240	3889	7254	7504	21596	30586	51061
150. - 250.	1885	10	165	601	718	2532	3016	4155	2193	4567	1465	4134	5857	13146	15299	29144
250. - 500.	0	3	0	201	780	920	2801	1610	2808	1861	1176	1756	617	6181	8182	12533
500. and more	0	0	0	0	891	0	0	0	0	0	780	0	1568	0	3239	0
TOTAL (In 1000)	46	1	58	53	142	162	214	212	214	197	176	156	309	377	1159	1159

VALUE OF CHI2 = 1968787.31
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-3 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR DIRECT PRODUCTION AND TRADE
(O=Observed; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 2.8223
SIGMA(Y) = 1.0729
MU(S) = 1.5298
SIGMA(S) = 0.57977
RHO(Y,S) = 0.29561

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	57962	4458	64384	60012	61166	107467	66378	102202	70219	77549	56222	53704	88729	106742	465060	512135
10. - 20.	16295	1375	27373	28060	63284	65611	69123	74925	78676	65023	69529	50007	144177	122963	468457	407964
20. - 30.	7945	476	17441	11705	28001	31068	33525	38902	46722	36214	27640	29458	81322	82195	242596	230018
30. - 40.	2077	208	5671	5756	11217	16553	18699	21980	29027	21402	23217	18051	51015	54863	140924	138812
40. - 50.	2436	105	7865	3164	6226	9649	12816	13379	14238	13466	17667	11665	26545	37846	87794	89274
50. - 60.	707	58	6375	1882	6000	6011	7592	8624	13588	8911	9603	7885	20609	26976	64474	60346
60. - 75.	765	47	374	1617	5008	5403	6948	8016	8784	8500	4709	7680	19813	27720	46399	58983
75. - 100.	1218	34	0	1267	5727	4479	4574	6928	8971	7587	4468	7035	21329	27197	46286	54529
100. - 150.	1519	20	2840	834	2840	3174	4510	5187	3883	5928	1473	5689	19083	24163	36148	44994
150. - 250.	0	7	1195	327	628	1372	2098	2409	2587	2910	386	2922	7146	14112	14041	24060
250. - 500.	0	1	579	83	1009	395	2384	768	2855	1004	2565	1075	5813	6358	15205	9684
500. and more	0	0	0	0	0	0	780	0	0	0	1028	0	1610	0	3418	0
TOTAL (In 1000)	91	7	134	115	191	251	229	283	280	248	219	195	487	531	1631	1631

VALUE OF CHI2 = 1299116.20
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-4 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR BLUE COLLAR HOUSEHOLDS
(O=Observed ; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 2.8728
SIGMA(Y) = 0.95740
MU(S) = 1.5786
SIGMA(S) = 0.54519
RHO(Y,S) = 0.20305

BRACKETS (In 1000 Intis)	HOUSEHOLD SIZE 1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	15165	609	12047	13156	23898	30458	19280	33582	26601	27919	16154	20532	31551	44099	144696	170354
10. - 20.	9552	309	7925	8809	17152	24410	29237	30588	24905	27987	33759	22202	47770	55818	170300	170124
20. - 30.	1575	121	6554	3991	15035	12175	12617	16373	30797	15813	22399	13101	39928	36294	128906	97869
30. - 40.	1377	56	1556	2006	14024	6508	8410	9158	8838	9159	9266	7805	24068	23079	67540	57770
40. - 50.	0	29	780	1104	4137	3747	5930	5452	5659	5595	6438	4868	12605	15125	35550	35920
50. - 60.	0	16	970	652	426	2291	8954	3423	7387	3585	3346	3171	5531	10254	26614	23392
60. - 75.	0	13	0	551	2929	2006	4290	3076	536	3287	2505	2955	8022	9946	18282	21835
75. - 100.	0	9	0	419	0	1593	0	2523	3788	2764	3016	2535	8162	8977	14966	18820
100. - 150.	669	5	0	260	770	1047	670	1730	669	1959	0	1846	3914	7000	6693	13848
150. - 250.	0	2	0	92	553	398	0	695	809	821	0	801	2473	3334	3835	6143
250. - 500.	0	0	0	19	0	90	0	170	0	213	445	218	0	1039	445	1750
500. and more	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	28338	1169	29832	31060	78925	84723	89388	106771	109990	99104	97329	80036	184026	214964	617827	617827

VALUE OF CHI2 = 848899.83
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-5 :BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR WHITE COLLAR HOUSEHOLDS
(O=Observed ; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 3.5993
SIGMA(Y) = 0.91728
MU(S) = 1.5275
SIGMA(S) = 0.46475
RHO(Y,S) = 0.19102

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	4409	56	3380	2720	2410	8124	6060	9213	3865	7120	6497	4651	1420	6705	28040	38589
10. - 20.	5889	70	5269	4342	8248	15267	17161	19546	14405	16572	8920	11657	10458	19072	70349	86525
20. - 30.	1479	43	7136	3118	11320	12129	23025	16758	16373	15072	9546	11118	15084	19806	83963	78044
30. - 40.	1061	26	750	2083	6957	8654	18305	12575	11453	11761	14504	8954	27724	16913	80754	60965
40. - 50.	0	16	3469	1404	6476	6127	14336	9242	9911	8899	11348	6937	16299	13701	61838	46325
50. - 60.	0	10	3030	968	8316	4395	13716	6829	4500	6730	4798	5346	7222	10946	41581	35225
60. - 75.	521	10	1097	951	5525	4486	8200	7180	7652	7240	6066	5859	8686	12441	37747	38168
75. - 100.	0	8	0	867	7182	4289	6155	7121	13026	7390	3236	6121	10440	13613	40039	39409
100. - 150.	0	6	780	678	1317	3571	3275	6224	11042	6709	3889	5732	3590	13572	23893	36492
150. - 250.	1339	2	165	318	165	1820	3016	3377	1384	3826	1465	3403	3384	8761	10918	21507
250. - 500.	0	1	0	94	780	600	2801	1216	2808	1478	731	1392	617	4071	7737	8852
500. and more	0	0	0	0	891	0	0	0	0	0	780	0	1568	0	3239	0
TOTAL	14697	248	25076	17542	59586	69461	116051	99280	96418	92797	71780	71171	106492	139600	490100	490100

VALUE OF CHI2 = 1790725.95
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-6 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR AGRICULTURAL SELF-EMPLOYED HOUSEHOLDS
(O=Observed ; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 2.5224
SIGMA(Y) = 1.0128
MU(S) = 1.5521
SIGMA(S) = 0.58533
RHO(Y,S) = 0.34469

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	33437	2627	42636	36839	40568	68384	47818	66880	45504	51860	39089	36542	66013	75139	315066	338271
10. - 20.	7195	458	13073	11364	27803	30068	34107	37377	41510	34502	44444	27828	88169	75535	256301	217131
20. - 30.	2554	114	6943	3596	10502	11185	10933	15643	20114	15797	10497	13691	45597	44005	107141	104031
30. - 40.	131	39	2731	1449	2865	4986	2457	7513	5299	8033	8403	7289	30687	26297	52572	55606
40. - 50.	131	17	3422	680	640	2519	1966	4007	4287	4469	7553	4195	17003	16539	35002	32425
50. - 60.	0	8	1317	354	1045	1390	857	2310	2799	2663	1672	2567	3988	10886	11678	20178
60. - 75.	131	5	0	266	1270	1104	2483	1912	1034	2277	734	2254	4226	10283	9879	18100
75. - 100.	0	3	0	175	1903	777	905	1418	1687	1758	1155	1798	4395	9016	10046	14944
100. - 150.	0	1	1987	90	522	438	636	855	1219	1117	456	1193	5949	6812	10770	10505
150. - 250.	0	0	1195	25	0	136	131	291	555	408	0	461	1582	3152	3464	4473
250. - 500.	0	0	0	4	0	24	819	58	1040	89	426	108	1756	969	4041	1251
500. and more	0	0	0	0	0	0	0	0	0	0	0	0	960	0	960	0
TOTAL	43580	3273	73305	54840	87117	121011	103113	138263	125047	122972	114428	97926	270327	278632	816918	816917

VALUE OF CHI2 = 718640.48
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-7 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR NON AGRICULTURAL SELF-EMPLOYED HOUSEHOLDS
(O=Observed ; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 3.1362
SIGMA(Y) = 1.0275
MU(S) = 1.5151
SIGMA(S) = 0.57283
RHO(Y,S) = 0.32951

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	22373	1668	18699	21208	16258	35195	16639	31047	19721	21996	15193	14314	19078	24583	127962	150010
10. - 20.	7854	715	13725	14168	32433	31327	31122	33666	33332	27577	20779	20103	46351	42898	185597	170454
20. - 30.	4698	270	9959	6674	16464	17157	20868	20570	24615	18311	16704	14266	33131	35027	126438	112274
30. - 40.	1946	122	2049	3486	5493	9863	14695	12688	22310	11920	12468	9698	18762	26229	77723	74006
40. - 50.	2305	63	4442	1986	4493	6029	7995	8170	8836	7988	9152	6711	9196	19551	46418	50497
50. - 60.	707	35	5058	1209	3156	3880	6067	5478	9557	5529	7491	4765	16621	14750	48658	35646
60. - 75.	633	28	374	1058	3033	3585	3915	5270	7749	5487	3975	4849	14390	15967	34069	36245
75. - 100.	0	20	0	843	3823	3056	2621	4724	7284	5114	2094	4664	14820	16624	30643	35046
100. - 150.	0	12	0	561	1551	2224	2469	3673	2089	4185	1017	3980	11871	15824	18998	30459
150. - 250.	0	4	0	220	628	977	1527	1760	2031	2145	0	2153	5564	9948	9751	17207
250. - 500.	0	1	579	53	1009	278	1565	564	1510	756	2139	820	3616	4815	10418	7288
500. and more	0	0	0	0	0	0	780	0	0	0	1028	0	649	0	2458	0
TOTAL	40517	2937	54886	51466	88342	113571	110264	127611	139034	111006	92040	86324	194050	226216	719132	719132

VALUE OF CHI2 = 629578.34
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-8 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR URBAN HOUSEHOLDS
(O=Observed;T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 3.2383
SIGMA(Y) = 1.0469
MU(S) = 1.5092
SIGMA(S) = 0.55359
RHO(Y,S) = 0.24777

BRACKETS (In 1000 Intis)	HOUSEHOLD SIZE 1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	45932	2861	43094	44519	48175	82845	47805	78291	40895	58024	34259	38980	43947	70255	304107	375775
10. - 20.	28581	1698	33440	35973	57953	82010	78196	89382	67533	73658	61732	53796	89234	114019	416669	450536
20. - 30.	10774	785	30164	19505	52435	49546	60211	58434	79812	51139	49067	39192	91410	91861	373873	310461
30. - 40.	6587	411	7079	11302	36940	30771	47321	38189	47366	34753	38844	27485	84783	68971	268920	211883
40. - 50.	2446	236	10533	7000	18939	20055	35638	25846	29633	24211	29126	19599	43377	51804	169692	148751
50. - 60.	1347	145	10232	4571	17602	13637	30925	18107	24602	17356	19018	14312	33356	39456	137082	107583
60. - 75.	1199	129	4184	4301	15268	13349	24598	18255	19264	17899	14843	15033	36409	43245	115765	112211
75. - 100.	1905	105	397	3770	12645	12295	11081	17441	27320	17593	11945	15118	38155	45912	103446	112234
100. - 150.	2188	72	2969	2871	3794	9995	11612	14885	18824	15590	6340	13811	28616	45167	74344	102392
150. - 250.	1885	30	1742	1360	3423	5154	4487	8178	5796	8997	2632	8294	13432	29979	33396	61992
250. - 500.	0	8	579	443	1789	1894	5344	3295	3922	3897	2334	3811	4674	16186	18642	29535
500. and more	0	0	0	0	891	0	780	0	701	0	2828	0	2217	0	7417	0
TOTAL (In 1000)	103	6	144	136	270	322	358	370	366	323	273	249	510	617	2023	2023

VALUE OF CHI2 = 1733680.88
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-9 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR RURAL HOUSEHOLDS
(O=Observed;T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: XMU(Y) = 2.4334
SIGMA(Y) = 1.0176
XMU(S) = 1.4997
SIGMA(S) = 0.60699
RHO(Y,S) = 0.34726

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	65382	6838	72210	73222	63067	118566	71443	108270	75021	81014	61197	56049	95227	115165	503548	559123
10. - 20.	12453	1116	28490	21080	48417	48732	53652	56475	69864	50217	64418	39705	138026	107646	415320	324971
20. - 30.	4688	272	8218	6500	15732	17625	16800	22920	31700	22245	19920	18863	60890	60407	157948	148832
30. - 40.	786	93	3562	2580	4875	7728	5094	10808	6810	11089	11432	9833	35593	35276	68152	77408
40. - 50.	589	39	4275	1198	3011	3859	3096	5692	5227	6084	9673	5575	16542	21824	42412	44271
50. - 60.	0	18	636	619	1355	2112	2325	3249	4289	3586	1720	3373	5254	14182	15578	27140
60. - 75.	765	13	0	462	2120	1663	907	2664	315	3036	734	2929	4589	13235	9430	24001
75. - 100.	0	7	0	301	2962	1160	878	1954	611	2315	1581	2306	5767	11433	11800	19476
100. - 150.	0	3	1280	153	1134	645	802	1162	654	1449	456	1505	4861	8476	9185	13393
150. - 250.	0	1	1312	42	165	198	627	390	1256	520	0	570	1589	3830	4950	5550
250. - 500.	0	0	0	6	0	34	1480	76	1741	111	1407	130	1756	1142	6384	1499
500. and more	0	0	0	0	0	0	0	0	0	0	0	0	960	0	960	0
TOTAL	85	8	120	106	143	202	157	214	197	182	173	141	371	393	1246	1246

VALUE OF CHI2 = 992254.01
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-10 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR HOUSEHOLDS IN THE LIMA METROPOLITAN AREA
(O=Observed;T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

PARAMETERS: MU(Y) = 3.4022
SIGMA(Y) = 1.0137
MU(S) = 1.4720
SIGMA(S) = 0.55975
RHO(Y,S) = 0.22653

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	19486	1493	19176	19774	16231	33577	12821	30072	16032	21549	15285	14156	15217	24796	114248	145416
10. - 20.	19129	1220	19806	21023	32403	42613	33791	43231	26157	34000	23364	24038	31010	48530	185661	214655
20. - 30.	7702	649	19469	12921	34707	28942	32874	31568	35883	26233	27251	19383	39056	42845	196942	162541
30. - 40.	3741	368	4885	8049	25844	19232	25718	21991	24835	18946	16983	14410	45006	33879	147013	116874
40. - 50.	599	223	6598	5237	16137	13124	17423	15539	15295	13751	17189	10686	20817	26332	94058	84892
50. - 60.	1347	143	5243	3547	13408	9231	23663	11238	13271	10158	11751	8030	18017	20554	86700	62902
60. - 75.	0	132	2514	3452	12149	9323	14422	11665	6845	10769	9894	8659	21789	23031	67613	67032
75. - 100.	1905	112	0	3147	7824	8901	9201	11524	16614	10922	7690	8970	17661	25054	60895	68630
100. - 150.	1519	82	2262	2510	1437	7549	9526	10226	15947	10037	4376	8479	16671	25316	51738	64199
150. - 250.	1885	36	584	1252	3423	4077	2502	5860	3726	6019	2632	5276	8091	17232	22844	39753
250. - 500.	0	11	0	431	1789	1571	5344	2461	2724	2703	1603	2503	1855	9438	13315	19117
500. and more	0	0	0	0	891	0	780	0	701	0	1809	0	805	0	4986	0
TOTAL	57	5	81	81	166	178	188	195	178	165	140	125	236	297	1046	1046

VALUE OF CHI2 = 876453.33
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

TABLE B-11 : BIVARIATE DISTRIBUTION OF TOTAL INCOME PER HOUSEHOLD (Y) AND HOUSEHOLD SIZE (S)
FOR HOUSEHOLDS IN THE SIERRA REGION
(O=Observed; T=Estimated)

FIT BIVARIATE LOGNORMAL DISTRIBUTION - MAXIMUM LIKELIHOOD METHOD

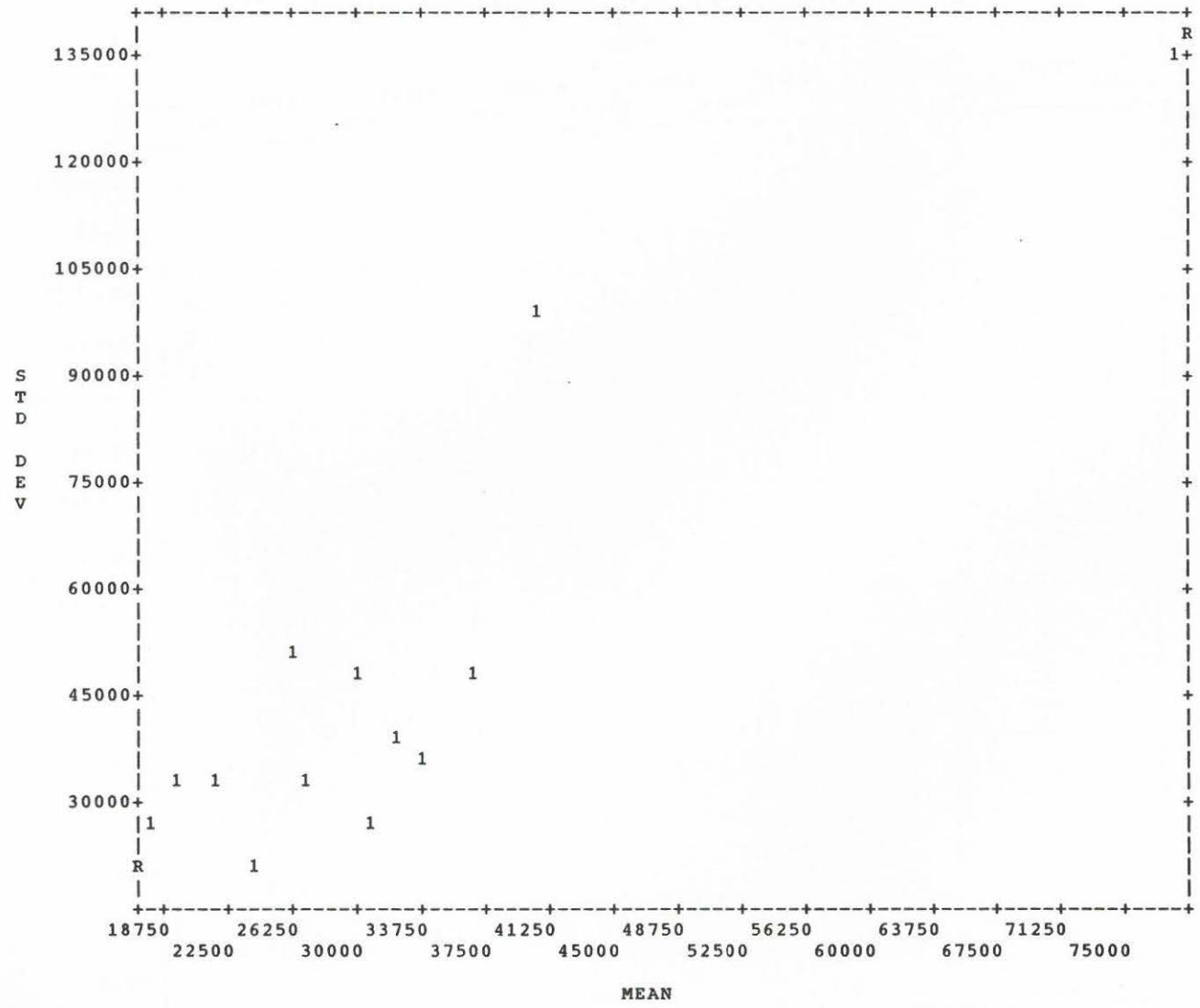
PARAMETERS: MU(Y) = 2.4755
SIGMA(Y) = 1.0785
MU(S) = 1.4750
SIGMA(S) = 0.59647
RHO(Y,S) = 0.34858

BRACKETS	HOUSEHOLD SIZE															
(In 1000 Intis)	1		2		3		4		5		6		7		TOTAL	
	O	T	O	T	O	T	O	T	O	T	O	T	O	T	O	T
< 10.	59965	6166	71149	68177	57326	109926	68690	98596	68254	72179	50222	48816	75186	94007	450792	497867
10. - 20.	9471	1015	25855	19756	41192	45383	54734	51587	55210	44822	53849	34605	102083	86879	342394	284047
20. - 30.	3527	269	10446	6563	11915	17572	22089	22317	29841	21096	23512	17423	53621	51031	154952	136271
30. - 40.	407	99	3618	2785	6471	8204	8367	11175	5837	11144	10061	9609	30912	31247	65673	74263
40. - 50.	2305	44	2319	1371	692	4331	9785	6210	6549	6441	7302	5733	20704	20199	49656	44329
50. - 60.	0	22	1903	746	1777	2491	5108	3719	4601	3980	3531	3633	7351	13665	24271	28256
60. - 75.	1199	16	374	588	611	2069	4604	3213	1812	3545	3078	3316	3571	13328	15249	26076
75. - 100.	0	10	0	413	2272	1552	877	2532	6137	2901	1253	2798	10412	12244	20951	22450
100. - 150.	0	5	530	234	822	961	877	1673	471	2015	1304	2024	3503	9957	7507	16869
150. - 250.	0	1	745	76	165	347	496	657	504	844	0	894	2329	5171	4239	7990
250. - 500.	0	0	579	14	0	77	661	164	1511	231	445	263	634	1954	3830	2704
500. and more	0	0	0	0	0	0	0	0	0	0	0	0	1610	0	1610	0
TOTAL (In 1000)	77	8	118	101	123	193	176	202	181	169	155	129	312	3397	1411	141

VALUE OF CHI2 = 929317.29
NUMBER OF D.O.F. = 61
PROBABILITY = 0.000000

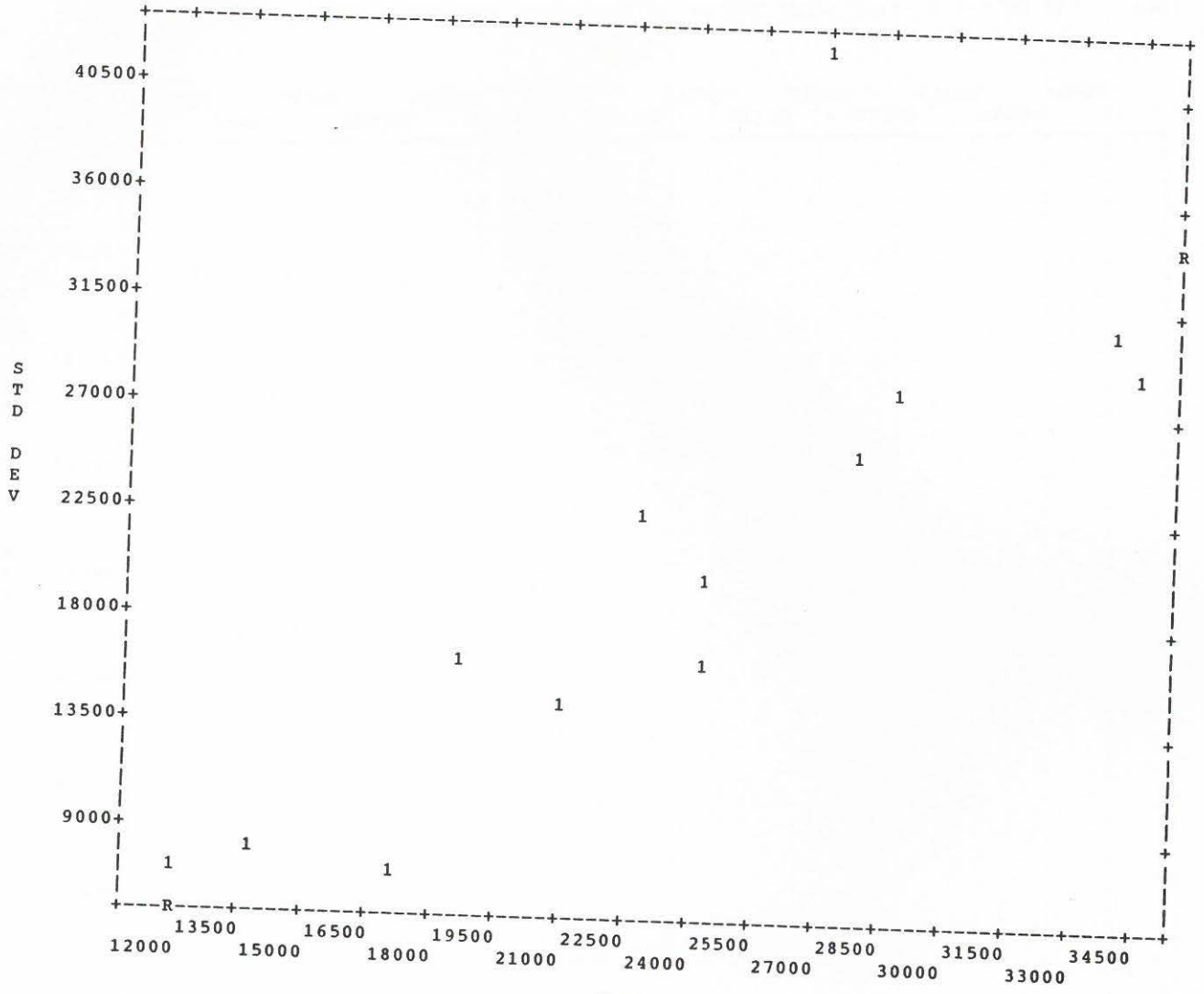
ANNEX C

FIGURE 3.1 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR ALL HOUSEHOLDS



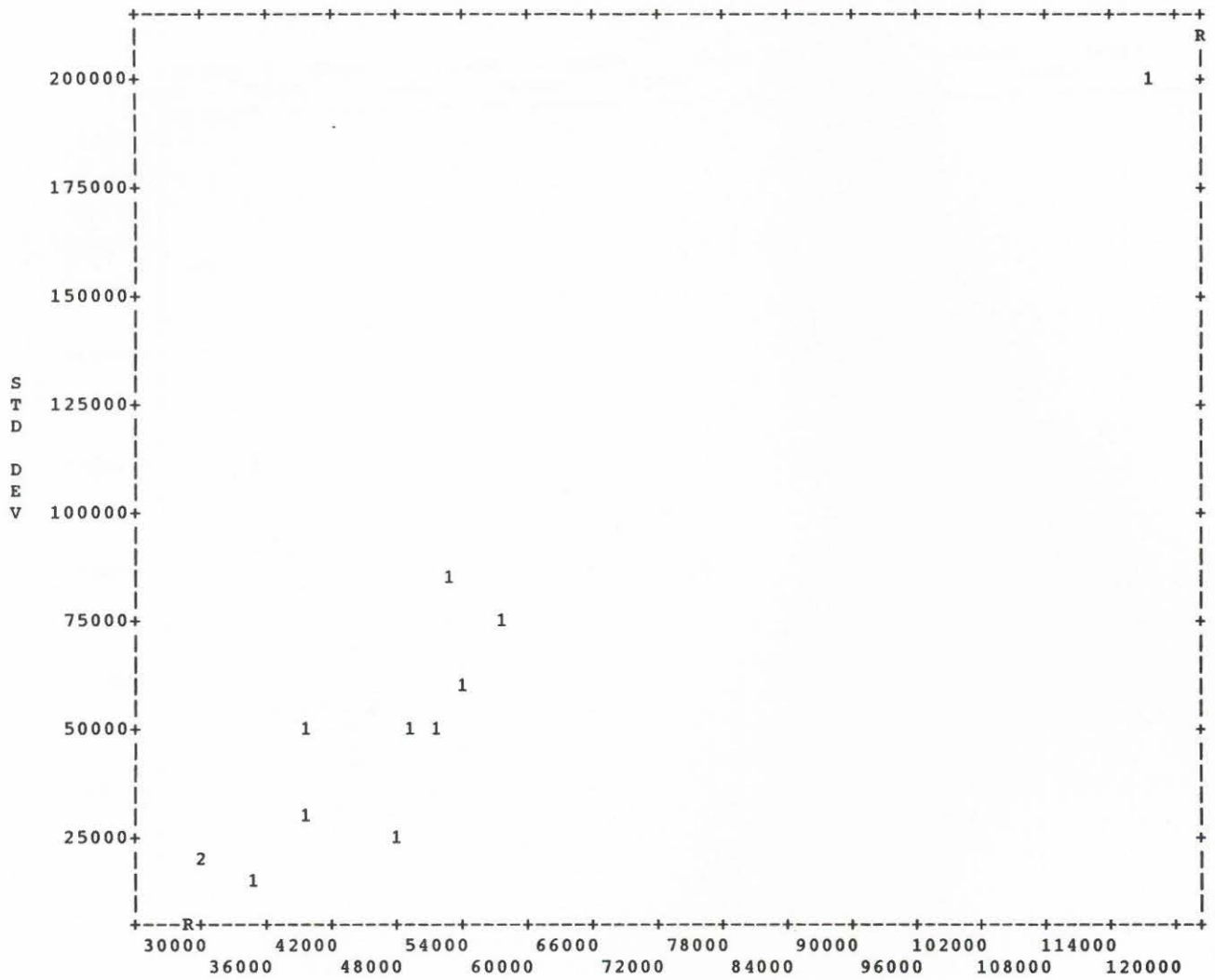
Correlation .90211 R Squared .81381 S.E. of Est 14728.3713 2-tailed Sig. .0000
Intercept(S.E.) -13379.873(9817.5693) Slope(S.E.) 1.92968(.27830)

FIGURE 3.2 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR BLUE COLLARS



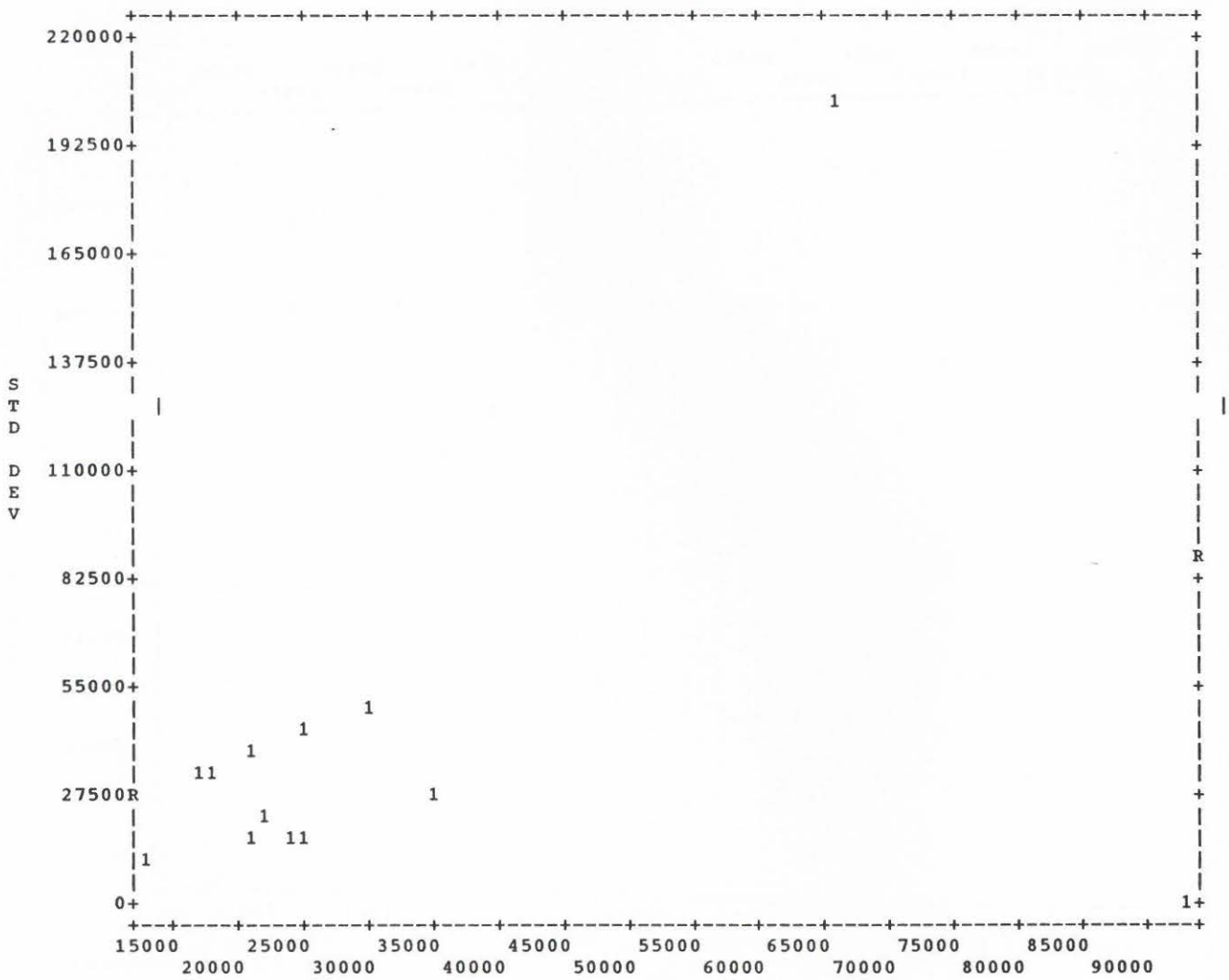
Correlation .81846 R Squared .66987 S.E. of Est 6270.08863 2-tailed Sig. .0006
Intercept(S.E.) -8303.7099(6333.5728) Slope(S.E.) 1.22050(.25834)

FIGURE 3.3 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR WHITE COLLARS



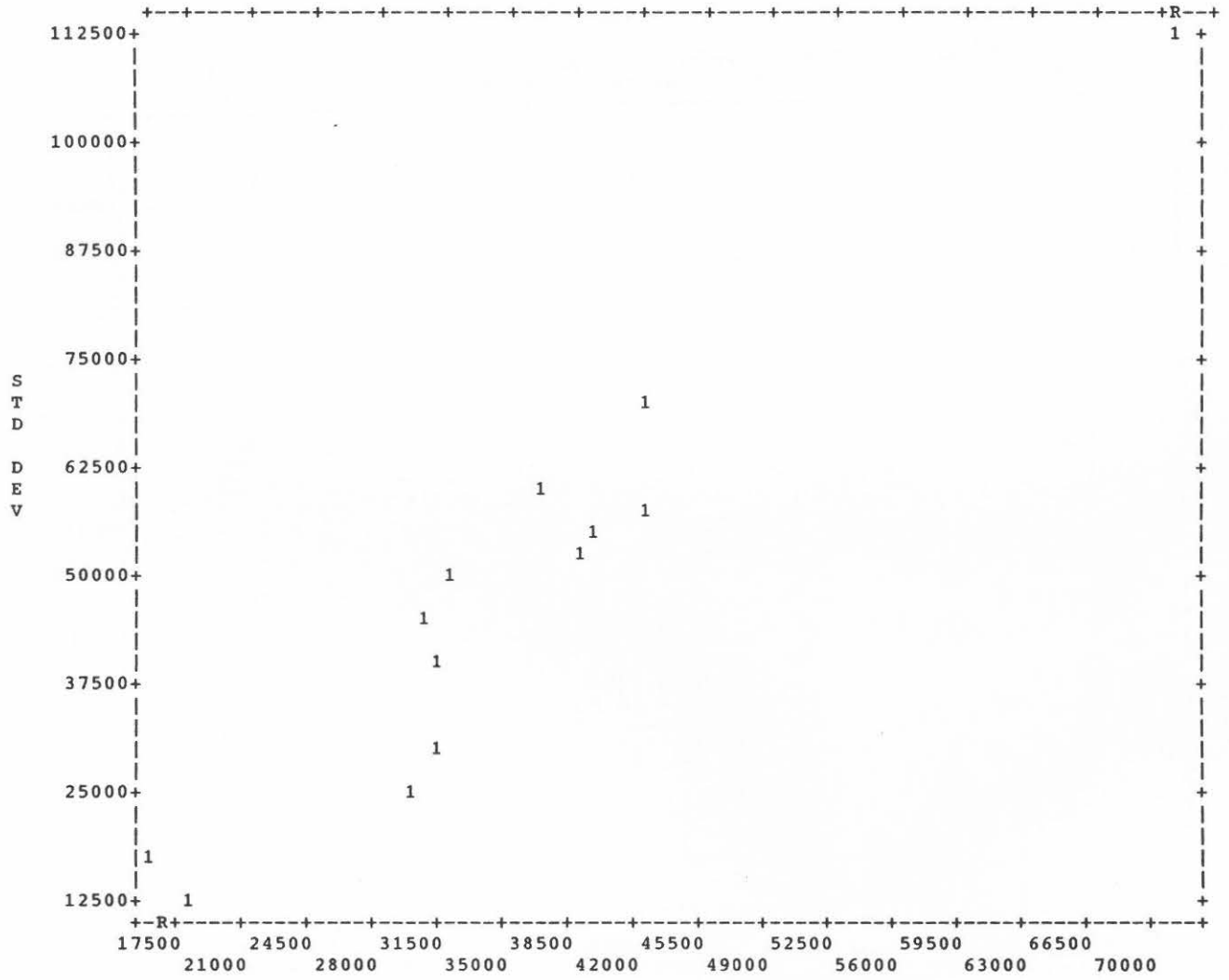
Correlation .96688 R Squared .93485 S.E. of Est 13681.5410 2-tailed Sig. .0000
Intercept(S.E.) -50489.474(9810.0547) Slope(S.E.) 2.13766(.17846)

FIGURE 3.4 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR AGRICULTURAL SELF EMPLOYED



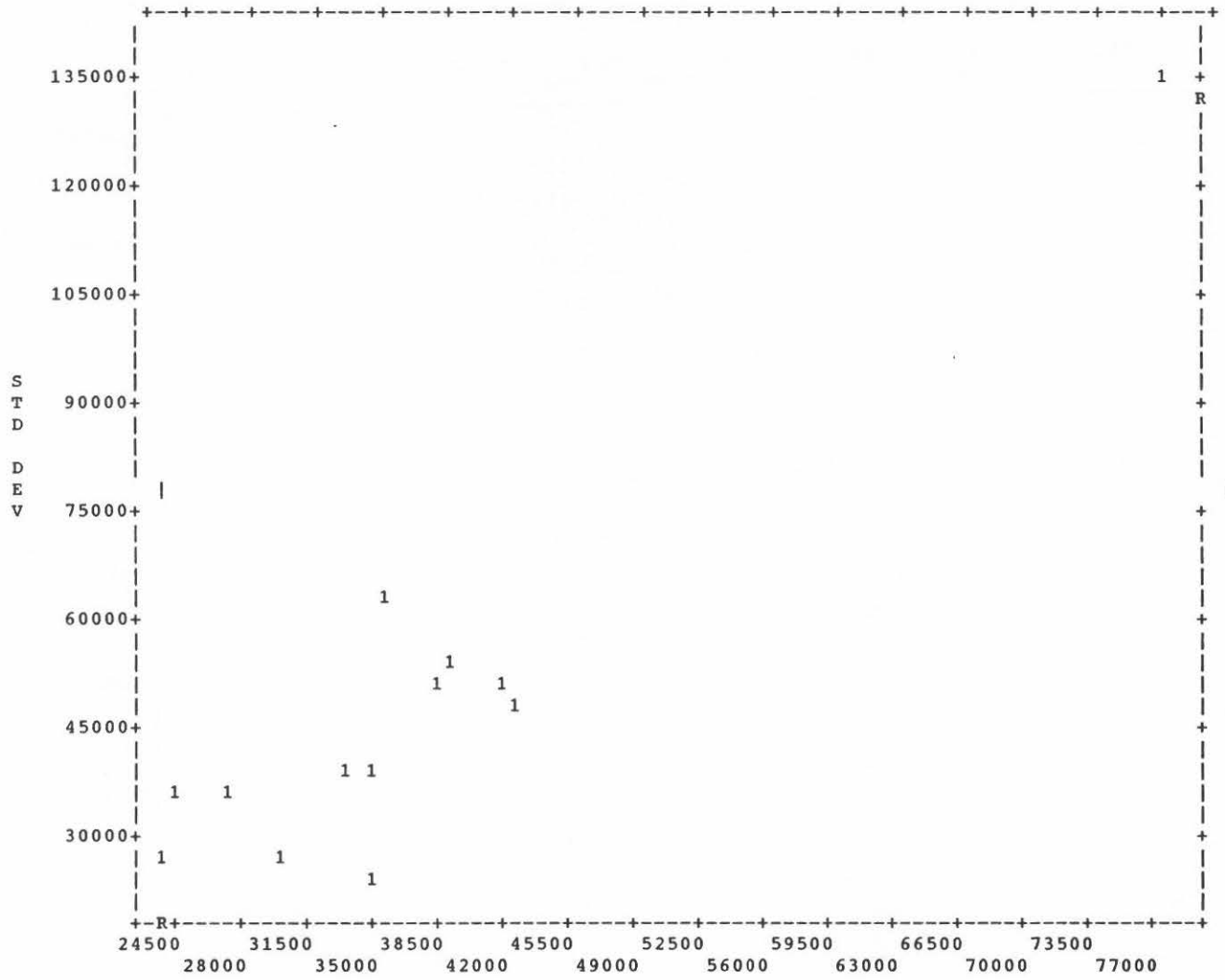
Correlation .32731 R Squared .10713 S.E. of Est 50940.1930 2-tailed Sig. .2750
Intercept(S.E.) 16310.0452(24860.574) Slope(S.E.) .74460(.64813)

FIGURE 3.5 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR AGRICULTURAL SELF EMPLOYED



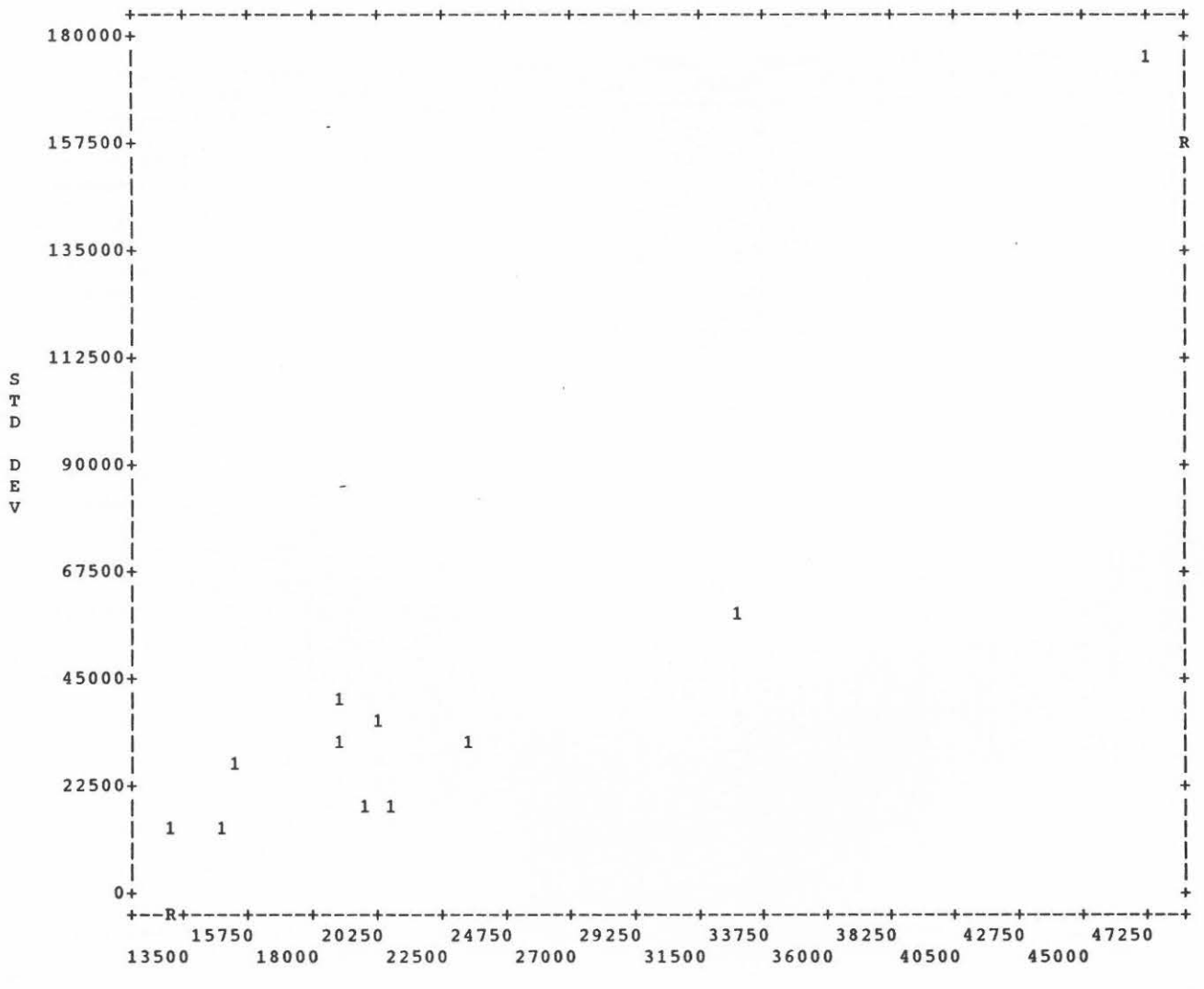
Correlation .96345 R Squared .92824 S.E. of Est 7285.50638 2-tailed Sig. .0000
Intercept(S.E.) -18092.526(5904.7725) Slope(S.E.) 1.85431(.15545)

FIGURE 3.6 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR URBAN HOUSEHOLDS



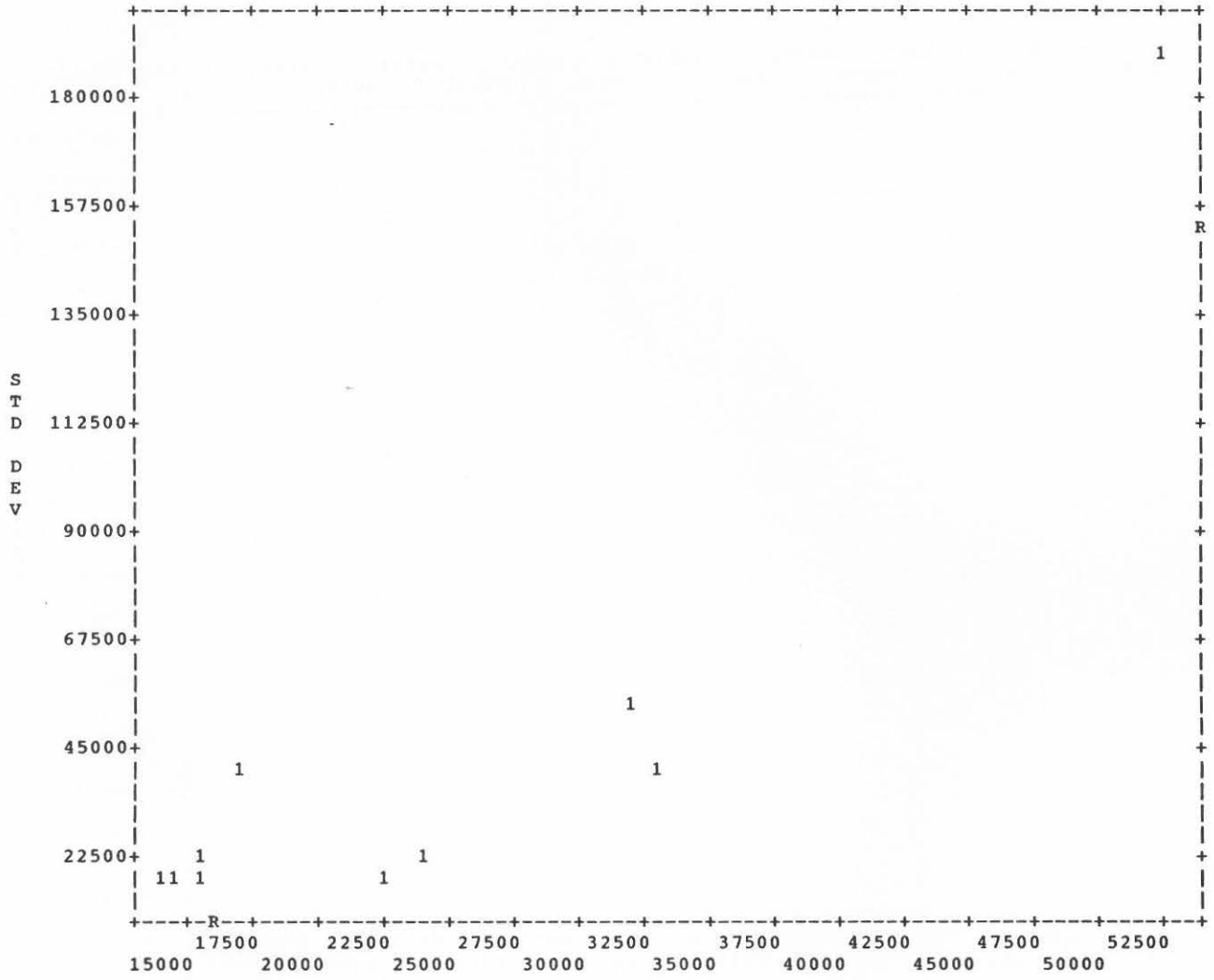
Correlation .93144 R Squared .86758 S.E. of Est 10927.0151 2-tailed Sig. .0000
Intercept(S.E.) -25411.103(9211.2021) Slope(S.E.) 1.97600(.23276)

FIGURE 3.7 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR RURAL HOUSEHOLDS



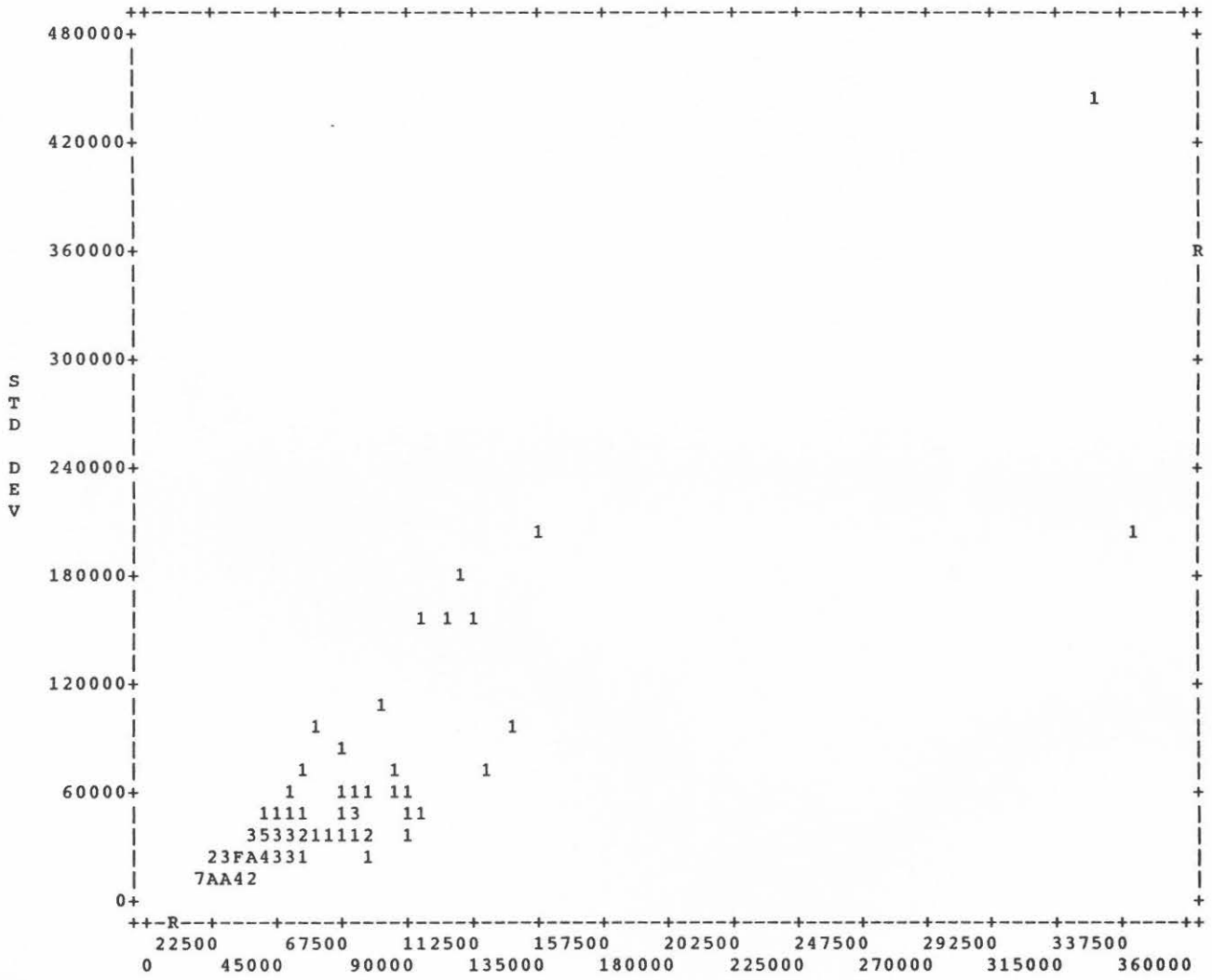
Correlation .93405 R Squared .87245 S.E. of Est 17575.7566 2-tailed Sig. .0000
Intercept(S.E.) -57259.279(13699.074) Slope(S.E.) 4.44714(.56679)

FIGURE 3.8 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR SIERRA REGION



Correlation .89082 R Squared .79356 S.E. of Est 24990.2343 2-tailed Sig. .0005
Intercept(S.E.) -46962.602(18156.969) Slope(S.E.) 3.76578(.67907)

FIGURE 3.9 : SCATTER DIAGRAM FOR MEAN AND STANDARD DEVIATION OF TOTAL HOUSEHOLD INCOME AND REGRESSION RESULTS FOR LIMA



Correlation .87532 R Squared .76619 S.E. of Est 24785.3320 2-tailed Sig. .0000
Intercept(S.E.) -10945.787(3347.9351) Slope(S.E.) 1.01884(.05014)

ANNEX D

TABLE D.1 : ATTRIBUTES OF WAGE EARNERS
(Percentages)

ATTRIBUTE	BLUE COLLARS	WHITE COLLARS
AGE		
Up to 34 years	31.6	30.4
35 to 42 years	23.4	25.9
43 to 50 years	22.1	20.5
51 to 60 years	16.3	16.9
More than 60 years	6.2	6.3
SEX		
Male	94.4	93.2
Female	5.6	6.8
EDUCATION		
None	3.6	0.0
Primary	55.3	13.4
Secondary	36.5	41.9
Superior	4.7	44.7
REGION		
Coast	28.5	17.0
Sierra	24.5	18.4
High Jungle	3.0	1.8
Low Jungle	3.4	3.3
Lima	40.6	59.4
AREA		
Urban	73.0	94.5
Rural	27.0	5.5
SECTOR OF ACTIVITY		
Agriculture and Fishing	22.9	2.1
Mining	5.6	3.0
Industry and Electricity	28.7	10.3
Construction and Transport	19.0	6.3
Commerce	8.1	13.4
Services	15.7	65.0
ENTERPRISE SIZE		
1 to 5 workers	33.4	20.4
6 to 20 workers	24.4	22.4
21 to 100 workers	19.5	28.0
More than 100 workers	22.7	29.3
TRADE UNION		
Trade Union in the Work Center	32.7	49.8
No Trade Union in the Work Center	67.3	50.2

TABLE D.2 : ATTRIBUTES OF AGRICULTURAL SELF EMPLOYED
(Percentages)

ATTRIBUTE	AGRICULTURAL SELF EMPLOYED
AGE	
Up to 34 years	16.8
35 to 42 years	19.7
43 to 50 years	20.7
51 to 60 years	22.8
More than 60 years	20.0
SEX	
Male	87.9
Female	12.1
EDUCATION	
None	5.4
Primary	83.4
Secondary	9.4
Superior	1.7
LAND	
Up to 0.5 hct.	15.4
0.5 to 1 hct	11.6
1 to 2.5 hct	27.6
2.5 to 5 hct.	20.4
More than 5 hct.	24.9
ACCESS TO IRRIGATED LAND	
Up to 25% of the land	16.4
26% to 50% of the land	12.1
51% to 75% of the land	7.5
76% to 100% of the land	64.0
AGRICULTURAL EQUIPMENT	
Up to 30 intis	17.7
From 30 to 65 intis	20.8
From 65 to 120 intis	20.7
From 120 to 300 intis	21.3
More than 300 intis	19.5
REGION	
Coast	11.2
Sierra	64.0
High Jungle	15.3
Low Jungle	8.9
Lima	0.6
TECHNICAL ASSISTANCE	
Yes	7.5
No	92.5
USE OF PESTICIDES	
Yes	40.6
No	59.4

TABLE R.3 : ATTRIBUTES OF NON AGRICULTURAL SELF EMPLOYED
(Percentages)

ATTRIBUTE	NON AGRICULTURAL SELF EMPLOYED
AGE	
Up to 34 years	22.5
35 to 42 years	22.7
43 to 50 years	20.9
51 to 60 years	19.4
More than 60 years	14.6
SEX	
Male	79.5
Female	20.5
EDUCATION	
None	1.4
Primary	55.8
Secondary	34.5
Superior	8.3
EQUIPMENT	
Up to 300 intis	12.1
From 300 to 1000 intis	15.3
From 1000 to 4000 intis	22.9
From 4000 to 12000 intis	20.0
More than 12000 intis	29.7
REGION	
Coast	27.7
Sierra	23.0
High Jungle	4.6
Low Jungle	6.1
Lima	38.6
AREA	
Urban	86.4
Rural	13.6
SECTOR OF ACTIVITY	
Agriculture and Fishing	1.3
Mining	0.3
Industry and Electricity	20.2
Construction and Transport	16.9
Commerce	49.2
Services	12.1