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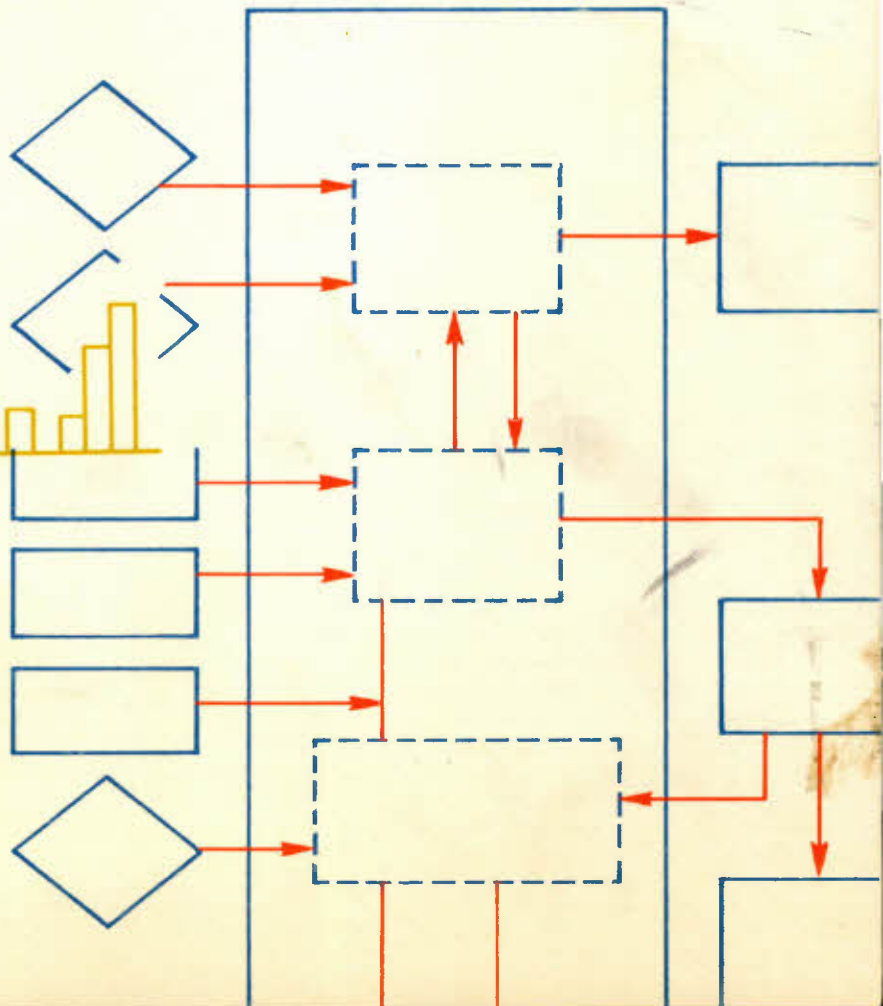
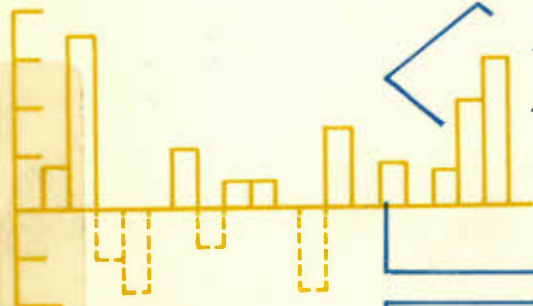


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DISCUSSION PAPER NO. 193

Macroeconomic Effects of Demographic  
Variables: Evidence from CANDIDE Model 2.0

by

P. Someshwar Rao

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## Résumé

Le présent document a pour principal objectif d'analyser, à l'aide du modèle CANDIDE 2.0, les répercussions macro-économiques de changements dans certaines variables démographiques clés. Il examine aussi la structure et les propriétés fondamentales du bloc démographique de ce modèle économétrique. Voici quelques-uns des résultats importants de l'étude :

1) En raison d'une baisse des taux de natalité, on s'attend à ce que la part de la population âgée de moins de 20 ans dans la population totale tombe de 34,4 % en 1979, à 27,4 % en 1990. Le pourcentage de personnes âgées, pour sa part, passerait de 9,1 % en 1979, à 11,0 % en 1990.

2) Nos résultats donnent à penser que le coût de l'immigration (c'est-à-dire les hausses du taux de chômage, les réductions du revenu par habitant, les modifications dans la répartition fonctionnelle du revenu et l'accroissement des déficits gouvernementaux) n'est pas compensé par les bénéfices qu'elle engendre (soit l'augmentation de la production et le fléchissement du taux d'inflation).

Pour que les immigrants arrivent à compenser la perte de revenu réel par habitant que subissent les Canadiens, il faudrait, selon nos calculs, que chacun d'entre eux paye une somme moyenne de \$ 3 100 par année (prix de 1971).

3) Nos résultats semblent indiquer également que les taux d'activité accrus des femmes et des jeunes, ainsi que le rajeunissement général de la population d'âge actif, ont contribué considérablement aux problèmes de la stagflation des années 70.

## ABSTRACT

The central objective of this paper is to analyze the macro-economic impact of changes in some of the key demographic variables, using the CANDIDE Model 2.0. This paper will also provide an analysis of the basic structure and properties of the demographic block of CANDIDE Model 2.0. The following are some of the important findings.

1) As a result of declining birth rates, the share of population under age 20 in total population is expected to decline from 34.4 per cent in 1979 to 27.4 per cent by 1990. By contrast, the share of elderly population is expected to rise from 9.1 per cent in 1979 to 11.0 per cent in 1990.

2) Our results suggest that the cost of immigration (increased unemployment rate, reduced per capita income, shifts in the functional distribution of income, and increased government deficits) out weigh the benefits (increased output, and drop in the inflation rate).

Our results imply that for immigrants to compensate prior Canadians for the loss in real per capita income, on the average a fee of \$3,100.00 (1971 prices) would have to be paid per year per immigrant.

3) Our results imply that the increased participation rates of females and youth, and twists in the age structure of working age population in favour of youth have contributed significantly to the stagflation problems of the 1970s.

## ACKNOWLEDGEMENTS

I am greatly indebted to Dr. R. S. Preston, Director, CANDIDE Project, for his guidance and encouragement with this project. I am extremely thankful to H. Saiyed for helping me with the simulations, and M. Willis for preparing the graphs. Finally, I am grateful to M. Rowe for patiently typing the whole manuscript.



## I INTRODUCTION

As a result of twists in the age structure, the share of youth (population 14-24) in the working age population has gone up from 21 per cent in 1960 to 25.6 per cent in 1970. This in turn has brought a record number of young people into the labour force. The distensions in the labour force and the economy brought about by the twists in the age structure were aggravated by an accompanying phenomenon: the enormous increase in the participation rates of youths and females. From 1970 to 1978 1.37 million women joined the labour force, accounting for 53 per cent of the total growth in labour force. These developments in turn have dramatically changed both the level and the composition of total labour force during the 1970s.

These dramatic changes in the composition of both the population and labour force are partly blamed for the socio-economic problems of the 1970s -- stagflation, increased divorce rates, suicide rates and crime rates, and political alienation. As a consequence of reduced economic growth, a worsening of the unemployment-inflation tradeoff, and increased government deficits, the federal government has tightened its immigration policy, resulting in a significant reduction in the level of net immigration during the 1970s. As a result of the tight immigration policy, the contribution of net immigration to the incremental labour supply has declined significantly in the 1970s, and probably this trend will continue at least up to 1990.

This in turn will have important implications for GNP growth, inflation-unemployment tradeoff, government deficit, trade balance, etc.

The primary objective of this paper is to analyze the impact of changes in some of the key demographic variables, using the CANDIDE Model 2.0. The following are some of the specific objectives of this paper:

- a) To discuss in some detail the structure of the demographic sector of the new CANDIDE Model 2.0.
- b) To outline some of the linkages between the demographic sector and rest of the blocks of the CANDIDE Model.
- c) To analyze both the past and the future (projected) trends in some of the key demographic variables.
- d) To evaluate the macroeconomic costs and benefits of immigration.
- e) To analyze the impact of increased participation of secondary workers on GNP, unemployment-inflation tradeoff, government budget position, and so on.
- f) To investigate the role of twists in the age structure of working age population in the stagflation problems of the 1970s.

The plan of the paper is as follows:

In Section II, we will discuss the structure of the demographic sector of CANDIDE 2.0 Model. We will also analyze the trends in some of the key demographic variables.

Section III, outlines the important feedbacks between the demographic sector and rest of the system. The macro-economic effects of immigration are analyzed in Section IV.

Section V examines the impact of increased participation of secondary workers on some of the key macro-economic variables.

The role of changes in the age composition of working age population of the economic system is examined in Section VI.

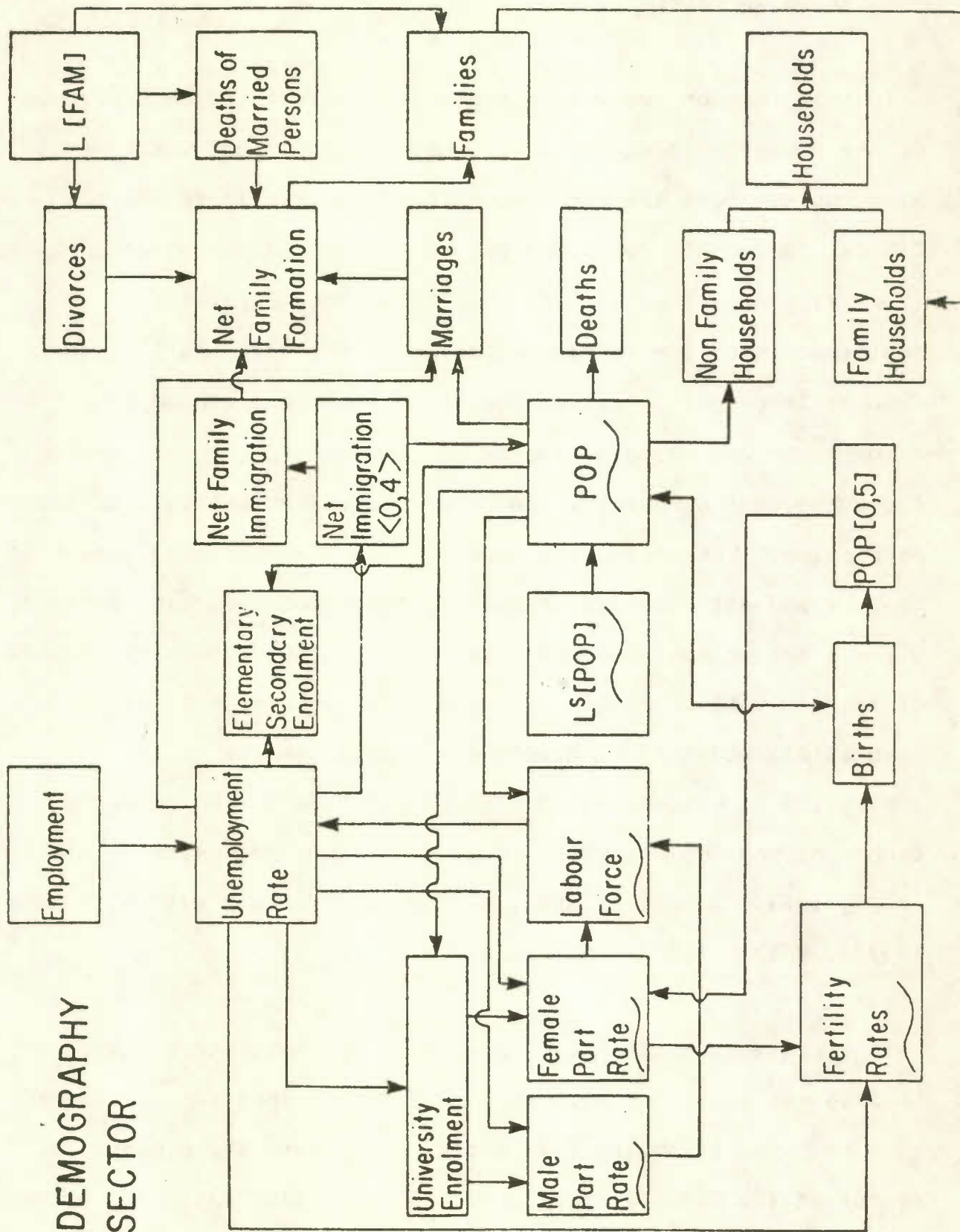
Finally, some of the important findings of this study are summarized in the last section.

## II THE DEMOGRAPHIC SECTOR OF CANDIDE MODEL 2.0 AND DEMOGRAPHIC TRENDS IN CANADA

In this section, we will discuss in some detail the structure of the demographic sector of the new CANDIDE Model 2.0. We will also analyze both the past and future demographic trends in Canada. Household decisions regarding desired number of children (fertility decisions), child quality (school enrolment decisions), and female participation in the market activities (labour force participation decisions) are conditioned by demographic and economic forces and in turn they contribute to the subsequent demographic and economic characteristics of the population. Therefore, the quantitative analysis should seek to specify and estimate simultaneously these behavioural relations, given a set of socio-economic variables. The demographic sector of the new CANDIDE Model 2.0 tries to do precisely this. The theoretical model of CANDIDE's demographic sector is an adaptation of extensions that have been made to the Becker's theory of household production (the new home economics): Becker (1960, 1963), Schultz (1969), Nerlove and Schultz (1970), Michael (1973), Willis (1973) and Rao (1975).

In the demographic block, we specify and estimate a number of behavioural equations with the above set of important feedbacks in mind. The following five blocks constitute the demographic sector of the CANDIDE Model 2.0: (1) fertility rates and births, (2) population cohort equations by age and sex, (3) participation rates and labour force, (4) school enrolment equations, and (5) family formation and household equations.

Chart 1



DEMOGRAPHY SECTOR

In the first block, three age-specific fertility rates are specified and estimated as a function of per capita income, female participation, school enrolment, and unemployment rate. Next, fertility rates are multiplied by the appropriate female population cohorts, to get an estimate of the total births (see Chart 1).

In CANDIDE 2.0, a population calculator determines both the male and female population by five year age-cohorts updating last year's population by adding total births and net immigration and subtracting total deaths.

One of the important places, where population cohort information enters is in the determination of total labour force. In CANDIDE 2.0, total labour force is obtained by summing the labour force of seven age-sex groupings. Therefore, the labour force projection involves the projection of both the source population and the participation rates by these age-sex groupings. In CANDIDE 2.0, the participation rates in general are influenced by the developments in after-tax real wage rate, unemployment rate, school enrolment rates, child-woman ratio, and real pension benefits.

Once we have population cohort information, we can determine elementary and secondary, non-university post secondary, undergraduate and graduate (full time and part time) university

enrolment by multiplying enrolment rates with the appropriate population cohorts. There are six enrolment rate equations. These enrolment rate equations in general depend upon per capita income, unemployment rate, and lagged enrolment rates.

In the last block, total households are determined by adding non-family households with the family households. Total family households are determined by adding net family formation to the previous year's stock of households. Net family formation in turn depends upon marriages, net family immigration, divorces, and deaths of married persons. Non-family households are obtained by multiplying the non-family household formation rate equation with the appropriate population cohort information.

(1) Fertility Rates and Births

In the CANDIDE 2.0, the fertility cohorts are divided as follows: females age 15-24, age 25-44, and age 45-49. As mentioned earlier, the theoretical basis of these equations is an adaptation of extensions that have been made to Becker's theory of household production [see Rao (1975)]. In these models, children are viewed as commodities. Theoretically, as family incomes go up, families have more children. However, as women's wage rates go up the opportunity cost of having children goes up as well, and the families tend to have fewer children.

In CANDIDE 2.0, fertility rates in general are influenced by per capita income (lagged distribution), female participation rates, school enrolment rates, and unemployment rate.

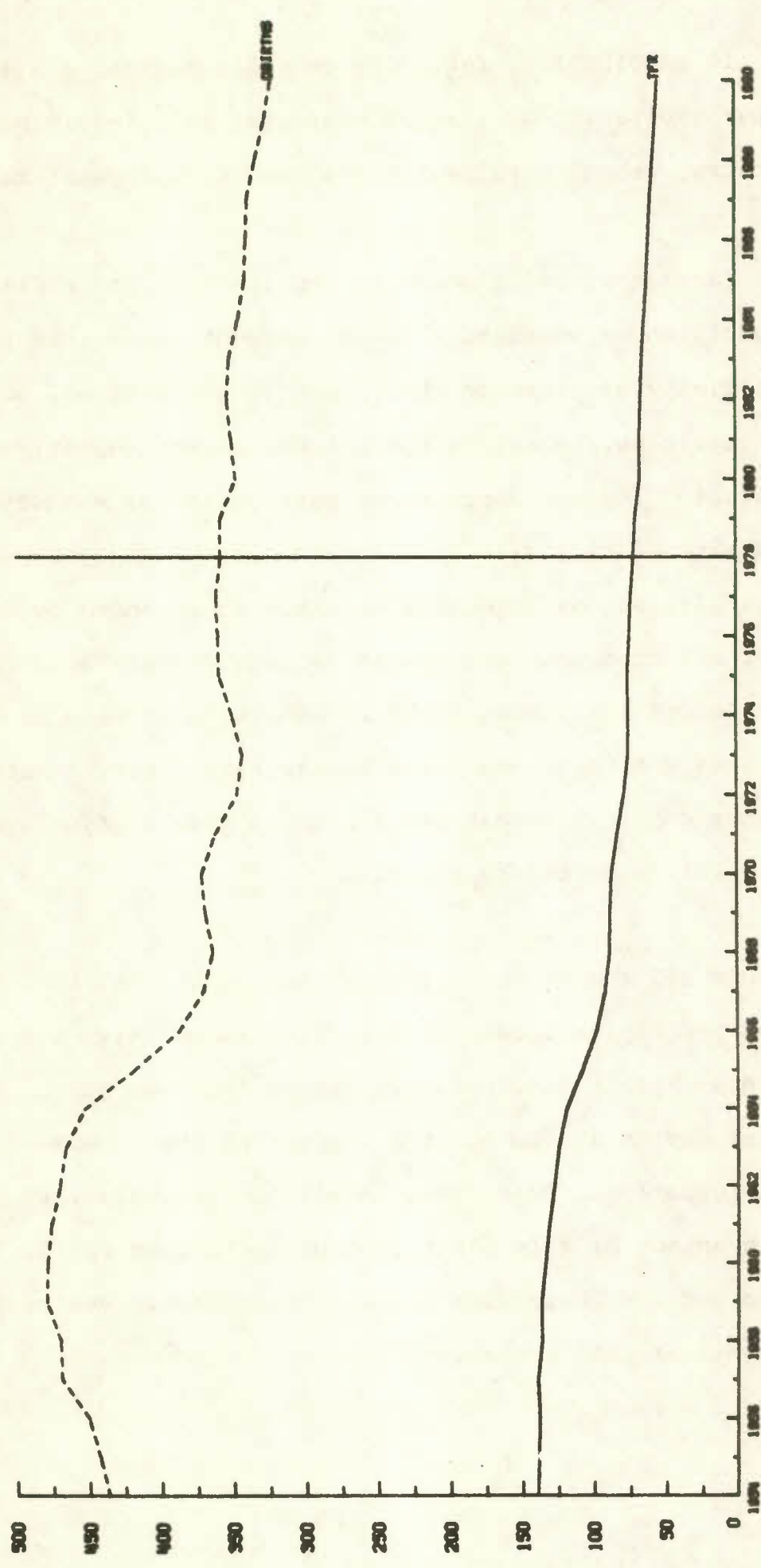
Participation of women in the labour force reflects the decision of women to allocate more of their time to labour force activity and less to child bearing and rearing, and homemaking activities. Where on the balance market incentives favour greater female labour force participation, we anticipate smaller desired family size. Similarly for the younger women (age 14-24), school enrolment variable is intended to capture the effect of school attendance as an alternative to motherhood. As expected the cohort 15-24 is sensitive to enrolment rates, while 25-44 cohort is sensitive to the female participation rate of the same cohort. Both these variables have a significant negative impact on fertility rates.

In all the three fertility rate equations, the long-run impact of per capita income on fertility is negative and significant. This implies that children are an inferior good. Alternatively, per capita income might be capturing the impact of birth control information. Over time, in all the industrialized countries, the invention of safe birth control techniques (pill, IUD, etc.) have helped the households in translating their desire to have small families into a reality.



Chart 2

### FERTILITY RATE AND BIRTHS



BIRTHS = TOTAL BIRTHS  
TFR = TOTAL FERTILITY RATE  
= (BIRTHS \* 1000.) / (POP15.19 + (POP25.41 + (POP35.49)

The unemployment rate variable is intended to capture the impact of timing on births. In periods of high unemployment, the opportunity cost of not participating in the market activities is low and therefore will induce families to carry out their plans to have children. As expected, the lagged unemployment rate has a significant positive coefficient.

In summary, fertility rates are influenced by per capita income, female participation, unemployment rate, and school enrolment rates. Therefore, future projection of births, in CANDIDE 2.0, depend on the developments in the above variables, and also on the size of the female population cohorts of childbearing age (primarily 15-44). The size of childbearing age population in turn depends on the past fertility rates, (ex., baby boom generation), and on net immigration.

Chart 2 displays both past and future (projected) trends in total fertility rate and total births. Total fertility rate has declined from a high of 139 (per thousand women of childbearing age) in 1954 to 87.4 in 1970, and 70.0 in 1979, and is projected to decline further in the future: it is expected to decline 61.4 in 1985, and 53.4 in 1990. However, it is expected to stabilize around 50.0. Similarly, total births also show a declining trend over time. Total number of births peaked in 1959 to 479 thousand, and these after declined gradually to 358 thousand in 1979, and are expected to decline to 341.0 thousand in 1985 and 323.0 thousand in 1990. As seen from Chart 2, the rate of

decline (past as well as projected) in the number of births is much smaller than the decline in the total fertility rate, implying that the female population of childbearing age has steadily increased over time.

(2) Population Cohorts by Age and Sex

As mentioned earlier, in CANDIDE 2.0, the population calculator determines both the male and female population by five year cohorts, updating last year's population by adding births and net immigration and subtracting deaths. Given births and net immigration, population for each of the age-sex cohorts<sup>1</sup> is calculated as: (one for each sex for the five year age groups up to age 65 and over).

$$\hat{P}_{ij,t} = \alpha_{ij} * P_{ij,t-5} + \beta_{ij} * \left( \sum_{k=1}^5 \text{NETIMM}_{t-k} \right)$$

$i = 2$  (2.1)

$j = 1, 2$

where  $\hat{P}_{ij,t}$  is the population of i-th age group/for the j-th sex group in time t.

where  $\hat{P}_{ij,t-5}$  is the population in cohort i five years earlier.

NETIMM is total net immigration (IMMIG-EMIG),  $\alpha_{ij}$  is an exogenously estimated survival rate, and  $\beta_{ij}$  is an immigration share calculator (based on 1961-1966 average coefficients).

In equation (2.1),  $i_j$  and  $i_j$  are not estimated using the regression techniques, instead they are calculated by making use of the survival rates from the life tables (1960-1965), and the data on age-sex distribution of immigrants for the years 1961-1966, respectively.

Population under five years of age is calculated as follows:

$$\begin{aligned} P\emptyset P_{0-4,jt} = & \lambda * \alpha_{0-4,j} * \sum_{k=0}^4 \text{BIRTHS}_{t-k} \\ & + \beta_{0-4,j} * \sum_{k=0}^4 \text{NETIMM}_{t-k} \end{aligned} \quad (2.2)$$

$$j = 1, 2$$

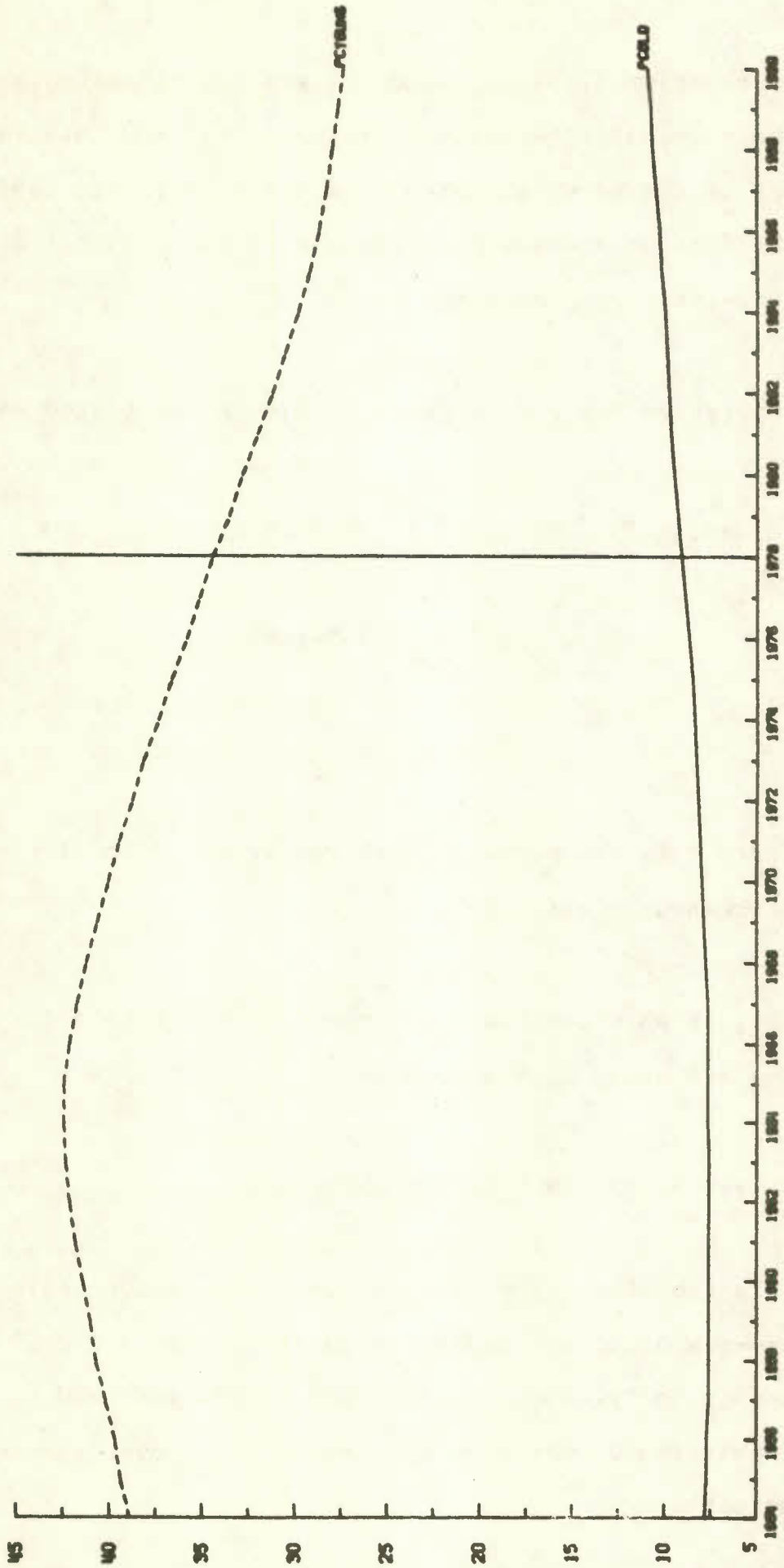
where  $\lambda$  is the share of  $j$ -th sex group in total births (exogenously estimated).

$\alpha_{0-4}$  is an exogenously estimated survival rate for the 0-4 age group of the  $j$ -th sex.

$\beta_{0-4,j}$  is the immigration share.

In the final step, the "Pseudo" population estimates for each age-sex group are regressed on time trend and real income per capita to "pick-up" the missing trends in and . Total population is obtained by summing  $P\emptyset P_{ij}$  over age-sex cohorts.

### AGE COMPOSITION OF POPULATION



ACTUOUS = RATIO OF POPULATION AGES 0-19 TO TOTAL POPULATION  
POELD = RATIO OF POPULATION AGES 65+ TO TOTAL POPULATION

Chart 3

In summary, given births, net immigration, and survival rates, the population calculator determines both the level and composition of total population in each time period.

In CANDIDE 2.0, the net immigration (immigration minus emigration) equation is sensitive to the real wage and the unemployment rate differentials (with a lag) between Canada and U.S.A. However, this equation is too sensitive to the unemployment rate differential to be used in policy simulations. Consequently, this variable is usually exogenized which can be interpreted as exogenously determined government policy. In projecting the population for 1980 and beyond, we have assumed a net immigration of 50,000 per year for the period 1980-1990.

As seen from Chart 3, the share of population under age 20 in total population peaked in 1964 to 42.4 per cent, and steadily declined from then on to 34.4 per cent in 1979. Furthermore, this share is expected to further decline to 27.4 per cent by 1990. As expected, the share of elderly population (65+) is expected to rise from 9.1 per cent in 1979 to 11 per cent in 1990. These changes in the age-sex composition of population will have significant macro-economic impacts via labour supply, government expenditure, government investment, and the composition of consumer expenditure.

(3) Participation Rates and Labour Supply

In the new CANDIDE 2.0 Model we have seven participation rates: males 14-19, males 20-24, males 25-54, males 55+, females 14-24, females 25-44, and females 45+. All the seven participation rates are endogenous in the system. Labour supply of these seven age-sex groups is obtained by multiplying each participation rate with the appropriate population cohort. Total labour force is obtained as an identity by summing these seven components. In constructing the source population by cohort, certain segments of the population are excluded by the Labour Force Survey. These segments include population resident in institutions and native people. Because of these definitional differences in actual versus source population concepts, it is necessary to adjust the initial estimates obtained from the participation rate/population cohort identities. In the CANDIDE model, this labour force adjustment<sup>2</sup> is determined endogenously as a function of the total participation rate and the total population. Unemployment rate is calculated by combining the total labour force (adjusted) estimate with the information obtained from the labour demand side of the model (employment estimate).

In the new CANDIDE Model, female participation rates in general are explained by after-tax real wage rate (distributed lag), unemployment rate, school enrolment rates, child-woman ratio, and the unemployment insurance dummy. The inclusion of after-tax

real wage rate can be justified in terms of both the work-leisure choice and/or the opportunity cost concept of the new home economics. In all the three female participation rate equations, as expected, the after-tax real wage rate has a positive impact: as the real wage increases, there is an incentive for females to substitute market activities for the non-market activities (eg., childbearing and rearing). The coefficient on the child-woman ratio variable is negative and significant for females aged 14-24 and 25-44; the coefficient on the unemployment rate implies discouraged worker effect for females 14-24 and 45+, and supports the additional worker hypothesis for females aged 25-44.<sup>3</sup> Both the school enrolment rates and the child-woman ratio variables (rather than the real wage) are likely to pick-up the influence of changes in social and institutional factors, since these variables are highly correlated with time trend. Inclusion of time trend in addition to these variables can not be theoretically justified and might also bias the coefficients of other explanatory variables.

Male participation rates are influenced by the after-tax real wage, unemployment rate, school enrolment rate, per capita real pension benefits, and the unemployment insurance dummy. The real after-tax wage rate again has a significant positive impact on all the four male participation rate equations, with the exception of males 25-54). For the prime aged males (the coefficient on real wage rate implies a backward bending supply curve. As in the case of females 14-24, the coefficient on the school



Chart 4

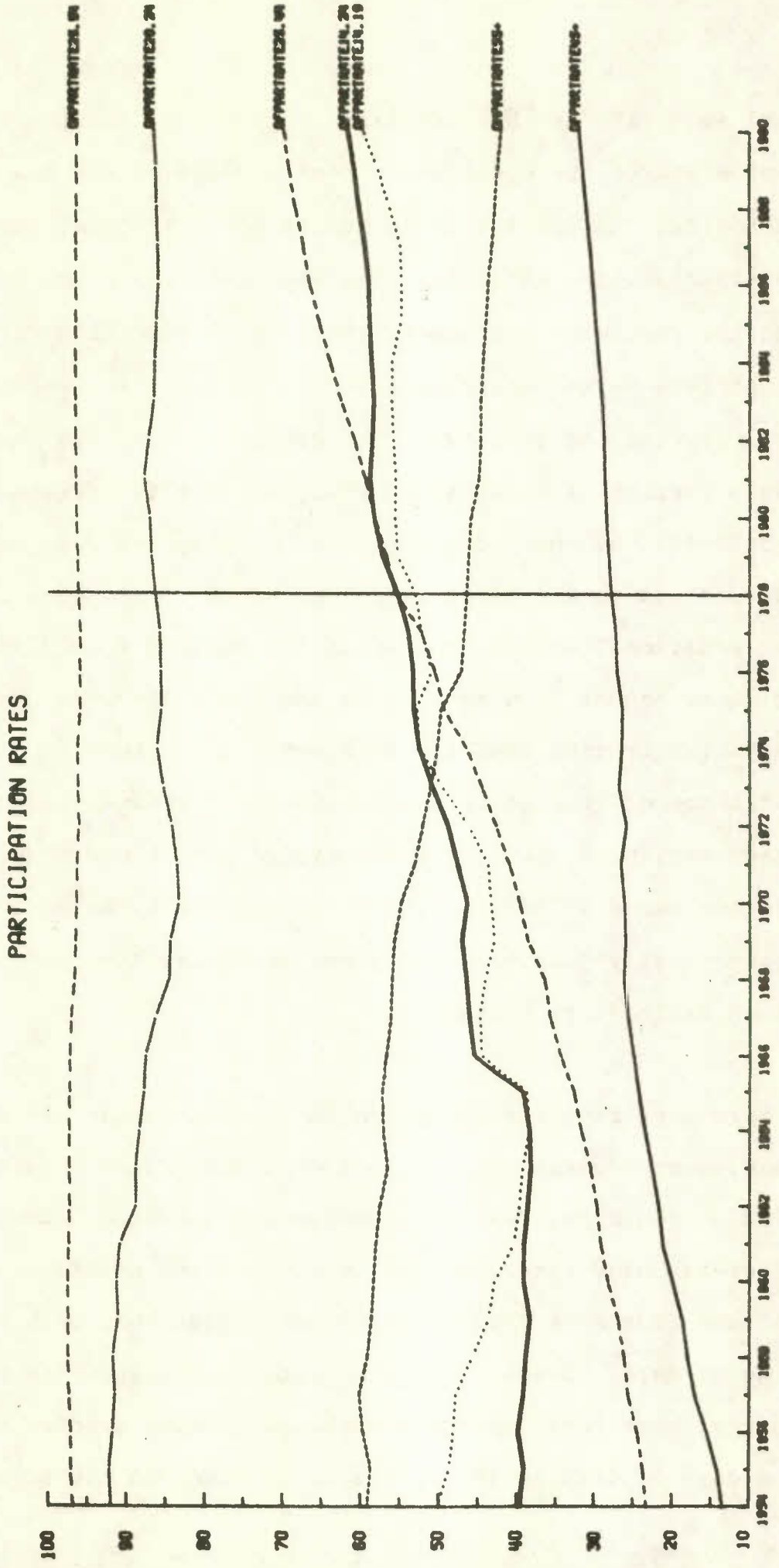
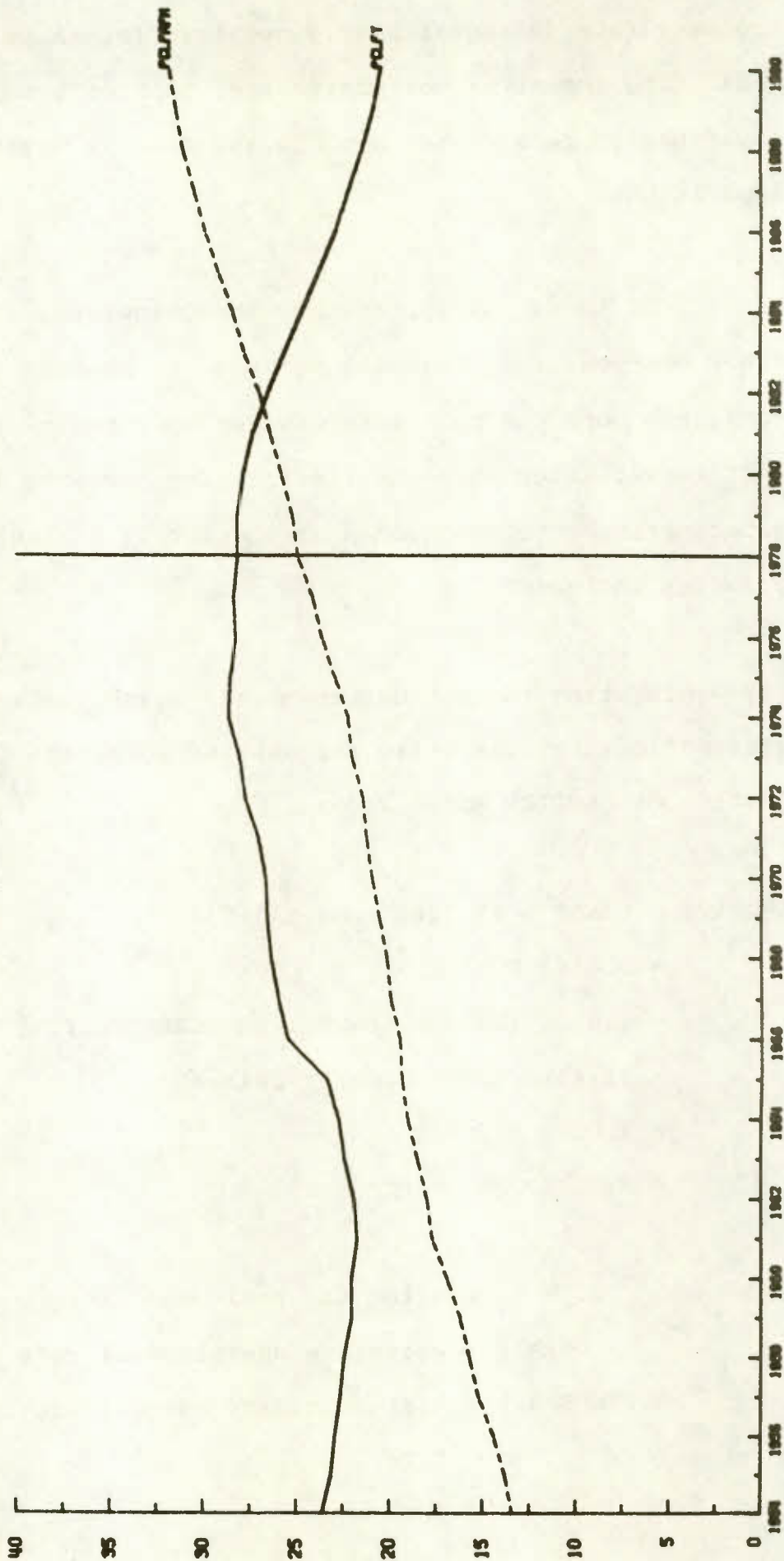


Chart 5

LABOUR FORCE COMPOSITION



POLFT = RATIO OF LABOUR FORCE AGES 14-24 TO TOTAL LABOUR FORCE  
POLFPM = RATIO OF FEMALE LABOUR FORCE AGES 25+ TO TOTAL LABOUR FORCE

enrolment rate is significantly negative for males aged 14-19 and 20-24. The impact of per capita real pension benefits on the participation rate of men aged 55 and over is negative and significant.

In all of these specifications, the unemployment rate enters with a one-year lag (that is, feedback is assumed to take a year), and both the real wage rate and per capita real pension benefits variables enter nonlinearly, so that the impact on the participation rate diminishes as the levels of these other variables increase.

By aggregating the parameters of all seven participation rate equations, we can write the implied aggregate participation equation of CANDIDE Model 2.0 as:

$$\begin{aligned} \text{PARTRATE} &= \text{CONST} + 17.7200 \ln \left[ \frac{W}{P}(1-\gamma) \right] \\ &- 0.0583 \text{ DURATE} \\ &- 1.4100 (\text{DR.PSNUENR}\text{\AA}L + \text{DR.UGRENF}\text{\AA}L.\text{FT}) \\ &- 11.4540 (\text{DP}\text{\AA}P00.04/\text{DFP}\text{\AA}P15.45) \\ &+ 1.0520 \text{ UIDUMMY} \\ &- 0.71 \text{ RPCPB} \end{aligned} \tag{2.3}$$

where  $\frac{W}{P} (1 - \gamma)$  = after tax real wage rate

DURATE = aggregate unemployment rate

DR.PSNUENR $\text{\AA}$ L = post-secondary non-university enrolment rate

DR.UGRENØL.FT = under-graduate university enrolment rate,  
full-time

DPØP00.04 = population under five years of age

DFPØP15.45 = female population of 15-45 age group

UIDUMMY = unemployment insurance dummy

and RPCPB = real per-capita pension benefits of old  
age population

The above equation implies that a 1 per cent increase in real after-tax wage rate will increase the aggregate participation rate approximately by about 0.2 per cent. In an effort to study both the short and long-run (general equilibrium) impact of after-tax real wage on the labour supply by age-sex groupings, we have run on simulation in which the real after-tax wage rate is kept 1 per cent above the base case value (sustained shock). The results of this simulation are reported in Table 1. The simulation results in general are in line with the long-run partial elasticity implied by the aggregate participation rate equation: wage elasticity has increased from 0.14 to 0.24 in the long-run. As expected, both youth and female participation rates are more sensitive to changes in real after-tax wage rate than males 25 years and over. As a matter of fact, prime age males participation rate is slightly negative (backward bending supply curve).

Table 1

Elasticity of Labour Supply with respect to the after-tax real wage rate.

Variable	Short-run	Long-run
Total labour supply	0.14	0.24
Males 14-19	0.78	1.20
Males 20-24	-0.15	0.11
Males 25-54	-0.01	-0.02
Males 55 +	0.41	0.20
Females 14-24	-0.12	0.42
Females 25-44	0.46	0.42
Females 45 +	0.10	0.34

Table 2

Elasticity of Man-hours employment with respect to the after-tax real wage rate.

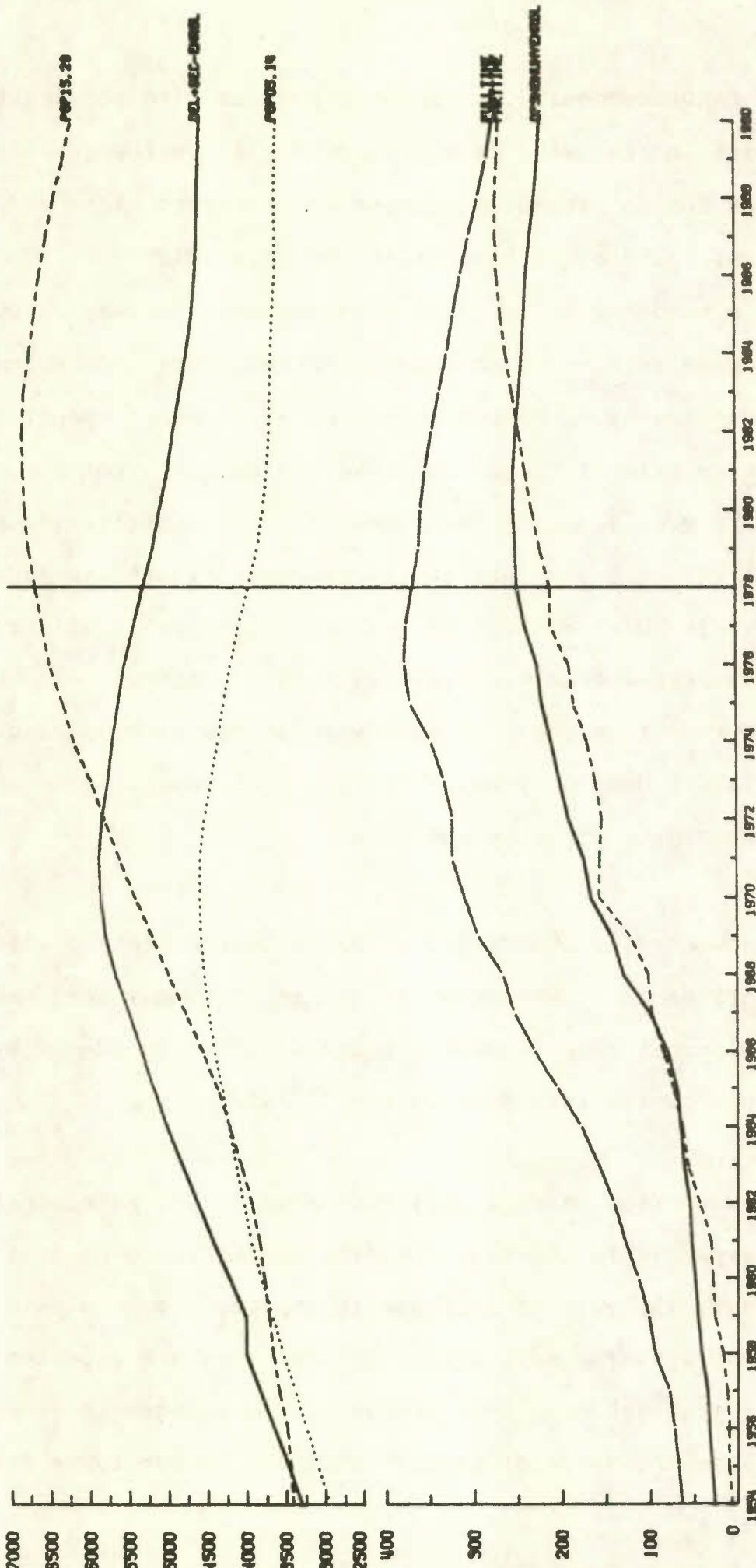
Industry	Short-run		Long-run	
	Man-hours	Employment	Man-hours	Employment
Total	-0.09	0.06	0.10	0.24
Agriculture	-0.31	-0.23	-0.25	-0.18
Forestry	-0.33	-0.18	-0.25	-0.13
Mining	-0.03	0.14	0.15	0.32
Manufacturing	-0.07	0.00	-0.01	0.03
Construction	-0.10	0.03	0.10	0.14
Transportation & communications	-0.22	0.00	0.01	0.22
Finance, insurance & real tax rate	-0.29	-0.19	0.16	0.26
Utilities	-0.64	0.48	-0.33	-0.24
Trade	-0.32	-0.27	0.02	0.07
Services	0.17	0.45	0.31	0.58
Public administration	0.10	0.15	0.12	0.17

In CANDIDE Model 2.0, labour demand is also sensitive to changes in real wage rate. Increases in real wage rate caused by either due to lagged adjustment of prices to wages and/or insensitivity of exchange rate, to wage-price developments, will have a tendency to increase both labour supply and labour demand. Real wage influences employment through both income and substitution effects. The net impact on employment depends on the relative size of these two effects. As seen from Table 2.0, in CANDIDE 2.0, income effect dominates the substitution effect resulting in a net increase in employment: the total employment elasticity with respect to real wage (general equilibrium effect) has increased from 0.06 to 0.24 in the long-run. In CANDIDE 2.0, a 1 per cent increase in real wage increases both labour supply and labour demand by about 0.2 per cent resulting in no change in the aggregate unemployment rate.

In summary, in CANDIDE 2.0, participation rate projections will be influenced by the developments in after-tax real wage rate, unemployment rate, school enrolment rates, child-woman ratio, and the per capita real pension benefits.

As seen from Chart 4, all the three female participation rates are expected to increase steadily during the period 1980-1990. However, the rate of increase is expected to be slowed some what. In contrast, the male participation rates are expected to be quite stable during this period. This in turn is expected to increase the share of females in total labour force from 25 per

# SCHOOL ENROLMENT



DEL + SEC - ENROL = ELEMENTARY & SECONDARY SCHOOL ENROLMENT  
 POST SEC - UNIV ENROL = POST SECONDARY NON UNIVERSITY SCHOOL ENROLMENT  
 FULL TIME = FULL TIME UNIVERSITY ENROLMENT  
 PART TIME = PART TIME UNIVERSITY ENROLMENT

Chart 6

cent in 1979 to about 32 per cent in 1990 (see Chart 5). In contrast, the share of young people in total labour force declines from 28 per cent in 1979 to 20.5 per cent in 1990. This trend is mainly attributable to decline in the source population of the young cohorts: males 14-24 and females 14-24.

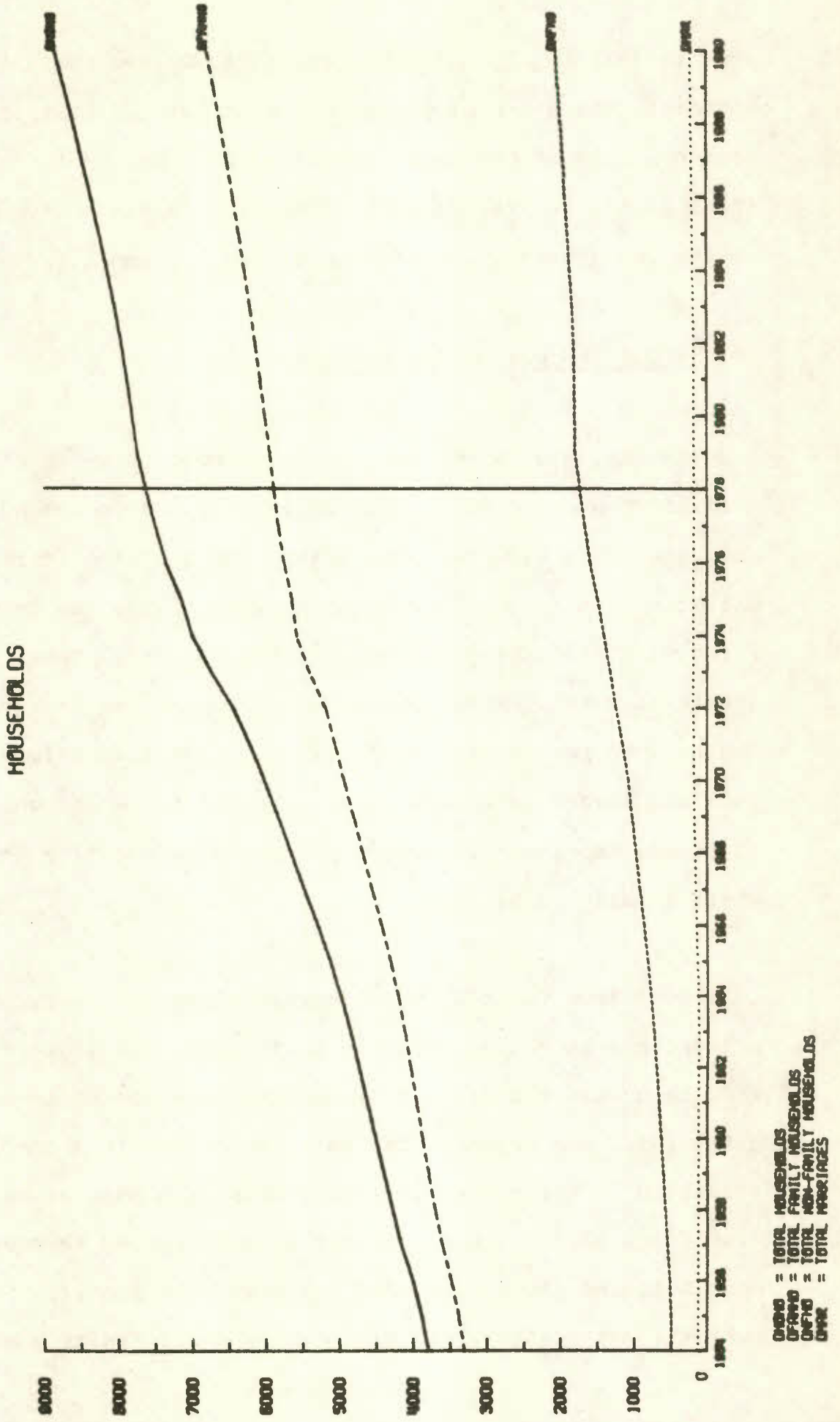
#### (4) School and University Enrolment

Using the information on population cohorts we determine elementary and secondary, non-university post secondary, under graduate (full time and part time), and graduate (full time and part time) university enrolment by multiplying the enrolment rates with the appropriate population cohorts. There are six enrolment rates. These enrolment rate equations in general depend upon per capita income (lagged distribution), unemployment rate and lagged enrolment rates. In all the equations, as expected, the long-run impact of income is positive and statistically significant.

As seen from Chart 6, the elementary and secondary school enrolment has increased steadily up to 1971, and started to decline from then on. Moreover, this decline is expected to continue until 1990, and beyond. The main reason for this decline is the reduction in the number of school going age population -- as seen from Chart 6, the trends in both elementary and secondary school enrolment and population aged 5-14 are very similar. Similarly, both the university (full time) and non-university post secondary



Chart 7



OSHHO = TOTAL HOUSEHOLDS  
OFHHO = TOTAL FAMILY HOUSEHOLDS  
ONFHO = TOTAL NON-FAMILY HOUSEHOLDS  
ONHR = TOTAL MARRIAGES

school enrolment is expected to decline steadily for the next ten years (see Chart 5), and most of this decline is again attributed to decline in the population aged 15-29. In contrast, increases in the enrolment rate offset the decline in source population, resulting in a slight increase in the part time university enrolment -- part time university enrolment increases from 232 thousand in 1979 to 267.5 thousand in 1990.

#### (5) Family Formation and Households

As mentioned earlier in this section, in CANDIDE 2.0, total households are determined by summing both the family and non-family households. Family households are obtained by adding the net family formation to previous years stock of family households. Net family formation in turn is determined by adding the marriages, and the net family immigration, and subtracting the divorces and the deaths of married persons.

In CANDIDE 2.0, marriages are determined as an identity by multiplying marriage rate with the appropriate population cohort (population aged 14 and over). Marriage rate is determined endogenously as a function of unemployment rate, divorce rate, and the lagged marriage rate.

Total deaths of married persons are obtained by multiplying the death rate of married persons with the total families in the

previous year. The death rate of married persons is negatively related to per capita income (lagged distribution).

Total net family immigration in each period is determined by multiplying the net immigration with an exogenously determined factor (the share of families in total immigration).

In CANDIDE 2.0, total divorces are obtained by multiplying an exogenously assumed divorce rate with the previous year's stock of total families.

Total non-family households are determined by an endogenously determined non-family household formation rate with the population aged 14 and over. The ratio of non-family households to population varies positively with the real per capita income (lagged distribution).

As seen from Chart 6, both the family and non-family households are expected to increase steadily up to 1990. However, the rate of increase of these variables has slowed considerably during the period 1980-1990.

### III LINKAGES BETWEEN THE DEMOGRAPHY SECTOR AND REST OF THE SYSTEM IN CANDIDE 2.0

In the previous section, we have discussed in some detail the structure of the demographic sector of CANDIDE 2.0. Before we discuss the simulation results of various demographic changes, it seems appropriate to discuss various linkages between the demographic sector and rest of the system. This will help the reader to appreciate fully the general equilibrium effects of changes in demographic variables.

CANDIDE Model 2.0 is a very large macro-economic model, estimated on Canadian annual data drawn largely from the period 1954 to 1976. It comprises 2361 equations, 830 (35%) of which are stochastic. Clearly, as a result of the enormity of the CANDIDE Model, a detailed exposition of the complete system would be inappropriate as such a technical discussion would probably not provide the clear, simple, understanding necessary for those neither associated nor familiar with model building. Rao and Whillans (1980) have condensed the CANDIDE 2.0 into a 52 equation textbook-type model. This caricature captures the major structural and behavioural relationships, abstracting the sectoral disaggregation incorporated in the actual model. Using this caricature, here we will outline the important channels through which demographic variables influence the important macro-economic variables<sup>4</sup>: economic growth, inflation, and unemployment.

(1) Consumer Expenditure

In CANDIDE 2.0, both the level and the composition of consumer expenditure is influenced by demographic variables: Cohort population, school enrolment rates, household formation, and unemployment rate.

Total consumer expenditure is determined residually from the income-saving-consumption identity. Both discretionary and private contractual saving are determined stochastically. A disaggregated set of stochastically estimated consumption functions are used to determine the composition of consumption once total consumption is derived as a residual. In CANDIDE 2.0, the aggregate saving rate is positively related to the unemployment rate. As mentioned earlier, the unemployment rate in turn is influenced by the developments in both labour supply and labour demand. Hence, in CANDIDE 2.0, population cohorts, school enrolments, and participation rates will influence the consumer expenditure indirectly through their impact on labour supply and unemployment rate.

All of the disaggregated categories of consumer expenditure are estimated either in per capita or per household terms.

School and university enrolment is one of the important determinants of consumer expenditure on books, newspapers and magazines (CHE20), education and cultural services (CSE40), and

other lodging (CSR30). Consumer expenditure on semi-durable household furnishings (CHH30) is influenced by the total number of marriages. Population of 15 years age and over is an important explanatory variable in the determination of consumer expenditure on alcoholic beverages (CNF20). Consumer expenditure on drugs and sundries (CNM40), other practitioners - gross fees (CSM13), hospitals, private and government (CSM29) are influenced by the size of older population (population aged 65 and over). Both population under nine years of age and total households determine the consumer expenditure on domestic services (CSH60). Similarly, consumer expenditure on furniture and carpets (CDH10); gas and other fuels (CNR50+CNR60), and other household services (CSH70) are influenced by the number of households.

In summary, the demographic variables both directly and indirectly influences the level and the composition of consumer expenditure in the CANDIDE system.

(2) Investment in Residential Construction

In CANDIDE 2.0, residential investment in both single and multiple dwelling starts are influenced by total new residential mortgage approvals, demographic factors, the relative advantage of renting versus owning and a proxy for the lagged change in vacancies. Population over 20 years of age is one of the most important determinants of total private new residential mortamortgage approvals. Residential investment in both

single and multiple housing starts is directly influenced by the population of 20 to 34 years of age.

In summary, both the level and composition of investment in residential construction is heavily influenced by the developments in demographic block.

(3) Government Investment

Both the school and university enrolment variables are the important determinants of government (both provincial and local) investment in school building construction. Moreover, in CANDIDE 2.0, almost all categories of government investment are influenced by the developments in demographic block via the unemployment rate.

(4) Government Expenditure

In CANDIDE 2.0, current government (all levels of government) expenditure on goods and services (other than defence) are influenced by the unemployment rate, which in turn is influenced by developments in the demographic sector. In addition to this, local government expenditure on wages and salaries, of municipal schools is mostly determined by the elementary and secondary school enrolment and the share of population aged 5 to 19 in total population.

(5) Government Transfers

Federal government transfer payments to persons include such items as family allowance benefits, unemployment insurance benefits, old age and guaranteed income security benefits, etc.

Family and youth allowances depend upon an indexed benefit rate and the population under 20 years of age. Unemployment insurance benefits also depend upon the indexed benefit rate, and the number of unemployed (from the demographic block). Similarly, old age security benefits depend upon the indexed benefit rate, cohort participation rate and population aged 65 years and over.

Transfer payments to persons in the provincial sector include workmen's compensation, government pensions, transfer payments to persons (post-secondary education), and welfare.

Workmen's compensation is in part determined by the total employment. Provincial government welfare and miscellaneous payments are influenced by total population and the total number of unemployed.

Canada Pension Plan retirement benefits are influenced by the old age population -- population of 65 years age and over. Similarly, Canada pension plan surviving spouse benefits, death



benefits, and, disability benefits are influenced by deaths of married persons.

Local government transfers to persons are also influenced by the demographic variables.

In summary, local, provincial and federal government transfer payments to persons are mainly determined by the demographic variables and the appropriate benefit rates.

(6) Wages and Prices

In CANDIDE 2.0, changes in unit labour costs (development in productivity and wages) are transmitted to final demand prices via sector output deflators.<sup>5</sup> Each sector's wage rate is essentially determined by two macro variables (labour market tightness and inflation expectations) and two sector specific variables (productivity growth and rate of change of wage rate in that sector in U.S.A.). In an effort to overcome the problem of dramatic shifts in the composition of labour force over time, prime age male unemployment rate is used as the indicator of labour market tightness. In CANDIDE 2.0, prime age male unemployment rate is determined as a nonlinear function of aggregate unemployment rate and the ratio of prime age male labour force to the total labour force.

In summation, the demographic trends will have a significant impact on the wage-price developments, and the functional distribution of income.

(7) Other Linkages

In CANDIDE 2.0, to some extent both exports and imports are also influenced by the developments in demographic block via the unemployment rate.

Both the conventional and NHA mortgage rates are influenced by the lagged vacancy rate which in turn is determined by the housing stock and the total households.

In the CANDIDE 2.0, the level of employment in each sector in part is determined by the developments in demographic block (unemployment rate) via the average weekly hours -- average weekly hours are negatively related to the unemployment rate.

Both the level and the composition of total labour force are the important determinant of government revenue via total number of tax filers, assessed income, (personal income tax), and personal exemptions and deductions.

Unemployment rate is an important determinant of net income of non-farm unincorporated business and transfers from the corporations to the household sector (bad debts, etc.).

In summary, the developments in demographic sector will have a significant impact on important macro-economic variables (economic growth, inflation, unemployment, government budget balance and productivity), through their impact on labour supply and labour demand, government expenditure and government revenue, investment in residential construction, and wages and prices.

#### IV MACROECONOMIC EFFECTS OF IMMIGRATION

The population growth in Canada may be much lower during the next 10 years than it has been during the past two decades based on available projections.<sup>6</sup> However, the rate depends on the assumptions made about fertility and immigration. Lower population growth in turn will have important implications for future output and labour force growth. In addition to this, the consequences of falling birth rates in the 1960s will soon be felt in the labour market as the children of that decade leave school to seek jobs. The reduced number of new entrants will have important effects on both the level and the composition of labour force in the 1980s. For example, the reduced rate of growth of labour supply might result in high real wage rates, and this in turn could induce young people to enter the job market earlier, the old to leave later, and women to spend larger fraction of their lives in the labour force. However, in spite of these favourable assumptions regarding participation rates, it seems likely that the labour force growth in the coming two decades will be substantially lower than in recent times.

Taking the last 30 years as a whole, the largest fraction (about 80%) of the labour force growth has come from domestic sources -- from changes in the population size and age distribution, and increases in the participation rate for some groups (women, in particular). Immigration has accounted

for only 20 per cent of the labour force growth, in net terms. However, immigration has been quantitatively more important in some periods than in others. In the 1950s it was indeed a major source, and in the earlier years of the decade it was dominant. Had it not been for large-scale immigration, the rate of economic expansion would have been much less rapid in that period.

We might face a similar situation in the coming two decades. In consequence of rapid fall in the birth rates since the beginning of the 1960s, the labour force growth rate might slowdown considerably. Immigration may therefore be a relatively more important source of labour growth than it has been during the past 10 years.

Discussion of immigration policy tends to focus on manpower and labour market effects. But immigrants do not represent merely addition to population and labour force. They affect every aspect of the economy. In the past quite a few number of researchers<sup>7</sup> have analyzed the costs and benefits of immigration to the recipient country. The benefits from the immigration include easing of both the general and specific labour shortages, economies-of-scale, offset the burden of an increasing dependency ratio, growth in per capita income, etc. In contrast, the often mentioned costs of immigration are: congestion, sharing of common wealth (natural resources and public infrastructure), increase in unemployment, racial

tensions, perpetuation of regional inequalities, burden on public purse in the form increases in unemployment insurance benefits and other transfer payments, etc.

In this section using CANDIDE 2.0, we will analyze the general equilibrium impacts of immigration on important macro-economic variables such as economic growth, unemployment rate, inflation, and per capita real income. For this purpose we have increased the net immigration from 50,000 per year in the base case<sup>8</sup> to 100,000 per year.<sup>9</sup>

#### Simulation Results

An increase in population size through immigration will be accompanied by an increase in the size of labour force, except in unusual circumstances by an increase in the size of the annual national income.

The impact of immigration on labour force is immediate, of course. Since immigrants tends to concentrate in the young adult ages, immigration has proportionately a somewhat larger labour force content than the domestic population.<sup>10</sup> In general, an increase in immigration level will influence both the size and composition of total labour force. On the final demand side of the economy, immigrants receive income in return for their productive services and generate new demand for consumer goods, investment in housing, and schooling. The demand for government

services will also expand. In general, while immigration increases the productive capacity of the economy (by increasing the supply of labour), immigrants as consumers will increase the demands for the economy for all sorts of goods, both public and private.

Even though there is less disagreement about the gross effects of immigration on national income, the net effects of immigration on per capita income, unemployment rate, inflation, and government budget balance are not very clear and these questions have been the subject of considerable debate.<sup>11</sup> We hope, the simulation results presented in this section will provide at least partial answers to these important policy related questions.

Simulation results of increased net immigration level are recorded in Tables 1.1 to 1.7. In view of the above discussion on the structure of demographic block and the linkages with the rest of the model, all the results are self explanatory. However, we will analyze these results in some detail under the following six headings:

1. Demographic Developments
2. Labour Supply and Labour Demand
3. GNP growth
4. Wages and Prices
5. Functional Distribution of Income
6. Government Budget Position

1. Demographic Developments

The impact of increased immigration level on some of the key demographic variables is recorded in Table 1.1. An increase of 50,000 immigrants per year adds 648,000 (2.5%) more people to the population (control level) by the year 1990. Since immigrants age distribution is biased more towards the working age population, the source (working age) population has also increased 2.1 per cent above the control solution, and moreover the incremental ratio of working age population to the total population is much higher in the earlier periods of simulation. As expected, the increased level of immigration has increased total births by increasing the child-bearing age female population -- total births are 20.5 thousand (6.6%) above the base case value in 1990. Similarly, since immigration raises the school and university going age population, both primary and secondary and university enrolment are above the control values. As expected, total households have increased -- in 1990, total households are 232,000 (2.6%) above the control value.

In summary, increased level of immigration has increased all of the key demographic variables -- population, working age population, births, school and university enrolment, and total households. As discussed in Section 3 these developments in turn will impact level and composition of consumption expenditure, investment in housing and schools,



labour market, government expenditure and revenue, etc.

## 2. Labour Supply and Labour Demand

As mentioned earlier, increased level of immigration has increased the working age population by 2.1 per cent in 1990. This in turn has increased the labour force by 1.9 per cent (248,000) above the control value in 1990. This in turn implies that the participation rate is reduced below the control values. As seen from Table 1.2, the increases in labour demand created by increases in final demand are not matched with the increases in labour supply resulting in higher unemployment rate -- in 1990, unemployment rate is 0.7 per cent above the control value. This in turn has put a downward pressure on the participation rate in the later periods of simulation, via the real wage.

In summation, increased level of immigration has increased both labour supply and labour demand. But the increases in labour supply are bigger than increases in employment, resulting in higher unemployment rates for all the years in the simulation period, and moreover, the increases in unemployment rate have accelerated over time. This in turn has reduced the participation rate below the base case values.

### 3. GNP Growth

As seen from 1.3, all the components of final demand are well above the control values. However, as expected, increased levels of immigration has increased the investment in residential construction and government expenditure directly by increasing the family households and government transfer payments. This in turn has increased the demand for other final demand components through multiplier effects -- consumer expenditure, investment in machinery and equipment, and non residential construction, and imports are all above the control values throughout the simulation period.

In general, increased immigration has not only increased the productive capacity of the economy but also has increased the demands on the economy for all sorts of goods, both public and private. These developments in turn have increased the level of national income in the economy -- by 1990, GNP is 1.6 billion dollars (0.94%) above the base case value.

### Wages and Prices

As seen from Table 1.4, an increase in immigration level has put a downward pressure on wages and prices by easing the labour market pressure -- by 1990, nominal wages and prices (CPI) have declined by 2.73 per cent and 1.5 per cent, respectively. As shown in Rao (1980) in CANDIDE 2.0, an increase (decrease) in unemployment rate lowers (increases) the real wage rate.

An increase in immigration level has reduced the real wage rate by 1.3 per cent in 1990. This in turn has put a downward pressure on participation rates.

In general, an increase in immigration level will put a downward pressure on wages and prices in the system by easing some of the labour market pressure -- in 1990 inflation rate is 0.3 per cent below the control value.

#### Functional Distribution of Income

Immigration through its impact on real wage rate has reduced the share of wage bill in national income -- in 1990, wage bill share is 1 per cent below the control value. In the beginning of simulation period, even though the wage bill is above the control value, its share in national income has declined, implying that the increases in profits and other income are bigger than the increases in wage bill (see Table 1.5).

As seen from Table 1.5, increased level of immigration has reduced the level of real per capita income throughout the whole simulation period and moreover this decline has accelerated over time -- in 1990, per capita real income is \$103.00 (1.5%) below the base case value. Our simulation results imply that for immigrants to compensate prior Canadians for the loss in real

income per capita, on the average a fee of \$3100.00 would have to be paid per year per immigrant.<sup>12</sup> However, it should be emphasized that this calculation implicitly assumes that the per capita income of new immigrants is equal to the per capita income of prior residents. If the per capita income of the new immigrants on the average is less than the prior residents, the fee would be much smaller.

In summary, immigration increases will reduce the share of wages in national income by reducing the real wage rate. Moreover, our simulation results suggest, that each immigrant has to pay a substantial amount in fee, to compensate prior residents for decline in their welfare. If one takes into consideration such costs as congestion and pollution<sup>13</sup>, and increased government deficits (resulting from larger population) the "admission" fee would be much higher than the fee implied by the simulation results.

#### Government Budget Position

The impact of immigration on federal budget position is recorded in Table 1.6A. As expected, the increase in unemployment rate and federal government revenue (in real terms) has increased the expenditure on goods and services (in real terms) initially. But the reduction in real wage has reduced the current expenditure on goods and services below the control value. As mentioned in Section III, increases in unemployment rate, and increased number of dependents (population under age 20, and above age 65), have increased the transfer payments

considerably -- in 1990, transfers to persons are above the base case value by about one billion dollars. However, the total federal government expenditure has increased only slightly -- total expenditure is only \$290 million above the base case value in 1990.

Due to increases in activity, the federal government revenue from all types of taxation has increased significantly. Due to changes in the functional distribution of income, by the end of simulation period, revenue from direct taxes, persons and indirect taxes is below the control by about \$660 million. However, the increases in corporate taxes more than offsets these reductions, resulting in a net revenue increase of \$530 million.

In summary, immigration has increased both the revenue and expenditure of the federal government. But the increases in revenue are somewhat bigger than the increases in expenditure, resulting in a slight improvement of the Budget position of federal government -- on the average, federal government Budget deficit is reduced by about \$150 million.

In contrast, the increases in expenditure are bigger than the increases in revenue for the provincial government's resulting in a net reduction of the budget surplus for the provinces (see Table 1'6B) -- in 1990, the provincial government budget surplus is reduced by almost \$2 billion.

In contrast to the budget position of federal government, increases in current expenditure on goods and services and interest payments have contributed to the increases in provincial government expenditure. As a matter of fact, by the end of simulation period, provincial transfer payments to persons are below the base case value.

In summary, immigration has slightly improved the budget position of federal government. In contrast, provincial government budget position has deteriorated considerably. However, our results imply that immigration worsens the total government (all levels) budget position.

Table 1.1  
Demographic Variables  
(in thousands)

Variable	1980	1982	1985	1990
Δ Net Immigration	50.0	50.0	50.0	50.0
Δ Population (% difference)	50.9 (0.21)	157.6 (0.43)	328.3 (1.32)	647.6 (2.53)
Δ Source Population (% difference)	37.5 (0.20)	112.9 (0.58)	229.3 (1.15)	438.7 (2.09)
Δ Births (% difference)	1.0 (0.28)	4.3 (1.23)	9.5 (2.86)	20.5 (6.6)
Δ School Enrolment (% difference)	9.2 (0.18)	27.7 (0.57)	56.8 (1.22)	128.9 (2.85)
Δ University Enrolment (% difference)	1.7 (0.29)	4.6 (0.76)	7.8 (1.29)	9.7 (1.73)
Δ Households (% difference)	25.1 (0.32)	74.1 (0.93)	140.3 (1.69)	231.7 (2.59)

Table 1.2  
Labour Supply and Labour Demand

Variable	1980	1982	1985	1990
Δ Source				
Population (% difference)	37.5 (0.20)	112.9 (0.58)	229.3 (1.15)	438.7 (2.09)
Δ Labour Supply (% difference)	23.7 (0.21)	68.8 (0.59)	135.3 (1.09)	247.8 (1.86)
Δ Labour Demand (% difference)	12.4 (0.12)	43.2 (0.40)	79.1 (0.68)	137.8 (1.09)
Δ Unemployment Rate	0.1	0.2	0.4	0.7

Table 1.3  
GNE Growth

Variable	1980	1982	1985	1990
Δ GNE (% difference)	219.1 (0.17)	682.3 (0.50)	1051.6 (0.71)	1612.7 (0.94)
Δ Consumption (% difference)	62.6 (0.08)	301.4 (0.35)	510.2 (0.54)	694.6 (0.65)
Δ Investment (% difference)	122.8 (0.42)	347.6 (1.10)	485.3 (1.32)	574.8 (1.31)
Δ Residential Investment (% difference)	84.1 (1.72)	152.6 (3.08)	198.3 (3.48)	303.0 (5.56)
Δ Government Expenditure (% difference)	38.6 (0.17)	120.4 (0.52)	229.3 (0.96)	430.4 (1.70)
Δ Imports (% difference)	37.3 (0.10)	153.4 (0.40)	233.9 (0.55)	213.5 (0.42)



Table 1.4  
Wages and Prices

Variable	1980	1982	1985	1990
% Change in Wages	0.01	-0.08	-0.51	-2.73
% Change in CPI	-0.02	-0.06	-0.22	-1.46
% Change in Real Wages	0.03	-0.02	-0.29	-1.27
Δ Productivity Growth (percent)	0.1	0.0	0.0	0.0
% Change in Inflation rate	0.0	0.0	-0.1	-0.3

Table 1.5  
Functional Distribution of Income

Variable	1980	1982	1985	1990
Δ Wage bill (\$ millions) (% difference)	165.0 (0.10)	525.1 (0.26)	239.2 (0.09)	-7500.7 (-1.68)
Δ Share of Wage bill in Net National Income (percent)	-0.1	-0.2	-0.4	-1.0
Δ Per capita Income - 1971\$ (% difference)	-14.0 (-0.25)	-9.0 (-0.15)	-37.0 (-0.60)	-103.0 (-1.50)

Table 1.6A  
Federal Gov't Budget Position  
(\$ Millions)

Variable	1980	1982	1985	1990
<u>Δ Revenue</u>				
Total	90.4	374.0	660.6	528.9
Direct taxes, Persons	27.3	95.2	109.8	-641.8
Direct taxes, Corporations	37.7	183.3	362.0	1035.0
Indirect taxes	20.0	69.2	105.5	-19.2
<u>Δ Expenditure</u>				
Total	99.7	252.6	419.4	290.3
Current expenditure on goods & services	21.6	63.2	48.2	-590.2
Interest payments	3.6	-13.7	-142.6	-89.8
Transfers to persons	71.7	192.3	497.9	995.1
Δ Deficit	-11.1	105.9	190.2	130.2

**Table 1.6B**  
**Budget Position of Provincial Gov'ts**  
 (\$ Millions)

Variable	1980	1982	1985	1990
<u>Δ Revenue</u>				
Total	52.3	210.9	277.5	-789.4
Direct taxes, persons	22.5	65.6	35.0	-851.0
Direct taxes, corporations	15.4	74.8	146.0	401.2
Indirect taxes	8.4	45.2	49.0	-295.0
<u>Δ Expenditure</u>				
Total	56.0	290.6	715.4	1119.1
Current expenditure on goods & services	48.5	145.9	337.5	654.3
Interest payments	0.1	3.2	41.2	299.5
Transfers to persons	3.2	35.3	44.9	-354.1
Δ Deficit	-9.1	-96.3	-450.9	-1923.1

V MACRO-ECONOMIC IMPACT OF INCREASED PARTICIPATION RATES  
OF SECONDARY WORKERS

The distensions in the labour force and the economy thus brought on just by demographic -- the sheer numbers of young people coming into working age -- were aggravated during the 1970s by an accompanying phenomenon: the enormous increase in the participation of youths and women. From 1970 to 1978, 1.37 million women joined the labour force, accounting for 53 per cent of its growth. In the 1970s, increases in participation rate have contributed about 30 per cent of the growth in labour force, and almost all of this increase has come from the secondary workers (youth and women). These changes in the level and composition of labour force will have important implications for unemployment -- inflation tradeoff, economic growth, and government Budget position.

As mentioned in Section II, due to reductions in the number of youths, and a slowdown in the rate of growth of participation rate of youth and women, total labour force is expected to increase by about 1.8 per cent per annum during the 1980s, compared to 3.2 per cent growth in the 1970s. Of course, the reliability of the projected rate of growth of labour force, critically depends upon the accuracy of growth projections for working age population, and participation rates. There is virtually no disagreement among the researchers about the growth rate of working age population. In contrast, regarding

the future developments about the participation rates there is some disagreement, and most of this difference is attributed to the differences in the assumed rate of increase in the participation rate of females (especially married women).

Our base case projections imply that the participation rates of females aged 14-24, 25-44, and 45+ will grow by 0.75, 1.9 and 1.2 per cent per annum, respectively, during the 1980s. With the exception of females aged 45 years and over the projected increases in the participation rates of females are much smaller than the increases experienced in the 1970s (see Table 2). As indicated in Section II, in CANDIDE 2.0, participation rates are influenced by the developments in real wage, unemployment rate, real pension benefits, school enrolment rates, and child-woman ratio. However, in the past, forecasting of the participation rates, proved to be a very difficult job.

In view of the past difficulties in predicting the secondary participation rates, it would be very useful to study the general equilibrium impact of alternative labour force projections, with the different set of assumptions about the secondary participation rates. This exercise will enable us to assess the impact of dramatic increases in the participation rate of secondary workers, on the key macro-economic variables in the 1970s. Moreover, the results of this simulation exercise will also help us to analyze the consequences of unexpected changes both in

Table 2.0

Average Annual Rate of Growth of Participation Rates 1980-1990  
(per cent)

<u>Age-sex Group</u>	<u>Base Case</u>	<u>Shocked Solution</u>
Males 14-19	0.80	3.00
Males 20-24	0.00	-0.50
Males 25-54	0.02	0.00
Males 55+	-0.85	-1.90
Females 14-24	0.75	2.30
Females 25-44	1.90	5.10
Females 45+	1.20	0.60

the level and composition of labour force on economic growth, unemployment-inflation tradeoff, and government budget position in the 1980s and beyond.

In this section, using CANDIDE Model 2.0, we will analyze the general equilibrium impacts of changes in participation rates. For this purpose, we have exogenized the participation rates, university enrolment rates, and the divorce rate,<sup>14</sup> and assumed that these variables increase by their respective average growth rates in the 1970s.<sup>15</sup>

Simulation results of the increase in participation rates are recorded in Tables 2.1 to 2.7. In view of the discussion in previous sections about the structure of demographic block, and the linkages between the demographic variables, and rest of the system, the results are self-explanatory. However, we will discuss these results in some detail under the following seven major groupings:

- 1) Demographic Variables
- 2) Labour Supply and Labour Demand
- 3) GNP Growth
- 4) Wages and Prices
- 5) Functional Distribution of Income
- 6) Government Budget Position
- 7) Balanceof-Payments and Exchange Rate

### Demographic Variables

As expected, the increases in participation rates of females have reduced the total number of births by lowering the fertility rates -- in 1990, total births are 7.4 thousand (2.40%) below the control value. As a consequence, in 1990 total population is 48 thousand below the base case population. Similarly, due to reductions in the university enrolment rates (especially full time), total university enrolment is reduced by 5.0 (0.93%) in 1990. Due to increases in the divorce rate, total households are reduced below the control values -- in 1990, in the shocked solution, there are 430 thousand fewer households than the base case (see Table 2.1).

In summary, increases in participation rates, and divorce rates have reduced the total population, and households below the base case values. Similarly, university enrolment is also reduced slightly.

### Labour Supply and Labour Demand

The impact of increased participation rates on both labour supply and labour demand is recorded in Table 2.2. As expected, the labour supply is well above the control values throughout the simulation period -- in 1990, labour supply is 9.4 per cent above the base case value. However, had we allowed the participation rates to react to the developments in labour market (caused by



an exogenous increase (shock) in the participation rates), the rate of increase in labour supply would have been reduced considerably in the later periods of simulation, due to reductions in the opportunity (real wage) cost of working (especially for females).

The increases in participation rates have also increased total employment in the economy by increasing the final demand in the system (see Table 3.1). Due to reductions in the real wage rate, in the CANDIDE 2.0 we would expect to see an increase employment, as employers substitute labour for capital. In 1990, compared to base case, 571 thousand (4.5%) more jobs are created. However, the increases in number of people looking for jobs are much bigger than the increases in employment resulting in a substantial increase in the unemployment rate. In 1990, unemployment rate is 4.5 per cent above the control value -- unemployment rate is around 10 per cent, compared to a 5.6 per cent unemployment rate in the base case.

In summary, the increases in secondary participation rates have increased both labour supply and labour demand well above the control values. However, the increases in labour supply are much bigger than the increases in employment, resulting in a substantial increase in the unemployment rate.

### GNP Growth

As seen from Table 2.3, increases in the secondary participation rates have increased all the components of final demand, by increasing both employment and government transfer payments (unemployment insurance benefits, welfare payments, etc.). Due to increases in unemployment, government expenditure on current goods and services and transfer payments have increased considerably above the base case, resulting in a 7 per cent increase in total government expenditure in 1990. These increases in employment income through multiplier effects have increased the other final demand components (consumption, investment, and imports) -- in 1990, real GNP is \$7.7 billion (4.5%), above the base case value. In contrast to increases in immigration, the increases in real GNP, resulting from increased participation rates will be translated into increases in per capital real income.

### Wages and Prices

As expected, the tremendous increase in unemployment rate has put a considerable downward pressure on both wages and prices in the system -- in 1990, nominal wage rate, and CPI are 5.4 per cent and 3.1 per cent below their base case values, respectively. As in the case of immigration, the reductions in prices are not as big as reductions in wages, resulting in a real wage reduction -- in 1990, the real wage rate is 2.2 per cent below the control

value. Due to increased economic activity, labour productivity growth is slightly above the base case value.

In summary, due to increases in unemployment rate, both wages and prices are reduced below the base case values. However, the reductions in prices are smaller than the reductions in wages, resulting in real wage losses. Both the downward pressure on wages and the increased labour productivity growth have helped to reduce the inflation rate substantially by the end of simulation period -- in 1990 inflation rate is 0.7 per cent (per annum) below the base case value.

#### Functional Distribution of Income

As seen from Table 2.5, due to reduction in real wages, inspite of a 4.5 per cent increase in total employment, by the end of the simulation period, wage bill is \$6.2 billion (1.4%) below the base case. In contrast, corporate profits are \$21.2 billion (20.8%) above the base case value in 1990. As a consequence, the wage share in national income is reduced by 2.1 per cent, and profit share has gone up by 3.1 per cent in 1990. This implies that the share of non-wage and non-profit income (interest income), is reduced by 1 per cent.

#### Government Budget Position

Table 2.6A records the impact of secondary participation rate increases on the Budget position of federal government. As

expected, most of the increase in federal government expenditure has come from the increases in transfer payments (unemployment insurance benefits) and interest payments on federal government debt. Moreover, the increases in interest payments are directly related to increases in transfer payments. Initially, increases in transfer payments were not matched by increases in tax revenue, resulting in budget deficits. A deficit leads to higher net interest payments which lead to a higher deficit, and so on.

In view of the changes in functional distribution of income, it is not surprising that most of the increase in federal government revenue has come from the corporate taxes. As a matter of fact, in 1990, direct taxes from persons are slightly below the base case value. In contrast, indirect taxes have increased by \$850 million in 1990.

In summary, the increased participation rates have increased both the revenue and expenditure of the federal government. However, the increases in expenditure are much bigger than the increases in revenue, resulting in huge budget deficits -- in 1990, federal government budget deficit has increased by almost \$9 billion.

As seen from Table 2.6B, the increased participation rates have also worsened the Budget position of provincial governments.

However, in contrast to the federal government, most of the increases in provincial government expenditure has come from the increases in current expenditure, and interest payments. In CANDIDE 2.0, other things remaining constant, an increase unemployment rate will increase the provincial government real expenditure on current goods and services.

As in the case of the federal government, all of the increases in provincial government revenue have come from corporate and indirect taxes. In contrast, direct taxes from persons are \$1.6 billion below the base case value.

In summary, increased participation rates have worsened the budget position of both the federal and the provincial government's -- in 1990, total government budget balance (federal and provincial) is reduced by \$14.5 billion.

#### Balance of Payments and Exchange Rate

In spite of reductions in domestic costs, the increased economic activity has increased the current account deficit by \$6.6 billion in 1990, of which, about 50 per cent has come from service transactions (see Table 2.7). Since the increases in net capital inflows are not sufficient to offset completely the increased deficit on current account, the value of Canadian dollar has depreciated against its U.S. counter part -- in 1990, Canadian dollar value is 1.74 per cent below the base case value.

In summary, the exogenous increases in participation rates have increased GNP, and real per capita income, and lowered the inflation rate. However, our results suggest that the negative impact of increased participation rates on the unemployment rate, functional distribution of income, real wages, government budget position, and current account balance and exchange rate outweighs the above positive impact.

Table 2.1  
Demographic Variables  
(in thousands)

Variable	1980	1982	1985	1990
Δ Population (% difference)	-4.0 (0.02)	-9.8 (0.04)	-17.8 (0.07)	-48.1 (0.19)
Δ Births (% difference)	-4.2 (1.22)	-2.3 (0.66)	-4.0 (1.22)	-7.4 (2.40)
Δ School enrolment (% difference)	-1.2 (0.02)	1.2 (0.02)	1.8 (0.04)	-0.4 (0.01)
Δ University enrolment (% difference)	-2.0 (0.34)	-7.8 (1.27)	-9.4 (1.55)	-5.2 (0.93)
Δ Households (% difference)	-5.6 (0.07)	-22.7 (0.28)	-100.2 (1.21)	-430.2 (4.81)

Table 2.2  
Labour Supply and Labour Demand  
(in thousands)

Variable	1980	1982	1985	1990
Δ Labour Supply (% difference)	-66.7 (0.59)	124.0 (1.06)	411.5 (3.33)	1247.1 (9.38)
Δ Labour demand (% difference)	-28.4 (0.27)	36.3 (0.33)	174.0 (1.50)	571.0 (4.51)
Δ Unemployment rate (per cent)	-0.3	0.7	1.7	4.2

Table 2.3

GNE Growth  
(millions - 1971\$)

Variable	1980	1982	1985	1990
Δ GNE (% difference)	-321.6 (0.25)	592.1 (0.43)	2275.2 (1.53)	7681.7 (4.50)
Δ Consumption (% difference)	-350.5 (0.42)	272.8 (0.31)	1487.5 (1.60)	4598.2 (4.30)
Δ Gov't expenditure (% difference)	-107.6 (+0.48)	144.4 (0.63)	496.0 (2.08)	1727.3 (6.84)
Δ Investment (% difference)	-108.6 (0.37)	135.5 (0.43)	716.5 (1.94)	2279.2 (5.19)
Δ Imports (% difference)	-163.5 (0.45)	102.6 (0.27)	641.5 (1.50)	1691.2 (3.32)

Table 2.4

Wages and Prices

Variable	1980	1982	1985	1990
% Difference in Wage Rate	0.25	0.30	-0.64	-5.36
% Difference in CPI	0.14	-0.02	-0.43	-3.12
% Difference in Real Wage Rate	0.11	0.32	-0.21	-2.24
Δ Productivity Growth (per cent)	-0.1	0.2	0.0	0.2
Δ Inflation Rate (per cent)	0.1	-0.2	-0.2	-0.7



Table 2.5  
Functional Distribution of Income

Variable	1980	1982	1985	1990
$\Delta$ Wage bill (% difference)	- 0.8 (0.00)	904.7 (0.46)	1557.4 (0.57)	-6159.7 (1.38)
$\Delta$ Corporate Profits (% difference)	-554.0 (1.66)	463.2 (1.04)	3710.6 (5.64)	21166.1 (20.84)
$\Delta$ Wage Share in Net National Income	0.1	0.0	-0.4	-2.1
$\Delta$ Profit Share in Net National Income	-0.2	0.1	0.8	3.1

Table 2.6A  
Federal Grovenment's Budget Position  
(\$ Millions)

Variable	1980	1982	1985	1990
<u>ΔRevenue</u>				
Total	-236.2	-114.1	944.8	6246.4
Direct Taxes Persons	- 66.6	-178.1	-313.1	-233.0
Direct Taxes, Corporations	-105.4	29.6	893.8	4653.9
Indirect Taxes	- 45.8	42.1	252.3	850.8
<u>ΔExpenditure</u>				
Total	-367.6	796.2	2892.6	14595.4
Goods & Services	- 43.6	120.8	223.5	337.1
Transfer Payments	-200.3	602.2	1915.7	7015.4
Interest Payments	-118.9	67.5	722.5	7177.5
ΔDeficit	132.7	-886.1	-2071.1	-8965.3

Table 2.6B  
 Budget Position of Provincial Government's  
 (\$ Millions)

Variable	1980	1982	1985	1990
<u>Δ Revenue</u>				
Total	-131.8	85.4	626.6	+1239.0
Direct Taxes, Persons	- 20.8	4.9	-140.0	-1553.6
Direct Taxes, Corporations	- 43.1	13.6	364.4	1873.4
Indirect Taxes	- 50.7	- 51.4	297.4	661.4
<u>Δ Expenditure</u>				
Total	- 52.8	417.2	1509.6	5925.4
Goods & Services	-150.2	322.7	1162.6	4546.0
Transfer Payments	121.5	79.9	53.0	- 232.1
Interest Payments	- 11.9	3.7	113.8	917.4
Δ Deficit	- 81.2	-381.6	-746.7	-4506.6

Table 2.7

Balance of Payments and Exchange Rate  
(\$ Millions)

Variable	1980	1982	1985	1990
Δ Current Account Balance	356.6	-285.5	-1831.0	-6646.2
Δ Merchandise	250.1	-209.5	-1116.1	-2994.6
Δ Service Transactions	91.6	- 63.6	-646.2	-3309.7
% Difference in Exchange Rate	- 0.15	0.08	0.42	1.74

## VI MACRO-ECONOMIC CONSEQUENCES OF TWISTS IN THE AGE STRUCTURE OF WORKING AGE POPULATION

The age structure of a population, at any given time, echoes with a lag chiefly the birth rate. The share of youth in working age population follow movements in the birth rate some 15 to 20 years earlier. Thus, the long-term future of age structure depends on the outlook for the birth rate. As a result of postwar baby boom, the share of youth in working age population in Canada has gone up from 21 per cent in 1960 to 25.6 per cent in 1970. In contrast, as a consequence of falling birth rates, since 1960, the share of youth in working age population is expected to decline from 25.6 per cent in 1970 to 24.7 per cent in 1980, and 18 per cent in 1990. As opposed to this, the share of prime age population (25-54), is expected to rise from 52.4 per cent in 1980 to 57.8 per cent in 1990. Similarly, the share of aged (55+) is expected to increase from 22.9 per cent in 1980 to 24.2 per cent in 1990 (see Table 3).

These dramatic changes in the composition of working age population will have serious socio-economic implications. For example, some of the researchers [Easterlin (1978), Guzzardi (1979)] have attributed some of the blame for the socio-economic problems of the 1970s (stagflation, cohort divorce rates, suicide among young males, crime rates, and political alienation), to changes in the composition of working age population. Age composition is of economic significance, because of its impact upon individual behaviour affecting economic and other characteristics of the population and its economy (eg., level and

Table 3.0

Changes in Age-Sex Composition of Working Age Population

	<u>1980</u>	<u>1985</u>	<u>1990</u>
Males 25-54 (base case)	15.1	26.4	28.0
Males 25-54 (shocked solution)	24.7	24.7	24.5
Youth (base case)	24.7	21.5	18.0
Youth (shocked solution)	26.0	26.1	26.2
Aged-55+ (base case)	22.9	23.8	24.2
Aged-55+ (shocked solution)	22.1	22.2	22.1
Females 25-54 (base case)	27.3	28.3	29.8
Females 25-52 (shocked solution)	27.2	27.1	27.2

composition of labour force, school and university enrolment, productivity, income distribution, consumption patterns, government transfers, attitudes affecting investment, and so on).

As mentioned in Section V, both changes in the composition of working age population (rising share of youth), and increased participation rates of females and youths have increased the labour force at record rates in the 1970s. Similarly, these changes have also altered significantly the composition of total labour force -- the share of youths, and females in total labour force has increased from 23.3 and 19.3 per cent in 1965 to 28.1 and 25.2 per cent in 1979, respectively. In the previous section, we have analyzed the macro-economic consequences of increased secondary participation rates. In this section, using CANDIDE 2.0 Model, we will analyze the general equilibrium impact of changes in the distribution of working age population on some of the key macro-economic variables. The results of this exercise would give us an idea about the macro-economic impact of changes in the working age population in the 1970s. Furthermore, they would also enable us to appreciate the consequences of continuous decline in the share of youth in working age population for the 1980s and beyond. For this purpose, we have exogenously determined the composition of population of 14 years and over, for the simulation period: using the 1971 cohort shares we have distributed the base case source population (working age population) among the various age-sex groupings.<sup>16</sup> It is important to note that the levels of

both total and as well as the working age population are identical in both the shocked and control solutions.

Simulation results for the twists in the age structure are recorded in Table 3.1 to 3.5. The following are some of the important findings.

- a) As a result of increased number of females in the child-bearing age group (25-44), total number of births have increased by 11.0 thousand in 1990. Moreover, the increased share of young females (15-24) is also partly responsible for the increased births, since in the simulation period the fertility rate for young females is higher than the fertility rate for prime aged females (25-44).
- b) Since the age-structure is twisted in favour of younger population, both school and university enrolments have increased substantially above the control solution -- in 1990, elementary and secondary school enrolment, and university enrolment (both full-time and part-time) are 991.0, and 135.0 thousand above the base case values (see Table 3.1).
- c) As seen from Table 3.1, changes in the composition of working age population have increased the total number of households by increasing both family and non-family households.



In CANDIDE 2.0 Model, increased number of young people will increase family households by increasing the number of marriages. Similarly, twists in the age structure of working age population favourable to young will increase the non-family households, by increasing the base population.

In summary, changes in the composition of working age population have increased births, school and university enrolment, and households. These demographic changes in turn will have significant impact both the level and composition of final demand.

- d) Since the participation rate of youth is well below the participation rate of prime age population, mere redistribution of working age population have depressed the total labour supply below the base case value -- in 1990, labour supply is 270.0 thousand below the base case (see Table 3.2).
  
- e) In spite of a significant reduction in total output (GNE), total employment has declined marginally -- in 1990, total employment is only reduced by 19 thousand. This in turn implies, that the changes in the composition of working age population favouring youth have depressed labour productivity by changing the composition of output in favour of labour intensive industries.

- f) As seen from Table 3.2, the reductions in labour force are much larger than the reductions in employment, resulting in a substantial reduction in the unemployment rate -- in 1990, the unemployment rate is 1.6 per cent below the base case.

Furthermore, the composition of unemployment imply that the reductions in the unemployment rate of prime aged males are much bigger than the reductions in aggregate unemployment rate. This in turn has put a tremendous upward pressure on wages and prices in the system.

- g) As expected, both wages and prices are well above control values. In 1990, nominal wage rate, and CPI are 14.7 and 9.1 per cent above their base case values, respectively. This in turn has increased the real wage rate by about 5.6 per cent.

In summary, changes in the age composition in favour of youth has put an upward pressure on inflation rate in the system -- in 1990, inflation rate is 1.1 per cent above the base case rate (see Table 3.2).

- h) As a result of increases in the real wage rate, total wage bill is about \$63 billion above the control value in 1990. In contrast, corporate profits have declined by about \$20.4 billion. These changes in turn have reduced the share of profits by 4.5 per cent, and increased the share of wages by

4.0 per cent, this in turn implies that the share of non-wage and non-profit income has gone up by 0.5 per cent (see Table 3.5).

- i) In spite of huge increases in real wages, price effects, have reduced all the final demand components (with the exception of imports) well below their base case values. As a result, in 1990, GNP is \$6.4 billion below the base case (see Table 3.4).
  
- j) Increased domestic costs (wages, and interest rates) have increased imports and reduced exports, resulting in a huge increase in current account deficit -- in 1990, current account deficit is \$5.0 billion above the base case value.

In summary, our results imply that specific changes in the composition of working age population of the 1970s namely have increased both the school and university enrolment, increased current account deficit, reduced the unemployment rate, put an upward pressure on wages and prices, and reduced GNP. In a nutshell our results imply that, mere twists in the age structure of working age population have contributed significantly to the stagflation problems of the 1970s.

Table 3.1  
Demographic Variables  
(in thousands)

Variable	1980	1982	1985	1990
Δ Births	2.8	-1.2	1.7	11.1
Δ School enrolment	248.0	438.5	749.2	991.3
Δ University enrolment	-1.7	16.1	50.6	134.6
Δ Households	5.6	20.4	112.0	510.4

Table 3.2  
Labour Supply and Labour Demand  
(in thousands)

Variable	1980	1982	1985	1990
Δ Labour Supply	-57.8	-100.3	-165.3	-271.1
Δ Labour demand	-18.2	-80.8	-12.1	-19.1
Δ Unemployment rate (per cent)	-0.3	-0.1	-1.1	-1.6

Table 3.3

GNE Growth  
(millions of 1971\$)

Variable	1980	1982	1985	1990
Δ GNE	-75.4	-1806.9	-1866.3	-6400.1
Δ Consumption	251.2	-750.0	-1394.7	-2527.9
Δ Gov't expenditure	119.9	-309.4	-235.5	-968.8
Δ Investment	-170.3	-777.1	-191.4	-1053.5
Δ Imports	106.9	-317.6	-123.1	776.3

Table 3.4

Wages and Prices

Variable	1980	1982	1985	1990
% Difference in Wage Rate	-0.01	0.57	3.09	14.69
% Difference in CPI	0.08	0.09	1.90	9.12
% Difference in Real Wage Rate	-0.09	0.48	1.19	5.57
Δ Productivity Growth (per cent)	-0.1	-0.2	0.2	0.1
Δ Inflation Rate (per cent)	0.1	0.1	0.7	1.11

Table 3.5

Functional Distribution of Income  
(\$ Millions)

Variable	1980	1982	1985	1990
Δ Wage bill	- 235.2	-450.5	8027.4	62988.0
Δ Corporate Profits	- 658.3	-2649.5	-1273.6	-20425.9
Δ Wage Share (per cent)	0.2	0.5	0.6	4.0
Δ Profit Share (per cent)	- 0.3	-0.8	0.7	-4.5

## VII CONCLUSIONS

The primary objective of this paper has been to analyze the macro-economic effects of changes in some of the important demographic variables, using CANDIDE Model 2.0. The following are some of the important findings.

- 1) Total number of births are projected to decline from 358 thousand in 1979 to 341.0 thousand in 1985 and 323.0 thousand in 1990. As a result of lower birth rates and lower levels of net immigration, population growth is expected to slowdown considerably in the 1980s.
- 2) As a result of declining birth rates, the share of population under age 20 in total population is expected to decline from 34.4 per cent in 1979 to 27.4 per cent by 1990. By contrast, the share of elderly population (aged 65 years and over) is expected to rise from 9.1 per cent in 1979 to 11.0 per cent in 1990.
- 3) All the three female participation rates are expected to increase steadily during the period 1980-1990. However, the rate of increase is expected to slowdown significantly mainly due to unfavourable developments on both the unemployment rate and the real wage rate fronts. In contrast, the male participation rates are expected to be quite stable during

this period. These developments are expected to raise the share of females in total labour force from 25.0 per cent in 1979 to 32.0 per cent in 1990.

- 4) As a result of decline in the level of youth population (under 25) both the school and university enrolments are expected to decline steadily in the 1980s and beyond.
- 5) Both the family and non-family households are expected to increase steadily at least up to 1990. However, the rate of increase of these variables will be slowed considerably during this period.
- 6) Our results suggest that the costs of immigration (increased unemployment rate, reduced per capita income, shifts in the functional distribution of income, and increased government deficits) outweigh the benefits (increased output level and a slight drop in inflation rate).

Our results imply that for immigrants to compensate prior Canadians for the loss in real per capita income, on the average a fee of \$3,100.00 would have to be paid per year per immigrant. Moreover, if we take into consideration such costs as congestion and pollution, and increased government deficits, the fee would be much higher than the fee implied by our simulation results. However, it should be emphasized that our calculation implicitly assumes that on the average the per capita income of the new immigrants is equal to



the per capital income of the prior residents. If immigrants on the average earn much less than the Canadians, the fee would be much smaller than the fee suggested by our calculations.

- 7) Our simulation results suggests that increased participation rates of females and youths in the 1970s have increased GNP, and real per capita income, and lowered the inflation rate. However, the negative impact of increased participation rates on unemployment rate, functional distribution of income, real wages, government budget position and trade balance outweighs the positive impact.
- 8) Our simulation results imply that changes in the composition of working age of population of the 1970s, have increased both the school and university enrolment, increased the current account deficit, reduced the unemployment rate, put an upward pressure on both wages and prices, and reduced the GNP.

In a nutshell our results imply that the increased participation rates of females and youth, and twists in the age structure of working age population have contributed significantly to the stagflation problems of the 1970s. These results in turn suggest, that an unexpected rise in the participation rates well above the increases implied by the base case, the inflation-unemployment trade off and the government budget position could be much worse in the 1980's, compared to the base case projections.

APPENDIX

SOLUTION: OIL.\$2.NETING  
=====

- 1. TITLE "INCREASE IN NET IMMIGRATION"
- 2. ASSU DNETIIMM 100. 1980 1990

?

SOLUTION: OIL.\$2.PARTI

=====

1.	TITLE "INCREASE IN PARTICIPATION RATES MALE & FEMALE"			
2.	ASSU DRATE.DIVORC	0.981	9.4	/GROW
3.	EX06 /VARI DFPARTRATE14.24			
4.	EX06 /VARI DFPARTRATE25.44			
5.	EX06 /VARI DFPARTRATE45+			
6.	EX06 /VARI DMPARTRATE14.19			
7.	EX06 /VARI DMPARTRATE20.24			
8.	EX06 /VARI DMPARTRATE25.54			
9.	EX06 /VARI DMPARTRATE55+			
10.	EX06 /VARI DR.GUENROL.FT			
11.	EX06 /VARI DR.GUENROL.FT			
12.	EX06 /VARI DR.PSNUENROL			
13.	EX06 /VARI DR.UGRENROL.FT			
14.	EX06 /VARI DR.UGRENROL.PT			
15.	ASSU DFPARTRATE14.24	55.14	2.3	/GROW
16.	ASSU DFPARTRATE25.44	55.49	5.1	/GROW
17.	ASSU DFPARTRATE45+	27.78	0.6	/GROW
18.	ASSU DMPARTRATE14.19	52.99	3.0	/GROW
19.	ASSU DMPARTRATE20.24	86.32	- .5	/GROW
20.	ASSU DMPARTRATE25.54	96.22		
21.	ASSU DMPARTRATE55+	46.4	-1.9	/GROW
22.	ASSU DR.GUENROL.FT	.941	-1.3	/GROW
23.	ASSU DR.GUENROL.PT	0.690	4.7	/GROW
24.	ASSU DR.PSNUENROL	5.370	3.2	/GROW
25.	ASSU DR.UGRENROL.FT	7.055	-0.3	/GROW
26.	ASSU DR.UGRENROL.PT	4.269	1.14	/GROW

SOLUTION: OIL.\$2.POPULAT  
 =====

1.	TITLE "INCREASE IN MALE AND FEMALE POPULATIONS AGE GROUP 15-65+"						
2.	EX06 /VARI DFPOP15.19	1318.4	1341.1	1363.4	1384.0	1399.0	1417.5 1980 1985
3.	EX06 /VARI DFPOP20.24	1435.0	1448.2	1461.0	1471.0	1483.0	1986 1990
4.	EX06 /VARI DFPOP25.29	1132.1	1147.9	1162.9	1177.3	1188.7	1203.0 1980 1985
5.	EX06 /VARI DFPOP30.34	1216.0	1228.1	1240.1	1249.5	1258.8	1986 1990
6.	EX06 /VARI DFPOP35.39	926.5	939.4	951.7	963.5	972.9	984.6 1980 1985
7.	EX06 /VARI DFPOP40.44	995.2	1005.1	1015.0	1022.6	1030.2	1986 1990
8.	EX06 /VARI DFPOP45.49	784.1	795.0	805.4	815.4	823.3	833.2 1980 1985
9.	EX06 /VARI DFPOP50.54	842.2	850.5	858.9	865.3	871.8	1986 1990
10.	EX06 /VARI DFPOP55.59	769.7	780.4	790.6	800.5	808.2	817.9 1980 1985
11.	EX06 /VARI DFPOP60.64	826.8	835.0	843.2	849.5	855.9	1986 1990
12.	EX06 /VARI DFPOP65+	782.1	793.1	803.4	813.4	821.3	831.1 1980 1985
13.	EX06 /VARI IMPOP15.19						
14.	EX06 /VARI IMPOP20.24						
15.	EX06 /VARI IMPOP25.29						
16.	EX06 /VARI IMPOP30.34						
17.	EX06 /VARI IMPOP35.39						
18.	EX06 /VARI IMPOP40.44						
19.	EX06 /VARI IMPOP45.49						
20.	EX06 /VARI IMPOP50.54						
21.	EX06 /VARI IMPOP55.59						
22.	EX06 /VARI IMPOP60.64						
23.	EX06 /VARI IMPOP65+						
24.	EX06 /VARI FDEP.GVC						
25.	EX06 /VARI RSS						
26.	EX06 /VARI Y.DIVPCR\$						
27.	ASSU DFPOP15.19	1318.4	1341.1	1363.4	1384.0	1399.0	1417.5 1980 1985
28.	ASSU DFPOP15.19	1435.0	1448.2	1461.0	1471.0	1483.0	1986 1990
29.	ASSU DFPOP20.24	1132.1	1147.9	1162.9	1177.3	1188.7	1203.0 1980 1985
30.	ASSU DFPOP20.24	1216.0	1228.1	1240.1	1249.5	1258.8	1986 1990
31.	ASSU DFPOP25.29	926.5	939.4	951.7	963.5	972.9	984.6 1980 1985
32.	ASSU DFPOP25.29	995.2	1005.1	1015.0	1022.6	1030.2	1986 1990
33.	ASSU DFPOP30.34	784.1	795.0	805.4	815.4	823.3	833.2 1980 1985
34.	ASSU DFPOP30.34	842.2	850.5	858.9	865.3	871.8	1986 1990
35.	ASSU DFPOP35.39	769.7	780.4	790.6	800.5	808.2	817.9 1980 1985
36.	ASSU DFPOP35.39	826.8	835.0	843.2	849.5	855.9	1986 1990
37.	ASSU DFPOP40.44	782.1	793.1	803.4	813.4	821.3	831.1 1980 1985

38.	ASSU IFPOP40.44	840.1	848.5	856.8	863.2	869.7	1986	1990
39.	ASSU IFPOP45.49	765.9	776.6	786.7	796.5	804.2	813.9	1980 1985
40.	ASSU IFPOP45.49	822.7	830.8	839.0	845.3	851.6	1986	1990
41.	ASSU IFPOP50.54	652.1	661.2	669.8	678.2	684.7	692.9	1980 1985
42.	ASSU IFPOP50.54	700.4	707.4	714.3	719.7	725.1	1986	1990
43.	ASSU IFPOP55.59	584.2	592.4	600.1	607.6	613.4	620.8	1980 1985
44.	ASSU IFPOP55.59	627.5	633.8	640.0	644.8	649.6	1986	1990
45.	ASSU IFPOP60.64	475.2	481.8	488.1	494.2	499.0	505.0	1980 1985
46.	ASSU IFPOP60.64	510.4	515.5	520.6	524.5	528.4	1986	1990
47.	ASSU IFPOP65+	1157.9	1174.1	1189.4	1204.2	1215.9	1230.4	1980 1985
48.	ASSU IFPOP65+	1243.7	1256.1	1268.4	1278.0	1287.5	1986	1990
49.	ASSU IMPOP15.19	1330.0	1350.9	1371.2	1388.0	1404.0	1417.3	1980 1985
50.	ASSU IMPOP15.19	1429.5	1440.0	1447.0	1458.2	1518.4	1986	1990
51.	ASSU DMPOP20.24	1114.5	1130.1	1144.6	1157.5	1171.1	1180.5	1980 1985
52.	ASSU DMPOP20.24	1192.8	1204.4	1215.3	1227.6	1227.8	1986	1990
53.	ASSU DMPOP25.29	926.1	939.1	951.1	961.9	973.1	981.0	1980 1985
54.	ASSU DMPOP25.29	991.2	1000.8	1009.9	1020.1	1020.3	1986	1990
55.	ASSU DMPOP30.34	788.7	799.8	810.1	819.2	828.8	835.5	1980 1985
56.	ASSU DMPOP30.34	844.2	852.4	860.1	868.8	869.0	1986	1990
57.	ASSU DMPOP35.39	789.7	800.8	811.0	820.2	829.8	836.5	1980 1985
58.	ASSU DMPOP35.39	845.2	853.4	861.2	869.9	870.0	1986	1990
59.	ASSU DMPOP40.44	784.1	795.1	805.3	814.4	823.9	830.6	1980 1985
60.	ASSU DMPOP40.44	839.3	847.4	855.1	863.7	863.8	1986	1990
61.	ASSU DMPOP45.49	736.8	747.1	756.7	765.2	774.2	780.5	1980 1985
62.	ASSU DMPOP45.49	788.6	796.2	803.5	811.6	811.7	1986	1990
63.	ASSU DMPOP50.54	627.3	636.1	644.3	651.5	659.1	664.5	1980 1985
64.	ASSU DMPOP50.54	671.4	677.9	684.1	691.0	691.1	1986	1990
65.	ASSU DMPOP55.59	567.0	574.9	582.3	588.9	595.8	600.6	1980 1985
66.	ASSU DMPOP55.59	606.8	612.7	618.3	624.5	624.6	1986	1990
67.	ASSU DMPOP60.64	452.8	459.2	465.1	470.3	475.8	479.7	1980 1985
68.	ASSU DMPOP60.64	484.7	489.4	493.8	498.8	498.9	1986	1990
69.	ASSU DMPOP65+	933.5	946.6	958.8	969.6	980.9	988.8	1980 1985
70.	ASSU DMPOP65+	999.2	1008.8	1018.0	1028.3	1028.4	1986	1990

## Footnotes

1 In total, for each sex there are fourteen age-groups: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, and 65+.

2 It is computed as the difference between the actual labour force and the labour force estimate obtained by summing the individual participation rate/population cohort identities.

3 Even though the coefficients on unemployment rates are not significant statistically, all the signs are intuitively right. Moreover, in time-series data, due to multi-collinearity among the explanatory variables we might not get significant coefficients on all the regressors: Therefore, the exclusion of theoretically important variables solely on the basis of t-statistics might result in misleading estimates of cause and effect of the explanatory variables.

4 For the discussion of caricature of CANDIDE 2.0, see Rao and Willans (1980).

5 For a detailed exposition of the wage-price dynamics of CANDIDE Model 2.0, see Rao (1980), and Lodh (1980).

6 Economic Council of Canada (1980) projections suggest that the population growth will be in the order of 0.75 per cent per annum during the period 1980-1990, compared to 1.9 per cent and 1.2 per cent per annum for 1960-1970 and 1970-1980, respectively.

7 Star (1975), Davies (1972, 1974), Davies and Sharir (1976), Denton and Spencer (1978).

8 For details see the Appendix and Economic Council of Canada (1980).

9 As noted in the preceding sections gross immigration does not appear as an exogenous variable in the model. Instead, we have net immigration (immigration minus emigration) as a policy variable. Therefore, the impact of immigration is implemented by operating on the net immigration variable.

10 The share of population under 20, in total immigration is 26.5 per cent, compared to 32.9 per cent for domestic population.

11 See for example, Grubel and Scott (1966), Thomas (1967, 1968), Johnson (1967), and Scott (1967).

12 The fee to be paid per year per immigrant (F) is calculated using the following equation:

$$F = \sum_{j=1980}^{1990} P_0 P_{1j} (Y_{1j} - Y_{2j}) / 50,000 (1 + 10 + 9 \dots + 1)$$

Where  $P_0 P_{1j}$  is the population in the base case solution/  
 $Y_{1j}$  is the per capita real income (1971\$) in the base case solution, and  
 $Y_{2j}$  is the per capita income when the net immigration is increased by 50,000 per year.

13 For a discussion of these costs, see Green Paper (1974) and Star (1975).

14 In the past increased participation rates of youths are accompanied by reductions in full-time university enrolment, and increases in part-time enrolment. Similarly, the dramatic increases in the participation rate of women were accompanied by an unprecedented amount of increase in divorces. In an effort to capture these interdependencies, participation rates, university enrolment rates and divorce rates are assumed to increase by their average growth rates in the 1970s.

15 For details see the Appendix.

16 The distribution of the working age population for both the base case and the shocked solutions is given in Table 3. For the details of the shocked solution, see the Appendix.

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