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TITLE OF THESIS/*TITRE DE LA THÈSE* Personal Income and Inflation in Canada During the Years 1966-1976

UNIVERSITY/*UNIVERSITÉ* Simon Fraser University

DEGREE FOR WHICH THESIS WAS PRESENTED/*GRADE POUR LEQUEL CETTE THÈSE FUT PRÉSENTÉE* Master of Arts

YEAR THIS DEGREE CONFERRED/*ANNÉE D'OBTENTION DE CE GRADE* 1980

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PERSONAL INCOME AND INFLATION IN CANADA DURING THE YEARS 1966-1976

by

Kent Harman Sproul

B.Sc., Simon Fraser University, 1973

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in the Department

of

Economics

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SIMON FRASER UNIVERSITY

March 1980

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Personal Income and Inflation in Canada During the Years 1966-1976

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Abstract

For two decades the Canadian economy has experienced persistent inflation. This thesis attempts to ascertain the impact of this inflation on the distribution of personal income during the period 1967-1976. A major part of the problem has been to disentangle the effects of changes in the rate of unemployment on income from the effects of inflation on income. To cope with this problem, five separate methodologies are used. These methods involve various applications of Lorenz Curves/Gini Coefficients and of regression analyses. While none of the methods prove to be entirely satisfactory, they collectively suggest some tentative conclusions regarding the impact of inflation on personal income. Perhaps more importantly, they serve to point out some of the difficulties and complexities inherent in any attempt to deal with macro data. These difficulties are pointed out.

The general conclusion of this thesis is that, despite very substantial increases in both the rate of inflation and the overall rate of unemployment during the period, there is no conclusive evidence to indicate that inflation had any significant impact upon the distribution of income in Canada.

Dedication

To my parents and to Sarah and Tony

Acknowledgements

I would like to express my special thanks to Peter Kennedy, my senior supervisor, for all his assistance and advice. Special thanks also go to my father, Rowland Sproul, for his help and encouragement from the very beginning and for acting as my liason with the university during my absence. I would also like to extend my warmest thanks to my mother, my family and a multitude of friends without whose encouragement I might never have finished. Finally, a very special thanks to my wife, Sarah, for all her patience and understanding and to both Sarah and her sister Leila for typing this manuscript.

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INTRODUCTION

During the 1970's inflation has become touted as the world's number one economic problem. Although inflation has various distributional, efficiency and stability effects on the economy, the one that most directly concerns people is the effect of inflation on personal income in terms of purchasing power. As prices rise, all segments of society struggle to cope with the increased cost of living and to maintain (or enhance) their relative economic position within the society. The intensity of this struggle is exemplified most clearly in those societies that suffer from "strata" inflation (defined as averaging a 30% increase, or more, in prices per annum) such as Brazil, Argentina and Chile. In these countries there appears to be a high degree of inflation-related social conflict. In the developed market economies of Europe and North America, by contrast, the inflation rate is much less, as are also the inflation-related social tensions, which manifest themselves chiefly in the form of strikes, taxpayer revolts, and the growth of consumer protection agencies.

This paper tries to isolate the effects of inflation on the personal incomes of various social groups in Canada (based on income class) during the decade 1966-1976. In making this attempt a major problem is to separate the effect of the level of employment on income from the effect of inflation

on income. In order to cope with the problem, five different techniques have been made use of. Three of these are based on adjustments to the data to eliminate the impact of unemployment while the remaining two use regression analysis to estimate the relevant impacts of unemployment and inflation.

SECTION I - REVIEW OF THE LITERATURE

The literature on inflation is enormous and, in one way or another, much of it touches on the effects of inflation on income and wealth. Many of these studies, such as those by Bach and Ando (1957) and by Friedman (1974) show that, during inflation, massive transfers of income and wealth take place from creditors to debtors, but do not make clear how various socio-economic groups are effected. Since nearly all economic units (persons, firms, etc.) are both creditors and debtors at one and the same time, the net results of these transfers present a confused and indeterminate picture.

Another general weakness of these studies is their failure to take into account changing levels of employment. Since unemployment tends to bear hardest on lower income groups (the young, the unskilled, the female worker), rather than affecting all income groups equally, it is obviously an important factor in the cause of changes in relative income shares. In fact, it has been argued by one writer (Lekachman, 1977) that full employment will do more toward redistributing income in an equitable manner than all other government policies put together. But the concern of this paper is, primarily, with the effects of inflation on personal income as distinct from the effect of unemployment on personal income and we are not here concerned with questions of the relationship between

inflation and the level of employment.

Two writers with rather different views on the effects of inflation on income groups are Tobin (1972) and Holzman (1964). The contrast between their two views highlights a major contention about the effects of inflation on income. According to Tobin inflation stimulates employment by bringing about a uniform reduction in real wages. As Tobin writes, "A general rise in prices is a neutral and universal method of reducing real wages; the only method in a decentralized and uncontrolled economy." Holzman contests the neutrality of this process, suggesting that those with greater economic power are better able to protect their incomes than those with less economic power. Those least able to adapt to inflation are not randomly scattered with respect to income but tend to be clustered at the bottom end of the income scale. As Holzman puts it, "...those hurt the most by inflation are an overlapping group consisting of the aged, retired, low income and asset families and individuals." The conclusions of this paper provide some evidence on this matter.

Since the five techniques used, in this thesis, to determine the effect of inflation on the distribution of income were all devised by the author, any review of the literature must be somewhat less specific than might otherwise be the case. That is to say, since no other investigator, as far as is known,

has used these methods, it is not possible to review the experience of others using them. This review, therefore, will consist of the five articles which were felt to be most pertinent. This represents approximately a 15% sampling of the articles read. The five articles to be reviewed are, in order, those by Kessel and Alchian (1962); Paglin (1975); Pesek (1960); Bach and Ando (1957); and the Economic Council of Canada (1976). The article by Kessel and Alchian constitutes a theoretical framework relative to the implications of inflation. The Paglin article illustrates the use of a methodology which is later adapted in the case of the methodology entitled, the Unemployment Gini. The Pesek article deals with inflation as a regressive tax. The Bach and Ando article deals with the influence of inflation on income distribution in the United States. Finally, the Economic Council of Canada article deals with the effect of inflation on income distribution in Canada during the major part of the same time period dealt with by the thesis.

The object of the article by Kessel and Alchian is to derive the theoretical implications of inflation. Kessel and Alchian distinguish between anticipated and unanticipated inflation and define "anticipated" and "unanticipated" in terms of the market phenomena implied by the postulate that prices are expected to rise or, alternatively, that the contemporaneous level of prices is expected to persist.

Inflation is dealt with as a tax on money (since it reduces the real value of nominal money balances) and in terms of the effect that inflation has on the demand for money. While money, relative to other assets, yields no explicit income stream, it competes with other assets because of its services as a hedge against relative price changes and because of its near zero transactions cost. The efficiency with which money performs these functions is adversely affected by inflation, which increases the cost of holding money and reduces the demand for it. Hence, during inflation, there is a movement from money to substitutes for money - notably, real assets and interest bearing securities.

Kessel and Alchian go on to deal with the economics, first of unanticipated inflation, then the transition from unanticipated to anticipated inflation, and finally to fully anticipated inflation.

In an unanticipated inflation prices rise generally but interest rates fail to rise enough to maintain pre-inflation economic relations between debtors and creditors. As a result, there are wealth transfers from net monetary creditors to net monetary debtors, plus the income effects associated with these wealth transfers.

In the transition period from unanticipated to anti-

cipated inflation there is a community-wide attempt to shift from monetary to real assets. The price of real assets, therefore, rises and, while nominal rates of interest also rise, the real rate fails to keep pace with inflation. This is part of the equilibrating process representing the desire of the community to hold its wealth in money, real assets, and monetary assets relative to the available stocks of each of these. As money holders adjust to the increased cost of holding money through shifting to real assets and other money substitutes (such as interest bearing securities) the community experiences a loss of efficiency due to the higher transactions cost of these assets. This loss of efficiency is the welfare cost of an anticipated inflation.

During ongoing, anticipated inflation all the trends noted relative to the transition period are continued. Prices rise at a constant rate but because of the increasing cost of holding money the production costs of industries which employ relatively money-intensive methods of production rise and their profitability falls vis-a-vis industries which employ less money-intensive methods. In the long run this difference in profitability implies a shift of resources toward less money-intensive production. For instance, industries which are relatively labour-intensive are also relatively money-intensive since wages are a larger part of their costs. Hence, in long-run inflation there is a tendency for production to become

more capital-intensive. Hence, the demand for labour falls and real wages decline.

As far as inflation-caused changes in the distribution of income and wealth are concerned the theory set forth in this article seems to imply:

1) That interest rates will suffer a relative decline in real terms. This decline will be greater in unanticipated inflation than if the inflation is partly or fully anticipated. This, in turn, suggests that during inflationary periods interest income will be a smaller fraction of total income than would otherwise have been the case (but not necessarily smaller than pre-inflation interest income).
2) That due to the long-run switch from labour-intensive to capital-intensive industry real wages will suffer a decline.
3) That due to the community's increased preference for real assets over monetary assets, and hence the relative increase in the value of real assets, the income returns to the holders of real assets will be a larger fraction of total income than would otherwise have been the case.

The Paglin article deals with the Lorenz Curve/ Gini Coefficient as a measure of the inequality of income distribution. Paglin argues that the 45 degree line of perfect equality, used in standard Lorenzian/Gini analysis, over-specifies the conditions of equality when used with annual

income data.

Paglin's argument is that, assuming no economic growth, the 45 degree line implies a flat (equal) age-income profile as one of the necessary conditions for income equality - an implication which is quite unwarranted. As an alternative, Paglin proposes a new function generated on a more careful and explicit definition of perfect equality. This restructuring is based on the premise that satisfactory conditions for perfect equality imply equal lifetime incomes but not the flat age-income profile implied by the 45 degree line. That is, all families would have the same age-income profiles.

Paglin generates the new reference line (to replace the 45 degree line) by taking average family income in each age group and then ranking the groups by mean income. As might be expected, the old and the young are clustered near the bottom. From this ranking, Paglin generates a Lorenz Curve and Gini Coefficient. Paglin call this Lorenz Curve the "P" Curve denoting perfect equality of lifetime earnings and the related Gini Coefficient is referred to as the Age-Gini. The area lying between the standard Lorenz Curve and the new "P" Curve becomes the measure of income distribution inequality and is represented by the Lorenz-Gini minus the Age-Gini. This new Gini, Paglin modestly christens "the Paglin-Gini".

One third of the income inequality indicated by 1972 U.S. income data, Paglin found, fell between the 45 degree line and the "P" line thus indicating that the degree of real inequality had been considerably overstated. United States data covering the period 1947 to 1972, using the Paglin-Gini, showed a decline in income inequality of some 23 percent. This compares to no change in income distribution using the standard Gini.

In summary, Paglin's method defines perfect equality, at any point in time, as equal incomes for all families at the same stage in their life cycle, but, not necessarily equal incomes between different age groups or equal lifetime earnings between different generations. In conclusion, Paglin remarks, that although many writers have stated that the 45 degree line has only mathematical significance, they, along with other users of the concept, have thrust upon it a considerable normative burden. This burden cannot really be avoided if one is to use the standard Lorenzian area of inequality as a measure of income distribution. He argues that by restructuring we are able to produce a measure that more realistically reflects our view of perfect equality, and hence the degree to which actual income distribution departs from this ideal.

In our third study Pesek compared the burden of inflation, considered as a form of taxation, with the alterna-

tive of an increase in income taxes or the imposition of a sales tax with food taxable and with food non-taxable. Pesek points out that Bach and Ando's (1957) conclusion, that everybody loses by inflation in proportion to his net monetary assets, is not fully satisfactory because it rests on the assumption that the alternative to the burden of inflation is no burden at all. In actual fact, since inflation is a phenomenom which serves the purpose of equilibrating supply and demand, the alternative facing the public is whether to bear the cost of inflation or some alternative economic policy designed to achieve equilibrium, for example direct controls or monetary or fiscal policy. Pesek's article estimates the relative impact on various income groups (and hence on the distribution of income) of inflation and the three alternative tax strategies.

In order to make the problem of comparison manageable, Pesek makes six simplifying assumptions,

1) that the supply of goods is perfectly inelastic, i.e. the demand function is based on the quantity theory of money. This means that the market will reach equilibrium if the public loses a given number of real dollars, regardless of whether the loss is caused by a price increase or by an increase in taxes;
2) that the taxes imposed as an alternative to inflation would

be such as to leave unchanged the proportion of the total income or sales taxes paid by each income group;

3) neglect of the fact that a general price increase would push some tax payers into a higher income-tax bracket;

4) that the entire sales tax is passed to the consumer;

5) that the public holds "composite shares" in which all the stocks in existence participate proportionally (instead of holding shares of various corporations). This assumption is made in view of the fact that, while the corporate sector as a whole is inflation-proof, many specific corporations are not. This avoids the need to consider that some income receivers hold a higher proportion of inflation-proof shares than others;

6) that changes in the rate of interest resulting from inflation or taxation can be ignored.

Pesek compares the costs of the four alternatives - inflation at 1%; an equivalent increase in income tax; an equivalent increase in sales tax (including food); an equivalent increase in sales tax (excluding food); - as these alternatives impinge on various income groups. Pesek proceeds as follows. First he lists monetary assets and monetary liabilities by family income groups (in the United States) and, by subtraction, arrives at net monetary assets of each group. He then applies a one percent inflation rate to these net assets in

order to calculate the potential capital loss of each income group. The total capital loss for all income groups combined is calculated. Pesek then "imposes" an alternate income tax designed to collect an amount equal in total to this same capital loss and shows how this would be distributed among the various income groups. Using an analagous procedure he then raises the same total amount by means of a sales tax with food taxable, and, again, by a sales tax with food non-taxable. Finally, he is able to present a table comparing the cost to each income group of a one percent inflation compared with the costs of each of the three alternate tax strategies.

The results of this comparison show that all families with incomes below $5,000 (in 1950) would pay the least if excess demand pressures are combatted by the use of income taxation. The income group receiving between $5,000 and $7,500 would find inflation to be the least burdensome tool of the equilibrating process, while the income group receiving in excess of $7,500 would prefer the sales tax with or without food taxable but preferably with food taxable. To put this another way, inflation presses most heavily on the lower income groups and the upper income groups and least heavily on the middle income group. As Pesek comments, some 35 million families out of a total of 49 millions have a clear incentive to support the use of an alternative (to inflation) equilibrating tool, namely the

use of income taxation. But he believes that this majority fail to initiate some tax action because of a basic distrust of the political process involved. Moreover, given a choice between inflation and the worst of the tax alternatives only 19 million out of the 49 million families would prefer any one of the three taxes to inflation. An important insight revealed by Pesek's figures (to the extent that reliance may be placed upon them) is that inflation is more regressive than would be an alternative income or sales tax. According to this finding, the lower income groups pay a disproportionably high share of the cost compared to any other solution to the problem of attaining equilibrium. A shift away from inflation to any one of the other three types of taxation would make the tax system more progressive.

Bach and Ando used the following four analytical propositions to provide guidance in analyzing the redistributional effects of inflation:

1) Inflation redistributes real purchasing power from those whose incomes rise more slowly as a result of inflation to those whose incomes rise more rapidly.
2) Inflation redistributes real purchasing power from those whose assets rise more slowly in price as a result of inflation to those whose assets rise more rapidly in price.
3) Inflation redistributes real purchasing power from creditors to debtors, when debts are stated in fixed dollar terms.

4) To the extent that accurate expectations of continuing inflation affect economic behaviour, the redistributional effects noted above will tend to be negated, except where readjustment of terms on economic contracts is prevented or retarded (by government rules, existence of long-term contracts, unequal knowledge, unequal bargaining power, etc.).

Using lead-lag theory, Bach and Ando interpreted these propositions to imply that wages would lag behind profits in inflation, while rents and interest would lag behind wages. They then proceeded to test this theory against empirical evidence for the period 1939-1952. Contrary to the theory they were testing their data showed that profits, rents and interest all lagged behind wages in terms of change in shares of total personal income during this 13 year inflation period. The labour share of total personal income rose by 6% while there was no change in rental incomes' share, a 4% decrease in the share going to interest income, and a 1% decrease in corporate profits after taxes. Further tests of the lead-lag theory using changes in percentage shares of total national income and per recipient income shares, slightly weakened but did not negate the conclusion that profits, rents and interest lagged behind the advance in labour income.

Bach and Ando then went on to test the theory that,

during inflation, real purchasing power is redistributed from creditors to debtors. They calculated that during the period 1939-1952 some $500 billion (in 1952 prices) of creditors claims were wiped out by inflation. Their data, based on a sectorized picture of the economy, listing five major net debtor and net creditor groups, showed that most of the $500 billion represented a transfer of real purchasing power from the household sector to the government sector. Government bond holders lose on both interest received and on the principal. But assuming that taxes are used to pay bond interest the government's gain, offsetting the loss to bond holders, accrues to tax payers. Since the higher income group carry a greater portion of the tax burden relative to their holdings of government bonds there exists a slight net benefit to this group. Bach and Ando, having identified the household sector as the major creditor group, proceeded to analyse the assets and debts of this group by money income, by occupation, by net worth and by age of the head of the household. The most significant finding of this analysis was that the upper age groups and especially retired families, because of their large net creditor position and high liquid asset ratio, are the greatest losers on asset account from inflation.

Overall, Bach and Ando concluded that inflation during the period studied had only minor impact on the distribution of current income among major income groups. But the

data for broad income groups tells us little about what may be happening to the income of various sub-groups. In Bach and Ando's words "...the redistributional impact of inflation is clearly more complex than is often suggested, requiring analysis cutting across, and through, the broad functional income groups to individual and smaller groups with clearly lagging incomes and substantial net creditor positions, not off-set by large holdings of variable price assets."

In our final review the Economic Council of Canada examined the effects of inflation (and other factors) on family incomes in Canada during the period 1969-1975. Their review was undertaken in view of the fact that the Economic Council of Canada Act stipulates that the Council should suggest how "all Canadians may share in rising living standards." Between 1965 and 1975 the average total income of all families in Canada rose by 135% but, since the consumer price index increased by 72%, the increase in real terms was about two thirds. The Economic Council devotes most of their report to the influence of demographic-related changes, in the Canadian population, on the distribution of incomes (i.e. the aging of families, changing family size, increases in the number of wage earners per family, etc.). They also mention the influence of other factors such as, changes in the demand for skills, regional development, the growth of collective bargaining, and changes in the employment rate, which last, they note, may fall

disproportionately on low-income families - but they make no attempt to quantify these factors. Finally, and subject to numerous reservations, they do make estimates of the effect of inflation on incomes, expenditures and net assets by age and income group during the period 1969-75.

the methodology used was that of determining the income/asset mix of a sample number of families classified, first by age, and then, again, separately, by income category in the base period and then estimating what would happen to these families over the six year period. The Economic Council assumed that the consumption and savings patterns in each income/age category remained stable throughout the period - that is, that the quantity and quality of the goods and services that each household bought, sold, or owned remained unchanged. Likewise they assumed stability throughout the period in the size of the family, number of earners and their occupations.

On the assumption that the proportion of income derived from different sources remained roughly constant between 1969 and 1975 for each income and age group, the Council estimated that those earning incomes of $4,000 or less in 1969 would have doubled that figure by 1975, that those with 1969 incomes in the $4,000 - $15,000 range would have increased their incomes by 70%, while those with incomes of

$15,000 and up in 1969 would have experienced gains of approximately 50%. In regard to expenditures, the Council found that the expenditures required in 1975 to maintain the same profile of consumption would have been roughly 47% higher than in 1969 for all groups. In the case of the value of net assets, the Council found a decrease on the order of 7-10% for the income groups below $4,000 and above $15,000, and for all age groups over 45 years. On the other hand, the value of the net assets of the middle income groups ($4,000 - $15,000) and of the age groups below 45 years increased between 5 and 20 percent.

The Economic Council of Canada interprets their findings as follows:

1) The highest-income group ($15,000 and over) realized the lowest relative gains on income and sustained the highest real capital losses on assets.
2) The lowest-income group (below $4,000) sustained real losses on their assets but these were partly offset by real income gains generated from enriched transfer payments.
3) Middle-income families gained through increased income and by an increase in the value of their net assets brought about by a reduction in the real value of their fixed obligations.
4) Overall the main losers from inflation during the period 1969-75 were the poorest and oldest groups and those among the very rich who held large amounts of financial assets.

The gainers, on the other hand, were the relatively young, middle and upper-middle class, especially those who had purchased homes prior to, or at the beginning of, the period.

In summary, the literature reviewed throws rather meager light on the effects of inflation on the distribution of income and, in some instances, the findings appear to be somewhat contradictory. There is general agreement that, during inflation, wealth transfers take place from net creditors to net debtors and with these transfers goes associated income effects. It seems clear that governments, as net debtors, are the single group most easily identifiable as gainers during inflation. But just how this translates into benefits or losses to specific income groups is much less clear. There also appears to be general agreement between the theory as set forth by Alchian and Kessel and the empirical findings of Bach and Ando and the Economic Council of Canada that real interest rates, and hence real interest income, suffer a relative decline during inflation, but again there is no clear identity between this phenomenon and income categories.

In the case of wage and salary income, the situation is even more confusing. According to theory inflation causes a relative decline in money-intensive industries, and since these industries are usually labour-intensive, a relative reduction in the demand for labour and hence a lowering of real

wages. But, the empirical findings of Bach and Ando seem to indicate that, during inflation, incomes from wages and salaries have forged ahead of income from profits, rents, and interest, and the findings of the Economic Council of Canada, while not clear-cut, also tend to support this view.

While much of the interest in inflation, and the concern about it, stems from a widely held belief that it redistributes income in such a way as to make the distribution less equal, there appears to be no strong empirical support for this argument in the literature.

SECTION II - METHODOLOGY

The aims of the methodology are two-fold: First to determine if there has been a redistribution of income in Canada during the decade 1966-76, and especially for the period 1972-76, traceable to inflation; and second, arising out of the first, to separate the impact of unemployment on the distribution of income from the impact of inflation on the distribution of income. In order to achieve these aims five separate methods will be used. Three of these rely on an adjustment of the data in order to eliminate the impact of unemployment, while the remaining two use regression analysis to estimate the relevant impacts of unemployment and inflation simultaneously. The five methods are entitled:

1) Normalizing by Equal Proportion;
2) The Unemployment Gini;
3) Cross-Sectional Regression;
4) The Aggregate Linear Model;
5) The Macro Model.

The first three of these methods are restricted to data for the period 1972-76. Each method will be discussed in turn including the data requirements, the assumptions made and the procedure to be used.

1) Normalizing by Equal Proportions

This method adjusts incomes over a five year period to reflect the level of unemployment that existed in the first year. For example, in those years where unemployment was greater than in the first year, incomes are adjusted upwards so as to reflect what incomes would have been without any increase in unemployment. Conversely, incomes are adjusted downwards in those years where unemployment was less than in the first year.

The data required are the unemployment rate and income by source for each income class. It is assumed that only two sources of income are affected by unemployment - that is, employment earnings and unemployment compensation; that total earned income, in any income class, is proportional to the percentage of the employed labour force in that class, and that, likewise, unemployment compensation from U.I.C. is proportional to the percentage of the labour force unemployed in that class. Hence, if the unemployment rate drops by one percent, transfer payments from U.I.C. will fall by a proportionate amount while employment earnings will rise by a proportionate amount.

The following are the steps in the procedure for this technique:

1) Determine the employment rate for each income class in each time period as follows:

$$E_{ij} = 100 - U_{ij} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

E_{ij} = the employment rate in period i for group j.

U_{ij} = the unemployment rate in period i for group J.

2) Adjust employment earnings for changes in the level of employment of each group in each period as follows:

$$\hat{YE}_{ij} = YE_{ij} \frac{E_{1j}}{E_{ij}} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

$\hat{YE}_{ij}$ = adjusted employment earnings for group j in period i.

YE_{ij} = unadjusted employment earnings for group j in period i.

3) Adjust transfer income from UIC for changes in the level of unemployment for each group in each period as follows:

$$\hat{YU}_{ij} = YU_{ij} \frac{U_{1j}}{U_{ij}} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

$\hat{YU}_{ij}$ = adjusted income from UIC in period i for group j.

YU_{ij} = unadjusted income from UIC in period i for group j.

4) Substitute the adjusted data for the unadjusted data in the original "income-by-source" data set.

5) The transformation of the data is now complete and the impact of changes in the level of unemployment from one period to the next has been neutralized. Any shifts in the distribution of the adjusted income detectable either through direct observation, shifts in the Lorenz Curve or changes in the Gini Coefficient may be attributed to inflation.

2) The Unemployment Gini

This method employs the technique used by Paglin (1975) to neutralize the income inequality, at any point in time, which can be directly related to the age of the earners. Paglin's technique involves generating a Lorenz Curve/Gini Coefficient for a subject group, whose ages are known, under the assumption that their life-time earnings are equal, but distributed unevenly over the duration of their lives, i.e. the highest incomes being earned during their mid-years, with negative or low incomes in early life,

and low incomes during retirement. Since this hypothesis assumes that earnings are lower in the early and late years and maximized in the mid-years, an unequal distribution of income is to be expected for a group homogenous in all respects except age. Using Paglin's technique it is possible to generate a Lorenz Curve/Gini Coefficient for a group which is homogenous in all respects except the level of unemployment and income derived from earnings. This Gini Coefficient (analogous to the Age Gini derived by Paglin) will be refered to as the Unemployment Gini and will measure that part of total income inequality due to unemployment.

Again, the data required for this method are the unemployment rate and income by source for each income class. The assumptions are:

(1) That the only two sources of income affected by changes in unemployment are employment earnings and transfer payments by way of unemployment compensation from UIC.

(2) That employment income in any income class in proportional to the percentage of the labour force in that class who are employed.

(3) That, likewise, unemployment compensation from UIC in any income class is proportional to the percentage of the labour force unemployed in that class.

(4) That prior to the introduction of unemployment in the model all incomes are equal in total amount although the proportions from various sources may vary (i.e. the 45 degree line of perfect equality). This assumption is necessary if the inequality of income related solely to unemployment is to be generated as a Lorenz Curve/ Gini Coefficient (the Unemployment Gini).

The procedure is as follows:

(1) Determine the employment rate for each group in each period.

$$E_{ij} = 100 - U_{ij} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

E_{ij} = the employment rate in period i for group j.

U_{ij} = the unemployment rate in period i for group j.

(2) Adjust earned income to reflect full employment.

$$\check{YE}_{ij} = YE_{ij} \frac{100}{E_{ij}} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

$\check{YE}_{ij}$ = adjusted employment earnings of group j in period i, assuming full employment.

YE_{ij} = unadjusted employment earnings of group j in period i.

(3) Determine employment income at full employment as

a proportion of full employment total income

$$\tilde{YE}_{ij} = \frac{\check{YE}_{ij}}{YT_{ij} - YU_{ij} + \check{YE}_{ij} - YE_{ij}} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

YE_{ij} = employment income as a proportion of total income in period i for group j assuming 100 percent employment.

YT_{ij} = total income in period i for group j.

YU_{ij} = transfer income from UIC for group j in period i.

(4) Determine transfer income from actual UIC as a proportion of employment income at 100 percent employment.

$$\check{U}_{ij} = \frac{YU_{ij}}{\check{YE}_{ij}} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

$\check{U}_{ij}$ = UIC transfer income as a proportion of total income.

(5) Determine the adjusted group income share.

$$\hat{GS}_{ij} = GS_{ij} \left[1 - \tilde{YE}_{ij} (1 - E_{ij}/100) + \tilde{YE}_{ij} \check{U}_{ij} \right]$$

for $\begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$

Where:

$\widetilde{GS}_{ij}$ = the adjusted group income shares.

GS_{ij} = a constant for all i, j, if all groups are of equal size. Otherwise equal to the proportion of the population represented by the group.

This step adjusts the group share to account for the fact that there is not full employment. This is accomplished by subtracting the income lost due to unemployment and adding the income received from unemployment insurance benefits.

(6) Determine the adjusted group income as a percentage of total income.

$$\hat{GS}_{ij} = \frac{\widetilde{GS}_{ij}}{\sum\sum \widetilde{GS}_{ij}} \qquad \begin{matrix} i = 1,2,3.....n \\ j = 1,2,3.....m \end{matrix}$$

Where:

$\hat{GS}_{ij}$ = adjusted group income as a percentage of total income.

On the basis of the adjusted group income shares, $\hat{GS}_{ij}$, it is now possible to trace out a Lorenz Curve depicting the distribution of income resulting solely from unemployment in any time period and to calculate the Unemployment Gini. By simple subtraction of the Unemployment Gini from the relevant total Gini a third Gini Coefficient is generated which excludes the impact of unemployment on the distribution of income. Intertemporal changes in this third Gini

Coefficient are assumed to be due to inflation.

3) Cross-Sectional Regression

The intent of this method is to isolate the impact of unemployment on the Gini Coefficient by examining groups which, while facing a common rate of inflation, face differing rates of unemployment.

The data here required are unemployment rates by age groups and income by age and income level. It is assumed:

(1) That the impact of any given change in the unemployment rate on the distribution of income, within any specific age group, is the same as for the population as a whole. While this is a very limiting assumption - since employment income as a proportion of total income varies with age - it is possible to restrict the analysis to those groups between 25 and 55 years of age. This confines the analysis to those groups where employment income is a more stable proportion of total income and thus reduces the variance of the estimator;

(2) that inflation has no impact on the distribution of income with respect to age. This assumption is unwarranted if we regress across the entire age spectrum - since there is some evidence that inflation does redistribute income from older age groups to younger age

groups - but this concern is likewise minimized by restricting the analysis to those between 25 and 55 years of age.

The procedure is as follows:

(1) Regress changes in the distribution of income over time, against changes in the age-specific unemployment rate over time.

$$G_{i+1,k} - G_{ik} = a(U_{i+1,k} - U_{ik}) + bT_1 + cT_2 + dT_3 + eT_4$$

$$i = 1,2,3.....n$$

$$j = 1,2,3.....m$$

Where:

G_{ik} = the Gini Coefficient for age group k in period i.

U_{ik} = the unemployment rate for age group k in period i.

T_1 = dummy variable equal to one for the first period and zero for all others.

T_2 = dummy variable equal to one for the second period and zero for all others.

T_3 = dummy variable equal to one for the third period and zero for all others.

T_4 = dummy variable equal to one for the fourth period and zero for all others.

(2) Regress changes in the distribution of income over time against changes in the age-specific unemployment rate and the inflation rate over time.

$$G_{i+1,k} - G_{ik} = a(U_{i+1,k} - U_{ik}) + bI_{i+1}$$

Where:

I_{i+1} = the inflation rate in period i+1

(3) Regress changes in the distribution of income over time against changes in the unemployment rate and the inflation rate over time.

$$G_{i+1,k} - G_{ik} = a(U_{i+1} - U_i) + bI_{i+1} + cS_1 + dS_2 + eS_3$$

$$i = 1,2,3.....n$$

$$k = 1,2,3.....m$$

Where:

S_1 = dummy variable equal to one for age group 25-34 and zero for all other age groups.

S_2 = dummy variable equal to one for age group 35-44 and zero for all other age groups.

S_3 = dummy variable equal to one for age group 45-54 and zero for all other age groups.

4) The Aggregate Linear Model

This technique is the most direct approach to separating the impact of inflation from the impact of unemployment in the Gini Coefficient. It consists of regressing changes in the Gini Coefficient against the inflation rate and changes in the unemployment rate. It differs from the preceding Cross-Sectional Regression

technique in that it deals with aggregate changes in the Gini Coefficient rather than age-specific changes. In order to generate estimates of sufficient accuracy the analysis must be extended to cover a time period of at least ten years. The data requirements are, again, unemployment and inflation rates, plus aggregate income subdivided by income size.

The assumptions underlying this method are:

1) that the inflation rate and changes in the unemployment rate are independent of one another;
2) that the relationship between the dependent and independent variables has been stable over the time period analysed.

The procedure is as follows:

1) Regress changes in the distribution of income over time against the level of inflation and changes in the level of unemployment. Unemployment has a "one-shot" effect by moving the unemployed from one position on the income scale to another. Thus it is the change in the level of unemployment that causes change in the income distribution. Inflation, on the other hand, has a continuous impact on the distribution of income since people are never all equally able to adjust to it. Therefore, it

is the level of inflation that causes redistribution of income and not the change in level.

$$G_{i+1} - G_i = a(U_{i+1} - U_i) + b\left(\frac{I_i + I_{i+1}}{2}\right).$$

Where:

G_i = the Gini ratio for period i.

U_i = the unemployment rate in period i.

I_i = the inflation rate in period i.

Note: Rather than choosing the inflation rate in either period i or i+1 the rate has been averaged over the two periods, which overcomes the problem of determining whether to use the inflation rate of i or i+1.

5) The Macro Model

This method consists of breaking aggregate income into its component parts which, for purposes of this analysis, are four in number - income from employment, income from transfer payment, interest income, and "other" income, principally from business profits. The influence of changes in the unemployment rate and of inflation on these component parts is then examined. As in method #4 data covering a period of at least ten years is desirable.

The data required are unemployment and inflation rates, aggregate income subdivided by source for each

income group and real gross national product. It is assumed:

1) that changes in income from employment are a function of changes in the unemployment rate, the inflation rate, and real growth of the economy. The magnitude of the impact of each of these variables is related to the level of income;

2) that changes in interest income are a function of the inflation rate, and the real growth of the economy. Interest income as a function of the inflation rate is based on the hypothesis that interest rates at least partially compensate for inflation over time, thus generating more income for a given level of interest bearing assets. The implicit assumption is made that savings in the form of interest bearing assets will not fall sufficiently to offset the increased income generated by higher interest;

3) that changes in the size of transfer income are a function of changes in the unemployment rate, and the inflation rate on the assumption that transfer payments are adjusted for inflation. The impact of the unemployment rate will vary across income groups;

4) that changes in other income are a function of the inflation rate, and the general growth rate.

The procedure is as follows:

(1) Taking first differences with respect to the following identity

$$Y_{ij} = E_{ij} + I_{ij} + TR_{ij} + O_{ij} \qquad i = 1,2,3.....n \qquad j = 1,2,3.....m$$

The following difference equation may be generated

$$Y_{i+1,j} - Y_{ij} = A_{ij}E_{ij} + B_{ij}I_{ij} + C_{ij}TR_{ij} + D_{ij}O_{ij} \qquad i = 1,2,3.....n \qquad j = 1,2,3.....m$$

Where:

A_{ij} = the percentage change in employment income from period i to period i+1 for all j.

B_{ij} = the percentage change in interest income from period i to period i+1 for all j.

C_{ij} = the percentage change in transfer income from period i to period i+1 for all j.

D_{ij} = the percentage change in other income from period i to period i+1 for all j.

(2) Using the data for the various years and income groups, calculate the coefficient A_{ij}; B_{ij}; C_{ij} and D_{ij} for all i,j.

(3) Regress each of the coefficients A through D against the relevant variables in accordance with the initial assumptions.

$$A_{ij} = Z_jU_i + Y_jI_{i+1} + X_jG_i \qquad i = 1,2,3.....n \qquad j = 1,2,3.....m$$

$$B_{ij} = SI_{i+1} + KG_i \qquad i = 1,2,3.....n \quad j = 1,2,3.....m$$

$$C_{ij} = T_jU_i + VI_{i+1} \qquad i = 1,2,3.....n \quad j = 1,2,3.....m$$

$$D_{ij} = MI_{i+1} + NG_i \qquad i = 1,2,3.....n \quad j = 1,2,3.....m$$

Where:

U_i = the change in the unemployment rate between period i and period i+1.

I_{i+1} = the inflation rate in period i+1

G_i = the change in the real gross national product between period i and period i+1 expressed as a percentage.

SECTION III - APPLICATION OF METHODOLOGY AND RESULTS

The Gini Coefficient varied very little between 1966 and 1976, and even less between 1972 and 1976, as shown in table A, below: (These Gini Coefficients were calculated as a preamble to the application of the methodology).

TABLE A

Gini Coefficients - Personal Income 1966-1976

Year	Gini Coefficient	Index of Gini Coefficient
1966	0.4095	100.0
1967	0.4148	101.3
1968	0.4228	103.2
1969	0.4298	105.0
1970	0.4342	106.0
1971	0.4320	105.5
1972	0.4324	105.6
1973	0.4340	106.0
1974	0.4354	106.3
1975	0.4318	105.4
1976	0.4255	103.9

Income inequality increased slightly during the late sixties and early seventies peaking in 1974 with a Gini Coefficient of 0.4354 some 6.3 percent above that in 1966. The Lorenz

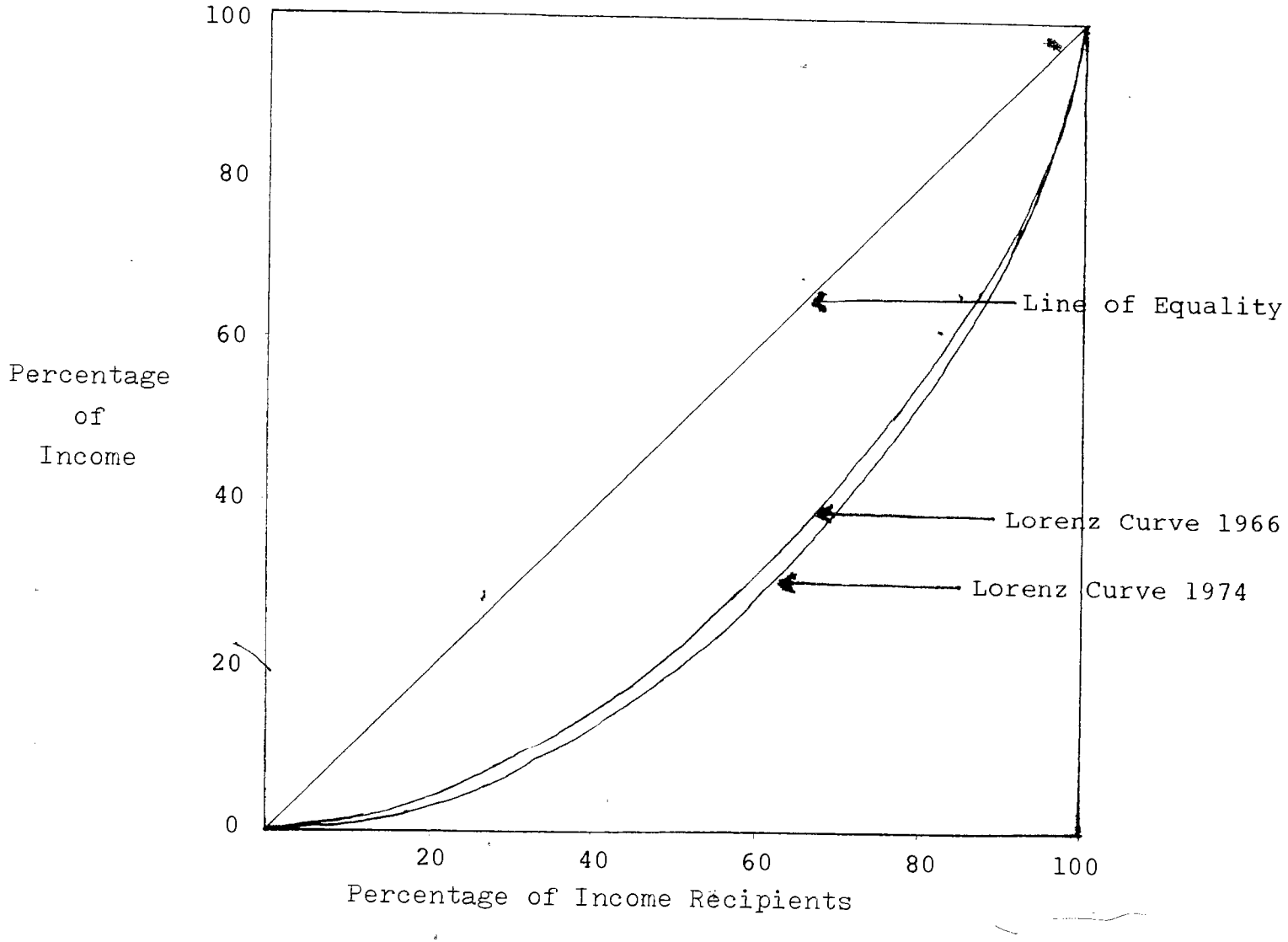
Curves depicting the distributions of income in 1966 and 1974 are shown in Graph A. Such a small change in the distribution of income seems quite remarkable in view of the fact that both the Consumer Price Index and the unemployment rate increased by 50% during the 1966-74 period, from 83.5 to 125.0 for the CPI and from 3.6% to 5.3% for unemployment. The results of applying the five methods outlined in the previous section will now be discussed, in turn, with a view to elucidating this remarkable stability of income distribution.

1) Normalizing by Equal Proportion

This method involved adjusting all income classes over the period 1972-76 to reflect the rate of employment in effect in 1972, the base year. Since we nowhere could find unemployment by income class as a reported statistic it was necessary to devise some way of generating these figures. This was accomplished by applying the age-specific unemployment rates, for each year, (as reported in the Labour Force Survey) to the age-specific income distribution, for each year, thereby generating the number of unemployed in each income class. The income-specific unemployment rates for each year were then generated by expressing the number of unemployed in each income class as a percentage of the total number of persons in each class. This technique assumes that unemployment within any given age group is evenly distributed with respect to income

GRAPH A

Lorenz Curves for 1966 and 1974



but that unemployment within any given income group varies according to the age distribution within that group. It must be admitted that these assumptions somewhat over-simplify matters since, a priori, one would expect that the lowest income groups suffer more unemployment than do higher income groups. Yet the method chosen would give such lower income groups the same overall unemployment rate as higher income groups provided both groups had the same age distributions. Moreover, during rising unemployment, those persons affected tend to drop to a lower income group. Therefore, it is necessary to keep in mind that the method used has a bias toward distributing unemployment more evenly with respect to income than is actually the case. The justification for using this method is that it partially solves what otherwise appears to be an unsolveable problem in allocating unemployment to income groups. Moreover, the resulting distribution of unemployment is still skewed in the right direction (although it may not be skewed enough) because the lower income groups contain a higher proportion of the lower age groups than do the upper income groups.

Following the adjustment of income for unemployment during the years 1972-76 in accordance with the foregoing explanation, and in accordance with the procedures outlined in the "methodology" section, a new set of Gini Coefficients were calculated as shown in Table B (which also shows the

inflation rate and overall unemployment rate for each year).

TABLE B

Gini Coefficients for 1972-76 Corrected for Impact of Unemployment on Income Distribution

Year	Uncorrected Gini	Uncorrected Gini Index	Corrected Gini	Corrected Gini Index	Inflation Rate	General Unemployment Rate
1972	0.4324	100.0	0.4324	100.0	4.8	6.2
1973	0.4340	100.4	0.4465	103.3	7.5	5.6
1974	0.4354	100.7	0.4258	98.5	10.9	5.3
1975	0.4318	99.9	0.4336	100.3	10.8	6.9
1976	0.4255	98.4	0.4297	99.4	7.5	7.1

The corrected Gini Coefficients are all correlated with movements in the unemployment rate as we would, a priori, expect - that is when the Gini Coefficient falls (following correction), indicating a more even distribution of income, the unemployment rate falls too and, vice versa, when the Gini Coefficient rises, indicating a less even distribution of income the unemployment rate rises too. But in Table B there is one exception. In 1973 the Gini Coefficient rises from 0.4340 to 0.4465 at the same time that the unemployment rate is falling. This one inconsistent result is most probably accounted for by the method used in calculating the unemployment rate for each income class. It will be remembered that the bias that

was introduced was in assuming that unemployment is more evenly distributed among income classes than is actually the case, i.e. the imputed rates are probably too high for the upper income groups and too low for the lower income groups. If this is the case, it could happen that as unemployment declines, and as employment income rises, and unemployment insurance transfer payments fall, the net income adjustments that take place are disproportionately high for the upper income groups and disproportionately low for the lower income groups. The force of these factors could have been strong enough, in this one instance, (where the relative movements are of small magnitude anyway) to make it appear, following adjustment, that income distribution became less equal in the face of falling unemployment. If the line of reasoning is correct, then elimination of the bias would have resulted in a lower Gini Coefficient for 1973, perhaps bringing it into line with the fall in unemployment. By the same token, the Gini Coefficient for 1974 would fall even more than is shown, while the 1975 and 1976 Gini Coefficients would rise. This is another way of saying that the unbiased data would even more strongly support the assumption that increased employment tends to make income distribution more equal.

Table B shows that the rate of inflation and the level of unemployment are inversely correlated. Therefore, since the distribution of income remained relatively stable

throughout the period, high rates of inflation must offset low levels of employment, and vice versa, as these affect the distribution of income. If we were to conclude that low unemployment increases the inequality of income then we would have to conclude that a rising level of inflation would lead to greater equality. Or, conversely, if we were to conclude that low levels of unemployment give rise to increasing equality of income, then high levels of inflation must tend toward greater inequalities of income. The results are, of course, also compatible with the hypothesis that neither inflation nor unemployment affect the distribution of income. However, we reject this hypothesis because it so strongly conflicts with theory regarding the implications of inflation and the implications of unemployment.

Although the results of the test are not strongly conclusive one way or the other, our estimate of the bias involved would seem to point to the conclusion that low levels of unemployment tend to promote a more even distribution of income while rising inflation has the opposite tendency. During 1972-76 these opposing forces appear to have worked with a sort of rachet effect to keep the distribution of income virtually constant.

2) The Unemployment Gini

As noted in the methodology, the Unemployment Gini is an extension of the technique used by Paglin to neutralize

the income inequality which can be directly related to the age of earners. The unemployment rate, by income class, was calculated in the same way as in the Normalizing by Equal Proportion method already discussed. Hence the resultant data has the same bias as in the previous method, namely that the unemployment rate by income class is probably not sufficiently skewed to the low end of the income scale.. Also, in this situation, since unemployment insurance payments are based on actual data, they tend to overcompensate those at the lower end of the income scale and undercompensate those at the upper end of the income scale given the bias in the relevant employment rates.

Income by source and income class was taken for each of the years 1972 to 1976, both inclusive, from the appropriate issues of Revenue Canada's annual publication, Taxation Statistics. The procedure involved defining an income distribution with a Gini Coefficient equal to zero (i.e. total income equality) and then, for each of the years 1972 to 1976 adjusting the various income shares to reflect the varying levels of unemployment by income class related to the aggregate level of unemployment (see methodology section). The resultant distribution generates what we have defined as the "Unemployment Gini" for the years 1972 to 1976. These Unemployment Gini Coefficients are then subtracted from the aggregate Gini Coefficients for each year 1972 to 1976. This generates an adjusted Gini Coefficient for each year which is free from the

distributional impact of unemployment. The Unemployment Gini Coefficients derived by this method are reported in Table C.

TABLE C

Unemployment Gini Coefficients and Adjusted Gini Coefficients 1972-1976

Year	Unemployment Gini	Aggregate Unemployment Rate	Adjusted Gini	Inflation Rate
1972	-0.0156	6.3	0.4480	4.8
1973	-0.0240	5.6	0.4580	7.5
1974	-0.0137	5.4	0.4491	10.9
1975	-0.0133	6.9	0.4451	10.8
1976	-0.0284	7.1	0.4539	7.5

The negative sign found on each of the Unemployment Gini Coefficients is counter intuitive since it is generally believed that unemployment hurts those at the low end of the income scale proportionately more than those at the top end of the income scale. Thus, unemployment is expected to cause a redistribution of income in favour of the middle and upper income classes, hence making income distribution less equitable than that prevailing prior to the increase in unemployment. But the Unemployment Gini Coefficients in Table C indicate the exact opposite of this expectation - namely that unemployment

increases the equality of income. This result is in agreement with the finding for one of the years (1973) using the previous method of "Normalizing by Equal Proportions." It will be recalled that this one inconsistent result was attributed to the bias introduced in calculating the unemployment rate for each income class. The negative sign on the Unemployment Gini Coefficients may also be due to this same bias. If, for instance, unemployment impinged solely on the lower income groups (unemployment insurance not fully compensating for income from employment losses) the Unemployment Gini Coefficients would certainly be positive. But, lacking precise information on how unemployment impinges on various income classes, the suggestion that Unemployment Gini Coefficients would be positive if these were known is only a conjecture. This is another way of saying that we have found no method of estimating the magnitude of the bias introduced by the procedures used for estimating unemployment by income class.

The results of Table C and the preceding discussion, do however reveal one important proposition, namely that it is the distribution of unemployment across income classes and not the overall level of unemployment which is important in determining the distributive effects of unemployment on income. For instance, with reference to Table C, the 1972-73 results suggest that greater equality of income is associated with a lower unemployment rate, as both the unemployment rate and the Unemploy-

ment Gini Coefficient fell - the unemployment rate from 6.3 to 5.6 percent and the Gini Coefficient from -0.0156 to -0.0240. Yet the 1975-76 data show the exact opposite with the unemployment rate rising from 6.9 to 7.1 percent while the related Gini Coefficient fell from -0.0133 to -0.0284. Clearly the aggregate unemployment rate alone is not a good predictor of changes in the distribution of income due to unemployment. Later on, it will be seen how this observation translates into low "t" statistics when changes in the level of aggregate unemployment are used as an explanatory variable in an aggregate model of changes in income distribution. Meaningful analysis must focus on the distribution of the unemployed by income class and not on the aggregate level of unemployment.

The "adjusted" Gini Coefficients appear to be contradictory regarding the impact of inflation on the distribution of income. For instance, in Table C the 1973-74 and 1975-76 periods suggest that higher rates of inflation lead to greater income equality with an increase in the inflation rate in 1973-74 (7.5 to 10.9 percent) coupled with a fall in the Gini Coefficient while in 1975-76 a fall in the inflation rate (10.8 to 7.5 percent) is coupled with a rise in the Gini Coefficient. But the exact opposite conclusion is suggested by an examination of the periods 1972-73 and 1974-75. In 1972-73 the inflation rate rises (4.8 to 7.5 percent) while the associated Gini Coefficient also rises. In 1974-75 the

inflation rate falls (10.9 to 10.8 percent) while the associated Gini Coefficient also falls, although in this case the changes are very small. Movements of inflation and Gini Coefficient in the same direction, of course, indicate that inflation leads to lesser income equality. Since, a priori, it seems unlikely that inflation can make for greater income equality in some years and lesser income equality in other years, it seems likely that these contradictory findings are also a result of the bias in the distribution of unemployment across income classes. If it were possible to eliminate this bias, it is not unreasonable to expect that the resultant changes in the Adjusted Gini Coefficient would result in a more consistent interpretation of the impact of inflation on the distribution of income.

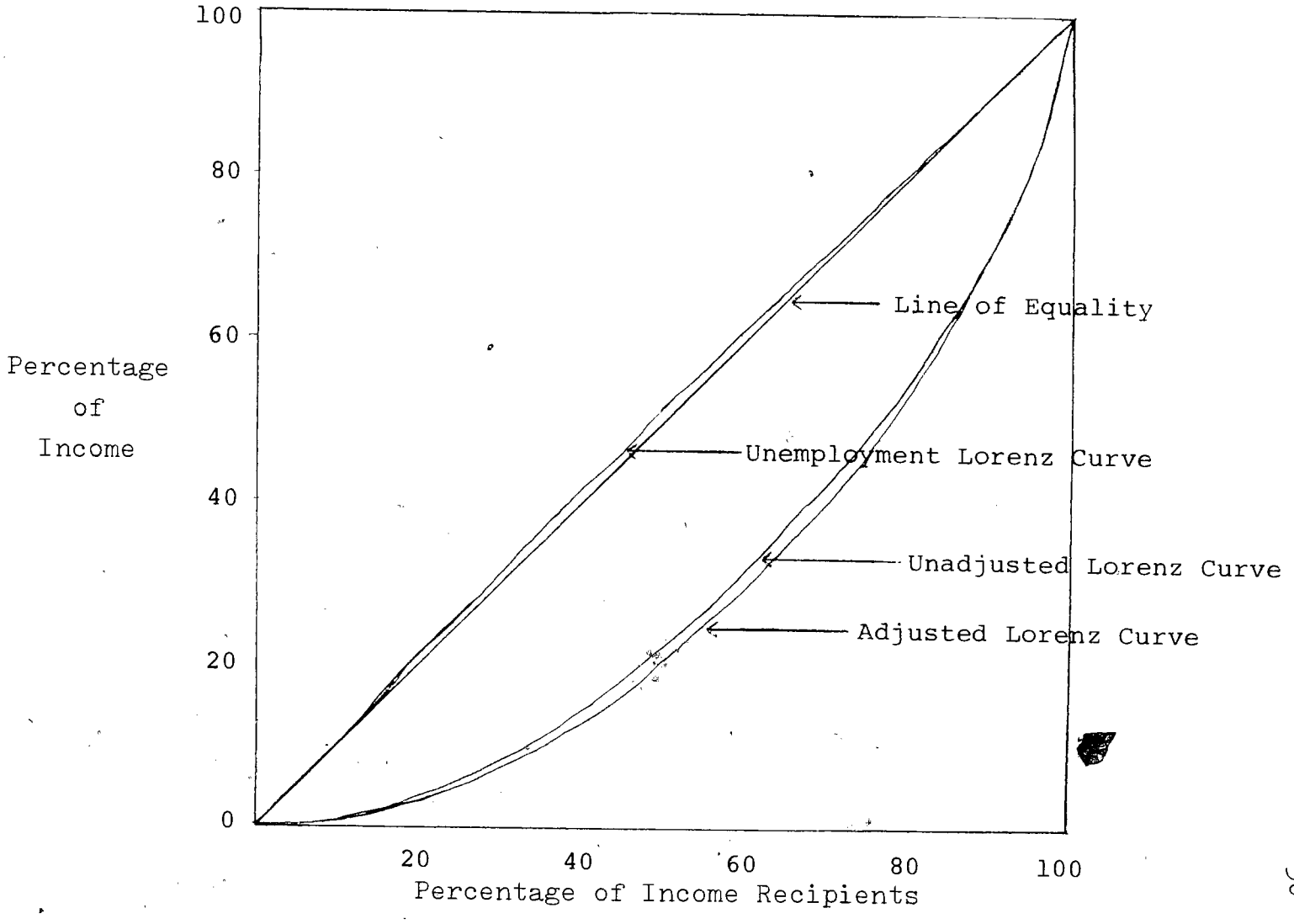
Graph B depicts the unadjusted Lorenz Curve, the adjusted Lorenz Curve and the unemployment Lorenz Curve for the year 1976.

3) The Cross-Sectional Regression Model

In this technique sample size was expanded by using age groupings within each time period. Specifically, three age groups within each year of a five year period were examined. The underlying assumptions (as stated in the methodology section) are as follows: 1) the impact of any given change

GRAPH B

Lorenz Curves for 1976



in the unemployment rate on the distribution of income within any specific age group is the same as the impact of any change of the unemployment rate for the population as a whole; 2) inflation has no impact on the distribution of income with respect to age. These two assumptions are made possible (as spelled out in the methodology section) by restricting the data to the population aged 25 to 55.

Changes in the Gini Coefficient (distribution of income) for various age groups were regressed in three separate ways:

1) Against changes in the age-specific unemployment rates.
2) Against changes in the age-specific unemployment rate and the annual inflation rate.
3) Against changes in the average unemployment rate and the inflation rate.

Age specific unemployment rates were taken from the Labour Force Survey. The inflation rate was calculated on the basis of changes in the Consumer Price Index as reported in the Statistical Review. The Gini Coefficients were calculated using data on income by age groups as reported in the Revenue Canada publication, Taxation Statistics.

Regression Analysis # 1

The first hypothesis tested was that differences in

the extent Gini Coefficients change for various groups between one year and the next are explained by the fact that changes in unemployment rates vary between groups. To test this hypothesis age-specific changes in the Gini Coefficients were regressed against age-specific changes in unemployment rates between 1972 and 1976. Four dummy variables were used to account for factors other than unemployment which may have affected the distribution of income over time. This regression was formulated as follows:

$$G_{i+1,k} - G_{ik} = a(U_{i+1,k} - U_{ik}) + bT_1 + cT_2 + dT_3 + eT_4$$

Where:

G_{ik} = the Gini Coefficient for age group k in period i.

U_{ik} = the unemployment rate for group k in period i.

T_1 = dummy variable equal to one for the first period and zero for all others.

T_2 = dummy variable equal to one for the second period and zero for all others.

T_3 = dummy variable equal to one for the third period and zero for all others.

T_4 = dummy variable equal to one for the fourth period and zero for all others.

It was further hypothesized that increases in unemployment would result in a less equal distribution of income while reductions in unemployment would have the opposite effect.

Hence, it was expected that the unemployment coefficient (a) would be positive.

The following table lists the estimates of the coefficients a, b, c, d, and e.

TABLE D

Cross-Sectional Regression - Coefficients

Estimate of a =	0.0095	(2.75)*
Estimate of b =	0.0058	(2.21)*
Estimate of c =	-0.0021	(-1.36)
Estimate of d =	-0.0290	(-6.47)*
Estimate of e =	-0.0060	(-4.23)*
F value =	36.55*	
$\bar{R}^2$ value =	0.94	

Note: The bracketted number to the right of each coefficient is the corresponding "t" value. Those coefficients with "t" values falling within the upper or lower five percent of the distribution are marked with an asterisk (*) indicating that they are considered to be significantly different from zero. The F value and corrected R^2 pertaining to the whole relationship are listed at the end of the table. Those F values falling within the

ten per cent tail are denoted by an asterisk (*) indicating they are significant. The Durbin-Watson test did not indicate auto-correlation. This note applies to all three regression analyses in this section and hence will not be repeated after each of the next two tables.

The relationship proved to be very significant with a positive unemployment coefficient (a) as expected. This result lends credence to the theory that increases in unemployment tend to make the distribution of income less equal as they more strongly affect those marginal workers who occupy the low end of the income scale. It should also be noted that, with the exception of (c), the dummy coefficients proved significant, indicating the presence of other factors affecting the distribution of income. In the last two years the impact of these factors was negative, indicating that they tended to reduce the inequality of income that would otherwise have been present.

Regression Analysis #2

The second hypothesis is similar to that under the previous analysis, except that in place of dummy variables the inflation rate was used as the explanatory variable for these changes. The regression is formulated as follows:

$$G_{i+1,k} - G_{ik} = a(U_{i+1,k} - U_{ik}) + bI_{i+1}$$

Where:

G_{ik} = the Gini Coefficient for age group k in period i.

U_{ik} = the unemployment rate for age group k in period i.

I_i = the inflation rate in period i.

Again, it was hypothesized that the unemployment coefficient (a) would be positive for the reasons previously stated. It was also hypothesized that the inflation coefficient (b) would be positive, as some current theory suggests that inflation makes the distribution of income less equal. The following table lists the estimates of (a) and (b).

TABLE E

Cross-Sectional Regression - Coefficients

Estimate of a =	-0.0069	(-3.80)*
Estimate of b =	-0.0007	(-4.69)*
F value =	23.99*	
$\overline{R^2}$ value =	0.70	

Both the unemployment and the inflation coefficient proved to be highly significant. The corrected R^2 value was slightly lower than in the previous regression but was not negligible. But the negative sign on the coefficients suggests that increases in the unemployment rate and in the inflation

rate both cause more equal distribution of incomes. Since these apparent results contradict our hypothesis, two explanations are possible. Either there exist other factors affecting income distribution which were strong enough to more than offset the influence of increased unemployment and inflation, or, the hypothesis is wrong. More study needs to be undertaken in this connection particularly since the third regression (to follow) indicates similar results.

Regression Analysis #3

This analysis is similar to #2 except that, first, the average unemployment rate was used in place of age-specific unemployment rates and, second, dummy variables were added to the equation to separate the differing effects of unemployment and inflation on different age groups. This relation is formulated as follows:

$$G_{i+1,k} - G_{ik} = a(U_{i+1} - U_i) + bI_{i+1} + cS_1 + dS_2 + eS_3$$

Where:

$G_{i,k}$ = the Gini Coefficient for age group k for period i.

U_i = the unemployment rate in period i.

I_i = the inflation rate in period i.

S_1 = dummy variable, equal to one, for age group 25 - 34, and zero for all other age groups.

S_2 = dummy variable, equal to one for age group 35 - 44, and zero for all other age groups.

S_3 = dummy variable, equal to one for age group 45 - 54, and zero for all other age groups.

As before the unemployment and inflation coefficients, (a) and (b), were assumed to be positive and since the impact of both unemployment and inflation were assumed to be greater for the youngest and oldest age groups than for the middle age group the coefficients (c) and (e) were expected to be significant. The following table lists the estimates of coefficients a, b, c, d, and e.

TABLE F

Cross-Sectional Regression - Coefficients

Estimate of a =	-0.0070	(-5.06)*
Estimate of b =	-0.0005	(-0.76)
Estimate of c =	-0.0003	(-0.05)
Estimate of d =	-0.0003	(-0.05)
Estimate of e =	0.0005	(-0.08)
F value =	16.86*	
$\overline{R^2}$ value =	0.87	

The above regression was also run a second time dropping the dummy variable c. The results did not differ significantly except that the inflation coefficient (b) then became significant. These results are as follows:

TABLE G

Cross-Sectional Regression - Coefficients

Estimate of a =	-0.0070	(-5.97)*
Estimate of b =	-0.0006	(-3.14)*
Estimate of d =	-0.00002	(-0.01)
Estimate of e =	0.0002	(-0.11)
F value =	24.073*	
$\overline{R^2}$ value =	0.88	

Both formulations of the hypothesis proved significant and generated high corrected R^2 values. In both cases the unemployment coefficient (a) proved significant and, in the second formulation, the inflation coefficient, (b), proved significant as well. In neither case did the dummy variables prove significant. Both the unemployment and inflation coefficients were again negative, indicating either that our hypothesis is false or that other unspecified factors are strong enough to negate the influence of unemployment and inflation.

Since the dummy variables proved insignificant in both of the above runs they were entirely dropped on a third run with results that were not significantly different from those previously obtained. These results were as follows:

TABLE H

Cross-Sectional Regression - Coefficients

Estimate of a =	-0.0069	(-6.70)*
Estimate of b =	-0.0006	(-5.90)*
F value =	60.068*	
$\overline{R^2}$ value =	0.91	

4) The Aggregate Linear Model

This method consists of regressing changes in the Gini Coefficient against both the level of inflation and changes in the unemployment rate via the linear relationship:

$$G_{i+1} - G_i = a(U_{i+1} - U_i) + b\left(\frac{I_i + I_{i+1}}{2}\right)$$

Where:

G_i = the Gini Coefficient for period i.

U_i = the unemployment rate for period i.

I_i = the inflation rate for period i.

The Gini Coefficients for the years 1966-76 were calculated on the basis of income data from Revenue Canada's annual Taxation Statistics, the unemployment rates were taken from the Statistics Canada publication Selected Economic Indicators, and inflation rates were calculated from the Consumer Price Index taken from the same sources.

Unfortunately, the results of this analysis proved to be a good deal less than satisfactory. Not only were the explanatory variables (unemployment and inflation) rejected as being insignificant individually but the R^2 and the F test categorized the entire relationship as non-meaningful in terms of its explanatory value. The actual results were as follows:

$$G_{i+1} - G_i = 0.0053\ (U_{i+1} - U_i) + 0.0001\ \left(\frac{I_i + I_{i+1}}{2}\right)$$

$t = 0.208$	$t = 0.048$
$F = 0.036$	$R^2 = 0.0089$
R^2 = not meaningful	Durbin-Watson = 0.48

The Durbin-Watson statistic of 0.48 indicates that the errors are autocorrelated. This suggests that the relationship is mis-specified either in terms of content (i.e. omitted variables) or in terms of form. In terms of omitted variables, a possible candidate may be the real growth in GNP. Unless the results of real growth in terms of income are proportionately divided among all income classes, real growth in the economy will alter the distribution of income. In a later method, the possible effects of real growth on the distribution of income is, in fact, taken into account.

There is also a real possibility of mis-specification in terms of form. The Gini Coefficient as a single number measure of the distribution of income is not related

to unemployment and inflation in any obviously simple fashion. However, it is approximately linearly related (as an analysis of the process by which the Gini is calculated will show) to the level of inflation and changes in the unemployment rate, given that the change in the proportion of income going to any particular group is itself linearly related to inflation level and changes in the unemployment rate. But, while it may be true that the change in income going to any group is linearly related to the inflation and unemployment variables, it is not necessarily true that the proportion of income going to these groups is so related. Thus the Gini Coefficient may not be a simple linear function of these two variables either. The actual relationships may be much more complicated.

It can be argued that the true functional form of the relationship does not easily lend itself to regression analysis. The true relationship could perhaps be adequately defined by the inclusion of a sufficient number of variables or by transformed variables. While the latter is quite possible, the inclusion of additional variables is limited by the small number of data available to regress against.

One possibility in connection with this method is the chance of increased error when change variables are regressed against change variables. In order to assess this possibility the Gini Coefficient (rather than the change in the Gini) was

regressed against the unemployment rate and the inflation rate as per the following equation:

$$G_i = a + bU_i + cI_i$$

Where:

G_i = the Gini Coefficient for the period i.

U_i = the unemployment rate for period i.

I_i = the inflation rate for period i.

The results of this regression were as follows:

$$G_i = 0.4019 + 0.0043U_i + 0.0004I_i$$

$t = 41.5$ $t = 2.18$ $t = 0.48$

$F = 3.77$ $R^2 = 0.485$ $R^2 = 0.357$

Durbin-Watson = 0.71

As might be expected, the intercept term proved highly significant. The unemployment and inflation coefficients are both positive, in part confirming the results of the original regression. The unemployment coefficient proved significant while the inflation coefficient proved insignificant. The overall results, although more positive than those of the regression using changes in the Gini Coefficient, are still less than satisfactory. The Durbin-Watson statistic still indicates auto-correlation, thus suggesting that the comments made in regard to the original regression apply in this instance as well.

5) The Macro Model

This method involves separating total income for each income group (groups ranked on the basis of income size) into four component parts according to the source of income. These four parts are:

1) Income from employment.
2) Interest income.
3) Income from transfer payment.
4) Other income.

These four parts together comprise "Total income." Changes in income in each category between time periods is hypothesized to be dependent on changes in the unemployment rate, the level of inflation, and the percentage growth in real gross national product or on some combination of these three. This hypothesis is then tested separately for each of the four sources of income, and for total income, by regression against one or more of the three determinants of income (the exact combination of determinants to be specified in each of the five regressions).

Income by source for each income group was taken from Revenue Canada's publication Taxation Statistics for each of the ten years in the period 1967 to 1976. The data was restructured to comprise ten groups ranked by size of income with ten percent of the total number of taxpayers in

each group. Unemployment rates and real gross national product figures for the same ten year period were taken from the Statistics Canada publication Selected Economic Indicators. The relevant inflation rates were calculated from the Consumer Price Index.

The results of each of the five regression analyses will be tabled and discussed in turn. In the case of each regression analysis (and to avoid repetition) the following remarks apply

1) The bracketted number to the right of each coefficient is the corresponding "t" value. Those coefficients with "t" values falling within either the upper or lower 5 percent of the distribution are marked with an asterisk (*) indicating that we consider them significantly different from zero.
2) The F value pertaining to the entire relationship is placed in the farthest column to the right. Those values falling in the 10 percent tail are denoted by an asterisk (*).
3) The Durbin-Watson statistics are not reported as in no instance was autocorrelation indicated.

Analysis - Income from Employment

It is hypothesized that percentage changes in employment income from period i-1 to period i are a function of

the change in the unemployment rate from period i-1 to period i; the inflation rate in period i; and real growth in the economy from period i-1 to period i expressed as a percentage. This relationship is summarized in the following equation:

$$A_{ij} = Z_j U_i + Y_j I_i + X_j G_i$$

Where:

A_{ij} = the change in employment income in all groups j from period i-1 to period i expressed as a percentage.

U_i = the change in the unemployment rate from period i-1 to period i.

I_i = the inflation rate in period i.

G_i = the change in real gross national product from period i-1 to period i expressed as a percentage.

Z_j, Y_j, X_j = The coefficients (to be estimated) with respect to the impact of the three variables (unemployment, inflation, growth) on employment income for all groups j.

It is further hypothesized that a rise in the unemployment rate will cause a fall in employment income and that the severity of the impact will be inversely related to the level of income. This incorporates the generally accepted view that any increase in unemployment bears most heavily on lower income groups.

With respect to inflation, it is hypothesized that

its impact on wages and salaries will be positive but that higher income groups will benefit more than lower income groups. This hypothesis is based on the view that wage and salary earners seek compensation for their inflationary losses, but that upper income groups are, for one reason or another, in a stronger bargaining position and, therefore, are better able to realize their goals.

Real gross national product is used as a trend variable which incorporates growth in income resulting from a generally prospering economy.

The following table gives the estimates of Z_j, Y_j, and X_j.

TABLE I

Coefficients for the Employment Income Relationship

j	Z_j	(t_Z)	Y_j	(t_Y)	X_j	(t_X)	$\overline{A_{ij}}$	F
1	10.0	(1.67)	2.7*	(2.56)	-3.0*	(-2.33)	4.6	4.89*
2	-2.7	(-0.53)	3.3*	(3.67)	-3.0*	(-2.68)	5.0	4.85*
3	-11.9	(-1.39)	2.9*	(1.95)	-1.9	(-1.06)	4.9	1.57
4	-10.9	(-1.20)	1.5	(0.97)	0.4	(0.20)	8.7	1.23
5	-9.7	(-1.46)	1.6	(1.33)	0.1	(0.04)	7.1	1.77
6	-2.0	(-0.45)	1.3	(1.70)	0.3	(0.34)	9.5	3.46*
7	-1.5	(-0.52)	1.0*	(2.05)	0.5	(0.72)	8.3	6.24*
8	3.1	(1.66)	1.1*	(3.31)	0.2	(0.59)	8.8	17.68*
9	3.5	(1.79)	0.9*	(2.47)	0.6	(1.46)	9.5	16.84*
10	2.7	(1.62)	0.8	(2.70)	0.7*	(1.96)	9.1	21.80*

$\overline{A}_{ij}$ is the average yearly increase in employment earnings between 1967 and 1976 for each of the ten income groups. It is apparent that the upper income groups obtained greater increases in their earnings over the period than the lower income groups. The top twenty percent increased their employment income by almost ten percent per annum, whereas the lowest twenty percent increased theirs by only half this proportion. In dollar terms, these differences become much greater as the five percent at the lower end is applied to a much smaller income base. Clearly, the gap between the lowest and highest wage and salary earners has widened during the ten year period.

None of the coefficients pertaining to unemployment, (Z_j), proved to be significantly different from zero at the 5% confidence level. This result is consistent with our previous findings which all suggest that the effect of unemployment on income is not clear cut. Secondly, it must be kept in mind that the data set used is quite small (i.e. includes only ten year's data). With the exception of the lowest income group (which includes numerous marginal workers) and the three highest income groups (which includes many workers who tend not to be affected by unemployment to the same degree) unemployment has a negative impact on earned income thus partially confirming our hypothesis. The estimates suggest that unemployment bears most heavily on the income groups in

the 30th to 50th percentile range of the distribution, somewhat less heavily on those immediately above and below this group and not at all on the highest thirty percent of wage and salary earners.

Seven out of ten of the inflation coefficients are significantly different from zero. The sign of the inflation coefficient (Y_j) is positive throughout, confirming our hypothesis that employment income adjusts to compensate for inflation. The magnitudes of this adjustment, however, contradict our hypothesis. We had hypothesized that the earnings of lower income groups would respond more slowly to inflation than those of upper income groups, but the data suggests the opposite, with lower income groups rising, on average, at more than twice the inflation rate, while the upper end of the income spectrum barely kept pace with the inflation rate. However, the upper income groups still received incremental increases that were several times larger in dollar terms than the increase of the lower groups.

Only three of the coefficients estimated for the impact of real growth of gross national product (X_j) proved significant and two of these displayed a negative sign. The negative signs indicate that real growth resulted in lower earned income for the three lowest income groups. This may be accounted for if, as seems not unreasonable, economic

growth tends to move the more productive workers out of the bottom thirty percent of wage earners, thus changing the composition of this group in the direction of a lower average wage. The remaining seven coefficients are all positive, suggesting that positive benefits accrue to wage earners as a result of economic growth. However, these positive coefficients are all less than unity, suggesting that while wage earners benefit from real economic growth they do so at a lower rate than the growth in G.N.P.

Analysis - Interest Income

The second regression analysis relates to interest income. It is hypothesized that the change in interest income between period i-1 and period i is a function of the inflation rate in period i and the percentage growth in the economy between period i-1 and period i. This relationship is specified in the following equation:

$$B_{ij} = SI_i + KG_i$$

Where:

B_{ij} = the percentage change in interest income from period i-1 to period i for all groups j.

I_i = the inflation rate in period i.

G_i = the percentage growth in real gross national product between period i-1 and period i.

S; K = the coefficients (to be estimated) with respect to the

impact of the two variables (inflation, growth) on interest income.

It is further hypothesized that changes in interest income will be positively correlated with the inflation rate but that the coefficient will be less than ten. This coefficient of ten is arrived at, arbitrarily, by assuming an interest rate of ten percent. Then a one percent rise in the inflation rate, if perfectly compensated for, would generate a one percent rise in the interest rate. This, in turn, would generate a ten percent rise in interest income. The reason for this is that the holders of monetary assets seek to be compensated for their inflation-induced loss of real capital in addition to some expected rate of return on their nominal capital. If we begin by assuming an interest rate of less than ten percent, then, our coefficient representing perfect compensation will be greater than ten. Actual interest rates on Government of Canada bonds during 1967-76 ranged between six and nine percent. Hence, a coefficient of ten is conservative. It is believed that interest rates tend to adjust imperfectly to inflation due, partly to government's manipulation of interest rates in connection with its monetary policies and partly due to changes in the preferences of the community for investment in real assets in place of monetary assets.

The growth in real gross national product was again used as a trend variable with the expectation that a positive coefficient would result. This expectation is based on the theory that in times of economic expansion, business is willing to pay higher interest rates.

Neither of the two coefficients were expected to vary with the level of income (hence the lack of subscripts).

The following table lists the estimates of S and K.

TABLE J

Coefficients for the Interest Income Relationship

j	S	(t_s)	K	(t_k)	$\overline{B_{ij}}$	F
1	3.4*	(2.44)	-0.9	(-0.49)	18.3	5.47*
2	5.5*	(3.71)	-3.3	(-1.76)	18.1	8.50*
3	2.2	(1.40)	0.7	(0.35)	17.5	3.56*
4	2.2*	(2.22)	0.7	(0.50)	18.1	8.69*
5	2.1*	(2.36)	0.9	(0.75)	18.0	11.14*
6	1.9	(1.55)	1.5	(0.92)	20.2	6.86*
7	2.2	(1.99)	1.5	(1.05)	21.8	10.47*
8	2.3*	(3.14)	0.9	(0.95)	19.6	19.40*
9	2.5*	(2.53)	0.6	(0.44)	19.2	10.51*
10	2.1	(1.77)	0.4	(0.28)	15.5	5.04*

In general interest income increased significantly over the decade ranging from 15 to 22 percent per annum. It should be noted again that much of this increase in interest income represents compensation for what would otherwise be an inflationary - induced wealth loss to the holder of the monetary asset and does not represent a greater real return on investment. Thus, much of this increase in interest income is, in a sense, spurious. There appears to be no correlation with the level of income - a result that supports our hypothesis. It is interesting to note that all the F statistics are significant.

Looking at the inflation coefficient (S) our hypothesis is confirmed. This coefficient is positive for all levels of income with six of the ten coefficients significantly different from zero. The coefficients are all much lower than ten, averaging around 2.5. This suggests that interest rates have adjusted very imperfectly for inflation and/or that people have been saving less. The first part of the conclusion is supported by Table K which indicates that after 1971 the net return on Government of Canada bonds declined drastically and in 1974 and 1975 was actually negative - thus, suggesting that during these years the inflation rate was largely unanticipated. It seems probable, then, that larger investors have reduced their monetary assets in favour of investment in real estate and other real assets. The increase in interest income

over the decade took place despite deteriorating net returns and is probably accounted for by a number of factors such as increased rates of interest, and a growing number of small savers who find few avenues of investment for their funds other than bank savings accounts, short term deposits, bonds, etc.

TABLE K

Net Return on Government of Canada Bonds 1967-76

Year	Gov't of Canada Average Bond Yields Ten Years & Over	Inflation Rate %	Net Return on Investment
1967	5.9	3.6	2.3
1968	6.8	4.0	2.8
1969	7.6	4.6	3.0
1970	7.9	3.3	4.6
1971	7.0	2.9	4.1
1972	7.2	4.8	1.4
1973	7.6	7.5	0.1
1974	8.9	10.9	-2.0
1975	9.0	10.8	-1.8
1976	9.2	7.5	1.7

The coefficient relating to growth (K) in all cases proved to be insignificant at the 5% confidence level. This suggests either that real growth in the economy has no significant impact upon interest income or, alternately that there

are off-setting impacts. For instance, while growth may generate more potential savings it also generates more investment opportunities. Although the coefficients are not significant they are, for the most part, positive and less than one, confirming our hypothesis about the direction of the impact of economic growth on interest income.

Analysis - Transfer Income

The third hypothesis tested relates to transfer income. Transfer payments are basically composed of unemployment insurance benefits and various types of pension benefits. It is hypothesized that percentage changes in transfer income are a function of changes in the level of employment and of the inflation rate. The exact relationship is expressed in the following equation:

$$C_{ij} = T_j U_i + VI_i$$

Where:

C_{ij} = the percentage change in transfer income from period i-1 to period i for all groups j.

U_i = the change in the unemployment rate between period i-1 and period i.

I_i = the inflation rate in period i.

$\overline{T_j}$ = the coefficients (to be estimated) with respect to the

V = impact of the two variables (unemployment and inflation)

— on transfer income.

The coefficient T_j is expected to be positive on the assumption that people receive more transfer income in the form of Unemployment Insurance benefits in periods of high unemployment. Furthermore, T_j is expected to decline as income increases, reflecting the theory that unemployment affects lower income groups to a greater degree than higher income groups.

The coefficient V is expected to be positive and less than one, reflecting the theory that transfer payments are increased during inflationary periods but insufficiently to fully compensate for the rate of inflation. V is expected to be independent of the level of income.

The table on page 76 lists the estimates of T_j and V. The coefficient of the unemployment rate (T) proved not to be significantly different from zero in any instance. This suggests either that changes in levels of unemployment insignificantly affect transfer income or, alternately, that there are offsetting impacts. However, the tendency of lower income groups to be more strongly affected than higher income groups is, at least, weakly indicated.

TABLE L

Coefficients for Transfer Income Relationship

j	T	(t_T)	V	(t_V)	$\bar{C}_{jj}$	F
1	63.2	(1.13)	9.3	(1.48)	75.7	2.70
2	1.0	(0.08)	3.3*	(2.47)	24.7	3.63*
3	-3.1	(-0.21)	3.3*	(1.99)	24.9	2.13
4	3.3	(0.18)	3.2	(1.58)	26.1	1.58
5	4.6	(0.27)	3.3	(1.71)	27.5	1.93
6	0.2	(0.01)	3.7	(1.75)	29.6	1.77
7	-6.3	(-0.37)	4.5*	(2.35)	31.1	2.91
8	-8.9	(-0.53)	5.0*	(2.61)	31.4	3.51*
9	-16.7	(-1.02)	5.6*	(3.05)	29.9	4.66*
10	-16.4	(-1.15)	5.0*	(3.13)	24.1	4.91*

The inflation coefficient V proved significant in six out of ten instances. This coefficient, contrary to expectations, seems to increase with the level of income, suggesting that transfer income to higher income groups adjusts for inflation to a greater degree than does that to lower income groups. In addition, quite contrary to expectations, all of the coefficients are greater than one. These anomalies appear to be due to the fact that pension income is included in transfer income. Although pension income accrues to all income groups, a greater portion accrues to high income groups

due to the fact that pensions are commonly a percentage of previously earned income. Retirements have increased in number over the period under review, as have pension rights. For instance, the Canada Pension Plan started in 1966 but did not become fully operative until ten years later. Consequently, the per capita pension income for each income group has been growing, with the greatest growth occuring at higher income levels. Given the growth in pensions and the indexation of these pensions, the correlations found are not surprising, nor are their magnitudes.

In addition, it is possible that inflation stimulated government into re-examining some of its transfer policies. This re-examination may have resulted in increasing the scale of payments by more than the amount required to compensate for inflation on the basis that the original payments were inadequate to meet the original need.

The average annual transfer income has increased significantly over the period, a result that may be as much due to the increased percentage of the population receiving transfer payments in the form of unemployment insurance payments, pensions, etc. as due to the increase in the size of the individual payments made.

Analysis - Other Income

The fourth hypothesis tested relates to all remaining income denoted as "other income." It is hypothesized that the change in "other income" between period i-1 and period i is a function of the inflation rate in period i and the percentage growth in the economy between period i-1 and period i. This relationship is specified by the following equation:

$$D_{ij} = MI_i + NG_i$$

Where:

D_{ij} = the percentage change in other income from period i-1 to period i for all groups j.

I_i = the inflation rate in period i.

G_i = the percentage growth in real gross national product between period i-1 and period i.

M, N = the coefficients (to be estimated) with respect to the impact of the two variables (inflation, growth) on other income.

Other income is predominantly comprised of business profits which accrue as income from self-employment or from dividends. It is hypothesized that this type of income will be positively correlated with inflation on the assumption that, in a period of rising prices, profits increase. General growth in the economy is also expected to have a positive impact on "other income" as it is assumed that when the economy is

growing business profits are increasing. Both M and N are expected to be independent of the level of income.

The following table lists the estimates of M and N.

TABLE M

Coefficients for Other Income Relationship

j	M	(t_M)	N	(t_N)	$\bar{D}_{ij}$	F
1	-	-	-	-	-	-
2	-3.6*	(-2.26)	4.0*	(3.24)	7.2*	5.34
3	2.3*	(2.35)	-1.9	(-1.48)	4.8	2.92
4	0.5	(0.93)	0.8	(1.08)	7.6*	4.52
5	0.9	(1.32)	0.2	(0.19)	6.0	2.74
6	0.8	(1.49)	0.7	(0.98)	8.0*	6.83
7	1.1	(1.55)	0.5	(0.49)	9.0*	4.80
8	1.0	(0.87)	0.7	(0.51)	9.2	2.16
9	0.8	(0.63)	0.9	(0.61)	8.1	1.72
10	0.7	(0.58)	1.1	(0.71)	8.5	1.86

In general, "other income" grew steadily over the period. The growth for upper income groups is slightly better than for lower income groups.

The inflation coefficient (M) is significant in only two instances. In every instance (but one) it is positive,

thus supporting our prior hypothesis. The magnitude of this coefficient seems to be largely independent of income level and is slightly less than one in most of the income groups, suggesting that growth in income from business profits tends to lag the inflation rate. The negative sign of the lowest income group may simply indicate that in times of inflation the improvement in business moves the incomes of those dependent on business profits to higher categories, thereby producing a negative impact on the residual "other income" of the lowest group. This hypothesis is supported by the higher than average coefficient found for the next higher income group. Inflation may well be beneficial for marginal businesses.

The real GNP coefficient (N) proved significant in only one instance. For the lowest income group, growth in the economy seems to significantly improve "other income," suggesting again that there are numerous marginal businesses which growth makes profitable.

Analysis - Total Income

Lastly, it is hypothesized that changes in total income between period i-1 and period i are a function of changes in the unemployment rate between the two periods, the inflation rate in period i, and the percentage growth in the

economy between period i-1 and period i. This relationship is specified by the following equation:

$$E_{ij} = P_j U_i + Q_j I_i + R G_i$$

Where:

E_{ij} = the percentage change in total income from period i-1 to period i for all groups j.

U_i = the change in the unemployment rate between period i-1 and period i.

I_i = the inflation rate in period i.

G_i = the percentage growth in real gross national product between period i-1 and period i.

P_j, Q_j, R = the coefficients (to be estimated) with respect to the three variables (unemployment, inflation, growth) on total income for all groups j.

This relationship represents an aggregation of those that went before. As such, it is hypothesized that the unemployment coefficient will be negative and will approach toward zero as average income increases. The inflation coefficient is expected to be negative, or zero, for low income groups, positive and greater than one for middle income groups and positive and near one for upper income groups. These expectations are based on the assumption that low income groups fail to keep pace with inflation, middle income groups more than keep pace with inflation (since most of their income

comes from employment) and high income groups merely keep pace with inflation (due to their more mixed sources of income). The growth coefficient is expected to be independent of the level of income and positive for all income groups on the assumption that real growth tends to increase incomes throughout the economy.

The following table lists the estimates of P_j, Q_j and R.

TABLE N

Coefficients for Total Income Relationship

j	P_j	(t_P)	Q_j	(t_Q)	R	(t_R)	E_{ij}	F
1	45.9*	(2.15)	8.5*	(2.25)	-9.2*	(-2.01)	19.9	5.20*
2	-0.9	(-0.30)	3.2*	(5.80)	-2.2*	(-3.26)	8.7	14.49*
3	-8.4	(-1.34)	2.6*	(2.37)	-1.3	(-0.92)	7.6	2.61
4	-7.2	(-1.14)	1.6	(1.43)	0.4	(0.32)	10.4	2.46
5	-7.7	(-1.58)	1.6	(1.90)	0.1	(0.11)	8.5	3.45*
6	-4.3	(-1.72)	1.5*	(3.52)	0.1	(0.28)	9.2	11.95*
7	-0.1	(-0.03)	1.4*	(4.82)	0.1	(0.17)	9.2	23.90*
8	2.4	(1.52)	1.2*	(4.34)	0.2	(0.64)	9.4	26.97*
9	2.5	(1.30)	1.0*	(3.01)	0.5	(1.27)	9.9	18.59*
10	0.5	(0.22)	1.0*	(2.21)	0.7	(1.24)	9.4	10.40*

In general, it appears that total incomes have been growing at about nine percent per year. The differences between groups (ignoring the aberrant figure for the lowest decile) are minor, thus supporting our earlier finding which showed an insignificant change in the Gini Coefficient over the period.

The unemployment coefficient proved insignificant for all income groups except the lowest. The apparent anomaly of the lowest income group receiving more income when unemployment increases may be (in part) due to a change in the composition of this group with some members of the group dropping out altogether in the sense that they file no income tax returns while other individuals previously included in higher deciles take their place. With the further exception of the three upper income groups all coefficients are negative (as expected) with the middle income groups most adversely affected by unemployment.

The inflation coefficient is significant in eight out of ten instances, and in the fourth to tenth deciles confirms the tested hypothesis, with the middle income groups more than keeping pace with inflation, while upper income groups just keep pace. However, contrary to expectations, the three lowest income groups seem to benefit most from inflation. These results suggest that inflation tends to promote a greater degree of income equality. However, it

should be reiterated that in dollar terms this increasing equality is not very impressive since the base income for the second lowest income group (for instance) is only about one twelfth of that of the highest group.

The growth coefficient is significant in only two instances and both of these are contrary to our expectations, indicating that growth has a negative impact on the two bottom deciles of the income distribution. This counter-intuitive result may be due to upwards shifts in the type of earner, from lower categories to higher categories, consequent on an expanding economy. The coefficients in the fourth to tenth deciles are positive but of low magnitude; suggesting that real economic growth had no significant impact on total incomes of individuals. However, much of this apparent lack of impact may be due to the growth of the labour force over the period, which would tend to negate the potential positive effect of growth on individual incomes.

SECTION IV - CONCLUSIONS AND EVALUATION

The results of the five methodologies were not as decisive as would seem to be desirable. Nevertheless, these results do shed light on the nature of the problems associated with any analyses of the effects of unemployment and inflation on income distribution and, despite the somewhat indecisive nature of the results, they do allow some preliminary conjectures to be made regarding the impact of unemployment and inflation.

Table (O) below provides a summary of the results of the five methodologies. In the case of unemployment a positive sign indicates that an increase in the unemployment rate is correlated with a more equal distribution of income while a negative sign is correlated with a less equal distribution. In the case of inflation a positive sign indicates a positive correlation between the inflation rate and a more equal distribution of income while a negative sign indicates the reverse.

TABLE O

Summary of Results of the Five Methodologies

Methodology	Impact of Increases in Unemployment Rate on Income Distribution	Impact of inflation Rate on Income Distribution
Normalizing by Equal Proportion	-	-
The Unemployment Gini	+	Inconclusive
Cross-Sectional Regression:		
Method I	-	n/a
Method II	+	+
Method III	+	+
Aggregate Linear Model	-	-
Macro Model		
Employment Income	-	+
Interest Income	n/a	Inconclusive
Transfer Income	+	-
Other Income	n/a	nil
Total Income	Inconclusive	+

It will be seen from the above that four of the five methods used lend some support to the theory that increases in the unemployment rate tend toward a lessening of equality of income distribution. In the case of inflation, two of the methods indicate a negative correlation between the infla-

tion rate and increasing income equality, two indicate a positive correlation, and one is inconclusive. However, methods 3 and 5 provided much stronger correlations on the positive side than did methods 1 and 4 on the negative side. Thus the weight of the evidence seems to favour the tentative conclusion that inflation, during the time period studied, tended to promote greater income equality. The results obtained by use of the Macro Model suggest that this outcome is mainly due to the proportionally larger gains in employment income made by lower income groups.

Given the general weakness of the results, it is perhaps appropriate to examine the main shortcomings of the analysis. This will help to reveal the nature of the problems associated with determining the impacts of unemployment and inflation on income distribution. The chief shortcomings, in our opinion are four in number, as follows:

1) The weakness of the Gini ratio as a measure of income distribution.
2) The difficulties encountered by the use of average unemployment rates.
3) The non-specification of the effect of government redistributive policies in the analysis (except to some extent in the Macro Model).
4) The inability to quantify, and thus take into consideration, the effect of changes in the work force brought about by

by a growing population and changes in labour force participation rates.

Each of these shortcomings will now be discussed in turn.

1) The use of a one-number measure of income equality, such as the Gini ratio, greatly restricts the analysis in that it may hide as much as it reveals. As an average measure it tells us nothing about individual income shifts but only about net shifts. For instance, if, due to inflation, the incomes of individuals on fixed incomes were to fall, while employment earnings were to rise, this would not necessarily change the distribution of income as shown by the Gini ratio. Yet, surely the individuals so affected would rightly regard the change as a change in the distribution of income. Considerable polarization of the income structure could conceivably take place, with little or no change in the Gini ratio, providing that the changes were approximately off-setting. The relatively more significant results of the Macro Model are in part due to the fact that income changes are focused on directly, rather than via the Gini ratio.

2) The use of the average unemployment rate creates problems of a type similar to those created by use of the Gini Ratio.

An underlying assumption of the analyses undertaken in this paper is that any change in the unemployment rate affects all income groups to the same degree, regardless of the level of employment. But it seems doubtful that this assumption is really warranted. For instance, an increase of one percent in the unemployment rate when unemployment is at four percent to begin with probably affects different income groups than does a one percent increase when unemployment is at eight percent. Moreover, average unemployment rates conceal the fact that unemployment affects different socio-economic groups depending upon its cause. The same average unemployment rate arising from a general recession affects a different set of individuals than it does if it arises from depressed conditions in a specific area or a specific industry. A better analysis would result from the use of income-specific unemployment rates but these rates appear to be nowhere available and the attempt we made at generating such rates introduced a bias as indicated in method #1, "Normalizing by Equal Proportion."

3) Government redistributive policies clearly affect the distribution of income. Some of these may not be identified in income statistics but the main ones, such as unemployment benefits, pension income, and family allowances are included in transfer income. A priori, it is reasonable to expect that redistributive policies will be undertaken in response

to the undesirable effects of unemployment and inflation on the distribution of income, and, in fact, we know that UIC benefits increase with increasing unemployment and that the Old Age and Canada Pension are indexed to compensate for inflation. Changes in income tax do not affect our data which is based on "total income" prior to any adjustments for exemptions or tax. To the extent that redistributive policies achieve their goal, they neutralize the effect of unemployment and inflation on income distribution. It seems clear that, to some extent at least, this accounts for the remarkable stability of the income distribution as evidenced by the Gini ratios for the years 1966 to 1976 (see page 35). Only the Macro-Model methodology disaggregates income and the summary of results in this section indicates that rising unemployment results in a more equal distribution of transfer income, perhaps as a result of UIC benefits reaching a wider spectrum of income groups. On the other hand, inflation is negatively correlated with the redistributional impact of transfer income suggesting that increases in UIC benefits, pensions and family allowances, whether by indexing, or by periodic government decision, tend to have favoured the higher income classes. These findings are not inconsistent with the theory that government redistributive policies tend toward maintaining the stability of income distribution. A detailed study of all

government redistributive policies would shed more light on this matter but is beyond the scope of this paper.

4) Over the ten year period studied, the labour force has increased significantly in number, due both to population growth, and increased participation rates as a higher percentage of the female population become gainfully employed. The significance of this phenomena tends to be indeterminate for the distribution of income, as, it may affect it, both in the direction of making it more equal, and in the direction of making it less equal, at one and the same time. As new workers register with Manpower for jobs, but are not employed, they contribute to a rise in the unemployment rate, but, since these individuals have no recorded income, the distribution of income remains unchanged. Consequently, the impact of unemployment on the "true" distribution of income is understated. On the other hand, as these new workers enter the labour force, they tend to reduce the unemployment rate, but, since most of them enter at or near the bottom of the income ladder, the distribution of income tends to become less equal. This generates the counter-intuitive result of falling unemployment associated with greater income inequality. This general problem is not easily solved using taxation data as there is no clear way to reconcile the labour force with those filing tax returns.

In conclusion, this analysis of the effects of unemployment and inflation on the distribution of income suggests that the redistributions which do take place cut across income groups and are frequently offsetting with regard to their net aggregate effect. This, of course, does not mean that they lack significance for the individuals concerned. To the extent that these individuals can be identified on some consistent basis, it becomes important from a policy viewpoint that a fruitful avenue for further research may lie in examining what happens to income, by source, of a sample of individual income receivers over time.

In the macro-sense our analyses indicate that during 1966-76, despite substantial increases in both the unemployment and inflation rates, the distribution of income remained virtually unchanged. There is no evidence to suggest that low income groups have suffered a deterioration of their relative position on the income ladder because of inflation. In fact the evidence seems to be rather the reverse. This, however, indicates no great improvement in income distribution in Canada (assuming that we consider an improvement to be a more even distribution). In summary, the overall analysis supports the hypothesis that, for a variety of reasons, inflation had little or no effect on the distribution of personal income during the period 1966-76.

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