MACRO-ECONOMIC INFLUENCES
ON THE DISTRIBUTION OF INCOME

MACRO-ECONOMIC INFLUENCES ON THE DISTRIBUTION OF INCOME: A CASE STUDY OF CANADA

by

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TO

MY MOTHER

ABSTRACT

The purpose of this thesis is to estimate the effects of macro-economic variables, such as unemployment, inflation and labor force participation rates, on the size distribution of income in Canada. Most previous studies of this kind have been based on U.S. data. These include studies by T. Paul Schultz Lester Thurow, Charles Metcalf, Charles Beach, Alan Blinder and Howard Esaki, and others. Recently, however, a study in the Canadian context has been published by Adolf Buse, in which he analyzes the distribution of incomes of individuals, based on income tax returns. In our study, in addition to the income distribution for all individuals, we analyze a number of other distributions. These include ones for all male individuals combined, particular age groups of male individuals, all families and unattached individuals combined, all families only, and families with age of head in a particular age group. There are two sources of distribution data: Taxation Statistics of Revenue Canada and the Survey of Consumer Finances of Statistics Canada. Data for family distributions are available only

from the latter source.

Our framework of analysis is highly disaggregative. Changes in income inequality are characterized by fluctuations in decile income levels relative to the mean of the distribution. The effects of macro-economic variables on these relative decile levels are estimated by econometric methods. The problem of multicollinearity is handled by using approaches based on principal components, including an approach suggested recently by Yair Mundlak. The responses of various points on the distribution to changes in the macro-economic variables are examined first. The decile model results are then analyzed in terms of single-valued measures of inequality such as the coefficient of variation, the Gini coefficient and the Atkinson index.

The results indicate that the effects of unemployment are disequalizing, but this is not true for all the distributions. The effects of inflation on inequality are not very clear in most cases. On the other hand, the effects of the unanticipated component of inflation, as approximated by changes in the inflation rate, appear to be disequalizing. There are some interesting results relating to the effects of labor force participation rates. Unemployment insurance benefits appear to improve the relative position of lower income groups. Evidence seems to suggest that lower income groups in the age range 65 and over gain more from retirement and old age benefits than do other groups in that age range.

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CHAPTER 1

INTRODUCTION

How do unemployment, inflation and other macroeconomic variables affect the size distribution of income? This question has been of interest to economists for a long time but the present economic recession and high rates of inflation make the answer to the question even more important and relevant for public policy. If there exist systematic effects of unemployment and inflation on the size distribution of income, government policies need to be evaluated in terms of their distributional consequences, as well as their effects on the aggregates. If high rates of unemployment and inflation have undesirable distributional consequences, then the importance of fiscal and monetary policies to eliminate these problems is enhanced. However, fiscal and monetary policies may not eliminate the problems completely, in which case supplementary policies may be desirable to help people in those income groups that are most adversely affected.

Our study deals directly with the question raised in the first sentence of this introduction. We try to answer the question empirically with Canadian data. Most previous research in this area has been carried out with U.S. data. Recently, however, a study in the Canadian context has been published by Buse (1982). Buse had little success in establishing significant effects of unemployment and inflation on the income distribution, based on his analysis of taxation data for all tax filers combined. In our study, we analyze, in addition to the overall income distribution of individuals, a number of distributions for particular groups. These distributions are based on data drawn from two different sources: Taxation Statistics of Revenue Canada and the Survey of Consumer Finances of Statistics Canada. The income distribution data from each source have their limitations and we discuss these in detail in Chapter 4. Distributions analyzed include ones for all individuals, all male individuals, male individuals of age under 25, male individuals 25-64, and male individuals 65 and over. The data underlying these distributions have been taken from both sources. In addition, data available only from the Survey of Consumer Finances are used to study the income distributions for all families and unattached individuals combined, families only, families with age of head under 25, families with age of head 25-64, and families with age of head 65 and over. We were motivated in selecting this set of income distributions by the fact that, in the past, different researchers have arrived at different conclusions, and one of the reasons for this may well be that they were analyzing different income distributions and different data sets.

Our framework of analysis is similar to that adopted by Beach (1972, 1976, 1977). The distributional variables to be explained in the model are the decile income levels relative to the mean income of the distribution. The effects of macro-economic variables on these relative decile income levels are estimated by econometric methods. The results allow us to study the way in which various points on the income distribution respond to changes in the macro-economic variables. The approach is therefore disaggregative, and we can analyze changes within the income distribution in some detail. This approach is preferred to the aggregative one in which income inequality is characterized by some single-valued measure, such as the Gini coefficient. The aggregative approach conceals the detailed changes that occur within the income distribution and gives only the net outcome, which can be misleading. On the other hand, the approach followed in this study not only allows us to examine the effects of macroeconomic variables on different parts of the income distribution, but also preserves the possibility of analyzing the implied response of overall income inequality in terms of any conventional single-valued measure. After analyzing the response of the income distribution in detail, we examine the implied response of overall inequality to each macro-economic variable in terms of three summary measures, namely the coefficient of variation, the Gini coefficient and the Atkinson index.

We encountered a severe problem of multicollinearity in the course of estimating our model. The approach adopted to handle this problem is based on principal components. Kendall (1957) proposed the approach initially; Massy (1965) suggested an improvement; and recently the approach has been formulated more rigorously by Mundlak (1980). The basic idea is as follows. First, the principal components are extracted from the full set of explanatory variables. The dependent variable of the model is then regressed on all the principal components. After that, those principal components that turn out to be statistically insignificant are dropped. However, Massy (1965) and Mundlak (1980) differ on the criteria to determine the set of statistically insignificant principal components. According to the Massy method, a t-test is applied to determine the statistical significance of each component, while the Mundlak method uses an F-test to determine the largest possible set of statistically insignificant components. Once the set of significant principal components has been selected (according to either method), the dependent variable is regressed on the selected set. The estimated coefficients of the principal components are then transformed into the implied set of coefficients of the original explanatory variables. Similarly, the variances of the coefficients of the principal components are transformed into the variances of the coefficients of the original variables, and corresponding t-ratios are calculated. The experience in this thesis is that the principal component method has much to offer, relative to ordinary least squares.

The plan of the study is as follows. In the next chapter, we critically review the major work done in the area of this study. The main focus of the review is on various approaches adopted in the past to examine the effects of macro-economic variables on the size distribution of income. We also discuss the principal findings of the studies under review.

Chapter 3 is devoted to the development of our own model. It is argued that an income distribution can be viewed as an element of a larger macro-econometric system. We try to define the set of variables which affect, directly or indirectly, the distributional variables (the decile income levels relative to the mean income) within such a larger system. Some of the explanatory variables in the model are the unemployment rate, the labor force participation rate, the inflation rate, the change in the inflation rate, the rate of growth of the real wage rate, unemployment insurance benefits as a ratio to gross national product, and retirement and old age benefits as a ratio to gross national product.

Chapter 4 begins with a discussion of the income distribution data. We discuss, in some detail, the problems and limitations of the data drawn from Taxation Statistics and from the Survey of Consumer Finances. After that, we outline the methodology of estimation, which includes the principal components approach to handle the problem of multicollinearity. In the final section of the chapter, we present the results of estimation and discuss the experiments which led to those results.

In Chapter 5, the effects of the macro-economic variables on the relative decile income levels are analyzed. One of the main conclusions is that we could not find strong support for the common view that the lower income groups are hardest hit by unemployment and inflation.

The analysis of the results in Chapter 5 shows how various points of an income distribution respond to particular macro-economic variables. In Chapter 6, we examine the implied responses of overall income inequality to the macro-economic variables in terms of single-valued inequality measures represented by the coefficient of variation, the Gini coefficient and the Atkinson index. We find, in some cases, that these measures yield conflicting results.

In the final chapter, we summarize our work and our main conclusions. We also point out some avenues for future research.

CHAPTER 2

SURVEY OF THE LITERATURE

In this chapter, we review critically a number of major studies relevant to the present dissertation[1]. This review will serve two main purposes. First, it will give the reader a sense of the subject. Second, it will help us in developing an analytical framework to be followed in our study. While reviewing the studies, the main emphasis will be on the various approaches adopted in the past to examine the effects of macro-economic fluctuations on the size distribution of income. From past studies, we can identify four major approaches: micro-simulation; analysis of overall income inequality without distributional restrictions; overall income inequality with particular functional forms assumed; and the quantile approach. Section 2.1 gives a critical summary of each approach. It also looks at some of the main conclusions regarding the effects of macro-economic fluctuations on the income distribution, arrived at in the studies discussed here. The final section discusses the analytical approach to be followed in this study.

2.1 MAJOR APPROACHES TO THE ANALYSIS OF THE EFFECTS OF MACRO-ECONOMIC FLUCTUATIONS

2.1.1 MICRO-SIMULATION APPROACH

To examine the effects of changes in the macro-economic variables, the unemployment rate and the inflation rate, on the income distribution, micro-data on the incomes of individuals or families are employed. The effects of changes in the macro-variables on each individual's income are simulated and the resulting income distribution after simulation is compared with the original distribution to see the changes in income inequality.

Two alternative approaches have been used to specify a relationship between each individual's income and the macro-variables. According to the first approach, each individual's income is disaggregated into various components, say, wage and salary income, self-employment income, capital income, etc. From historical data, a relationship between each aggregate factor income (the construction of the factors correspond to the disaggregation of individual's income into various components) and the macro-variables is estimated. To simulate the effects of a given change in the macro-variables, the various components of each individual's income are adjusted using the estimated coefficients of the macro-variables. Then two distributions, before and after simulation, are compared to examine the changes in income inequality. This approach is adopted by Budd and Seiders (1971), Mirer (1973B), and Minarik (1979). The second approach divides individuals into different groups according to their race, sex, age and occupation rather than dividing each individual's income into various components as is done in the first approach. Again, from historical data a relationship between each group's income and the macro-variables is estimated. The estimated coefficients of the macro-variables are used to simulate the effects of a given change in the macro-variables on the income of the individuals. This approach is followed by Budd and Whiteman (1978).

All the above mentioned studies are based on U.S. data. One of these studies (Budd and Whiteman) investigates the effects of the unemployment rate only, two others (Budd and Seiders, Minarik) concentrate on the inflation rate only, and a fourth, (Mirer, 1973B) encompasses the effects of both variables. The conclusions arrived at in these studies are not always in complete agreement with each other. Differences in results can be attributed to differences in either one or a combination of the following: the time period, the income concept, the income recipient unit and the methodology. Contrary to general belief, some of the studies suggest that the incidence of unemployment or inflation is not regressive[2].

There are two other studies which are based on the longitudinal survey data on family income. Mirer (1973A) has annual U.S. data on the income of individual families over the period 1967-1970 and he poses this question: What would have been the income of these families in 1970 if the economic conditions of 1967-1969 had prevailed? (The unemployment rate was much higher in 1970 than it was in 1967-1969.) To answer his question, Mirer extrapolates each family's income experience of 1967-1969 to 1970. Then he expresses the actual income realized by each family in 1970 as a ratio to the extrapolated income and calls this ratio the "income realization rate" of each family. He finds that the lower income families, on the average, had a higher income realization rate than the upper income families. From this he concludes that in the 1970 recession the poorer families fared relatively better than the richer ones.

Gramlich (1974) uses the same data source as does Mirer on the income of families over the period 1967-1972 and employs somewhat different methodology. He concludes that the lower income families suffered relatively more because of the higher unemployment rate.

2.1.2 OVERALL INCOME INEQUALITY: DISTRIBUTION FREE APPROACH

In this approach (as well as in the remaining ones) the analysis is done with time-series macro-data on the income distribution. The approach is distribution free in the sense that the income distribution is not required to obey any particular statistical density function. Here the behaviour of income inequality over time is characterized by the movements of some single-valued measure of income inequality, such as the Gini coefficient. Then the fluctuations in income inequality are explained by the fluctuations in aggregate economic activity. This is accomplished by regressing the inequality measure on appropriate macro-economic variables.

Schultz (1969) selects two different measures, the Gini coefficient and the variance of the logarithm of income, to describe the behaviour of income inequality over time. He estimates his model with the Gini coefficient as the dependent variable and the unemployment rate, the inflation rate, the rate of growth of real GNP and a time trend as the explanatory variables. The basic income-recipient unit in his model is an individual with income, and the model is estimated for all individuals (males and females) in the U.S. over the period 1944-1965. He ends up with the following estimated equation:

$$(2.1) \qquad G = .475 - .0003\dot{P} + .0006\dot{Y} + .0015UR + .0014T$$
$$\qquad\qquad\qquad\quad (.005) \qquad (.0008) \qquad (.0025) \qquad (.0006)$$

$$R^2 = .543$$

where G is the Gini coefficient of income, $\dot{P}$ is the rate of change in wholesale prices, $\dot{Y}$ is the rate of change in real output, UR is the unemployment rate of the civilian labor force, and T is a linear time trend variable. The figures in brackets below the coefficients are their standard errors. It is obvious that the coefficients of $\dot{P}$, $\dot{Y}$ and UR are not statistically significant at any conventional significance level. However, Schultz argues that the signs of these coefficients accord with _a priori_ expectations. There are two serious problems with this approach. First, a number of summary measures of income inequality are available, and none of them claims the widespread support of economists. The main reason for the lack of this widespread support is that each measure is based on some implicit value judgements which are, in a way, quite arbitrary. For example, the degree of sensitivity to changes in different parts of the distribution may differ from one summary measure to another. Thus, the measures may record the same change in the distribution differently. By looking at Schultz's results, we observe that over some time periods the movements of his two measures are in different directions[3]. Shcultz estimates his model only using the Gini coefficient as the dependent variable. If he had estimated his model using variance of the logarithm of income as the dependent variable, he might have got different results. In fact, Beach (1977), using Schultz's published inequality data on males (Schultz estimates his regression model for males plus females), estimates the same model for the Gini coefficient and variance of log of income separately. In the case with the Gini coefficient as the dependent variable the coefficient of the unemployment rate is positive and statistically significant, but in the case with the variance of log of income it is negative and statistically insignificant. Thus, the results may depend critically on the choice of inequality measure. The second problem with all these summary measures is that they bring out only the net effect of changes in the distribution. It is quite possible that certain changes in the distribution may not show up in these measures at all, and that the measure may be misleading, or at least inadequately informative. For example, people at the lower end of the distribution may be losing relatively but an aggregate measure such as the Gini coefficient may indicate a reduction of income inequality simply because the distribution among higher income groups has become more equal.

2.1.3 OVERALL INCOME INEQUALITY: FUNCTIONAL FORM APPROACH

The basic idea of this approach is to fit a statistical density function to income distribution data, and then try to explain variations in the estimated parameters of the function over time.

In general, a number of functional forms can be used to fit a given set of income distribution data, Thurow (1970) argues for the beta function because it is flexible, has only two parameters and fits well the particular observed distributions in which he is interested. He estimates the parameters of the beta function (denoted by ρ and σ) for each year and then treats the estimated parameters as endogenous variables in his model. He works with the following model for U.S. households (families and unrelated individuals), with whites and blacks treated separately, for the period 1949-1966:

$$\rho \text{ or } \sigma = \beta_0 + \beta_1 \log(\frac{GNP}{E}) + \beta_2 \log(P) + \beta_3 \log(\frac{PI}{GNP}) + \beta_4 \log(\frac{E}{LF}) + \beta_5 \log(\frac{TP}{H}) + \beta_6 \log(\frac{GP}{H}) \quad (2.2)$$

where GNP is gross national product, E is total employment, P is the implicit GNP deflator, PI is personal income, LF is total labour force, TP is total transfer payments, H is the number of households, and GP is total government purchases of goods and services. Most of the coefficients of these variables turn out to be statistically significant. But as Beach (1972, p. 24) points out, it is very difficult to interpret his regression results becuase individually the dependent variables in (2.2) do not have any intuitive meaning as far as income concentration is concerned. Thurow's major conclusions are that (1) recession does not have any effect on the relative income distribution of whites, but for blacks it increases income inequality, and (2) a rise in the inflation rate reduces income inequality for whites, while for blacks it increases inequality.

Metcalf (1969, 1972) argues for the use of a functional form based on a displaced lognormal distribution. His argument is based on the empirical observation that income distribution is positively skewed. The log transformation of income can make the income distribution approximately normal but it usually overcorrects for positive skewness and turns the distribution into one that is negatively skewed. Metcalf suggests instead the transformation $\log(Y + C)$, where Y is income and C is some constant chosen so that $-C < Y < \infty$ and $\log(Y + C)$ has zero skewness. This displaced lognormal distribution thus has three parameters: mean, variance and constant of displacement. These parameters are estimated indirectly using three decile income levels: the first (D1); the fifth, or median (D5); and the ninth (D9)[4]. Unlike Thurow, Metcalf does not employ the estimated parameters of the displaced lognormal distribution directly as the dependent variables in his model; rather his dependent variables are M (the mean income), H = D1/D5, and J = D9/D5. From the M, H and J equations one can derive the implied responses of all the parameters of the displaced lognormal distribution. The advantage of this formulation is that H and J have identifiable relationships with the two tails of the distribution, and therefore the results are directly interpretable without making any reference to the assumption of displaced lognormality. Even if the assumption of a displaced lognormal distribution is not valid, the H and J equations retain some meaning.

Metcalf estimates his model for six subgroups in the population: families with a male head and wife in the labor force; families with a male head and wife not in the labor force; families with a male head having "other" marital status; families with a female head; unrelated individuals who were earners; and unrelated individuals who were not earners. The set of explanatory variables for each group is somewhat different. Some of the important explanatory variables employed are the unemployment rate, the implicit price deflator, the labor force participation rate, unemployment benefits per unemployed person, the annual rate of change of the wage rate, and corporate profits plus capital consumption allowances as a share of gross private product.

Metcalf's general conclusions are best summarized in his own words (Metcalf, 1972, pp. 66-67):

> "We can expect the following distributional response to a movement from recession to tight employment. The mean of the income distribution moves with an increase in output. As the unemployment rate falls and real wages rise, the lower tail of the distribution improves relative to the median. The upper tail of the distribution improves relative to the median when the nonwage share of personal income increases. This is more likely to occur in recessions rather than in the early stages of the boom, however, for the increased profit share found during boom periods is slow in finding its way into the personal income stream. Overall, the upper tail of the distribution tends to be fairly stable, in absolute terms, over the cycle. Equivalently, it improves relative to the median during recession and declines during periods of tight employment.
>
> Given this general pattern, families and individuals in the lower tail of the distribution who are not 'related' to the labor force tend to be harmed during inflationary periods, relative to the median. The extent of this harm, and the harm suffered by labor force oriented groups in a recession, depends upon the level of transfer payments. Not surprisingly, at a given level of wages and employment, the lower tail of the income distribution is improved relative to the median by increased levels of transfer payments."

Metcalf's assumption of a displaced lognormal distribution seems unnecessary because his results are directly interpretable without making any reference to that assumption. Further, his assumption may not be appropriate in all cases. As Beach points out (1972, p. 82):

> "In the case of income distributions for families with a male head, the fit may be fairly good. But some distributions, such as those for unrelated individuals, are more closely exponential than lognormal; and squeezing them into a displaced lognormal density results in a rather poor fit."

2.1.4 QUANTILE APPROACH

Under this approach the behaviour of the whole distribution is characterized by selected quantiles; these quantiles can be defined in terms of income levels (Beach) or income shares (Blinder and Esaki; Buse). The analysis of the effects of macro-economic variables on income inequality is conducted in terms of their effects on selected quantiles. This approach provides detailed information on how various income groups are affected by macro-economic fluctuations. Using the response of quantile income levels to changes in macro-economic variables, Beach (1977) derives the implied behaviour of overall income inequality, defined in terms of conventional summary measures of income inequality (Gini coefficient, Atkinson index, coefficient of variation, and others).

Beach's model (1972, 1976, 1977) is based on nine decile income levels. The ith decile is defined to be that level of income such that 10 × i percent of the population of the distribution have income less than or equal to that level. Each decile can have many income components based on different sources of income. Thus, the income of the ith decile can be expressed as the sum of these income components:

$$D_i = YE_i + YU_i + YT_i + YK_i + YF_i + YO_i \tag{2.3}$$

where D_i is ith decile income level, YE_i is income received from employment, YU_i is average unemployment compensation benefits received, YT_i is transfers income excluding unemployment benefits, YK_i is capital income, YF_i is farm proprietary income and YO_i represents all other minor sources of income. The first two income components, YE_i and YU_i, can be further disaggregated into:

$$\begin{aligned} YE_i &= (PR_i)(ER_i)(W_i) \\ YU_i &= (PR_i(UR_i)(UB_i) \end{aligned} \tag{2.4}$$

where PR_i is the ith decile labor force participation rate, ER_i is the employment rate, UR_i is the unemployment rate $(1 - ER_i)$, W_i is the wage rate, and UB_i is the rate of unemployment compensation. The variables on the right hand side of (2.3) and (2.4) are specific to the ith decile and there are no decile-specific data available. Thus, Beach assumes that these decile-specific variables are nondecreasing linear functions of their corresponding observed economic aggregates. For example,

$$
\begin{array}{lll}
PR_i = \alpha_{PR_i} + \delta_{PR_i} PR & & \delta_{PR_i} \geq 0 \\
ER_i = \alpha_{ER_i} + \delta_{ER_i} ER & & \delta_{ER_i} \geq 0 \\
\vdots \qquad \vdots \qquad \vdots & & \vdots \\
YF_i = \alpha_{YF_i} + \delta_{YF_i} YF & & \delta_{YF_i} \geq 0
\end{array}
\tag{2.5}
$$

Beach's assumption of nondecreasing relationships between the decile-specific variables and the corresponding observable economic aggregates is not necessary, and it also may not be true in all cases. For example, the aggregate participation rate may rise due to the "added worker" effect, while the participation rates of some subgroups might fall due to the "discouraged worker" effect. By combining (2.3), (2.4) and (2.5), a reduced form equation for the ith decile is obtained. Similarly, an equation for the mean income of the distribution is specified. Thus, Beach's model consists of ten equations: nine decile equations and a mean income equation[5]. Then he imposes two types of restrictions on the coefficients of the variables. The first are homogeneity restrictions and are imposed within the equations. He argues, on a priori grounds, that some of the explanatory variables have no effect at all on some decile equations. The second type of restrictions are adding-up restrictions and are imposed on the coefficients of the variables across the equations. The idea behind these is that a change in some explanatory variable affects the whole distribution, and that the effect on individual deciles should sum to the total effect of the initial change. In other words, the average effect upon the individual deciles should equal the effect upon the mean income of the distribution.

An important aspect of Beach's model is that all the variables are in nominal terms and the price level does not play any role directly. As Beach, (1972,pp. 58-61) himself points out, there are three possible distributional effects of inflation, namely a wealth effect, an expenditure effect, and an income effect. The wealth effect pertains to changes in the real value of financial assets with fixed monetary value. This effect is ignored because his study is not concerned with the distribution of wealth. The expenditure effect arises because different income groups consume different bundles of goods, the prices of which can rise at different rates. Beach refers to a study by Hollister and Palmer (1972) in which such expenditure effect is found to be rather minor. The income effect derives from the inability of some groups, especially fixed-income recipients, to protect their real incomes against inflation. In this context, Beach refers to a study by Bach and Ando (1957) in which it was found that relatively fixed income individuals were more or less scattered throughout the distribution, rather than being concentrated in some particular income group or groups. From all these studies, Beach concludes that inflation per se does not have any substantial effect upon the distribution of personal income. This conclusion may not be that unreasonable considering that the time periods covered in his studies are 1947-1970 and 1947-1973. The problem of inflation has become much more serious since 1973, suggesting the possibility that its distributional effects may have been more pronounced in recent years. With this in mind, we introduce the price variable as one of the explanatory variables in our model.

From the decile equations, Beach (1977) derives the implied responses both of income shares and of conventional summary measures of income inequality. Thus his approach is quite flexible. It provides the opportunity to look at the effects of changes in the macro-economic variables on the income distribution at both disaggregated and aggregated levels.

Beach's 1972 and 1976 studies are based on U.S. time series (1947-1970) data on the income distribution of males of different ages. His 1977 study is also for the U.S.; it covers a slightly longer period (1947-1973) and is based on the income distribution of male individuals, all ages combined. His major findings are that

> "... inequality among secondary aged males fourteen to nineteen and sixty-five and over tends to fluctuate pro-cyclically, while among the remaining groups aged twenty to sixty-four, it tends to move anticyclically at least in so far as the participation and employment rate effects are concerned."[6]

Blinder and Esaki (1978) report regressions of income shares (quintiles) on the unemployment rate, the inflation rate and a linear time trend variable. Their study is based on U.S. family income distributions over the period 1947-1974. They conclude that the incidence of unemployment is quite regressive and of inflation slightly progressive.

Buse (1982) is quite important from the point of view of our study because his study is the only one conducted in the Canadian context. The income distribution data are drawn from the Taxation Statistics of Revenue Canada and the size distribution is based on individual tax returns (both taxable and non-taxable). Income inequality is measured by the Gini coefficient and the income shares (quintiles and deciles). In the case of the Gini coefficient as the dependent variable in the model, both the unemployment rate and the inflation rate turn out to be statistically insignificant. Both have positive coefficients, which means an increase in either the unemployment rate or the inflation rate is associated with an increase in income inequality. The aggregate labor force participation rate has significant equalizing effect on the income distribution. The results are not much different when quintile shares are used as the dependent variables in the model. The coefficients of the unemployment rate and the inflation rate are again statistically insignificant. However, in the case of the unemployment rate a systematic pattern of inequality emerges which implies that lower income groups may lose their income share to higher income groups as the unemployment rate rises, even though statistical significance is not attained for the individual coefficients. There is no such systemmatic effect in the case of the inflation rate. As before, the aggregate labor force participation rate has significant equalizing effect on the income distribution. After the failure of the Gini coefficient and the quintile share models to establish statistically significant effects of the unemployment and inflation rates, Buse tries to determine the effects of these variables on the bottom and the top decile shares. The unemployment rate and the inflation rate do have statistically significant (negative) effects on the bottom decile share, but there is no significant effects on the top decile. However, Buse finds some evidence that the top decile share is positively linked to the share of pre-tax corporate profits in GNP.

Buse mentions some other variables, such as transfer payments, wage rates, GNP growth rates and government expenditures, that might account for variations in the income distribution but does not experiment with these explanatory variables in any of his models. It is possible that such variables might have led to an improvement in the determination of unemployment and inflation effects.

2.2 THE APPROACH FOLLOWED IN THIS STUDY

In any empirical study the choice of a framework of analysis is motivated by the objective of the investigator and the availability of data. Our objective is to examine the effects of macro-economic variables on the size distribution of income. As noted previously, time series income distribution data are available from the Taxation Statistics of Revenue Canada and the Survey of Consumer Finances of Statistics Canada. We would require an approach that allows the detailed analysis of changes in these distributional data, and makes it possible to analyze the behaviour of various parts of the distributions as the macro-economic variables fluctuate. We wish also to be able to infer the response of overall income inequality from the behaviour of the particular parts of the distributions.

Beach's use of quantiles seems most suitable for our purposes, and we follow his general approach. However, we introduce some modifications to Beach's model. We discuss these modifications in the next chapter and describe our own model in detail.

FOOTNOTES

Chapter 2

1. The following studies are of some relevance but are not reviewed in this chapter due to space limitations: Goldenthal (1940), Mendershausen (1946), Hanna, Pechman and Lerner (1948), Kuznets (1953), Creamer (1956), Gallaway (1965), Aaron (1967), Anderson (1967), Perl and Solnick (1971), and Hollister and Palmer (1972). Most of these studies are of a descriptive nature. A good summary of these studies can be found in Beach (1972, Ch. 2).

2. See Budd and Whiteman (1978) and Minarik (1979).

3. See Schultz (1969), Tables 1 and 2, pp. 79-81.

4. The first decile is defined to be that level of income such that 10 percent of the population of the distribution have income equal to or less than that level; for the fifth decile it is 50 percent of the population; and for the ninth it is 90 percent of the population.

5. Some of his work (1972, 1976) does not incorporate an equation for mean income. In those studies, his model is based on decile equations only.

6. Beach (1976), pp. 44-45.

CHAPTER 3

A MODEL OF MACRO-ECONOMIC INFLUENCES ON THE DISTRIBUTION OF INCOME

Many factors may influence the income distribution, but we are interested primarily in analyzing the effects of macro-economic variables. In Section 3.1, we formally develop our model. We consider the income distribution as a component of a full macro-econometric system and define a set of variables in that larger system that would affect the income distribution, either directly or indirectly. In Section 3.2, we discuss the possible effects of each macro-economic variable on the degree of inequality represented by the income distribution.

3.1 SPECIFICATION OF THE MODEL

We are interested in defining those macro-economic variables that would influence the income distribution. We conceive of a full-macro-econometric model of which the income distribution sector is a component. The parameters of the income distribution, which can change from year to year, are determined within that model. Let the general form of our macro-econometric model be given by the following implicit functional relation:

$$(3.1) \qquad F(D/M,\ Y_1,\ Y_2,\ Z) \;=\; 0$$

where D/M is a set of decile income levels, expressed as ratios to the mean of the distribution. The vector variable Y_1 represents the set of endogenous variables that have either direct or indirect effects on the income distribution (the unemployment rate, the inflation rate, etc.). The vector variable Y_2 represents the set of endogenous variables that are directly affected by income distribution variables. (These variables would include the aggregate consumption expenditures, personal income tax yield, etc.) The vector variable Z stands for the set of exogenous variables in the system; these variables can have direct or indirect effects on the income distribution. (Government expenditures on goods and services, exports, and demographic variables can be considered in this category.)

As stated earlier, Y_2 is directly affected by the distributional variables and (under appropriate assumptions) we can solve (3.1) to obtain an explicit solution for Y_2 in terms of the other variables of the system. That is,

$$(3.2) \qquad Y_2 = G(D/M, Y_1, Z)$$

Using (3.2) we can substitute in (3.1) to eliminate Y_2 obtaining

$$(3.3) \qquad F(D/M, Y_1, Z, G(D/M, Y_1, Z)) = 0$$

Next, we can solve the system (3.3) explicitly for D/M in terms of other variables. That is,

$$(3.4) \qquad D/M = H(Y_1, Z)$$

Writing $\overline{X} = (Y_1, Z)$, and introducing an error vector (u) into the model, we can then rewrite (3.4) as

$$(3.5) \qquad D/M = H(\overline{X}) + u$$

We assume that the model (3.5) is linear. This can be considered as an approximation to reality. The vector $\overline{X}$, which represents the set of explanatory variables of the income distribution model, will be defined shortly.

We have tried to analyze a large number of income distributions. They include distributions for all families, families with head in a specific age group, all individuals, all male individuals, male individuals in a specific age group.

The vector $\overline{X}$ is defined, for our purposes, to consist of the following variables. (All variables identified as rates are in percentage form.):

UR	: overall unemployment rate
FPR	: female labor force participation rate (women 15 and over)
PR15	: labor force participation rate of those aged 15-24 (both sexes)
PR65	: labor force participation rate of those aged 65 and over (both sexes)
PROP15	: population aged 15-24 as a ratio to population aged 15 and over
PROP65	: population aged 65 and over as a ratio to population aged 15 and over
$\dot{P}$	: inflation rate defined as annual percentage change in the consumer price index
$\Delta\dot{P}$	: change in the inflation rate
$\dot{W}$	: rate of growth of the real wage rate (represented by industrial composite average weekly wages and salaries deflated by the consumer price index)
YRNF/GNP*	: net realized farm income as a ratio to gross national product adjusted for fluctuations in farm inventories (GNP*)
PROF/GNP*	: pre-tax corporate profits as a ratio to GNP*

YUB/GNP* : unemployment insurance benefits as a ratio to GNP*

YOB/GNP* : retirement and old age benefits as a ratio to GNP*

GE/GNP* : government expenditures on goods and services as a ratio to GNP*

X/GNP* : exports of goods and services as a ratio to GNP*

The foregoing represents the basic and most comprehensive definition of the $\overline{X}$ vector. We modify the set of explanatory variables for different income distributions. These modifications are discussed in the next chapter where we discuss the estimation of our model for different income distributions.

3.2 THEORETICAL EXPLANATIONS OF THE EFFECTS OF THE MACRO-ECONOMIC VARIABLES ON THE INCOME DISTRIBUTION

Most of the discussion of the possible effects of the macro-economic variables just listed will be carried out in general terms, i.e., without making reference to any particular income distribution. We look at the possible effects of each variable separately.

UNEMPLOYMENT RATE (UR)

The distributional consequences of changes in the unemployment rate are discussed in many places in the literature[1]. The common view is that lower paid workers are the main victims of higher unemployment. It is argued that the least skilled and least experienced workers lose their jobs first. Moreover, the lower paid workers who do have jobs experience a decline in their relative wages as a result of their greater excess supply in times of higher unemployment. Some economists have tried to rationalize this phenomenon of greater probability of losing jobs for less skilled and lower paid workers during a recession. Budd and Whiteman discuss the attempts of Oi (1962) and Reder (1955, 1962, 1964) in this context. Oi offers an explanation in terms of human capital theory. Budd and Whiteman (1978, p. 13) summarize his explanation in the following way:

> "Employers incur a fixed cost in hiring workers and in providing them with specific on-the-job training (i.e., training which raises the productivity of a worker to a specific employer, but not to others), and they must expect to be able to recoup these costs (in terms of the difference between the worker's specific marginal product and wage rate) over the worker's tenure with the firm. The ratio between this cost and the wage rate (the degree of fixity), Oi argues, is greater for those with larger investment in human capital, hence more skilled and more highly paid. During periods of declining product demand the employer thus has more of

> an incentive to retain such workers and to concentrate layoffs among those with little specific training. The results are larger increases in unemployment among the unskilled and/or widening of wage differentials (assuming relatively inelastic labor supplies and sufficient wage flexibility)."

Reder explains the same phenomenon in a somewhat different way. He argues that during recession employers use their underemployed skilled workers for less skilled jobs rather than laying them off. The employers avoid laying off their skilled workers in a recession because they are afraid of losing them permanently. They are also afraid of higher costs of rehiring such workers in subsequent recoveries.

Generally, most of the unemployment can be attributed to lower income groups. However, as unemployment rises it may have an increasing impact on higher paid workers. Moreover, the higher paid workers who are able to keep their jobs during a downswing may be forced to work fewer hours. Professionals and other self-employed may also suffer income losses during a recession. Thus, it is possible that those who belong to the upper part of the distribution may suffer income losses as well during periods of high unemployment. If people from all parts of the distribution suffer income losses during a recession, then the ultimate impact on income inequality will depend on which part of the distribution loses the most.

FEMALE LABOR FORCE PARTICIPATION RATE (FPR)

Over the years the composition of labor supply has changed substantially. The female labor force participation rate almost doubled during the period 1947-1979. The distributional consequences of an increase in the FPR will depend, to some extent, on the nature of the income distribution being analyzed. If the distribution is that of all individuals, then the most likely impact of an increase in the FPR would be an increase in income inequality since females, generally, have gone into those occupations that are lower paid, and as a result have entered in the lower segments of the income distribution. According to Weisskoff (1972), the main reason for female concentration in lower paid jobs is that the labor market is segregated on the basis of sex:

> "Thus it appears that the enormous postwar expansion of the female labor force has not altered the segregated nature of female employment. The increasing numbers of women have been absorbed into the labor force not through an across-the-board expansion of employment opportunities, but rather through a growth in traditionally female jobs, particularly in the clerical and service category, through the emergence of new occupations that rapidly became female, and, in some cases, through a shift in the sexual composition of an occupation from male to female." (p. 163)

It is hard to predict the effects of changes in the FPR on the income distribution of families[2]. If the wives of those who are in the lower income groups start working, that will increase their family income, and as a result income inequality will decline. However, the income inequality might increase if the wives whose husbands are in the higher income brackets also join the labor force. The situation becomes more complicated when one considers the indirect effects of the increase in the FPR, such as a substantial increase in the number of single-parent families[3]. It is also possible that the work habits of husbands may be affected if their wives start working.

LABOR FORCE PARTICIPATION RATE OF THOSE AGED 15-24 (PR15)

Persons in the labor force from the age group 15-24 obviously would not have much work experience, and their lack of experience would tend to put them in lower income groups. However, if they have some skill or a higher-than-average level of education they may be further up the income ladder. It is difficult to predict, *a priori*, the net distributional consequences of changes in the PR15 variable.

LABOR FORCE PARTICIPATION RATE OF THOSE AGED 65 AND OVER (PR65)

Participation rate for persons 65 and over has been declining over the years. Most of the people in this age group live primarily on retirement or old age pensions, and as a result many are in lower segments of the income distribution. If they continue working they will supplement their incomes from other sources. One might expect, therefore, that an increase in the PR65 variable would reduce income inequality, *ceteris paribus*.

POPULATION AGED 15-24 AS A RATIO TO POPULATION AGED 15 AND OVER (PROP15)

Demographic changes can have an important influence on the income distribution. Inequality will increase if the population share of the age groups with lower incomes increases. The most likely impact of an increase in the PROP15 variable will be an increase in income inequality.

POPULATION AGED 65 AND OVER AS A RATIO TO POPULATION AGED 15 AND OVER (PROP65)

The majority of the population in the age group 65 and over can be classified as in the lower part of the income distribution. Therefore, any increase in the PROP65 variable will tend to increase income inequality.

INFLATION RATE ($\dot{P}$)

Although there is no formal model that spells out the effects of the inflation on the size distribution of income, the popular belief is that it causes a redistribution away from the poor to the rich. An income group is relatively worse off when the nominal income of the group does not keep pace with the prices of the commodities consumed by that group. The bundles of goods and services consumed by different income groups may not be the same, and the prices of these bundles can rise at different rates. An income group that experiences a disproportionate increase in prices is adversely affected in so far as the "expenditure effects" of inflation are concerned. For example, if the price of food rises disproportionately, and the poor spend a larger share of their income on food, then the overall price increase experienced by the poor is larger than that experienced by other groups. Palmer and Barth (1977) constructed separate price indices for the poor and the rich, and found the changes in these price indices over time to be very close. From this they conclude that the expenditure effects of inflation are rather minor. Denton, Kliman and Spencer (1981) calculated an overall Canadian index of consumer prices for the elderly for the period 1971-1978 and found it almost identical to the official consumer price index. In our study we ignore the expenditure effects of inflation. However, it should be emphasized that even if the prices of all commodities rise at the same rate, the hardship will be greater for the poor than for the non-poor if their nominal income does not rise at the rate of inflation, owing to their higher marginal utility of income. This brings us to the "income effects" of inflation. Some people are not able to raise their nominal incomes sufficiently rapidly to compensate for general price increases. For example, unorganized labor may not be able to obtain full cost-of-living adjustments. Moreover, the people living on fixed incomes (e.g., private pensions) will witness an erosion in their purchasing power during inflationary periods. As long as there are some income groups that cannot protect their real incomes against inflation, there will be changes in the relative income distribution.

Schultz (1969) argues that inflation can increase or decrease income inequality, depending upon the origin of the inflationary forces. Income inequality will increase if the inflation is due to demand forces, because prices will rise faster than costs, and this will increase profit shares. Since profits go mainly to upper income groups, this will increase their share in total income, and as a result income inequality will increase. On the other hand, if inflation is the result of cost-push forces, then income inequality will decrease because the share of profits will fall relative to wages, which in turn will reduce the share of upper income groups.

CHANGE IN THE INFLATION RATE ($\Delta\dot{P}$)

The distributional consequences of unanticipated inflation may differ from those when inflation is fully anticipated. The variable $\Delta\dot{P}$ is intended to capture, to some extent, the effects of unanticipated inflation. In addition, the incorporation of $\Delta\dot{P}$ into the model implies some allowance for possible lagged effects of the inflation. $\Delta\dot{P}$ is defined by

$$(3.6) \qquad \Delta\dot{P}_t = \dot{P}_t - \dot{P}_{t-1}$$

RATE OF GROWTH OF THE REAL WAGE RATE ($\dot{W}$)

Workers who are well organized and working in larger establishments might be expected to benefit the most, at least in the short run, from the rate of growth of real wage rate (defined to include both wages and salaries). However, it is hard to speculate, a priori, as to the effects of changes in $\dot{W}$ on the income distribution. The effects of the rate of growth of the nominal wage rate can be examined by combining the coefficients of $\dot{W}$ and $\dot{P}$ since the rate of growth of the nominal rate is equal to $\dot{W}$ plus $\dot{P}$.[5]

The effects of $\dot{W}$ on the income distribution can also be interpreted as the effects of productivity growth of the economy if we think of $\dot{W}$ as a proxy for such growth. Again, it is difficult to predict the effects of productivity growth on the income distribution as a whole. However, we can predict the effects for one particular group -- people living on fixed income such as old age pensioners. Since the income of these people are, at best, only partially indexed to the rate of inflation, their relative economic position deteriorates (improves) when there is positive (negative) growth of real wages.

NET REALIZED FARM INCOME AS A RATIO TO GNP* (YRNF/GNP*)

Most farmers belong to the lower or middle part of the income distribution[3]. Any increase in YRNF/GNP* is therefore expected to reduce income inequality.

PRE-TAX CORPORATE PROFITS AS A RATIO TO GNP* (PROF/GNP*)

Generally, corporate profits accrue to higher income groups. The direct effect of an increase in PROF/GNP* should therefore be an increase in income inequality. However, a higher value of PROF/GNP* may also reflect a higher level of economic activity, and it is difficult to predict who will benefit most from such activity.

UNEMPLOYMENT INSURANCE BENEFITS AS A RATIO TO GNP* (YUB/GNP*)

Unemployment insurance benefits are not restricted to any particular income group, although there is a maximum level of benefit that can be received. The levels were raised substantially in 1972 and the coverage of the unemployment insurance program was extended at the same time. To the extent that unemployment is concentrated in lower income groups, the benefits should tend to reduce income inequality. However, benefits are determined by previous employment, and are subject to exhaustion if unemployment persists. Moreover, it has been argued that unemployment insurance may reduce work effort and lengthen the duration of unemployment[6]. Thus, some people may prefer to remain unemployed for a longer period and hence accept a lower level of income. This makes it unwise to be categorical about the expected net impact of unemployment insurance benefits on overall income inequality.

RETIREMENT AND OLD AGE BENEFITS AS A RATIO TO GNP* (YOB/GNP*)

These benefits accrue mainly to persons 65 years of age and over, and since people in this age group tend to be concentrated in lower income groups, so should be the benefits. One might therefore expect that benefits would tend to reduce income inequality. Again, though, there may be effects on work incentives, and these may be difficult to disentangle from the direct effects of the benefit payments on annual income levels. Work incentive effects may induce lower labor force participation in the older population, but they may also be operative in other age groups if the incentive to save for retirement is reduced[7].

GOVERNMENT EXPENDITURES ON GOODS AND SERVICES AS A RATIO TO GNP* (GE/GNP*)

A higher value of GE/GNP* means a larger public sector. It can be argued that an enlarged public sector brings greater economic stability since this sector is largely protected from business cycles. However, it is difficult to say who benefits the most from economic stability. Moreover, the argument that an enlarged public sector means greater economic stability invites the counter-argument that modern government policies themselves are a major source of economic instability in the private sector. The net effects of GE/GNP* are therefore uncertain.

EXPORTS OF GOODS AND SERVICES AS A RATIO TO GNP* (X/GNP*)

We have argued that the income distribution sector should be viewed as a component of a full macro-econometric model and have tried to choose variables that affect the distribution either directly or indirectly. X/GNP* may be regarded as an exogenous variable in the larger model and its effects on the income distribution as mainly indirect. An increase in X/GNP* generally implies greater economic activity but it is hard to predict how the benefits of expanded exports will be spread across the income distribution.

We conclude our discussion of the possible effects of the macro-economic variables on the income distribution by emphasizing that, for most variables, it is very difficult to determine, *a priori*, their effects on the degree of income inequality. In the next chapter, we estimate our model with different income distributions and let the data speak for themselves.

FOOTNOTES

Chapter 3

1. See, for example, Mendershausen (1946), Schultz (1969), Budd and Whiteman (1978). Buse (1982) explains the distributional effects of unemployment with the help of the Lorenz curve.

2. See Danziger (1980) and Bergmann et al. (1980) on this subject.

3. See Danziger (1980).

4. See Income Distribution by Size in Canada, 1965, Statistics Canada, Catalogue 13-528, p. 19.

5. The real wage rate (W) can be defined as

$$W = \frac{\omega}{P} \tag{3.7}$$

where ω is the nominal wage rate and P is the price deflator. We can write (3.7) as

$$\omega = PW \tag{3.8}$$

If we take the log of both sides, we obtain

$$\log \omega = \log P + \log W \tag{3.9}$$

By taking total differential of (3.9), we can write

$$\frac{d\omega}{\omega} = \frac{dP}{P} + \frac{dW}{W} \tag{3.10}$$

or

$$\dot{\omega} = \dot{P} + \dot{W} \tag{3.11}$$

where $\dot{\omega}$ is the rate of growth of the nominal wage rate, $\dot{P}$ is the rate of inflation and $\dot{W}$ is the rate of growth of the real wage rate.

6. See, for example, Danziger et al. (1981).

7. See Danziger et al. (1981), p. 979.

CHAPTER 4

DATA AND ESTIMATION OF THE MODEL

We now turn to a discussion of the data and the methods employed to estimate the model that is represented, in general form, by equation (3.5). Section 4.1 focuses on the data. Most of that section is devoted to the discussion of the income distribution data which are drawn from two sources: Taxation Statistics of Revenue Canada and the Survey of Consumer Finances of Statistics Canada. In Section 4.2 we discuss the methodological approach, based on the use of principal components, that we have adopted to handle the problem of multicollinearity. In the last section, 4.3, we present the final results of estimation and describe the particular procedures and experiments that led to those results.

4.1 DATA

In this section, we discuss the nature of the data employed in the study. The main focus of our discussion is the income distribution data. Detailed descriptions of data sources are provided in Appendix A.

4.1.1 DATA ON THE SIZE DISTRIBUTION OF INCOME

The size distribution of income, as revealed by Taxation Statistics, is based on samples drawn from the tax returns filed by individuals. We employ data on the distribution of all returns -- both taxable and non-taxable. Where the data on taxable and non-taxable returns are reported separately, we combine them to obtain the distribution of all returns[1]. The income concept used in Taxation Statistics is total income assessed (pre-tax gross income before any allowable deductions are made). It may be argued, on welfare grounds, that the distribution for analysis should be based on after-tax income. However, this argument leads to serious complications if one considers all kinds of taxes in the system, not just the income tax, and also various kinds of government-provided services. We return to this issue towards the end of the present section.

There are a few problems with the taxation data which should be noted[2]. Some of these problems are specific to particular income distribution series, and it is best therefore to treat them in conjunction with the discussion of the types of series being analyzed. As mentioned earlier, the size distribution of income in Taxation Statistics is based on a sample of individual tax returns. Therefore, there are no data on the income distribution of families. One of the distribution series is based on all individuals -- males plus females. This is the longest series available from Taxation Statistics. The time period covered by this series, in our study, is 1947-1979. In 1963, data started to be published for males and females separately, and in different age groups. We have made use of the income distribution series for males of all ages combined and for males in the age groups under 25, 25-64, and 65 and over. Data are available for more detailed age groups in some cases but we have aggregated the group distributions to obtain these three[3]. We decided to aggregate the distributions into only three categories on the grounds that the more detailed ones are likely to be rather similar from the point of view of the present analysis[4]. The time period covered, in our study, by the aggregated age series is 1963-1979.

As mentioned earlier, there are a few problems with the taxation data. First, there is a problem of joint returns filed by both spouses. Joint filing is common when one spouse has an income that is quite small. However, each spouse is required by law to file a tax return separately if his or her income exceeds a certain minimum level. This level has varied over the years but has remained relatively low[5]. Thus, we can presume that the phenomenon of joint returns has negligible effect on the relative income distribution. Second, some people with very low incomes may not file tax returns at all. However, one should remember that it is a criminal offence not to file a tax return if one's income is in the taxable range. The basic personal examption limits have been relatively low and we expect that above these limits the filing of tax returns should be almost universal. The basic personal exemption limit was raised in 1949 from $750 to $1000. This limit remained effective until 1971 when it was raised to $1500. Since then it has been adjusted annually for the rate of inflation. Buse (1982) argues that the changes in the exemption limit in 1949 and 1972 must have affected the total numbers of tax returns filed, which in turn, must have affected the relative income distribution. To capture the effect of this structural change, Buse introduces dummy variables for these years. Our view is that these increases should not have had any substantial effect on the relative income distribution[6]. However, we introduce the same dummy variables into our model to see how much difference they make to the results. Third, there was a slight change in the definition of income in 1972 when unemployment insurance benefits and net taxable capital gains[7] became part of pre-tax income. One may argue that the inclusion of these two items would have had offsetting impacts on relative income inequality since unemployment benefits are received, in large measure, by lower income groups, whereas capital gains accrue mainly to higher income groups. However, inclusion of unemployment benefits in pre-tax gross income has significant implications of another kind. One of our explanatory variables is the ratio of unemployment benefits to GNP*, and we have therefore modified this variable to take account of the change: the unemployment benefit ratio variable is assigned a zero value up to 1971, and after that, its actual value; in the analysis of the taxation data, this variable thus does not become operative until 1972. We note that unemployment insurance benefit levels were raised substantially in 1972, and that the insurance coverage was also extended at that time. Accordingly, these benefits have become much larger in relation to GNP* since 1972. Finally, the introduction of the child tax credit in 1978 generated a large number of new tax returns with zero or very little income. Buse (1982) introduces a dummy variable to capture the impact of this structural change in the tax system, and we do the same in our analysis based on taxation data for males and females combined. The child tax credit appears not to have had much impact on the income distributions for male individuals, either in total or in particular age groups because almost all of the tax returns in which the credit is claimed are filed by females. The dummy variable is therefore not employed in the analysis of the data for males alone.

The second source of data on the income distribution is the Survey of Consumer Finances. This Survey provides sample estimates of income distribution of families as well as individuals. The main problem with the Survey series is that they are not continuous over time. The Survey has been conducted annually since 1971, prior to which it provided data only for the years 1951, 1954, 1957, 1959, 1961, 1965, 1967, and 1969. If we use only the continuous annual data since 1971, the series are too short for effective regression analysis because of the number of explanatory variables involved. Serious consideration was given to generating estimates for the earlier missing years, the idea being to use an interpolation technique based on the available annual taxation series. However, this approach seemed unsatisfactory and was abandoned. Instead, the Survey series were simply used in the form in which they are available (i.e., with the missing earlier years). Thus the income distribution series drawn from the Survey are based on the following years: 1951, 1954, 1957, 1959, 1961, 1965, 1967, 1969, and 1971-1979. (The utilized data on the explanatory variables relate, of course, to these same years.)

Coverage of the Survey was enlarged in 1965 when individuals and families with farm income were also included. (Prior to 1965, the Survey was limited to individuals and families with non-farm income only.) However, this change in coverage had little impact on the relative income distributions being analyzed in this study. For 1965 only, income distributions based on non-farm income as well as non-farm plus farm income are reported separately. When we compare these distributions, we find negligible differences between them. Ross (1980, footnote to Table 1) arrives at the same conclusion.

The specific income distribution series from the Survey of Consumer Finances that we use in our analysis are as follows:

All Families and Unattached Individuals,
All Families,
Families: Age of Head Under 25,
Families: Age of Head 25-64,
Families: Age of Head 65 and Over,
All Individuals,
All Male Individuals,
Male Individuals of Age Under 25,
Male Individuals of Age 25-64,
Male Individuals of Age 65 and Over

The Survey defines a family as a group of individuals sharing a common dwelling unit and related by blood, marriage or adoption. Thus, all relatives living together are considered to be part of a family, irrespective of the degree of their family relationships. Unattached individuals are persons living alone or rooming in a household where they are not related to other household members. Unattached individuals are considered households by themselves. Thus, the income distribution for all families and unattached individuals combined can be considered as the distribution for all households.

The head of a family, in the Survey, is determined in the following manner:

> "...(i) in families consisting of married couples with or without children, the husband is considered the head; (ii) in single-parent families with unmarried children, the parent is the head; (iii) in single-parent families with married children, the member who is mainly responsible for the maintenance of the family becomes the head; and (iv) in families where relationships are other than husband-wife or parent-child, normally the eldest in the family is considered the head."[8]

The income distribution for individuals relates to individuals of age 15 years and over who received income during the year. Here every individual is treated as a separate unit, and whether an individual belongs to a family or not is of no concern.

Some of the distributions being analyzed belong to specific age groups. One such distribution is for families with age of head 25-64. In fact, the data are reported in terms of more detailed age groups (25-34, 35-44, 45-54, and 55-64) and we have combined these[9]. For a few later years the age group 65 and over is divided into two groups (65-69 and 70 and over) and we have aggregated these also. Similarly, we have aggregated, where necessary, the age group distributions for male individuals to obtain the age group distributions for under 25, 25-64, and 65 and over[10].

All income distributions from the Survey are based on the income of individuals who are at least 15 years of age. If a person is under 15 years of age any income that he or she may have received is not considered a part of the family income and that person is not included in the income distribution for individuals. Prior to 1975, the minimum age was 14 years. Statistics Canada notes that the impact of this change on the income distributions is unimportant:

> "In terms of the income distributions, the impact of the exclusion of 14 year olds is minimal. One of the most affected categories is obviously the '19 years and under' grouping [in our case this is a component of 'under 25 years']... However, the general shape of this distribution is not changed by the exclusion of 14 year olds... The exclusion of 14 year olds affected the averages and distributions in the family income series even less."[11]

All the income distribution series being analyzed in this study are based on current dollar pre-tax incomes. The relative income inequality remains the same irrespective of whether income is measured in current dollars or in constant dollars, as long as the same price index has been used to convert every group's current dollar income into constant dollars. The pre-tax income concept might appear inappropriate because the utility that a person obtains from his income depends on what he is able to use rather than what he is paid[12]. However, this argument loses much of its weight when one considers not only the personal income tax but other taxes and government expenditures also[13]. The personal income tax structure in Canada is highly progressive, and the after-tax income distribution should therefore exhibit a smaller degree of inequality than the pre-tax distribution, if only the income tax is considered. Ross (1980) compares pre-tax and after-tax income distributions of all families and unattached individuals on this basis for the years 1971-1977 and concludes the following:

> "To be sure, the income tax redistributes in favor of low income recipients but its impact is less considerable than commonly imagined."[14]

Now if we go one step further and look at all taxes in the system, we find that the redistributive impact of income tax is offset to a large extent by other taxes which are regressive in nature. Ross (1980) reviews the issue and concludes as follows:

> "The present tax system as a whole does little to equalize incomes. This means that if governments continued to levy taxes in the present manner and never returned the money to the public through the expenditure side, there would be little change in the percentages of total income going to each quintile -- in fact, the lowest quintile might be worse off. The same cannot be said of the personal income tax system, which is generally progressive in nature but whose redistributive effects are largely offset by regressive sales and property taxes. Consequently, if government budgetary action has tended to equalize incomes in Canada, it must have been due to a progressive expenditure program."[15]

When we examine the expenditure side of the fiscal system, we face such complicated issues as who benefits from government expenditures on defence, education, health, etc. Different assumptions about the allocation of these expenditures among income classes will lead to different conclusions. A substantial part of government expenditures goes to cash transfer payments -- unemployment insurance benefits, old age benefits, etc. Ross (1980) notes that the poor benefit more than the rich from these transfer payments. However, payments of this kind are included in the incomes of individuals and families.

Our income distribution series are thus based on pre-tax but post-transfer incomes. The foregoing suggests that these pre-tax, post-transfer income distributions, as compared to after-personal-tax, post-transfers income distributions may not be as bad as one might first think.

The decile income levels, expressed in relative terms, constitute the dependent variables in our model. The decile income levels are estimated by linear interpolation. In those distributions in which the ninth and other deciles happen to be in the upper open-end income class, a Pareto approximation has been used (for those deciles only). The details of the interpolation procedure and Pareto approximation method are outlined in Appendix B. We also tried log-linear interpolation (Pareto-Interpolation) to estimate all of the decile income levels, but in some cases, the estimated values for lower deciles were unrealistically low and the method was rejected in favor of linear interpolation. Beach (1972, 1976, 1977) also used linear interpolation.

4.1.2 DATA ON THE EXPLANATORY VARIABLES

Data on all the explanatory variables are taken from various publications of Statistics Canada. The publications that have been consulted are listed in

Appendix A. There are two points to note. First, in 1976, the Labor Force Survey minimum age for inclusion in the labor force was raised from 14 years to 15 years. Statistics Canada provides estimates of labor force and related series based on the revised definition going back to 1966. For earlier years, where necessary, we have made adjustments to the unrevised data to obtain consistent series based on the new definition. (The adjusted series were available as a result of a project carried out at McMaster University by F.T. Denton, C.H. Feaver, A.L. Robb and B.G. Spencer.) The second point is that, in the case of those explanatory variables that are expressed as ratios to the gross national product, we have adjusted the GNP to eliminate fluctuations in farm inventories. Such fluctuations are largely random, and for purposes of our analysis represent unwanted "noise" in the GNP series.

4.2 METHODOLOGY OF ESTIMATION

Our model is represented by a set of nine equations. Since each equation has the same set of explanatory variables, we can estimate each one separately using the ordinary least-squares method. However, a problem of multicollinearity was to be expected since our study is based on time series data and the model has a rather large set of explanatory variables. Indeed, the problem turned out to be quite serious; many of the explanatory variables were found to be highly correlated with each other. The severity of the problem became further evident when the estimated coefficients of the explanatory variables were found to be quite unstable: the addition or deletion of a single variable often changed the signs of the coefficients of several of the other variables.

There are several remedies available for dealing with multicollinearity. One is to obtain prior estimates of the coefficients of some of the variables that are highly correlated with others, substitute these estimates into the model, and then estimate the remaining coefficients. However, in our case, it is virtually impossible to obtain such estimates because we would require a large number of them, and they are not available. A second suggested solution is to drop those variables that turn out to be statistically insignificant and estimate the model with only the remaining variables. The problem with this approach is that the variables that turn out to be statistically insignificant may be so due to the problem of multicollinearity, since the coefficients of highly correlated explanatory variables tend to have large variances. Moreover, Mundlak points out that this procedure of partitioning the variables into two disjoint sets, one significant and the other insignificant, may not work:

> "The reason is that the various estimated coefficients are generally correlated and the test statistic of a given coefficient is a function of the choice of variables to be retained in the regression. This is a structural property of regression analysis and it is invariant to the procedure followed, namely whether it is backward or forward."[16]

A third approach for dealing with multicollinearity has been suggested by Kendall (1957) and Massy (1965), among others; it is based on principal components analysis. This approach has been formulated more rigorously recently by Mundlak (1980). Before going into the details of Mundlak's approach, it is desirable to look briefly at the properties of principal components[17].

First, the principal components of a set of variables are defined as linear combinations of the explanatory variables. If X is an (n x K) matrix in which each column represents the observations on a different variable then the equation

$$(4.1) \qquad (X'X - \lambda I_K)P = 0$$

defines K characteristic roots (λ) and K corresponding characteristic vectors (P) of $X'X$. The ith principal component (Z_i) is defined as

$$(4.2) \qquad Z_i = XP_i \qquad\qquad i = 1,\ldots,K$$

where P_i is the ith characteristic vector corresponding to the ith characteristic root, λi. The principal components can be ordered according to the values of the characteristic roots. The first principal component corresponds to the largest characteristic root, the second principal component corresponds to the second largest characteristic root, and so forth. Arranged in this way, the first principal component accounts for the largest proportion of the combined variance of the original set of variables (the columns of X); the second principal component accounts for the largest proportion of the combined variance of the variables that is not accounted for by the first principal component; the third principal component accounts for the largest proportion of the remaining combined variance, and so forth. There are as many principal components as there are explanatory variables. A second property of principal components is that they are orthogonal to each other. A third is that they are not invariant to changes in the measurement units of the variables on which they are based. To avoid this latter problem, the principal components can be extracted from standardized variables[18].

Once the principal components have been obtained, they can be treated as a set of explanatory variables in a subsequent regression model. This model can be written as

$$(4.3) \qquad y = Z\delta + u$$

where y denotes an $(n \times 1)$ vector of observations on a dependent variable, Z an $(n \times K)$ matrix of the principal components, δ a $(K \times 1)$ vector of the coefficients of the principal components and u an $(n \times 1)$ vector of random errors. The ordinary least-squares (OLS) estimator of δ is

$$(4.4) \qquad \hat{\delta} = (Z'Z)^{-1}Z'y$$

with variance-covariance matrix given by

$$(4.5) \qquad V(\hat{\delta}) = \sigma^2(Z'Z)^{-1}$$

where σ^2 can be estimated from the residuals (e) of the fitted regression equation using

$$(4.6) \qquad \hat{\sigma}^2 = e'e/(n-K)$$

There is an exact relationship between δ and the coefficient vector of the original explanatory variables (β), which can be shown as follows. Let the model based on the original explanatory variables be

$$(4.7) \qquad y = X\beta + u$$

Using the result[19]

$$(4.8) \qquad PP' = I_K$$

equation (4.7) can be written as

$$(4.9) \qquad y = XPP'\beta + u$$

By definition, $XP = Z$, and $P'\beta$ is thus equal to the coefficient vector of Z:

$$(4.10) \qquad \delta = P'\beta$$

or

$$(4.11) \qquad \beta = P\delta$$

since $PP' = I$.

With the help of (4.11) we can therefore translate the coefficients of the principal components into the coefficients of the original explanatory variables. Similarly, the variance-covariance matrix of $\hat{\beta}$ can be derived using the relation

$$(4.12) \qquad V(\hat{\beta}) = PV(\hat{\delta})P'$$

If we estimate the model (4.3) with all the principal components and then transform the estimated coefficients into coefficients of the original explanatory variables, the result will be exactly equivalent to regressing y directly on all the original explanatory variables[20]. Thus, the regression of y on all the principal components does not help at all in terms of solving the problem of multicollinearity. The usual approach is to drop some of the principal components and work only with those that are most "important", according to some criterion. There are two alternative ways suggested in the literature to define the importance of a principal component. One way is to take only the first few principal components, i.e., those that correspond to the largest characteristic roots. These principal components will generally account for a very large proportion of the variation of the explanatory variables.

However, there is no guarantee that they will be the ones most highly correlated with the dependent variable. The second way is to keep only those principal components that are, in fact, highly correlated with the dependent variable. We have adopted the second approach. Its implications will become clearer as we proceed.

One way to implement the second approach is to run the regression on all the principal components and select those that turn out to be statistically significant taken individually. That is, we test the null hypothesis

$$H_0 : \delta_i = 0 \quad \text{for each } i, \qquad i = 1,\ldots,K \tag{4.13}$$

and retain the principal components for which the null hypothesis is rejected at a given level of significance. For future reference, we call this the Massy approach, since it is basically the one suggested by Massy (1965). However, Scheffé (1959, pp. 30, 71) cautions the reader about the use of individual t-ratios for deciding the significance of the coefficients in such cases. His argument is that we are applying t-ratios to the same data set again and again (bearing in mind that each principal component is a linear combination of all the explanatory variables). The level of significance of the coefficients of the principal components can be much less than what we are ascribing to them. He suggests an alternative method to overcome this problem, called the method of multiple comparisons. It guarantees the level of significance we are ascribing to the estimates of the coefficients. Although Mundlak's (1980) approach is discussed and applied by him in terms of an F test, he proves the equivalence of his approach to that of multiple comparisons.

The Mundlak approach deals with the following question: what is the largest set of coefficients that are not statistically different from zero simultaneously? To answer this question, we need to test the hypothesis that in a set of K coefficients (δ), K_2 of them (δ_2) have zero coefficients. The null hypothesis is

$$(4.14) \qquad H_0 \ : \ \delta_2 = 0$$

The appropriate ratio to test the hypothesis is given by[21]

$$(4.15) \qquad F_s = \frac{\|\hat{y}\|^2 - \|\hat{y}_H\|^2}{\hat{\sigma}^2 K_2}$$

where $\|\hat{y}\|^2$ is the explained sum of squares when the regression is performed on all the principal components and $\|\hat{y}_H\|^2$ is the explained sum of squares when only K_1 (where $K_1 = K - K_2$) of the principal components are included, F_s has the central F distribution with K_2 and $n - K$ degrees of freedom. To apply F_s directly as it is given in (4.15), in order to determine K_2, is extremely difficult because it requires estimation of the model with all possible combinations of the principal components. However, Mundlak provides a simple way to effect the determination. The expression (4.15) can be translated into the following expression[22]

$$(4.16) \qquad F_s = \frac{1}{K_2} \left(\sum_{j}^{K_2} t_j^2 \right)$$

where t_j^2 is the square value of the t-ratio for the jth coefficient. Our interest is in finding the largest K_2 for which the null hypothesis given in (4.14) is not rejected (i.e., $F_s < F_{\alpha,\ K_2, n-K}$, where the latter is the critical F value at the α level of significance with K_2 and $n - K$ degrees of freedom). This requires that the regression be carried out with all principal components included. Based on this regression, the principal components can then be ordered in accordance with the ordering of their associated t-ratios:

$$(4.17) \qquad t_1^2 \geq t_2^2 \geq \ldots \geq t_K^2$$

The t^2 -values are then accumulated from right to left. We start with t_K^2; and if $F_s < F_{\alpha,1,n-K}$, we add to it t_{K-1}^2; if $F_s < F_{\alpha,2,n-K}$, we add t_{K-2}^2; and we continue until the point at which $F_s > F_{\alpha,K_2+1,n-K}$ is reached. We then ignore the last t^2-value, i.e., the one that resulted in $F_s > F$. In this way we determine the set of K_2 coefficients that are statistically insignificant simultaneously. Mundlak refers to this set of K_2 coefficients as <u>non-significant functions</u> and to the remaining K_1 coefficients as <u>significant functions</u>.

To summarize, we run the regression on the full set of principal components and then select a subset according to the criterion just described. We then run the regression only on the selected subset of principal components. The coefficients of the principal components in this second regression are transformed into coefficients of the original explanatory variables, using the relation (4.11), and the variance-covariance matrix of the coefficients is transformed correspondingly, using (4.12). The coefficients of the original explanatory variables derived in this way are based on the matrix X (the matrix of original explanatory variables), subject to the K_2 linear restrictions on the columns of X implied by the deletion of the K_2 principal components from the model. Mundlak's (p. 140) view is

> "... that the pertinent information of the matrix X is retained in X subject to the K_2 linear restrictions on the columns of X."

There is one practical problem with the Mundlak method which can be explained in stages. Suppose that some of the explanatory variables are perfectly correlated with others. There will then be zero-valued characteristic roots equal in number to the number of perfect correlations. Kendall (1957) points out that one does not need the principal components that correspond to zero-valued characteristic roots. He summarizes the issue in the following manner:

> "If certain λ's [characteristic roots] vanish, say p-m of them, the correlation matrix is of rank m and we are back to the case... in which the variation collapses into a space of m dimensions. The last p-m ζ's [principal components] are then not required." (p. 17.)

However, if there is no perfect multicollinearity but the explanatory variables are still highly correlated, then some of the characteristic roots will have almost zero value. According to the Mundlak method, the regression at the first stage is performed on all the principal components, and then the subset is chosen according to his criterion. Now suppose the principal components that correspond to almost-zero-valued (precise definition to follow) characteristic roots are chosen along with others. When the coefficients of the principal components are transformed into the coefficients of the original explanatory variables, based on the second-stage regression, it is possible that nonsense results will emerge as a result of rounding error -- in particular, for example, the values of the coefficients may be ridiculously large. This problem can be avoided if we drop those principal components that correspond to almost-zero-valued characteristic roots right at the beginning. The difficulty appears to be resolved if we drop the last few principal components. We adopt a somewhat liberal definition and define a characteristic root as "almost zero" if its value is zero up to two decimal places. In our analysis, the principal components dropped according to this criterion explain less than one-tenth of one percent of the combined variance of all the original explanatory variables, so that the loss of information may be regarded as negligible.

In summary, then, our modified version of the Mundlak method involves three stages. At the first stage, we drop those principal components corresponding to characteristic roots with zero value up to two digits. At the second stage, we run the regression on all the remaining principal components, and then choose a subset of these according to the Mundlak criterion. At the third stage, we run the regression on the chosen subset, and then transform the coefficients of the principal components back into coefficients of the original explanatory variables.

The Massy method discussed earlier differs from the Mundlak method only in the criterion for selecting principal components after the first stage regression. The problem relating to zero-valued characteristic roots can therefore arise with that method also. The problem here can be handled in the same fashion as it is for the Mundlak case. (The Massy method, it will be recalled, selects principal components according to their individual statistical significance, whereas the Mundlak method according to their joint statistical significance.)

4.3 RESULTS

We turn now to the results based on the income distributions drawn from Taxation Statistics and the Survey of Consumer Finances (SCF). The results of principal interest are reported at the end of the chapter, in Tables 4.2-4.37; others are provided in Appendix C. A list of definitions of all variables appearing in the tables is provided in Table 4.1. Each column of a table in the set 4.2-4.37 reports estimated results for a particular decile equation. Altogether we have estimated the model with 15 income distributions. The results presented are the outcome of a large number of experiments. The basic model outlined in the preceding chapter, and the basic method of estimation were adapted in applying them to some of the particular distributions. We describe here all the procedures and experiments that led to the results reported. Detailed interpretation of the results is the subject of the next two chapters.

We first estimated our model with the income distribution for all individuals drawn from Taxation Statistics. This was the longest income distribution series (1947-1979) available. We estimated two versions of the model with this series. In one version we followed Buse (1982) and introduced dummy variables to take into account the previously noted structural changes in the taxation system. As pointed out in the data section, some of these dummy variables appeared to us not to be necessary[23]. In the second version of the model, we included no dummy variables. Results are reported also based on different methods of estimation, namely the ordinary least squares method (OLS), the Mundlak method and the Massy method. In applying the Mundlak method we used a 5 percent critical F-value. However, in applying the Massy method we used only a 20 percent significance level for the t tests, the reason for which will become clear shortly.

Our model is based on a set of nine decile equations, and it is not unlikely that there would be contempraneous correlation among the residuals of different equations in the model. In such circumstances, an appropriate method of estimation is Zellner's seemingly unrelated regression method. However, if each equation in the model has the same set of explanatory variables, then the Zellner and the OLS methods give identical results[24]. In our case, the set of principal components is the same for all decile equations when we run the regressions at the first stage. However, it is not necessary that the same set of principal components be selected for each decile equation. We therefore re-estimated the model, based on the principal components selected according to the Mundlak criterion, using the Zellner method. The estimated coefficients of the principal components have then been transformed into the coefficients of the original explanatory variables, as before, and the results are reported in Tables 4.3 and 4.7. (The t-ratios of the coefficients of the explanatory variables are not presented in this case because of difficulties in effecting the necessary transformation.) The results based on the Zellner method are very close to those reported in Tables 4.2 and 4.6, based on OLS (combined with the Mundlak selection criterion). We did not repeat this experiment in the case of other income distributions because (i) it seemed unlikely that the results would differ much, and (ii) estimation with the Zellner method involves a considerable amount of computation to transform the estimated coefficients of the principal components into coefficients of the original variables since SHAZAM, the computer program being used, will do this transformation only if the model is estimated by OLS.

All the other income distribution series are based on a smaller number (17) of observations. The series for particular categories of tax filers taken from Taxation Statistics cover the period 1963-1979, while the series from the SCF are for the years 1951, 1954, 1957, 1959, 1961, 1965, 1967, 1969 and 1971-1979. We tried to estimate our model for all series using the Mundlak method. The same set of explanatory variables was used in each case, consisting of the 15 explanatory variables that had been used earlier for the all individuals income distribution from Taxation Statistics. The results were very disappointing, in the sense that, for some decile equations in almost all the income distributions, not a single principal component could be selected according to the Mundlak method. The Mundlak method is based on an F-test, and implies a strict criterion for selecting principal components. Therefore, we turned to the Massy method, which is based on a t-test, and implies a more liberal criterion of selection. Initially, we decided to use just those principal components whose t-ratios were significantly different from zero at the 5 percent level. However, the same problem occurred as was with the Mundlak method, and we therefore tried a 10 percent significance level. That did not help much, and so we substituted the 20 percent level. At the 20 percent level, for every decile equation in almost all of the income distributions, there was at least one principal component whose t-ratio was significant. We then estimated our model for each distribution series, based on the principal components selected according to this criterion, but the results were again disappointing; the estimated coefficients appeared to make little economic sense. As mentioned earlier, we were using, at this point, the same set of explanatory variables for all income distributions. We then modified the set somewhat for different distributions; for instance, for specific age-group income distributions, we tried the groups' own unemployment and labor force participation rates, and dropped the population age-distribution variables from the explanatory set. Still, there was not much improvement in the results. We then concluded that we were simply asking too much from the smaller sets of observations, and we drastically reduced the number of the explanatory variables from 15 to 6. These six variables include an unemployment rate, a labor force participation rate, the inflation rate, the change in the inflation rate, the rate of growth of the real wage rate, and unemployment benefits as a ratio to GNP*. Even with this smaller set of explanatory variables, we were not successful in estimating the model with the Mundlak method, in the sense again that for some decile equations, in almost all the income distributions, not a single principal component could be selected. However, the Massy method, with a 20 percent significance criterion, produced at least one significant principal component for each decile equation in almost every income distribution. We did some further experiments for each income distribution by trying different unemployment rates and labor force participation rates. For example, in the case of the income distribution for all male individuals, in one experiment we tried the overall unemployment rate and the overall labor force participation rate, and in a second experiment we replaced these variables by the overall male unemployment rate and the overall male labor force participation rate. Out of these experiments a set of estimated equations which lend themselves to reasonable economic interpretation was selected, and these are the ones reported at the end of the chapter; the remaining ones are reported in Appendix C. We report both the OLS results and the results based on the Massy method.

In closing this chapter, we remind the reader that the results reported under the headings "Mundlak Method" and "Massy Method" are based on principal components selected according to the Mundlak and Massy criteria. The estimated coefficients of the principal components have been transformed, in both cases, into coefficients of the original explanatory variables, and similarly for the t-ratios. We report also the degrees of freedom (D.F.) for each decile equation. (The degrees of freedom are based on the numbers of principal components selected, rather than on the number of explanatory variables. For example, with 17 observations and 4 selected principal components, together with a constant term, D.F. would be equal to 12.) Durbin-Watson (D.W.) ratios are reported for the equations based on Taxation Statistics but not for those based on SCF data, since in the latter case there are missing years.

FOOTNOTES

Chapter 4

1. In some cases, a complete distribution of taxable returns by income classes is given. However, for non-taxable returns a detailed distribution is available only for lower income classes, with only an aggregate figure reported for all the remaining income classes. This aggregate figure is relatively small since most non-taxable returns belong to lower income classes. We allocate the aggregate figure to the income classes given for comparable taxable returns on the assumption that the non-taxable returns are distributed in the same proportions as the corresponding taxable ones.

2. For a more detailed discussion of these problems, see Tahir (1981, Appendix A). Buse (1982) also discusses some of the problems.

3. There is no problem in aggregating different age group distributions because the data are reported in terms of income classes and numbers of returns therein, and the income classes are the same for all age groups.

4. Beach (1972, 1976) analyzes more detailed age group distributions (25-34, 35-44, 45-54 and 55-64, among others). His results are very similar for these groups.

5. For details, see Tahir (1981, p. 161)

6. See footnote 23.

7. Net taxable capital gains are defined as one-half of total capital gains mimus allowable losses. The allowable losses were limited to $1000 until 1976, and then raised to $2000 after that.

8. Income Distribution by Size in Canada, 1979, Statistics Canada, Catalogue 13-207, p. 12.

9. The income distributions in the Survey are reported in terms of income classes and percentages of population therein. To aggregate different age group distributions, we take weighted averages, the

weights being the population shares. To calculate the weights we need the total population for each age group. For alternate years, since 1967, the overall estimated numbers in each age group are reported. To obtain the estimated numbers for the alternate missing years (after 1967) we take the average of the estimated numbers in the two adjacent years. For earlier years (prior to 1967) we use information from the Census of Canada, where the distribution of families according to age of head is available. The population census is conducted every five years, and to obtain estimates for in-between years we use linear interpolation procedure. To check for consistency, we compared the Census percentage distributions of families by age of head with the corresponding Survey of Consumer Finances distributions for some particular years, and found them to be almost identical.

10. For earlier years (prior to 1967), the overall estimated populations of the age group distribution are not reported. For those years we use male labor force estimates to aggregate over different age group distributions (25-34, 35-44, 45-54, and 55-64).

11. Income Distribution by Size in Canada, 1975, Statistics Canada, Catalogue 13-207, p. 151.

12. It might be useful to note that data on the after-personal-tax income distribution are available only since 1971 from the Survey of Consumer Finances.

13. See Gillespie (1976, 1980A, 1980B) on this subject.

14. Ross (1980), p. 50

15. Ross (1980), p. 60

16. Mundlak (1980), p. 139

17. For proof of these properties and a comprehensive discussion of the subject, see Theil (1971, Ch. 1) and Kendall (1957, Ch. 2).

18. For standardization of a variable, we take deviations from the mean and divide by the standard deviation of the variable.

19. P contains, as columns, the characteristic vectors of $X'X$ and normalization of these vectors yields $PP' = I_K$, where I_K is the $(K \times K)$ identity matrix.

20. To prove this result, let the OLS estimators of β and δ be given by

$$(4.18) \quad \hat{\beta} = (X'X)^{-1} X'y$$

$$(4.19) \quad \hat{\delta} = (Z'Z)^{-1} Z'y$$

We can write (4.19) as

$$(4.20) \quad \hat{\delta} = (P'X'XP)^{-1} P'X'y$$

We can rewrite (4.20) as

$$(4.21) \quad \hat{\delta} = P'(X'X)^{-1} PP' X'y, \text{ since } P^{-1} = P'$$

or

$$(4.22) \quad \hat{\delta} = P'(X'X)^{-1} X'y = P'\hat{\beta}$$

Hence $\hat{\beta} = P\hat{\delta}$

21. The notation used here is the same as in Mundlak's paper.

22. For detailed derivation, see Mundlak (1980), pp. 142-143.

23. As discussed in the data section, for income tax purposes the basic personal exemption limits were raised in 1949 and 1972. Buse argues that this should have had some impact on the total number of returns filed, which in turn should have had an impact on the relative income distribution. He therefore introduces two dummy variables, one for the 1949 change and one for the 1972 change. However, if we look at the data there are no apparent jumps in it for the years 1949 and 1972.

The child tax credit, introduced in 1978, generated a large number of new tax returns with zero or very little income, and Buse introduces a dummy variable to take account of this also. In one of our experiments (not reported in the tables), we introduced only one dummy variable related to child tax credit and the results were very close to those when all three dummy variables were present.

24. See Zellner (1962).

TABLE 4.1

DEFINITION OF VARIABLES

The variables are listed in alphabetical order. All variables are based on annual data, and those identified as rates are in percentage form.

Di/M	: estimated ith decile income level relative to the mean income of the distribution (ith decile income level is obtained by linear interpolation)
D49	: dummy variable taking zero value up to 1948 and one after that
D72	: dummy variable taking zero value up to 1971 and one after that
D78	: dummy variable taking zero value up to 1977 and one after that
FPR	: female labor force participation rate (women 15 and over)
FPR15	: female participation rate of those aged 15-24
FPR25	: female participation rate of those aged 25-64
FPR65	: female participation rate of those aged 65 and over

GE/GNP^{*}	:	government expenditures on goods and services as a ratio to gross national product adjusted for fluctuations in farm inventories
MPR	:	male labor force participation rate (men 15 and over)
MPR15	:	male participation rate of those aged 15-24
MPR25	:	male participation rate of those aged 25-64
MPR65	:	male participation rate of those aged 65 and over
MUR	:	male unemployment rate (men 15 and over)
MUR15	:	male unemployment rate of those aged 15-24
MUR25	:	male unemployment rate of those aged 25-64
MUR65	:	male unemployment rate of those aged 65 and over
$\dot{P}$	:	rate of inflation defined by the rate of change in the consumer price index
$\Delta\dot{P}$	:	change in the rate of inflation
PR	:	overall labor force participation rate (both sexes combined)
PR15	:	participation rate of those aged 15-24
PR25	:	participation rate of those aged 25-64
PR65	:	participation rate of those aged 65 and over
PROP15	:	population aged 15-24 as a ratio to population aged 15 and over
PROP65	:	population aged 65 and over as a ratio to population aged 15 and over

$PROF/GNP^*$	:	pre-tax corporate profits as a ratio to GNP^*
$\dot{W}$	:	rate of growth of the real wage rate (represented by industrial composite average weekly wages and salaries deflated by the consumer price index)
UR	:	overall unemployment rate (both sexes combined)
UR15	:	unemployment rate of those aged 15-24
UR25	:	unemployment rate of those aged 25-64
UR65	:	unemployment rate of those aged 65 and over
X/GNP^*	:	exports of goods and services as a ratio to GNP^*
YOB/GNP^*	:	retirement and old age benefits (all types combined) as a ratio to GNP^*
$YRNF/GNP^*$	:	net realized farm income as a ratio to GNP^*
YUB/GNP^*	:	unemployment insurance benefits as a ratio to GNP^*
YUB^*/GNP^*	:	zero value up to 1971 and after that the value of unemployment insurance benefits as a ratio to GNP^*

ESTIMATED EQUATIONS

TABLE 4.2

ALL INDIVIDUALS (TAXATION STATISTICS)
Mundlak Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.7887	.7875	.7442	.8415	.8194	.7539	.7318	.5110	1.0627
	(11.31)	(8.21)	(10.28)	(15.83)	(30.60)	(18.13)	(12.68)	(4.97)	(7.94)
UR	-.0011	-.0007	-.0035	-.0006	-.0005	-.0003	.0021	.0042	.0048
	(-1.37)	(-.82)	(-3.13)	(-1.28)	(-2.92)	(-.65)	(6.27)	(7.12)	(4.17)
FPR	-.0014	-.0016	-.0015	-.0010	-.0005	.0001	.0008	.0016	.0027
	(-12.85)	(-15.21)	(-18.39)	(-17.66)	(-22.31)	(1.55)	(18.62)	(19.35)	(18.86)
PR15	.0017	.0027	.0014	.0013	.0004	-.0000	-.0000	.0004	-.0030
	(4.11)	(4.97)	(3.43)	(4.14)	(2.70)	(-.01)	(-.12)	(.61)	(-4.02)
PR65	.0016	.0018	.0014	.0011	.0005	-.0002	-.0010	-.0020	-.0034
	(18.67)	(22.41)	(17.80)	(25.25)	(19.40)	(-3.99)	(-18.66)	(-18.66)	(-31.09)
PROP15	-.4371	-.6299	-.6754	-.4663	-.2835	-.0444	.2704	.4844	.9808
	(10.78)	(-8.88)	(-12.15)	(-11.75)	(-12.33)	(-1.99)	(9.38)	(14.31)	(9.91)
PROP65	-3.6198	-2.2541	.4821	-.0369	1.1195	2.4143	2.8558	5.1354	3.7087
	(-6.26)	(-2.97)	(.67)	(-.09)	(5.44)	(7.38)	(7.43)	(7.95)	(3.51)
$\dot{P}$	-.0001	-.0004	.0015	-.0009	-.0009	.0001	-.0000	.0005	.0011
	(-.63)	(-2.55)	(1.69)	(-7.45)	(-13.84)	(.29)	(-.25)	(5.22)	(5.09)
$\Delta\dot{P}$	.0028	.0022	.0003	.0003	-.0007	-.0007	-.0002	-.0008	-.0020
	(3.58)	(2.96)	(.60)	(.77)	(-10.20)	(-2.78)	(-.53)	(-1.13)	(-1.98)
$\dot{W}$	.0050	.0043	.0035	.0021	.0003	-.0002	-.0008	-.0030	-.0048
	(4.12)	(3.79)	(4.40)	(3.30)	(3.14)	(-.54)	(-1.71)	(-3.30)	(-3.05)
YRNF/GNP*	.3773	.4288	.6044	.2219	.0800	-.0276	-.3161	-.5261	-.8043
	(18.05)	(21.90)	(6.04)	(15.18)	(8.80)	(-.72)	(-31.26)	(-35.47)	(-29.46)
PROF/GNP*	-.1101	.0719	-.1927	.0735	.9097	-.3028	-.5254	-.5689	-.3489
	(-1.15)	(.71)	(-1.66)	(1.24)	(3.94)	(-4.26)	(-5.85)	(-3.25)	(-2.47)
YUB*/GNP*	.2847	.3771	.0929	-.0448	-.2413	-.5872	-.6539	-.5058	.4931
	(.93)	(1.27)	(.45)	(-.27)	(-6.05)	(-4.31)	(-3.32)	(-1.29)	(1.19)
YOB/GNP*	-1.3075	-1.3617	-1.2373	-.8013	-.3449	.1704	.8698	1.7200	2.5711
	(-16.39)	(-17.37)	(-20.35)	(-18.47)	(-15.16)	(7.04)	(27.92)	(29.10)	(23.53)
GE/GNP*	-.2211	-.2651	-.0678	-.1654	-.0834	.0999	.2135	.3638	.5115
	(-18.10)	(-20.83)	(-1.17)	(-22.20)	(-17.03)	(4.36)	(25.61)	(22.97)	(28.83)
X/GNP*	-.3262	-.3647	-.4700	-.2539	-.1306	.0567	.3088	.5410	.4785
	(-5.26)	(-6.24)	(-7.70)	(-7.44)	(-14.71)	(1.55)	(6.59)	(5.82)	(5.87)
R^2	.921	.948	.972	.964	.949	.912	.984	.980	.972
$\bar{R}^2$	.916	.943	.966	.959	.944	.892	.981	.978	.969
S.E.	.018	.016	.011	.009	.006	.004	.006	.013	.023
D.W.	1.265	1.364	1.469	1.499	1.827	1.917	2.267	1.964	1.467
D.F.	30	29	27	28	29	26	27	29	29

NOTE: $\bar{R}^2$ -- R^2 adjusted for degrees of freedom; where $\bar{R}^2$ is zero it is replaced by (--)

S.E. -- standard error of estimate

D.W. -- the Durbin-Watson Statistic

D.F. -- degrees of freedom

The values in the parentheses are t-ratios.

For definition of variables see Table 4.1

TABLE 4.3

ALL INDIVIDUALS (TAXATION STATISTICS)
Zellner Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.7616	.8235	.8194	.8478	.8348	.7701	.7520	.7482	.8960
UR	-.0013	-.0014	-.0022	-.0011	-.0006	.0002	.0022	.0056	.0065
FPR	-.0013	-.0015	-.0014	-.0009	-.0005	.0001	.0008	.0016	.0025
PR15	.0016	.0021	.0015	.0010	.0004	.0000	-.0002	.0023	-.0020
PR65	.0016	.0018	.0015	.0011	.0005	-.0002	-.0011	-.0020	-.0035
PROP15	-.4257	-.5587	-.5698	-.4122	-.2660	-.0369	.2406	.5127	.7534
PROP65	-3.4440	-2.4639	-.6928	-.1727	.9468	2.1965	2.8435	1.6148	5.3908
$\dot{P}$	-.0001	-.0004	.0000	-.0008	-.0008	-.0004	.0001	.0026	.0005
$\Delta\dot{P}$	.0025	.0019	.0007	.0001	-.0006	-.0008	-.0006	.0016	-.0024
$\dot{W}$	.0047	.0039	.0031	.0016	.0003	-.0005	-.0012	-.0021	-.0044
YRNF/GNP*	.3738	.4200	.4324	.2274	.0872	-.0729	-.3110	-.3269	-.8263
PROF/GNP*	-.0813	.0711	-.0042	.1108	.0975	-.1799	-.3632	-.2583	-.3217
Y UB*/GNP*	.1920	.1531	-.0468	-.1852	-.2393	-.5033	-.3344	1.1331	.8324
Y OB/GNP*	-1.2916	-1.3615	-1.1877	-.7943	-.3507	.1995	.9003	1.5770	2.6372
GE/GNP*	-.2213	-.2600	-.1721	-.1653	-.0841	.0637	.1984	.3054	.5033
XGNP*	-.3073	-.3234	-.3465	-.2076	-.1184	.0636	.2364	.4611	.3610
R^2	.920	.946	.966	.960	.946	.898	.981	.979	.971
$\bar{R}^2$	.916	.941	.960	.955	.941	.879	.978	.977	.968
S.E.	.017	.016	.011	.009	.006	.004	.006	.012	.022

NOTE: The results are based on the principal components selected according to the Mundlak method.

For definition of symbols see note to Table 4.2

TABLE 4.4

ALL INDIVIDUALS (TAXATION STATISTICS)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	1.4266	1.7021	1.7752	1.4755	1.2061	1.1065	.8035	.5896	-.0922
	(1.72)	(2.01)	(2.82)	(2.96)	(3.66)	(5.35)	(2.50)	(.92)	(-.06)
UR	.0049	.0024	-.0020	-.0022	-.0026	-.0038	-.0036	-.0026	-.0028
	(1.08)	(.51)	(-.57)	(-.80)	(-1.46)	(-3.33)	(-2.03)	(-.74)	(-.45)
FPR	-.0087	-.0056	-.0024	-.0013	.0003	.0019	.0030	.0066	.0094
	(-2.52)	(-1.59)	(-.92)	(-.65)	(.24)	(2.18)	(2.27)	(2.47)	(1.96)
PR15	-.0006	-.0016	-.0010	.0003	.0002	-.0002	-.0003	-.0014	-.0020
	(-.21)	(-.57)	(-.47)	(.18)	(.20)	(-.36)	(-.25)	(-.69)	(-.54)
PR65	-.0093	-.0059	-.0048	-.0034	-.0020	-.0017	-.0008	-.0001	.0099
	(-1.42)	(-.88)	(-.97)	(-.88)	(-.76)	(-1.01)	(-.32)	(-.03)	(1.08)
PROP15	-.0517	-1.1233	-1.4444	-1.1226	-.9194	-.6955	-.1559	-.0443	.8164
	(-.05)	(-.95)	(-1.64)	(-1.61)	(-1.99)	(-2.40)	(-.35)	(-.05)	(.50)
PROP65	-4.8162	-5.3442	-4.9316	-2.9628	-.5085	.6618	3.0074	5.3645	11.0570
	(-1.09)	(-1.19)	(-1.48)	(-1.12)	(-.29)	(.60)	(1.77)	(1.58)	(1.80)
$\dot{P}$	.0042	.0027	.0013	.0006	-.0002	-.0007	-.0009	-.0016	.0017
	(1.52)	(.96)	(.59)	(.33)	(-.20)	(-1.04)	(-.80)	(-.74)	(.44)
$\Delta\dot{P}$	-.0025	-.0003	-.0011	-.0010	-.0006	.0000	.0009	.0020	.0015
	(-1.53)	(-.15)	(-.89)	(-1.01)	(-.85)	(.04)	(1.35)	(1.54)	(.65)
$\dot{W}$	.0028	.0031	.0011	.0002	-.0002	-.0006	-.0003	-.0004	.0002
	(1.12)	(1.19)	(.56)	(.10)	(-.25)	(-.89)	(-.34)	(-.23)	(.06)
$YRNF/GNP^*$	.4290	.7199	.7008	.4809	.3365	.0804	-.2176	-.2792	-2.0255
	(.54)	(.89)	(1.17)	(1.01)	(1.07)	(.41)	(-.71)	(-.46)	(-1.83)
$PROF/GNP^*$	.2338	.3717	.1156	-.0211	-.2328	-.4370	-.7201	-.7704	-1.2330
	(.51)	(.79)	(.33)	(-.07)	(-1.27)	(-3.81)	(-4.04)	(-2.16)	(-1.92)
YUB^*/GNP^*	.8515	.2630	.2911	-.2486	-.4566	-.6662	-.2317	-.0007	-1.8328
	(.64)	(.19)	(.29)	(-.31)	(-.86)	(-2.01)	(-.45)	(-.00)	(.99)
YOB/GNP^*	-3.7551	-1.4942	-2.2292	-1.8278	-.9045	.1755	1.1400	1.8005	3.5987
	(-1.33)	(-.52)	(-1.04)	(-1.08)	(-.81)	(.25)	(1.04)	(.82)	(.91)
GE/GNP^*	-.3130	-.1765	-.0295	.0606	.0279	.0803	.1183	.1331	-.1480
	(-.62)	(-.35)	(-.08)	(.20)	(.14)	(.65)	(.61)	(.35)	(-.21)
X/GNP^*	-.4583	-.4251	-.4073	-.3079	-.1190	.1142	.3359	.6452	.8999
	(-1.06)	(-.96)	(-1.24)	(-1.18)	(-.69)	(1.06)	(2.00)	(1.92)	(1.49)
R^2	.971	.975	.983	.980	.973	.960	.992	.991	.988
$\bar{R}^2$	.945	.954	.968	.963	.948	.926	.985	.983	.976
S.E.	.015	.015	.011	.009	.006	.004	.006	.011	.020
D.W.	2.522	2.260	2.236	1.977	1.889	2.431	2.724	2.615	2.045

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.5

ALL INDIVIDUALS (TAXATION STATISTICS)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.8035	.9582	.9561	.8609	.7766	.7649	.7252	.6197	.4923
	(5.35)	(7.34)	(10.15)	(11.71)	(29.06)	(18.02)	(12.77)	(5.36)	(1.30)
UR	-.0003	-.0034	-.0038	-.0028	-.0018	-.0028	-.0027	-.0006	.0030
	(-.12)	(-2.55)	(-3.91)	(-3.73)	(-4.01)	(-2.68)	(-1.96)	(-.36)	(.85)
FPR	-.0021	-.0016	-.0015	-.0011	-.0006	.0002	.0010	.0022	.0048
	(-4.68)	(-14.81)	(-18.31)	(-17.61)	(-20.99)	(1.43)	(6.22)	(6.77)	(5.73)
PR15	.0018	.0004	-.0000	.0004	.0001	-.0003	-.0004	-.0016	-.0047
	(1.33)	(.44)	(-.00)	(.78)	(.55)	(-.77)	(-.68)	(-1.62)	(-2.34)
PR65	.0004	.0014	.0012	.0009	.0005	-.0001	-.0010	-.0017	-.0012
	(.95)	(10.19)	(12.12)	(11.75)	(13.09)	(-.87)	(-5.54)	(-5.07)	(-1.78)
PROP15	-.1150	-.6710	-.6335	-.5072	-.3290	-.1284	.1455	.3215	.7929
	(-.48)	(-9.57)	(-12.52)	(-12.85)	(-14.03)	(-2.02)	(1.67)	(1.83)	(1.78)
PROP65	-4.3112	-2.0220	-.6916	.5842	1.9246	2.8336	3.5585	5.4046	10.8700
	(-3.63)	(-1.97)	(-.93)	(1.01)	(6.63)	(8.61)	(9.16)	(6.85)	(2.93)
$\dot{P}$	.0006	.0016	.0015	.0011	.0004	.0000	-.0002	.0017	.0024
	(.42)	(1.46)	(1.92)	(1.70)	(.96)	(.09)	(-.43)	(2.44)	(1.11)
$\Delta\dot{P}$	-.0007	.0003	-.0006	-.0006	-.0009	-.0001	-.0005	.0005	.0006
	(-.69)	(.40)	(-1.00)	(-1.37)	(-4.28)	(-.54)	(1.40)	(.70)	(.52)
$\dot{W}$	.0023	.0039	.0027	.0018	.0007	-.0002	-.0001	.0004	.0021
	(1.29)	(3.85)	(3.74)	(3.23)	(.31)	(-.38)	(-.10)	(.25)	(.80)
YRNF/GNP*	.7823	.6511	.6046	.4414	.2156	-.0673	-.3774	-.6538	-1.2804
	(5.65)	(5.36)	(6.90)	(6.45)	(4.70)	(-1.79)	(-15.56)	(-13.66)	(-6.74)
PROF/GNP*	.4976	.1973	.1876	.0294	-.0400	-.4228	-.6843	-.6280	-1.4925
	(1.80)	(.88)	(1.17)	(.23)	(-.88)	(-4.27)	(-5.26)	(-3.00)	(-3.43)
YUB*/GNP*	1.2417	1.1924	.8577	.2988	-.2395	-.2931	-.1157	-.4289	1.1522
	(2.51)	(2.78)	(2.78)	(1.24)	(-6.54)	(-1.61)	(-.46)	(-1.18)	(1.07)
YOB/GNP*	-3.6035	-1.3853	-1.1974	-.8486	-.3957	.7360	1.8381	3.3621	3.6321
	(-2.62)	(-18.23)	(-21.85)	(-19.84)	(-16.40)	(2.04)	(3.69)	(3.31)	(1.37)
GE/GNP*	.3656	-.1423	-.0989	-.0503	-.0002	-.0039	.0488	.0635	-.8216
	(1.27)	(-1.98)	(-1.91)	(-1.24)	(-.01)	(-.05)	(.48)	(.31)	(-1.72)
X/GNP*	-.8422	-.7339	-.6628	-.4311	-.2041	.0849	.3762	.6725	1.2412
	(-5.94)	(-6.38)	(-7.99)	(-6.66)	(-9.19)	(2.26)	(7.94)	(7.03)	(6.02)
R^2	.958	.968	.979	.976	.966	.945	.990	.988	.983
$\bar{R}^2$	.946	.960	.974	.971	.959	.919	.987	.985	.978
S.E.	.014	.014	.009	.008	.005	.004	.005	.011	.020
D.W.	2.136	2.180	1.906	1.710	1.589	2.125	2.775	2.535	1.863
D.F.	25	26	26	26	27	22	24	26	25

NOTE: For definition for symbols see note to Table 4.2

TABLE 4.6

ALL INDIVIDUALS (TAXATION STATISTICS)
Mundlak Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.3627	.7475	.7665	.8211	.8372	.9095	.9343	.9814	1.2107
	(4.95)	(16.21)	(17.75)	(24.59)	(38.69)	(37.92)	(35.38)	(27.23)	(16.21)
D49	.0226	-.0065	-.0022	.0031	.0073	-.0060	.0019	.0152	.0079
	(3.18)	(-1.27)	(-.52)	(.93)	(4.89)	(-1.20)	(.47)	(3.72)	(.96)
D72	.0076	.0058	.0038	.0005	-.0057	-.0011	-.0014	.0005	.0036
	(2.33)	(2.41)	(1.93)	(.34)	(-11.09)	(-1.26)	(-1.24)	(.24)	(.95)
D78	-.0796	-.0644	-.0413	-.0241	.0050	.0082	.0308	.0523	.0807
	(-13.15)	(-9.87)	(-6.97)	(-5.23)	(2.38)	(3.03)	(9.13)	(10.23)	(7.64)
UR	.0030	-.0007	-.0003	-.0002	-.0008	-.0001	.0013	.0021	.0044
	(2.24)	(-.84)	(-.50)	(-.34)	(-7.29)	(-.22)	(3.48)	(3.32)	(3.40)
FPR	-.0019	-.0014	-.0013	-.0010	-.0005	.0001	.0008	.0016	.0024
	(-7.35)	(-25.77)	(-26.82)	(-25.58)	(-18.57)	(3.03)	(24.50)	(38.29)	(28.16)
PR15	.0004	.0017	.0018	.0011	.0002	-.0009	-.0010	-.0022	-.0027
	(.56)	(6.48)	(8.22)	(6.14)	(1.32)	(-4.51)	(-4.65)	(-10.00)	(-6.54)
PR65	.0015	.0016	.0015	.0011	.0005	-.0002	-.0011	-.0021	-.0030
	(21.07)	(18.83)	(21.33)	(19.82)	(17.71)	(-4.70)	(-27.93)	(-32.21)	(-22.52)
PROP15	-.5786	-.5969	-.6169	-.4764	-.2354	-.0735	.2846	.6428	.9596
	(-15.86)	(-15.29)	(-15.25)	(-15.15)	(-11.62)	(-2.79)	(12.30)	(20.90)	(15.18)
PROP65	-.0501	-1.4930	-.4447	.2109	.8718	1.6725	1.6134	2.1734	2.4979
	(-.10)	(-7.51)	(-1.57)	(.93)	(4.79)	(4.61)	(11.23)	(12.79)	(7.76)
$\dot{P}$	-.0003	-.0004	-.0005	-.0007	-.0008	-.0001	-.0002	.0005	.0012
	(-.42)	(-4.08)	(-6.82)	(-8.63)	(-11.56)	(-.59)	(-2.48)	(4.61)	(8.41)
$\Delta\dot{P}$	-.0004	-.0001	-.0002	-.0004	-.0004	-.0008	.0009	.0009	.0014
	(-.82)	(-.25)	(-.48)	(-1.42)	(-2.25)	(-3.32)	(2.88)	(2.82)	(2.12)
$\dot{W}$	-.0004	.0012	.0002	.0002	.0000	-.0002	.0010	-.0013	-.0031
	(-.54)	(3.38)	(.47)	(.72)	(.09)	(-1.33)	(1.84)	(-4.23)	(-5.23)
YRNF/GNP*	.9966	.4337	.3847	.2443	.0743	-.0414	-.3675	-.5890	-.8106
	(5.53)	(17.39)	(18.39)	(13.69)	(5.67)	(-1.78)	(-20.83)	(-27.27)	(-20.06)
PROF/GNP*	.1288	.2235	.2592	.1489	.0908	-.1137	-.2827	-.3125	-.5551
	(1.07)	(2.19)	(3.05)	(2.22)	(4.11)	(-3.40)	(-5.43)	(-3.84)	(-3.36)
YUB*/GNP*	.4868	.3843	.2619	.0623	-.3241	-.0783	-.0905	-.0291	.1620
	(2.87)	(2.65)	(2.20)	(.67)	(-11.09)	(-1.94)	(-1.30)	(-.25)	(.69)
YOB/GNP*	-1.2619	-1.1246	-1.0125	-.7164	-.3601	.3509	.7906	1.4217	2.1724
	(-17.64)	(-25.43)	(-27.62)	(-25.09)	(-17.27)	(4.15)	(32.38)	(40.84)	(30.34)
GE/GNP*	-.0739	-.2579	-.2506	-.1765	-.0809	.0633	.1948	.3402	.4757
	(-1.40)	(-17.32)	(-19.30)	(-17.15)	(-13.96)	(3.94)	(23.64)	(28.41)	(19.73)
X/GNP*	-.0761	-.3832	-.3464	-.2701	-.1031	-.0582	.1504	.3136	.4919
	(-.67)	(-10.58)	(-11.15)	(-10.77)	(-10.09)	(-4.28)	(8.04)	(10.57)	(8.38)
R^2	.987	.975	.980	.978	.937	.894	.988	.991	.982
$\bar{R}^2$	.983	.971	.976	.973	.928	.875	.986	.989	.980
S.E.	.008	.012	.010	.007	.007	.005	.006	.009	.019
D.W.	1.526	1.184	.897	1.256	1.479	1.832	2.213	2.109	1.433
D.F.	25	28	27	26	28	27	26	27	28

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.7

ALL INDIVIDUALS (TAXATION STATISTICS)
Zellner Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-1.1204	-.9562	-.9005	-.6879	-.3998	.0706	.6453	1.1916	1.9056
D49	.0198	-.0036	-.0020	.0024	.0063	.0007	.0033	.0116	.0034
D72	.0087	.0023	.0010	-.0016	-.0053	-.0042	-.0006	.0024	.0083
D78	-.0744	-.0560	-.0382	-.0188	.0044	.0076	.0294	.0497	.0705
UR	.0029	-.0017	-.0012	-.0008	-.0008	.0005	.0016	.0028	.0058
F PR	-.0020	-.0013	-.0012	-.0009	-.0005	.0000	.0008	.0016	.0024
PR15	-.0001	.0014	.0015	.0010	.0002	-.0007	-.0010	-.0019	-.0024
PR65	.0015	.0015	.0014	.0010	.0005	-.0003	-.0011	-.0020	-.0029
PROP15	-.5534	-.5369	-.5285	-.4214	-.2218	-.0584	.2898	.6098	.8790
PROP65	-.1000	-1.3310	-.7359	.0566	.7171	.5342	1.3533	1.9841	2.2588
$\dot{P}$	-.0009	-.0004	-.0006	-.0007	-.0007	-.0007	-.0001	.0006	.0013
$\Delta\dot{P}$	-.0003	-.0001	-.0004	-.0006	-.0005	-.0006	.0005	.0008	.0014
$\dot{W}$	-.0002	.0014	.0009	.0005	.0001	-.0007	.0002	-.0015	-.0034
YRNF/GNP*	1.0011	.4098	.3773	.2462	.0850	-.1340	-.3334	-.5618	-.7760
PROF/GNP*	.2303	.2942	.2722	.1722	.0990	-.2179	-.2914	-.3674	-.6671
YUB*/GNP*	.5223	.1595	.0898	-.0693	-.3048	-.2278	-.0418	.0995	.4594
YOB /GNP*	-1.2285	-1.1329	-1.0033	-.7150	-.3600	.0369	.7819	1.4318	2.1922
GE/GNP*	-.0781	-.2433	-.2333	-.1705	-.0814	-.0009	.1804	.3257	.4544
X /GNP*	-.0289	-.3236	-.2816	-.2169	-.0910	-.0588	.1408	.2899	.4139
R^2	.986	.972	.976	.974	.933	.880	.986	.999	.981
$\bar{R}^2$	.983	.969	.972	.970	.925	.862	.984	.988	.979
S.E.	.007	.011	.010	.007	.006	.005	.005	.009	.018

NOTE: The results are based on the principal components selected according to the Mundlak method.

For definition of symbols see note to Table 4.2

TABLE 4.8

ALL INDIVIDUALS (TAXATION STATISTICS)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-.1143	.1336	.7719	.9078	1.1238	1.3293	1.2538	1.7053	1.6511
	(-.2560)	(.210)	(1.87)	(2.38)	(3.87)	(4.95)	(3.31)	(2.61)	(1.43)
D49	.0257	-.0014	.0185	.0196	.0217	.0157	.0034	.0116	.0234
	(1.32)	(-.49)	(1.03)	(1.19)	(1.72)	(1.35)	(.20)	(.41)	(.46)
D72	-.0861	-.1443	-.1272	-.1224	-.0919	-.0199	.0248	.0783	.2256
	(-2.68)	(-3.06)	(-4.29)	(-4.46)	(-4.40)	(-1.03)	(.91)	(1.66)	(2.71)
D78	-.1292	-.1217	-.0939	-.0649	-.0299	.0029	.0311	.0772	.1288
	(-8.85)	(-5.68)	(-6.98)	(-5.21)	(-3.15)	(.33)	(2.52)	(3.61)	(3.40)
UR	.0019	.0002	-.0046	-.0045	-.0044	-.0045	-.0032	-.0017	-.0009
	(.92)	(.06)	(-2.36)	(-2.51)	(-3.26)	(-3.58)	(-1.81)	(-.56)	(-.17)
FPR	-.0009	.0014	.0029	.0022	.0018	.0016	.0012	.0021	.0025
	(-.51)	(.57)	(1.89)	(1.53)	(1.66)	(1.61)	(.83)	(.86)	(.58)
PR15	.0006	.0003	-.0003	.0005	-.0002	-.0009	-.0009	-.0030	-.0046
	(.42)	(.13)	(-.20)	(.43)	(-.21)	(-1.08)	(-.75)	(-1.52)	(-1.32)
PR65	.0005	.0014	.0007	-.0003	-.0012	-.0022	-.0029	-.0049	.0043
	(.18)	(.33)	(.27)	(-.13)	(-.63)	(-1.20)	(-1.16)	(-1.13)	(.56)
PROP15	-.4334	-1.2361	-1.7957	-1.4922	-1.2898	-.9170	-.1782	-.1227	.7471
	(-.79)	(-1.54)	(-3.56)	(-3.19)	(-3.62)	(-2.79)	(-.38)	(-.15)	(.53)
PROP65	4.0012	3.8056	.9180	.3998	.0402	-.6205	.3975	-1.1378	.8260
	(1.62)	(1.05)	(.40)	(.19)	(.03)	(-.42)	(.19)	(-.32)	(.13)
$\dot{P}$	-.0010	-.0028	-.0024	-.0017	-.0009	-.0001	.0006	.0022	.0080
	(-.66)	(-1.30)	(-1.80)	(-1.38)	(-.91)	(-.13)	(.52)	(1.04)	(2.12)
$\Delta\dot{P}$	.0000	.0013	.0007	.0048	.0005	.0005	.0006	.0013	.0006
	(.04)	(.93)	(.81)	(.60)	(.86)	(.84)	(.70)	(.95)	(.24)
$\dot{W}$	-.0001	-.0004	-.0010	-.0011	-.0004	-.0000	.0006	.0020	.0044
	(-.11)	(-.19)	(-.87)	(-1.00)	(-.53)	(-.04)	(.59)	(1.10)	(1.33)
YRNF/GNP*	1.1781	1.3927	1.2497	.8728	.5381	.0889	-.3843	-.6891	-2.7104
	(3.45)	(2.78)	(3.97)	(2.99)	(2.43)	(.43)	(-1.33)	(-1.38)	(-3.06)
PROF/GNP*	.0493	.5347	.1321	.0186	-.2264	-.5037	-.7563	-.9233	-1.737
	(.21)	(1.52)	(.60)	(.09)	(-1.46)	(-3.50)	(-3.73)	(-2.63)	(-2.79)
YUB/GNP*	5.1402	7.4446	6.6227	5.8427	4.1202	.3274	-1.4673	-3.9009	-9.3922
	(3.03)	(2.99)	(4.24)	(4.04)	(3.74)	(.32)	(-1.02)	(-1.57)	(-2.14)
YOB/GNP*	.6151	1.6588	1.5101	1.4717	1.6830	1.2411	.6198	.5562	.9204
	(.35)	(.65)	(.94)	(.99)	(1.48)	(1.18)	(.42)	(.22)	(.20)
GE/GNP*	-.8330	-.5959	-.5126	-.3768	-.3180	-.0548	.1853	.3045	.2666
	(-3.20)	(-1.55)	(-2.13)	(-1.70)	(-1.88)	(-.35)	(.84)	(.80)	(.40)
X/GNP*	.2783	.1209	.1335	.1108	.1535	.1979	.2156	.3649	.4471
	(1.24)	(.37)	(.64)	(.58)	(1.05)	(1.47)	(1.13)	(1.11)	(.77)
R^2	.996	.993	.996	.994	.990	.967	.995	.995	.994
$\bar{R}^2$	.990	.983	.992	.987	.976	.925	.988	.989	.986
S.E.	.006	.009	.006	.005	.004	.004	.005	.009	.016
D.W.	2.495	2.495	2.421	2.523	2.764	2.454	2.548	2.532	2.255

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.9

ALL INDIVIDUALS (TAXATION STATISTICS)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.0859 (.61)	.5399 (7.45)	.6985 (14.37)	.6767 (11.44)	.7477 (16.49)	.8274 (22.85)	.8944 (19.71)	.9696 (22.72)	.9499 (3.26)
D49	.0133 (1.95)	-.0156 (-1.43)	-.0161 (-1.86)	-.0022 (-.28)	-.0002 (-.04)	-.0005 (-.10)	-.0008 (-.13)	.0035 (.60)	-.0032 (-.37)
D72	.0144 (3.28)	.0104 (3.65)	.0044 (2.48)	-.0026 (-1.08)	-.0045 (-2.42)	-.0027 (-1.47)	.0006 (.28)	.0004 (.21)	.0107 (1.14)
D78	-.1058 (-9.34)	-.0636 (-9.39)	-.0447 (-9.00)	-.0301 (-6.42)	-.0094 (-2.60)	.0119 (3.74)	.0298 (7.50)	.0522 (9.63)	.0622 (3.89)
UR	.0022 (1.87)	.0008 (.46)	-.0018 (-1.97)	-.0011 (-1.39)	-.0006 (-1.05)	-.0020 (-2.24)	-.0016 (-1.53)	.0020 (3.53)	-.0008 (-.31)
FPR	-.0018 (-7.17)	-.0020 (-6.52)	-.0013 (-32.78)	-.0010 (-26.92)	-.0006 (-20.04)	-.0002 (-.46)	.0007 (12.99)	.0016 (32.16)	.0039 (6.79)
PR15	.0004 (.45)	-.0003 (-.32)	.0009 (2.34)	.0012 (2.85)	.0005 (1.54)	-.0004 (-1.41)	-.0009 (-2.72)	-.0017 (-5.62)	-.0022 (-1.30)
PR65	.0017 (8.44)	.0015 (12.07)	.0013 (13.63)	.0010 (11.89)	.0005 (7.85)	-.0003 (-6.33)	-.0012 (-21.04)	-.0021 (-36.01)	-.0026 (-6.73)
PROP15	-.4626 (-8.27)	-.7664 (-12.33)	-.7059 (-14.21)	-.5521 (-12.78)	-.3650 (-11.02)	-.0593 (-2.14)	.2770 (8.09)	.6412 (16.04)	1.2263 (9.82)
PROP65	2.5694 (1.77)	1.1121 (1.30)	.9403 (1.53)	1.5884 (2.78)	1.9523 (4.45)	2.1875 (6.49)	2.2665 (5.47)	2.0962 (7.25)	6.2582 (1.84)
$\dot{P}$	-.0001 (-.15)	-.0010 (-1.47)	-.0002 (-.59)	.0006 (1.18)	.0004 (1.10)	.0001 (.46)	.0002 (.56)	.0003 (1.97)	.0047 (3.33)
$\Delta\dot{P}$	-.0011 (-2.21)	.0001 (.22)	-.0010 (-2.24)	-.0008 (-2.18)	-.0008 (-2.82)	-.0002 (-.80)	.0007 (1.99)	.0015 (3.23)	-.0007 (-.84)
$\dot{W}$	-.0005 (-.49)	.0002 (.49)	.0005 (1.30)	.0002 (.75)	-.0001 (-.63)	.0002 (.37)	.0007 (1.38)	.0009 (1.07)	-.0003 (-.24)
YRNF/GNP*	.7302 (3.88)	.8754 (4.12)	.4362 (10.52)	.3709 (7.81)	.2080 (5.71)	.0098 (.29)	-.2356 (-5.71)	-.6195 (-23.66)	-1.8952 (-4.57)
PROF/GNP*	-.1010 (-.68)	.3676 (3.85)	.2751 (3.56)	.0269 (.27)	-.0695 (-.90)	-.3219 (-3.34)	-.5699 (-4.82)	-.3955 (-5.09)	-1.1646 (-3.81)
YUB*/GNP*	.5375 (2.44)	.5771 (3.77)	.2554 (2.55)	-.1099 (-.88)	-.2308 (-2.41)	-.1119 (-.97)	.0914 (.65)	-.0149 (-.15)	.2498 (.69)
YOB/GNP*	-1.7810 (-4.32)	-.9526 (-5.27)	-.7100 (-5.04)	-.5941 (-4.70)	-.2373 (-2.45)	.2392 (3.01)	.8143 (8.36)	1.4720 (40.68)	.8171 (.89)
GE/GNP*	-.3562 (-2.39)	-.1266 (-2.06)	-.1884 (-6.75)	-.0864 (-2.61)	-.0157 (-.62)	.1184 (5.94)	.2677 (10.95)	.3606 (28.44)	-.2572 (-.72)
X/GNP*	.2125 (1.51)	-.2010 (-1.48)	-.4030 (-13.25)	-.2699 (-9.69)	-.1664 (-7.79)	-.0200 (-1.21)	.1453 (7.11)	.3562 (12.12)	.4131 (1.32)
R^2	.992	.985	.988	.984	.970	.939	.993	.993	.988
$\bar{R}^2$	.988	.980	.984	.978	.959	.917	.990	.991	.985
S.E.	.007	.009	.008	.007	.005	.004	.005	.008	.016
D.W.	1.886	1.404	1.145	1.176	1.476	1.942	2.376	2.560	1.421
D.F.	21	25	25	24	24	23	22	25	24

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.10

ALL INDIVIDUALS (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.3339	.3386	.5755	.7952	.9449	1.0593	1.1279	1.2171	1.5575
	(5.81)	(7.54)	(13.98)	(20.17)	(27.87)	(38.79)	(43.51)	(27.16)	(14.95)
UR	.0150	.0027	.0037	-.0012	.0005	-.0006	.0006	.0076	.0266
	(1.27)	(.29)	(.43)	(-.15)	(.07)	(-.10)	(.11)	(.83)	(1.24)
FPR	-.0075	-.0028	-.0057	-.0049	-.0028	.0002	.0045	.0092	.0101
	(-3.94)	(-1.89)	(-4.14)	(-3.71)	(-2.49)	(.18)	(5.27)	(6.14)	(2.90)
$\dot{P}$	.0104	.0031	.0045	.0025	.0008	-.0015	-.0051	-.0074	-.0055
	(2.91)	(1.09)	(1.73)	(1.01)	(.35)	(-.88)	(-3.41)	(-2.66)	(-.84)
$\Delta\dot{P}$	-.0028	-.0041	-.0064	-.0070	-.0038	.0010	.0084	.0125	.0113
	(-.48)	(-.92)	(-1.56)	(-1.78)	(-1.14)	(.37)	(3.28)	(2.81)	(1.09)
$\dot{W}$	-.0030	-.0051	-.0070	-.0079	-.0053	-.0015	.0028	.0053	.0149
	(-.70)	(-1.52)	(-2.27)	(-2.66)	(-2.06)	(-.74)	(1.42)	(1.58)	(1.90)
YUB/GNP*	-3.1279	1.1299	1.2948	.1508	-1.7758	-1.5045	-.6215	-.9613	-4.2636
	(-1.05)	(.49)	(.61)	(.07)	(-1.01)	(-1.06)	(-.46)	(-.41)	(-.79)
R^2	.756	.419	.738	.807	.795	.578	.814	.919	.818
$\bar{R}^2$	.610	.071	.581	.691	.672	.325	.703	.870	.709
S.E.	.026	.020	.018	.017	.015	.012	.012	.020	.046

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.11

ALL INDIVIDUALS (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.3277	.3482	.5803	.7961	.9467	1.0654	1.1250	1.2163	1.5640
	(6.03)	(9.03)	(14.57)	(21.06)	(30.05)	(115.12)	(47.03)	(28.19)	(15.59)
UR	.0130	-.0008	-.0024	-.0043	-.0034	-.0017	.0042	.0108	.0167
	(1.13)	(-.52)	(-1.27)	(-2.66)	(-2.55)	(-3.67)	(3.80)	(5.37)	(3.82)
FPR	-.0065	-.0023	-.0052	-.0043	-.0026	-.0004	.0043	.0088	.0096
	(-3.76)	(-2.09)	(-4.43)	(-4.28)	(-3.16)	(-3.67)	(6.04)	(6.97)	(3.64)
$\dot{P}$	.0113	.0021	.0037	.0017	-.0002	-.0006	-.0047	-.0065	-.0073
	(3.47)	(.91)	(1.60)	(.77)	(-.09)	(-3.67)	(-3.39)	(-2.61)	(-1.24)
$\Delta\dot{P}$	-.0053	-.0068	-.0071	-.0095	-.0045	.0004	.0089	.0141	.0140
	(-1.03)	(-1.91)	(-1.85)	(-2.93)	(-1.67)	(3.67)	(3.92)	(3.46)	(1.57)
$\dot{W}$	-.0042	-.0054	-.0077	-.0081	-.0045	.0005	.0032	.0047	.0175
	(-1.80)	(-2.24)	(-2.66)	(-3.63)	(-2.43)	(3.67)	(1.94)	(1.56)	(2.77)
YUB/GNP*	-5.0275	.8382	2.6348	.2224	-.3588	-.5549	-1.4219	-1.8318	1.0890
	(-1.96)	(2.32)	(2.39)	(.55)	(-1.07)	(-3.67)	(-2.14)	(-1.53)	(1.01)
R^2	.713	.293	.724	.763	.764	.473	.805	.907	.793
$\bar{R}^2$	.613	.192	.598	.708	.709	.438	.740	.876	.724
S.E.	.025	.018	.018	.017	.014	.011	.011	.019	.045
D.F.	12	14	11	13	13	15	12	12	12

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.12

ALL MALE INDIVIDUALS (TAXATION STATISTICS)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-1.1589	-3.0204	-2.6134	-1.3365	-.0728	.8926	1.6220	3.7042	8.1307
	(-3.60)	(-6.38)	(-5.16)	(-2.61)	(-.16)	(2.08)	(3.11)	(3.41)	(3.85)
MUR	-.0032	.0032	.0017	.0060	.0136	.0181	.0209	.0148	.0514
	(-1.00)	(.66)	(.33)	(1.16)	(3.01)	(4.20)	(4.00)	(1.36)	(2.43)
MPR	.0177	.0434	.0403	.0259	.0114	.0006	-.0070	-.0303	-.0841
	(4.54)	(7.56)	(6.56)	(4.17)	(2.10)	(.12)	(-1.11)	(-2.31)	(-3.29)
$\dot{P}$	-.0030	-.0068	-.0031	-.0017	-.0013	.0015	.0051	-.0011	.0140
	(-2.40)	(-3.75)	(-1.63)	(-.84)	(-.78)	(.92)	(2.56)	(-.26)	(1.73)
$\Delta\dot{P}$	-.0010	.0005	-.0008	.0038	.0089	.0123	.0187	.0264	.0568
	(-.52)	(.17)	(-.29)	(1.29)	(3.47)	(5.03)	(6.26)	(4.28)	(4.72)
$\dot{W}$	-.0011	.0003	.0029	.0026	.0014	.0022	.0034	.0050	.0085
	(-.71)	(.15)	(1.19)	(1.07)	(.65)	(1.04)	(1.36)	(.95)	(.84)
YUB^*/GNP^*	1.7910	2.8675	2.2927	.4452	-1.1229	-2.2543	-3.0869	-.5380	-16.5060
	(3.50)	(3.82)	(2.85)	(.55)	(-1.58)	(-3.31)	(-3.73)	(-.31)	(-4.93)
R^2	.879	.943	.908	.828	.776	.797	.880	.829	.842
$\bar{R}^2$	.806	.909	.853	.725	.642	.674	.808	.726	.747
S.E.	.007	.011	.011	.011	.010	.010	.011	.024	.047
D.W.	1.855	2.66	2.59	2.89	2.94	2.785	2.957	2.636	2.558

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.13

ALL MALE INDIVIDUALS (TAXATION STATISTICS)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-1.1589	-3.0877	-2.6703	-1.0153	.4855	.6760	1.1177	4.1903	7.9416
	(-3.96)	(-8.06)	(-6.48)	(-2.61)	(1.63)	(2.61)	(2.99)	(9.65)	(4.03)
MUR	-.0032	.0091	.0026	.0028	.0101	.0184	.0235	.0093	.0492
	(-1.00)	(4.00)	(.92)	(1.20)	(2.40)	(4.99)	(4.65)	(2.08)	(2.48)
MPR	.0177	.0438	.0409	.0022	.0046	.0034	-.0009	-.0360	-.0814
	(4.54)	(9.27)	(8.00)	(4.62)	(1.30)	(1.11)	(-.19)	(-6.48)	(-3.42)
$\dot{P}$	- .0030	-.0066	-.0028	-.0034	-.0003	.0009	.0041	-.0037	.0130
	(-2.40)	(-8.24)	(-2.28)	(-4.22)	(-.16)	(.65)	(2.14)	(-1.76)	(1.72)
$\Delta\dot{P}$	-.0010	.0037	-.0005	.0028	.0095	.0121	.0197	.0222	.0566
	(-.52)	(2.01)	(-.22)	(1.50)	(4.33)	(6.23)	(6.68)	(5.54)	(5.26)
$\dot{W}$	-.0011	.0014	.0033	.0011	.0010	.0025	.0053	.0039	.0093
	(-.72)	(4.20)	(1.78)	(.58)	(.66)	(1.82)	(2.49)	(1.64)	(.99)
YUB^*/GNP^*	1.7910	2.1809	2.1685	.9464	-1.6624	-2.2126	-2.3553	.4865	-16.8490
	(3.50)	(4.20)	(4.09)	(1.80)	(-3.00)	(-4.57)	(-3.67)	(1.53)	(-5.35)
R^2	.879	.928	.908	.809	.708	.754	.859	.806	.830
$\bar{R}^2$	.806	.904	.866	.746	.611	.698	.794	.761	.773
S.E.	.007	.011	.011	.011	.011	.009	.012	.023	.045
D.W.	1.855	2.202	2.569	2.845	2.488	2.363	2.570	2.433	2.447
D.F.	10	12	11	12	12	13	11	13	12

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.14

ALL MALE INDIVIDUALS (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-.6619	-.8476	-.3679	.0623	.6445	1.1340	1.6110	2.3273	3.2951
	(-3.03)	(-3.25)	(-1.37)	(.33)	(4.17)	(9.34)	(7.77)	(14.52)	(4.14)
MUR	.0001	-.0018	-.0066	.0024	.0065	.0120	.0185	.0284	.0236
	(.02)	(-.20)	(-.72)	(.37)	(1.22)	(2.88)	(2.59)	(5.15)	(.86)
MPR	.0105	.0151	.0122	.0087	.0032	-.0013	-.0057	-.0124	-.0200
	(4.05)	(4.88)	(3.85)	(3.88)	(1.73)	(-.91)	(-2.30)	(-6.55)	(-2.12)
$\dot{P}$	.0017	-.0001	-.0025	-.0008	-.0014	-.0015	-.0005	.0028	.0138
	(.86)	(-.03)	(-1.03)	(-.49)	(-1.02)	(-1.40)	(-.29)	(1.91)	(1.92)
$\Delta\dot{P}$	-.0041	-.0036	-.0037	-.0010	.0020	.0037	.0057	.0082	-.0015
	(-1.12)	(-.81)	(-.81)	(-.31)	(.75)	(1.81)	(1.61)	(3.04)	(-.11)
$\dot{W}$	-.0014	-.0013	-.0021	.0001	.0001	-.0008	-.0009	.0008	.0144
	(-.46)	(-.34)	(-.56)	(.04)	(.05)	(-.45)	(-.32)	(.35)	(1.31)
YUB/GNP*	1.1128	1.2372	.5456	-1.1866	-.6731	-.8643	-1.1199	-4.2374	-7.1263
	(.57)	(.53)	(.23)	(-.70)	(-.49)	(-.80)	(-.60)	(-2.95)	(-1.00)
R^2	.664	.801	.816	.814	.549	.708	.795	.944	.688
$\bar{R}^2$	.463	.682	.706	.702	.278	.533	.671	.911	.501
S.E.	.012	.021	.022	.015	.012	.010	.017	.013	.064

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.15

ALL MALE INDIVIDUALS (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-.6597	-.8507	.0284	.1600	.7190	1.0363	1.5542	2.3273	3.1458
	(-3.19)	(-3.51)	(.24)	(.99)	(11.70)	(9.34)	(15.20)	(14.52)	(10.13)
MUR	.0034	.0032	-.0009	.0008	.0016	-.0117	.0181	.0284	-.0039
	(1.70)	(1.36)	(-.37)	(.46)	(1.28)	(-.03)	(2.62)	(5.15)	(-.61)
MPR	.0103	.0149	.0072	.0075	.0026	-.0000	-.0051	-.0124	-.0174
	(4.23)	(5.22)	(4.80)	(4.08)	(3.30)	(-.27)	(-3.67)	(-6.55)	(-4.42)
$\dot{P}$	.0017	.0005	-.0036	-.0024	-.0015	.0002	-.0001	.0028	.0094
	(1.01)	(.28)	(-3.64)	(-2.76)	(-3.01)	(.22)	(-.06)	(1.91)	(3.66)
$\Delta\dot{P}$	-.0038	-.0022	.0021	.0013	.0002	.0009	.0055	.0082	-.0032
	(-1.29)	(-.64)	(3.43)	(1.60)	(.53)	(.73)	(1.63)	(3.04)	(-2.02)
$\dot{W}$	-.0002	-.0005	-.0050	.0005	-.0026	-.0014	.0029	.0008	.0144
	(-.06)	(-.18)	(-2.68)	(.21)	(-2.67)	(-.88)	(2.25)	(.35)	(2.98)
YUB/GNP*	.2448	.0494	-1.3813	-.2155	-.1441	-1.3829	-.8265	-4.2374	2.2257
	(.29)	(.05)	(-3.76)	(-.35)	(-.76)	(-1.28)	(-.48)	(-2.95)	(2.33)
R^2	.638	.795	.719	.790	.447	.623	.735	.944	.633
$\bar{R}^2$	.517	.726	.679	.721	.368	.498	.674	.911	.580
S.E.	.017	.019	.023	.015	.012	.010	.017	.013	.059
D.F.	12	12	14	12	14	12	13	10	14

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.16

MALE INDIVIDUALS OF AGE UNDER 25 (TAXATION STATISTICS)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.0358	-.1081	-.2220	-.2133	.3374	1.0663	1.8214	2.5061	3.0026
	(.26)	(-.46)	(-.68)	(-.56)	(1.12)	(4.81)	(12.84)	(6.17)	(6.93)
MUR15	-.0032	-.0072	-.0096	-.0110	-.0122	-.0082	-.0021	.0053	.0142
	(-2.66)	(-3.48)	(-3.38)	(-3.34)	(-4.64)	(-4.26)	(-1.70)	(1.49)	(3.75)
MPR15	.0030	.0085	.0135	.0164	.0111	.0022	-.0073	-.0151	-.0197
	(1.41)	(2.32)	(2.66)	(2.80)	(2.37)	(.65)	(-3.34)	(-2.40)	(-2.93)
$\dot{P}$	-.0052	-.0077	-.0119	-.0146	-.0098	-.0025	.0063	.0102	.0232
	(-3.38)	(-2.93)	(-3.26)	(-3.46)	(-2.92)	(-1.01)	(3.97)	(2.26)	(4.80)
$\Delta\dot{P}$	-.0035	-.0039	-.0041	-.0047	-.0104	-.0106	-.0085	-.0133	-.0124
	(-1.78)	(-1.15)	(-.87)	(-.87)	(-2.39)	(-3.31)	(-4.16)	(-2.28)	(-1.99)
$\dot{W}$	-.0042	-.0015	-.0020	-.0019	-.0045	-.0035	-.0002	.0008	.0101
	(-2.50)	(-.52)	(-.51)	(-.41)	(-1.23)	(-1.30)	(-.12)	(.15)	(1.91)
YUB^*/GNP^*	2.6286	2.7083	2.4180	2.7362	2.4514	.9339	-1.0778	-.8985	-1.5318
	(4.79)	(2.90)	(1.87)	(1.84)	(2.05)	(1.07)	(-1.92)	(-.56)	(-.90)
R^2	.899	.778	.740	.743	.793	.772	.932	.790	.916
$\bar{R}^2$	.838	.645	.584	.588	.669	.634	.890	.665	.865
S.E.	.007	.012	.017	.019	.015	.011	.077	.021	.022
D.W.	3.033	1.386	1.129	1.130	1.561	1.757	2.321	2.559	2.719

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.17

MALE INDIVIDUALS OF AGE UNDER 25 (TAXATION STATISTICS)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.0694	.1996	-.1860	-.1805	.6979	1.0173	1.8157	2.4727	2.9495
	(5.20)	(4.57)	(-.56)	(-.49)	(14.50)	(26.84)	(12.93)	(6.59)	(7.00)
MUR15	-.0029	-.0077	-.0099	-.0113	-.0129	-.0080	-.0019	.0048	.0122
	(-3.71)	(-3.86)	(-3.47)	(-3.49)	(-5.15)	(-4.71)	(-1.58)	(1.98)	(4.32)
MPR15	.0025	.0036	.0131	.0159	.0056	.0030	-.0072	-.0144	-.0186
	(9.72)	(4.24)	(2.54)	(2.76)	(5.45)	(3.97)	(-3.32)	(-2.51)	(-2.87)
$\dot{P}$	-.0051	-.0049	-.0123	-.0149	-.0072	-.0028	.0060	.0101	.0242
	(-5.13)	(-2.50)	(-3.33)	(-3.58)	(-2.92)	(-1.64)	(3.91)	(2.53)	(5.29)
$\Delta\dot{P}$	-.0042	-.0068	-.0043	-.0049	-.0139	-.0105	-.0092	-.0156	-.0147
	(-4.74)	(-3.63)	(-.90)	(-.91)	(-4.33)	(-5.42)	(-4.91)	(-3.52)	(-2.66)
$\dot{W}$	-.0043	-.0023	-.0016	-.0015	-.0077	-.0029	-.0011	-.0010	.0100
	(-4.80)	(-5.21)	(-.40)	(-.33)	(-3.66)	(-1.99)	(-.76)	(-.25)	(1.94)
YUB^*/GNP^*	2.7131	3.4140	2.2805	2.6106	3.0190	.8695	-1.1723	-1.1467	-1.6795
	(6.00)	(4.00)	(1.75)	(1.77)	(2.84)	(1.18)	(-2.15)	(-.78)	(-1.00)
R^2	.891	.697	.705	.721	.763	.768	.926	.780	.911
$\bar{R}^2$	.866	.627	.571	.594	.684	.691	.892	.706	.870
S.E.	.006	.012	.017	.019	.015	.010	.007	.019	.022
D.W.	2.965	1.107	1.131	1.154	1.537	1.790	2.278	2.248	2.344
D.F.	13	13	11	11	12	12	11	12	11

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.18

MALE INDIVIDUALS OF AGE UNDER 25 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-.1906	-.3654	-.5064	-.4969	.0252	1.0125	1.7939	2.4834	3.4673
	(-2.43)	(-2.34)	(-2.58)	(-1.91)	(.11)	(7.20)	(18.90)	(14.87)	(7.68)
MUR15	-.0021	-.0045	-.0057	-.0067	-.0091	-.0145	-.0088	.0037	.0211
	(-.61)	(-.64)	(-.65)	(-.57)	(-.89)	(-2.29)	(-2.06)	(.49)	(1.04)
MPR15	.0050	.0096	.0141	.0169	.0135	.0042	-.0040	-.0112	-.0220
	(4.86)	(4.74)	(5.54)	(5.00)	(4.53)	(2.29)	(-3.27)	(-5.16)	(-3.75)
$\dot{P}$	-.0039	-.0065	-.0100	-.0126	-.0136	-.0077	-.0017	.0065	.0132
	(-2.50)	(-2.10)	(-2.58)	(-2.43)	(-3.00)	(-2.76)	(-.90)	(1.93)	(1.47)
$\Delta\dot{P}$	.0005	.0002	.0008	-.0013	-.0007	-.0068	-.0029	.0060	.0166
	(.16)	(.04)	(.10)	(-.13)	(-.08)	(-1.20)	(-.76)	(.89)	(.92)
$\dot{W}$	.0011	.0015	.0018	.0026	.0010	-.0052	-.0020	.0032	-.0025
	(.43)	(.29)	(.27)	(.29)	(.13)	(-1.12)	(-.63)	(.57)	(-.17)
YUB/GNP*	.6272	2.0842	3.4744	4.4780	3.6882	1.5726	-.4509	-5.0679	-6.4834
	(.34)	(.57)	(.76)	(.74)	(.70)	(.48)	(-.20)	(-1.30)	(-.61)
R^2	.819	.792	.834	.794	.810	.830	.809	.782	.697
$\bar{R}^2$	.710	.666	.735	.670	.697	.728	.694	.651	.515
S.E.	.016	.031	.039	.052	.045	.023	.019	.034	.091

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.19

MALE INDIVIDUALS OF AGE UNDER 25 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-.1535	-.3204	-.4395	-.4241	.0450	.9467	1.7597	2.4473	3.4531
	(-2.74)	(-2.95)	(-3.17)	(-2.34)	(.28)	(8.59)	(20.71)	(20.60)	(10.63)
MUR15	-.0007	-.0001	.0002	.0011	-.0016	-.0143	-.0031	-.0033	-.0013
	(-1.23)	(-.11)	(.13)	(.64)	(-.94)	(-2.39)	(-5.30)	(-2.54)	(-.42)
MPR15	.0046	.0089	.0132	.0158	.0131	.0048	-.0041	-.0104	-.0200
	(5.55)	(5.47)	(6.32)	(5.82)	(5.55)	(3.27)	(-3.66)	(-6.00)	(-4.09)
$\dot{P}$	-.0038	-.0059	-.0089	-.0113	-.0119	-.0075	-.0021	.0068	.0142
	(-4.56)	(-3.91)	(-4.63)	(-4.49)	(-4.93)	(-4.73)	(-1.59)	(3.84)	(3.15)
$\Delta\dot{P}$	-.0005	-.0007	-.0015	-.0033	-.0030	-.0048	.0009	.0039	.0039
	(-.63)	(-.40)	(-.70)	(-1.14)	(-1.19)	(-1.60)	(1.16)	(2.13)	(.77)
$\dot{W}$	-.0018	-.0054	-.0078	-.0089	-.0043	-.0011	-.0001	.0069	.0113
	(-2.45)	(-6.06)	(-6.85)	(-5.98)	(-2.04)	(-.68)	(-.04)	(4.47)	(4.24)
YUB/GNP*	-.7649	-.4850	-.5857	-.3681	-2.1187	2.3205	-2.3459	-1.1683	.5120
	(-2.49)	(-1.34)	(-1.27)	(-.61)	(-2.39)	(.80)	(-6.45)	(-1.79)	(.47)
R^2	.783	.727	.775	.731	.777	.815	.768	.741	.576
$\bar{R}^2$	.733	.688	.742	.693	.726	.753	.714	.682	.515
S.E.	.015	.030	.039	.051	.002	.027	.018	.032	.091
D.F.	13	14	14	14	13	12	13	13	14

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.20

MALE INDIVIDUALS OF AGE 25-64 (TAXATION STATISTICS)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	1.0566	1.3849	1.1428	1.1116	1.0465	.9973	.9092	.5888	.4859
	(2.76)	(4.66)	(4.20)	(5.23)	(5.20)	(5.08)	(3.55)	(1.38)	(.38)
UR25	-.0182	-.0038	.0046	.0173	.0225	.0234	.0225	.0544	.0662
	(-1.49)	(-.40)	(.52)	(2.55)	(3.50)	(3.73)	(2.75)	(3.99)	(1.62)
PR25	-.0101	-.0131	-.0073	-.0056	-.0033	-.0010	.0024	.0077	.0138
	(-1.60)	(-2.67)	(-1.63)	(-1.59)	(-1.00)	(-.32)	(.56)	(1.10)	(.65)
$\dot{P}$	-.0004	.0044	.0012	.0001	.0009	.0009	-.0042	-.0043	.0076
	(-.08)	(1.17)	(.34)	(.02)	(.37)	(.35)	(-1.27)	(-.79)	(.46)
$\Delta\dot{P}$	-.0036	-.0027	.0022	.0069	.0107	.0144	.0210	.0429	.0559
	(-.62)	(-.61)	(.54)	(2.16)	(3.52)	(4.88)	(5.46)	(6.68)	(2.90)
$\dot{W}$	-.0075	-.0059	-.0042	-.0024	-.0000	.0012	.0048	.0199	.0181
	(-1.91)	(-1.93)	(-1.50)	(-1.11)	(-.02)	(.62)	(1.83)	(4.58)	(1.38)
YUB^*/GNP^*	4.5191	2.2839	.4332	-1.2494	-2.3840	-2.7531	-1.1932	-5.3713	-16.8140
	(2.75)	(1.79)	(.37)	(-1.37)	(-2.76)	(-3.27)	(-1.09)	(-2.93)	(-3.05)
R^2	.660	.669	.530	.701	.744	.798	.791	.834	.615
$\bar{R}^2$	.457	.469	.249	.522	.590	.678	.666	.734	.384
S.E.	.022	.017	.016	.012	.012	.011	.015	.024	.074
D.W.	1.838	1.688	2.048	2.580	2.557	2.837	3.001	2.376	2.461

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.21

MALE INDIVIDUALS OF AGE 25-64 (TAXATION STATISTICS)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	1.1894	1.1836	.7267	1.1611	1.0362	1.0092	.8397	.2123	-.5966
	(5.54)	(6.84)	(38.88)	(7.42)	(5.37)	(5.35)	(5.32)	(.75)	(-.75)
UR25	-.0133	-.0103	-.0025	.0170	.0228	.0231	.0205	.0473	.0203
	(-4.63)	(-4.50)	(-3.00)	(2.67)	(3.69)	(3.82)	(4.87)	(6.25)	(1.86)
PR25	-.0123	-.0094	-.0006	-.0064	-.0032	-.0012	.0036	.0144	.0334
	(-3.93)	(-3.78)	(-3.00)	(-2.27)	(-1.01)	(-.37)	(1.58)	(3.44)	(2.95)
$\dot{P}$	.0007	.0006	.0001	.0004	.0011	.0008	-.0055	-.0115	-.0039
	(4.43)	(4.29)	(3.00)	(.14)	(.42)	(.31)	(-4.29)	(-5.00)	(-2.62)
$\Delta\dot{P}$	-.0051	-.0036	.0047	.0059	.0107	.0144	.0205	.0359	.0504
	(-1.32)	(-1.17)	(3.00)	(2.49)	(3.67)	(5.02)	(6.20)	(6.55)	(3.64)
$\dot{W}$	-.0091	-.0071	-.0023	-.0032	-.0001	.0014	.0040	.0166	.0152
	(-4.88)	(-4.77)	(-3.00)	(-1.71)	(-.07)	(.71)	(2.56)	(6.52)	(2.23)
YUB^*/GNP^*	3.8364	2.9149	-.0566	-.7927	-2.3459	-2.7971	-1.0106	-4.5751	-13.8520
	(3.58)	(3.42)	(-3.00)	(-1.35)	(-2.83)	(-3.44)	(-1.27)	(-3.13)	(-3.58)
R^2	.636	.628	.376	.660	.738	.792	.787	.756	.561
$\bar{R}^2$	.584	.574	.335	.546	.619	.698	.715	.721	.459
S.E.	.019	.015	.015	.012	.011	.011	.014	.025	.069
D.W.	1.888	1.921	1.459	2.446	2.497	2.757	2.973	1.792	2.536
D.F.	14	14	15	12	11	11	12	14	13

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.22

MALE INDIVIDUALS OF AGE 25-64 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.6376	.7456	.8499	.8670	.9333	.9609	1.0347	1.0532	1.7114
	(3.97)	(6.31)	(7.77)	(12.32)	(13.49)	(1.09)	(12.49)	(4.43)	(2.50)
UR25	-.0259	-.0134	.0026	.0090	.0164	.0216	.0264	.0462	-.0075
	(-1.95)	(-1.38)	(.29)	(1.55)	(2.87)	(2.99)	(3.86)	(2.35)	(-.13)
PR25	-.0033	-.0023	-.0025	-.0013	-.0010	-.0001	.0006	.0019	-.0017
	(-1.23)	(-1.16)	(-1.36)	(-1.08)	(-.87)	(-.05)	(.40)	(.47)	(-.15)
$\dot{P}$	.0007	.0006	.0012	-.0002	-.0007	-.0006	.0015	.0013	.0179
	(.22)	(.26)	(.57)	(-.13)	(-.52)	(-.34)	(.91)	(.29)	(1.34)
$\Delta\dot{P}$	-.0072	-.0046	-.0005	.0019	.0036	.0048	.0051	.0093	-.0155
	(-1.38)	(-1.21)	(-.15)	(.83)	(1.59)	(1.69)	(1.90)	(1.21)	(-.70)
$\dot{W}$	-.0048	-.0031	-.0009	-.0001	-.0004	.0006	.0013	.0099	.0050
	(-1.17)	(-1.02)	(-.32)	(-.06)	(-.25)	(.26)	(.63)	(1.64)	(.29)
YUB/GNP*	3.7749	1.3674	-.4443	-.6974	-1.1123	-1.3657	-3.0209	-5.2595	.7723
	(1.39)	(.69)	(-.24)	(-.59)	(-.95)	(-.93)	(-2.16)	(-1.31)	(.07)
R^2	.501	.467	.284	.365	.661	.717	.797	.555	.315
$\bar{R}^2$	.202	.147	--	--	.458	.547	.674	.289	--
S.E.	.023	.017	.016	.010	.010	.012	.012	.034	.098

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.23

MALE INDIVIDUALS OF AGE 25-64 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.4408	.6127	.7314	.8460	.9091	.9985	1.0533	1.1830	1.4536
	(12.95)	(24.88)	(33.15)	(50.69)	(27.04)	(34.86)	(58.39)	(23.51)	(10.37)
UR25	-.0260	-.0024	-.0013	.0017	.0136	.0207	.0255	.0444	.0084
	(-2.17)	(-2.62)	(-1.54)	(1.99)	(1.96)	(3.05)	(4.01)	(2.51)	(1.61)
PR25	-.0001	-.0007	-.0004	-.0005	-.0007	-.0005	.0003	.0001	.0024
	(-.18)	(-2.62)	(-1.54)	(-1.99)	(-.94)	(-1.08)	(.98)	(.16)	(1.61)
$\dot{P}$	-.0026	-.0005	-.0003	-.0009	.0013	.0005	.0027	.0045	.0019
	(-2.52)	(-2.62)	(-1.54)	(-1.99)	(2.19)	(.66)	(4.80)	(2.90)	(1.61)
$\Delta\dot{P}$	-.0032	.0005	.0003	-.0001	.0026	.0019	.0029	.0054	-.0017
	(-1.61)	(2.62)	(1.54)	(-1.99)	(1.75)	(1.72)	(2.77)	(1.87)	(1.61)
$\dot{W}$	-.0027	.0006	.0003	-.0019	.0026	-.0012	.0025	.0047	-.0020
	(-1.51)	(2.62)	(1.54)	(-1.99)	(1.67)	(-.74)	(2.57)	(1.77)	(-1.61)
YUB/GNP*	3.5905	-.5833	-.3067	.1290	-1.3514	-2.0416	-3.2683	-6.1825	2.0315
	(1.59)	(-2.62)	(-1.54)	(1.99)	(.94)	(-1.61)	(-2.73)	(-1.85)	(1.61)
R^2	.407	.315	.137	.209	.329	.669	.745	.473	.147
$\bar{R}^2$	.323	.269	.079	.156	.174	.593	.708	.398	.090
S.E.	.021	.016	.014	.009	.012	.012	.011	.031	.089
D.F.	14	15	15	15	13	13	14	14	15

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.24

MALE INDIVIDUALS OF AGE 65 AND OVER (TAXATION STATISTICS)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.2223	.0991	.1456	.1902	1.0562	1.4517	1.2129	2.6919	3.9553
	(.27)	(.30)	(.79)	(.48)	(2.08)	(2.42)	(2.46)	(5.89)	(5.12)
MUR65	.0135	.0036	-.0047	-.0079	-.0118	-.0198	-.0134	.0004	.0066
	(1.03	(.68)	(-1.56)	(-1.21)	(-1.44)	(-2.04)	(-1.68)	(.06)	(.53)
MPR65	-.0047	.0052	.0103	.0121	-.0016	-.0039	.0012	-.0274	-.0457
	(-.30)	(.81)	(2.85)	(1.56)	(-.17)	(-.34)	(.13)	(-3.08)	(-3.04)
$\dot{P}$	-.0083	-.0020	-.0041	-.0026	-.0005	.0136	.0122	.0000	.0026
	(-1.11)	(-.67)	(-2.34)	(-.71)	(-.11)	(2.46)	(2.68)	(.01)	(.37)
$\Delta\dot{P}$	-.0073	-.0038	.0013	.0041	-.0047	-.0097	-.0012	-.0151	-.0167
	(-.44)	(-.56)	(.35)	(.50)	(-.45)	(-.78)	(-.12)	(-1.59)	(-1.04)
$\dot{W}$	-.0065	-.0026	-.0007	.0014	.0017	.0132	.0151	-.0063	-.0158
	(-.47)	(-.46)	(-.22)	(.21)	(.19)	(1.28)	(1.78)	(-.81)	(-1.19)
YOB/GNP*	2.7707	4.0033	4.2550	5.2694	-8.2264	-16.1240	-7.2365	-24.4690	-34.6090
	(.18)	(.65)	(1.23)	(.71)	(-.87)	(-1.44)	(-.79)	(-2.88)	(-2.41)
R^2	.222	.663	.958	.808	.541	.720	.661	.774	.876
$\bar{R}^2$	--	.461	.933	.693	.265	.551	.457	.638	.787
S.E.	.042	.017	.010	.021	.026	.031	.026	.024	.040
D.W.	.997	.858	2.183	2.244	2.634	2.961	3.155	2.948	1.874

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.25

MALE INDIVIDUALS OF AGE 65 AND OVER (TAXATION STATISTICS)
OLS METHOD

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.1674	.4113	.5893	.6923	.7768	1.0056	1.1625	1.2301	1.5774
	(1.84)	(10.62)	(15.53)	(12.34)	(12.14)	(12.55)	(18.21)	(17.17)	(13.58)
$\dot{P}$	-.0074	-.0031	-.0060	-.0051	-.0002	.0143	.0120	.0055	.0118
	(-1.17)	(-1.14)	(-2.29)	(-1.29)	(-.04)	(2.58)	(2.69)	(1.11)	(1.46)
$\Delta\dot{P}$	.0018	-.0009	.0003	.0004	-.0092	-.0258	-.0172	-.0088	-.0003
	(.24)	(-.27)	(.09)	(.09)	(-1.72)	(-3.86)	(-3.24)	(-1.48)	(-.03)
YOB/GNP*	3.0240	-1.7782	-3.3674	-3.2509	-2.4275	-7.1594	-5.9031	1.9986	8.2122
	(.78)	(-1.08)	(-2.08)	(-1.36)	(-.89)	(-2.09)	(-2.17)	(.65)	(1.66)
R^2	.113	.581	.841	.660	.341	.548	.487	.498	.729
$\bar{R}^2$	--	.484	.804	.581	.189	.444	.369	.382	.666
S.E.	.040	.017	.016	.024	.028	.035	.028	.031	.050
D.W.	.731	.906	.779	1.129	1.617	1.731	2.344	2.264	1.915

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.26

MALD INDIVIDUALS OF AGE 65 AND OVER (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.1206	.2431	.3331	.7273	1.1572	1.1990	1.5853	.8403	1.0026
	(.18)	(.46)	(.84)	(.34)	(2.75)	(2.81)	(3.30)	(1.47)	(1.05)
MUR65	.0141	.0089	.0035	-.0001	.0025	.0004	-.0020	-.0012	-.0125
	(1.94)	(1.54)	(.82)	(-.02)	(.55)	(.08)	(-.38)	(-.19)	(-1.20)
MPR65	-.0014	-.0016	-.0006	-.0046	-.0088	-.0039	-.0053	.0149	.0196
	(-.14)	(-.19)	(-.09)	(-.88)	(-1.33)	(-.32)	(-.71)	(1.66)	(1.32)
$\dot{P}$	.0059	.0036	.0032	.0018	.0012	-.0016	-.0096	-.0048	-.0242
	(.78)	(.60)	(.71)	(.47)	(.24)	(-.32)	(-1.76)	(-.73)	(-2.21)
$\Delta\dot{P}$	-.0109	-.0064	-.0047	-.0034	-.0090	-.0073	-.0002	-.0042	.0185
	(-.89)	(-.67)	(-.64)	(-.56)	(-1.17)	(-.93)	(-.03)	(-.40)	(1.05)
$\dot{W}$	-.0041	-.0040	-.0034	-.0050	-.0098	-.0126	-.0161	-.0092	.0078
	(-.38)	(-.46)	(-.52)	(-.92)	(-1.44)	(-1.82)	(2.05)	(-.99)	(.50)
YOB/GNP*	4.0342	3.8442	3.2992	-3.0760	-10.2330	-8.3826	-10.4170	9.1296	25.2090
	(.31)	(.37)	(.42)	(-.47)	(-1.24)	(-1.00)	(1.10)	(.82)	(1.35)
R^2	.684	.710	.708	.648	.335	.473	.729	.805	.627
$\bar{R}^2$	.494	.536	.533	.436	--	.157	.567	.688	.402
S.E.	.051	.041	.031	.026	.032	.032	.037	.044	.073

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.27

MALE INDIVIDUALS OF AGE 65 AND OVER (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.1283	.2001	.3059	.4211	.5992	.8855	1.1454	1.6315	2.0941
	(1.67)	(3.48)	(7.64)	(12.27)	(12.99)	(18.10)	(19.52)	(20.84)	(18.75)
$\dot{P}$	-.0015	-.0010	.0013	.0027	.0014	-.0013	-.0078	-.0075	-.0214
	(-.24)	(-.21)	(.42)	(.98)	(.38)	(-.32)	(-1.65)	(-1.19)	(-2.38)
$\Delta\dot{P}$	-.0064	-.0027	-.0020	.0003	-.0014	.0016	.0108	.0005	.0102
	(-.66)	(-.37)	(-.39)	(.08)	(-.24)	(.25)	(1.47)	(.05)	(.73)
YOB/GNP*	6.3815	6.2730	4.4978	2.8992	1.1237	-2.0155	-1.9518	-6.0328	1.9713
	(1.96)	(2.58)	(2.66)	(2.00)	(.57)	(-.97)	(-.79)	(-1.82)	(.42)
R^2	.552	.634	.686	.610	.156	.269	.572	.612	.459
$\bar{R}^2$	.448	.550	.613	.520	--	.101	.474	.522	.333
S.E.	.053	.040	.028	.023	.032	.034	.041	.054	.078

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.28

ALL FAMILIES AND UNATTACHED INDIVIDUALS (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.3851	.4903	.6622	.7422	.7979	.8709	.9898	1.1495	1.6422
	(8.73)	(17.35)	(19.93)	(23.49)	(32.24)	(41.66)	(42.30)	(35.48)	(15.97)
UR	.0023	-.0090	-.0046	-.0028	-.0009	-.0001	.0031	.0034	.0647
	(.26)	(-1.55)	(-.67)	(-.44)	(-.19)	(-.02)	(.64)	(.51)	(3.06)
FPR	-.0047	-.0009	-.0014	.0005	.0028	.0046	.0058	.0082	.0008
	(-3.23)	(-.99)	(-1.27)	(.45)	(3.35)	(6.66)	(7.53)	(7.60)	(.22)
$\dot{P}$	.0069	-.0014	-.0014	-.0030	-.0043	-.0047	-.0032	-.0023	.0107
	(2.52)	(-.79)	(-.66)	(-1.51)	(-2.78)	(-3.58)	(-2.17)	(-1.12)	(1.66)
$\Delta\dot{P}$	-.0016	-.0055	-.0042	-.0002	.0028	.0051	.0050	.0053	.0271
	(-.38)	(-1.97)	(-1.29)	(-.06)	(1.15)	(2.46)	(2.15)	(1.66)	(2.65)
$\dot{W}$	-.0039	-.0049	-.0045	-.0023	.0004	.0020	.0028	.0034	.0221
	(-1.19)	(-2.32)	(-1.78)	(-.94)	(.23)	(1.28)	(1.58)	(1.39)	(2.85)
YUB/GNP*	-1.9596	-.1168	-1.0745	-.4039	.1330	.8534	-.0503	-1.5119	-21.3270
	(-.86)	(-.08)	(-.62)	(-.25)	(.10)	(.79)	(-.04)	(-.90)	(-4.00)
R^2	.809	.801	.778	.472	.678	.928	.957	.956	.758
$\bar{R}^2$	.696	.681	.645	.156	.483	.885	.932	.930	.612
S.E.	.019	.013	.015	.014	.011	.009	.010	.014	.045

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.29

ALL FAMILIES AND UNATTACHED INDIVIDUALS (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.3904	.4549	.6329	.7567	.7914	.8789	.9866	1.1475	1.6141
	(9.85)	(33.69)	(43.09)	(55.58)	(34.74)	(42.58)	(43.16)	(37.36)	(17.37)
UR	-.0086	-.0023	-.0018	-.0004	.0038	.0005	.0072	.0072	.0677
	(-5.46)	(-2.33)	(-1.99)	(-.42)	(4.27)	(.12)	(6.57)	(4.99)	(3.34)
FPR	-.0035	-.0005	-.0011	-.0006	.0021	.0045	.0055	.0079	-.0001
	(-3.26)	(-1.17)	(-5.22)	(-2.78)	(3.35)	(6.32)	(8.24)	(8.71)	(-.02)
$\dot{P}$	.0061	-.0024	-.0028	-.0016	-.0037	-.0053	-.0027	-.0015	.0108
	(2.78)	(-3.25)	(-3.58)	(-2.16)	(-2.91)	(-4.31)	(-2.00)	(-.85)	(1.76)
$\Delta\dot{P}$	-.0039	-.0013	.0003	.0000	.0046	.0049	.0055	.0064	.0300
	(-1.07)	(-1.11)	(1.26)	(.06)	(2.18)	(2.30)	(2.48)	(2.22)	(3.32)
$\dot{W}$	-.0055	-.0038	-.0026	-.0020	.0024	.0006	.0033	.0033	.0248
	(-3.86)	(-2.08)	(-1.62)	(-1.30)	(2.95)	(.50)	(1.95)	(1.53)	(3.79)
YUB/GNP*	-.5049	-1.6894	-.7982	-.2594	-.1033	.9598	-.9490	-2.4287	-18.6800
	(-1.22)	(-2.26)	(-3.57)	(-1.25)	(-.43)	(.86)	(-1.50)	(-2.85)	(-17.37)
R^2	.776	.736	.729	.387	.599	.916	.954	.952	.728
$\bar{R}^2$	.724	.676	.689	.299	.507	.878	.933	.936	.637
S.E.	.018	.013	.014	.013	.011	.010	.010	.014	.044
D.F.	13	13	14	14	13	11	11	12	12

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.30

ALL FAMILIES (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.4052	.5959	.6913	.7518	.8312	.9273	1.0558	1.2918	1.7158
	(19.28)	(15.55)	(21.77)	(27.78)	(34.59)	(45.40)	(39.08)	(35.99)	(14.04)
UR	-.0081	-.0057	-.0026	.0016	.0031	.0068	.0019	-.0001	.0767
	(-1.88)	(-.73)	(-.40)	(.29)	(.63)	(1.62)	(.35)	(-.02)	(3.06)
FPR	-.0010	-.0008	.0001	.0013	.0022	.0025	.0040	.0035	-.0040
	(-1.49)	(-.61)	(.06)	(1.49)	(2.72)	(3.74)	(4.44)	(2.93)	(-.98)
$\dot{P}$	-.0007	-.0015	-.0016	-.0028	-.0032	-.0023	-.0036	-.0028	.0143
	(-.50)	(-.62)	(-.79)	(-1.68)	(-2.13)	(-1.80)	(-2.14)	(-1.26)	(1.88)
$\Delta\dot{P}$	-.0047	-.0038	-.0020	.0013	.0034	.0036	.0012	.0006	.0254
	(-2.27)	(-1.01)	(-.65)	(.49)	(1.44)	(1.78)	(.45)	(.16)	(2.09)
$\dot{W}$	-.0044	-.0058	-.0037	-.0016	-.0005	.0007	-.0009	-.0008	.0207
	(-2.76)	(-2.02)	(-1.55)	(-.79)	(-.27)	(.45)	(-.42)	(-.29)	(2.24)
YUB/GNP*	1.8735	-.4539	-.3570	-.6812	-.7990	-1.8030	-1.3698	-1.6703	-28.9500
	(1.72)	(-.23)	(-.22)	(-.49)	(-.64)	(-1.70)	(-.98)	(-.90)	(-4.56)
R^2	.691	.607	.358	.389	.632	.824	.848	.649	.807
$\bar{R}^2$	.506	.371	--	.023	.412	.719	.757	.439	.692
S.E.	.009	.017	.014	.012	.011	.009	.012	.015	.054

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.31

ALL FAMILIES (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.4057	.5698	.6864	.7506	.8263	.9332	1.0553	1.2959	1.7951
	(20.93)	(34.37)	(51.12)	(32.66)	(38.84)	(50.99)	(44.93)	(40.81)	(29.74)
UR	-.0083	-.0006	.0003	.0012	.0032	.0033	.0043	.0022	.0763
	(-2.09)	(-.62)	(.34)	(1.51)	(3.95)	(4.22)	(4.09)	(1.60)	(3.12)
FPR	-.0010	-.0009	-.0005	.0010	.0019	.0028	.0038	.0032	-.0080
	(-1.71)	(-3.76)	(-2.33)	(1.51)	(3.25)	(5.02)	(5.35)	(3.35)	(-3.74)
$\dot{P}$	-.0005	-.0026	-.0015	-.0020	-.0028	-.0027	-.0034	-.0025	.0188
	(-.46)	(-2.90)	(-2.09)	(-1.51)	(-2.42)	(-2.72)	(-2.65)	(-1.44)	(4.28)
$\Delta\dot{P}$	-.0046	.0000	-.0001	.0034	.0050	.0035	.0014	.0016	.0223
	(-2.68)	(.13)	(-.62)	(1.51)	(2.63)	(1.97)	(.60)	(.53)	(5.32)
$\dot{W}$	-.0047	-.0032	-.0024	.0010	.0012	-.0005	-.0008	-.0021	.0228
	(-3.85)	(-1.73)	(-1.58)	(1.51)	(2.05)	(-.62)	(-.67)	(-1.41)	(3.10)
YUB/GNP*	1.1803	-.4402	-.0694	-.3059	-.0756	-1.0264	-1.8419	-2.1815	-24.9900
	(2.06)	(-1.74)	(-.34)	(-1.51)	(-.34)	(-1.96)	(-2.74)	(-2.40)	(-4.63)
R^2	.684	.539	.281	.132	.545	.793	.845	.598	.774
$\bar{R}^2$	.578	.473	.179	.074	.480	.746	.794	.505	.699
S.E.	.009	.015	.012	.012	.010	.009	.011	.015	.054
D.F.	12	14	14	15	14	13	12	13	12

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.32

FAMILIES: AGE OF HEAD UNDER 25 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	1.1402	1.0938	.8323	1.2342	.9866	1.1470	1.3010	1.4360	1.4257
	(3.43)	(4.98)	(3.93)	(6.73)	(6.41)	(3.87)	(8.20)	(8.14)	(4.81)
UR15	-.0241	-.0173	-.0067	.0018	.0051	.0062	.0145	.0138	.0149
	(-2.64)	(-2.85)	(-1.15)	(.36)	(1.20)	(.76)	(3.33)	(2.84)	(1.82)
PR15	-.0094	-.0066	-.0007	-.0068	-.0007	-.0024	-.0033	-.0023	.0016
	(-1.64)	(-1.75)	(-.20)	(-2.13)	(-.26)	(-.47)	(-1.20)	(-.76)	(.32)
$\dot{P}$	-.0003	-.0018	-.0006	.0084	.0016	.0063	.0015	-.0019	-.0103
	(-.05)	(-.53)	(-.18)	(2.92)	(.68)	(1.36)	(.60)	(-.67)	(-2.22)
$\Delta\dot{P}$	-.0197	-.0034	.0029	.0004	.0076	.0075	.0146	.0121	.0152
	(-2.37)	(-.62)	(.54)	(.08)	(1.95)	(1.01)	(3.70)	(2.75)	(2.05)
$\dot{W}$	-.0143	-.0045	-.0022	-.0029	-.0002	.0042	.0015	-.0001	.0058
	(-1.99)	(-.94)	(-.48)	(-.72)	(-.05)	(.65)	(.43)	(-.01)	(.90)
YUB/GNP*	5.9847	4.9560	.4553	-2.8572	-2.8671	-.7631	-3.1364	-2.8851	-.0120
	(1.32)	(1.65)	(.16)	(-1.14)	(-1.37)	(-.19)	(-1.44)	(-1.19)	(-.00)
R^2	.767	.810	.588	.591	.586	.460	.752	.576	.507
$\bar{R}^2$	.595	.696	.341	.346	.338	.136	.604	.322	.211
S.E.	.041	.027	.026	.023	.019	.037	.020	.022	.037

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.33

FAMILIES: AGE OF HEAD UNDER 25 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	1.0360	.9772	.8048	1.2361	.9033	.8991	1.2012	1.3742	1.4038
	(8.44)	(12.23)	(20.71)	(9.79)	(20.29)	(11.99)	(12.08)	(13.45)	(5.17)
UR15	-.0246	-.0181	-.0032	.0007	.0041	.0008	.0141	.0136	.0143
	(-3.07)	(-3.12)	(-4.25)	(.84)	(1.07)	(1.09)	(3.33)	(3.16)	(1.84)
PR15	-.0078	-.0046	-.0005	-.0063	.0012	.0025	-.0015	-.0014	.0019
	(-5.63)	(-4.91)	(-.96)	(-2.90)	(2.38)	(2.75)	(-.82)	(-.78)	(.39)
$\dot{P}$	-.0031	.0007	-.0002	.0070	-.0007	.0045	-.0012	-.0019	-.0088
	(-1.11)	(.49)	(-.36)	(3.29)	(-.77)	(2.21)	(-1.27)	(1.93)	(-2.25)
$\Delta\dot{P}$	-.0157	-.0064	.0038	-.0024	.0064	.0014	.0158	.0125	.0157
	(-3.25)	(-1.73)	(3.35)	(-1.28)	(2.61)	(2.09)	(4.43)	(3.54)	(2.24)
$\dot{W}$	-.0117	-.0010	-.0012	-.0071	-.0005	.0054	.0013	.0026	.0105
	(-2.13)	(-.59)	(-1.33)	(-3.69)	(-.51)	(1.15)	(1.04)	(2.24)	(2.82)
YUB/GNP*	1.0360	3.4232	-1.6291	-2.9755	-3.1862	.6965	-2.3572	-2.5827	-.2953
	(8.44)	(1.38)	(-4.17)	(-3.65)	(-1.93)	(1.62)	(-1.18)	(-1.26)	(-.08)
R^2	.732	.765	.564	.514	.491	.349	.716	.551	.464
$\bar{R}^2$	.670	.711	.501	.445	.419	.257	.622	.448	.285
S.E.	.037	.026	.023	.021	.018	.034	.019	.019	.035
D.F.	13	13	14	14	14	14	12	13	12

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.34

FAMILIES: AGE OF HEAD 25-64 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.6777	.6962	.6155	.7399	.5993	.6254	.5412	.7273	.4419
	(7.15)	(6.28)	(7.23)	(9.56)	(5.43)	(4.42)	(3.01)	(2.43)	(.83)
UR25	-.0098	.0005	.0036	.0039	.0097	.0096	.0079	.0009	.0519
	(-1.26)	(.06)	(.52)	(.61)	(1.07)	(.82)	(.53)	(.04)	(1.19)
PR25	-.0037	-.0018	.0013	.0004	.0047	.0062	.0101	.0111	.0221
	(-2.34)	(-.99)	(.93)	(.32)	(2.54)	(2.64)	(3.37)	(2.23)	(2.51)
$\dot{P}$	-.0008	-.0009	-.0032	.0009	-.0043	-.0055	-.0089	-.0117	-.0246
	(-.40)	(-.40)	(-1.92)	(.61)	(-1.98)	(-1.96)	(-2.52)	(-2.00)	(-2.36)
$\Delta\dot{P}$	-.0072	-.0012	.0021	.0011	.0069	.0074	.0094	.0102	.0231
	(-2.33)	(-.33)	(.77)	(.44)	(1.94)	(1.60)	(1.62)	(1.05)	(1.34)
$\dot{W}$	-.0087	-.0059	-.0036	.0012	-.0010	-.0017	-.0026	-.0062	-.0036
	(-3.58)	(-2.09)	(-1.67)	(.61)	(-.36)	(-.47)	(-.56)	(-.81)	(-.27)
YUB/GNP*	.9072	-.3959	-.5842	.7025	-1.8774	-2.2366	-2.7768	-3.6247	-24.0380
	(.57)	(-.21)	(-.41)	(.54)	(-1.00)	(-.94)	(-.92)	(-.72)	(-2.68)
R^2	.749	.495	.492	.578	.559	.549	.623	.444	.702
$\bar{R}^2$	.598	.193	.187	.325	.295	.278	.397	.109	.523
S.E.	.014	.016	.012	.011	.016	.020	.025	.054	.076

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.35

FAMILIES: AGE OF HEAD 25-64 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.6981	.6249	.7433	.7402	.6222	.5977	.5095	.6538	.3091
	(7.88)	(22.51)	(36.09)	(48.94)	(6.19)	(4.70)	(3.23)	(2.66)	(.60)
UR25	.0014	.0036	.0029	.0023	.0020	.0005	-.0001	-.0037	.0423
	(.98)	(2.53)	(2.78)	(4.05)	(2.12)	(.29)	(-.02)	(-1.55)	(.98)
PR25	-.0047	-.0010	-.0008	.0006	.0042	.0069	.0108	.0122	.0241
	(-3.39)	(-2.53)	(-2.78)	(4.05)	(2.72)	(3.30)	(4.13)	(2.96)	(2.81)
$\dot{P}$	.0002	-.0001	-.0016	.0005	-.0042	.0053	-.0083	-.0102	-.0188
	(.08)	(-2.53)	(-2.79)	(4.05)	(-2.29)	(-2.44)	(-3.06)	(-2.36)	(-1.97)
$\Delta\dot{P}$	-.0047	-.0040	-.0001	-.0005	.0070	.0059	.0087	.0095	.0272
	(-1.87)	(-2.53)	(-2.79)	(-4.05)	(2.38)	(1.56)	(1.85)	(1.26)	(1.61)
$\dot{W}$	-.0059	-.0040	-.0032	-.0005	.0019	-.0008	-.0016	-.0024	.0009
	(-3.69)	(-2.53)	(-2.79)	(-4.05)	(2.04)	(-.38)	(-.62)	(-.59)	(.08)
YUB/GNP*	-.4464	.2722	.2228	.5530	.5774	-.9202	-1.7917	-3.4040	-24.7200
	(-1.97)	(2.53)	(2.79)	(4.05)	(2.39)	(-.94)	(-1.47)	(-1.81)	(-2.76)
R^2	.681	.298	.341	.522	.383	.491	.593	.400	.640
$\bar{R}^2$	.607	.252	.297	.491	.295	.374	.499	.315	.519
S.E.	.013	.015	.011	.010	.016	.019	.023	.037	.076
D.F.	12	15	15	15	14	13	13	14	12

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.36

FAMILIES: AGE OF HEAD 65 AND OVER (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.3563	.2638	.4911	.7887	.8702	.9823	1.0476	.3076	1.3629
	(.67)	(.88)	(2.22)	(2.39)	(2.97)	(2.18)	(1.95)	(.37)	(.96)
UR65	.0142	.0076	.0027	-.0010	-.0009	-.0024	-.0030	.0021	.0038
	(2.42)	(2.30)	(1.11)	(-.27)	(-.28)	(-.49)	(-.51)	(.23)	(.25)
PR65	-.0086	-.0021	-.0028	-.0058	-.0028	-.0004	.0054	.0347	.0224
	(-.58)	(-.25)	(-.45)	(-.63)	(-.34)	(-.04)	(.37)	(1.52)	(.57)
$\dot{P}$	.0066	.0038	.0017	-.0015	-.0034	-.0037	-.0040	.0109	-.0063
	(1.29)	(1.30)	(.80)	(-.46)	(-1.22)	(-.85)	(-.78)	(1.38)	(-.46)
$\Delta\dot{P}$	-.0150	-.0040	-.0025	-.0013	-.0016	.0016	.0036	.0002	-.0025
	(-1.61)	(-.76)	(-.66)	(-.23)	(-.32)	(.21)	(.38)	(.01)	(-.10)
$\dot{W}$	-.0063	.0024	-.0004	-.0043	-.0062	-.0046	-.0027	.0119	-.0031
	(-.78)	(.52)	(-.12)	(-.86)	(-1.39)	(-.67)	(-.33)	(.95)	(-.14)
YOB/GNP*	-.1775	4.2552	1.0731	-2.9537	-2.2602	-1.2533	1.1470	18.6060	11.2600
	(-.02)	(.74)	(.25)	(-.46)	(-.40)	(-.14)	(.11)	(1.17)	(.41)
R^2	.813	.891	.811	.232	.370	.297	.472	.319	.353
$\bar{R}^2$	.701	.826	.697	--	--	--	.155	--	--
S.E.	.035	.019	.015	.022	.019	.029	.035	.054	.093

NOTE: For definition of symbols see note to Table 4.2

TABLE 4.37

FAMILIES: AGE OF HEAD 65 AND OVER (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.1488	.2762	.4199	.5577	.7271	.9138	1.1826	1.5612	2.1156
	(2.61)	(7.99)	(20.80)	(19.30)	(25.82)	(22.70)	(24.70)	(20.45)	(17.27)
$\dot{P}$	.0018	.0010	.0010	-.0004	-.0029	-.0027	-.0036	.0058	-.0109
	(.38)	(.35)	(.58)	(-.17)	(-1.27)	(-.84)	(-.93)	(.95)	(-1.10)
$\Delta\dot{P}$	-.0075	-.0041	-.0015	.0020	.0027	.0044	.0044	-.0111	-.0021
	(-1.04)	(-.95)	(-.61)	(.56)	(.76)	(.87)	(.73)	(-1.16)	(-.14)
$Y\,OB/GNP^*$	5.6798	4.9271	2.7593	1.3619	.4651	-.1613	-1.6915	-4.9091	-2.2601
	(2.36)	(8.00)	(3.23)	(1.11)	(.40)	(-.09)	(-.84)	(-1.52)	(-.44)
R^2	.691	.793	.773	.156	.162	.191	.395	.159	.302
$\bar{R}^2$	.620	.745	.721	--	--	.005	.256	--	.141
S.E.	.040	.024	.014	.020	.019	.028	.033	.053	.085

NOTE: For definition of symbols see note to Table 4.2

CHAPTER 5

ANALYSIS OF DECILE RESPONSES TO MACRO-ECONOMIC VARIABLES

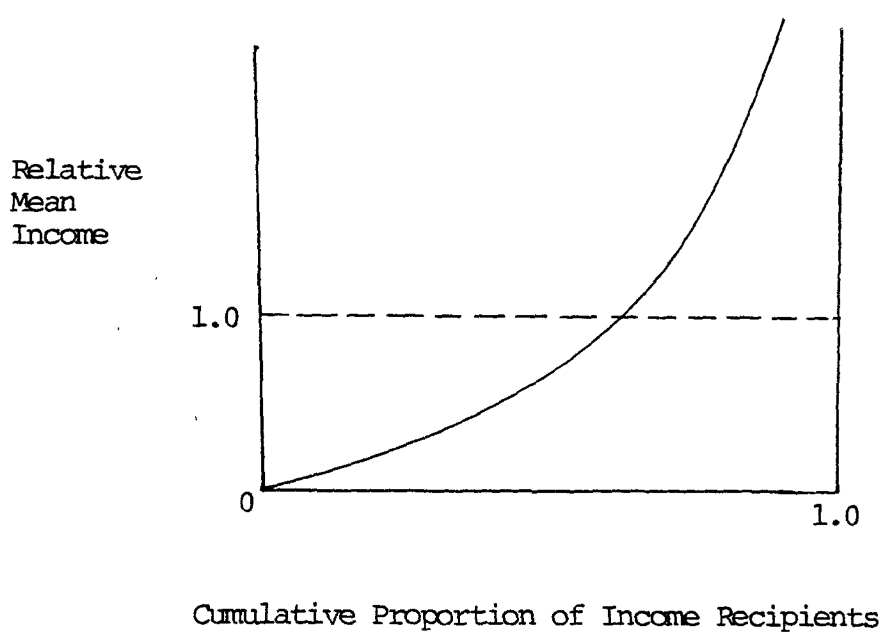
In the last chapter we discussed the estimation of our model with different income distributions and presented the estimated results. In this chapter we analyze the implications of those results for variations in income inequality. With the estimated deciles model, we can examine in detail the responses of various parts of the income distribution to changes in the macro-economic variables. The signs of the estimated coefficients of the macro-economic variables are of particular interest, and we report those signs in tabular form to facilitate the discussion.

The chapter has been organized in the following way. Section 5.1 looks at different ways in which the estimated decile equations can be interpreted. Section 5.2 provides detailed economic analysis of the equations. The model is estimated for 15 different income distributions and we analyze the results for each one separately, except where it is useful to present a comparison of results based on different distributions. A final section summarizes the principal findings of the chapter.

5.1 HOW TO INTERPRET THE ESTIMATED COEFFICIENTS

The dependent variables in our model are decile income levels expressed as ratios to the mean income of the relevant distribution. The slope of the Lorenz curve for a given distribution can be interpretted as the ratio of quantile income level to mean income, and the curve representing this slope may be termed the "relative mean income curve"; such a curve is drawn in Figure 5.1.

Figure 5.1 RELATIVE MEAN INCOME CURVE



Cumulative proportions of income recipients, from lowest to highest, are measured on the horizontal axis, and relative mean incomes (quantile income levels divided by the distribution mean) are measured on the vertical axis. The relative mean income curve is a useful device for characterizing income inequality. In the case of perfect equality, the curve becomes horizontal, with unit value at all points. The extent of divergence of different points from unity shows the degree of inequality in the distribution. Any factor that brings the whole or part of the curve closer to unity reduces income inequality, and conversely. Given the positive skewness of observed income distributions, the relative mean income is always below unity up to the fifth decile, and greater than unity for higher deciles. Consequently, a positive value of the estimated coefficient of an explanatory variable for the lower deciles (up to the fifth), or a negative value for the higher deciles (sixth and above), means a reduction of income inequality when there is an increase in that explanatory variable, the converse being true if the signs of the coefficients are reversed.

Another way of looking at the implications of the results would be to consider the level of some particular decile as the average income of the population in the vicinity of that decile. If the average incomes of the lower groups rise, relative to the overall mean of the distribution, and if the average incomes of the higher groups fall, then there is a decline in income inequality. If we accept a decile income level as the average income of the 10 percent of the population centered on that decile, we can interpret the results in terms of changes in income shares. The income share of a group is defined as its total income divided by the total for the whole population. Let D_i be the average income of the ith 10 percent of the population and let M be the overall mean income; then the percentage share of the ith 10 percent of the population (S_i) is defined by

$$(5.1) \quad S_i = \frac{D_i}{10 \times M}$$

The dependent variable in the ith equation of the model is D_i/M, and hence the coefficients of the equation divided by 10 represent the responses of S_i to changes in the individual explanatory variables. The equations thus indicate how income shares respond to macro-economic influences, as well as the responses of the relative decile levels.

5.2 ANALYSIS OF THE RESULTS

The model is estimated for 15 income distributions, and for each one it is estimated by different methods. Moreover, experiments have been conducted with various sets of explanatory variables. There is therefore a large volume of results to be examined. We analyze the results for each income distribution separately, but make comparisons from one distribution to another,where useful.

5.2.1 ALL INDIVIDUALS (TAXATION STATISTICS)

This is the longest income distribution series that we have. We have estimated two versions of the model for this series, using the OLS, Mundlak, Zellner, and Massy methods. In one version of the model we have no dummy variables; we shall refer to this as Version A. In the other we follow Buse (1982) and add some dummy variables, as indicated previously; this we shall call Version B. We discuss the results for each method of estimation (for both versions of the model) in turn.

RESULTS BASED ON THE OLS METHOD

The equations for Version A of the model, estimated by OLS, are reported in Table 4.4. The signs of the coefficients in these equations are presented, for convenience of comparison, in Table 5.1. Each column of Table 5.1 contains results for a particular decile, as indicated by the column heading. The model fits the data quite well. The $\bar{R}^2$ values (coefficients of determination adjusted for degrees of freedom) are over .90 in all cases. However, most of the estimated coefficients are statistically insignificant. Indeed, not a single variable has a significant coefficient (at conventional significance levels) in all of the decile equations. (This is perhaps not surprising, in view of the very high degree of multicollinearity among the explanatory variables.)

If we consider only the signs of the estimated coefficients, the following results emerge. When the unemployment rate (UR) increases, people in the lowest two deciles improve their income position relative to others in the distribution. The lower part of the distribution loses relatively when there is an increase in the female labor force participation rate (FPR). The effects of the rate of inflation ($\dot{P}$) and the rate of growth of the real wage rate ($\dot{W}$) are similar; people in the lower four deciles improve their relative position at the expense of others when there is an increase in either of these variables, but so do people in the ninth decile. The following variables have disequalizing effects on the income distribution, in the sense that increases in them cause the lower income groups to be relatively worse off: the change in the rate of inflation ($\Delta\dot{P}$); the labor force participation of those aged 65 and over (PR65); the population aged 15-24 as a ratio to the population aged 15 and over (PROP15); the population aged 65 and over as a ratio to the population aged 15 and over (PROP65); retirement and old age benefits as a ratio to gross national product, adjusted for fluctuations in farm inventories (YOB/GNP^*); and exports of goods and services as a ratio to GNP^* (X/GNP^*). On the other hand, the following variables have equalizing effects: net realized farm income as a ratio to GNP^* ($YRNF/GNP^*$); pre-tax corporate profits as a ratio to GNP^* ($PROF/GNP^*$); and unemployment insurance benefits as a ratio to GNP^* (YUB^*/GNP^*). The effects of changes in the labor force participation rate of those aged 15-24 (PR15), and of government expenditures on goods and services as a ratio to GNP^* (GE/GNP^*), are not very systematic, as evidenced by the signs of their coefficients: an increase in PR15 improves the relative position of those in the fourth and fifth deciles at the expense of others; those in the lower three deciles, and in the ninth decile, are relatively worse off when there is an increase in GE/GNP^*.

The equations of version B of the model are reported in Table 4.8 and the coefficient signs in Table 5.2. $\bar{R}^2$ is again above .90 in each of the decile equations. Again too, most of the estimated coefficients of the explanatory variables are statistically insignificant. Inspection of their signs reveals that the results for the variables UR, FPR, $YRNF/GNP^*$, $PROF/GNP^*$ and YUB^*/GNP^* are similar to those obtained for Version A of the model. The results for other variables are substantially different from those obtained for Version A, and in some cases completely reversed.

In summary, then, the explanatory power of both versions of the model is quite good, if one judges by overall goodness-of-fit measures, but the high degree of multicollinearity among the explanatory variables prevents most of the coefficients estimated by OLS from being statistically significant. We now turn to the results based on the other methods, which make use of principal components to cope with the multicollinearity problem.

RESULTS BASED ON MUNDLAK METHOD

The equations for versions A and B are reported in Tables 4.2 and 4.6, respectively, and the coefficient signs in Tables 5.3 and 5.4. $\bar{R}^2$ is above .90 for all but the sixth decile equation, for which it is .892 for version A and .875 for version B. The t-ratios of most of the coefficients are statistically significant at the 5 percent significance level. It should be remembered that the t-ratios are calculated by transforming the variances of coefficients of the principal components into variances of coefficients of the explanatory variables, and should not be interpreted in the way that one would interpret t-ratios if the equations had been fitted directly to the full set of explanatory variables, without restriction. (This is true of the results based on the Massy method too.) Moreover, there is evidence of autocorrelation in the residuals for some deciles, implying that the t-ratios may be somewhat overstated. If we look at the signs of the estimated coefficients of the explanatory variables, we find that the results for most variables are the same for both versions of the model. When results differ, version B's results are generally better. In discussing the results, we shall make reference to a particular version of the model only when the results differ enough between the two versions to affect the conclusions that one would draw.

The t-ratios of the coefficients of the unemployment variable are significant at the 5 percent level for only five out of nine deciles. However, an inspection of the signs reveals a clear pattern. For version A, an increase in the unemployment rate worsens the relative income position of those in the lower six deciles, and improves the position of those in the others. The results support the contention that the less experienced and less skilled are hardest hit by higher unemployment rates. The results for version B of the model are slightly different because the sign of the coefficient for the first decile is positive, but otherwise they are the same. FPR has a significant disequalizing effect in the sense that an increase in this variable makes the lower part of the distribution lose ground to the upper part, a result that appears reasonable since working women tend to be concentrated in the lower part. PR15 seems to have an equalizing effect, although this result emerges more strongly in version B than in version A of the model. An increase in PR65 also reduces income concentration. An increase in PROP15 makes the lower six deciles lose relatively. The lower few deciles are relatively worse off also when there is an increase in PROP65, a result that is consistent with the concentration of older population in those deciles.

It appears that inflation makes the upper income groups relatively better off, although this result comes out more clearly in version B than in version A. The t-ratios of almost half of the estimated coefficients of $\Delta\dot{P}$ are statistically insignificant and if we consider only signs of the coefficients, the results are substantially different in the two versions: for version A, the lower four deciles are relatively better off, while for version B, the lower six deciles are relatively worse off when there is an increase in $\Delta\dot{P}$. For version A, with an increase in $\dot{W}$, the lower part of the distribution is relatively better off. However, the signs of the coefficients are different for version B in some cases.

The effect of YRNF/GNP* appears to be equalizing. For PROF/GNP*, version A does not produce a clear pattern of inequality effects. However, for version B, the effect of this variable seems equalizing. One reason may be that a higher value of PROF/GNP* implies greater economic activity and the lower income groups benefit relatively more from that activity.

With an increase in YUB^*/GNP^*, the lowest three deciles (the lowest four deciles in version B) and the ninth decile gain at the expense of the others. It appears from this result that lower income groups benefit relatively more from unemployment insurance benefits; however, this conclusion is weakened somewhat by the fact that the sign for the ninth decile is positive in both versions of the model. However, the t-ratio for the ninth decile is quite low in both versions. The effect of YOB/GNP^* appears to be disequalizing. It seems the indirect effects of retirement and old age benefits, such as reduced labor force participation of the older population, dominate. The effects of both GE/GNP^* and X/GNP^* are disequalizing, which means the upper income groups benefit relatively more from a larger public sector and an expanding export sector.

RESULTS BASED ON THE ZELLNER METHOD

The model based on principal components selected according to the Mundlak method is re-estimated with the Zellner method. The estimated coefficients of the principal components are transformed into coefficients of the original variables, and the equations for versions A and B of the model are presented in Tables 4.3 to 4.7, respectively. These results are very close to those reported under the heading of the Mundlak method, and there is therefore no need to describe them.

RESULTS BASED ON THE MASSY METHOD

In applying the Massy method, the principal components are selected according to a t-test at the 20 percent significance level, as discussed previously. The equations for versions A and B of the model are presented in Tables 4.5 and 4.9, respectively, and the signs of the estimated coefficients are displayed in Tables 5.5 and 5.6. For the most part, the results are quite similar to those obtained with the Mundlak method. Exceptions are the variables $\dot{P}$, $\Delta\dot{P}$, and PROF/GNP* in version A, and PROP65 in version B.

SUMMARY OF THE RESULTS

Given the severity of the problem of multicollinearity, the OLS results are of only limited interest. On the whole, the results based on the Mundlak method appear more reasonable. The results based on the Massy method are not much different, in their interpretation and implications, from those obtained with the Mundlak method. Some results emerge clearly, irrespective of the method of estimation or version of the model; in particular, FPR and PROP15 have disequalizing effects on the income distribution and YRNF/GNP* has an equalizing effect. A clear disequalizing effect of YOB/GNP* on the distribution emerges everywhere except in version B of the model estimated with the OLS method.

5.2.2 ALL INDIVIDUALS (SCF)

We look next at the results based on the income distribution for all individuals in the Survey of Consumer Finances. As discussed previously, in this case, as well as for the remaining distributions, we do not have any results based on the Mundlak method and the set of explanatory variables is necessarily smaller than before. Equations estimated by OLS are reported in Table 4.10 and those estimated by the Massy method in Table 4.11. The signs of the coefficients for both sets of equations are shown in Table 5.7. Although the set of explanatory variables is relatively small now, there is still a problem of multicollinearity, and the use of the Massy method is intended to cope with this problem. The explanatory power of the model, for both methods of estimation, appears rather good, given the much smaller set of explanatory variables. $\overline{R}^2$ is above .60 for six out of nine deciles under both methods of estimation.

The UR variable is statistically insignificant for all deciles when the model is estimated by OLS, and the signs of the coefficients do not reveal any clear pattern of inequality effects. However, the results for UR with the Massy method are much better: the t-ratios for six deciles are highly significant statistically, and the signs of the coefficients reveal that the lower six deciles, except the first one, are relatively worse off when there is an increase in the unemployment rate. The effect of FPR on the income distribution is significant and disequalizing under both methods of estimation. (It is interesting to note that a similar result emerged when the model was estimated for all individuals with data drawn from Taxation Statistics.) Looking at the signs of the coefficients, we find the effect of $\dot{P}$ to be equalizing under both methods of estimation. If the rate of inflation rises to a higher level and remains there, one would expect the new rate to get built into expectations and that most incomes would tend to adjust as a result of correct anticipation. On the other hand, $\Delta\dot{P}$, though not exactly representing the unanticipated component of inflation, should capture some of the effects of that component. Both methods of estimation suggest that the effect of $\Delta\dot{P}$ is disequalizing. The effect of $\dot{W}$ is also disequalizing. (If we consider $\dot{W}$ as a proxy for the real rate of growth of the economy, this means that the upper income groups benefit relatively more from such growth.) YUB/GNP^* is statistically insignificant for all deciles when the model is estimated by OLS. The t-ratios are much better with the Massy method. However, the signs of the coefficients are generally similar under both methods. The second, third and fourth deciles (and the ninth, in the case of the Massy method) gain relatively, while the others lose when there is an increase in YUB/GNP^*.

5.2.3 ALL MALE INDIVIDUALS (TAXATION STATISTICS)

The results based on the OLS method and the Massy method are reported in Tables 4.12 and 4.13, and the signs of the coefficients in Table 5.8. The model fits the data quite well, $\bar{R}^2$ being greater than .60 for all decile equations. The t-ratios are quite respectable for most of the coefficients. Inspection of the signs reveals that the two methods of estimation yield almost identical results. An increase in the male unemployment rate (MUR) hits hardest the lowest income decile. An increase in the male labor force participation rate (MPR) improves the relative income position of the lower six deciles, and worsens the position of the upper three. A higher rate of inflation makes the lower five deciles and the eighth decile relatively worse off, and the others relatively better off. In response to an increase in $\Delta\dot{P}$, the first and third deciles lose ground to other deciles. All the deciles, except the first one, improve their position relative to the mean income of the distribution in response to an increase in $\dot{W}$. The effect of YUB^*/GNP^* on the distribution appears equalizing. (This inference is slightly weaker for the Massy method because the coefficient of the eighth decile turns out to be positive, but otherwise it holds.)

In a supplementary experiment, the variables MUR and MPR were replaced by UR and PR, and the results of this experiment are presented in Tables C.1 and C.2 of Appendix C. The results for the overall labor force participation rate (PR) are strikingly different from those obtained when the male rate (MPR) was used. The effect of PR on the income distribution of male individuals appears to be disequalizing. This result is quite interesting because MPR has an apparent equalizing effect. This suggested that the participation rate of females has a disequalizing effect on the income distribution for male individuals. To further check this result, we replaced PR by FPR and estimated the model again, both by OLS and by the Massy method. (Results are not reported.) A clear disequalizing effect of FPR emerged. One might rationalize this result by arguing that females tend to compete with males primarily for lower paid jobs, and as a result it is the lower part of the male income distribution that suffers from a higher level of FPR.

5.2.4 ALL MALE INDIVIDUALS (SCF)

The results based on OLS and the Massy method are presented in Tables 4.14 and 4.15 and the coefficient signs in Table 5.9. The sign patterns for MPR and YUB/GNP* are quite similar to those obtained with the income distribution for all male individuals from Taxation Statistics. The results for other variables are somewhat different, but in no case is the general conclusion completely reversed.

When the specification of the model is modified by replacing MUR and MPR by UR and PR, a result for the PR emerges that is similar to what was obtained with the corresponding Taxation Statistics distribution. The results of this experiment are reported in Tables C.3 and C.4 of Appendix C. The PR variable has a disequalizing effect on the income distribution. This implies that FPR has a disequalizing effect, and confirmation of this is obtained when FPR is explicitly introduced into the model.

5.2.5 MALE INDIVIDUALS UNDER 25 (TAXATION STATISTICS)

The OLS and Massy equations are reported in Tables 4.16 and 4.17 and the coefficient signs in Table 5.10. The model fits the data reasonably well with both methods of estimation; $\bar{R}^2$ ranges from .571 to .892. The t-ratios for most of the variables are quite high. The signs of the coefficients are almost identical for both methods. The unemployment rate of males 15-24 (MUR15) has a very strong disequalizing effect on the income distribution: the lower seven deciles all respond negatively to an increase in MUR15. Strong disequalizing effects of $\dot{P}$ and $\dot{W}$ also emerge. The effects of MPR15 and YUB^*/GNP^* are equalizing. $\Delta\dot{P}$ increases inequality in the lower part of the distribution by moving decile levels away from the mean income but reduces inequality in the upper part of the distribution by bringing the decile income levels closer to the mean.

Most of the results are unchanged when the model is modified by replacing MUR15 and MPR15 by UR15 and PR15. The results using the latter two variables are reported in Tables C.5 and C.6. In this specification of the model, no clear pattern of inequality emerges for PR15.

5.2.6 MALE INDIVIDUALS UNDER 25 (SCF)

The results based on the OLS and Massy methods are presented in Tables 4.18 and 4.19 and the signs in Table 5.11. The signs reveal results for MPR15 and $\dot{P}$ that are similar to those obtained with the corresponding income distribution from Taxation Statistics. The OLS results for MUR15 and YUB/GNP* are similar to the results obtained with the Taxation Statistics data, and the same is true for $\dot{W}$ when the model is estimated with the Massy method. For $\Delta\dot{P}$, a clear disequalizing effect emerges under the Massy method.

The model specification with UR15 and PR15, instead of MUR15 and MPR15, provides relatively better results in terms of systematic patterns of inequality effects. These results are reported in Tables C.7 and C.8. The results, in terms of signs of the coefficients, are very close for the two methods. An increase in UR15 makes the lower seven deciles relatively worse off and the upper two relatively better off. Similarly, an increase in $\dot{P}$ reduces the lower six deciles relatively, and raises the upper three. The effects of PR15 and YUB/GNP* are equalizing. The effect of $\dot{W}$ also appears to be equalizing, although this result is slightly weaker when the model is estimated by OLS. The effect of $\Delta\dot{P}$ is equalizing under the Massy method.

5.2.7 MALE INDIVIDUALS 25-64 (TAXATION STATISTICS)

For this particular age group, the model specification with unemployment and participation rates for both sexes combined, ages 25-64 (UR25), provided the best results, in terms of plausible patterns of inequality effects. The equations are reported in Tables 4.20 and 4.21 and the signs in Table 5.12. $\bar{R}^2$ ranges from .249 to .734 when the model is estimated by OLS, and from .335 to .721 when it is estimated by the Massy method. The t-ratios are much better under the Massy method, but the signs of the coefficients are almost identical under both methods. An increase in UR25 induces a negative response in the lowest two deciles. The relative position of the upper three deicles improves, and that of the lower six deterioriates when there is an increase in PR25. There is no systematic effect of $\dot{P}$ on the income distribution under OLS, but under the Massy method the upper part of the distribution loses relatively during periods of higher inflation. The lowest two deciles are relatively worse off when there is an increase in $\Delta\dot{P}$. The effect of $\dot{W}$ on the income distribution is disequalizing. The lower end of the distribution benefits most from higher levels of YUB^*/GNP^*.

The equations obtained when UR25 and PR25 are replaced by MUR25 and MPR25 are presented in Tables C.9 and C.10. The only interesting result is one that emerges for MPR25: its effect on the income distribution is equalizing.

5.2.8 MALE INDIVIDUALS 25-64 (SCF)

The equations based on OLS and the Massy method are reported in Tables 4.22 and 4.23 and the signs in Table 5.13. The sign patterns for UR25 and PR25 are very close to those obtained with the corresponding Taxation Statistics income distribution. The same is true of the OLS results for $\Delta\dot{P}$, $\dot{W}$ and YUB/GNP^*. The results for $\dot{P}$, based on the Massy method, appear almost reversed when compared with the results for the Taxation Statistics distribution.

When the model is estimated with MUR25 and MPR25 instead of UR25 and PR25, the effect of MPR25 is found to be clearly equalizing under the Massy method although this result is slightly weaker under OLS. The equations are reported in Tables C.11 and C.12.

5.2.9 MALE INDIVIDUALS 65 AND OVER (TAXATION STATISTICS)

The results based on the Massy method are not presented for this age group because for many decile equations not a single principal component was significant at the 20 percent level. The OLS results are not very impressive either, the t-ratios of most of the coefficients being very low. Given the fact that it is relatively a small age group, these poor results may be attributed to large sample variances.

We present the results of estimating two versions of the model; in one version we have six explanatory variables, as usual, while in the other we have only three -- $\dot{P}$, $\Delta\dot{P}$, YOB/GNP^*. The equations are reported in Tables 4.24 and 4.25 and the signs of the coefficients in Table 5.14. The explanatory power ($\bar{R}^2$) of some of the decile equations based on the larger set of variables is quite good but the t-ratios of most of the coefficients are very low. However, inspection of the signs of the coefficients reveals some interesting patterns. The middle part of the distribution loses the most in response to an increase in MUR65; interestingly, too, the t-ratios of the middle five decile equations are quite respectable. Other interesting results emerge for $\dot{P}$ and YOB/GNP* variables: effect of $\dot{P}$ on the income distribution is disequalizing while the effect of YOB/GNP* is equalizing.

When the model is estimated with only $\dot{P}$, $\Delta\dot{P}$ and YOB/GNP* as explanatory variables, the t-ratios of $\dot{P}$ are relatively better (eight out of nine are above unity) and the signs of the coefficients reveal a disequalizing effect of $\dot{P}$ on the income distribution.

5.2.10 MALE INDIVIDUALS 65 AND OVER (SCF)

The equations are reported in Tables 4.26 and 4.27 and the coefficient signs in Table 5.15. Again, the t-ratios of most of the coefficients are very low. However, the signs of the coefficients do reveal some noteworthy patterns. The effects of MPR65, $\Delta\dot{P}$ and $\dot{W}$ on the income distribution are highly disequalizing; an increase in any of these variables makes the upper one or two deciles relatively better off, and all the others relatively worse off. The effect of $\dot{P}$ is equalizing, whereas its effect was found to be disequalizing in the

Taxation Statistics equations. When the model is estimated with only $\dot{P}$, $\Delta\dot{P}$ and YOB/GNP* as explanatory variables, the only interesting result to emerge is one pertaining to YOB/GNP*: five out of nine coefficients for this variable are significant at the 10 percent significance level, and the signs of the coefficients show that it is the lower part of the distribution that gains the most from higher levels of YOB/GNP*.

5.2.11 ALL FAMILIES AND UNATTACHED INDIVIDUALS (SCF)

Up to this point we have been discussing the results based on the income distributions of individuals. We now look at the results based on the income distribution of families. Here we can only use SCF data source. First, we analyze the income distribution of all families and unattached individuals. (In effect, this is the income distribution of households because each family and each individual living alone, can be considered a separate household.) We report results based on the OLS and Massy methods in Tables 4.28 and 4.29 and the signs of the coefficients in Table 5.16. The explanatory power of the decile equations varies substantially; $\bar{R}^2$ ranges from .156 to .932 under OLS and from .299 to .936 under the Massy method. The t-ratios of most of the coefficients are statistically significant at conventional levels when the model is estimated by the Massy method. The signs of the coefficients show quite similar patterns for the two methods of estimation. The lower four deciles are relatively worse off when UR rises, and the upper five are relatively better off, if we consider the results based on the Massy method; and in the case of the OLS results, it is the upper three deciles and the lowest decile that are relatively better off, and the others that are relatively worse off. However, the OLS results cannot be relied upon much since the t-ratios of UR are very low in most of the decile equations. In response to an increase in the FPR, the lower three deciles are relatively worse off when the model is estimated by OLS. However, the result in this case is slightly different under the Massy method: the lower four deciles and the ninth decile are relatively worse off. (However, the t-ratio for the ninth decile is extremely low.) An increase in $\dot{P}$ causes a relative gain in the first and ninth deciles at the expense of the other deciles. The lower few deciles lose relatively when there is an increase in $\Delta\dot{P}$. The effect of $\dot{W}$ on the income distribution seems disequalizing. The t-ratios of YUB/GNP^*, for the majority of decile equations, are statistically insignificant, and the signs of the coefficients do not reveal any interesting patterns of inequality effects.

5.2.12 ALL FAMILIES (SCF)

The results based on the OLS and Massy methods are reported in Tables 4.30 and 4.31 and the signs in Table 5.17. We describe the results based on the Massy method because the t-ratios of most of the coefficients are statistically significant under that method, and the patterns of coefficient signs are almost the same from both methods. The lower two deciles are relatively worse off when UR rises, and the converse is true for other deciles. The middle part of the distribution gains relatively from a higher level of FPR. The effect of $\dot{P}$ on the income distribution appears highly disequalizing, since the ninth decile gains at the expense of all others. In response to an increase in $\Delta\dot{P}$, the first and the third deciles are relatively worse off. (OLS produces a more systematic result in this case, inasmuch as all three of the lowest deciles are relatively worse off.) No systematic pattern of inequality effects emerges for $\dot{W}$: the fourth, fifth and ninth deciles gain relatively from a higher $\dot{W}$. The result for YUB/GNP* suggests that the lowest decile benefits the most from a higher level of YUB/GNP*.

5.2.13 FAMILIES: AGE OF HEAD UNDER 25 (SCF)

Equations based on the OLS and Massy methods are presented in Tables 4.32 and 4.33 and the signs of the coefficients in Table 5.18. $\bar{R}^2$ ranges from .136 to .696 in these equations for the OLS method, and from .285 to .711 for the Massy method. The signs of the coefficients for UR15 are the same under both methods of estimation, and the t-ratios for most of the coefficients of this variable are quite impressive. The lower three deciles are hardest hit by higher levels of UR15. The t-ratios for PR15 are quite low for most of the coefficients under OLS, but the signs of the coefficients reveal a pattern such that the lower eight deciles have negative signs while only the ninth has a positive one. Under the Massy method, five out of nine t-ratios are statistically significant for this variable, at conventional significance levels, but the signs of the coefficients reveal no clear pattern of inequality effects. The signs of the coefficients of $\dot{P}$ are quite different under the two methods, and the t-ratios for most of the coefficients are also rather low. An increase in $\Delta\dot{P}$ causes the lowest two deciles to lose, under the OLS method; under the Massy method, the fourth decile, in addition to the two lowest ones, loses relatively. The effect of $\dot{W}$ appears to be disequalizing. The lowest two deciles and the sixth decile gain relatively when there is an increase in YUB/GNP*, based on the Massy method results, whereas the OLS results suggest that it is the lowest three deciles that gain the most from higher YUB/GNP*; however, most of the coefficients have very low t-ratios, so that the significance of these patterns is questionable.

We have also estimated a slightly modified form of the model in which PR15 is replaced by FPR15. The results are reported in Tables C.13 and C.14. The only interesting new result to emerge is that the effect of FPR15 is highly disequalizing inasmuch as all of the lower seven deciles are relatively worse off when there is an increase in this variable.

5.2.14 FAMILIES: AGE OF HEAD 25-64 (SCF)

The equations are reported in Tables 4.34 and 4.35 and the signs in Table 5.19. The t-ratios of most of the coefficients are quite good when the model is estimated by the Massy method. Under OLS, the t-ratios of PR25 and $\Delta\dot{P}$ are relatively better. The signs reveal systematic patterns for PR25 and $\Delta\dot{P}$, under both methods of estimation, and for UR25, under the OLS method. The lowest decile is hardest hit by higher levels of UR25. The lowest three deciles under the Massy method, and the lowest two under OLS are worse off, relatively, when PR25 increases. A similar result emerges for $\Delta\dot{P}$.

When the model is estimated with FPR25 instead of PR25, there is hardly any change in the results. The modified equations are presented in Tables C.15 and C.16. The result for FPR25 is similar to that obtained for PR25 in the original equations.

5.2.15 FAMILIES: AGE OF HEAD 65 AND OVER (SCF)

We do not present results based on the Massy method because for some deciles not a single principal component was statistically significant at the 20 percent level. However, we do present OLS results for two versions of the model. One version includes six explanatory variables, as usual; and the other includes only $\dot{P}$, $\Delta\dot{P}$ and YOB/GNP*. The equations are presented in Tables 4.36 and 4.37 and the signs of the coefficients in Table 5.20. The explanatory power ($\bar{R}^2$) of some decile equations is very poor and most of the coefficients are statistically insignificant. However, there are a few interesting results. For UR65, the coefficients in the lower two decile equations are highly significant, statistically, and the t-ratio for the third decile is 1.11. The signs of these coefficients are all positive. If we consider the signs in the other decile equations, it appears that the middle part of the distribution loses the most when there is an increase in UR65. Interestingly, we obtained a similar result for the income distribution of male individuals 65 and over drawn from Taxation Statistics. If we consider only the signs of the coefficients, the effect of PR65 on the income distribution seems highly disequalizing. In the version of the model with only three explanatory variables, the signs of the coefficients reveal an equalizing effect of YOB/GNP^* on the income distribution. It should be added that the coefficients of YOB/GNP^* for the lower three deciles are highly significant, statistically, and that the t-ratios in the fourth and eight decile equations are above 1.10.

5.3 SUMMARY OF PRINCIPAL FINDINGS

We have discussed a large number of results, and it may be helpful now to summarize the major findings.

In general, we could not find categorical support for the common belief that the lower income groups suffer the most from higher unemployment and inflation rates. On the other hand, we have found some interesting effects of labor force participation rates on changes in the income distribution; we discuss them shortly. We also have some evidence that the lower income groups in the age range 65 and over benefit the most from retirement pension and old age benefits.

We now briefly summarize the principal findings for each of the income distributions analyzed. First, we consider the income distribution for all individuals. There is some evidence that the lower part of that distribution is relatively worse off when there is an increase in the unemployment rate. However, this evidence is weak, in the sense that not all methods of estimation, and not all formulations of the model, tell the same story. A similar result emerges for the rate of inflation. The effect of the female participation rate on the income distribution is disequalizing, in the sense that the lower part of the distribution loses ground to the upper part in response to an increase in FPR. The effects of PR15 and PR65, on the other hand, appear to be of an equalizing nature. The effect of PROP15 seems disequalizing, and the same is true of YOB/GNP^*, GE/GNP^* and X/GNP^*. The effect of $YRNF/GNP^*$ is equalizing.

In the case of the income distribution for all male individuals, there are some interesting results associated with the labor force participation rates. The effect of MPR is equalizing, while the effects of PR and FPR are disequalizing. The lowest decile may be hardest hit by a higher overall male unemployment rate, although the evidence for this emerges only with the income distribution taken from Taxation Statistics. The effects of $\Delta\dot{P}$ and $\dot{W}$ appear to be disequalizing. There is some evidence that the lowest few deciles gain the most from higher levels of YUB/GNP*.

For male individuals under 25, the rate of inflation appears to have a strong disequalizing effect. The results seem to suggest similar effects in the case of MUR15 and $\dot{W}$. The effect of MPR15, on the other hand, is equalizing. YUB/GNP* appears also to have an equalizing effect, based on the results obtained when the model is estimated with the Taxation Statistics income distribution.

Among male individuals of age 25-64, the lowest few deciles are made relatively worse off as a result of any increase in UR25, and relatively better off when YUB/GNP* increases. The effect of PR25 is disequalizing, while the effect of MPR25 is equalizing. The effects of $\Delta\dot{P}$ and $\dot{W}$ appear disequalizing, if one accepts the evidence from equations estimated with the Taxation Statistics income distribution.

Among male individuals of age 65 and over, the results seem to suggest that the lowest income groups benefit the most from higher levels of YOB/GNP*. When the model is estimated with the Taxation Statistics income distribution, the lower part of the distribution loses relatively in response to an increase in $\dot{P}$ and the middle part loses relatively in response to an increase in MUR65.

In the case of the income distribution for all families and unattached individuals combined, the lowest few deciles are relatively worse off when there is an increase in UR. Similar results emerge for FPR and $\Delta\dot{P}$. The lowest four deciles lose relatively in response to an increase in $\dot{W}$. In the case of the family distribution by itself, the results for UR and $\Delta\dot{P}$ are similar to those obtained with the income distribution for all families and unattached individuals combined. The middle part of the family distribution seems to gain from higher levels of FPR; the effect of $\dot{P}$ is highly disequalizing; the lowest decile gains the most from higher YUB/GNP*.

In the case of families with age of head under 25, the effect of FPR15 is highly disequalizing. The lowest few deciles are made relatively worse off by an increase in UR15 or $\Delta\dot{P}$. The effect of $\dot{W}$ seems disequalizing. For families with age of head 25-64, the lowest few deciles lose relatively when there is an increase in FPR25, and similar results emerge for PR25 and $\Delta\dot{P}$. For families with age of head 65 and over, the lower part of the distribution benefits the most from higher levels of YOB/GNP*.

FOOTNOTES

Chapter 5

1. See Kendall and Stuart (1969), pp. 48-49.

TABLE 5.1

ALL INDIVIDUALS (TAXATION STATISTICS)

OLS Method

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
UR	+	+	-	-	-	-	-	-	-
FPR	-	-	-	-	+	+	+	+	+
PR15	-	-	-	+	+	-	-	-	-
PR65	-	-	-	-	-	-	-	-	+
PROP15	-	-	-	-	-	-	-	-	+
PROP65	-	-	-	-	-	+	+	+	+
$\dot{P}$	+	+	+	+	-	-	-	-	+
$\Delta\dot{P}$	-	-	-	-	-	+	+	+	+
$\dot{W}$	+	+	+	+	-	-	-	-	+
YRNF/GNP*	+	+	+	+	+	+	-	-	-
PROF/GNP*	+	+	+	-	-	-	-	-	-
YUB*/GNP*	+	+	+	-	-	-	-	-	-
YOB/GNP*	-	-	-	-	-	+	+	+	+
GE/GNP*	-	-	-	+	+	+	+	+	-
X/GNP*	-	-	-	-	-	+	+	+	+

NOTE: For defnition of variables see Table 4.1.

The signs are based on the results reported in Table 4.4.

TABLE 5.2

ALL INDIVIDUALS (TAXATION STATISTICS)

OLS Method

Signs of the Estimated Coefficients of the Explanatory Variables When the Dummy Variables are Added to the Model

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
UR	+	+	-	-	-	-	-	-	-
FPR	-	+	+	+	+	+	+	+	+
PR15	+	+	-	-	-	-	-	-	-
PR65	+	+	+	-	-	-	-	-	+
PROP15	-	-	-	-	-	-	-	-	+
PROP65	+	+	+	+	+	-	+	-	+
$\dot{P}$	-	-	-	-	-	-	+	+	+
$\Delta\dot{P}$	+	+	+	+	+	+	+	+	+
$\dot{W}$	-	-	-	-	-	-	+	+	+
YRNF/GNP*	+	+	+	+	+	+	-	-	-
PROF/GNP*	+	+	+	+	-	-	-	-	-
YUB*/GNP*	+	+	+	+	+	+	-	-	-
YOB/GNP*	+	+	+	+	+	+	+	+	+
GE/GNP*	-	-	-	-	-	-	+	+	+
X/GNP*	+	+	+	+	+	+	+	+	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Table 4.8.

TABLE 5.3

ALL INDIVIDUALS (TAXATION STATISTICS)

Mundlak Method

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
UR	-	-	-	-	-	-	+	+	+
FPR	-	-	-	-	-	+	+	+	+
PR15	+	+	+	+	+	-	-	+	-
PR65	+	+	+	+	+	-	-	-	-
PROP15	-	-	-	-	-	-	+	+	+
PROP65	-	-	+	-	+	+	+	+	+
$\dot{P}$	-	-	+	-	-	+	-	+	+
$\Delta\dot{P}$	+	+	+	+	-	-	-	-	-
$\dot{W}$	+	+	+	+	+	-	-	-	-
YRNF/GNP*	+	+	+	+	+	-	-	-	-
PROF/GNP*	-	+	-	+	+	-	-	-	-
YUB*/GNP*	+	+	+	-	-	-	-	-	+
YOB/GNP*	-	-	-	-	-	+	+	+	+
GE/GNP*	-	-	-	-	-	+	+	+	+
X/GNP*	-	-	-	-	-	+	+	+	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Table 4.2.

TABLE 5.4

ALL INDIVIDUALS (TAXATION STATISTICS)

Mundlak Method

Signs of the Estimated Coefficient of the Explanatory Variables When the Dummy Variables are Added to the Model

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
UR	+	-	-	-	-	-	+	+	+
FPR	-	-	-	-	-	+	+	+	+
PR15	+	+	+	+	+	-	-	-	-
PR65	+	+	+	+	+	-	-	-	-
PROP15	-	-	-	-	-	-	+	+	+
PROP65	-	-	-	+	+	+	+	+	+
$\dot{P}$	-	-	-	-	-	-	-	+	+
$\Delta\dot{P}$	-	-	-	-	-	-	+	+	+
$\dot{W}$	-	+	+	+	+	-	+	-	-
YRNF/GNP*	+	+	+	+	+	-	-	-	-
PROF/GNP*	+	+	+	+	+	-	-	-	-
YUB*/GNP*	+	+	+	+	-	-	-	-	+
YOB/GNP*	-	-	-	-	-	+	+	+	+
GE/GNP*	-	-	-	-	-	+	+	+	+
X/GNP*	-	-	-	-	-	-	+	+	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Table 4.6.

TABLE 5.5

ALL INDIVIDUALS (TAXATION STATISTICS)

Massy Method

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
UR	-	-	-	-	-	-	-	-	+
FPR	-	-	-	-	-	+	+	+	+
PR15	+	+	-	+	+	-	-	-	-
PR65	+	+	+	+	+	-	-	-	-
PROP15	-	-	-	-	-	-	+	+	+
PROP65	-	-	-	+	+	+	+	+	+
$\dot{P}$	+	+	+	+	+	+	-	+	+
$\Delta\dot{P}$	-	+	-	-	-	-	-	+	+
$\dot{W}$	+	+	+	+	+	-	-	+	+
YRNF/GNP*	+	+	+	+	+	-	-	-	-
PROF/GNP*	+	+	+	+	-	-	-	-	-
YUB*/GNP*	+	+	+	+	-	-	-	-	+
YOB/GNP*	-	-	-	-	-	+	+	+	+
GE/GNP*	+	-	-	-	-	-	+	+	-
X/GNP*	-	-	-	-	-	+	+	+	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Table 4.5.

TABLE 5.6

ALL INDIVIDUALS (TAXATION STATISTICS)

Massy Method

Signs of the Estimated Coefficients of the Explanatory Variables When the Dummy Variables are Added to the Model

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
UR	+	+	-	-	-	-	-	+	-
FPR	-	-	-	-	-	-	+	+	+
PR15	+	-	+	+	+	-	-	-	-
PR65	+	+	+	+	+	-	-	-	-
PROP15	-	-	-	-	-	-	+	+	+
PROP65	+	+	+	+	+	+	+	+	+
$\dot{P}$	-	-	-	+	+	+	+	+	+
$\Delta\dot{P}$	-	+	-	-	-	-	+	+	-
$\dot{W}$	-	+	+	+	-	+	+	+	-
YRNF/GNP*	+	+	+	+	+	+	-	-	-
PROF/GNP*	-	+	+	+	-	-	-	-	-
YUB*/GNP*	+	+	+	-	-	-	+	-	+
YOB/GNP*	-	-	-	-	-	+	+	+	+
GE/GNP*	-	-	-	-	-	+	+	+	-
X/GNP*	+	-	-	-	-	-	+	+	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Table 4.9.

TABLE 5.7

ALL INDIVIDUALS (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
---------- OLS Method ----------									
UR	+	+	+	-	+	-	+	+	+
FPR	-	-	-	-	-	+	+	+	+
$\dot{P}$	+	+	+	+	+	-	-	-	-
$\Delta\dot{P}$	-	-	-	-	-	+	+	+	+
$\dot{W}$	-	-	-	-	-	-	+	+	+
YUB/GNP*	-	+	+	+	-	-	-	-	-
---------- Massy Method ----------									
UR	+	-	-	-	-	-	+	+	+
FPR	-	-	-	-	-	-	+	+	+
$\dot{P}$	+	+	+	+	-	-	-	-	-
$\Delta\dot{P}$	-	-	-	-	-	+	+	+	+
$\dot{W}$	-	-	-	-	-	+	+	+	+
YUB/GNP*	-	+	+	+	-	-	-	-	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.10 and 4.11.

TABLE 5.8

ALL MALE INDIVIDUALS (TAXATION STATISTICS)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
MUR	-	+	+	+	+	+	+	+	+
MPR	+	+	+	+	+	+	-	-	-
$\dot{P}$	-	-	-	-	-	+	+	-	+
$\Delta\dot{P}$	-	+	-	+	+	+	+	+	+
$\dot{W}$	-	+	+	+	+	+	+	+	+
YUB*/GNP*	+	+	+	+	-	-	-	-	-
Massy Method									
MUR	-	+	+	+	+	+	+	+	+
MPR	+	+	+	+	+	+	-	-	-
$\dot{P}$	-	-	-	-	-	+	+	-	+
$\Delta\dot{P}$	-	+	-	+	+	+	+	+	+
$\dot{W}$	-	+	+	+	+	+	+	+	+
YUB*/GNP*	+	+	+	+	-	-	-	+	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.12 and 4.13.

TABLE 5.9

ALL MALE INDIVIDUALS (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
MUR	+	-	-	+	+	+	+	+	+
MPR	+	+	+	+	+	-	-	-	-
$\dot{P}$	+	-	-	-	-	-	-	+	+
$\Delta\dot{P}$	-	-	-	-	+	+	+	+	-
$\dot{W}$	-	-	-	+	+	-	-	+	+
YUB/GNP*	+	+	+	-	-	-	-	-	-
Massy Method									
MUR	+	+	-	+	+	-	+	+	-
MPR	+	+	+	+	+	-	-	-	-
$\dot{P}$	+	+	-	-	-	+	-	+	+
$\Delta\dot{P}$	-	-	+	+	+	+	+	+	-
$\dot{W}$	-	-	-	+	-	-	+	+	+
YUB/GNP*	+	+	-	-	-	-	-	-	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.14 and 4.15.

TABLE 5.10

MALE INDIVIDUALS OF AGE UNDER 25 (TAXATION STATISTICS)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
MUR15	-	-	-	-	-	-	-	+	+
MPR15	+	+	+	+	+	+	-	-	-
$\dot{P}$	-	-	-	-	-	-	+	+	+
$\Delta\dot{P}$	-	-	-	-	-	-	-	-	-
$\dot{W}$	-	-	-	-	-	-	-	+	+
YUB*/GNP*	+	+	+	+	+	+	-	-	-
Massy Method									
MUR15	-	-	-	-	-	-	-	+	+
MPR15	+	+	+	+	+	+	-	-	-
$\dot{P}$	-	-	-	-	-	-	+	+	+
$\Delta\dot{P}$	-	-	-	-	-	-	-	-	-
$\dot{W}$	-	-	-	-	-	-	-	-	+
YUB*/GNP*	+	+	+	+	+	+	-	-	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.16 and 4.17.

TABLE 5.11

MALE INDIVIDUALS OF AGE UNDER 25 (SCF)

Signs of the Estimated Coefficient of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
MUR15	-	-	-	-	-	-	-	+	+
MPR15	+	+	+	+	+	+	-	-	-
$\dot{P}$	-	-	-	-	-	-	-	+	+
$\Delta\dot{P}$	+	+	+	-	-	-	-	+	+
$\dot{W}$	+	+	+	+	+	-	-	+	-
YUB/GNP*	+	+	+	+	+	+	-	-	-
Massy Method									
MUR15	-	-	+	+	-	-	-	-	-
MPR15	+	+	+	+	+	+	-	-	-
$\dot{P}$	-	-	-	-	-	-	-	+	+
$\Delta\dot{P}$	-	-	-	-	-	-	+	+	+
$\dot{W}$	-	-	-	-	-	-	-	+	+
YUB/GNP*	-	-	-	-	-	+	-	-	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.18 and 4.19.

TABLE 5.12

MALE INDIVIDUALS OF AGE 25-64 (TAXATION STATISTICS)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
UR25	-	-	+	+	+	+	+	+	+
PR25	-	-	-	-	-	-	+	+	+
$\dot{P}$	-	+	+	+	+	+	-	-	+
$\Delta\dot{P}$	-	-	+	+	+	+	+	+	+
$\dot{W}$	-	-	-	-	-	+	+	+	+
YUB*/GNP*	+	+	+	-	-	-	-	-	-
Massy Method									
UR25	-	-	-	+	+	+	+	+	+
PR25	-	-	-	-	-	-	+	+	+
$\dot{P}$	+	+	+	+	+	+	-	-	-
$\Delta\dot{P}$	-	-	+	+	+	+	+	+	+
$\dot{W}$	-	-	-	-	-	+	+	+	+
YUB*/GNP*	+	+	-	-	-	-	-	-	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.20 and 4.21.

TABLE 5.13

MALE INDIVIDUALS OF AGE 25-64 (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
UR25	-	-	+	+	+	+	+	+	-
PR25	-	-	-	-	-	-	+	+	-
$\dot{P}$	+	+	+	-	-	-	+	+	+
$\Delta\dot{P}$	-	-	-	+	+	+	+	+	-
$\dot{W}$	-	-	-	-	-	+	+	+	+
YUB/GNP*	+	+	-	-	-	-	-	-	+
Massy Method									
UR25	-	-	-	+	+	+	+	+	+
PR25	-	-	-	-	-	-	+	+	+
$\dot{P}$	-	-	-	-	+	+	+	+	+
$\Delta\dot{P}$	-	+	+	-	+	+	+	+	-
$\dot{W}$	-	+	+	-	+	-	+	+	-
YUB/GNP*	+	-	-	+	-	-	-	-	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.22 and 4.23.

TABLE 5.14

MALE INDIVIDUALS OF AGE 65 AND OVER (TAXATION STATISTICS)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
MUR65	+	+	-	-	-	-	-	+	+
MPR65	-	+	+	+	-	-	+	-	-
$\dot{P}$	-	-	-	-	-	+	+	+	+
$\Delta\dot{P}$	-	-	+	+	-	-	-	-	-
$\dot{W}$	-	-	-	+	+	+	+	-	-
YOB/GNP*	+	+	+	+	-	-	-	-	-
OLS Method (Smaller Set of Explanatory Variables)									
$\dot{P}$	-	-	-	-	-	+	+	+	+
$\Delta\dot{P}$	+	-	+	+	-	-	-	-	-
YOB/GNP*	+	-	-	-	-	-	-	+	+

NOTE: For definition of variables see Table 4.1.

The sgins are based on the results reported in Tables 4.24 and 4.25.

TABLE 5.15

MALE INDIVIDUALS OF AGE 65 AND OVER (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
MUR65	+	+	+	-	+	+	-	-	-
MPR65	-	-	-	-	-	-	-	+	+
$\dot{P}$	+	+	+	+	+	-	-	-	-
$\Delta\dot{P}$	-	-	-	-	-	-	-	-	+
$\dot{W}$	-	-	-	-	-	-	-	-	+
YOB/GNP*	+	+	+	-	-	-	-	+	+
OLS Method (Smaller Set of Explanatory Variables)									
$\dot{P}$	-	-	+	+	+	-	-	-	-
$\Delta\dot{P}$	-	-	-	+	-	+	+	+	+
YOB/GNP*	+	+	+	+	+	-	-	-	+

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.26 and 4.27.

TABLE 5.16

ALL FAMILIES AND UNATTACHED INDIVIDUALS (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
UR	+	-	-	-	-	-	+	+	+
FPR	-	-	-	+	+	+	+	+	+
$\dot{P}$	+	-	-	-	-	-	-	-	+
$\Delta\dot{P}$	-	-	-	-	+	+	+	+	+
$\dot{W}$	-	-	-	-	+	+	+	+	+
YUB/GNP*	-	-	-	-	+	+	-	-	-
Massy Method									
UR	-	-	-	-	+	+	+	+	+
FPR	-	-	-	-	+	+	+	+	-
$\dot{P}$	+	-	-	-	-	-	-	-	+
$\Delta\dot{P}$	-	-	+	+	+	+	+	+	+
$\dot{W}$	-	-	-	-	+	+	+	+	+
YUB/GNP*	-	-	-	-	-	+	-	-	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.28 and 4.29.

TABLE 5.17

ALL FAMILIES (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
---------- OLS Method ----------									
UR	-	-	-	+	+	+	+	-	+
FPR	-	-	+	+	+	+	+	+	-
$\dot{P}$	-	-	-	-	-	-	-	-	+
$\Delta\dot{P}$	-	-	-	+	+	+	+	+	+
$\dot{W}$	-	-	-	-	-	+	-	-	+
YUB/GNP*	+	-	-	-	-	-	-	-	-
---------- Massy Method ----------									
UR	-	-	+	+	+	+	+	+	+
FPR	-	-	-	+	+	+	+	+	-
$\dot{P}$	-	-	-	-	-	-	-	-	+
$\Delta\dot{P}$	-	+	-	+	+	+	+	+	+
$\dot{W}$	-	-	-	+	+	-	-	-	+
YUB/GNP*	+	-	-	-	-	-	-	-	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.30 and 4.31.

TABLE 5.18

FAMILIES: AGE OF HEAD UNDER 25 (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
UR15	-	-	-	+	+	+	+	+	+
PR15	-	-	-	-	-	-	-	-	+
$\dot{P}$	-	-	-	+	+	+	+	-	-
$\Delta\dot{P}$	-	-	+	+	+	+	+	+	+
$\dot{W}$	-	-	-	-	-	+	+	-	+
YUB/GNP*	+	+	+	-	-	-	-	-	-
Massy Method									
UR15	-	-	-	+	+	+	+	+	+
PR15	-	-	-	-	+	+	-	-	+
$\dot{P}$	-	+	-	+	-	+	-	-	-
$\Delta\dot{P}$	-	-	+	-	+	+	+	+	+
$\dot{W}$	-	-	-	-	-	+	+	+	+
YUB/GNP*	+	+	-	-	-	+	-	-	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.32 and 4.33.

TABLE 5.19

FAMILIES: AGE OF HEAD 25-64 (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
OLS Method									
UR25	-	+	+	+	+	+	+	+	+
PR25	-	-	+	+	+	+	+	+	+
$\dot{P}$	-	-	-	+	-	-	-	-	-
$\Delta\dot{P}$	-	-	+	+	+	+	+	+	+
$\dot{W}$	-	-	-	+	-	-	-	-	-
YUB/GNP*	+	-	-	+	-	-	-	-	-
Massy Method									
UR25	+	+	+	+	+	+	-	-	+
PR25	-	-	-	+	+	+	+	+	+
$\dot{P}$	+	-	-	+	-	+	-	-	-
$\Delta\dot{P}$	-	-	-	-	+	+	+	+	+
$\dot{W}$	-	-	-	-	+	-	-	-	+
YUB/GNP*	-	+	+	+	+	-	-	-	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.34 and 4.35.

TABLE 5.20

FAMILIES: AGE OF HEAD 65 AND OVER (SCF)

Signs of the Estimated Coefficients of the Explanatory Variables

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
---------- OLS Method ----------									
UR65	+	+	+	-	-	-	-	+	+
PR65	-	-	-	-	-	-	+	+	+
$\dot{P}$	+	+	+	-	-	-	-	+	-
$\Delta\dot{P}$	-	-	-	-	-	+	+	+	-
$\dot{W}$	-	+	-	-	-	-	-	+	-
YOB/GNP*	-	+	+	-	-	-	+	+	+
---------- OLS Method ---------- (Smaller Set of Explanatory Variables)									
$\dot{P}$	+	+	+	-	-	-	-	+	-
$\Delta\dot{P}$	-	-	-	+	+	+	+	-	-
YOB/GNP*	+	+	+	+	+	-	-	-	-

NOTE: For definition of variables see Table 4.1.

The signs are based on the results reported in Tables 4.36 and 4.37.

CHAPTER 6

ANALYSIS OF RESPONSES OF OVERALL INCOME INEQUALITY TO MACRO-ECONOMIC VARIABLES

In the previous chapter, we analyzed the response of income inequality in different parts of the distribution to changes in macro-economic variables. To investigate the net effects, we need some overall measure of inequality. An advantage of the analytical framework employed in this study is that it is possible to examine the implied response of any conventional inequality measure. There are a number of summary measures available and the choice of any particular one is arbitrary, to some extent. For our purposes, we have chosen the following commonly used measures: the coefficient of variation, the Gini coefficient, and the Atkinson index. We briefly describe and discuss these measures in Section 6.1. Section 6.2 explains how the responses of these measures to macro-economic variables have been computed, using the results of the deciles model. In Section 6.3, the results are presented and analyzed. We briefly summarize the findings of the chapter in the final section.

6.1 DESCRIPTION OF THE INCOME INEQUALITY MEASURES EMPLOYED

While there are a number of summary measures of inequality available[1], the problem is that their ranking of various income distributions, in terms of degree of inequality, may not be the same. This problem has been noted by many authors, but Kolm (1976A, p. 416) puts it somewhat bluntly.

> "... different measures of inequality give widely different, and even opposite, results. Such policy which diminishes some apparently reasonable measure increases other ones. And I can take any country and prove that in some period (whatever it is) inequality has increased or decreased in it, or any two countries and prove that inequality is higher in the one or in the other, by choosing different inequality measures, all of which would probably seem good and valuable at first sight."

The main reason for this weakness is that the measures differ in their degree of sensitivity to changes in different parts of the distribution. Some are more sensitive to changes in the middle part of the distribution, and some to changes in the tails; others are sensitive only to changes in specific ranges of the distribution. We shall note this aspect of the measures employed here during the course of their description. Since the choice of any particular measure of inequality is arbitrary, to some extent, it is better to use more than one such measure. It is with this in mind that we have chosen the coefficient of variation, the Gini coefficient and the Atkinson index. We now look at each of these measures, in turn.

THE COEFFICIENT OF VARIATION

A possible measure of dispersion, or inequality, would be the variance of the income distribution. However, a problem with the variance is that its value depends on the location or scale of the distribution, as well as on its shape. The coefficient of variation takes care of this problem. It is defined as the ratio of the square root of the variance to the mean income level. It can be written as

$$(6.1) \qquad CV = \frac{\sqrt{\sum_{i=1}^{n} f_i (Y_i - M)^2}}{M}$$

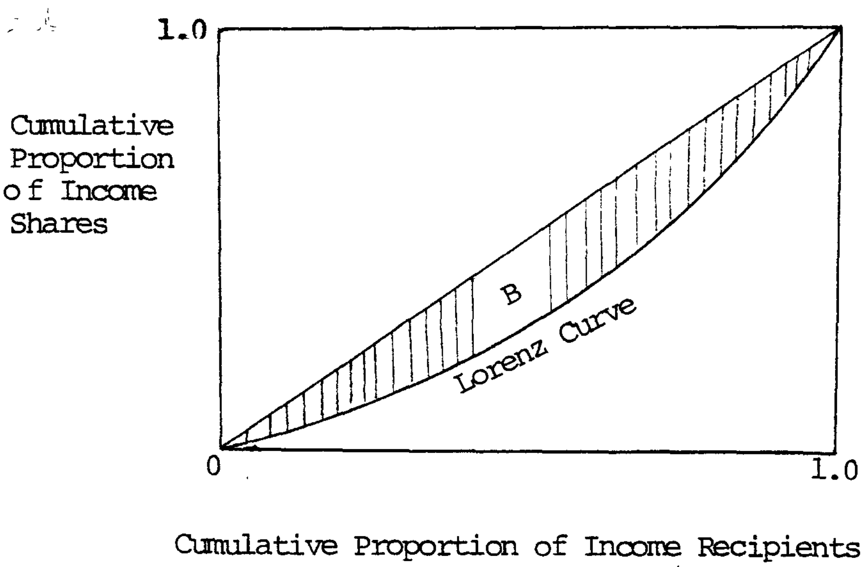
where CV is the coefficient of variation, Y_i is the mean of the ith income group, M is overall mean of the income distribution, f_i is the relative frequency of the ith income group and n is the number of income groups.

The coefficient of variation has a number of properties that should be noted. One of these is that it is invariant to uniform proportionate changes in all incomes. A second is that any transfer from a richer to a poorer person reduces the value of CV. A third is that it attaches equal weights to transfers of income at different levels of income; for example, the impact of a transfer of $10 will be the same if the transfer is from a person with $10000 of income to a person with $9000, or from a person with $5000 to a person with $4000.

THE GINI COEFFICIENT

This is the most commonly used measure of income inequality. The most intuitive way to define and interpret the Gini coefficient is in terms of a Lorenz curve, as depicted in Figure 6.1

Figure 6.1 LORENZ CURVE



The cumulative proportions of the population, arranged from poorest to richest, are measured along the horizontal axis, and the corresponding cumulative percentage income shares along the vertical axis. If everybody has the same income, the Lorenz curve will be the diagonal line, also called the line of perfect equality. But in the absence of perfect equality, the lower income groups will have proportionately lower shares of income, and the Lorenz curve will be below the diagonal line. The Gini coefficient is defined as the area between the diagonal line and the actual curve, represented by the shaded area B in Figure 6.1, expressed as a ratio to the whole of the triangular area under the diagonal line. The value of the Gini coefficient lies between zero and one -- zero when everybody has the same income and one when all the income goes to one person. The measure has the desirable property that any transfer from the richer to the poorer reduces its value. Furthermore, it is more sensitive than the coefficient of variation to income changes affecting the middle portion of the distribution[2].

THE ATKINSON INDEX

Given the fact that different summary measures attach different weights to inequality in different parts of the distribution, the measures implicitly embody value judgements. Instead of accepting those value judgements that are implicit in conventional measures, one might prefer to have a measure into which value judgements can be introduced explicitly. Atkinson (1970) proposes one such measure, defined as follows:

$$(6.2) \qquad A = 1 - \left[\sum_{i=1}^{n} (Y_i/M)^{1-\varepsilon} f_i \right]^{\frac{1}{1-\varepsilon}}, \qquad \varepsilon \neq 1$$

ε is called the "inequality aversion parameter". In the case of $\varepsilon = 1$, the Atkinson inequality index (A) takes the special form[3]

$$(6.3) \qquad A = 1 - \exp \left[\sum_{i=1}^{n} f_i \log(Y_i/M) \right]$$

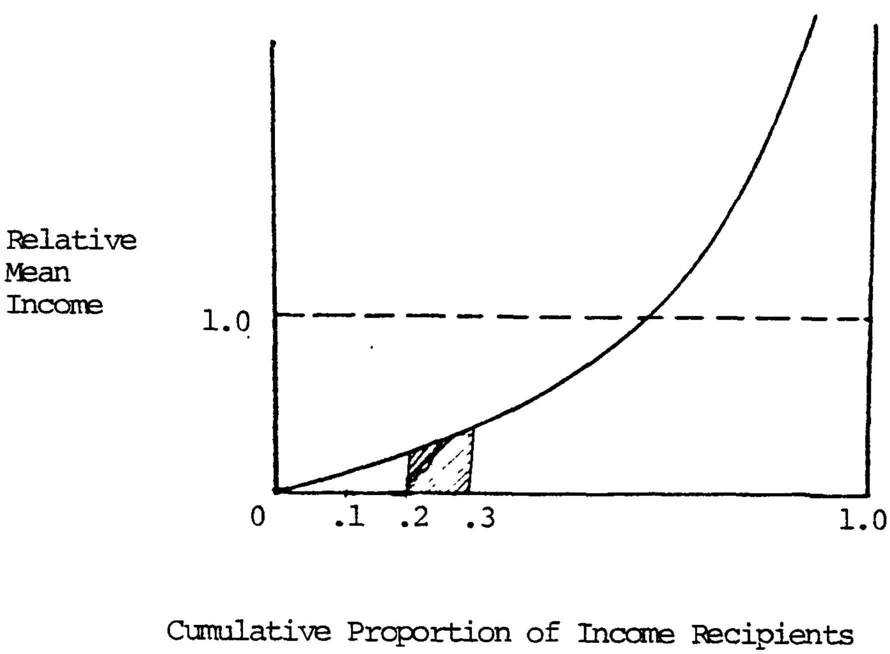
By assigning different values to ε, one can introduce the desired value judgements explicitly. Different values of ε attach different weights to inequality in different parts of the distribution. For example, assume two distributions, X and Y. The distribution X is relatively more unequal at the upper end, and the distribution Y is relatively more unequal at the lower end. A low value of ε (say .5) will rank X as relatively more unequal, whereas a higher value of ε (say 2.0) will rank Y as relatively more unequal. Theoretically, ε can take values from zero to infinity. However, Atkinson's work (1970, 1975) seems to suggest it is sufficient to vary ε with a range such as .5 to 3.0. In our study, ε is assigned a lower bound of .5, and then incremented continuously by .5 until it reaches 3.0, the highest value assumed. Like the Gini coefficient, the Atkinson inequality index ranges from zero to one -- zero when everybody has equal income and one when all the income goes to one person.

6.2 COMPUTATION OF RESPONSES OF THE INCOME INEQUALITY MEASURES TO MACRO-ECONOMIC VARIABLES

As discussed in Chapter 5, the slope of the Lorenz curve at any point is equal to a quantile income level divided by the mean income of the distribution.

The curve based on the slope of the Lorenz curve can be referred to as the "relative mean income curve". The area under this curve, between any two points, gives the share of the income group that lies between the points. For example, in Figure 6.2, the area under the curve between the points .2 and .3, defined on the horizontal axis, gives the income share of the third 10 percent income group.

Figure 6.2 RELATIVE MEAN INCOME CURVE



We approximate the area under the curve as a trapezoid, which means that points on the curve are joined by straight lines, as an approximation. The share of the ith 10 percent income group (S_i) can then be estimated as

$$(6.4) \qquad S_i = .1\left(\frac{D_{i-1}}{M} + \frac{D_i}{M}\right)/2$$

or

$$(6.5) \qquad S_i = .05\left(\frac{D_{i-1}}{M} + \frac{D_i}{M}\right)$$

If we are interested in looking at the response of the ith income share to a change in, say, the unemployment rate, we can write

$$(6.6) \qquad \frac{\partial S_i}{\partial UR} = .05\left[\frac{\partial (D_{i-1}/M)}{\partial UR} + \frac{\partial (D_i/M)}{\partial UR}\right]$$

From the results reported in Chapter 4, we can estimate the response of the ith income share to changes in a macro-economic variable, such as UR. Since our model is based on nine relative decile income levels, the response of the income share of the highest ten percent income group must be estimated residually. The income share of the highest ten percent income group (S_{10}) is estimated as

$$(6.7) \qquad S_{10} = 1 - \sum_{i=1}^{9} S_i$$

The response of S_{10} to a change in UR can be computed as

$$(6.8) \qquad \frac{\partial S_{10}}{\partial UR} = - \sum_{i=1}^{9} \frac{\partial S_i}{\partial UR}$$

The responses of all the income inequality indices to a change in any given variable can be worked out in terms of the responses of the income shares.

Let us now look at how the response of each index is, in fact, calculated.

THE COEFFICIENT OF VARIATION

The coefficient of variation is defined as

$$(6.9) \qquad CV = \frac{\sqrt{\sum_{i=1}^{n} (Y_i - M)^2 f_i}}{M}$$

or, equivalently, as

$$(6.10) \qquad CV = \sqrt{\sum_{i=1}^{n} \left(\frac{Y_i}{M} - 1\right)^2 f_i}$$

CV can also be written in terms of income shares. Since our model is based on deciles, let us assume that there are 10 income groups (i.e., n = 10), multiply and divide the expression Y_i/M by 10 and let S_i be equal to $Y_i/10M$, where S_i is the ith ten percent income group's income share. The expression for the coefficient of variation can then be written as

$$(6.11) \qquad CV = \sqrt{.1 \sum_{i=1}^{10} (10(S_i)-1)^2}, \text{ since } f_i = .1 \ \forall\ i$$

We can then determine the response of CV to the unemployment rate, for example, as follows:

$$(6.12) \qquad \frac{\partial CV}{\partial UR} = (.1 \sum_{i=1}^{10} (10(S_i)-1)^2)^{-1/2} (\sum_{i=1}^{10} (10(S_i)-1)\frac{\partial S_i}{\partial UR})$$

The response varies from year to year as the income shares change. However, for summary purposes we do the evaluation at mean values of S_i over the entire period covered by the data being analyzed.

THE GINI COEFFICIENT[4]

We have defined the Gini coefficient in terms of Figure 6.1, which is based on the Lorenz curve. From decile income shares, we can derive corresponding cumulative income shares. The cumulative income share up to the ith 10 percent income group (A_i) can be expressed as

$$(6.13) \qquad A_i = \sum_{j=1}^{i} S_j$$

In this way, we can have 10 points on the Lorenz curve corresponding to the ten deciles. To determine the shaded area B in Figure 6.1, we first approximate the area under the Lorenz curve using the trapezoidal rule. That area is given by

$$(6.14) \qquad F = .1(0 + A_1)/2 + .1(A_1 + A_2)/2 + \ldots + .1(A_9 + A_{10})/2$$

Since $A_{10} = 1$, we can rewrite (6.14) as

$$(6.15) \qquad F = .05 + .1 \sum_{i=1}^{9} A_i$$

The area of the triangle under the diagonal line is .5

and the shaded area B in Figure 6.2 becomes

$$(6.16) \qquad B = .5 - F$$

The Gini coefficient (G) is defined as

$$(6.17) \qquad G = \frac{.5 - F}{.5}$$

Substituting the expression for F from (6.15) and simplifying the expression, we get

$$(6.18) \qquad G = .9 - .2 \sum_{i=1}^{9} A_i$$

The effect of some factor, say UR, on G can then be computed as

$$(6.19) \qquad \frac{\partial G}{\partial UR} = -.2 \sum_{i=1}^{n} \frac{\partial A_i}{\partial UR}$$

THE ATKINSON INEQUALITY INDEX

It is defined as

$$(6.20) \qquad A = 1 - \left[\sum_{i=1}^{n} (Y_i/M)^{1-\varepsilon} \quad f_i \right]^{\frac{1}{1-\varepsilon}} , \quad \varepsilon \neq 1$$

It can be written in terms of income shares (assuming 10 income groups) as

$$(6.21) \qquad A = 1 - \left[.1 \sum_{i=1}^{10} (10(S_i))^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$$

The response of A to a variable such as UR can then be found:

$$(6.22) \qquad \frac{\partial A}{\partial UR} = -\left[.1 \sum_{i=1}^{10} (10(S_i))^{1-\varepsilon} \right]^{\frac{\varepsilon}{1-\varepsilon}} \left[\sum_{i=1}^{10} (10(S_i))^{-\varepsilon} \frac{\partial S_i}{\partial UR} \right]$$

When ε takes the value of one, the formula for the Atkinson index becomes

$$(6.23) \qquad A = 1 - \exp\left[\sum_{i=1}^{n} f_i \log(Y_i/M) \right]$$

which can be written in terms of income shares as

$$(6.24) \qquad A = 1 - \exp\left[\sum_{i=1}^{n} f_i \log(10(S_i)) \right]$$

The response of A to UR can then be computed as

$$(6.25) \qquad \frac{\partial A}{\partial UR} = -\left[\exp \sum_{i=1}^{10} .1 \log(10(S_i)) \right] \left[\sum_{i=1}^{10} \frac{.1}{S_i} \frac{\partial S_i}{\partial UR} \right]$$

6.3 RESULTS

Having outlined the procedures for computing the responses of the income inequality measures to macro-economic variables, we now present and analyze the results of applying these procedures to the estimated equations of our model. Tables 6.1 to 6.20 contain results for various income distributions. These results are based on the equations reported in Chapter 4. A quick look at them shows support for the already well established finding that different summary measures of income inequality can produce different results. However, when this occurs one can go back to the results of Chapter 4, examine the detailed changes in the income distribution, and accept the result of a particular summary measure of inequality that is in accordance with one's value judgements. We now discuss the results for each income distribution separately.

6.3.1 ALL INDIVIDUALS (TAXATION STATISTICS)

The results for this data set are presented at the end of the chapter in Tables 6.1 to 6.6. We concluded in the last chapter that the regression results for all individuals, based on Taxation Statistics, were much better when the deciles model was estimated by the Mundlak method. Therefore, we first discuss the results based on this method. For the majority of the variables, the results of both version A and version B of the model are identical as far as the change in direction of the income inequality is concerned. All the measures of income inequality indicate an increase in inequality when there is an increase in any of FPR, PROP15, YOB/GNP*, GE/GNP* and X/GNP*, while the converse is true for PR15, PR65, and YRNF/GNP*. In version A of the model, all the measures of inequality show a disequalizing effect of UR and PROF/GNP*, and equalizing effect of $\Delta\dot{P}$, but these results are completely reversed in version B. In version A, in response to an increase in PROP65, the coefficient of variation indicates a reduction in income inequality, while both the Gini coefficient and the Atkinson inequality index show increases. In version B, the coefficient of variation, and the Atkinson inequality index for values of the inequality aversion parameter (ε) of 1.0 and over, yield results similar to those obtained in version A, whereas the results are reversed for the Gini coefficient and for the Atkinson index with a value of ε of .5. The effect of $\dot{P}$ appears disequalizing in both versions of the model, except for the coefficient of variation in version A of the model where its value is zero. Moreover, in version A, the impact of $\dot{P}$ on the Gini coefficient and the Atkinson index is very small. The effect of $\dot{W}$ is equalizing in Version A of the model, and the same is true in version B, for the coefficient of variation, for the Gini coefficient and for the Atkinson index with values of ε of .5 and 1.0, but the result is reversed for the Atkinson index with higher values of ε. The effect of YUB*/GNP* is to reduce income inequality, except in version A of the model, where the coefficient of variation indicates the opposite.

For most of the variables, the results based on the Massy Method are similar to those based on the Mundlak method. In version A of the model, the results for all variables except $\dot{P}$, $\Delta\dot{P}$, PROF/GNP* and GE/GNP* are identical, in terms of changes in the direction of income inequality, to those based on the Mundlak method. In version B, however, the results for UR, PROP65, $\dot{P}$ and PROF/GNP* are somewhat different. The results based on OLS method are also presented, and they differ for many of the variables from those based on the Mundlak and Massy methods. However, these results are not of much importance because the regression results on which they are based are generally statistically insignificant.

We note that all the measures of inequality show the effect of PROP15 to be to increase income inequality, and the effect of YRNF/GNP* to be to reduce it. This is true for both versions of the model, and for all three methods of estimation.

6.3.2 ALL INDIVIDUALS (SCF)

The results for this data set are reported in Table 6.7. The results based on the OLS and Massy methods are identical, as far as changes in the direction of income inequality are concerned. All the income inequality measures show increases in inequality in response to increases in FPR, $\Delta\dot{P}$, $\dot{W}$ and YUB/GNP*, while the converse is true for UR and $\dot{P}$. A good example of how misleading these results can be, sometimes, is afforded by the result for UR. All the inequality measures indicate reduction in overall inequality when there is an increase in UR. However, if we go back to the results of the decile model estimated by the Massy method (Table 4.11), we find that deciles 2 to 6 lose relatively in response to an increase in UR. Thus a large portion of the lower part of the distribution is relatively worse off, even though the overall inequality measure declines. It should be noted that in this particular case the Lorenz curves corresponding to the distribution before and after an increase in UR intersect.

6.3.3 ALL MALE INDIVIDUALS (TAXATION STATISTICS)

Table 6.8 contains the results. The results based on OLS and the Massy method are again identical in terms of changes in the direction of inequality. In response to an increase in MUR, overall inequality declines, whether measured by the coefficient of variation, by the Gini coefficient or the Atkinson index with values of ε 1.5 and under. For higher values of ε, on the other hand, the result is reversed for the Atkinson index. The reason for the reverse is that higher values of ε attach more weight to changes in the lower end of the distribution, and if we look at the decile results (Tables 4.12 and 4.13), we find that the lowest decile loses relatively in response to an increase in MUR. The results for $\Delta\dot{P}$ and $\dot{W}$ are similar to those obtained for MUR. The effect of MPR is to reduce income inequality, and the same is true for YUB^*/GNP^* when the income inequality is measured by the Gini coefficient or the Atkinson index, although the coefficient of variation shows an increase. Income inequality increases in response to an increase in $\dot{P}$.

6.3.4 ALL MALE INDIVIDUALS (SCF)

The results are presented in Table 6.9. The results for MUR and MPR are very similar to those obtained with the corresponding income distribution from Taxation Statistics. The effect of $\dot{W}$ is to increase overall income inequality. For the remaining variables, the results based on OLS method are somewhat different than those based on the Massy method. Also, different measures of the income inequality produce conflicting results for these variables.

6.3.5 MALE INDIVIDUALS UNDER 25 (TAXATION STATISTICS)

The results are reported in Table 6.10. The results based on the OLS and Massy methods are identical (in the same sense as before). All the income inequality measures show increases in inequality when there are increases in MUR15, $\dot{P}$, $\Delta\dot{P}$ and $\dot{W}$, while the converse is true for MPR15 and YUB^*/GNP^*.

6.3.6 MALE INDIVIDUALS UNDER 25 (SCF)

The results are presented in Table 6.11. The results for MUR15 and $\dot{P}$ are similar to those obtained with the income distribution taken from Taxation Statistics. The same is true for $\Delta\dot{P}$ and $\dot{W}$ when the results are based on the Massy method. The results for YUB/GNP* are similar to the Taxation Statistics distribution results when they are based on OLS but completely opposite when they are based on the Massy method.

6.3.7 MALE INDIVIDUALS 25-64 (TAXATION STATISTICS)

Table 6.12 contains the results. Since the results based on the two estimation methods are very similar, we describe only those based on the Massy method. In response to an increase in UR25, income inequality declines when measured by the coefficient of variation, the Gini coefficient or the Atkinson index with a value of ε of .5; and for higher values of ε the direction of change is reversed. A similar result emerges for $\Delta\dot{P}$. All the measures of inequality indicate an increase in response to an increase in PR25 and $\dot{W}$. The effect of $\dot{P}$ is to increase inequality when defined in terms of the coefficient of variation, the Gini coefficient or the Atkinson index with values of ε 1.0 and below, while for higher values of ε the Atkinson index indicates a decline. The coefficient of variation shows an increase in inequality in response to an increase in YUB^*/GNP^*, whereas the Gini coefficient and the Atkinson index indicate the opposite.

6.3.8 MALE INDIVIDUALS 25-64 (SCF)

The results, as reported in Table 6.13, do not differ substantially from those obtained with the income distribution from Taxation Statistics. Therefore, there is no need to comment on them.

6.3.9 MALE INDIVIDUALS 65 AND OVER (TAXATION STATISTICS)

The results are presented in Table 6.14. Two versions of the decile model were estimated by OLS. One version included six explanatory variables, the other version only three ($\dot{P}$, $\Delta\dot{P}$ and YOB/GNP^*). The results for both versions of the model are not interesting, in the sense that, for all variables except $\Delta\dot{P}$, the various measures of the income inequality produce conflicting results. The effect of $\Delta\dot{P}$, in the version of the model based on six explanatory variables, is to increase income inequality.

6.3.10 MALE INDIVIDUALS 65 AND OVER (SCF)

Table 6.15 contains the results. The results here are relatively better than those obtained with the income distribution from Taxation Statistics. When the larger set of explanatory variables is used, income inequality increases in response to an increase in MUR65 and converse is true for MPR65 and $\dot{W}$. When the smaller set is used, inequality increases in response to an increase in $\dot{P}$ and decreases in response to an increase in YOB/GNP^*.

6.3.11 ALL FAMILIES AND UNATTACHED INDIVIDUALS (SCF)

A look at Table 6.16 shows the results based on the OLS and Massy methods to be very close in terms of changes in the direction of income inequality. The Gini coefficient and the Atkinson index show an increase in the income inequality, and the coefficient of variation a decrease, when there is an increase in UR. The Atkinson index indicates an increase while the coefficient of variation and the Gini coefficient show decreases when there is an increase in FPR. For $\dot{P}$, the Gini coefficient and the coefficient of variation show an increase and the Atkinson index a decrease. In response to an increase in $\Delta\dot{P}$, inequality drops when measured by the coefficient of variation, the Gini index or the Atkinson index with a value of ε of .5, while the converse is true for the latter index with higher values of ε. All the measures of inequality indicate increases when there are increases in $\dot{W}$ or YUB/GNP*.

6.3.12 ALL FAMILIES (SCF)

Table 6.17 contains the results. All measures indicate an increase in inequality in response to rise in $\dot{P}$. For other variables, the results are more or less the same as those obtained with the income distribution for all families and unattached individuals.

6.3.13 FAMILIES: AGE OF HEAD UNDER 25 (SCF)

The results are reported in Table 6.18. All the inequality measures show increases in inequality in response to increases in the UR15, PR15, and YUB/GNP*.

The same is true of $\Delta\dot{P}$ when the results are based on the Massy method, but the OLS results are slightly different. For $\dot{P}$, the results based on the Massy method show a reduction in inequality when the inequality is measured by the coefficient of variation or the Gini coefficient, while the Atkinson index indicates the opposite; the OLS results are somewhat different for the Atkinson index. For YUB/GNP*, the results based on OLS show a reduction in inequality, whatever measure of inequality is employed; the results based on the Massy method do not indicate a unique direction of change in inequality.

6.3.14 FAMILIES: AGE OF HEAD 25-64 (SCF)

The results are presented in Table 6.19. The results of both methods of estimation are similar for PR25, $\Delta\dot{P}$, and $\dot{W}$, while for the other variables they are somewhat different. We describe here the results based on the Massy method. All the income inequality measures show a reduction in income inequality when there is an increase in UR25 or $\dot{P}$. In response to an increase in PR25, the coefficient of variation, the Gini coefficient and the Atkinson index with values of ε of .5 and 1.0 show reductions in inequality, while the Atkinson index for higher values of ε indicate otherwise. Similar results emerge for $\Delta\dot{P}$ and YUB/GNP*.

6.3.15 FAMILIES: AGE OF HEAD 65 AND OVER (SCF)

We estimated two versions of the decile model with the OLS method, as we did for male individuals in the same age group. The results based on the two versions of the decile model are reported in Table 6.20. In the version with the larger set of explanatory variables, all the income inequality measures indicate a reduction in inequality in response to an increase in UR65, $\dot{P}$ or YOB/GNP*, while the converse is true for $\Delta\dot{P}$, and $\dot{W}$. The Gini coefficient and the Atkinson index show increases, and the coefficient of variation a decrease in inequality, in response to an increase in PR65.

In the version of the model with the smaller set of explanatory variables, the results for $\Delta\dot{P}$ and YOB/GNP* remain unchanged. For $\dot{P}$, though, different measures of inequality produce different results.

6.4 SUMMARY OF PRINCIPAL FINDINGS

The results of this chapter enable us to classify the responses of overall income inequality (measured by conventional summary measures) to changes in macro-economic variables. Unfortunately, in some cases, different measures of income inequality produce different results. Therefore, we now concentrate on those results for which all the measures agree.

In the case of the income distribution for all individuals, we do not have any conclusive result about the effect of UR on income inequality. The results based on different formulations of the model and different methods of estimation yield conflicting results. The same is true of the rate of inflation. If we ignore the equations estimated by OLS, we have the following interesting results: Income inequality increases when there is an increase in FPR, PROP15, YOB/GNP* or X/GNP*, and decreases when there is an increase in PR15, PR65 or YRNF/GNP*. (The results for PROP15 and YRNF/GNP* are supported also by the OLS evidence.)

For all male individuals, an increase in MPR reduces income inequality. When the model is estimated with the Taxation Statistics distribution, the effect of

$\dot{P}$ is to increase income inequality. Among male individuals under 25 of age, income inequality increases in response to an increase in MUR15 or $\dot{P}$, and decreases in response to an increase in MPR15. In the case of male individuals of age 25-64, inequality increases when there is an increase in PR25. A similar result emerges for $\dot{W}$ when the model is estimated with the Taxation Statistics data. For male individuals 65 and over, there is some evidence that YOB/GNP* reduces the income inequality, and that $\dot{P}$ increases it.

In the case of all families and unattached individuals combined, income inequality increases in response to an increase in $\dot{W}$ or YUB/GNP*. A similar result emerges for $\dot{W}$ when we consider the distribution for families only, and $\dot{P}$ also increases income inequality in this case. For families with age of head under 25, inequality increases in response to an increase in UR15 or PR15. In the case of families with age of head 25-64, the results seem to suggest that income inequality increases in response to an increase in $\dot{W}$. Among families with age of head 65 and over, inequality declines in response to an increase in YOB/GNP*, and the result for UR65 is similar. The effect of $\Delta\dot{P}$ and $\dot{W}$ is to increase income inequality.

In most cases, the various measures produce identical results as far as change in the direction of inequality is concerned. However, if we consider only those cases where some of the measures do not agree, we find that most of the time this disagreement is either between the Atkinson index for higher values of ε and the other measures (the Gini coefficient and the coefficient of variation), or between the coefficient of variation and the other measures.

FOOTNOTES

Chapter 6

1. For a good discussion of these measures, see Cowell (1977) and Sen (1973). Recently other measures have been proposed by Dagum (1980) to measure inequality between income distributions. These can be applied to ascertain the relative degree of affluence of one population with respect to another. Shorrocks (1982) raises some questions regarding these measures. Dagum, in a reply (unpublished at the time of writing), argues that Shorrocks misinterprets his ideas, and that the measures are valid. Dagum's measures have not been applied here but could be applied in an extension of the work reported in this thesis.

2. See Atkinson (1970), pp. 256-257.

3. The formula for the Atkinson index when $\varepsilon = 1$ is not given in Atkinson's original work (1970) and, also, I could not find it at some other places in the literature -- Atkinson (1975), Cowell (1977), and Sen (1973). However, the result in (6.3) can be obtained by considering the limit of A as ε tends to 1, and applying l'Hopitals' rule for finding a limit when the original function takes an indeterminate form.

4. The procedure described here to compute the response of the Gini coefficient to a macro-economic variable is taken from Beach (1977).

TABLE 6.1

ALL INDIVIDUALS (TAXATION STATISTICS)
INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Results Based on OLS Method

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
UR	.00183	.00010	-.00034	-.00152	-.00333	-.00494	-.00567	-.00565
FPR	.00282	.00217	.00185	.00454	.00763	.00994	.01071	.01034
PR15	.00144	.00051	.00037	.00068	.00090	.00097	.00092	.00081
PR65	.00796	.00371	.00277	.00589	.00901	.01113	.01169	.01115
PROP15	1.53561	.62093	.35225	.55622	.57473	.45125	.29684	.18421
PROP65	3.22377	2.16496	1.54371	3.39928	5.17668	6.25226	6.39295	5.97326
$\dot{P}$	-.00235	-.00121	-.00101	-.00233	-.00378	-.00485	-.00519	-.00500
$\Delta\dot{P}$	.00107	.00066	.00053	.00125	.00208	.00273	.00297	.00290
$\dot{W}$	-.00207	-.00102	-.00082	-.00180	-.00280	-.00347	-.00362	-.00342
YRNF/GNP*	-.58208	-.32132	-.20743	-.41262	-.57205	-.63970	-.61896	-.55827
PROF/GNP*	.33360	.01477	-.00592	-.08250	-.19251	-.27599	-.30221	-.28927
YUB*/GNP*	.07994	-.07704	-.10631	-.33194	-.63648	-.89281	-1.00085	-.98661
YOB/GNP*	2.33468	1.27547	.97022	2.16701	3.43052	4.34022	4.62049	4.44455
GE/GNP*	.09442	.06029	.05910	.14951	.25878	.34538	.37790	.36802
X/GNP*	.25108	.18606	.13404	.30247	.47000	.57673	.59653	.56167

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.2

ALL INDIVIDUALS (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Results Based on OLS Method With Dummy Variables Included

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
UR	.00530	.00167	.00076	.00069	-.00012	-.00113	-.00178	-.00199
FPR	-.00337	-.00110	-.00057	-.00067	-.00032	.00023	.00064	.00083
PR15	.00104	.00010	.00004	-.00010	-.00036	-.00059	-.00069	-.00069
PR65	.00127	.00016	.00004	-.00015	-.00044	-.00065	-.00070	-.00066
PROP15	2.09626	.84207	.50210	.84257	.97619	.92219	.77926	.64048
PROP65	-2.84979	-1.36855	-1.10492	-2.44955	-3.84925	-4.82288	-5.07982	-4.84005
$\dot{P}$	.00156	.00100	.00062	.00122	.00164	.00175	.00161	.00140
$\Delta\dot{P}$	-.00268	-.00097	-.00054	-.00081	-.00077	-.00054	-.00031	-.00016
$\dot{W}$	.00003	.00023	.00011	.00022	.00029	.00027	.00022	.00017
YRNF/GNP*	-1.23284	-.65531	-.45004	-.92817	-1.34845	-1.58103	-1.59017	-1.47333
PROF/GNP*	.42222	.03101	.01731	-.02477	-.08320	-.11373	-.10920	-.09045
YUB*/GNP*	-7.30081	-3.60359	-2.38435	-4.69680	-6.52598	-7.37144	-7.21839	-6.57565
YOB/GNP*	-2.69994	-1.00681	-.62006	-1.04095	-1.22435	-1.18915	-1.03691	-.87466
GE/GNP*	.73125	.35047	.25844	.54777	.83001	1.01668	1.05926	1.00538
X/GNP*	-.44890	-.14886	-.10751	-.20218	-.28395	-.33665	-.34831	-.33142

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.3

ALL INDIVIDUALS (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Results Based on Mundlak Method

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
UR	.00044	.00060	.00037	.00084	.00127	.00149	.00149	.00138
FPR	.00118	.00071	.00049	.00105	.00156	.00185	.00188	.00174
PR15	-.00045	-.00023	-.00020	-.00052	-.00098	-.00145	-.00173	-.00180
PR65	-.00111	-.00073	-.00052	-.00113	-.00172	-.00208	-.00212	-.00198
PROP15	.55712	.29865	.19697	.39486	.55419	.62841	.61559	.56032
PROP65	-.87908	.29117	.42153	1.41840	2.76793	3.88127	4.32843	4.24429
$\dot{P}$	-.00000	.00003	.00002	.00004	.00008	.00011	.00012	.00012
$\Delta\dot{P}$	-.00117	-.00071	-.00062	-.00150	-.00249	-.00323	-.00347	-.00334
$\dot{W}$	-.00375	-.00202	-.00150	-.00327	-.00503	-.00618	-.00643	-.00608
YRNF/GNP*	-.30433	-.19708	-.13563	-.29038	-.43036	-.50822	-.51148	-.47327
PROF/GNP*	.13306	.01105	.02215	.04465	.07453	.10414	.12018	.12169
YUB*/GNP*	.16202	-.00635	-.02954	-.11898	-.23899	-.33114	-.36132	-.34731
YOB/GNP*	.84628	.57383	.40726	.90462	1.38370	1.67862	1.72286	1.61419
GE/GNP*	.07503	.07817	.05881	.13881	.22268	.27763	.28890	.27232
X/GNP*	.26528	.17052	.11702	.25008	.37044	.43768	.44092	.40837

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.4

ALL INDIVIDUALS (TAXATION STATISTICS)

INCOME INEQUALITIES RESPONSES (PARTIAL DERIVATIVES)

Results Based on Mundlak Method With Dummy Variables Included

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
UR	-.00147	-.00044	-.00049	-.00118	-.00210	-.00294	-.00335	-.00336
FPR	.00125	.00074	.00054	.00120	.00187	.00231	.00242	.00230
PR15	-.00055	-.00049	-.00030	-.00061	-.00081	-.00084	-.00074	-.00061
PR65	-.00104	-.00069	-.00049	-.00107	-.00162	-.00195	-.00199	-.00186
PROP15	.52768	.29712	.20565	.43243	.63863	.75837	.76959	.71720
PROP65	-1.00902	-.09931	-.04767	.04422	.17060	.22685	.20273	.15188
$\dot{P}$	.00068	.00032	.00019	.00034	.00044	.00047	.00044	.00039
$\Delta\dot{P}$	.00032	.00018	.00012	.00025	.00038	.00047	.00049	.00047
$\dot{W}$	-.00005	-.00013	-.00004	-.00004	.00005	.00019	.00031	.00037
YRNF/GNP*	-.43433	-.27100	-.22199	-.52532	-.86688	-1.12473	-1.21329	-1.17438
PROF/GNP*	-.07233	-.07665	-.05010	-.11100	-.16426	-.18979	-.18594	-.16819
YUB*/GNP*	-.27803	-.14287	-.12201	-.28055	-.45223	-.57536	-.61118	-.58502
YOB/GNP*	.72459	.49758	.36407	.81900	1.27532	1.57137	1.63160	1.54049
GE/GNP*	.09968	.08139	.04931	.10001	.13490	.14194	.12786	.10832
X/GNP*	.24606	.13667	.08140	.15006	.18595	.18127	.15284	.12291

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.5

ALL INDIVIDUALS (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSSES (PARTIAL DERIVATIVES)

Results Based on Massy Method

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
UR	.00479	.00184	.00107	.00169	.00178	.00146	.00103	.00070
FPR	.00113	.00079	.00058	.00131	.00206	.00256	.00268	.00254
PR15	-.00006	-.00028	-.00027	-.00075	-.00138	-.00189	-.00211	-.00208
PR65	-.00070	-.00046	-.00028	-.00055	-.00073	-.00077	-.00069	-.00058
PROP15	.56126	.27210	.16034	.28172	.33329	.31096	.25219	.19660
PROP65	-1.63385	.24152	.42003	1.57997	3.19663	4.54857	5.10737	5.02624
$\dot{P}$	-.00208	-.00076	-.00050	-.00087	-.00107	-.00109	-.00098	-.00084
$\Delta\dot{P}$	.00052	.00026	.00018	.00038	.00059	.00076	.00082	.00080
$\dot{W}$	-.00383	-.00161	-.00112	-.00216	-.00297	-.00334	-.00326	-.00297
YRNF/GNP*	-.53244	-.32121	-.23365	-.51387	-.79094	-.97061	-1.00753	-.95215
PROF/GNP*	.19446	-.04063	-.05266	-.19052	-.37764	-.53091	-.59224	-.58101
YUB*/GNP*	-1.02974	-.48512	-.37926	-.81893	-1.25487	-1.54150	-1.60240	-1.51497
YOB/GNP*	.93828	.82440	.70408	1.76768	3.02019	3.99185	4.34628	4.22604
GE/GNP*	.00888	-.01826	-.03293	-.10951	-.22621	-.33825	-.39734	-.40402
X/GNP*	.58816	.34787	.25418	.55761	.85660	1.04948	1.08794	1.02709

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.6

ALL INDIVIDUALS (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Results Based on Massy Method With Dummy Variables Included

Partial derivatives with respect to--	Coefficient or Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			$\varepsilon = .5$	$\varepsilon = 1.0$	$\varepsilon = 1.5$	$\varepsilon = 2.0$	$\varepsilon = 2.5$	$\varepsilon = 3.0$
UR	.00052	.00008	-.00014	-.00063	-.00141	-.00213	-.00249	-.00250
FPR	.00141	.00083	.00059	.00127	.00192	.00232	.00238	.00222
PR15	-.00001	-.00017	-.00009	-.00023	-.00037	-.00046	-.00048	-.00046
PR65	-.00097	-.00067	-.00049	-.00110	-.00171	-.00211	-.00219	-.00207
PROP15	.61925	.33772	.21999	.43865	.61020	.68474	.66441	.60041
PROP65	-4.66649	-1.46820	-1.04059	-1.92741	-2.66814	-3.13256	-3.22497	-3.06240
$\dot{P}$	-.00036	.00002	.00002	.00010	.00019	.00023	.00021	.00018
$\Delta\dot{P}$	.00078	.00040	.00029	.00063	.00098	.00123	.00132	.00128
$\dot{W}$	-.00042	-.00010	-.00002	.00006	.00023	.00041	.00052	.00054
YRNF/GNP*	-.51933	-.32304	-.23245	-.50904	-.77594	-.94069	-.96536	-.90413
PROF/GNP*	.21165	.00410	.01140	.00699	.01356	.04014	.06948	.08674
YUB*/GNP*	-.37363	-.17707	-.14859	-.33245	-.52448	-.65665	-.68956	-.65490
YOB/GNP*	.81413	.51488	.41494	.97357	1.59067	2.04551	2.19199	2.11243
GE/GNP*	.12083	.08503	.07342	.17979	.30290	.39737	.43102	.41832
X/GNP*	.11148	.07070	.02083	.00529	-.05743	-.13956	-.19661	-.21689

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.7

ALL INDIVIDUALS (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
			Results Based on OLS Method					
UR	-.00969	-.00383	-.00419	-.01019	-.01678	-.02043	-.02035	-.01864
FPR	.00420	.00261	.00258	.00609	.00946	.01094	.01055	.00950
$\dot{P}$	-.00391	-.00253	-.00288	-.00736	-.01212	-.01457	-.01435	-.01304
$\Delta\dot{P}$	.00257	.00206	.00177	.00377	.00509	.00516	.00452	.00383
$\dot{W}$	.00629	.00319	.00247	.00474	.00597	.00581	.00497	.00416
YUB/GNP*	1.59097	.54533	.61334	1.60741	2.90820	3.81332	3.98339	3.75110
			Results Based on Massy Method					
UR	-.00451	-.00158	-.00242	-.00689	-.01268	-.01648	-.01700	-.01584
FPR	.00361	.00229	.00224	.00529	.00820	.00948	.00914	.00823
$\dot{P}$	-.00347	-.00234	-.00283	-.00746	-.01263	-.01545	-.01538	-.01407
$\Delta\dot{P}$	.00496	.00326	.00287	.00619	.00865	.00911	.00822	.00710
$\dot{W}$	.00625	.00331	.00271	.00548	.00730	.00746	.00662	.00566
YUB/GNP*	1.26489	.54825	.83412	2.47743	4.69423	6.21167	6.47640	6.07696

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.8

ALL MALE INDIVIDUALS (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
			Results Based on OLS Method					
MUR	-.02048	-.00531	-.00271	-.00285	-.00095	.00143	.00290	.00336
MPR	-.02929	-.01658	-.01021	-.02032	-.02781	-.03016	-.02803	-.02439
$\dot{P}$	.00268	.00177	.00122	.00267	.00397	.00461	.00448	.00401
$\Delta\dot{P}$	-.01846	-.00418	-.00237	-.00267	-.00153	-.00012	.00072	.00101
$\dot{W}$	-.00437	-.00121	-.00058	-.00055	-.00001	.00067	.00108	.00119
YUB*/GNP*	.43191	-.48721	-.39584	-1.12183	-1.94077	-2.45623	-2.51225	-2.31139
			Results Based on Massy Method					
MUR	-.02037	-.00561	-.00296	-.00347	-.00181	.00062	.00233	.00302
MPR	-.02250	-.01385	-.00893	-.01852	-.02627	-.02924	-.02761	-.02424
$\dot{P}$	.00362	.00198	.00134	.00280	.00406	.00464	.00449	.00401
$\Delta\dot{P}$	-.01888	-.00455	-.00259	-.00313	-.00210	-.00062	.00039	.00082
$\dot{W}$	-.00466	-.00131	-.00066	-.00071	-.00019	.00050	.00097	.00113
YUB*/GNP*	.37762	-.44146	-.36598	-1.04633	-1.83484	-2.35723	-2.44347	-2.27104

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.9

ALL MALE INDIVIDUALS (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
	Results Based on OLS Method							
MUR	-.01145	-.00259	-.00127	-.00128	-.00065	-.00014	-.00001	-.00000
MPR	-.01042	-.00593	-.00428	-.00938	-.01405	-.01621	-.01560	-.01388
$\dot{P}$	-.00018	.00017	-.00012	-.00050	-.00119	-.00182	-.00207	-.00202
$\Delta\dot{P}$	.00042	.00087	.00094	.00256	.00445	.00563	.00572	.00524
$\dot{W}$	.00074	.00062	.00045	.00107	.00169	.00203	.00200	.00181
YUB/GNP*	1.02020	.06030	-.09780	-.50475	-1.07494	-1.47119	-1.53749	-1.42150
	Results Based on Massy Method							
MUR	-.00739	-.00207	-.00154	-.00291	-.00413	-.00480	-.00475	-.00433
MPR	-.00895	-.00518	-.00387	-.00868	-.01329	-.01558	-.01515	-.01355
$\dot{P}$	.00023	.00032	-.00005	-.00042	-.00114	-.00181	-.00208	-.00203
$\Delta\dot{P}$	-.00123	-.00001	.00041	.00160	.00332	.00465	.00499	.00471
$\dot{W}$	.00144	.00091	.00045	.00077	.00085	.00069	.00049	.00035
YUB/GNP*	1.32673	.41021	.18504	.18882	.03291	-.15335	-.25381	-.27514

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.10

MALE INDIVIDUALS OF AGE UNDER 25 (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
			Results Based on OLS Method					
MUR15	.01164	.00556	.00316	.00567	.00685	.00655	.00554	.00457
MPR15	-.01041	-.00548	-.00328	-.00602	-.00728	-.00681	-.00557	-.00447
$\dot{P}$	.01030	.00540	.00342	.00667	.00883	.00917	.00824	.00707
$\Delta\dot{P}$	.01169	.00486	.00263	.00462	.00573	.00586	.00532	.00463
$\dot{W}$	.00391	.00194	.00138	.00304	.00472	.00570	.00573	.00526
YUB*/GNP*	-3.31959	-1.65827	-1.14655	-2.41036	-3.50840	-3.98826	-3.82966	-3.42149
			Results Based on Massy Method					
MUR15	.01205	.00573	.00323	.00571	.00677	.00632	.00522	.00424
MPR15	-.00769	-.00415	-.00247	-.00454	-.00550	-.00521	-.00434	-.00356
$\dot{P}$	.00914	.00484	.00307	.00605	.00810	.00855	.00781	.00679
$\Delta\dot{P}$	.04101	.00589	.00326	.00578	.00721	.00732	.00657	.00567
$\dot{W}$	.00486	.00233	.00158	.00335	.00506	.00599	.00595	.00543
YUB*/GNP*	-4.23304	-2.03230	-1.33040	-2.70169	-3.81759	-4.24796	-4.02476	-3.56795

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.11

MALE INDIVIDUALS OF AGE UNDER 25 (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			$\varepsilon = .5$	$\varepsilon = 1.0$	$\varepsilon = 1.5$	$\varepsilon = 2.0$	$\varepsilon = 2.5$	$\varepsilon = 3.0$
	Results Based on OLS Method							
MUR15	.00990	.00446	.00287	.00497	.00556	.00482	.00379	.00303
MPR15	-.01363	-.00673	-.00515	-.00985	-.01199	-.01094	-.00884	-.00715
$\dot{P}$	.01242	.00584	.00416	.00769	.00918	.00836	.00679	.00552
$\Delta\dot{P}$	.00052	.00026	.00002	-.00021	-.00057	-.00077	-.00075	-.00066
$\dot{W}$	-.00112	-.00063	-.00066	-.00148	-.00209	-.00212	-.00182	-.00152
YUB/GNP*	-3.15926	-1.56611	-1.11813	-1.97960	-2.15229	-1.73849	-1.27288	-.96720
	Results Based on Massy Method							
MUR15	.00365	.00140	.00069	.00105	.00119	.00117	.00105	.00091
MPR15	-.01294	-.00637	-.00483	-.00919	-.01112	-.01011	-.00815	-.00659
$\dot{P}$	.01119	.00529	.00380	.00711	.00862	.00796	.00653	.00535
$\Delta\dot{P}$	.00246	.00115	.00074	.00125	.00135	.00114	.00089	.00071
$\dot{W}$	.00654	.00326	.00247	.00460	.00531	.00455	.00348	.00271
YUB/GNP*	1.09327	.49489	.39957	.86063	1.24016	1.32308	1.18911	1.02284

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.12

MALE INDIVIDUALS OF AGE 25-64 (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			$\varepsilon = .5$	$\varepsilon = 1.0$	$\varepsilon = 1.5$	$\varepsilon = 2.0$	$\varepsilon = 2.5$	$\varepsilon = 3.0$
Results Based on OLS Method								
UR25	-.02945	-.00592	-.00240	-.00071	.00442	.01080	.01569	.01790
PR25	.00953	.00511	.00281	.00578	.00864	.01080	.01176	.01163
$\dot{P}$	-.00102	-.00064	-.00027	-.00047	-.00051	-.00037	-.00014	.00007
$\Delta\dot{P}$	-.02312	-.00490	-.00265	-.00299	-.00154	.00062	.00237	.00325
$\dot{W}$	.00012	.00187	.00103	.00274	.00488	.00683	.00797	.00820
YUB*/GNP*	1.68810	-.23350	-.25640	-1.05718	-2.28942	-3.57153	-4.43466	-4.73004
Results Based on Massy Method								
UR25	-.02161	-.00406	-.00155	.00000	.00402	.00877	.01220	.01360
PR25	.00439	.00371	.00214	.00501	.00834	.01133	.01307	.01341
$\dot{P}$	.00250	.00024	.00020	.00012	-.00015	-.00045	-.00065	-.00073
$\Delta\dot{P}$	-.02096	-.00443	-.00227	-.00228	-.00052	.00195	.00389	.00484
$\dot{W}$	.00171	.00232	.00138	.00344	.00595	.00825	.00961	.00991
YUB*/GNP*	1.33174	-.26164	-.25424	-.97102	-2.04222	-3.13266	-3.184661	-4.07187

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.13

MALE INDIVIDUALS OF AGE 25-64 (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
			Results Based on OLS Method					
UR25	-.01089	-.00053	.00083	.00461	.01096	.01807	.02342	.02580
PR25	.00288	.00140	.00076	.00156	.00237	.00307	.00347	.00355
$\dot{P}$	-.00218	-.00053	-.00033	-.00056	-.00070	-.00078	-.00081	-.00079
$\Delta\dot{P}$	.00021	.00073	.00068	.00193	.00368	.00551	.00682	.00734
$\dot{W}$	.00067	.00099	.00060	.00153	.00273	.00390	.00470	.00498
YUB/GNP*	.53769	-.21556	-.25317	-.84573	-1.74238	-2.71958	-3.44634	-3.76422
			Results Based on Massy Method					
UR25	-.01101	-.00060	.00068	.00423	.01036	.01739	.02282	.02537
PR25	.00054	.00029	.00012	.00021	.00025	.00025	.00022	.00018
$\dot{P}$	-.00044	.00021	.00018	.00060	.00122	.00189	.00238	.00259
$\Delta\dot{P}$	-.00148	-.00022	.00003	.00042	.00114	.00201	.00271	.00305
$\dot{W}$	-.00031	.00014	.00016	.00055	.00115	.00183	.00236	.00261
YUB/GNP*	.61578	-.14735	-.19425	-.70314	-1.51084	-2.42578	-3.13727	-3.47703

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.14

MALE INDIVIDUALS OF AGE 65 AND OVER (TAXATION STATISTICS)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
	Results Based on OLS Method							
MUR65	.00992	.00169	.00038	-.00218	-.00669	-.01103	-.01355	-.01421
MPR65	.00494	-.00102	.00006	.00005	.00080	.00220	.00346	.00416
$\dot{P}$	-.00140	.00099	.00105	.00323	.00589	.00803	.00904	.00909
$\Delta\dot{P}$	.01178	.00297	.00275	.00478	.00644	.00767	.00819	.00809
$\dot{W}$	-.00218	-.00005	.00039	.00188	.00402	.00591	.00689	.00705
YOB/GNP*	12.68134	1.10674	1.04432	.10195	-1.57378	-2.84436	-3.33809	-3.30354
	Results Based on OLS Method (Smaller Set of Explanatory Variables)							
$\dot{P}$	-.00237	.00120	.00105	.00324	.00576	.00763	.00839	.00831
$\Delta\dot{P}$	.01606	.00351	.00253	.00266	.00133	-.00020	-.00120	-.00163
YOB/GNP*	4.65886	1.42072	.78444	.59167	-.40782	-1.62252	-2.48719	-2.86713

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.15

MALE INDIVIDUALS OF AGE 65 AND OVER (SCF)

INCOME INDQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
	Results Based on OLS Method							
MUR65	-.00787	-.00417	-.00324	-.00650	-.00938	-.01158	-.01290	-.01340
MPR65	.00279	.00175	.00115	.00197	.00230	.00225	.00203	.00179
$\dot{P}$	.00093	-.00129	-.00091	-.00234	-.00378	-.00487	-.00549	-.00570
$\Delta\dot{P}$	.01245	.00507	.00383	.00682	.00888	.01013	.01072	.01078
$\dot{W}$	.01718	.00506	.00377	.00561	.00603	.00575	.00526	.00477
YOB/GNP*	1.05870	.14964	-.04825	-.65324	-1.63718	-2.62743	-3.33682	-3.69219
	Results Based on OLS Method (Smaller set of Explanatory Variables)							
$\dot{P}$	.00505	.00073	.00070	.00090	.00096	.00105	.00117	.00127
$\Delta\dot{P}$	-.00015	.00108	.00085	.00217	.00359	.00478	.00555	.00590
YOB/GNP*	-4.83073	-2.63062	-1.95654	-3.78969	-5.23244	06.14851	-6.55120	-6.56564

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.16

ALL FAMILIES AND UNATTACHED INDIVIDUALS (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter $\varepsilon = .5$	$\varepsilon = 1.0$	$\varepsilon = 1.5$	$\varepsilon = 2.0$	$\varepsilon = 2.5$	$\varepsilon = 3.0$
	Results Based on OLS Method							
UR	-.00093	.00105	.00039	.00069	.00039	-.00051	-.00139	-.00189
FPR	-.00200	-.00006	.00036	.00154	.00330	.00482	.00547	.00541
$\dot{P}$	.00167	.00039	-.00037	-.00179	-.00415	-.00642	-.00758	-.00769
$\Delta\dot{P}$	-.00179	.00038	.00039	.00125	.00217	.00263	.00256	.00226
$\dot{W}$	.00177	.00160	.00118	.00273	.00427	.00519	.00528	.00490
YUB/GNP*	2.53557	.72420	.57694	1.15370	1.74427	2.19136	2.34704	2.27534
	Results Based on Massy Method							
UR	-.00365	.00045	.00083	.00313	.00636	.00905	.01014	.00997
FPR	-.00195	-.00014	.00021	.00109	.00241	.00356	.00406	.00402
$\dot{P}$	.00206	.00064	-.00015	-.00127	-.00332	-.00539	-.00651	-.00669
$\Delta\dot{P}$	-.00456	-.00071	-.00008	.00084	.00242	.00384	.00449	.00448
$\dot{W}$	.00090	.00129	.00112	.00290	.00496	.00645	.00689	.00659
YUB/GNP*	2.54385	.70217	.47763	.79310	.94679	.94455	.84265	.71979

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.17

ALL FAMILIES (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			$\varepsilon = .5$	$\varepsilon = 1.0$	$\varepsilon = 1.5$	$\varepsilon = 2.0$	$\varepsilon = 2.5$	$\varepsilon = 3.0$
			Results Based on OLS Method					
UR	-.00256	.00078	.00066	.00224	.00447	.00667	.00808	.00852
FPR	-.00190	-.0050	-.00017	-.00009	.00020	.00057	.00085	.00098
$\dot{P}$	.00337	.00143	.00066	.00110	.00130	.00129	.00115	.00098
$\Delta\dot{P}$	-.00051	.00060	.00049	.00145	.00274	.00398	.00476	.00499
$\dot{W}$	.00373	.00213	.00118	.00246	.00371	.00465	.00507	.00502
YUB/GNP*	2.70728	.47715	.18634	.00236	-.48658	-1.08617	-1.55246	-1.77778
			Results Based on Massy Method					
UR	-.00483	-.00023	.00017	.00141	.00353	.00585	.00753	.00824
FPR	-.00128	-.00031	-.00008	.00005	.00034	.00067	.00092	.00102
$\dot{P}$	.00303	.00139	.00063	.00106	.00126	.00122	.00104	.00084
$\Delta\dot{P}$	-.00316	-.00062	-.00007	.00051	.00165	.00299	.00401	.00448
$\dot{W}$	.00188	.00128	.00081	.00188	.00311	.00421	.00487	.00503
YUB/GNP*	2.11966	.28704	.10270	-.11128	-.58094	-1.13218	-1.54982	-1.74346

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.18

FAMILIES: AGE OF HEAD UNDER 25 (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
	Results Based on OLS Method							
UR15	.00773	.00518	.00326	.00791	.01372	.01947	.02342	.02487
PR15	.00795	.00388	.00192	.00403	.00626	.00827	.00953	.00989
$\dot{P}$	-.00304	-.00123	-.00038	-.00051	-.00040	-.00016	-.00008	.00022
$\Delta\dot{P}$	-.00036	.00099	.00143	.00434	.00871	.01360	.01739	.01919
$\dot{W}$	.00607	.00331	.00197	.00460	.00786	.01114	.01347	.01442
YUB/GNP*	-1.36991	-.95075	-.71285	-1.81056	-3.24632	-4.70792	-5.73849	-6.13882
	Results Based on Massy Method							
UR15	.00873	.00556	.00341	.00818	.01409	.01991	.02391	.02538
PR15	.00506	.00259	.00137	.00300	.00484	.00656	.00771	.00809
$\dot{P}$	-.00055	-.00037	.00007	.00039	.00101	.00180	.00248	.00286
$\Delta\dot{P}$	.00062	.00140	.00136	.00388	.00747	.01136	.01427	.01557
$\dot{W}$	.00426	.00250	.00149	.00355	.00616	.00884	.01080	.01164
YUB/GNP*	.93511	.28579	.00496	-.15631	-.45653	-.79229	-1.03132	-1.12112

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.19

FAMILIES: AGE OF HEAD 25-64 (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
	------------------------------- Results Based on OLS Method -------------------------------							
UR25	-.00873	-.00179	-.00052	.00028	.00227	.00487	.00716	.00854
PR25	-.00651	-.00122	-.00053	-.00029	.00058	.00173	.00272	.00328
$\dot{P}$	.00896	.00240	.00125	.00187	.00198	.00176	.00145	.00117
$\Delta\dot{P}$	-.00656	-.00114	-.00033	.00033	.00187	.00381	.00546	.00652
$\dot{W}$	.00800	.00326	.00186	.00374	.00562	.00728	.00839	.00880
YUB/GNP*	3.41357	.65525	.35302	.38390	.16086	-.18689	-.50698	-.70898
	------------------------------- Results Based On Massy Method -------------------------------							
UR25	-.00599	-.00193	-.00100	-.00167	-.00202	-.00212	-.00202	-.00183
PR25	-.00642	-.00102	-.00043	-.00002	.00105	.00242	.00356	.00421
$\dot{P}$	-.00599	-.00193	-.00100	-.00167	-.00202	-.00212	-.00202	-.00183
$\Delta\dot{P}$	-.00642	-.00102	-.00043	-.00002	.00105	.00242	.00356	.00421
$\dot{W}$	.00477	.00105	.00058	.00078	.00068	.00043	.00018	-.00001
YUB/GNP*	-.00522	-.00057	-.00020	.00035	.00150	.00283	.00390	.00444

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

TABLE 6.20

FAMILIES: AGE OF HEAD 65 AND OVER (SCF)

INCOME INEQUALITY RESPONSES (PARTIAL DERIVATIVES)

Partial derivatives with respect to--	Coefficient of Variation	Gini Coefficient	Atkinson Index: Values of Inequality Aversion Parameter					
			ε = .5	ε = 1.0	ε = 1.5	ε = 2.0	ε = 2.5	ε = 3.0
	Results Based on OLS Method							
UR65	-.00701	-.00350	-.00266	-.00563	-.00867	-.01127	-.01296	-.01365
PR65	-.00242	.00152	.00101	.00286	.00496	.00673	.00783	.00825
$\dot{P}$	-.00226	-.00125	-.00102	-.00231	-.00374	-.00504	-.00591	-.00629
$\Delta\dot{P}$	.00698	.00349	.00266	.00566	.00876	.01147	.01331	.01412
$\dot{W}$	.00441	.00193	.00137	.00265	.00380	.00476	.00542	.00575
YOB/GNP*	-4.46415	-.85968	-.63308	-.83850	-.78125	-.60479	-.40203	-.22463
	Results Based on OLS Method (Smaller Set of Explanatory Variables)							
$\dot{P}$	.00104	.00003	-.00003	-.00032	-.00077	-.00122	-.00153	-.00168
$\Delta\dot{P}$	.00309	.00145	.00119	.00264	.00424	.00569	.00668	.00712
YOB/GNP*	-3.41500	-1.98927	-1.38246	-2.83696	-4.16457	-5.15176	-5.68018	-5.79702

NOTE: The values in the table are partial derivatives of income inequality measures (columns) with respect to particular variables (rows).

CHAPTER 7

SUMMARY AND CONCLUSIONS

We have been concerned in this study with the estimation of the effects of unemployment, inflation and other macro-economic variables on the size distribution of income in the Canadian context. The analytical framework adopted is highly disaggregative. Changes in income inequality are characterized by fluctuations in decile income levels relative to the mean of the distribution. The effects of the macro-economic variables on the relative decile income levels are estimated by econometric methods, and the problem of multicollinearity is handled by using approaches based on principal components. The model is estimated for a large number of income distributions. These include distributions for all individuals, all male individuals, male individuals of age under 25, male individuals of age 25-64, male individuals of age 65 and over, all families and unattached individuals combined, all families separately, families with age of head under 25, families with age of head 25-64, and families with age of head 65 and over. The income distributions for all individuals, all male individuals and the three age groups of male individuals are drawn from two sources: Taxation Statistics of Revenue Canada and the Survey of Consumer Finances of Statistics Canada. The distributions relating to families are available only from the Survey of Consumer Finances.

Before summarizing the main findings of the study, we emphasize that, given the nature and limitations of the income distribution data, these findings must be considered as tentative.

We find that the results depend in considerable degree on the particular income distribution being analyzed. Therefore, when we talk about the effects of macro-economic variables on the size distribution of income, we need to define the primary income recipient unit on which the distribution is based. For example, the unemployment rate is not as important an explanatory variable for the income distribution of male individuals of age 65 and over as it is for the distribution of all male individuals combined. Similarly, changes in the female labor force participation rate may have different implications for changes in the income distribution of all individuals than for changes in the distribution of all families.

For those income distributions that are drawn from both data sources, the results based on comparable distributions are not always the same. One of the possible reasons for this discrepancy may be the difference of time period for which data are available from the two sources. The Survey of Consumer Finances covers the years 1951, 1954, 1957, 1959, 1961, 1965, 1967, 1969, and 1971-1979. The income distribution for all individuals from Taxation Statistics is based on all years in the period 1947-1979, while the distributions for male individuals from the same source are available only for the period 1963-1979.

The common view is that the main victims of unemployment are those who belong to the lower income groups. We could find only qualified support for this: for some income distributions, the belief seems to be valid, but for others we have obtained a variety of results. For all individuals combined, there is some evidence that the lower part of the distribution is relatively worse off when there is an increase in the unemployment rate. However, this evidence is weak, in the sense that not all methods of estimation and not all specifications of the model tell the same story. For all male individuals, the taxation data indicate that the lower income groups suffer most from higher unemployment rates. Among male individuals of age under 25, the effect of unemployment appears to be disequalizing in the sense that the lower part of the distribution is relatively worse off in response to an increase in the unemployment rate for that age group. Similar results emerge for male individuals in the age bracket 25-64, for all families and unattached individuals combined, for all families only, and for families with age of head under 25. There is a variety of results for the remaining distributions which include male individuals 65 and over, families with age of head 25-64 and families with age of head 65 and over.

The effects of the inflation rate on inequality are not very clear in most cases. Moreover, where comparable distributions are taken from the two different sources, in most cases the results do not agree. However, there are two exceptions. The distributions for all families and male individuals of age under 25 indicate a disequalizing effect of the inflation rate. On the other hand, the effects of unanticipated inflation, as approximated by changes in the inflation rate, are disequalizing in most cases. This seems to be true for all individuals combined, all male individuals separately, male individuals of age 25-64 (taxation data only), all families and unattached individuals combined, all families only, families with age of head under 25, and families with age of head 25-64.

The effects of the labor force participation variables turn out to be the most pervasive and systematic. The female participation rate has a disequalizing effect on the distributions for all individuals combined, all male individuals separately, and all families and unattached individuals combined. For all families only, it appears that the middle part of the distribution gains from higher levels of female participation. The distributions for families with age of head under 25 and for families with age of head 25-64 indicate a disequalizing effect of female participation for those particular age groups. The male participation rate has an equalizing effect on the distributions for all male individuals, male individuals under 25 years of age and male individuals of age 25-64.

In most cases, the effects of the rate of growth of the real wage rate on income inequality are not very systematic. However, where these effects are systematic, it appears that the upper income groups benefit relatively more from growth of the real wage rate. Such seems to be the case for all male individuals, male individuals of age under 25, male individuals of age 25-64 (taxation data only), all families and unattached individuals combined, and families with age of head under 25.

It appears that unemployment insurance benefits improve the relative position of lower income groups. This result emerges more clearly with the taxation data sets than with the Survey data sets. The results also seem to suggest that the lower income groups in the age range 65 and over gain relatively more from retirement and old age benefits, as one might have expected.

In addition to the results already discussed for the distribution for all individuals combined, we have some additional findings based on the taxation data set only. The effects of the participation rates of those in the age groups under 25 and 65 and over appear to be equalizing. The same is true of net realized farm income as a ratio to gross national product. While the effects of retirement and old age benefits, government expenditures on goods and services, and exports of goods and services (all expressed as ratios to gross national product) seem to be disequalizing.

Up to now we have been discussing the results relating to changes in particular segments of the income distributions. However, these results which are based on equations of the decile model, can be translated into effects on any conventional single-valued summary measure of income inequality. Consequently, the responses of overall income inequality can also be analyzed. There are several summary measures of income inequality available, and the choice of any one such measure is arbitrary, to some extent. For our purposes we have employed the coefficient of variation, the Gini coefficient and the Atkinson index. Apart from some conflicting results which these measures yield in particular cases, on the whole the results are consistent with the findings already summarized.

Having summarized our principal findings, we now briefly discuss some ways in which the work reported in this thesis could be improved and extended. First, the estimated model could be used in a simulation analysis to determine the effects of assumed simultaneous changes in the macro-economic variables on the size distribution of income. Beach (1976) has done some work along these lines, using U.S. data. Secondly, the model could be linked formally to an econometric model of the entire economy, and the effects of various government policies on the distribution of income could then be simulated. Metcalf (1972) has carried out an analysis of this kind, again using U.S. data. Thirdly, it would be possible with our estimated model to determine the effects of the macro-economic variables on the "poverty rate", as defined in some appropriate way. In this case we would need to estimate a separate equation for the mean income of the distribution, since the equations so far discussed are only for decile income levels relative to the mean. The estimated model, with the separate equation for mean income included, could then be used to study the effects of particular macro-economic variables, or of particular states of the economy, on the proportions of people or families below the specified "poverty line". Fourthly, by simulating the model under different states of the economy, we could measure the relative degree of affluence under one state as compared to another, using Dagum's (1980) economic distance ratios.

We have made extensive use of principal components to handle the problem of multicollinearity. We think that this is a very useful and practical approach, but that much research needs to be done to further improve it. Two questions on which further research is particularly desirable are: (1) how the problem of autocorrelation should be handled within the frameworks proposed by Massy and Mundlak, and (2) if there is a need to impose restrictions on the coefficients of the original explanatory variables, across equations, how this should be done within these frameworks.

APPENDIX A

DETAILED DATA SOURCES

All the data are annual. The labor force and price variables are annual averages; all other variables are annual flows.

DATA ON INCOME DISTRIBUTION

The income distribution data are drawn from two sources: Taxation Statistics and the Survey of Consumer Finances. Taxation Statistics is an annual publication of Revenue Canada. The Survey data are taken from the following publications of Statistics Canada:

1. Incomes of Non-Farm Families and Individuals in Canada: Selected Years 1951-1965 (catalogue 13-529)
2. Income Distribution by Size in Canada, 1965 (catalogue 13-528)
3. Income Distribution by Size in Canada, 1967 (catalogue 13-534)
4. Income Distribution by Size in Canada, 1969 (catalogue 13-544)
5. Income Distribution by Size in Canada, Annual since 1971 (catalogue 13-207)

DATA ON THE EXPLANATORY VARIABLES

Data on all the explanatory variables come from various publications of Statistics Canada. For the following variables, the basic source is the Labor Force Survey; where necessary, historical series have been adjusted for consistency with the new survey definitions introduced in 1976. (The adjusted series were available as a result of a project carried out at McMaster University by F.T. Denton, C.H. Feaver, A.L. Robb and B.G. Spencer.)

UR : overall unemployment rate

UR15 : unemployment rate of those aged 15-24

UR25 : unemployment rate of those aged 25-64

UR65 : unemployment rate of those aged 65 and over

MUR : male unemployment rate

MUR15 : male unemployment rate of those aged 15-24

MUR25 : male unemployment rate of those aged 25-64

MUR65 : male unemployment rate of those aged 65 and over

PR : overall labor force participation rate

PR15 : participation rate of those aged 15-24

PR25 : participation rate of those aged 25-64

PR65 : participation rate of those aged 65 and over

MPR : male participation rate

MPR15 : male participation rate of those aged 15-24

MPR25 : male participation rate of those aged 25-64

MPR65 : male participation rate of those aged 65 and over

FPR : overall female labor force participation rate

FPR15 : female participation rate of those aged 15-24

FPR25 : female participation rate of those aged 25-64

FPR65 : female participation rate of those aged 65 and over

PROP15 : population aged 15-24 as a ratio to population aged 15 and over

PROP65 : population aged 65 and over as a ratio to population aged 15 and over

Data on the variables listed below are taken from System of National Accounts: National Income and Expenditure Accounts, Annual, Catalogue 13-201 (the 1979 issue of this publication provides a summary of annual estimates going back to 1965), and Canadian Statistical Review: Historical Summary, 1970, Catalogue 11-505, occasional (the data prior to 1965 are taken from this publication).

GNP : gross national product in current dollars

PROF : corporate profits before taxes in current dollars (excludes profits of government business enterprises)

GE : government expenditures on goods and services in current dollars (includes government gross fixed capital formation and is adjusted for physical change in government inventories)

X : exports of goods and services in current dollars

Data on the consumer price index are taken from various issues of The Consumer Price Index, Monthly, Catalogue 62-001, and Canadian Statistical Review: Historical Summary 1970, catalogue 11-505, occasional. Various issues of Employment, Earnings and Hours, Monthly, catalogue 72-002, provide data on nominal average weekly wages and salaries.

Data on unemployment insurance benefits in current dollars (YUB), and all types of retirement and old age benefits (YOB) are drawn from System of National Accounts: National Income and Expenditure Accounts, Annual, catalogue 13-201 (the 1979 issue of this publication provides a summary of annual estimates going back to 1961), and National Income and Expenditure Accounts: Annual Estimates 1926-1974, Vol. 1, Catalogue 13-531 (the data prior to 1961 are taken from this publication).

Various issues of Farm Net Income, Annual, Catalogue 21-202, have been consulted to collect the data on realized net farm income (YRNF). Estimates in this publication are frequently revised. Efforts have been made to obtain consistent and latest data on YRNF. In our empirical work, we use gross national product, excluding changes in farm inventories (GNP^*); the data for changes in farm inventories come from the same source as YRNF.

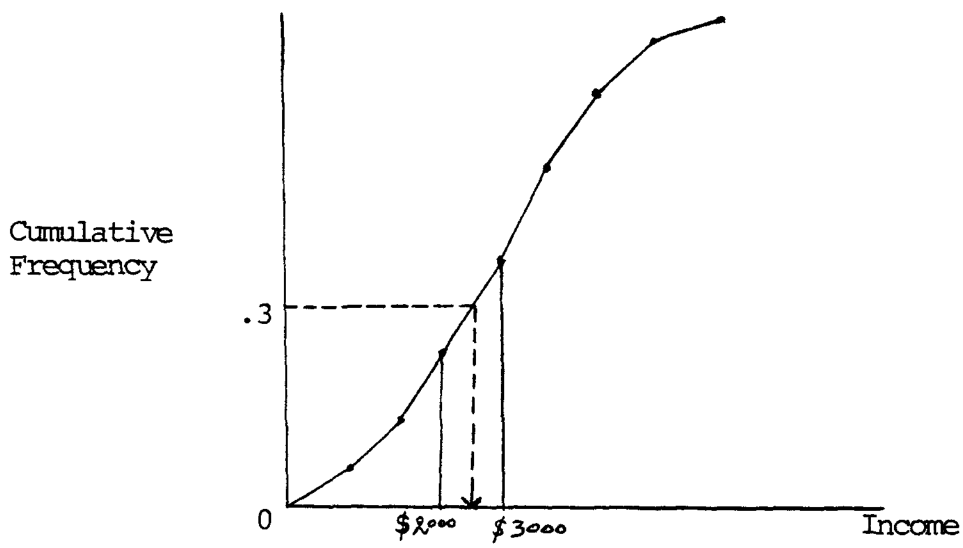
APPENDIX B

ESTIMATION OF DECILE INCOME LEVELS

The income distribution data from Taxation Statistics are available in terms of income classes and number of all returns in each class, while the Survey of Consumer Finances reports the data in terms of income classes and the relative frequencies of the income units. We can convert Taxation Statistics data into relative frequencies.

To estimate decile income levels, we use a linear interpolation procedure within income classes that contain particular deciles. This procedure can be illustrated with the help of Figure B.1.

Figure B.1 ILLUSTRATION OF INTERPOLATION METHOD



On the horizontal axis we have income classes and on the vertical axis we have cumulative frequencies of income units. By plotting the income distribution data, as in Figure B.1, and joining the points by straight lines, we obtain the required distribution curve. The income level corresponding to .3 on the vertical axis is the third decile. Other decile income levels can be estimated in a similar way.

There are two income classes that require special procedures: the lowest one and the highest one. If the first decile falls in the lowest income class, we assume that minimum income is one dollar. If the ninth or other deciles fall in the open-end income class at the upper end of the distribution, we employ a Pareto approximation[1]. The Pareto function can be written as[2]

$$\text{(B.1)} \quad 1 - F(Y) = 1-F(YL)\left(\frac{YL}{Y}\right)^{K}$$

where Y is the upper limit of some income class, YL is the upper limit of the preceding income class, F(Y) represents the cumulative frequency up to income level Y and K is a positive parameter determined from the data. We determine K from (B.1) using the information contained in the two income classes preceding the open-end one. To estimate the ninth decile income level, we solve

(B.1) for Y by substituting F(Y) equal to .9 and YL becomes the upper limit of the income class preceding the open-end one.

FOOTNOTES

Appendix B

1. The relative frequencies of two income classes preceding the upper open-end income class are critical in determining whether Pareto approximation can be employed in this case. If the relative frequency of the lower income class is less than or equal to the relative frequency of the upper income class, then Pareto approximation is not appropriate. (See Schultz (1969, p. 77).) Fortunately, this was not a problem in our data sets.

2. Royal Commission on the Distribution of Income and Wealth, Report No. 1, July 1975, Her Majesty's Stationery Office, London, pp. 180-182.

APPENDIX C

RESULTS OF SOME OF THE ESTIMATION EXPERIMENTS

In this appendix, we present the results of some of our estimation experiments based on various income distributions. The only difference between the equations reported here and those in Chapter 4, is that the sets of explanatory variables are somewhat different.

TABLE C.1

ALL MALE INDIVIDUALS (TAXATION STATISTICS)

OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.4589	1.5536	1.7264	1.4765	1.2246	1.0074	.9868	.3638	-.0531
	(1.56)	(2.76)	(3.34)	(3.65)	(4.25)	(4.16)	(3.44)	(.55)	(-.03)
UR	-.0104	-.0096	-.0093	-.0012	.1027	.0172	.0229	.0214	.0783
	(-2.06)	(-.99)	(-1.06)	(-.17)	(2.09)	(4.17)	(4.69)	(1.91)	(2.96)
PR	-.0029	-.0184	-.0189	-.0125	-.0064	-.0010	.0012	.0156	.0237
	(-.54)	(-1.77)	(-1.97)	(-1.67)	(-1.21)	(-.22)	(.22)	(1.29)	(.83)
$\dot{P}$	-.0021	-.0000	-.0040	.0028	.0004	.0009	.0036	-.0081	.0031
	(-.64)	(-.01)	(.71)	(.64)	(.13)	(.34)	(1.15)	(-1.13)	(.18)
$\Delta\dot{P}$	-.0042	-.0100	-.0111	-.0028	.0061	.0125	.0206	.0351	.0755
	(-1.29)	(-1.61)	(-1.95)	(-.63)	(1.90)	(4.66)	(6.51)	(4.83)	(4.41)
$\dot{W}$	-.0060	-.0137	-.0104	-.0060	-.0026	.0018	.0054	.0153	.0336
	(-2.72)	(-3.22)	(-2.68)	(-1.97)	(-1.19)	(1.00)	(2.51)	(3.09)	(2.88)
YUB^*/GNP^*	1.7132	2.4388	1.9732	.1609	-1.4245	-2.5463	-3.4044	-.5311	-16.6130
	(1.95)	(1.48)	(1.28)	(.13)	(-1.66)	(-3.52)	(-3.98)	(-.27)	(-3.60)
R^2	.670	.737	.689	.652	.700	.789	.883	.797	.724
$\bar{R}^2$	.471	.578	.503	.443	.520	.663	.812	.675	.559
S.E.	.012	.023	.021	.016	.012	.010	.012	.026	.063
D.W.	1.753	1.859	1.948	2.393	2.858	2.981	2.943	2.387	2.076

NOTE: For definition of symbols see note to Table 4.2

TABLE C.2

ALL MALE INDIVIDUALS (TAXATION STATISTICS)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.5716	1.1278	1.2131	.8776	1.0423	.7874	.6764	.9108	-.4318
	(5.71)	(5.90)	(6.67)	(23.86)	(22.74)	(8.83)	(6.13)	(3.63)	(-.82)
UR	-.0088	-.0157	-.0152	-.0035	.0030	.0134	.0189	.0305	.0794
	(-3.72)	(-3.38)	(-3.56)	(-3.89)	(1.14)	(4.75)	(5.40)	(3.84)	(4.82)
PR	-.0052	-.0104	-.0094	-.0019	-.0025	.0032	.0071	.0051	.0309
	(-3.51)	(-3.64)	(-3.47)	(-3.86)	(-2.78)	(2.31)	(4.06)	(1.28)	(3.74)
$\dot{P}$	-.0011	-.0042	-.0023	-.0009	-.0033	-.0018	.0002	-.0018	-.0033
	(-3.25)	(-3.78)	(-3.89)	(-2.90)	(-2.54)	(-1.91)	(.20)	(-.63)	(-.59)
$\Delta\dot{P}$	-.0024	-.0090	-.0058	.0039	.0044	.0137	.0217	.0296	.0638
	(-1.02)	(-1.77)	(-1.37)	(2.25)	(1.88)	(5.92)	(7.03)	(4.59)	(5.24)
$\dot{W}$	-.0043	-.0127	-.0061	-.0012	-.0031	.0032	.0062	.0154	.0289
	(-3.59)	(-3.39)	(-2.82)	(-1.30)	(-1.69)	(3.11)	(3.01)	(3.40)	(5.37)
YUB*/GNP*	1.8932	2.9110	3.0911	-.4034	-.0605	-2.2855	-3.0403	-1.1651	-17.0890
	(2.59)	(2.04)	(2.33)	(-3.55)	(-.21)	(-3.50)	(-3.76)	(-.63)	(-.83)
R^2	.617	.719	.613	.529	.606	.730	.867	.749	.674
$\bar{R}^2$	.529	.626	.524	.462	.475	.668	.806	.665	.627
S.E.	.011	.021	.020	.016	.012	.009	.012	.027	.057
D.W.	1.077	1.855	1.401	1.448	2.973	2.599	2.747	1.911	1.804
D.F.	13	12	13	14	12	13	11	12	14

NOTE: For definition of symbols see note to Table 4.2

TABLE C.3

ALL MALE INDIVIDUALS (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	1.1041	1.8483	1.7969	1.6745	1.2473	.9633	.7048	.4172	.2105
	(3.26)	(4.95)	(5.26)	(6.50)	(5.84)	(6.62)	(3.10)	(1.61)	(.19)
UR	.0016	.0026	-.0043	.0053	.0068	.0124	.0187	.0249	.0085
	(.16)	(.23)	(-.42)	(.68)	(1.05)	(2.80)	(2.71)	(3.19)	(.25)
PR	-.0163	-.0263	-.0209	-.0162	-.0061	.0012	.0081	.0163	.0269
	(2.56)	(-3.75)	(-3.27)	(-3.35)	(-1.51)	(.45)	(1.88)	(3.36)	(1.27)
$\dot{P}$	.0077	.0102	.0062	.0053	.0003	-.0032	-.0054	-.0057	.0025
	(1.94)	(2.35)	(1.57)	(1.76)	(.12)	(-1.86)	(-2.03)	(-1.90)	(.19)
$\Delta\dot{P}$	-.0085	-.0112	-.0102	-.0057	.0002	.0045	.0088	.0124	.0015
	(-1.67)	(-1.98)	(-1.98)	(-1.48)	(.05)	(2.06)	(2.56)	(3.18)	(.09)
$\dot{W}$	-.0075	-.0106	-.0097	-.0055	-.0021	-.0002	.0023	.0068	.0229
	(-1.96)	(-2.52)	(-2.53)	(-1.91)	(-.88)	(-.10)	(.89)	(2.36)	(1.81)
YUB/GNP*	.8144	.6465	.4271	-1.5805	-.7618	-1.1330	-1.5167	-3.8386	-3.9373
	(.33)	(.23)	(.17)	(-.83)	(-.48)	(-1.05)	(-.90)	(-2.01)	(-.47)
R^2	.510	.753	.819	.791	.478	.746	.850	.912	.620
$\bar{R}^2$	.216	.605	.711	.666	.165	.593	.760	.859	.392
S.E.	.021	.024	.021	.016	.013	.009	.014	.016	.071

NOTE: For definition of symbols see note to Table 4.2

TABLE C.4

ALL MALE INDIVIDUALS (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.9729	1.7671	1.7555	1.4969	1.0171	.8901	.7607	.6339	1.1313
	(3.00)	(4.82)	(5.29)	(6.59)	(29.19)	(13.65)	(7.69)	(5.84)	(6.05)
UR	.0018	.0016	-.0040	.0122	.0000	.0108	.0205	.0302	.0037
	(.18)	(.14)	(-.39)	(2.00)	(.04)	(3.99)	(4.98)	(6.51)	(.83)
PR	-.0141	-.0245	-.0201	-.0133	-.0014	.0028	.0071	.0121	.0098
	(2.33)	(-3.59)	(-3.25)	(-3.04)	(-2.87)	(2.77)	(4.69)	(7.30)	(3.73)
$\dot{P}$	.0089	.0105	.0058	.0033	-.0018	-.0035	-.0044	-.0045	.0098
	(2.41)	(2.42)	(1.49)	(1.23)	(-2.41)	(-4.07)	(-3.31)	(-3.69)	(2.37)
$\Delta\dot{P}$	-.0109	-.0137	-.0128	-.0032	-.0001	.0039	.0075	.0125	-.0050
	(-2.44)	(-2.66)	(-2.85)	(-2.16)	(-.54)	(2.22)	(2.82)	(4.15)	(-1.37)
$\dot{W}$	-.0049	-.0122	-.0092	-.0032	-.0025	-.0007	.0015	.0062	.0213
	(-2.37)	(-3.15)	(-2.74)	(-1.55)	(-1.65)	(-.48)	(.72)	(3.94)	(2.41)
YUB/GNP*	.6159	-.7484	-.1062	-3.5775	-.1858	-1.4271	-2.3634	-3.8972	1.999
	(.19)	(-.31)	(-.05)	(-3.13)	(-1.01)	(-2.11)	(-2.31)	(-3.36)	(1.93)
R^2	.321	.727	.785	.725	.372	.718	.343	.900	.564
$\bar{R}^2$	.224	.602	.714	.662	.282	.624	.791	.877	.463
S.E.	.021	.024	.021	.016	.012	.009	.013	.015	.066
D.F.	14	11	12	13	14	12	12	13	13

NOTE: For definition of symbols see note to Table 4.2

TABLE C.5

MALE INDIVIDUALS OF AGE UNDER 25 (TAXATION STATISTICS)

OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.1331	.4881	.7417	.9570	1.0380	1.3066	1.4273	1.4776	2.1914
	(1.03)	(2.08)	(2.17)	(2.39)	(3.47)	(7.19)	(8.08)	(3.46)	(4.51)
UR15	-.0040	-.0081	-.0109	-.0126	-.0141	-.0085	-.0013	.0062	.0183
	(-2.42)	(-2.74)	(-2.53)	(-2.48)	(-3.73)	(-3.70)	(-.58)	(1.16)	(2.98)
PR15	.0018	-.0010	-.0018	-.0022	.0002	-.0019	-.0016	.0011	-.0085
	(.73)	(-.22)	(-.28)	(-.29)	(.03)	(-.55)	(-.46)	(.13)	(-.91)
$\dot{P}$	-.0049	-.0022	-.0031	-.0040	-.0035	.0010	.0044	.0018	.0191
	(-2.08)	(-.52)	(-.50)	(-.55)	(-.64)	(.31)	(1.37)	(.23)	(2.17)
$\Delta\dot{P}$	-.0044	-.0092	-.0124	-.0149	-.0169	-.0131	-.0055	-.0050	-.0056
	(-2.03)	(-2.34)	(-2.18)	(-2.22)	(-3.37)	(-4.31)	(-1.88)	(-.70)	(-.69)
$\dot{W}$	-.0053	-.0068	-.0105	-.0122	-.0109	-.0056	.0034	.0098	.0182
	(-3.35)	(-2.39)	(-2.54)	(-2.51)	(-3.08)	(-2.52)	(1.58)	(1.89)	(3.08)
YUB^*/GNP^*	2.8306	3.7052	3.9978	4.6639	3.7218	1.3325	-1.7447	-2.4849	-3.1250
	(4.90)	(3.54)	(2.63)	(2.61)	(2.79)	(1.64)	(-2.21)	(-1.31)	(-1.44)
R^2	.878	.698	.610	.600	.720	.788	.853	.680	.854
$\bar{R}^2$	.805	.516	.376	.360	.553	.660	.765	.488	.766
S.E.	.008	.014	.021	.024	.018	.011	.011	.026	.029
D.W.	2.784	1.314	1.163	1.084	1.556	1.931	1.351	1.946	2.425

NOTE: For definition of symbols see note to Table 4.2

TABLE C.7

MALE INDIVIDUALS OF AGE UNDER 25 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-.2267	-.4482	-.6714	-.6980	-.0963	1.0874	1.9310	2.7048	3.6173
	(-1.33)	(-1.35)	(-1.51)	(-1.25)	(-.21)	(4.70)	(10.68)	(7.67)	(4.15)
UR15	-.0091	-.0181	-.0247	-.0298	-.0278	-.0208	-.0037	.0175	.0508
	(-1.94)	(-1.98)	(-2.01)	(-1.93)	(-2.15)	(-3.27)	(-.75)	(1.81)	(2.11)
PR15	.0072	.0143	.0216	.0260	.0199	.0040	-.0080	-.0187	-.0316
	(2.45)	(2.49)	(2.81)	(2.68)	(2.46)	(1.00)	(-2.55)	(-3.06)	(-2.09)
$\dot{P}$	-.0062	-.0111	-.0174	-.0216	-.0196	-.0063	.0033	.0134	.0215
	(-2.33)	(-2.14)	(-2.50)	(-2.43)	(-2.67)	(-1.73)	(1.15)	(2.42)	(1.57)
$\Delta\dot{P}$	.0015	.0021	.0041	.0024	.0019	-.0069	-.0046	.0026	.0123
	(.35)	(.25)	(.37)	(.17)	(.16)	(-1.20)	(-1.03)	(.29)	(.56)
$\dot{W}$	.0012	.0017	.0025	.0034	.0013	-.0063	-.0031	.0017	-.0027
	(.32)	(.24)	(.26)	(.28)	(.12)	(-1.24)	(-.79)	(.22)	(-.14)
YUB/GNP*	2.1733	5.0785	7.4091	9.3793	7.6286	2.8421	-1.6223	-7.5948	-12.4950
	(.93)	(1.12)	(1.22)	(1.22)	(1.19)	(.90)	(-.65)	(-1.57)	(-1.04)
R^2	.676	.647	.677	.641	.699	.826	.738	.634	.573
$\bar{R}^2$	.482	.435	.483	.425	.519	.722	.581	.414	.318
S.E.	.021	.041	.054	.005	.057	.029	.022	.044	.107

NOTE: For definition of symbols see note to Table 4.2

TABLE C.6

MALE INDIVIDUALS OF AGE UNDER 25 (TAXATION STATISTICS)

Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.2667	.5221	.8012	1.0211	1.1081	1.2394	1.3610	1.4628	2.1843
	(7.96)	(9.17)	(10.19)	(11.22)	(15.05)	(27.37)	(61.78)	(15.03)	(4.73)
UR15	-.0033	-.0063	-.0085	-.0099	-.0127	-.0090	-.0038	.0064	.0177
	(-3.12)	(-3.60)	(-3.28)	(-3.28)	(-4.25)	(-5.07)	(-3.01)	(2.12)	(3.61)
PR15	-.0008	-.0020	-.0031	-.0036	-.0014	-.0006	.0002	.0014	-.0083
	(-2.04)	(-2.92)	(-3.43)	(-3.45)	(-1.31)	(-.94)	(.43)	(1.25)	(-.94)
$\dot{P}$	-.0018	-.0025	-.0050	-.0059	-.0017	-.0002	.0020	.0011	.0196
	(-3.14)	(-3.00)	(-3.62)	(-3.69)	(-.90)	(-.13)	(1.28)	(.77)	(2.42)
$\Delta\dot{P}$	-.0071	-.0079	-.0099	-.0122	-.0198	-.0126	-.0074	-.0059	-.0061
	(-4.66)	(-3.86)	(-2.36)	(-2.49)	(-5.08)	(-5.47)	(-4.45)	(-1.41)	(-.88)
$\dot{W}$	-.0059	-.0044	-.0101	-.0118	-.0105	-.0051	.0024	.0086	.0181
	(-4.67)	(-4.56)	(-3.14)	(-3.18)	(-3.85)	(-3.16)	(4.08)	(4.30)	(3.22)
YUB^*/GNP^*	2.7500	4.0746	4.2429	4.9601	3.7941	1.3414	-.8240	-2.5934	-3.1946
	(4.80)	(4.25)	(3.05)	(3.09)	(3.01)	(1.80)	(-4.85)	(-1.60)	(-1.57)
R^2	.838	.619	.556	.558	.672	.785	.817	.676	.854
$\bar{R}^2$	.800	.564	.453	.455	.596	.713	.775	.602	.787
S.E.	.008	.013	.019	.022	.017	.010	.010	.023	.028
D.F.	13	14	13	13	13	12	13	13	11

NOTE: For definition of symbols see note to Table 4.2

TABLE C.9

MALE INDIVIDUALS OF AGE 25-64 (TAXATION STATISTICS)
OLS METHOD

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-4.5087	-4.8737	-2.4631	-1.3815	-.3737	.8728	1.8703	2.9149	6.6190
	(-2.58)	(-3.91)	(-1.97)	(-1.43)	(-1.38)	(.86)	(1.38)	(1.20)	(.97)
MUR25	.0044	.0217	.0202	.0292	.0305	.0257	.0220	.0561	.0496
	(.28)	(1.92)	(1.78)	(3.34)	(3.45)	(2.79)	(1.79)	(2.55)	(.81)
MPR25	.0512	.0563	.0326	.0221	.0124	.0005	-.0086	-.0195	-.0549
	(2.84)	(4.39)	(2.52)	(2.21)	(1.23)	(.05)	(-.61)	(-.78)	(-.79)
$\dot{P}$	.0017	.0066	.0029	.0017	.0024	.0017	-.0031	-.0003	.0094
	(.37)	(2.05)	(.90)	(.68)	(.97)	(.64)	(-.87)	(-.05)	(.54)
$\Delta\dot{P}$	-.0010	.0006	.0039	.0082	.0113	.0145	.0203	.0406	.0516
	(-.21)	(.18)	(1.12)	(3.02)	(4.12)	(5.07)	(5.33)	(5.93)	(2.71)
$\dot{W}$	-.0008	.0019	.0004	.0009	.0020	.0017	.0039	.0177	.0111
	(-.19)	(.67)	(.13)	(.42)	(.88)	(.71)	(1.23)	(3.13)	(.70)
YUB*/GNP*	5.2882	3.3684	1.2326	-.4447	-1.6591	-2.2748	-.9049	-4.5642	-16.4680
	(3.70)	(3.31)	(1.20)	(-.56)	(-2.07)	(-2.74)	(-.82	(-2.29)	(-2.96)
R^2	.738	.785	.632	.770	.776	.800	.782	.799	.599
$\bar{R}^2$	.581	.655	.411	.633	.642	.679	.652	.679	.359
S.E.	.019	.014	.014	.011	.011	.011	.015	.027	.076
D.W.	2.072	1.909	2.058	2.460	2.348	2.692	2.944	2.081	2.506

NOTE: For definition of symbols see note to Table 4.2

TABLE C.8

MALE INDIVIDUALS OF AGE UNDER 25 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-.2049	3.1971	-.7142	-.7501	-.0992	1.0874	1.8672	2.8376	3.6821
	(-1.57)	(-1.99)	(-2.16)	(-1.79)	(-.27)	(4.70)	(15.06)	(8.51)	(5.32)
UR15	-.0041	-.0065	-.0095	-.0106	-.0116	-.0208	-.0005	.0060	.0124
	(-4.36)	(-3.85)	(-4.16)	(-3.69)	(-4.27)	(-3.27)	(-.66)	(3.23)	(2.60)
PR15	.0061	.0131	.0198	.0237	.0175	.0040	-.0072	-.0197	-.0268
	(2.78)	(3.12)	(3.50)	(3.31)	(2.77)	(1.00)	(-3.44)	(-3.23)	(-2.26)
$\dot{P}$	-.0065	-.0112	-.0171	-.0209	-.0195	-.0063	.0028	.0141	.0234
	(-3.01)	(-2.70)	(-3.06)	(-2.96)	(-3.16)	(-1.73)	(1.36)	(3.08)	(2.00)
$\Delta\dot{P}$	.0072	.0140	.0205	.0232	.0199	-.0070	-.0040	-.0031	-.0269
	(3.87)	(3.83)	(4.16)	(3.73)	(3.70)	(-1.20)	(-2.73)	(-.47)	(-2.62)
$\dot{W}$	.0046	.0072	.0113	.0146	.0146	-.0063	-.0013	-.0109	-.0159
	(2.32)	(1.92)	(2.26)	(2.30)	(2.57)	(-1.24)	(-.74)	(-2.72)	(-1.52)
YUB/GNP*	1.2074	3.1971	5.0197	6.4310	3.7411	2.8421	-3.0245	-2.4210	-7.0332
	(1.43)	(2.02)	(2.35)	(2.38)	(1.54)	(.90)	(-3.94)	(-.90)	(-1.58)
R^2	.594	.514	.554	.499	.586	.826	.714	.449	.328
$\bar{R}^2$	.500	.445	.490	.428	.491	.722	.674	.370	.232
S.E.	.021	.041	.055	.069	.059	.029	.020	.045	.115
D.F.	13	14	14	14	13	10	14	14	14

NOTE: For definition of symbols see note to Table 4.2

TABLE C.10

MALE INDIVIDUALS OF AGE 25-64 (TAXATION STATISTICS)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-4.5240	-4.8525	-2.0964	-1.4341	-.3463	1.5874	1.4538	3.5754	4.8949
	(-2.87)	(-4.33)	(-1.77)	(-1.53)	(-.37)	(7.20)	(11.93)	(7.59)	(3.27)
MUR25	.0096	.0247	.0176	.0290	.0309	.0192	.0154	.0502	.0229
	(.74)	(2.70)	(1.82)	(3.44)	(3.63)	(4.50)	(3.86)	(7.01)	(1.50)
MPR25	.0512	.0559	.0286	.0226	.0121	-.0068	-.0039	-.0263	-.0359
	(3.15)	(4.86)	(2.36)	(2.36)	(1.25)	(-2.73)	(-2.68)	(-4.94)	(-2.13)
$\dot{P}$	.0004	.0057	.0059	.0013	.0026	-.0000	-.0041	-.0016	.0219
	(.10)	(2.11)	(2.32)	(.59)	(1.05)	(-.02)	(-3.83)	(-.51)	(2.69)
$\Delta\dot{P}$	.0006	.0025	.0050	.0076	.0114	.0142	.0188	.0386	.0317
	(.21)	(1.36)	(3.64)	(3.12)	(4.29)	(5.26)	(5.59)	(7.08)	(2.96)
$\dot{W}$	-.0009	.0027	.0019	.0004	.0019	.0006	.0049	.0189	.0065
	(-.34)	(1.43)	(.98)	(.21)	(.87)	(.37)	(2.79)	(7.03)	(1.31)
YUB^*/GNP^*	5.2127	3.3814	.3828	.0986	1.6194	-2.4299	.6532	-4.6461	-16.5250
	(4.10)	(3.75)	(2.22)	(.52)	(2.11)	(-3.14)	(4.29)	(-2.73)	(-3.12)
R^2	.721	.772	.514	.730	.771	.782	.719	.782	.499
$\bar{R}^2$	.656	.719	.445	.640	.667	.709	.654	.750	.383
S.E.	.018	.013	.014	.011	.011	.011	.015	.024	.074
D.W.	1.955	1.778	1.425	2.288	2.291	2.743	2.322	2.089	2.241
D.F.	13	13	14	12	11	12	13	14	13

NOTE: For definition of symbols see note to Table 4.2

TABLE C.11

MALE INDIVIDUALS OF AGE 25-64 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-3.1703	-1.7425	-1.0255	.2211	1.0742	2.0208	2.3257	3.1866	.0589
	(-3.70)	(-2.70)	(-1.71)	(.49)	(2.16)	(3.34)	(4.40)	(1.84)	(.01)
MUR25	-.0091	-.0034	.0079	.0094	.0131	.0151	.0203	.0332	-.0110
	(-1.10)	(-.54)	(1.36)	(2.18)	(2.73)	(2.58)	(3.97)	(1.98)	(-.24)
MPR25	.0374	.0243	.0179	.0059	-.0021	-.0111	-.0131	-.0210	.0164
	(4.18)	(3.61)	(2.86)	(1.26)	(-.41)	(-1.76)	(-2.38)	(-1.16)	(.33)
$\dot{P}$	.0040	.0028	.0029	.0004	-.0010	-.0016	.0010	.0013	.0184
	(1.65)	(1.53)	(1.71)	(.35)	(-.74)	(-.93)	(.70)	(.28)	(1.37)
$\Delta\dot{P}$	-.0061	-.0041	-.0004	.0017	.0035	.0045	.0042	.0060	-.0166
	(-1.77)	(-1.58)	(-.17)	(.95)	(1.75)	(1.85)	(1.98)	(.87)	(-.87)
$\dot{W}$	-.0010	-.0007	.0006	.0002	-.0008	-.0006	-.0001	.0069	.0052
	(-.33)	(-.32)	(.31)	(.15)	(-.48)	(-.31)	(-.04)	(1.16)	(.32)
YUB/GNP*	4.5881	2.1468	.8712	.2236	-.3373	-.9043	-2.5229	-3.7044	2.6035
	(2.43)	(1.51)	(.66)	(.22)	(-.31)	(-.67)	(-2.16)	(-.97)	(.25)
R^2	.715	.681	.570	.487	.650	.729	.834	.527	.323
$\bar{R}^2$	.545	.489	.311	.179	.440	.566	.734	.243	--
S.E.	.017	.013	.012	.009	.010	.012	.011	.035	.097

NOTE: For definition of symbols see note to Table 4.2

TABLE C.12

MALE INDIVIDUALS OF AGE 25-64 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	-3.1006 (-4.33)	-1.6228 (-2.98)	-.9369 (-1.63)	.5540 (6.45)	.7099 (6.32)	2.2075 (3.96)	2.3803 (4.51)	1.8536 (9.48)	2.6347 (3.98)
MUR25	-.0097 (-5.66)	-.0066 (-5.07)	.0063 (1.19)	.0057 (3.02)	.0091 (4.00)	.0096 (4.17)	.0197 (4.09)	.0062 (2.63)	-.0211 (1.45)
MPR25	.0366 (4.86)	.0231 (4.03)	.0171 (2.83)	.0025 (3.06)	.0018 (1.61)	-.0127 (-2.17)	-.0136 (-2.46)	-.0060 (-2.63)	-.0099 (-1.45)
$\dot{P}$	.0046 (3.81)	.0027 (2.95)	.0029 (1.84)	-.0010 (-3.06)	-.0011 (-2.76)	-.0021 (-2.02)	.0008 (.58)	.0011 (2.63)	.0047 (1.45)
$\Delta\dot{P}$	-.0071 (-3.98)	-.0042 (-3.11)	-.0026 (-1.86)	.0023 (1.88)	.0024 (1.64)	.0022 (1.62)	.0023 (1.80)	-.0013 (-2.63)	-.0014 (-1.45)
$\dot{W}$	.0002 (.94)	.0003 (1.49)	-.0005 (-.40)	-.0003 (-.27)	-.0014 (-.94)	-.0020 (-2.57)	-.0004 (-.35)	-.0011 (-2.63)	.0124 (1.45)
YUB/GNP*	4.2313 (3.62)	2.4481 (2.75)	.3976 (.33)	.5041 (1.60)	.9102 (2.32)	-.9740 (-1.08)	-2.8386 (-2.57)	1.4151 (2.63)	.1979 (1.45)
R^2	.696	.653	.511	.404	.596	.678	.796	.315	.123
$\bar{R}^2$	.652	.603	.349	.319	.503	.604	.728	.270	.064
S.E.	.015	.012	.012	.008	.009	.012	.011	.034	.090
D.F.	14	14	12	14	13	13	12	15	15

NOTE: For definition of symbols see note to Table 4.2

TABLE C.13

FAMILIES: AGE OF HEAD UNDER 25 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.7925	.8065	.9684	1.0510	.9884	1.3284	1.2096	1.2407	1.3552
	(3.48)	(5.18)	(8.05)	(8.57)	(10.24)	(8.45)	(11.82)	(11.02)	(7.52)
UR15	-.0184	-.0144	-.0014	.0080	.0063	.0158	.0175	.0119	.0099
	(-1.54)	(-1.77)	(-.22)	(1.24)	(1.25)	(1.92)	(3.26)	(2.02)	(1.05)
FPR15	-.0046	-.0022	-.0044	-.0049	-.0010	-.0078	-.0023	.0015	.0040
	(-.85)	(-.60)	(-1.54)	(-1.71)	(-.44)	(-2.11)	(-.97)	(.59)	(.95)
$\dot{P}$	-.0023	-.0039	.0018	.0080	.0019	.0099	.0013	-.0040	-.0119
	(-.41)	(-1.01)	(.58)	(2.58)	(.79)	(2.52)	(.49)	(-1.43)	(-2.65)
$\Delta\dot{P}$	-.0204	-.0036	.0017	-.0007	.0072	.0054	.0141	.0126	.0162
	(-2.24)	(-.58)	(.34)	(-.13)	(1.87)	(.85)	(3.45)	(2.81)	(2.25)
$\dot{W}$	-.0124	-.0025	-.0045	-.0026	-.0005	.0005	.0017	.0021	.0075
	(-1.57)	(-.47)	(-1.09)	(-.60)	(-.14)	(.10)	(.47)	(.53)	(1.20)
YUB/GNP*	3.6058	3.5420	-.7666	-4.9991	-3.2122	-3.0952	-4.1634	-2.7806	1.2402
	(.71)	(1.02)	(-.29)	(-1.83)	(-1.49)	(-.88)	(-1.83)	(-1.11)	(.31)
R^2	.701	.761	.666	.540	.591	.619	.741	.567	.543
$\bar{R}^2$	.521	.618	.466	.264	.346	.390	.586	.307	.269
S.E.	.044	.304	.024	.024	.019	.031	.020	.022	.035

NOTE: For definition of symbols see note to Table 4.2

TABLE C.14

FAMILIES: AGE OF HEAD UNDER 25 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.9250	.7523	.8233	.9479	1.0525	1.1648	1.1833	1.2159	1.2812
	(5.24)	(21.47)	(32.10)	(15.19)	(23.95)	(12.86)	(12.06)	(12.36)	(9.41)
UR15	-.0071	-.0035	-.0029	.0100	.0058	.0166	.0172	.0120	.0047
	(-2.92)	(-5.39)	(-4.64)	(1.65)	(1.32)	(2.04)	(3.14)	(2.20)	(2.60)
FPR15	-.0084	-.0023	-.0011	-.0033	-.0021	-.0040	-.0012	.0021	.0068
	(-2.61	(-5.39)	(-3.44)	(-1.79)	(-1.53	(-1.61)	(-.52)	(.92)	(2.60)
$\dot{P}$	.0003	-.0024	-.0000	.0047	.0022	.0079	.0004	-.0030	-.0093
	(.06)	(-5.39)	(-.06)	(2.67)	(3.10)	(3.32)	(.17)	(-1.70)	(-2.60)
$\Delta\dot{P}$	-.0151	.0008	.0037	.0058	.0047	.0070	.0116	.0109	.0156
	(-2.02)	(5.39)	(3.21)	(3.18)	(3.82)	(2.88)	(3.04)	(2.98)	(2.60)
$\dot{W}$	-.0162	.0029	-.0014	.0007	-.0037	.0026	-.0016	.0039	.0093
	(-2.22)	(5.39)	(-1.31)	(.22)	(-3.98)	(.58)	(-.67)	(1.74)	(2.60)
YUB/GNP*	-.9213	-2.0658	-1.4085	-4.4470	-2.9222	-5.6140	-5.5744	-3.2666	-1.2713
	(-1.11)	(-5.39)	(-4.54)	(-2.02)	(-1.83)	(-1.89)	(-2.81)	(-1.65)	(-2.60)
R^2	.630	.659	.606	.441	.545	.538	.674	.509	.311
$\bar{R}^2$	.545	.636	.550	.313	.480	.384	.566	.397	.265
S.E.	.043	.030	.022	.023	.017	.031	.020	.021	.035
D.F.	13	15	14	13	14	12	12	13	15

NOTE: For definition of symbols see note to Table 4.2

TABLE C.15

FAMILIES: AGE OF HEAD 25-64 (SCF)
OLS Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.4964	.6073	.6804	.7604	.8288	.9305	1.0368	1.2742	1.5361
	(17.74)	(18.40)	(26.72)	(32.82)	(25.07)	(22.09)	(19.36)	(14.21)	(9.57)
UR25	-.0096	.0007	.0036	.0039	.0096	.0093	.0076	.0008	.0518
	(-1.25)	(.07)	(.51)	(.61)	(1.05)	(.80)	(.51)	(.03)	(1.17)
FPR25	-.0018	-.0008	.0006	.0002	.0021	.0028	.0045	.0049	.0096
	(-2.43)	(-1.04)	(.93)	(.30)	(2.53)	(2.67)	(3.39)	(2.21)	(2.44)
$\dot{P}$	-.0008	-.0008	-.0032	.0009	-.0042	-.0054	-.0088	-.0115	-.0239
	(-.40)	(-.38)	(-1.92)	(.63)	(-1.96)	(-1.97)	(-2.52)	(-1.97)	(-2.29)
$\Delta\dot{P}$	-.0072	-.0013	.0021	.0011	.0069	.0074	.0095	.0102	.0227
	(-2.38)	(-.35)	(.77)	(.43)	(1.94)	(1.62)	(1.63)	(1.04)	(1.31)
$\dot{W}$	-.0086	-.0059	-.0037	.0012	-.0011	-.0019	-.0028	-.0065	-.0042
	(-3.59)	(-2.09)	(-1.69)	(.60)	(-.40)	(-.51)	(-.62)	(-.84)	(-.31)
YUB/GNP*	1.0682	-.3145	-.6405	.6859	-2.0756	-2.5025	-3.2067	-4.0934	-24.9610
	(.68)	(-.17)	(-.45)	(.52)	(-1.11)	(-1.05)	(-1.06)	(-.81)	(-2.75)
R^2	.755	.500	.492	.578	.559	.553	.626	.440	.695
$\bar{R}^2$	.608	.200	.188	.324	.294	.285	.402	.104	.512
S.E.	.013	.016	.012	.011	.016	.020	.025	.042	.076

NOTE: For definition of symbols see note to Table 4.2

TABLE C.16

FAMILIES: AGE OF HEAD 25-64 (SCF)
Massy Method

	D1/M	D2/M	D3/M	D4/M	D5/M	D6/M	D7/M	D8/M	D9/M
Intercept	.4927	.5899	.7018	.7722	.8324	.9399	1.0424	1.257	.4979
	(18.98)	(44.41)	(116.68)	(103.93)	(34.24)	(31.42)	(27.99)	(23.71)	(9.39)
UR25	-.0089	.0023	.0029	.0023	.0012	-.0005	-.0017	-.0055	.0411
	(-1.23)	(1.45)	(2.87)	(4.04)	(1.35)	(-.32)	(-.77)	(-2.09)	(.92)
FPR25	-.0019	-.0006	-.0003	.0003	.0019	.0031	.0048	.0054	.0106
	(-3.24)	(-3.04)	(-2.87)	(4.04)	(2.72)	(3.26)	(4.08)	(2.88)	(2.68)
$\dot{P}$	-.0008	-.0023	-.0017	.0005	-.0042	-.0052	-.0081	-.0099	-.0173
	(-.47)	(-2.94)	(-2.87)	(4.04)	(-2.31)	(-2.38)	(-2.98)	(-2.26)	(-1.79)
$\Delta\dot{P}$	-.0064	.0001	-.0002	-.0005	.0068	.0058	.0085	.0093	.0272
	(-2.51)	(.32)	(-2.87)	(-4.04)	(2.39)	(1.53)	(1.82)	(1.23)	(1.57)
$\dot{W}$	-.0075	-.0038	-.0034	-.0005	.0016	-.0008	-.0017	-.0024	.0016
	(-4.10)	(-2.46)	(-2.87)	(-4.04)	(2.02)	(-.41)	(-.68)	(-.61)	(.15)
YUB/GNP*	1.6074	-.0844	.1838	.5508	.4333	-1.0545	-2.0124	-3.6051	-25.5830
	(1.20)	(-.38)	(2.87)	(4.04)	(1.92)	(-1.03)	(-1.59)	(-1.83)	(-2.77)
R^2	.740	.399	.355	.521	.384	.485	.587	.387	.618
$\bar{R}^2$	.653	.313	.312	.489	.296	.366	.492	.299	.491
S.E.	.013	.015	.011	.010	.016	.019	.024	.038	.078
D.F.	12	14	15	15	14	13	13	14	12

NOTE: For definition of symbols see note to Table 4.2

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