PERSONAL NON-WEALTH INCOME INEQUALITY AND TAX EVASION IN GREECE 1962-1975

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ABSTRACT

The purpose of this study is to describe personal non-wealth income inequality in Greece covering the total of the economically active population as well as the group of pensioners for a number of years that data are availablbe (1962-1975). The computational procedure does not follow the traditional treatment of the subject i.e. the use of tax return data, but a rather complex and indirect way that ensures coverage of the total population that receives income. The results show a trend towards worsening of inequality. A side result is the estimation of tax evasion which is also shown to exhibit a worsening trend.

I. INTRODUCTION

Unequal distribution of income is one of the various fundamental problems societies face. However, a comprehensive theoretical framework that analyzes the process of distribution does not exist[1]. Income distribution theories have deen developed on a partial framework and the situation worsens when we consider alternative distributional criteria (i.e. personal, functional, by family, by sex, regional). On the empirical level the problem worsens even more since we encounter data problems as well. The conclusion that emerges is that the most it is to be expected from an empirical study of income distribution is an approximate partial picture of the real world.

1. For a survey of personal income distribution theories see (14)

This study is empirical aiming at the description of personal income distribution in Greece for a number of consecutive years (1962 - 1975) at the same time covering the total of the population. Some of the very few studies existing on the subject focus on a particular year while others do not cover the total of the population. This means that the study is a new and different attempt to study income inequality in Greece. An interesting «by product» of the computational procedure is the estimation of tax evasion for the same number of years.

Part II contains a brief literature review, some remarks and the definition of the concept of equality and income, and the method of inequality estimation. Part ΠI contains a somewhat detailed description of the calculations. Part IV consists of the specification of the inequality measure used and the related computational procedure. Part V contains the results of the study and part VI concluding remarks.

Finally, quotations from Greek sources in the Greek language are translated into English by the author and the translated quotation is related to a footnote or to bibliography where it is specified that the source is in Greek.

II. LITERATURE REVIEW, DEFINITIONS, METHOD

1. Empirical Studies of Personal Income Distribution in Greece

Only three studies of personal income distribution in Greece could be found. The first is by D. Karageorgas[5], which «...is predominantly concerned with the redistributive effects of taxes and transfers in Greece... in principle the derived distribution covers all the population and money income. The Gini coefficient is put at 0.54» [2]. The other study is by T. Lianos and K. Prodrômidis and it «... is based solely on income tax data, covers only 21 percent of the working population and excludes transfer payments. For 1971 the authors estimate a Gini coefficient of 0.46»[3]. The third study is by M. Negrepondi - Delivani[4]. which gives the following Gini coefficients for the years 1961, 1966, 1971, 1976 after direct and indirect taxes have been deducted and transfer payments have been added :0317, 0.314, 0.302 and 0.316.

2. Sawyer, M. «Income Distribution in OECD Countries» OECD Economic Outlook, Occasional Studies July 1976, pg. 24.

3. Ibid.,pg 24.

4. Negrepondi - Delivani, M., «On the Tax Burden, Tax Evasion, Targets and Achievements of Public Policy» Οικονομικός Ταχυδρόμος Mar 8,1977 : pp 14 - 16 (in Greek)

2. On the Concept of Inequality

There exist many statements that have been made in reference to inequality of income among individuals. These statements refer to equality of abilities, earnings, or to ethical questions. The statetments vary from» «... the idea that men are equal is poisonpus doctrine»[5] or «.. .economic equality is a scientific impossibility»[6] to «A system founded on it (inequality) is against nature and, in the long run, breaks down»[7].

This is a sample of the wide range of opinions on the subject of inequality, and it can be attributed to the fact that the concept of inequality has more than one meanings. The first meaning refers to the belief that individuals do not possess the same abilities. This can be extented to social groups considered to be of greater or lower ability. The second meaning refers to the belief that there exists inequality of opportunities within the economic environment.

For the purpose of this study equality is defined as the situation where each income - receiving unit receives an equal proportion of income. This is necessary since we cannot measure abilities and incomes on an aggregate basis.

3. On the Concept of Income

Income in its various definitional forms is related to the concept of the social welfare function. It is implicitly assumed that social welfare is a function of income. The higher the income of an individual the higher his/her utility and consequently the higher the collective social welfare, ceteris paribus. In addition, the utility of each individual increases at a decreasing rate as additional equal increments of income are received. This implies that reduction of inequality by transfer of income from a few individuals at the top of income distribution to many low income individuals would increase the level of collective welfare.

Income for this study is money receipts plus all kinds of transfer payments minus all kinds of taxes and mandatory contributions direct and indirect. No

5. These remarks are taken from, Tawney, R., H., «The Religion of Inequality» in Wealth Income and Inequality edited by A., B., Atkinson Penguin Education, 1973, pg 23, and they do not constitute Tawney's ideas on inequality. They are rather a survey of opinions presented by Tawney.

6. Ibid.,pg23.

7. Ibid., pg 17.

income in kind is considered. The time frame relevant to the measurement of income is one year since most of the data are available on an annual basis.

An income - receiving unit is an individual that receives pension or participates in production. In this context, helping and nonremunerated family members are considered to be income - receiving units since in order to be classified as such by the National Statistical Service of Greece (from now on NSSG) they must help systematically.

Moreover, income inequality attributed to unequal distribution of wealth is not considered because of lack of data.

4. Method

This study is an attempt to cover the total of income - receiving population. This is done best when we consider three groups : The fixed income group, the group of wage - salary earners, and the group of entrepreneurs.

The fixed income group, consists of pensioners.

The wage - salary earners group consists of individuals who receive wages or salary. As noted previously helping and nonremunerated family members are included in this group where applicable.

The entrepreneur group consists of individuals whose income is based on profits. Both profits and salary of the entrepreneur for services rendered to the firm are considered to be entrepreneurial income. Furthermore, an individual is considered to be an entrepreneur only when he employs other persons. Self-employed individuals are considered to be wage - salary earners.

In order to achieve variation we further divide the groups into sub-groups according to the standard classification by NSSG.

In some cases we are able to derive more than one sub - group within one classification.

The period covered is from and including 1962 up to and including 1975 and it is determined by data availability, since the latest data on some sub - groups (i. e small scale industry, pensioners) by NSSG are those for the year 1975.

An additional point relates to the traditional way of deriving inequality coefficients. The usual way is to use income tax return data. This method implies that either all households (or income-receiving units) have to file a tax return and they

actually do or that households with incomes below the taxable level are not considered. This kind of data base is adequate in the case of some countries where almost every individual files a tax return but hardly advisable in the case of Greece where the tax system does not work smoothly. The method employed is a search for wage and profit data for various sub-groups. This method has not been used before in the case of Greece and, therefore, it constitutes a new approach not comparable to the one taken by the very few studies existing.

A final point relates to the fact that all interpolations used are linear. The reason is that after careful observation and working with the data the feeling is that almost all time series encountered in the study anvance in a linear way and no significant advantage is to be gained by using non-linear interpolations which are more complicated. This belief is vindicated as shown in chapter III section 17.

III. DATA AND CALCULATIONS

This chapter is a description of calculations. The description seems necessary since the derivation of income-receiving populations and incomes for the various sub-groups considered is indirect and consequently not straightforward [8].

1. **Pensioner Population and Income**

Pensioners in Greece are of two major categories: Pensioners of social insurance organizations (and there exist many organizations of this kind in Greece) and pensioners of the state. Furhtermore, for pensioners of social insurance organizations we distinguish between two kinds of pensions, regular pension and subsidiary pension.

More specifically, from NSSG data we obtain the number of pensioners and expenditure on pension of the main insurance organizations. This gives average pension for each organization and each one constitutes a sub-group within the group of pensioners. The rest of pensioners not included in data above are treated as a residual of the subtraction of the number of pensioners of principal social insurance organizations from the total number of pensioners

8. The result of the calculations is a lengthy data base and it is omitted to save space. Nevertheless the interested reader can obtain a copy from the author by means of personal contact.

of the same organizations. The same applies to the derivation of income for the residual group. The residual number of pensioners constitutes roughly two to four percent of the total number of social insurance organizations pensioners.

The number of pensioners and expenditure on pensions by the state are obtained directly from tables. We distinguish among four sub-groups of state pensioners and pension data in this case include both regular and subsidiary pension. However, for social insurance organizations pensioners we have only an aggregate figure for subsidiary pension and we determine a basis for allocation based on the following : First, farmer pensioners do not receive subsidiary pension. Second, in 1977 «… one third of individuals insured by IKA have subsidiary coverage»[9]. IKA is the largest organization covering more than fifty percent of social insurance organizations pensioners. Third, subsidiary pension is assumed to be one half the regular pension. Fpurth, there is no reason to assume the situation is different with respect to other organizations or with respect to previous years.

These observations suggest the following way of allocating subsidiary pension : Let the number of pensioners in the i^{th} subgroup equal yi and average income of the two thirds of the sub - group that do not receive subsidiary pension equal zj. Then, we have,

number of recipients	income	average income
2yi/3		zi
yi/3		Zi+Zi/2

and assuming total sub - group income =k we have,
k = (2yi/7) Zj+(yi/3) (zi+zi/2) and since k and *yi* are ônown numbers we solve for zi to obtain

$$Zj = k/1.17yi$$

The procedure is applicable to allocation within each group. To allocate subsidiary pension among eligible sub-groups we calculate the percentage of each sub-group population out of the total eligible population and we assume that the same percentage of subsidiary pension accrues to each sub - group.

9. Kyriakoulakos, P., «Retirement Age and Subsidiary Pension», Οικονομικός Ταχυδρόμος, May 4,1978, pg 27 (in Greek).

2. Workers and Entrepreneurs in Agriculture

The task set forth in this section is to estimate agricultural population **for** the period 1962- 75 on one hand, and divide population in agriculture into workers and entrepreneurs and derive corresponding incomes on the other.

a. Agricultural Population

The data we have with respect to agricultural population are available for three years 1961, 1971 and 1977 (the 1977 figure is from «Οικονομικός Ταχυδρόμος» Dec. 28, 1978 pg., 11). When we plot the three points against a time scale we obtain an almost straight line and this enables us to derive the population for each year at a constant decreasing rate.

b. A Base to Determine Annual Increases in Magnitudes Related to Entrepreneurs

In this sub- go up we establish an annual rate of increase that is to be used for most of the calculations pertaining to entrepreneurs in agriculture.

The percentage of cultivated land in holdings of fifty hectares and above over total cultivated land[10] in 1954 is 7.93 percent. The same percentage[11] for **1971** is 55.1. Assuming a constant annual increase in the ratio we postulate that the number or entrepreneurs in agriculture increases at the same rate of 2.77 percent annually.

c. Employers in Agriculture

There is one figure available for employers in agriculture from **1961** census data[12]. We assume that the number of entrepreneurs increases at the rate of 2.77 percent annually. We can further subdivide the number into entrepreneurs with holding's greater than 500 hectares and entrepreneurs with holdings less that 500. Holders.of more than 500 hectares are assumed to be of a constant number. The number of entrepreneurs in fishing is assumed to be the same as the number of overseas and open sea vessels.

For the number of entrepreneurs in livestock we observe the distribution

10. United Nations, «European Agriculture, A Statement of Problems», U.N., Geneva 1954, E/ECE/175,pg.,16.
11. NSSG, «Statistical Yearbook of Greece», Athens, 1978, pg215.
12. NSSG, «Statistical Yearbook of Greece», Athens, 1964, pg 215.

of holdings of cattle, sheep, goats, pigs and poulrty[13] for 1971. There are no entrepreneurs with goats and sheep according to the data because the largest observed holding consists of approximately 1000 animals, a size that can be managed by a family. In the case of cattle the number of holdings of the greatest size (fifty and over) is the number of entrepreneurs, assuming one owner per holding. The some applies to the case of entrepreneurs in pig production as well as to poultry.

d. Gross and Net Income to Agriculture

Gross Agricultural Product is obtained from NSSG data. From gross product we need to deduct costs of production. To this end we first assume that costs of production are the same for agriculture, livestock and fishing but we also include wages in the case of fishing. From 1952 to 1965 the average annual increase in operating costs as a percentage of gross output is .3467 of a percentage unit and the same rate of increase[14] is assumed up to 1973. From 1973 on we estimate[15] an average increase of four percent due to accelerating inflation.

e. Wage Earners and Income in Fishing

The number of wage earners in fishing is obtained directly from NSSG data. Income is determind using mostly annual averages of wages under the assumption that fishermen do not command specially high wages.

f. Entrepreneurs and Income in Livestock

There exist no data that allow us to distinguish between wage earners in crop production and animal production. Furthermore, it seems that there exist no two groups on a small scale. This means that it is necessary to deduce the percentage of animal production that accrues to livestock entrepreneurs and add the residual to crop production accruing to wage earners in agriculture.

From 1971 census data, it is observed that employers in cattle owned 1.73 percent of the total stock of cattle, employers in pig stock owned 28.5 percent, and employers in poultry 46.3 percent. Then from «Meat Balances in OECD Me-

13. NSSG, «Statistical Yearbook of Greece», Athens, 1978, pp 203 - 204.

14. United Nations, «Sixth Report on Output, Expenses, and Income of Agriculture in European Countries», Vol III, U.N., E E, New York, 1969, pg., 353i

15. Basep on U.N., «Prices of Agricultural Propucts and Seldcted in and North America» U.N., HCH, New York, 1963/64-1977/78.

mber Countries» 1973- 1978, OECD Paris, and same for 1959-1972 we obtain production of meat in tons in the following categories : Beef and veal, pig, poultry, and mutton and lamb. Along with these figures we obtain milk production from cattle, and milk production from goats and sheep, from «Milk and Milk Product Balances in OECD Member Countries» OECD Paris, 1974. It is observed that production of milk in tons is from five to eleven times the production of meat. If it is assumed, based on experience, that the price of milk is ten times smaller than the price of meat on the average, the figures suggest that milk productisn can be converted into meat equivalent. The results of this calculation indicate that sixty percent of gross livestock production is meat and forty percent is milk production. If the same relationship in the absence of any datum, is assumed to hold between poultry meat and egg production we obtain production of veal and beef plus cattle milk in tons equivalent to beef and veal, poultry meat and egg production in poultry meat equivalent, and mutton lamb and goat meat along with milk in meat equivalencies. When it is further assumed that the price relationship among beef, pig meat, mutton and poultry meat is 100-60- 80-40 respectively we obtain production of the four kinds of meats in beef equivalencies. The results indicate that the value of cattle production constitutes forty percent of total livestock production. The values of pig, poultry, and mutton production constitute eleven, thirteen, and thirty six perceut of total production respectively.

Then, from table «Livestock Numbers», pg. 2 of «Meat Balances in OECD Member Countries» we deduce that cattle entrepreneurs own a constant percentage (1.73%) of cattle stock, based on the fact that cattle numbers remain fairly constant. The increase in the number of pig stock is 5.6. percent annually on the average. This is the rate of increase we assume for the share of entrepreneurs in pig and poultry production in the absence of any other datum. Combining all these findings we estimate livestock output percentage accruing to cattle entrepreneurs. That is .0173 X (.4 X total livestock output) for cattle entrepreneurs, (5.6 percent annually increasing share with 28.5 percent as base in 1971) χ (.11 χ total livestock output) for pig stock entrepreneurs, and (5.6 percent annually increasing share with 46.3 percent as base in 1971 X (.13 χ total livestock output) for poultry entrepreneurs.

g. Income of Entrepreneurs, Number and Income of Wage Earners in Crop Production

We first estimate yield per hectare (value of crop production divided by the size of cultivated area). The number of entrepreneurs with holdings of less than 500 hectares in 1971 is seventy six percent of the number of holdings 100-500

hectares. This implies that seventy six percent of the area corresponding to hold.ngs 100- 500 hectares belongs to entrepreneurs with holdings of less than 500 hectares. We also assume that income of entrepreneurs with holdings of less than 500 hectares increases at an annual rate of 2.77 percent annually. Income of wage earners in agriculture is obtained as the residual sum of crop and livestock production. The number of wage earners is also obtained as a residual.

3. Workers and Enterpreneurs in Manufacturing

The data on populations and incomes for manufacturing are obtained directly from tables in the «Statistical Yearbook of Greece», section in Manufacturing. The data allow us to divide entrepreneurs into three sub-groups, large scale industry, small scale industry employing five to nine persons, and small scale industry employing one to four persons. However, self-employed are considered to be wage earners rather than entrepreneurs. The data actually refer to small scale industry employing zero to four persons which implies that own-account workers are considered to be entrepreneurs. To separate them we observe that the ratio of own-account to employers is for 1961 is 9. This means that ninety percent of entrepreneurs in small! scale industry are actuality own - account workers. The same percentage is assumed to hold throughout in the absence of any indication that it changes. The data allow us to also distinguish among salary earners in large scale industry, wage earners in large scale industry, and wage and salary earners in small scale industry (no dinstinction available).

4. Incomes in Manufacturing

There exist some dat.a from 1974 to 1977 compiled by ICAP [16] which pertain to firms in the form of corporations. From the data we observe that the number of firms in the form of corporation is 25 percent of the number of large scale industry establishments. However, this twenty five percent of firms employs about eighty percent of all emplpyed in large scale industry. This implies that profits for firms in the form of corporations are about eighty percent of profits in large scale indiistry. In addition, from [10] 1962- 1975 we obtain net income of corporations including undistributed profits. This figure multiplied by 1.25 gives a figure for net profits in large scale industry. Income of small scale industry (five to nine persons) entrepreneuers is obtained by assigning salaries in industry because the method used for large scale industry gives inconsistent results.

16. Οικονομικός Ταχυδρόμος, Jan. 12,1978, pg 31

5. Enterpreneurs and Workers in Trade

There exist data on trade based on two surveys conducted in 1958 and 1969, by NSSG. Using these data we obtain an average annual increase in the number of establishments in wholesale trade of 2.8 percent. From the same source we obtain an annual average rate of increase for retail trade establishments of 2.6 percent. The number of entrepreneurs in both wholesale and retail trade is the number of establishments increasing at the above annual rates. This implies one owner per establishment. We also have the number of employees in wholesale and retail trade in 1961. We use these numbers increasing at the above annual rates.

6. incomes in Trade

Both wholesale and retail trade emplo3'ees are assigned wages. There exist data for the years 1975-1977 giving annual averages of montly receipts of employees in retail trade. The same wages are assigned to wholesale trade employees since there is no reason to assume that they are paid better. For the years prior to 1975 we tie variation of their wages to variation of wages of industry salaried personnel. Also, the wage level pertaining to males is used.

In order to estimate income of employers we proceed in two steps. First, we estimate income to trade in general and second, we allocate that income to retail and wholesale. To this end we use GDP figures from national accounts. Observing the manufacturing section we see that the ratio of production consumption expenditures to gross production value is extremely stable over the years and it equals .63 for large scale industry and. 64 for small scale industry. Based on this relationship for industry we assume that operating expenses in trade are about forty percent of **GDP** in trade. We also deduct wages from the GDP figure and this gives net income to trade. We then link income level in wholesale and retail trade to the level of economic activity in each branch. Economic activity is approximately by the number of persons employed in each branch.

7. Incomes and Populations in Mining

The total of employment in mining for 1961 and 1971 is almost the same. This gives us a non - increasing trend. Based on this observation we assume that the number of employers in mining in 1961 remains constant throughout. The number and income of employees in mining is obtained directly from NSSG tables. Income of entrepreneurs is obtained as a percentage of GDP in mining. The per-

centage is determined by the ratio of net income to value added in large scale industry.

8. Incomes and Populations in Construction

The basis of determination of the population of entrepreneurs and employees in construction is the 1961 census. Also the increase in employment from 1961 to 1971 is 5.3 percent annually on the average. This is the rate of increase assumed to hold for the number of employers and employees. The same method, as in the case of mining, is used to derive income of entrepreneur in Construction. To derive income of workers we observe that wages in construction are traditionally about double the wages in manufacturing. However, this observation should be coupled with the offsetting fact that weather conditions affect duration of the working year. We assume that under normal conditions workers work two thirds of a year, unless there exists increased economic activity in construction. We approximate economic activity by the value of new buildings and repairs. The highest increase is from 1971 to 1972 of the magnitude of forty one percent. We assume that when annual increase is 35.7 percent (forty one percent minus the trend increase of 5.3 percent) workers are employed for the full length of the additional one third of the year which means that the demand for construction services is strong and it offsets adverse weather effects. Then we derive the duration of the average working year considering the additional one third of the year to be 100 percent in 1971. Then we use double the wages in manufacturing to derive income of employees.

9. Incomes and Populations in Transportation

We have a 1961 census for a number of employers in transportation. The average annual increase in employment is 3.8 percent. This is the assumed rate of increase of the base 1961 figure for employers and employees. Income of entrepreneurs is a percentage of **GDP** in transportation. The percentage is the same as the one for Mining. Income of employees is obtained by linking it to pensions since other more suitable data are unavailable. The relevant social insurance organizations are NAT, **ΤΣΑ** and OTE.

10. Employees and Income in Electricity - Gas

We have employment in Electricity - Gas in 1961 as well as average annual increase in employment from 1961 to 1971 of 2.5 percent. Income of employees is obtained by assigning annual average monthly salaries of large scale industry

personnel the implicit assumption being that wage structure in both the public and private sectors is similar.

11. Employees and Income in Banking

We have a 1971 census figure for the number of employees in Banking. We also have the average annual increase in employment from 1961 to 1971 which equals 1.3 percent. Income is the same as for employees in Electricity.

12. Employees and Income in other Services

This section includes both state employees and liberal professionals. We need, therefore, to separate Other Services into two parts. We calculate the total number of employees in services minus total number of liberal professionals for 1961. The average annual increase is assumed to be the same as in the case of Banking. The average annual increase for liberal professionals is 4.7 percent. Incomes are estimated by linking salaries to pensions of relevant social insurance organizations. This ratio is then multiplied by average monthly wages in industry to give incomes of state employees and liberal professionals.

13. Transfer Payments and Incomes

In order to add transfer payments to incomes we assume that the group of entrepreneurs does not reap any benefits from transfer payments. We also assume that transfer payments apply on per capita basis.

The first category of transfers is state expenditure on social welfare which accrues to state pensioners. The second category of transfers is welfare expenditure and sickness allowance of social insurance organizations which accrues to pensioners of social insurance organizations and also to some wage- salary earner sudgroups. The third and last kind of subsidy is other subsidies, mainly unemployment compensation, and it accrues to some wage - salary earner sub - groups.

14. Direct Tax Deductions

The total of direct taxes is deducted from all eligible sub-group incomes. The first task is to allocate tax receipts among groups. The total of direct taxes consists of physical persons taxes, corporate taxes and employee - employer contribution.

From NSSG tables we obtain the ratio of declared pensioner income over total declared income, and accordingly ratios for the other two groups. This is the base of allocation among groups. We also need to correct total tax accruing to physical persons for tax rentier income since we do not consider wealth income. To this end we obtain the ratio of rentier tax over total tax from the same source above. Then we obtain physical persons tax minus the percentage accruing to rentiers. Tax accruing to entrepreneurs is the above prescribed percentage of physical persons tax plus tax accruing to corporations multiplied by 1.25 since corporations employ about eighty percent of the personnel of large scale Industry plus employer contribution. Employer contribution, however, is not included in our figures due to the way we have derived income of entrepreneurs. That is, we have considered net taxable income which, of course, has been declared after employer contribution has been deducted. Tax accruing to pensioners is their percentage out of physical persons tax since they do not pay employee contributions. Tax for wage - salary earners is their share of physical persons tax (employee contribution is considered separately in section 16 of this chapter).

The next step is to allocate group income tax among sub - groups of the group. We do that using tax scales from NSSG [9j. We also need to correct the theoretical (according to scales) level of income which separates taxable from non-taxable income because there exists another level in practice due to various exemptions. This is done by observing the percentage of tax receipts from each income classes in [9]. Using the scales, appropriate income brackets and the above minimum taxable income levels we deduct tax from each sub-group. However, this shows tax according to scales given that every individual who had to pay tax actually did. The tax figures thus obtained are normalized using actual group direct tax as the basis of normalization. Then a per capita direct tax deduction figure is obtained for each income class we have used which includes various sub - groups from various groups.

Two points need to be stressed in connection to this section. First, farmers whether entrepreneurs or workers do not pay taxes. Second, the ratio of tax actually paid to tax according to scales gives a measure of tax evasion by groups see table 3.

15. Indirect Tax Allocation

The allocation of indirect tax is based on work done by D. Karageorgas [5]. The work is based on a survey by NSSG conducted in 1964. Six income brackets are estimated along with the percentage of brackets income taken up by indirect consumption taxes. The author states that «...there are indications showing that the basic structures ... used for allocation of the tax burden are not likely

to have changed too much» [17]. This seems to be true up to 1973 when the study was published. However, the situation seems to have changed after 1973 as the following two indicators show : First, the ratio of direct to indirect taxes is fairly constant up to 1973 but it changes afterwards. Second, income brackets in 1964 are used to estimate a cummulative income distribution for the whole population. The same brackets, adjusted for inflation, are used to calculate a similar distribution for 1974. The cummulative distributions appeared to be different.

These two facts suggest the following way of allocating indirect tax burden : First, the income brackets given by Karageorgas are used up to 1973 inflated each year by the correlative price index, adjusted to equal 100 in 1964, from U.N. data[18]. Second, in order to compensate for the change after 1973 we observe that the increase in the average ratio of direct to indirect taxes for 1962-1973 compared to the average ratio for 1974-1976 is fotry four percent. Then we observe that if indirect taxes were born equally each income class should pay 16.7 percent out of its income in indirect taxes. The difference between the actual and the theoretical percentage is mulitplied by .44. This gives the amount by which each income bracket percentage should decrease for 1974- 1976. The percentage should decrease because the ratio has increased a fact that implies less impact of indirect taxes on income.

As a final point it should be noted that by inflating income brackets by the correlative price index we probably underestimate the adverse impact of indirect taxes on income because the average annual increase in indirect tax receipts is about sixteen percent higher than average annual increase in inflation.

16. Employee Contribution Deduction

The deduction applies to wage - salary earners other than employees because the figure we use pertains to social insurance organizations. Furthermore, sub-groups in agriculture do not pay contributions and they are excluded. In addition, we do not deduct contribution from the construction sub - group in 1973 since that was a very slow year for them, and their income comes mostly from unemployment compensation.

17. [5] pg 441

18. United Nations, «Yearbook of National Accounts Statistics», U.N., New York, 1976, pg 512

17. Estimated and Actual Incomes

We have made certain assumptions in order to derive the incomes of the various groups and sub - groups and we need some way to obtain confidence in our data before proceeding any further. We note that we can obtain figures for aggregate disposable income of the economy and since our study covers the total of the population estimated income should be comparable to disposable income from national accounts data. Actual disposable income figures do nor include direct taxes but they contain indirect taxes. This means that we need to add indirect taxes to our figures as the first step toward comparison. We also need to include wealth income in our figures. Income from wealth takes the form of rent from dwellings, net income from abroad and interest income. Interest income is estimated by multiplying sight deposifts by interest rate on sight deposits, plus interest rate on savings deposits excluding public entity deposits which by law do not earn interest. We also account for the discrepancy between direct tax used to derive actua disposable income and personal tax we have used in our calculations which does not include employer contribution. The results of the comparison are given in table 1 where we observe that maximum percentage error is ±6.5 and that average error over the years equals zero. Also, the differences are tested using a rank sum (Wilcoxon) test with acceptance of the null hypothesis as a result. The null hypothesis is that the two population relative frequency distributions are identical.

IV. ESTIMATION OF INEQUALITY

1. Introduction

The data on incomes and populations of the various subgroups are used devire a Lorenz curve for the total of the population and then a Gini coefficient for every year [19]. The estimation of Gini coefficients requires the arrangement of the data into as many brackets as possible. There exists a relationship between the number of income brackets and the accuracy of the results obtained and the question is investigated in section 3 of this chapter.

19. The Gini coefficient is not the only index of inequality. For arguments concerning the relative merits of various inequality measures see [6], [16J.

TABLE 1

ESTIMATED AND ACTUAL INCOMES

(In Million Drachmae)

year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1962	74004	7224	3260	14650	-718	1116	99536	105300	5.5
63	83732	8338	4160	16575	-493	1390	113702	117700	3.4
64	90723	12532	3350	20273	-980	1594	127492	130900	2.6
65	104653	13496	3630	23953	-330	1767	147169	152000	3.2
66	111276	14889	3898	28810	-446	2292	160719	167400	4.0
67	128775	16336	4300	32680	-273	2503	184321	180300	-2.2
68	129357	17867	5042	36442	16	3228	191952	192300	0.2
69	146032	19517	4974	40812	-44	3946	215237	215200	0.0
70	168163	21160	5289	44925	-284	4938	244191	240700	-1.5
71	193722	22389	7322	48453	-128	6531	278289	271900	-2.3
72	227831	25048	9577	55413	2000	8666	328535	308400	-6.5
73	241239	28798	13085	68585	7419	11872	370998	395800	6.3
74	342431	33888	17868	77336	10618	18782	501023	471000	-6.4
75	400302	38508	19207	100556	13478	23774	595825	560800	-6.2

(1) non-wealth income

(2) rent from dwellings

(3) net income from abroad

(4) indirect tax

(5) discrepancy between direct tax and personal tax

(6) interest income

(7) estimated disposable income

(8) actual disposable income

(9) difference between actual (8) and estimated (7) income in percentages

2. The SpeCific Forms of the Function

The Lorenz curve is non-linear and it is approximated by the following functional form [20] :

$$(1) \qquad p = a\, e^{-b(1-a)}$$

where (a) is the cummulative fraction of income- receiving units to which fraction (p) of income accrues. The function is estimated by applying OLS to the logarithmic form of it :

$$(2) \qquad y = -bz + u$$

where $y = 1n\ (p/a)$, and $\zeta = 1 - a$.

The formulation of (1) satisfies the following conditions that should be satisfied by a Lorenz curve by definition :

1. If $a = 0$, $p = 0$
2. If $a = 1$, $p = 1$

These two conditions mean that the range and the demain of function are contained in the interval from zero to unity.

3. $P < a$, since the curve lies under the equality line always.
4. The slope of the curve increases monotonically, i.e.

$$\vartheta\rho/\vartheta a = e^{-b(1-a)}\ (1+ab)$$

$$\vartheta^2 p/\vartheta\alpha^2 = be^{-b(1-a)}\ (2+ab)$$

and if $b > 0$ both derivatives are positive for all values of (a) between zero and unity.

The Gini coefficient for this formulation is estimated as follows :

$$G = \frac{\frac{1}{2} - {}_0\int^1 ae^{-b(1-a)}\ da}{\frac{1}{2}}$$

20. Kakwani, N., and Podder, N., «On the Estimation of Lorenz Curves from Grouped Observations» International Economic Review 1973 (14) : 278-292

$$= 1 - \frac{2(b-1) - 2e^{-b}}{b^2} - \frac{}{b^2}$$

3. Some General Considerations

The data in our case are grouped and we investigate the significance of this fact upon the accuracy of our calculations[21]. If xij are observations (j= 1, 2,.. ni) total variation (total sura of squares, Sxx) consists of two parts, between group variation (SSxxb) and within group variation (SSxxw), and Sxx = SSxxb+ SSxxw. Then if $\hat{b}$ is our estimator of b from ungrouped data and $\hat{bb}$ is the estimator from group means, $var(\hat{b}) = \sigma^2/Sxx$ and $var(\hat{bb})$ equals $a^2/SSxxb$. This means that :

$$var\ (\hat{b})/var\ (\hat{b}_b) = SSxxb/Sxx =$$

$$= \frac{SSxxb\ /\ SSxxb}{Sxx\ /\ SSxxb} = \frac{1}{1 + SSxxw\ /\ SSxxb}$$

and this shows that the estimator from grouped data is always less efficient. This result also indicates that the loss in efficiency is minimized when the within group variation is minimized and the between group variation is maximized, i.e. when we consider as many groups as possible. The general conclusion is that the results are more efficient the more groups we consider.

A second argument on the same subject along different lines can also be made. The variance of $\hat{b}$ from (2) is :

$var\ (\hat{b}) = s^2\ (z\ z)^{-1} = (y'\ y - bz'\ y)\ (z'\ z)^{-1}\ /N - 1$ where y and ζ are vectors of cummulative points from equation (2) and (5) an estimate of the standard deviation of the regression of y on z in (2).

The expression for the var $(\hat{b})$ immediately indicates that the larger N the smaller var $(\hat{b})$. Then relating $var(\hat{b})$ to an estimate of the concentration ratio we have :

$$var\ (CR) = 2\ \left((b-2) + (b+2)e^{-b}\right)^2 var(\hat{b})\ /\ (b^3)^2$$

and the expression suggests that the condition for minimum possible variance of

21. The discussion is based on [7]

CR, since $\hat{b}$ is constant, is minimum var $(\hat{b})$. It has also been shown previously that the larger the number of income brackets the smaller var$(\hat{b})$. This again means that we need to consider as many brackets as possible.

However, we are not unrestricted in specifying the number of brackets. Since we use aggregate data a large number of brackets would mean that we would have zero observations for some brackets and this would increase var(b) without adding any new information. We need, in other words, to consider an optimal number of brackets. In our case, based on trial - and - error calculations the optimum number of brackets is set at ten (eleven for wage - salary earners). Furthermore, the bracket intervals are flexible in order not to allow any zero observation in any bracket.

V RESULTS

1. Gini Coefficients

The results of the calculations pertaining to income inequality are presented in table 2 and also in fig. 1.

Table 2

GINI COEFFICIENTS

year	coefficient
1962	0.39316
1963	0.35013
1964	0.33526
1965	0.35554
1966	0.34627
1967	0.34942
1968	0.32391
1969	0.34127
1970	0.35737
1971	0.38605
1972	0.40974
1973	0.37272
1974	0.41000
1975	0.38113

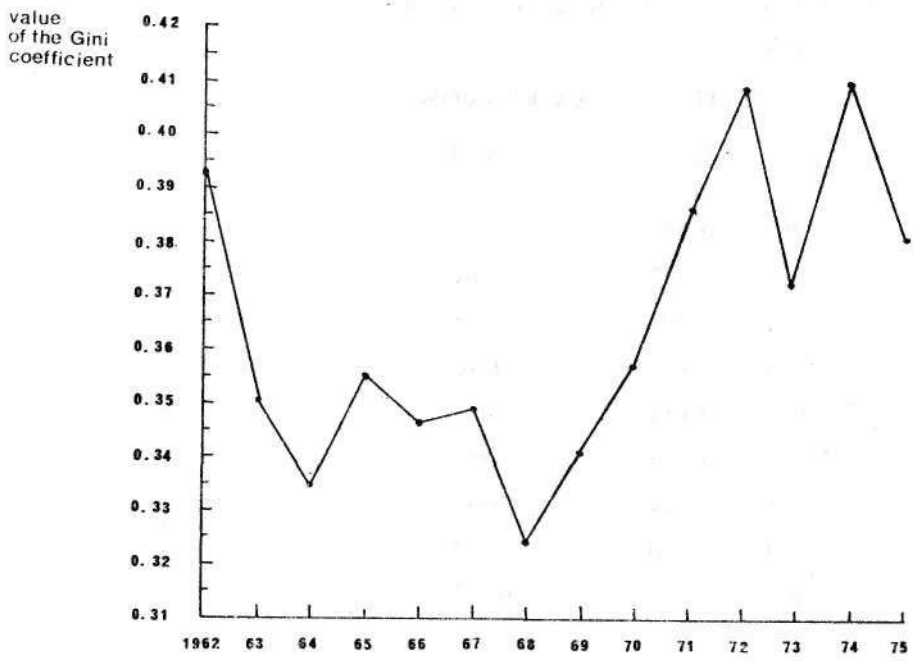

Figure 1. Gini Coefficients

2. Tax Evasion

An interesting side result of the computational procedure is the calculation of tax evasion. Tax evasion is estimated in two forms. First, as an index defined by the ratio of what was actually paid as tax to what it should have been paid according to tax scales and estimated incomes. Second as a monetary figure. The estimated figures do not include evasion out of wealth income. The figures also do not include evasion due to existence of the so called underground or secondary economy.

VI. CONCLUDING REMARKS

Table 2 and fig. 1 show that personal non - wealth income inequality decreases from 1962 to 1964 remains roughly on the same level up to 1968 worsens steadily up to 1972 oscillating around a constant level thereafter.

Table 3 and figures 2, 3 summarize the results.

Table 3

ESTIMATES OF TAX EVASION

year	index of tax evasion	actual amount*
1962	0.664	1702
1963	0.547	2564
1964	0.404	5303
1965	0.472	4319
1966	0.613	3098
1967	0.604	3926
1968	0.688	3336
1969	0.530	7519
1970	0.486	10177
1971	0.465	14483
1972	0.438	18215
1973	0.546	18987
1974	0.452	40256
1975	0.410	49947

* (current prices, million drachmae)

The values of our Gini coefficients are on the average between the values calculated by D. Karageorgas and Negrepondi - Delivani (see section II1).

Table 3 and fig. 2,3 show how tax evasion changes over the years in relative and absolute terms respectively. Tax evasion out of measured non-wealth income exhibits a slowly worsening trend in relative terms. In absolute monetary terms we observe a skyrocketing increase between 1973 and 1974. The worsening in both relative and absolute terms is probably an indication of inefficiency of the tax system.

Moreover, it should be noted that the indirect and complex computational procedure of sub - group incomes and populations along with unavailability

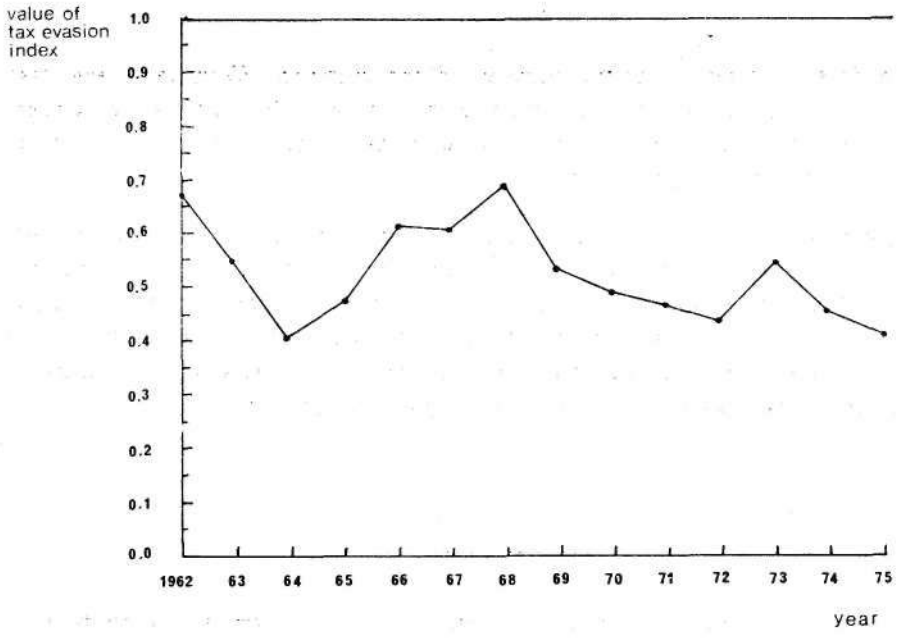

Figure 2. Index of tax evasion

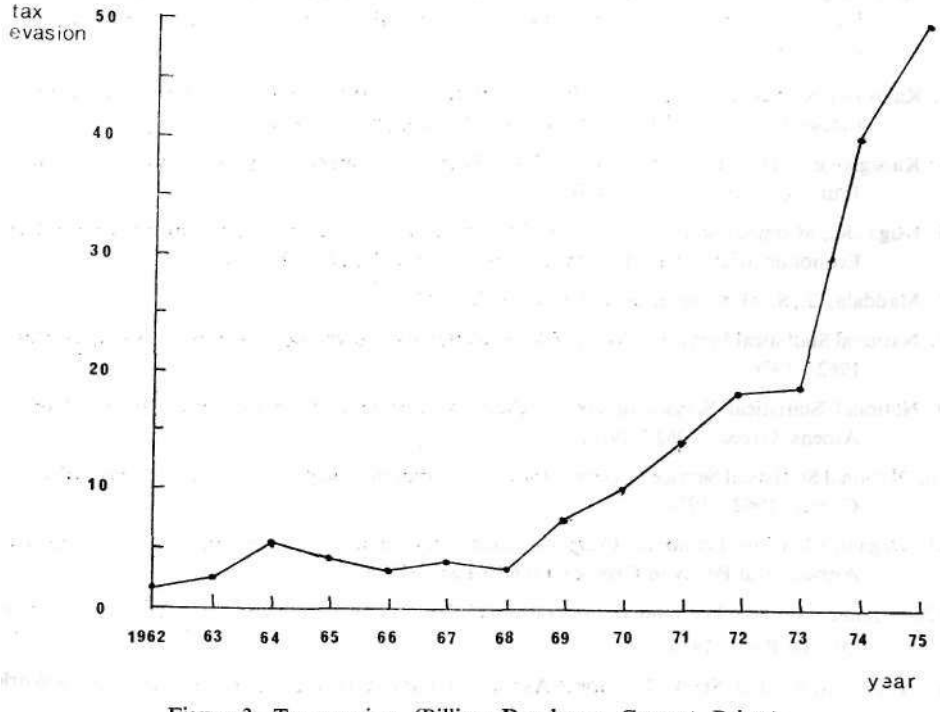

Figure 3. Tax evasion. (Billion Drachmae, Current Prices)

of some data required a certain number of assumptions. Whenever there was a choice the most conservative assumption was chosen. The implication is that if the estimation is biased it will probably be in the direction of underestimating rather than overestimating inequality.

Suggestions for further study include : First, analysis of income policies for the years covered in the study to deduce public policy priorities and relative effectiveness. Second, quantitative analysis of the effect of the changes in inequality upon the level of economic activity through the channels of consumption and investment. Third, the modification of the Gini coefficient to enable the distinction between inequality within groups and inequality among groups.

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