



National Library of Canada  
Collections Development Branch

Canadian Theses on  
Microfiche Service

Bibliothèque nationale du Canada  
Direction du développement des collections

Service des thèses canadiennes  
sur microfiche

## NOTICE

The quality of this microfiche is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us a poor photocopy.

Previously copyrighted materials (journal articles, published tests, etc.) are not filmed.

Reproduction in full or in part of this film is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30. Please read the authorization forms which accompany this thesis.

**THIS DISSERTATION  
HAS BEEN MICROFILMED  
EXACTLY AS RECEIVED**

## AVIS

La qualité de cette microfiche dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de mauvaise qualité.

Les documents qui font déjà l'objet d'un droit d'auteur (articles de revue, examens publiés, etc.) ne sont pas microfilmés.

La reproduction, même partielle, de ce microfilm est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30. Veuillez prendre connaissance des formules d'autorisation qui accompagnent cette thèse.

**LA THÈSE A ÉTÉ  
MICROFILMÉE TELLE QUE  
NOUS L'AVONS REÇUE**

THE UNIVERSITY OF OTTAWA

THE SHORT-RUN DYNAMICS OF CANADIAN  
LABOUR FORCE PARTICIPATION

A THESIS SUBMITTED TO  
THE SCHOOL OF GRADUATE STUDIES  
FOR CANDIDACY FOR THE DEGREE OF  
MASTER OF ARTS  
DEPARTMENT OF ECONOMICS

BY

RICHARD DAVID SMITH

OTTAWA, ONTARIO

MAY, 1979

## CONTENTS

ACKNOWLEDGEMENTS .....	ii
INTRODUCTION .....	1
I. THEORETICAL CONSIDERATIONS IN THE ANALYSIS OF LABOUR SUPPLY .....	4
II. A REVIEW OF EMPIRICAL RESEARCH .....	11
III. THE PARTICIPATION RATE IN A GROSS FLOW FRAMEWORK .....	24
IV. MODEL SPECIFICATION AND RESULTS .....	33
V. CONCLUSIONS .....	52
.....	
APPENDICES	
1. THE GROSS FLOW DATABASE .....	54
2. VARIABLE DESCRIPTION .....	56
3. CORRELATION MATRIX .....	58
REFERENCES .....	59

## ACKNOWLEDGMENTS

The author wishes to acknowledge those whose inspiration and assistance made this study possible. Introduction to the gross flow database came while I was an employee in Research Projects Group at the Department of Manpower and Immigration under Mr. A.E. Kyffin. Mr. Kyffin recognized the importance of flow data and flow concepts for labour market analysis and was the driving force behind the production of the flow estimates used in this study. I wish to thank him as well for cultivating my interest in the labour market. The Department of Employment and Immigration and the Labour Force Survey Division of Statistics Canada provided the unpublished data used in this study. Finally, Professor R.G. Bodkin served ably in the capacity of thesis adviser, ensuring the study moved in the right direction and, most importantly, was completed.

The opinions expressed in this study are those of the author and do not necessarily reflect the views of organizations with which he is, or has been, associated.

## INTRODUCTION

This thesis examines labour supply in the context of the monthly movement of workers in and out of the labour force. It begins with an examination of the theoretical issues in short-run labour supply analysis, reviews the relevant empirical research, and then models the gross movements of male and female workers between participation and non-participation in the labour force during the 1966 to 1975 period.

Labour supply research has traditionally concentrated on the interaction between job availability and the number of persons seeking work. The discouraged worker model has emerged, on this basis, as the major determinant of short-run labour supply. Briefly stated, the discouraged worker (DW) model postulates that workers time their labour market participation to coincide with job availability. During a cyclical downturn the pool of available workers expands relative to the number of jobs. This causes some workers, faced with little prospect of finding a job, to become discouraged and withdraw from the labour market. Similarly, a cyclical upturn attracts workers into the labour market. The importance of this concept is that measured unemployment understates the cyclical variation in the demand for labour.

An opposite effect is known to exist. The additional worker (AW) phenomenon involves the behaviour of family members when the household head experiences unemployment. The resultant loss of income draws other members of the family unit into the labour market to maintain living standards. The subsequent re-employment of the household head would then lead to the withdrawal of the additional worker.

The simultaneous occurrence of the DW and AW effects has led most authors to test for the net of the two in the aggregate. The analysis has also been extended to various demographic groups in the labour force who face differing market/non-market alternatives. While based on firm theoretical constructs, a number of problems have emerged in empirical verification, indicating the importance of variables not included in the model.

Neoclassical models concentrate on the impact of price and real wage movements on labour supply. Short-run changes in labour supply are the result of deviations between expected and actual movements in real wages and prices. According to the permanent wage hypothesis, for example, workers will time their labour force participation to coincide with periods in which real wages are high: a transitory rise in real wages will draw workers into the labour market; a transitory fall will cause them to withdraw or reduce their labour services. As with the DW hypothesis, a countervailing effect exists. According to the relative wage theory, families attempt to maintain their accustomed living standards in the face of transitory movements in real wages. If real wages of one worker in a family unit fall or do not rise quickly enough to maintain living standards, other family members may enter the labour market to bolster family income.

Direct parallels exist between the DW and permanent wage theories and the AW and relative wage theories. The empirical question is one of whether job availability, real wage fluctuations or a combination of the two best represent the income and substitution effects borrowed from demand theory.

Price effects are also important to the neoclassical model, which attempts to ascertain whether labour supply is inflation-neutral. Money illusion could lead potential workers to misread wage increases and enter the labour market when real wages may in fact be declining. This is the same mechanism that results in the short-run inflation-unemployment trade-off in the natural rate of unemployment theory. The money illusion concept need not be imposed, however, as inflation may act simply as a measure of uncertainty. Rapid price increases may cause additional workers to enter the labour market to build a hedge against a future decline in income. Section I will present these and other considerations in the analysis of labour supply. This will be followed by a review of the literature.

A common criticism of labour supply models is that they capture net rather than gross effects. This reflects predominantly the data used in the analysis: static snapshots of the labour market. The variable being explained is usually the labour force participation rate which is treated as the probability of being in the labour market. A richer database would provide separate treatment of the probabilities of entry and withdrawal. These added dimensions are provided by gross flow data: tabulations of the number of persons in each labour force state by their status in the previous month. Using this database, dynamic effects are derived analytically in Section III and econometrically in Section IV. Section V summarizes the results.

## SECTION I

### Theoretical Considerations in the Analysis of Labour Supply

The study of labour supply has many dimensions. It can be examined in terms of the hours people are willing to work, the number of persons willing to work, the skills and attitudes they bring to the market place, etc.. Similarly, there are many levels of aggregation from the household and firm, to individual industries and occupations and at the level of the economy as a whole.

At the highest level of aggregation, labour statistics treat labour supply as determined by two factors: the size of the population and the propensity of the population to work or seek work. For many years population has been treated as an exogenous factor in the determination of labour supply. Over time, however, this has become more subject to conscious control. For example, the availability and use of birth control techniques have had a substantial impact on population growth. There is also recognized to be a simultaneity between birth rates and participation decisions.

Immigration is also a policy variable that can alter not only the rate of population growth but also its age and sex distribution. Different propensities to participate in the labour market relative to the indigenous population will also feed into the aggregate participation rate.

The demographic structure of the population is an important determinant of the total participation rate. At different points in time, a changing share of the population will belong to the peak-participation age groups. Recently it has been recognized that the relative number of competitors in the labour market influence the participation decisions of individuals, causing cohort or intermediate swings in group participation rates.<sup>1</sup> For example, given imperfect substitutability of labour, a rise in the relative share of one age group in the labour force will lead to a decline in relative wages. This may result in more participation in order to maintain relative living standards.

This study concentrates on the participation aspect of labour supply. As Becker has pointed out, the decision to participate in the labour market is in fact one of making a choice between alternative uses of time. The standard labour supply model involves two alternatives: work and leisure. Work, however, can take many forms. The most common distinction is between market work such as employment and non-market activities such as work in the home or schooling. This is an important differentiation as most labour market surveys deal with market activity on a national accounts basis.

For an adult male most work activity is market-oriented. The opportunity cost of not working, then, is the price of leisure, which can be represented by the market wage rate. Borrowing from micro demand

---

<sup>1</sup> See Michael L. Wachter, "Intermediate Swings in Labor Force Participation", Brookings Papers on Economic Activity, 2 (1977), pp. 545-576.

theory, changes in wages will have both income and substitution effects on labour supply.<sup>2</sup> The income effect is negative: a rise in income will result in the "purchase" of more leisure. The substitution effect is positive: as wages increase, leisure becomes more expensive relative to other goods and less will be "purchased". The net effect, therefore, is theoretically uncertain.

The adult male participation rate has declined over time as have average hours worked. Given a general upward progression of wages, this implies that income have dominated substitution effects in the longer term.

When examining other sub-groups in the labour market, non-market activities become important alternatives to market work. For married women activities in the home represent an important substitute, as is schooling for young people. Examining labour supply in a family context then, involves the balancing of market and home productivity and the investment in human capital decisions.

In contrast to the downward trend in adult male participation, women have entered the labour market in greater numbers over time. The traditional role of the woman in the home is increasingly being replaced

---

<sup>2</sup> This follows the treatment by Lionel Robbins of the effect of income and wage rates on labour supply. See Lionel Robbins, "On the Elasticity of Demand for Income in Terms of Effort", Economica 10 (June, 1930), pp. 123-129.

by one in which both husband and wife contribute to family income. A rise in income would be both a cause of and a reaction to the substitution of market for non-market activity.

The longer run record for young people is mixed. The major alternative to market work for this group is education. Education is typically viewed as an investment in human capital decision and is, therefore, sensitive to both costs and returns. Rising family income will provide the opportunity for the investment but a decline in the return to education should induce more market activity.

Income and wages contain both permanent and transitory components. Short-run changes in economic conditions influence participation rates in two ways. During a recession, the unemployment of a breadwinner may cause other members of the household to enter the labour market to bolster family income. This transitory income effect is the additional worker phenomenon.

What was once presented as a competing theory was the discouraged worker hypothesis. A person who becomes unemployed may discontinue job search in the belief that no suitable work is available. Similarly, people who normally would enter or re-enter the labour market refrain in times of high unemployment. If we were to associate with a wage rate the probability of finding a job paying that wage, we can obtain the expected value of job search. A worsening in economic conditions, then, can alter this value even if there is no influence on the wage rate in the short-run. In this sense, the discouraged worker effect is a substitution effect.

These same reactions can, of course, result directly from wage fluctuations. A rise in wages above a norm may attract workers into the labour force. Workers time their labour force entry to coincide with periods of high wages. This is the permanent wage hypothesis. A rise above the same norm, however, may induce some members of a family unit to withdraw from the labour market either to consume more leisure or to undertake another non-market activity. This is the relative wage effect.

Direct parallels exist between the DW and permanent wage theories and the AW and relative wage theories. The controversy is one of which variables best reflect changes in relative demand/supply conditions for different demographic groups. To some extent, it is also a question of degree. The unemployment of a family head can represent a discontinuation of income rather than a much smaller relative decline. This is likely to have a pronounced effect on the families affected. Their numbers, however, are small relative to those employed. A decline in wages is spread more evenly among the labour force.

The impact of price changes on labour force participation can be developed in two ways. A rise in prices may cause workers to misread market signs and interpret a nominal increase in wages as a real one. Money illusion, then, would lead to an expansion of labour supply. Alternatively, a rise in prices could cause potential workers to be uncertain about future employment and income possibilities and enter the labour market in order to expand their savings. Both price-induced uncertainty and money illusion would have the same impact on labour supply.

The modern neoclassical literature has also examined the implications of relative competition in the labour market on labour supply. A relative over-supply of one type of labour would tend to depress its relative wages. In order to maintain an accustomed living standard, a rise in the relative supply of the affected group may occur. For example, the post-war baby-boom altered the age distribution of the population. The entry into the labour market of the baby-boom generation caused an increase in the ratio of young to older workers. Assuming imperfect substitutability of younger for older workers in production, this supply shock would result in a decline in the relative wages of young people who would respond by increasing their labour force participation to maintain the living standards formed when they were living with their parents. This effect would be more group-specific than one involving general changes as reflected by the relative wage model.

The 1971 liberalization of unemployment insurance benefits could alter the labour force effects of unemployment. The reduced income loss associated with unemployment may cause fewer additional workers to enter the labour market. At the same time, the income maintenance may result in workers extending their job search rather than withdrawing when faced with unemployment or the attraction of people into the labour force in search of paid leisure following a short spell of employment.

In summary, the theoretical framework for labour supply analysis involves the income and substitution effects of microeconomic demand theory. This may differ between the long and short run and between different groups in the labour force. The next section reviews the evolution of short-run labour supply theory and its empirical testing.

## SECTION II

### A Review of Empirical Research

Interest in the inter-relationship between job availability and labour supply originated with the high levels of unemployment experienced in the Great Depression. In 1940, Woytinsky<sup>1</sup> argued that unemployment figures during the period over-estimated the degree of demand deficiency. The unemployment of a family head caused other members of the family unit to enter the labour market in order to sustain family income. These "additional workers" (AW) swelled the ranks of the unemployed.

The initial concerns, then, were with an explanation of Depression unemployment. The movements considered were between the non-labour force and unemployment. Later observers have extended this reasoning to the milder recessions observed since that time.

In 1953 Long countered the AW hypothesis. While he acknowledged its existence, he suggested that its influence on unemployment was offset in part or in whole by those who had become too discouraged by unemployment to continue looking for work. Long examined the inter-relationships between wages, income, unemployment, military strength and participation for the period ending in 1952. From this analysis he developed his stable labour force hypothesis. Over long periods the participation rate standardized for composition was shown to vary

---

<sup>1</sup> Full citations are contained in the references, pp.59-61.

less than it did seasonally. This stability implied that the discouraged worker (DW) effect offsets the AW. A preliminary glance at gross flow data confirmed this hypothesis.

During the early 1960s there were a number of direct tests of the AW and DW hypothesis using gross flow data. In 1961, Hansen examined entries to and exits from the unemployed state at peak and trough unemployment years. His analysis covered the 1948-1959 period.

Hansen's results appeared to confirm Long's stable labour force hypothesis. Both the AW and DW effects occur and tend to offset each other. Hansen concluded, therefore, that over the period examined the elasticity of the labour force with respect to unemployment was close to zero.

Hansen's formulation of the test was based upon the original concerns underlying the AW and DW hypothesis: whether unemployment was expanded or contracted by a recession-induced flow of workers in and out of the labour force. Movements between employment and the non-labour force were not examined and the effect on the total labour force was not indicated.

A more detailed analysis was performed by Altman in 1964. He examined movements between both employment and unemployment and the non-labour force. His concentration, however, was on the behaviour of married women over the 1955-1962 period.

Altman's results confirmed Hansen's earlier analysis. The entry of married women into the labour force was positively related to the unemployment rate of married men, confirming the AW hypothesis. At the same time, labour force withdrawal was positively related to their own unemployment rate as suggested by the DW hypothesis. Differences in cyclical timing were also thought to occur between the two effects.

In 1964, Tella examined the relationship between the labour force and employment over the 1948-1962 period. Annual data was used and males and females were tested separately. Because Tella used stock data, he could test only for the net of the DW and AW effects. This was done by correlating the change in the labour force with the change in employment and the participation rate with the employment/population ratio and a time trend. Both forms resulted in a positive relation, confirming the dominance of the DW effect. The coefficient was larger for women, indicating that during a recession a woman is more likely to withdraw from the labour force than a man; the male being more likely to become unemployed and remain in the labour force. As a result, Tella concluded that a moderate increase in employment is more likely to increase the labour force than significantly to reduce unemployment. This would be especially true if the employment expansion were to favour women.

During the year of Tella's study, Strand and Dernberg (1964) released the first of a series of tests of the DW, AW and offset hypotheses. They set up a two equation simultaneous model to explain the monthly

behaviour of the participation rate and unemployment compensation exhaustions. The participation equation is similar to Tella's, but includes other variables. The ratio of unemployment compensation exhaustions to the population served as a test of the AW hypothesis. The prospect of a household head exhausting benefits would lead to the entry of other family members into the labour force. The employment to population ratio serves to test the DW hypothesis. A third variable, the reciprocal of the population, was introduced to avoid a spurious relation due to the change in population over time. It also serves as a time trend. The Strand-Dernberg results are:

$$(1) \quad \left(\frac{L}{P}\right)_t = a + .9490 \left(\frac{E}{P}\right)_t + 12.699 \left(\frac{X}{P}\right)_{t+2} \\ - 5326.1 \left(\frac{1}{P}\right)_t \\ (695.4)$$
$$R^2 = 0.8766 \quad S_u = .00206$$

Where L is labour force, E is employment, X is the number of exhaustees of unemployment benefits and P the non-institutional working-age population. The subscript refers to the time period and the figures in parenthesis are the standard errors of the respective coefficients. All variables are significant at the 95 per cent level of confidence. This confirms the existence of both the AW and DW effects with a net dominance of the DW. Furthermore, as suggested by the earlier studies using gross flow information, there is a timing difference over the cycle in the two effects. Early declines in employment lead to a decline in the labour force. As the recession continues, this reduction is offset by the inflow of AWs.

In a later study, Dernberg and Strand (1966) performed the same analysis by disaggregated age and sex group to determine who are the AW and DWs. Both effects were significant for 11 of the 14 groups tested. These included all females and both young and older males. Again, the DW effect dominated.

In 1965, Bowen and Finnegan released a cross-sectional study of participation rates between metropolitan areas. Five age-sex groups were examined using census data covering the years 1940, 1950 and 1960. They related the participation rate to the unemployment rate and a number of other control variables. A negative net relation was found for all groups, confirming the dominance of the DW hypothesis in the cross-section. Prime-aged males were least affected with the influence strongest on younger and older males. The female coefficients fell in between these results. It was also noted that the size of the coefficients increased over time. While qualitatively similar to the results obtained in time-series analysis, the cross-sectional estimates tended to be quantitatively larger.

Jacob Mincer reviewed the participation/unemployment literature in 1966, attempting to reconcile the results of various analyses and data bases. He began his review by classifying each study by the type of data used in the analysis.

Gross flow data was deemed to be the best source of information for testing the AW and DW hypothesis because it allows separate identification of the two effects. Mincer acknowledged, however, the problems of reliability associated with the data available at that time.

The standard cross-sectional model was of the form:

$$(2) \quad \frac{L}{P} = a_1 + b_1 Y + b_2 W + b_3 \frac{U}{L} + e$$

where Y is income, W, wages and U/L the unemployment rate. The unemployment rate in this equation serves as a proxy for transitory (cyclical) income and wages and therefore tests the net of the AW and DW effects. Mincer suggested a number of statistical problems with the model. Spurious correlation and negative biases due to seasonality tended to exaggerate the size of the coefficient. As a result, Mincer concluded that the large negative relation between participation and unemployment obtained in the cross-section reflected a long-run reaction to depressed labour market conditions rather than the short-run reaction observed in the time-series.<sup>1</sup>

Mincer turned next to a review of time-series studies. He had difficulty interpreting the coefficient of the unemployment exhaustion

---

<sup>1</sup> This suspicion was later confirmed by Fleisher and Rhodes (1976) who employed a simultaneous equations model of participation and unemployment using a cross-sectional database. They attempted to isolate the cyclical component of cross-sectional employment opportunity differentials. This yielded parameters quantitatively similar to those obtained in the time-series.

variable used in the Dernberg-Strand model. The size of the coefficient suggests that for every person about to exhaust benefits, 12 others are attracted into the labour market. Mincer concluded that the variable serves as a proxy for unemployment, resulting in a tautological relationship. Further evidence was supplied by the small estimation errors, smaller in fact than the sampling variability of the data itself.

Following a number of adjustments to the estimates, Mincer concluded that the net sensitivity had been over-estimated in both time-series and cross-sectional studies due to the failure to control for structural factors. The sensitivity to employment conditions is also a characteristic of the secondary labour force. Mincer interprets the results as an illustration of labour force flexibility rather than disguised unemployment. Cyclical sensitivity can equally result from an optimization process in which workers time their labour force attachment according to job availability.

The time-series labour supply studies to this point have concentrated on the importance of employment opportunities as the short-run determinant of labour supply. A number of studies that followed have included other variables observed as important in cross-sectional relationships. These have introduced a neoclassical flavour into the model.

In 1969, Lucas and Rapping developed an aggregate model of the U.S. labour market. The labour supply portion involved normal real wages, transitory wages and price deviations where expectations

are formed adaptively. Their results showed a negative relation between labour supply and permanent wages and a positive relation with both wage and price deviations.

In 1971, Fair presented a combined DW-neoclassical model. His purpose was to determine the response of labour supply to wage rate changes and the importance of money illusion. A quarterly model was developed for 16 age-sex groups and covering the period 1956 to 1970. Generally, the results indicated a positive wage effect for women and a negative one for males. Collinearity problems were recognized to exist between the coefficients on his Almon lag variables and a time trend. This resulted in sensitivity to the lag structure chosen. Overall, short-run money or price illusion was not very pronounced.

Wachter's 1974 study represented a continuation of earlier work and is similar in structure to Fair's. His participation rate equation included a time trend, the ratio of observed to expected real wages, a similar variable for prices, the long-term unemployment rate for males and a population mix variable. This latter variable was calculated by regressing the ratio of prime-age male labour force to total population on time trends. It was introduced as an interaction term that is equivalent to imposing a downward trend on the coefficients. As a result, the coefficient on wages changes over the sample period, providing permanent wage effects at the beginning and relative wage effects afterwards. The price variable had a positive effect throughout the period and explained most of the variation. The coefficient on the unemployment rate was negative, indicating net discouragement effects.

In 1974, Ralph Smith examined the discouraged worker phenomenon in a gross flow framework. He found little cyclical variation in the probabilities of labour force withdrawal when employed or unemployed. The DW phenomenon resulted from a different mechanism. The probability of withdrawal is higher for the unemployed than the employed; in a recession there are relatively more unemployed and the withdrawal rate increases.

Wachter presented an intermediate swings model of participation in 1977. This was based upon Easterlin's work involving the relationship between population cohorts and relative wage rates. Easterlin hypothesized that high relative wages facing a cohort of fertility age would encourage births. The next generation would observe a relative degree of excess competition due to their large numbers which would decrease their wages relative to older workers. This would encourage more participation to maintain relative living standards at the expense of a declining birth rate. Thus, the cycle would be repeated every two generations.

Wachter uses this as the explanation of the rise in participation rates of young females in the mid 1960s. Relative wages are proxied by relative population. Ignoring this term, he concludes, has biased upwards earlier measures of the number of discouraged workers. Correcting for this factor did not, however, eliminate the dominance of the DW effect.

Canadian Studies

While studies of the cyclical variability of the U.S. labour force participation support the dominance of the DW effect, Canadian studies are mixed. The differences are most pronounced among detailed age-sex groups. It can be concluded that the Canadian labour force is less responsive to employment conditions than the U.S.

In 1962, Kaliski examined the participation behaviour of 10 age-sex groups using annual data covering the 1946-1959 period. Each group's participation rate was correlated with its own unemployment rate, wages and prices. Women between the ages of 25-64 demonstrate AW effects while men and women under 20 and men over 65 display DW effects.

Kaliski suggests that the predominance of the income effect (AW) would likely be as a result of someone else's unemployment such as the household head, while the substitution effect (DW) would likely result from one's own unemployment. To test this, he repeated the relations including the unemployment rate of men 25-64 instead. This produced a stronger positive relation for women aged 25-64.

Swidinsky (1969) examined the same demographic groups using quarterly data from 1953 to 1966. He related the participation rate of each group to a time trend and the aggregate employment population ratio lagged one quarter. AW effects were found to exist for male workers aged 20 to 44 and females over 45. DW effects were noted for men 14-19 and over 65 and women under 45.

A further test was made using cross-sectional information from the 1961 Census. In contrast to the difference with U.S. results using time series, Swidinsky found similarity in the cross-sectional relationship. This would indicate similar long-run adjustment patterns in the two countries.

Proulx (1969) used annual data to test the relationship between the unemployment rate of men 25 to 44 and the participation rates of 10 demographic groups. The analysis covered the 1948 to 1967 period. A similar regression was performed replacing the unemployment rate with an excess demand indicator. His results show an aggregate dominance of the AW effect due to its significance for men 20 to 24 and women over 45. The DW effect was found in the male 14 to 19 age group and for women aged 20 to 24.

In the same year, Officer and Anderson examined the sensitivity of age-sex specific participation rates to measures of the severity of male unemployment. Using quarterly data from 1950 to 1967, they found an aggregate dominance of the AW effect as did Proulx. DW effects predominated for men and young women and AW effects for older women.

In the Officer and Anderson analysis, variables were included to capture living standard, wage rate and birth rate effects on participation. Negative income effects were found for young and old males and teenage females but positive effects for women aged 20 and over. Wage rates are not significant and the birth rate significant for women 20-44.

The Economic Council's annual CANDIDE model of the Canadian economy contains a labour supply block. In 1973, Illing divided the labour force into a primary labour force composed of males between the ages of 25 to 54 and a secondary labour force split into three groups: men 14 to 24 and 55 and over; women under 35; and women 35 and over. The primary participation rate was found to be stable over time and, therefore, treated exogeneously.

The secondary male participation rate was related to the total employment/population ratio and real per capita disposable income. The female groups' equations contained a variable measuring real wages in the service sector and the aggregate unemployment rate. The income variables were intended to capture long-run effects while the labour market variables measured short-run conditions.

The DW effect was found to dominate for secondary males and women under 35, while the AW effect existed for women 35 and over. Although no estimate is given concerning the dominant effect for the aggregate labour force, the disaggregated results are consistent with those obtained by earlier authors.

Later work with the CANDIDE model indicates an aggregate dominance of the DW effect. In 1976, Siedule, Skoulas and Newton further disaggregated CANDIDE's labour supply block into 10 age-sex groups. Participation rate equations were estimated using annual data covering the 1953 to 1973 period. Variables were introduced to measure age-sex specific employment opportunities, general opportunities, the effect of

changing retirement and workmen's compensation benefits and the impact of the 1971 revision to the Unemployment Insurance program.

DW effects were found to dominate for male teenagers and women aged 20 to 65. AW effects were larger for males 20 to 24, males and females aged 65 and over and female teenagers. On aggregate the DW effect was found to be dominant. The 1971 revision to the UI act increased the participation rates of men under 25 and women under 45.

In Denton, Feaver and Robb's study for the Economic Council (1976), labour market transition probabilities were related to the aggregate unemployment rate. Although their purpose was not specifically to test for the AW and DW effects, some information can be discerned from their results. An increase in the unemployment rate was associated with an increase in the rate of labour force entry of both men and women implying the existence of AW effects. The unemployment rate was negatively associated with the withdrawal from both employment and unemployment for women but only with the rate of withdrawal from unemployment of men. However, because the authors did not examine the total exit flows, it cannot be determined whether the AW or DW effect dominates.

To summarize, labour supply models have become more complex over time. While the AW and DW explanations of short-run labour supply movements remain, the importance of other factors has been recognized. Their exclusion from earlier works may have biased upwards estimates of the impact of job availability on labour supply.

The AW and DW effects are likely to operate at the same time and tend to be self-cancelling. A flow framework is required to separate them. This is developed in the next section.

SECTION III

The Participation Rate in a Gross Flow Framework.

The labour market is in a continual state of change. Each month large numbers of individuals alter their labour market status: leave or lose jobs to become unemployed, find other jobs, enter or leave the labour market. The static labour market estimates present only the outcome of these processes, an inventory of the numbers caught in each state at points in time.

A more complete description of the labour market can be obtained by examining the underlying flow processes themselves. In any given month the stocks of employed ( $E$ ), unemployed ( $U$ ) and of those outside the labour force ( $N$ ) are made up of people who have the same activity in the previous month plus those who took up that activity during the month. This relationship can be illustrated conveniently by a flow matrix of the following form:

GROSS FLOW MATRIX

	Status in Current Month (t)			Stocks in Previous Month
	$E$	$U$	$N$	
Status in Previous Month (t-1)	$E$	$U$	$N$	
	$EE$	$EU$	$EN$	$E(t-1)$
	$UE$	$UU$	$UN$	$U(t-1)$
	$NE$	$NU$	$NN$	$N(t-1)$
Stocks in Current Month	$E(t)$	$U(t)$	$N(t)$	

Each cell of the matrix contains the number of persons moving between the indicated states. Nine flows are involved in describing the labour market.<sup>1</sup>

1. Population flows resulting from immigration, emigration, deaths and the aging of the population are assumed to be neutral in their effect on the labour market in the short run.

Transition Probabilities

If the labour market is viewed as a stochastic Markovian process, transition probabilities can be estimated on the basis of the outcome of an event. In the expected value sense, the conditional probability that an individual employed in one month will be unemployed in the next can be defined as the ratio of the flow  $EU$  to the stock  $E$ .

The transition probabilities determine the relative number of people in each labour market state, and thus the rates of unemployment and participation. When the labour market is in flow equilibrium, the flows in and out of each state are equal. This yields the following three equations:

$$[1] \quad U(ue) + N(ne) = E(eu + en)$$

$$[2] \quad E(eu) + N(nu) = U(ue + un)$$

$$[3] \quad E(en) + U(un) = N(ne + nu).$$

where,  $eu$  is the probability of a person employed in one month being unemployed in the next,  
 $en$  is the probability of a person employed in one month being out of the labour force in the next,  
 $ue$  is the probability of a person unemployed in one month being employed in the next,  
 $un$  is the probability of a person unemployed in one month being out of the labour force in the next,  
 $ne$  is the probability of a person out of the labour force in one month being employed the next,  
 $nu$  is the probability of a person out of the labour force in one month being unemployed in the next.

Following Marston [1976] and Ralph Smith [1974], these equations can be used to express the unemployment and participation rates solely in transition probability terms. Substituting equation [3] into equation [2] to eliminate  $N$  yields:

$$[4a] E(eu) + [E(en) + U(un)] \times \frac{nu}{(ne + nu)} = U(ue + un).$$

Define [4b]  $pne = \frac{ne}{ne + nu}$ , the probability of successful labour market entry; then

$$[4c] E[eu + (1-pne) \times en] = U[ue + pne \times un]$$

Define [4d]  $\alpha = eu + (1-pne) \times en$  and

$$[4e] \beta = ue + pne \times un,$$

equation [4c] becomes:

$$[5] \alpha E = \beta U.$$

As the unemployment rate is defined as  $u = \frac{U}{E + U}$ , equation [5] can be written as:

$$[6] u = \frac{\alpha}{\alpha + \beta}$$

The participation rate can be similarly derived through the use of equations [3] and [5]. In stock form the participation rate is  $p = \frac{E+U}{E+U+N}$  and in flow terms as:

$$[7a] \frac{E(1 + \alpha/\beta)}{E(1 + \alpha/\beta) + \frac{E(en + un \times \alpha/\beta)}{(ne + nu)}}$$

Dividing by  $E(1 + \alpha/\beta)$  and multiplying by  $(ne + nu)$  yields:

$$[8] p = \frac{ne + nu}{ne + nu + \frac{1}{\alpha + \beta} (\alpha \times un + \beta \times en)}$$

Define [9a]  $ER = ne + nu$  and

$$[9b] WR = \frac{1}{\alpha + \beta} (\alpha \times un + \beta \times en) = u \times un + (1 - u) \times en,$$

equation [8] can be expressed as:

$$[10] p = \frac{ER}{ER + WR}$$

It remains to interpret the terms  $\alpha$ ,  $\beta$ ,  $ER$ , and  $WR$ . In the unemployment rate equation  $\alpha$  is the probability that a person employed in one month will cease being employed and become unemployed either directly or indirectly.<sup>2</sup> Similarly,  $\beta$  is the probability that a person unemployed in one month will leave the unemployed state and become employed.

In the participation rate equation  $ER$  is the probability of entering the labour market and  $WR$  the probability of withdrawal. The  $WR$  term is a weighted average of the probabilities of withdrawal when employed or unemployed.

It is readily apparent from the above analysis that the probabilities of entering the labour market and withdrawing from it affect directly both the participation and unemployment rates. Ceteris paribus, if the probability that a labour market entrant will become unemployed is higher than that of an employed person, a rise in the entry rate will increase the unemployment rate. Similarly, if the probability of labour market withdrawal is higher for the unemployed than the employed, a neutral rise in the withdrawal rate will decrease the rate of unemployment.

An equation [8] illustrates, cyclical variation in participation rates can occur in four ways:

2. The indirect method involves the withdrawal from the labour force and subsequent reentry. This takes the form of an infinite sum:

$$en \times \sum_{i=0}^{\infty} (nn)^i \times nu = en \times nu \times \frac{1}{1-nn} = \frac{en \times nu}{ne + nu} = en \times (1-pne)$$

- (i) changes in the probability of labour market entry;
- (ii) changes in the probability of withdrawal when employed;
- (iii) changes in the probability of withdrawal when unemployed;
- and
- (iv) given different probabilities of withdrawal when employed or unemployed, a change in the mix of the two in the labour market.

Table 1 presents selected labour market flow and stock rates covering the 1966-1975 period. The participation rate has risen almost continuously: by 1.0 percentage point from 1966 to 1971, and by 2.7 percentage points thereafter. The rate of labour force entry exhibits more variation but also appears to have moved to a higher plateau in 1971. Between 1966 and 1970, 5.3 per cent of those out of the labour force entered the labour market in an average month, compared to 5.8 per cent in the following period.

TABLE 1  
SELECTED LABOUR MARKET STOCK AND FLOW RATES  
(annual averages: per cent)

	Participation (P)	Entry	- RATES OF -			Unemployment (u)
			Withdrawal When:		Total	
			Employed	Unemployed		
1966	55.1	5.1	4.0	10.5	4.2	3.6
1967	55.5	5.2	3.8	11.0	4.1	4.1
1968	55.5	5.5	3.9	10.8	4.2	4.8
1969	55.8	5.3	3.8	11.8	4.2	4.7
1970	55.8	5.4	3.9	11.6	4.4	5.9
1971	56.1	5.9	3.9	11.4	4.4	6.4
1972	56.5	5.7	3.8	11.7	4.3	6.3
1973	57.5	5.9	3.8	12.0	4.3	5.6
1974	58.3	5.9	3.8	12.0	4.2	5.4
1975	58.8	5.8	3.6	10.6	4.1	7.1
AVE.	56.5	5.6	3.8	11.3	4.2	5.4

Source: Participation and unemployment rates from The Labour Force, Statistics Canada, December 1975. Entry and withdrawal rates calculated from unpublished gross flow estimates from the Labour Force Survey, Statistics Canada.

The rate at which employed persons withdrew from the labour market has varied by only a small amount around its average of 3.8 per cent per month. The highest rate of withdrawal occurred in 1966; the lowest in 1975. The withdrawal rate from unemployment averaged 11.3 per cent over the sample period. It appears to move in the opposite direction as the unemployment rate. The discouraged worker phenomenon would not, therefore, appear to result from this mechanism.

The years 1969 and 1974 were ones in which the flows into the labour market were approximately equal to the flows out.<sup>3</sup> They correspond, then, to the steady-state condition necessary for equation [10] to hold. The contribution of changes in each of the flow rates to change in the participation rate can be derived for these years. Recall equation [10],

$$[10 \text{ repeated}] \quad P = \frac{ER}{ER + WR}$$

and the withdrawal rate equation [9b],

$$[9b \text{ repeated}] \quad WR = u \times un + (1 - u) \times en.$$

Substituting [9b] into [10] and then differentiating with respect to each of the factors yields the following partial derivatives:

---

3. In an average month during 1969, approximately 344 thousand persons entered the labour market and an equal number withdrew. During 1974, there were 409 thousand entries and 408 withdrawals in an average month.

$$[11] \frac{\partial P}{\partial ER} = \frac{WR}{(ER + WR)^2}$$

$$\frac{\partial P}{\partial en} = \frac{-(1-u) \times ER}{(ER + WR)^2}$$

$$\frac{\partial P}{\partial un} = \frac{-u \times ER}{(ER + WR)^2}$$

$$\frac{\partial P}{\partial u} = \frac{-(un-en) \times ER}{(ER + WR)^2}$$

These partial derivatives are presented in table 2.

TABLE 2  
PARTIAL DERIVATIVE ESTIMATES

	1969	1974
$\bar{P}$ (actual)	55.8	58.3
$\bar{P}$ (steady-state)	55.8	58.3
$\frac{\partial P}{\partial ER}$	4.7	4.1
$\frac{\partial P}{\partial en}$	-5.6	-5.5
$\frac{\partial P}{\partial un}$	-0.3	-0.3
$\frac{\partial P}{\partial u}$	-0.5	-0.5

Source: Calculated from text equation 11 based upon data contained in Table 1.

In 1969, a one percentage point rise in the entry rate would increase the participation rate by 4.7 percentage points holding the other factors constant. By 1974, this rate had fallen to 4.1 due to a rise in the entry rate.<sup>4</sup> The remaining factors had similar effects in each of the two years.

4. The first term of equation [11] shows that each successive increase in the entry rate has less of an impact on the participation rate.

In absolute terms, the largest partial derivative is associated with the movement between employment and out of the labour force. A one percentage point increase in this rate would lead to a participation rate 5.6 percentage points lower.

The movement out of the labour force from the unemployed state and the change in the labour force mix measured by the unemployment rate have smaller absolute effects on the participation rate. A one percentage point rise in the withdrawal rate from unemployment would reduce the participation rate by 0.3 percentage points; a one percentage point increase in the unemployment rate would reduce the participation rate by 0.5. This could be interpreted as the model's counterpart of the discouraged worker effect.

The impact of each of these factors on the change in the participation rate between the two years can be calculated as:

$$[12] dp = \sum_i \frac{\partial p}{\partial x_i} dx_i$$

Approximating the differential by finite differences an estimate of the change between the years can be obtained by averaging:

$$[13] dp = \sum_i \frac{\partial \bar{P}}{\partial x_i} dx_i$$

Multiplying these by the change in the factor between years yields the total derivative. These calculations are outlined in Table 3.

TABLE 3  
TOTAL DERIVATIVE ESTIMATES

	<i>ER</i>	<i>en</i>	<i>un</i>	<i>u</i>	Total
$\frac{\partial P}{\partial x}$	4.4	-5.5	-0.3	-0.5	-
$\Delta x$	0.61	-0.03	0.16	0.75	-
<i>dP</i>	2.68	0.17	-0.05	-0.38	2.4

Source: Calculated from text equation 12, using data from tables 1 and 2 in raw form (unrounded).

The participation rate in 1974 was 58.8 per cent, up 2.5 percentage points from 1969. During the period, the labour force entry rate rose by 0.6 percentage points from 5.3 to 5.9 per cent. If other factors had remained constant, the participation rate would have been 2.7 percentage points higher. The drop in the withdrawal rate from employment increased the participation rate by 0.2, more than offsetting the effect of the increase in the withdrawal rate from unemployment. The larger number of withdrawals due to the greater proportion of unemployed in the labour market reduced the participation rate by 0.4.

In total, the rising entry rate dominated other changes accounting for more than the full change in the participation rate. It was partially offset by increased withdrawals resulting mainly from the greater share of unemployed in the labour force. The probability of labour market withdrawal is higher for an unemployed person than for one employed.

Factors were operating in the labour market between the years that expanded both the rates of labour force entry and withdrawal. In the next section, a model of these factors will be developed and estimated.

## SECTION IV

### Model Specification and Results

The analysis and review of the previous sections provides insight into the factors affecting decisions to enter and withdraw from the labour market. In this section, a model of labour force entry and withdrawal rates will be developed and estimated.

The dependent variables in the analysis are the labour market entry and withdrawal rates of men and women.<sup>1</sup> The entry rate is defined as the proportion of those outside the labour market one month ago who are in the labour market in the present month. The withdrawal rate is the proportion in the labour force one month ago and out the next. These entry and exit probabilities were estimated on a monthly basis from gross flow data and cover the period January 1966 to December 1975. A short description of the database is contained as Appendix 1, which also explains why the model was estimated on a monthly basis, rather than using the quarterly approach common to other econometric models.

The model has 6 main independent variables to capture additional and discouraged worker effects, price and wage effects and the impact of the 1971 revision in the Unemployment Insurance Act on labour force behaviour.

#### Additional Worker Effects

As noted earlier, the AW effect is the inflow of other family workers into the labour market to bolster income when the head

---

1. Data limitations preclude a further disaggregation along the age dimension at this time.

becomes unemployed. To capture this effect, the probability that an employed male will become unemployed is used.<sup>2</sup> A positive relation is assumed to exist. The greater is the probability that a male will become unemployed, the greater will be the probability of labour market entry.

$$[1a] ER = f(eu_m), f' > 0$$

An important question that analysis of this type should seek to answer is whether the movements resulting from AW and DW effects are temporary or more longer term. Are they symmetric over the cycle or do they result in a ratcheting of the participation rate over time? In the AW case, workers enter the labour market when a family member becomes unemployed and withdraw when that member is re-employed. The entrant's commitment could last beyond the re-employment period as necessity alters to choice, resulting in a longer term expansion of the labour force. A symmetry test is conducted by including the probability that an unemployed male will become employed in the withdrawal rate equations. Insignificance would indicate a ratcheting, while a positive sign would indicate a degree of symmetry.

$$[2a] WR = f(ue_m), f' > 0$$

2. Ideally, the probability that an employed household head would lose his or her job would be used, but this was precluded by data limitations.

Discouraged Worker Effects

Individuals are likely to become discouraged if labour market prospects deteriorate. For those in the labour force, this could be measured with the probability of finding a job for those unemployed:

$$[2a] WR = f(ue), f' < 0$$

A ~~negative~~ relation will likely exist. When the probability that an unemployed person will find a job declines, the withdrawal rate will increase. It was noted above, however, that the probability of an unemployed male becoming employed would also be used to measure the AW effect for males. In their withdrawal rate equation, therefore, the *ue* variable will capture the net of the two. When the probability that an unemployed male will find a job improves, AWs will tend to withdraw from the labour market but fewer potential DWs will withdraw. The net effect is theoretically uncertain. This is not a problem in the female equation because it is assumed that the DW phenomenon is generated by one's own **chances of** finding employment while the AW effect is a reaction to someone else's (the household head's) unemployment.

A decline in job prospects could also inhibit the entry of potential workers into the labour force. The probability of successful job entry will be used to measure this effect. As this probability rises, the entry rate should increase:

$$[1b] ER = f(pne) f' > 0$$

Wage Effects

(a) As measured by wage rate variations

Real wages affect labour supply when they vary from what is perceived to be a norm. The permanent wage theory predicts that workers will be more likely to enter the labour market when real wages are above the norm. The relative wage theory treats the norm as a measure of living standards. A fall below the norm will cause workers to enter the labour market to maintain the standard.

Expectations are assumed to be formed adaptively. Following Wachter [1974] the following adaptive expectations model will be used:

$$[3] W^* = B \sum A_i W_{t-i}; A_i = 1/n, \text{ all } i$$

Setting  $n = 60$ , the norm is assumed to be formed over a 5 year period, where each period is given equal weight. The B term sets the mean values of W and W\* equal. The ratio W/W\* will be used to test for relative and permanent wage effects.

$$[1c] ER = f(W/W^*) \quad f' = ?$$

$$[2b] WR = f(W/W^*) \quad f' = ?$$

The signs of the derivatives will depend on whether the permanent or relative wage effects dominate.

(b) As measured by demographic movements

Wachter's intermediate swings model links cohort competition to cohort participation decisions. A relative increase in a cohort's size as might occur due to demographic movements results in above normal competition for jobs usually taken by that cohort. This will lead to a downward adjustment in wages facing this group and induce greater participation to maintain living standards. Because age-sex-specific wage rates are not available in a time series, Wachter proxies this effect by demographic movements directly. His variable form is:

$$[4] \text{ DEM} = \text{POP}_{14-34} / \text{POP}_{35+}$$

As a positive relation is assumed between this and the participation rate of the young cohort, it would be expected that:

$$[1d] \text{ ER} = f(\text{DEM}) \quad f' > 0$$

$$[2c] \text{ WR} = f(\text{DEM}) \quad f' < 0$$

for the younger age groups. Because the data used in the present study is not age-specific, this variable will also pick up the impact of changes in the demographic structure on the aggregate participation rate. As the younger age groups have higher than average entry and withdrawal rates, the effect will be to increase the absolute size of the coefficient on entry above what would be predicted solely on the basis of cohort-induced excess competition while reducing it for the

withdrawal rate. There will also be a tendency for the cohort-induced relative wage effect to cancel when aggregation occurs across age groups.

### Price Effects

In the earlier section it was noted that price movements can affect labour market entry and exit decisions through money illusion or by increasing uncertainty about future income prospects. As with wage effects, these are assumed to occur via adoptive expectations. To test this hypothesis, the price level perceived to be the norm is formulated as:

$$[5] P^* = D \sum A_i P_{t-i}; A_i = 1/n, \text{ all } i$$

As with the wage variable, expectations are assumed to be formed over a 5 year period and  $P/P^*$  is used to test for price effects. Both uncertainty and money illusion imply an expansion of labour supply:

$$[1e] ER = f(P/P^*) \quad f' > 0$$

$$[2d] WR = f(P/P^*) \quad f' < 0$$

### Unemployment Insurance Effects

The 1971 revision to the Unemployment Insurance Act expanded eligibility to the majority of employees, increased the benefit rate, made benefits taxable, made benefits easier to obtain by lowering the

entrance requirement and provided special benefits for sickness, maternity and retirement. It is virtually impossible to separate the influences of these many changes in the time series. Following common practice, the benefit/wage ratio will be used. The benefits are deflated post-1971 using the average tax rate applicable to unemployment insurance recipients. It is assumed that the more generous benefits will dampen the additional and discouraged worker effects as long as benefit entitlement periods are long enough to maintain income until subsequent re-employment<sup>3</sup>:

$$[1f] ER = f(BW) \quad f' < 0$$

$$[2d] WR = f(BW) \quad f' < 0$$

It is also possible that the more generous benefits will induce workers into the labour market to look for work in the knowledge that benefits will be available after a work period. In this case, the sign on the variable would be positive in the entry rate equation. It should be noted that each of these effects is independent of the work disincentive (job search) issue that predominates in the literature.

---

3. If individuals were to exhaust benefits before re-employment, the effect of the UI changes would only be to postpone rather than dampen the AW and DW effects.

Complete Specification

We are now in a position to specify fully the entry and withdrawal rate equations.

$$[1] ER = f(eu_m, pne, W/W^*, P/P^*, DEM, BW)$$

$$[2] WR = f(ue, W/W^*, P/P^*, DEM, BW)$$

Seasonal dichotomous variables are also introduced.

Colinearity Problems

Prior to estimation, however, a limited statistical analysis was performed on the data-base. The first test was for multicollinearity among the independent variable used in the analysis. While this is not a major statistical problem, high correlation between independent variables means that separate identification of different factors will be at best difficult due to the resultant inflation of the standard errors.

High correlation was in evidence between a limited number of variables: a linear time trend, the demographic variable, price movements and the UI benefit-wage ratio. The almost perfect correlation between

TABLE 4  
CORRELATION MATRIX

	TIME	DEM	P/P*	BW
TIME	1.000	1.000	.837	.889
DEM		1.000	.842	.889
P/P*			1.000	.693
BW				1.000

the time trend and the demographic variable (1 to three decimals) is a reflection of the method used by Statistics Canada to produce monthly population estimates. These are in fact interpolated between Census years. It would appear that a linear interpolation technique has been used. The sample period is not long enough to isolate the demographic phenomenon developed in the earlier section.

Increasing inflation has characterized the sample period and it is not totally surprising that the price variable is highly correlated with the time trend. Again, a longer sample period would permit a more meaningful isolation of the reaction of labour supply to inflation.

The benefit-wage ratio has the appearance of a step function, being at one level prior to the 1971 liberalization of the UI Act and moving to a higher level thereafter. This ratcheting effect is highly correlated with the smoother evolution represented by the time trend.

The complete correlation matrix is presented in the third appendix.

### Trend and Seasonal Factors

A second test involves the examination of seasonal and trend elements in the entry and withdrawal rate series. The AW, DW and neoclassical effects are more likely to be cyclical than regular (seasonal) or evolutionary (trend). If the seasonal and trend factors "explain" a high proportion of the variation in the time series, there would appear to be little room remaining for cyclical determinants.<sup>4</sup> It was such a test which formed the basis for Long's stable labour force hypothesis.

As the results in Table 5 illustrate, the entry rates of both men and women increase substantially in the summer months, reflecting the influx of students into the labour market. The female entry rate has a second peak in September. Combining this with their high withdrawal rate in July implies a short-term withdrawal during the summer months perhaps to take care of younger children during vacation. Withdrawal rates of both sexes peak in September, again associated with the school year.

The male entry rate does not exhibit a significant trend. The withdrawal rate, however, has increased over the sample period and accounts for the entire reduction in the male participation rate. The length of an average period in the labour force has decreased.

---

4. This abstracts from the possibility that the trend is in fact an unrealized cycle.

TABLE 5

TREND AND SEASONALITY EQUATION RESULTS

	KON	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEP	OCT	NOV	DEC	DEM <sup>1</sup>	RB2	COV	DW
$ER_m$	6.21 (3.50)	.541 (1.13)	.612 (1.27)	2.28 (4.74)	7.63 (15.9)	9.02 (18.8)	11.8 (24.4)	4.29 (8.92)	1.74 (3.61)	1.22 (2.53)	.281 (.58)	-.258 (-.54)	-.737 (-1.37)	.93	12.2	2.28
$ER_f$	-2.58 (-4.88)	.421 (2.94)	.332 (2.32)	.839 (5.87)	1.66 (11.6)	2.17 (15.2)	2.68 (18.7)	1.48 (10.3)	2.86 (23.0)	1.23 (8.60)	.510 (3.56)	.142 (.99)	6.60 (11.2)	.91	7.2	2.14
$WR_m$	.935 (2.65)	-.513 (-5.37)	-.738 (-7.72)	-.630 (-6.60)	-.580 (-6.07)	-.584 (-6.11)	-.349 (-3.65)	.511 (5.34)	4.53 (47.3)	-.227 (-2.37)	-.277 (-2.89)	-.334 (-3.49)	1.65 (4.17)	.98	8.7	1.75
$WR_f$	13.7 (12.5)	-1.83 (-6.18)	-2.16 (-7.30)	-1.64 (-5.52)	-1.17 (-3.95)	-.696 (-2.35)	1.20 (4.04)	.829 (2.79)	4.23 (14.3)	-.725 (-2.44)	-1.14 (-3.83)	-1.69 (-5.70)	-6.17 (-5.04)	.87	8.4	2.05

Note: Regression Coefficients scaled by 100  
T-values in parenthesis

1. Recall from Table 4 that the demographic variable (the ratio of population aged 14 to 34 to population aged 35 and over) is virtually indistinguishable from a time trend.

The rising female participation rate is the result of reinforcing flows: an increasing entry rate coupled with a declining rate of withdrawal. Not only are more women entering the labour market, but their average attachment has increased.

The summary statistics indicate that seasonal and trend factors dominate the entry and withdrawal rate time series. There would appear to be little variation remaining that could be attributable to AW, DW and neoclassical factors.

Estimation Results: The Complete Model

Table 6 presents the results of the fully specified model. The probability that an employed male will become unemployed has the expected positive and significant effect on the male entry rate. This indicates the additional worker effect exists for males. The positive sign on the probability of successful labour market entry ( $pne_m$ ) also indicates that a deterioration in job prospects inhibits labour market entry as would be expected from the discouraged worker hypothesis. This is, however, not quite significant at the 90 per cent level of confidence.

The addition of these variables to the female entry rate equation does nothing to improve its results. Trend and seasonal influences dominate all other factors.

TABLE 6

## ESTIMATION RESULTS

DEPENDENT VARIABLE	INDEPENDENT VARIABLES							SUMMARY STATISTICS				
	$eu_m$	$ue_m$	$pne_m$	$ue_f$	$pne_f$	$W/W^*$	$P/P^*$	DEM	BW	RB2	COV	DW
$ER_m$	1.273 (2.35)		.0621 (1.55)			-.0447 (-.35)	-.1225 (-1.27)	.1146 (1.13)	-.0189 (-.35)	.93	11.9	2.29
$ER_f$	.1766 (1.05)			.0074 (.50)		-.0106 (-.29)	-.0041 (-.14)	.0667 (2.08)	.0033 (.21)	.91	7.3	2.08
$WR_m$		.0068 (1.13)				-.0066 (-.34)	-.0439 (-2.72)	.0829 (4.32)	-.0287 (-3.12)	.98	7.8	2.18
$WR_f$		.0069 (3.18)		.0287 (1.29)		.0647 (1.05)	-.0422 (-.82)	.0943 (1.53)	-.0569 (-1.94)	.89	7.7	2.05

Note: T-values in parenthesis

The coefficient of the unemployed male probability of finding employment is positive in the male withdrawal rate equation. This is what would be expected on the basis of the symmetry of the AW effect over the cycle. It is not, however, significant.

Price movements are of the expected negative sign. It would appear that inflation increases the size of the male labour force by inhibiting withdrawal. The 1971 revision to the UI Act also appears to have increased the male labour force in the same manner.

The significance of the  $ue_m$  variable in the female withdrawal rate equation indicates that an improvement in economic conditions for males will likely reduce (or at least slow down the rate of increase in) the female participation rate. The fact that the symmetrical variable is not significant in the entry rate equation would indicate a ratcheting effect on the female participation rate.

The introduction of the UI benefit-wage variable reduces the demographic (trend) variable to insignificance. This implies that the trend observed in the earlier equation above was in actuality a step function. The 1971 revision to the UI Act would appear to have expanded the female labour force by encouraging women to remain in the labour market.

Conversion from Flows to Stocks

In Section III, the relationship between the entry and withdrawal rates and the participation rate was developed in the steady state:

$$[3] \quad PR = \frac{ER}{ER + WR}$$

The functional relation between the participation rate and a factor  $x_i$  can be approximated as:

$$[4] \quad \frac{\partial PR}{\partial x_i} = \frac{\partial ER}{\partial x_i} \cdot (ER + WR) - \frac{\partial (ER + WR)}{\partial x_i} \cdot \frac{ER}{(ER + WR)^2}$$

Under the assumption of independence between the  $ER$  and  $WR$ :

$$[5] \quad \frac{\partial}{\partial x_i} (ER + WR) = \frac{\partial ER}{\partial x_i} + \frac{\partial WR}{\partial x_i}$$

Table 7 presents these partial derivatives estimated at the means of  $ER$  and  $WR$ . The estimates are in terms of percentage points: a one percentage point increase in a factor is associated with a change in the participation rate in the same units.

AW effects are observable for both men and women in the sense that an increase in male job loss is associated with a higher participation rate. A one percentage point increase in  $eu_m$  is associated with a 2.5 percentage point increase in the male participation rate but a

0.9 percentage point increase in the female rate. A degree of cyclical symmetry is apparent in that the  $ue_m$  probability has the opposite sign.

In absolute numbers there would appear to be more male than female AWs at a point in time. In relation to the size of the labour force, and thus the impact on the unemployment rate, however, it should be noted that the female was approximately half as large as the male labour force over the sample period.

The positive sign on the  $pne$  variables indicate DW effects. A deterioration in job prospects for labour market entrants inhibits entry. The effect is stronger for men than women.

TABLE 7  
PARTIAL DERIVATIVE ESTIMATES) CONVERTED TO  
PARTICIPATION RATES

<u><math>X_i</math></u>	<u>Male</u>	<u>Female</u>
$eu_m$	2.466	0.915
$ue_m$	-0.047	-0.020
$pne_m$	0.120	-
$ue_f$	-	-0.009
$pne_f$	-	0.038
W/W*	-0.041	-0.245
P/P*	0.067	0.103
DEM	-0.353	0.068
BW	0.163	0.169

The dominance of relative wage effects is indicated by the negative coefficient on the wage variable. This effect is stronger for women than men. Unanticipated inflation appears to expand both the male and female labour force, but again women appear to be more strongly effected.

The demographic variable is negative for men and positive for women. The fact that the variable is virtually a linear time trend should be kept in mind when interpreting the results.

The benefit-wage ratio used to capture the impact of the 1971 revision to the UI Act has the expected positive sign. In terms of the participation ratio, the coefficient is virtually the same size for men as women. Because the male/female population sizes are almost equal, this implies as many male as female workers affected by the UI change. It should be noted, however, that the female labour force is approximately one-half the size of the male labour force. Relative to the size of the respective labour forces (and ceteris paribus on the respective unemployment rates), twice the proportion of women were affected as men.

#### Factor Contribution to Participation Rate Changes

In order to properly evaluate the magnitude of the coefficients estimated above, it is necessary to reference them to movements in the factors over time. Again using the steady-state formulation developed

in Section III, the impact of each factor on the change in the participation rates between 1966 and 1975 was estimated using the formulation:

$$[6] \quad dP = \sum_i \frac{\partial P}{\partial x_i} dx_i$$

These estimates are presented in Table 8.<sup>5</sup> It should be noted that the steady-rate assumption is being violated by the choice of years and the results should be treated as approximations. This is illustrated by the difference between the actual and calculated changes. The points in time were chosen, however, to reflect unemployment rate extremes and the adaptation to the new UI Act.

TABLE 8

TOTAL DERIVATIVE ESTIMATES  
1966-1975

$x_i$	$\Delta x_i$	$\frac{\partial P}{\partial x_i} \Delta x_i$ Male	$\frac{\partial P}{\partial x_i} \Delta x_i$ Female
$eu_m$	.0057	.0141	.0052
$ue_m$	.0025	.0056	.0024
$pne_m$	-.0158	-.0149	-
$ue_f$	.0011	-	.0010
$pne_f$	-.0005	-	-.0044
W/W*	.0026	.0004	.0025
P/P*	.0158	.0100	.0153
DEM	.0097	-.0543	.0105
BW	.0287	.0268	.0278
Total: Estimated		-.012	.060
Actual		-.006	.081

5. Again approximating differentials by finite differences.

Over the sample period AW effects increased the male participation rate by almost 2.0 percentage points ( $1.41+0.56$ ) and the female rate by 0.9 points ( $0.52+0.24+0.10$ ) as the chances of losing a job and of finding one deteriorated. This effect was partially offset by a reduced inflow of workers discouraged by their weakened job prospects. The male and female participation rates were reduced by 1.5 and 0.4 percentage points respectively. On net the AW effect dominated for both men and women, according to these estimates, increasing both participation rates by about 0.5 points between 1966 and 1975.

Both higher relative levels of real wages and price increases expanded the labour force, adding 1.0 point for men and 1.8 points for women ( $0.25+1.53$ ).

Of all the variables, the trend factor dominated the changing participation rate picture for males over the sample period. At 5.4 points, it offset almost all factors which served to increase the rate. This variable was not as important for women, accounting for a 1.0 point increase.

The results indicate that the 1971 change in the UI Act increased the male and female rates by virtually the same amount: 2.7 and 2.8 points respectively. This was the largest single factor contributing to the participation rate rise for women.

## SECTION V

### Conclusions

This paper examined the dynamics of labour force behaviour in Canada using labour market entry and withdrawal rates calculated from monthly gross flow data. It began with the traditional AW and DW hypotheses and expanded them to include neoclassical price and wage factors, demographic movements and the impact of the 1971 revision to the UI Act. Although multicollinearity obscured the statistical significance of some results, the salient features emerging from the study are:

1. Seasonal and trend factors explain most of the variation in the entry and withdrawal rate time series between 1966 and 1975. The trend is negative for men and positive for women;
2. There is evidence that both AW and DW effects were in existence over the period. The DW effect appears to operate mainly through inhibited entry rather than increased withdrawal. In terms of this phenomenon, it would appear that men are more likely to be both AWs and DWs than are women. On net, the AW effect dominated over the period and was of roughly equal magnitude for the two sexes;
3. There appears to be a dominance of the relative over the permanent wage effect for both men and women: an increase in real wages relative to the norm reduces the participation rate. The effect is stronger for women than men;

4. Unanticipated inflation serves to expand the size of the labour force. This is compatible with both the uncertainty and money illusion views of inflation. However, the fact that the relative wage effect dominates would imply that the uncertainty argument is stronger; and
  
5. The 1971 revision to the UI Act increased both male and female participation rates by equal amounts. The new Act provides strong incentives to remain in the labour force and seek work, and affects predominantly the withdrawal rate from the labour force. The fact that the numbers involved are roughly equal for men and women implies, however, that relative to the size of the respective labour forces, the impact was twice as large for women as men.

## APPENDIX 1

### The Gross Flow Database

The gross flow data used in this study were provided by the Policy and Programs Analysis Branch of the Department of Employment and Immigration. They were produced under contract with the Labour Force Survey, Statistics Canada.

The Labour Force Survey is a household sample. When households are selected for inclusion, they are interviewed for 6 consecutive months before being replaced. The rotation system is such that one-sixth of the sample is replaced each month.

Individual movements were ascertained by matching the status declared by a respondent in one month to that declared in the previous month. Due to the rotation problem, estimates were obtained for approximately five-sixths of the sample. These were weighted to population estimates, using normal Labour Force Survey weights. Transition probabilities (the ratio of the flow to the previous month's stock) were then calculated and applied to the published stocks to produce flow estimates.

Although a number of technical and conceptual problems arise from the generation of flow data in this manner, analysis indicates the matching method offers a greater potential for reliability than other methods such as asking individuals to recall their previous status. It will form the basis for official flow estimates to be published by the Labour Force Survey in the future.

These transition probabilities are conditional probabilities: the probability, for example, that an individual who was not in the labour force in the previous month (at the time of the last survey) was in the labour force during the present month (at the time of the current survey). Quarterly estimates could be obtained by matching individual's responses over three-month periods, but this would entail a significant loss of information. Due to the rotation pattern, only one-half of the Labour Force Survey sample at a point in time was in the sample three months ago. The data used in this study are monthly, therefore, rather than quarterly as is common in most econometric models.

APPENDIX 2

Variable Description

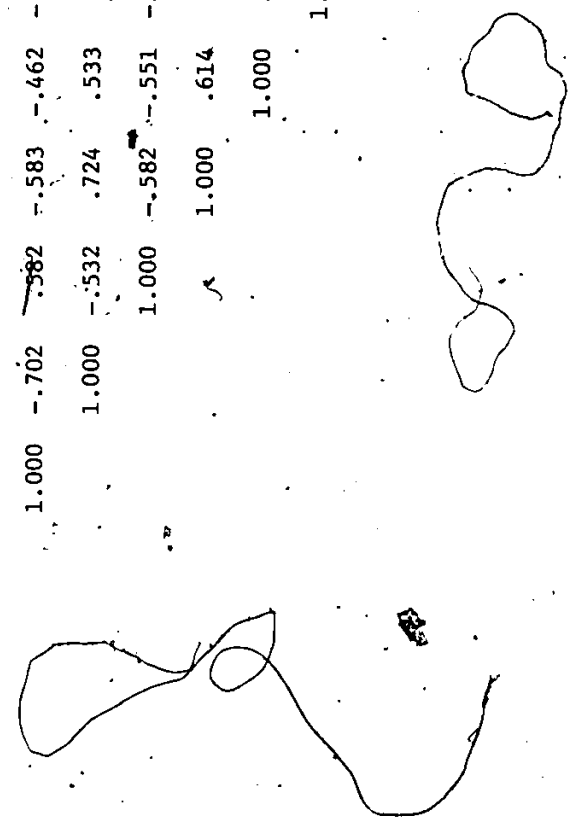
<u>Mnemonic</u>	<u>Description</u>
<i>ER</i>	<ul style="list-style-type: none"><li>- the probability of labour force entry</li><li>- the proportion of those out of the labour force in one month who are in the labour force in the next month</li></ul>
<i>WR</i>	<ul style="list-style-type: none"><li>- the probability of labour force withdrawal</li><li>- the proportion of those in the labour force in one month who are out of the labour force in the next</li></ul>
<i>eu<sub>m</sub></i>	<ul style="list-style-type: none"><li>- the probability of an employed male becoming unemployed</li><li>- the proportion of males employed in one month who are unemployed in the next</li></ul>
<i>ue</i>	<ul style="list-style-type: none"><li>- the probability of an unemployed person becoming employed</li><li>- the proportion of those unemployed in one month who are employed in the next.</li></ul>
<i>pne</i>	<ul style="list-style-type: none"><li>- the probability of successful labour force entry</li><li>- the proportion of those entering the labour force who move directly into employment</li></ul>

- W - the industrial composite wage rate deflated by the consumer price index
- W\* - a five year moving average of W
- P - the consumer price index
- P\* - a five year moving average of P
- DEM - the working age population aged 14 to 34 divided by the same population aged 35 and older (virtually a time trend - see Table 4, page 40)
- BW - the ratio of unemployment insurance benefits to average wages deflated by the marginal tax rate of unemployment insurance recipients. The deflation term takes the value of 1 to June 1971 and declines linearly to 0.87 in January 1972 where it remains constant for the remainder of the sample period
- Di - monthly dichotomous variables having a value of 1 in the relevant month and 0 otherwise (January is excluded to avoid singularity)
- KON - the constant term

APPENDIX 3

CORRELATION MATRIX

	ER <sub>m</sub>	WR <sub>m</sub>	ER <sub>f</sub>	WR <sub>f</sub>	TIME	DEM	W/W*	P/P*	eu <sub>m</sub>	ue <sub>m</sub>	eu <sub>f</sub>	ue <sub>f</sub>	pne <sub>m</sub>	pne <sub>f</sub>	BW
ER <sub>m</sub>	1.000	<del>-0.131</del>	.671	.234	-.013	.012	.062	.005	-.518	.641	-.224	.276	.205	-.125	-.087
WR <sub>m</sub>		1.000	.486	.827	.086	.085	.072	.066	-.196	.084	.071	.247	.038	.147	-.012
ER <sub>f</sub>			1.000	.580	.333	.333	.023	.324	-.596	.511	-.005	.299	.095	-.176	.167
WR <sub>f</sub>				1.000	-.143	-.143	.114	-.116	-.298	.345	-.080	.425	.243	.252	-.245
TIME					1.000	1.000	-.137	.837	.157	-.411	.657	-.586	-.482	-.701	.889
DEM						1.000	-.146	.842	.157	-.409	-.659	-.583	-.480	-.701	.889
W/W*							1.000	-.551	-.033	-.017	-.043	-.025	-.292	-.165	-.162
P/P*								1.000	.098	-.252	.569	-.395	-.289	-.502	.693
eu <sub>m</sub>									1.000	-.702	.582	-.583	-.462	-.221	.199
ue <sub>m</sub>										1.000	-.532	.724	.533	.319	-.437
eu <sub>f</sub>											1.000	-.582	-.551	-.579	.610
ue <sub>f</sub>												1.000	.614	.565	-.560
pne <sub>m</sub>													1.000	.733	-.406
pne <sub>f</sub>														1.000	-.625
BW															1.000



## REFERENCES

1. Stuart Altman, Factors Affecting the Unemployment of Married Women: A Study of the Dynamics of the Labor Force Behaviour of Secondary Family Workers, unpublished Ph.D. dissertation, University of California at Los Angeles, (1963).
2. Gary S. Becker, Human Capital, Second Edition, National Bureau of Economic Research, New York (1975).
3. Serge Bertrand, "A Study of the Reliability of Estimates of Gross Movements in the Canadian Labour Market," Department of Manpower and Immigration (August 1975), (mimeographed).
4. S.W. Black and H.H. Kelijian, "A Macro Model of the U.S. Labor Market," Econometrica, Vol. 38, No. 5. (September, 1970) pp. 712-741.
5. William G. Bowen and T.A. Finnegan, "Labor Force Participation and Unemployment," in A.M. Ross, Employment Policy and the Labor Market, University of California Press (1965) pp. 115-161.
6. Glen C. Cain, Married Women in the Labor Force, University of Chicago Press, (1966).
7. Frank T. Denton, Christine H. Feaver, A. Leslie Robb, The Short-run Dynamics of the Canadian Labour Market, Economic Council of Canada, Ottawa (1976).
8. Thomas Dernberg and Kenneth Strand, "Hidden Unemployment 1953-62: A Quantitative Analysis by Age and Sex," American Economic Review (March, 1966) pp. 71-95.
9. Ray C. Fair, "Labor Force Participation, Wage Rates, and Money Illusion," Review of Economics and Statistics Vol. LII, No. 2. (May, 1971) pp. 164-168.
10. Belton M. Fleisher and George Rhodes, "Unemployment and Labor Force Participation of Married Men and Women: A Simultaneous Model," The Review of Economics and Statistics, (November, 1976) pp. 398-406.
11. Benjamin M. Friedman and Michael L. Wachter, "Unemployment: Okun's Law, Labor Force, and Productivity," The Review of Economics and Statistics (May, 1974) pp. 167-176.
12. W. Lee Hansen, "The Cyclical Sensitivity of the Labor Supply," American Economic Review Vol. 51 No. 3, (June, 1961), pp. 299-309.
13. Wolfgang M. Illing, "CANDIDE model 1.0: Labour Supply and Demographic Variables," CANDIDE Project Paper No. 9, Economic Council of Canada, Ottawa (November, 1973).

14. S.F. Kaliski, "The Relation between Labour Force Participation and Unemployment in Canada: Interim Report on a Pilot Study", paper presented to the Canadian Political Science Association Conference on Statistics, McMaster University, Hamilton, (June, 1962).
15. Clarence D. Long, "Impact of Effective Demand on the Labor Supply," American Economic Review (May 1953) pp. 458-467.
16. Robert E. Lucas, Jr., and Leonard A. Rapping, "Real Wages, Employment, and Inflation," Journal of Political Economy Vol. 77, No. 5, (September/October 1969) pp. 721-754.
17. Stephen T. Marston, "Employment Instability and High Unemployment Rates", Brookings Papers on Economic Activity, 1 (1976) pp. 169-210.
18. Jacob Mincer, "Labor Force Participation and Unemployment: A Review of Recent Evidence," in Gordon and Gordon, Prosperity and Unemployment, John Wiley and Sons (1966) pp. 73-112.
19. Lawrence H. Officer and Peter R. Anderson, "Labour Force Participation in Canada," Canadian Journal of Economics (May, 1969) pp. 278-287.
20. George Perry, "Unemployment Flows in the U.S. Labor Market," Brookings Papers on Economic Activity, 2 (1972), pp. 245-292.
21. Pierre-Paul Proulx, "La Variabilité Cyclique des Taux de Participation à la Main-d'Oeuvre au Canada," Canadian Journal of Economics (May, 1969) pp. 268-277.
22. Research Projects Group, "Labour Market Flows in Canada," Department of Manpower and Immigration (June, 1976) (mimeographed).
23. Tom Siedule, Nicholas Skoulas, and Keith Newton, The Impact of Economy-Wide Changes on the Labour Force, Economic Council of Canada, Ottawa (1976).
24. Ralph E. Smith, "The Discouraged Worker in a Full Employment Economy," Working Paper: 350-62, The Urban Institute, Washington D.C. (January 28, 1974) (mimeographed).
25. Ralph E. Smith, "A Simulation Model of the Demographic Composition of Employment, Unemployment, and Labor Force Participation," in R.G. Ehrenberg, Research in Labor Economics, Vol. 1, JAI Press (1977) pp. 259-304.
26. Richard Smith, "Gross Flows in the Labour Force: Concepts, Measurement, and Potential Uses," Canada Manpower and Immigration Review, Vol. 9 No. 3, (Third Quarter, 1976).
27. Kenneth Strand and Thomas Dernberg, "Cyclical Variation in Civilian Labor Force Participation," The Review of Economics and Statistics Vol. XLVI (November, 1964) pp. 378-391.

28. Robert Swidinsky, "Unemployment and Labour Force Participation: The Canadian Experience, "Discussion paper No.16, Department of Economics, University of British Columbia, (March, 1969).
29. Alfred Tella, "The Relation of Labor Force to Employment," Industrial and Labor Relations Review Vol. 17, No. 3 (April, 1964) pp. 454-469.
30. Michael L. Wachter, "A New Approach to the Equilibrium Labour Force," Economica (February, 1974) pp. 35-51.
31. Michael L. Wachter, "Intermediate Swings in Labor Force Participation," Brookings Papers on Economic Activity, 2 (1977), pp. 545-576.
32. W.S. Woytinsky, Three Aspects of Labour Dynamics, Social Science Research Council, (1940).