



# IMPACT OF DEMOGRAPHIC CHANGE ON INDUSTRY STRUCTURE IN AUSTRALIA

A joint study by the Australian Bureau of Statistics, the Department of Employment and Industrial Relations, the Department of Environment, Housing and Community Development, the Department of Industry and Commerce and the Industries Assistance Commission

CONFIDENTIAL : Not for quotation without prior clearance  
from the authors; comments welcome

AN ANALYSIS OF LABOUR FORCE  
PARTICIPATION RATES IN AUSTRALIA

by

J. Leaper & R. Silberberg  
Industries Assistance Commission

Working Paper No. B-04 Melbourne September 1976

*The views expressed in this paper do not necessarily reflect the opinions of the participating agencies, nor of the Australian government.*



CONTENTS

Page

1	INTRODUCTION	
1.1	Scope and Limitations of the Analysis	
1.2	Recent Changes in Labour Force Participation Rates in Australia	
2	THEORETICAL BACKGROUND	
2.1	Cyclical Fluctuations	
2.2	Secular Trends	
3	SPECIFICATION OF THE MODEL	
4	DATA SOURCES AND DEFICIENCIES	
5	ALTERNATIVE SPECIFICATIONS	
6	REGRESSION RESULTS	
5.1	Married Women 15-54	
5.2	Married Women 55 and over	
5.3	Other Women 15-24	
5.4	Other Women 25-54	
5.5	Other Women 55 and over	
5.6	Males 15-24	
5.7	Males 25-54	
5.8	Males 55 and over	
7	SUMMARY AND CONCLUSIONS	

Appendices

1	Labour Force Participation Rates in Australia by Age, Sex and Female Marital Status	
2	Size and Composition of the Workforce	
3	Data Sources and Data Summary	
4	Elasticities at Means	
5	Actual and Predicted Participation Rates	



# AN ANALYSIS OF LABOUR FORCE PARTICIPATION RATES IN AUSTRALIA

by

J. Leaper & R. Silberberg\*

## 1 INTRODUCTION

### 1.1 Scope and Limitations of the Analysis

The size and composition of the workforce of a country depends on not only the size and composition of the population but also the proportion of that population employed or seeking employment.<sup>1</sup> Since estimates of the Australian workforce over the next decade are an important output of the BACHUROO<sup>2</sup> module in the IMPACT<sup>3</sup> project, attempts are being made to model both population changes and variations in labour force participation rates.

This paper reports on the initial specification of a model to be used to explain medium- to longer-term variations in labour force participation rates in Australia. The results are preliminary in that

---

\* This paper proceeds from the earlier unpublished work by Judy Rich. Thanks are due to Alan Powell, Ashok Tulpulé and Allen Kelley for critical advice and suggestions - responsibility for errors remains with the authors.

1. The proportion of any group offering for work (employed or seeking employment) is known as the "labour force participation rate" of that group.
2. See: Ashok H. Tulpulé and M.K. McIntosh, "BACHUROO - An Economic-Demographic Module for Australia", Impact of Demographic Change on Industry Structure in Australia, Working Paper No. B-02, Industries Assistance Commission, Melbourne, April 1976.
3. See: Alan Powell and Tony Lawson, "IMPACT : An Economic-Demographic Model of Australian Industry Structure", Impact of Demographic Change on Industry Structure in Australia, Working Paper No. I-01, Industries Assistance Commission, Melbourne, September, 1975.

they are based on a single equations approach rather than on a systems approach in which the labour force participation decision is taken simultaneously with important other related household decisions, such as those affecting age at marriage and subsequent numbers and spacing of children. These issues, we hope, will be taken up in subsequent work. The results are also preliminary in that statistical problems encountered with the time series sample data meant that the earnings variable did not appear in the finally "preferred" regression results which we report.

### 1.2 Recent Variations in Labour Force Participation Rates in Australia

The proportion of Australians employed or seeking employment rose only slightly from 58.7% of the population in 1964 to 61.5% in 1975 (see Appendix 1, Table 1). However, this small increase in the overall labour force participation rate was the result of much larger contrasting movements in the components, as can be seen when participation rates are analysed by sex, marital status and age. For example, over the same period the participation rate for females rose from 33.4% to 42.3% but male rates declined from 84.2% to 81.0% (see Appendix 1, Table 2). Within the female category, participation rates for married women<sup>4</sup> rose from 24.5% to 40.4% while those for other women<sup>5</sup> declined from 49.9% to 46.0% (see Appendix 1, Table 3). Analysis of these movements by age groups reveals that further contrasts occurred within groups. Participation rates for married women of all ages rose substantially but those of other groups did not. In the youngest and oldest age groups of other women and men participation rates fell; in the age groups in between they remained

---

4. Includes Separated women.

5. Never Married, Widowed and Divorced women.

virtually static (see Appendix 1, Tables 2 and 3).

To account for these diverse trends in the components of the overall labour force participation rate, behavioural relationships were specified for participation rates classified by sex, marital status and age. In order to evaluate the significance of differences in the relationships identified for these groups, it is useful to analyse the size and composition of the Australian labour force and the changes that have occurred over the 1964-75 period.

Estimates of the Australian workforce classified by age, sex and marital status are presented in Appendix 2, Table 1. The most notable feature in this table is the growth in the size of all ages of the married women group. The total number of married women in the workforce rose by 109% over the period. This compares to a growth of 20% in the male workforce and only 12% in the number of other women. As a consequence, despite the rise in the number of males and other women in the workforce, the proportion of all workers in these groups has fallen and the proportion of married women has risen from 14% of all workers in 1964 to 22% of all workers in 1975 (see Appendix 2, Table 2).

The most significant differences in the distribution of workers by age is found in the composition of the female workforce (see Appendix 2, Table 3). The 15-19 year old age group is by far the largest cohort for other women, but one of the smallest for married women. Approximately two-thirds of other women in the workforce are in the 15-24 age group. Less than one woman in twelve in the workforce is over 55 years old. This emphasises the importance of married women and younger other women in the modelling of female labour force participation rates.

## 2 THEORETICAL BACKGROUND

Variations in labour force participation rates over time can be analysed in terms of secular and cyclical movements.

### 2.1 Cyclical Variations

Considerable research has been undertaken into cyclical variations in order to determine whether changes in participation rates, or the supply of labour, occur because of changes in unemployment rates, or some measure of the demand for labour.<sup>6</sup> Contrasting hypotheses have been advanced suggesting that a fall in the demand for labour will alternatively reduce participation rates due to the "discouraged worker effect"<sup>7</sup> or increase them due to the "additional worker effect".<sup>8</sup> In the former case, it is postulated that higher rates of unemployment cause some workers to postpone job search activities due to the belief that such searches would be fruitless. In the latter case, it is postulated that higher rates of unemployment cause some persons not in the workforce to enter it in an attempt to supplement family incomes reduced by the fall in the demand for labour.

- 
6. Recent interest in these areas occurred in the United States in the 1960's following such articles as W. Lee Hansen "Cyclical Sensitivity of the Labour Force", American Economic Review, Vol. 51, June 1961, pp. 299-309 and Thomas Dernberg and Kenneth Strand, "Cyclical Variation in Labour Force Participation", Review of Economics and Statistics, Vol. 46, November 1964, pp. 378-391. The most comprehensive analysis was undertaken by William Bowen and Aldrich Finegan, The Economics of Labour Force Participation, Princeton, Princeton University Press, 1969.
  7. Attributed to Paul Douglas, Real Wages in the United States, 1890-1926 Cambridge, Massachusetts, 1930.
  8. Attributed to Wladimir Woytinsky, "Additional Workers and the Volume of Unemployment in the Depression", Social Science Research Council, Pamphlet Series No. 1 Washington, D.C. 1940.



Research in the United States suggests that both hypotheses may be valid, but that the net result of discouraged and additional worker effects is generally to reduce participation rates.<sup>9</sup> Males in the prime working age groups between 25 and 54 were found to have the least cyclical response in participation rates to variations in labour demand; married women made up the majority of the discouraged workers.<sup>10</sup> Although the estimates of discouraged worker effects varied widely in the United States,<sup>11</sup> there appears to be a strong case for the inclusion of a short-term demand variable in each age-specific participation rate model in order to account for cyclical variations.

Studies of the Australian labour market have produced varying conclusions about the response of labour supply to cyclical variations in demand. In a survey of participation rates classified by sex and marital status (but not by age), J. Bowdler and C. Higgins found net discouraged worker effects prevailing for both the males and married women groups.<sup>12</sup> For the other women group they found significant added worker effects occurred soon after an increase in the unemployment rate but that these were gradually offset by decreases in participation rates over the

- 
9. See: Jacob Mincer, "Labour Force Participation and Unemployment : A Review of Recent Evidence", in Prosperity and Unemployment, edited by M.S. Gordon and R.A. Gordon, New York, Wiley 1966, pp. 73-134.
  10. See: Paul Flaim, "Discouraged Workers and Changes in Unemployment", Monthly Labour Review, No. 96, March 1973, p. 9.
  11. See: Joseph Gastwirth, "Estimating the Number of 'Hidden Unemployed' " Monthly Labour Review, No. 96, March 1973, pp. 17-26.
  12. J.B. Bowdler and C.I. Higgins, "Short Term Variation in Labour Force Participation", Paper Presented to Second Conference of Economists, Sydney, August 1971.

following four quarters. The study by R. Gregory and P. Sheehan classified the labour force by age and sex but not by marital status.<sup>13</sup> Males in the 15-19 year age group displayed net additional worker effects while 20-24 year old males displayed net discouragement. A small additional worker effect was found for prime age (25 to 54) males, and the results for males aged 55 and over were inconclusive. For females, the groups in the 15-34 years range displayed net discouraged worker effects as did the 45-54 group, but the 35-44 and 55 and over groups revealed net additional worker effects. Finally, B. Haig and M. Wood analysed female participation rates classified by marital status but not age.<sup>14</sup> They found a significant negative relationship between the male unemployment rate and participation rates for both married women and other women. Although this was interpreted as indicating the response of female participation to secular demand pressures, it lends support to the discouraged worker hypothesis as a cyclical explanation of the labour market behaviour of Australian women.

The differences in classification of the labour market, specification of labour-market-tightness variables and in the periods covered makes it hard to generalise the results of these studies. If a synthesis can be made, it would be that all three lend support to the discouraged worker hypothesis as an explanation of the net labour force behaviour of married women to cyclical variations in demand. The results

---

13. R.G. Gregory and P.J. Sheehan, "The Cyclical Behaviour of the Australian Labour Market", Paper Presented to Third Conference of Economists, Adelaide, May 1973.

14. B.D. Haig and M. Wood, "The Participation of Married Women in the Australian Work-Force 1961 to 1972", Working Paper Series No. 5, Institute of Labour Studies, Flinders University, Bedford Park, September 1973.

for males and other women by age groups do not display such consistency.<sup>15</sup>

## 2.2 Secular Variations

Far less attention has been given to the explanation of secular variations in participation rates. In most studies, a time trend variable is used to account for secular variation; while this may be adequate for short-term analyses, a greater degree of explanatory power is desirable for the longer-term purposes of the IMPACT project.

In the younger age groups of males and single women, the tendency to continue to higher levels of educational attainment is likely to be the most important factor involved in the decline in workforce participation by these groups over the last decade or more. For other groups, the influence of higher levels of educational attainment may vary.

Cross-section studies of participation rates and educational attainment have revealed a strong positive relationship.<sup>16</sup> In the case of prime-age males, however, where participation rates are near unity, there is little scope for such a relationship over time. The influence of higher levels of educational attainment for this group would be expected to be more toward a change in occupational distribution than an increase in the proportion of males offering for work. For females the scope exists for both such movements since improved qualifications raise

---

15. However, in the case of males aged 25 to 54 and other women aged 25 to 54 there would appear to be little chance of significant added worker effects. In the first case, most of the males represent the household heads themselves. In the second case, no male household head is present. If there is a significant cyclical response in participation rates for these age groups, it is therefore expected to be of the discouraged worker type. The opposite result obtained for prime age males by Gregory and Sheehan is left unexplained but may be the result of sample error, given the very small variation in participation rates shown by this group.

16. See Bowen and Finegan, op. cit., pp. 53-114, 254 and 413.

the opportunity costs of non-participation and at the same time direct new entrants towards the occupations which require higher skills. Insofar as increasing levels of educational attainment reflect increased social acceptance of female workforce participation, the influence on the behaviour of married women would be expected to be particularly strong. For a large proportion of other women, the necessity to earn some kind of market income meant that participation rates for this group were substantial regardless of social acceptability.

A similar argument can be advanced regarding the influence of service sector growth on participation rates. Oppenheimer<sup>17</sup> has suggested that this secular demand influence was one of the most important factors inducing greater female labour market activity. While increases in the demand for female labour have occurred as service sector growth has taken place, there has also been an induced increase in the supply of female labour by virtue of the type of job becoming available rather than simply an increase in the wages offered to females. Greater opportunities for part-time or part-year employment in service sector occupations would be expected to have the largest impact on the married women group, where non-market commitments are strongest, with the impact on other women and males being once again toward a change in occupational distribution.

In the oldest age groups, improved provisions for retirement income may well explain the tendency toward earlier retirement and consequent reductions in participation rates. The impact would be expected to be greatest for males, where participation rates in the older groups

---

17. See Valerie Oppenheimer, "The Female Labour Force in the United States", Population Monograph Series, No. 5, Berkley, Institute of International Studies, University of California, 1970.

are higher than for females, and where provision for retirement income is more substantial.

The final influence on secular participation rates considered in the model is again suggested from cross-section analyses ; the presence of young children in the home. Census data reveal that participation rates for married women with husbands present are substantially reduced by the presence of pre-school age children.<sup>18</sup> Reductions in family size over time would therefore be expected to increase female participation rates although causality in this relationship is ambiguous. It is likely that workforce participation also affects family size and that specification of this relationship will be significantly improved in a simultaneous framework.

### 3 SPECIFICATION OF THE MODEL

The following equations were specified to represent the relationships outlined in the above theoretical framework. Anticipated signs of coefficients are denoted in superscripts.

$$MW_{a,b,c,d,e} = \alpha_0 S_F + \alpha_1 S_M + \alpha_2 S_A + \alpha_3 S_N + \alpha_4 U^? + \alpha_5 E_F^+ + \alpha_6 M^- + \alpha_7 C^-_{a,b,c,d,e}$$

$$MW_{f,g,h} = \beta_0 S_F + \beta_1 S_M + \beta_2 S_A + \beta_3 S_N + \beta_4 U^? + \beta_5 E_F^+ + \beta_6 M^- + \beta_7 R^-$$

---

18. See Bowen and Finegan, *op. cit.*, p. 96. On Australia see, Vince Manion, "Regional Variations in Labour Force Participation Rates : Australia 1971", Impact on Demographic Change on Industry Structure in Australia, Preliminary Working Paper, BP-02, Industries Assistance Commission, Melbourne, July 1976, p. 24.

$$OW_{a,b} = \gamma_0 S_F + \gamma_1 S_M + \gamma_2 S_A + \gamma_3 S_N + \gamma_4 U^? + \gamma_5 E_F^- + \gamma_6 M^-$$

$$OW_{c,d,e} = \delta_0 S_F + \delta_1 S_M + \delta_2 S_A + \delta_3 S_N + \delta_4 U^- + \delta_5 E_F^+ + \delta_6 M^-$$

$$OW_{f,g,h} = \eta_0 S_F + \eta_1 S_M + \eta_2 S_A + \eta_3 S_N + \eta_4 U^? + \eta_5 E_F^+ + \eta_6 M^- + \eta_7 R^-$$

$$M_{a,b} = \pi_0 S_F + \pi_1 S_M + \pi_2 S_A + \pi_3 S_N + \pi_4 U^? + \pi_5 E_M^-$$

$$M_{c,d,e} = \rho_0 S_F + \rho_1 S_M + \rho_2 S_A + \rho_3 S_N + \rho_4 U^-$$

$$M_{f,g,h} = \tau_0 S_F + \tau_1 S_M + \tau_2 S_A + \tau_3 S_N + \tau_4 U^? + \tau_5 R^-$$

Where :

$MW_a$  = the labour force participation rate for married women in the age group 15-19 years (other subscripts refer to the following age groups : b=20-24; c=25-34; d=35-44; e=45-54; f=55-59; g=60-64; and, h=65 and over).

$OW_a$  = the labour force participation rate for never married, widowed and divorced women aged 15-19 years.

$M_a$  = the labour force participation rate for males aged 15-19 years.

$S_F$  =  $\begin{cases} 1 & \text{if the observation relates to the February quarter;} \\ 0 & \text{otherwise.} \end{cases}$

$S_M$  =  $\begin{cases} 1 & \text{if the observation relates to the May quarter;} \\ 0 & \text{otherwise.} \end{cases}$

$S_A$  =  $\begin{cases} 1 & \text{if the observation relates to the August quarter;} \\ 0 & \text{otherwise.} \end{cases}$

$S_N$  =  $\begin{cases} 1 & \text{if the observation relates to the November quarter;} \\ 0 & \text{otherwise.} \end{cases}$

- U = the unemployment rate for persons aged 15 years and over.
- $E_F$  = the proportion of university students aged 17 to 22 who are female.
- $E_M$  = the proportion of 17 year old males attending educational institutions.
- M = the proportion of total employment engaged in manufacturing industries.
- $C_a$  = the average number of confinements in a five year period per married woman aged 15-19 years (other subscripts refer to the same age groups as previously).
- R = total household income from dwellings, general government transfers, dividends, interest on life and superannuation funds and other interest deflated by the Consumer Price Index and divided by the number of persons aged 55 and over.

#### 4 DATA SOURCES AND DEFICIENCIES

The detailed sources and derivations of data used in the model are given in Appendix 3. Deficiencies in the ability of the data to reflect accurately the variables suggested by the theoretical framework of the model, and in the ability of the data to enable estimation of the relationships postulated, need to be examined.

The choice of the Labour Force Survey measure of unemployment rather than the Commonwealth Employment Service (CES) estimate was made on the grounds that the CES measure has recognized deficiencies as a measure of the general level of unused labour resources.<sup>19</sup> Because the

---

19. See Keith Hancock, Duncan Ironmonger and Joseph Isaac, Report of the Advisory Committee on Commonwealth Employment Service Statistics, Australian Government Publishing Service, November 1973, p. 3.

Survey data are collected by use of a rotating sample (one-eighth of the observations replaced each quarter), the likelihood of serious auto-correlation was increased, but it was felt that adjustment for this error was possible and this was preferable to use of the CES estimate.

The data chosen to represent educational attainment reflect the differences in the postulated responses of participation rates to this variable. For females, both positive and negative influences are suggested. In the younger age groups of other women the negative influence of education as an alternative use of time is expected to dominate. For other groups, the positive influence of educational attainment reflecting greater social acceptance of female workforce participation is expected to dominate. For males, no such positive influence is postulated; male participation rates are so high that increasing educational attainment would be unable to raise participation rates. The male educational attainment variable, the proportion of seventeen year old males in educational institutions, represents solely the alternative use of time that participation in education represents for the younger age groups. The female variable, the proportion of university students who are female, is a more general measure intended to capture both the time - use and attitudinal factors involved.

In the absence of a linked series of published data on service sector employment, data on manufacturing sector employment were used to represent the inverse relationship to that specified in the theoretical framework. Variations in primary sector employment restrict the accuracy of this approximation but the significance and direction of the relationship should still be apparent.<sup>20</sup>

---

20. Unpublished data on service sector employment are being sought and will be used when available.



A significant deficiency of the data on the presence of young children was that no estimate could be made for other women. Our estimate therefore overstates the number of children under five per cohort of married women. This would not appear to be a significant deficiency in the estimation of participation rates for married women, but the lack of a similar measure for other women means that the estimated relationships for some ages of this group should be treated with caution. The severity of this problem is nevertheless modified by the fact that the majority of the other women category is comprised of young never married women, most of whom do not have children.

The estimate of the provision for retirement income is subject to extreme aggregation but no better approximation could be found.

Although the measure is a definite overestimate of retirement income available to persons aged fifty-five and over, this is of no consequence to the accurate modelling of the relationship between retirement income and participation rates if the actual figures move in step with those of the variable used. The limited evidence available on income distribution in Australia suggests that this may well be the case.<sup>21</sup>

The final and possibly most significant data deficiency was the short period for which linked data were available. Since instability of coefficients is commonly a problem in participation rate studies, there was a high probability of large shifts in the size of estimated

---

21. Between 1968-69 and 1973-74, the distribution of unearned income, for persons whose main source of income was unearned, remained virtually unchanged between persons 55 and over and persons under 55. In 1968-69, 70.5% went to persons 55 and over and in 1973-74 the proportion was 71.6% (see the ABS publications Income Distribution 1968-69 and 1973-74, Ref. Nos 17.17 and 17.6, Canberra, 1975 and 1976).

relationships due to small changes in the data base. This problem was accentuated by the significant increase in unemployment rates in the most recent years and the likelihood that the last few observations would prove critical to the size of the coefficients estimated. Furthermore, since the purpose of the study was to provide behavioural relationships for workforce estimates up to a decade hence, it was unfortunate that data for the estimation of these relationships were available for only a slightly longer period. In order to utilize fully the limited data which were available, quarterly models of participation rates were estimated even though the IMPACT model has been set up on an annual basis. The stability of the coefficients estimated over the full data base was tested by re-estimation without the most recent and most distant observations.

## 5 ALTERNATIVE SPECIFICATIONS

Several alternative specifications were considered. The reasons for their omission are outlined below.

Cross-sectional analysis<sup>22</sup> indicated that the proportion of migrants in an area significantly affected participation rates. The higher the proportion of migrants, the higher was the participation rate for the area. Variations in migration over time may therefore be expected to influence participation rates by age, sex and marital status. Inclusion of a variable to account for such differences was not possible at this stage, due to the unavailability of detailed data, but should be in the near future.

---

22. See Manion, op. cit.

The use of an earnings variable, to model variations in the supply of labour due to variations in the price of labour, was rendered unacceptable because of statistical problems associated with the complex nature of the relationships involved. To start with, the a priori effect of an increase in wages (real or nominal) is ambiguous : the net effect of positive substitution effects and negative income effects could be to increase or decrease participation rates. Second, the effect may be to change the supply of labour in terms of hours offered but not in terms of participation rates.<sup>23</sup> Third, the results obtained for regression analyses using such a variable produced coefficients of varying sign with no logical pattern between age, sex and marital status groups. Last, but not least, data deficiencies, such as the limited age breakdown (junior and adult only), cyclical variations in overtime, and the problem of real versus money wages, proved to be intractable. These difficulties led to the omission of a price of labour variable from the final model.

Alternative specifications of the labour market tightness variable were considered. Regressions were run using the difference in the unemployment rate between the current quarter and the corresponding quarter of the previous year. In addition, the inverse of the unemployment rate was also used.<sup>24</sup> The results were highly consistent with those obtained by use of the current unemployment rate variable but did not improve the explanatory power of the model and were dropped in favour of the more direct measure.

- 
23. A modelling of labour supply in terms of hours offered is intended at a later stage of the IMPACT project.
24. This was tested in an effort to produce greater proportional variation in the labour market tightness variable for small changes in the unemployment rate.

The quarterly labour force participation rate model was tested against an alternative which used annual data. But because of the small number of annual observations, the data were pooled across age groups and one regression with eight dummy variables (one for each age group) was estimated for each sex and marital status group. The results obtained were generally consistent with the quarterly model outlined above but suffered from extreme instability : very slight alterations in data produced wild fluctuations in the size, sign and significance of coefficients. Until greater stability could be obtained, the use of such a model was felt to be unacceptable.

The pooling of age groups was considered, but it was decided to first estimate relationships with as much disaggregation as possible and then to estimate pooled relationships on the basis of similarities revealed in the disaggregated results. This pooling may be the next step taken before the formulation of a simultaneous framework.

The specified model therefore represents the current state of modelling of participation rates for use in the IMPACT model, but is by no means the version in which it will eventually be implemented.

## 6 REGRESSION RESULTS

An analysis of the regression results follows below. The results are discussed for married women, other women and males, respectively. Where serious serial correlation was evident, the Dhrymes<sup>25</sup> scheme of

---

25. See Phoebus J. Dhrymes, Distributed Lags : Problems of Estimation and Formulation, Holden-Day, San Francisco, 1971, pp. 64-68. It should be noted that the use of Dhrymes' scheme implicitly involves a behavioural quarterly lag dynamics.

correcting for auto-correlated residuals was employed.

### 5.1 Married Women 15-54

The participation rates of married women 15-54 have risen substantially throughout the sample period. At the beginning of 1964 28 per cent of married women in this age group were engaged in the work-force; this figure had risen to nearly 49 per cent at the end of 1975. The strong upward trend in labour force participation of married women is evident in all subgroups of this age cohort (see Appendix 1, Table 3). Despite the dominance of the trend influence, however, the participation rate of married women in this age group also displays the influence of significant cyclical forces. In all equations, the regression coefficients of the unemployment variable have a negative sign, indicating the presence of a net discouraged worker effect (Table 1). Although only the 45-54 age group has a coefficient on unemployment which is independently significant, all the other coefficients on unemployment are jointly significant with one or more explanatory variables, except for the 25-34 age group where the presence of young children has its greatest impact. This high incidence of joint significance was not surprising in light of the specification of the model.

The high degree of correlation that exists between several of the explanatory variables makes it very difficult to disentangle their separate influences. In such a situation the separate contributions of the explanatory variables to the explanation of the variations of participation rates may fail individual significance tests, whereas their joint contribution, which cannot be decomposed, may be highly significant. This proposition can be illustrated by reference to equation (1a). In this equation we can see that the regression coefficients on the unemployment

Table 1  
Regression Results, Married Women, 15-54

Equation	Age group	S <sub>F</sub>	S <sub>M</sub>	S <sub>A</sub>	S <sub>N</sub>	U	E <sub>F</sub>	M	C	R <sup>2</sup>	DW	SE
1a.	15-19	67.31 (49.13)	67.55 (48.77)	67.68 (48.54)	66.74 (48.63)	-1.748 <sup>δ</sup> (1.002)	1.275* (0.498)	-1.869 <sup>δ</sup> (1.166)	-14.645 <sup>δ</sup> (15.104)	.926	2.01	2.57
1b. <sup>+</sup>	20-24	148.02* (33.38)	148.17* (33.22)	147.51* (33.10)	148.40* (33.08)	-0.729 <sup>δ</sup> (0.501)	-0.112 <sup>δ</sup> (0.421)	-1.643* (0.540)	-52.186* (14.884)	.851	2.07	0.77
1c. <sup>+</sup>	25-34	102.66* (27.70)	102.43* (27.59)	102.68* (27.49)	103.50* (27.48)	-0.412 (0.444)	0.161 <sup>δ</sup> (0.334)	-1.220* (0.487)	-37.698* (14.691)	.811	2.02	0.68
1d.	35-44*	27.87* (12.94)	27.55* (12.83)	27.98* (12.77)	29.55* (12.81)	-0.398 <sup>δ</sup> (0.319)	1.261* (0.122)	-0.631* (0.355)	-34.816* (11.895)	.993	1.40	0.62
1e.	45-54	30.20 (16.28)	29.73 (16.14)	29.91 (16.06)	31.40 (16.08)	-1.535* (0.322)	1.384* (0.225)	-1.335* (0.274)	328.234 <sup>δ</sup> (203.440)	.985	1.74	0.74
2a.	15-19	179.27* (62.14)	180.33* (62.02)	179.83* (61.74)	178.54* (61.69)	-0.559 <sup>δ</sup> (1.370)	0.153 <sup>δ</sup> (0.639)	-4.940* (1.518)	13.623 <sup>δ</sup> (18.745)	.913	2.09	2.46
2b. <sup>+</sup>	20-24	150.83* (44.40)	150.98* (44.23)	150.29* (44.05)	151.25* (44.03)	-1.003 <sup>δ</sup> (0.622)	-0.056 <sup>δ</sup> (0.505)	-1.955* (0.956)	-45.757* (25.414)	.838	2.06	0.84
2c. <sup>+</sup>	25-34	133.30* (35.86)	133.13* (35.74)	133.20* (35.58)	133.97* (35.58)	-0.540 (0.543)	-0.095 (0.408)	-2.112* (0.862)	-30.471 <sup>δ</sup> (19.843)	.808	2.01	0.71
2d.	35-44	11.41 (17.39)	11.20 (17.33)	11.63 (17.25)	13.25 (17.28)	-0.628 <sup>δ</sup> (0.386)	1.415* (0.154)	-0.212 <sup>δ</sup> (0.491)	-42.206* (15.575)	.991	1.40	0.60
2e.	45-54	51.04* (19.62)	50.72* (19.54)	50.92* (19.45)	52.09* (19.42)	-1.036* (0.407)	0.980* (0.275)	-1.459* (0.353)	38.366 (234.191)	.982	1.68	0.73

## Notes:

- 1 = the period 1964 (1) to 1975 (4) inclusive.  
 2 = the period 1965 (1) to 1974 (4) inclusive.  
 + = Dhrymes' transformation applied to correct for auto-correlated residuals.  
 S<sub>F</sub> = the seasonal intercept for the February quarter.  
 S<sub>M</sub> = the seasonal intercept for the May quarter.  
 S<sub>A</sub> = the seasonal intercept for the August quarter.  
 S<sub>N</sub> = the seasonal intercept for the November quarter.  
 U = the unemployment rate for persons aged 15 years and over.  
 E<sub>F</sub> = the proportion of university students aged 17 to 22 who are female.  
 M = the proportion of total employment engaged in manufacturing industries.  
 C = age-specific quinquennial confinements per married woman.  
 R<sup>2</sup> in transformed equations is the square of the simple correlation coefficient between participation rates and participation rates estimated from the transformed equation.  
 DW = the Durbin-Watson statistic.  
 SE = the standard error of estimate.  
 \* = significantly different from zero at the 5% level or better.  
 δ = jointly significant at the 5% level or better.  
 Standard errors of the coefficients are in parentheses.

rate, manufacturing employment and children variables are not independently significant but when the F statistic is expressed in terms of the contribution of these variables to the regression sum of squares we find that the coefficients are jointly significant.<sup>26</sup> Even in cases where a regression coefficient is insignificant individually and jointly, it is not clear that the explanatory variable should then be omitted from the analysis since the set of sample data may be the cause for the non-recognition of a relationship. Our experience indicates that estimates of coefficients can be very sensitive to particular sets of sample data, and the addition or deletion of a few more observations can sometimes produce sudden shifts in some of the coefficients. For example, in equation (1a) the children coefficient is negative and jointly significant at the five per cent level, but when the equation is fitted to data for the period 1965 (1) - 1974 (4), the coefficient not only loses statistical significance, but also changes sign.

Despite these problems, some important features do emerge from the regression results. There is firm evidence to suggest that the supply of married women is responsive to longer term job opportunities, as indicated by the industry structure variable, M. The regression coefficients on the manufacturing employment variable have the anticipated sign and are statistically significant for all age groups. Elasticity estimates reveal that the participation rate behaviour of married women 15-54 is quite sensitive to variations in industry structure.<sup>27</sup> At 1974 (1) levels, the growth in the workforce following a 10 per cent reduction in the manufacturing

---

26. See Jan Kamenta, Elements of Econometrics, New York, 1971, p. 366.

27. See Appendix 4 for definitions and elasticity estimates using the Married Women regressions.

employment variable is nearly 107,000 married women, or 9.3 per cent of the labour force, if the coefficients in period (1) are used; it is 136,000 or 11.8 per cent if period (2) estimates are used. This compares with an exodus of 15,800 (15,100 using period (2) estimates) married women from the workforce consequent upon an increase in the unemployment rate from three to four per cent and suggests that a large part of the explanation for the trend increase in workforce participation by married women has been changes in longer term demand conditions.<sup>28</sup>

Nevertheless, other factors which are more clearly supply-based have played an important role. Increases in the female composition of university students indicate that educational influences have been important in the determination of the number of married women willing to work. The regression coefficients of the education variable generally confirm that there is a positive association between education and participation rates. Statistical problems appear to explain the exceptions. For example, the previously noted high degree of sample correlation between several of the explanatory variables leads to instability in the signs of some of the estimated coefficients and the education variable in equations (1b), (2b) and (2c) appears to suffer from this problem. Elasticity estimates reveal that the participation rate of married women is fairly responsive to variations in educational attainment. A rise in the education variable of 10 per cent will bring about a 6.5 per cent (or 75,000) increase in the number of married women 15-54 in the workforce at 1974 (1) levels using the coefficients in equation (1a); alternatively, a predicted increase of 5.4 per cent (or 62,000) results from the use of the coefficients on the shorter period. It seems

---

28. To the extent that variations in the manufacturing employment variable occur cyclically as a result of variation in the unemployment rate, the above estimates understate the influence of M and overstate the discouraged worker effect.



reasonable to suggest that the education variable represents more than an increase in the opportunity costs of non-participation associated with an increase in potential earnings. It is probable that the education variable is acting as a proxy for long-run changes in the attitude of married women to market work. For this reason, the lack of a direct measure of educational attainment (such as median school years completed) is not felt to be a severe handicap. The female proportion of university students was felt to represent both the increasing acceptance of female participation in education and the workforce, and also the increased opportunity cost of non-participation in the labour market.

The presence of children under five tends to have a depressing influence on the participation of married women in the labour force, as indicated by the negative sign on the regression coefficients for married women 15-44. A steady decline in the number of children to married women has been an important factor in the secular growth of participation rates. A 10 per cent decline in the children variable is expected to lead to a 4.7 per cent or 53,600 increase in the number of married women 15-54 in the workforce at February 1974 workforce levels, (4.3 per cent or 49,900 rise if equation (2) estimates are used).

The high values for the coefficient of determination indicate that we have been able to explain a large proportion of the variation in the participation rates of married women 15-54. Furthermore, the average error of our estimated equations is 18,000 persons or 1.6 per cent of the female workforce in these age groups at February 1974 levels. However, there does appear to be some instability in the education coefficients for the age groups 20-24 and 25-34. In these age groups, the influence of education on the participation rates of married women is apparently swamped by the influence of the children and manufacturing employment variables.

## 5.2 Married Women 55 and over

The strong secular growth in participation rates observed for married women 15-54 is less evident for married women over 55. At the beginning of 1964 approximately one-tenth of married women 55 and over were in the workforce; to the end of 1975 this figure had risen to only 14 per cent. Once again, the high degree of correlation between the explanatory variables causes some of the regression coefficients to become unstable. In the regression equation for married women 55-59 the coefficient of the manufacturing employment variable is the only one individually significant, but the combination of explanatory variables succeeds in explaining more than 95 per cent of the variation in participation rates (Table 2).

Although it loses significance in equation (2f), the coefficient of the unemployment rate is consistently negative. At 1974 (1) workforce levels, the decline in the labour force consequent upon a rise in unemployment from 3 to 4 per cent is approximately 2,510 women or 2.6 per cent of the workforce in this group (but no change if the alternative unemployment rate coefficients are used). The regression results also provide evidence that changes in industry structure influence the participation rate of married women 55 and over. The coefficients on the manufacturing employment variable have the expected negative sign and are statistically significant over the longer period. When regressions are fitted to the data for the period 1965 (1) - 1974 (4), the manufacturing employment coefficient becomes insignificant, although it is of the right sign to support the hypothesis that a relative rise in non-manufacturing employment will increase the participation rate of married women. The sign on the regression coefficient of education in equation (1h) is inconsistent with a priori expectations. On the other hand, there is some

Table 2

## Regression Results, Married Women, 55 and over

Equation	Age group	S <sub>F</sub>	S <sub>M</sub>	S <sub>A</sub>	S <sub>N</sub>	U	E <sub>F</sub>	M	R	R <sup>2</sup>	DW	SE
1f. <sup>+</sup>	55-59	53.57 (27.78)	53.52 (27.62)	53.38 (27.51)	54.45 (27.55)	-0.532 <sup>δ</sup> (0.556)	0.592 <sup>δ</sup> (0.444)	-1.382* (0.576)	-3.140 <sup>δ</sup> (4.800)	.955	1.86	0.91
1g.	60-64	-4.22 (9.39)	-4.60 (9.31)	-4.21 (9.26)	-3.33 (9.28)	-0.372 <sup>δ</sup> (0.209)	0.737* (0.155)	-0.071 <sup>δ</sup> (0.196)	-3.227* (1.490)	.904	2.13	0.50
1h.	65 and over	11.94 (6.57)	11.83 (6.51)	11.85 (6.48)	11.87 (6.49)	-0.242 <sup>δ</sup> (0.146)	-0.075 <sup>δ</sup> (0.108)	-0.199 <sup>δ</sup> (0.130)	0.256 <sup>δ</sup> (1.042)	.173	1.74	0.35
2f. <sup>+</sup>	55-59	43.54 (36.06)	43.87 (35.94)	43.60 (35.78)	44.13 (35.79)	0.144 <sup>δ</sup> (0.550)	0.073 <sup>δ</sup> (0.538)	-0.967 <sup>δ</sup> (0.742)	4.147 <sup>δ</sup> (5.165)	.811	2.00	0.74
2g.	60-64	-2.89 (1.25)	-3.23 (11.21)	-2.72 (11.15)	-2.02 (11.14)	-0.132 <sup>δ</sup> (0.252)	0.634* (0.191)	-0.073 <sup>δ</sup> (0.221)	-2.246 <sup>δ</sup> (1.579)	.917	2.07	0.46
2h.	65 and over	19.75* (8.73)	19.69* (8.70)	19.68* (8.65)	19.58* (8.64)	-0.005 <sup>δ</sup> (0.196)	-0.268* (0.149)	-0.316* (0.171)	1.389 <sup>δ</sup> (1.225)	.191	1.74	0.36

Notes: See Table 1 above.

R = real unearned income divided by the number of persons 55 and over.

support for the view that there is a positive relationship between education and the supply of labour since the coefficients of the education variable have the hypothesized sign in equations (lf) and (lg) and are statistically significant. While the results are not uniform, there are grounds for believing that the participation rates of married women 55 and over are influenced by the amount of income available from financial assets and the level of government transfer payments. In equations (lf) and (lg) the coefficients of the retirement income variable bear a negative sign indicating that, as the level of real unearned income rises, leisure is substituted for workforce activity. In the light of the strong trend increase in participation rates of married women 55 and over, there was considerable doubt whether the retirement income variable would be able to accurately describe the relationship postulated. The results obtained in two age groups, which include the overwhelming majority of women aged 55 and over, are particularly encouraging. One explanation for the results obtained may be that the retirement income variable was not available by sex. For this reason, the relationship between the participation rates of married women and the level of real transfer income per capita may reflect the reaction of married women to improved retirement provisions for their husbands as well as for themselves.

### 5.3 Other Women 15-24

The change since 1964 in the labour force participation rate of other females aged 15-19 closely resembles the movement in the participation rate of males in the same age group. The proportion of other females 15-19 in the workforce fell from 68 per cent in 1964 to 57 per cent in 1975, whereas the participation rate for males 15-19 declined from 69 per cent to 59 per cent over the same period. In

addition to the overall downward trend, the participation rate series reveals considerable variation in the short-run. In contrast to our previous regression results, the sign of the coefficient attached to the unemployment variable is positive and statistically significant, indicating that additional worker effects have more than offset any discouraged worker effects (Table 3). Moreover, when the regression equation is run over a shorter period the estimated unemployment coefficient remains positive and even increases in magnitude. At 1974 (1) workforce levels, a percentage point increase in the rate of unemployment would bring about a 4.3 per cent (or approximately 13,200) increase in the size of the workforce in this group if the unemployment coefficient in equation (1a) is used and a 5.1 per cent (or 15,700) rise if the alternative coefficient is applied. This contrasts with the results for males 15-19 where a net discouraged worker effect accompanied a rise in the rate of unemployment.

The long-run decline in the participation rate of other females 15-19, according to our regression results has been brought about by two forces. First, there has been an increasing propensity on the part of females to continue in education. (In equations (1a) and (2a) the education coefficient is negative and statistically significant.) Second, the relative decline in the manufacturing sector has apparently restricted the job opportunities for unskilled and semi-skilled junior female labour. The estimated coefficient of the manufacturing employment variable possesses a positive sign suggesting that a fall in the ratio of manufacturing employment to total employment will lead to a reduction in the supply of labour of not-married junior females. This was contrary to a priori expectations but may well reflect the considerable demand for junior staff

Table 3

## Regression Results, Other Women, 15-24

Equation	Age group	S <sub>F</sub>	S <sub>M</sub>	S <sub>A</sub>	S <sub>N</sub>	U	E <sub>F</sub>	M	R <sup>2</sup>	DW	SE
1a. +	15-19	50.99 (42.90)	49.71 (42.62)	47.95 (42.44)	47.56 (42.49)	2.542* (0.831)	-0.901* (0.469)	1.194 <sup>δ</sup> (0.841)	.931	1.98	1.36
1b. +	20-24	152.91* (36.10)	151.89* (35.90)	150.72* (35.76)	150.58* (35.77)	-0.145 <sup>δ</sup> (0.657)	-1.264* (0.440)	-0.671 <sup>δ</sup> (0.692)	.808	1.82	1.01
2a. +	15-19	19.06 (61.41)	17.77 (61.19)	16.15 (60.92)	15.69 (60.92)	3.026* (0.984)	-0.603 <sup>δ</sup> (0.659)	1.855 <sup>δ</sup> (1.232)	.929	1.92	1.36
2b. +	20-24	163.16* (44.64)	161.94* (44.49)	160.61* (44.29)	160.46* (44.29)	-0.558 <sup>δ</sup> (0.715)	-1.489* (0.479)	-0.708 <sup>δ</sup> (0.896)	.897	1.80	0.99

Notes: See Table 1 above.

by manufacturing industries which hire juniors in an effort to avoid the higher payments to older employees that are required by minimum wage laws.<sup>29</sup>

The model succeeds in explaining 93 per cent of the variation in the participation for 15-19 year old other women though the standard error of estimate is approximately 1.4 percentage points or 7,100 females at February, 1974, levels.

The participation rate of other females 20-24 until 1970 fluctuated around 90 per cent, but since then the series has declined quite dramatically. In the period 1970-75 the participation rate of this age group has fallen from over 90 per cent to under 82 per cent. The regression equations reveal a discouraged worker effect although the coefficient of the unemployment variable is insignificant when the data are run over the period 1965 (1) to 1974 (4), (Table 3). The size of the coefficient in equation (1b) shows that the net discouraged worker effect is quite small; a rise in the rate of unemployment from 3 to 4 per cent would lead to 300 females aged 20-24 withdrawing from the labour force at February, 1974, population levels.

The regression results also indicate that the steady rise in educational involvement has, as anticipated, depressed the participation rate of other women 20-24. The estimated coefficient on the educational variable has the expected negative sign and is highly significant in both equations. If the female proportion of university students rises by 10 per cent, the participation rate of this age group falls by 5 per cent (or 9,940 females at 1974 (1) levels) using equation (1b), and by 5.7 per cent (or 11,440) if the other coefficient is used. An important divergence

---

29. The negative sign on the manufacturing employment variable for married females aged 15-19 probably indicates a greater preference for part-time work by these women.

between the regression results for other females aged 15-19 and 20-24 concerns the signs on the manufacturing and unemployment rate coefficients.<sup>30</sup> The estimated coefficients for the 20-24 group have the postulated negative signs and are jointly significant in both equations. However, because of the relative size of the population in the two age groups, the net effects for the 15-24 group of increases in M and U are positive. In the case of an increase in the unemployment rate from three to four per cent, the net increase in the participation rate for the 15-24 group would be 12,900 (2.7 per cent of the 15-24 other women workforce) using the longer period estimates or 13,400 (2.8 per cent) using the shorter period.

#### 5.4 Other Women 25-54

The participation rates of other females 25-54 have been quite stable over the last decade, although there have been considerable cyclical variations. Once again, the presence of multicollinearity in the sample data has made it extremely difficult to isolate the separate influences of the various explanatory variables. Furthermore, several of the estimated coefficients are unstable when the data period is varied. The coefficient attached to the unemployment rate shows the most stability in sign, though not significant. It is significantly different from zero in both equations only for the 45-54 age group (Table 4). At 1974 (1) levels, an increase in the rate of unemployment from 3 per cent to 4 per cent would result in the withdrawal of approximately 1,600 women aged 25-54 (or 2.4 per cent of the labour force). The coefficients for period (2) predict a smaller change of about 1.8 per cent, or 1,200 women.

---

30. See Appendix 4 for elasticity estimates using the Other Women regressions.



Table 4

Regression Results, Other Women, 25-54

Equation	Age group	S <sub>F</sub>	S <sub>M</sub>	S <sub>A</sub>	S <sub>N</sub>	U	E <sub>F</sub>	M	R <sup>2</sup>	DW	SE
1c. †	25-34	108.48* (32.77)	107.27* (32.54)	106.48* (32.39)	107.18* (32.45)	-0.784 <sup>δ</sup> (0.651)	-0.277 <sup>δ</sup> (0.346)	-0.461 <sup>δ</sup> (0.648)	.944	1.79	1.22
1d. †	35-44	50.69 (63.72)	50.25 (63.31)	50.70 (63.04)	51.55 (63.12)	-1.179 <sup>δ</sup> (1.228)	0.532 <sup>δ</sup> (0.702)	0.172 <sup>δ</sup> (1.247)	.985	2.11	1.98
1e.	45-54	74.87* (23.28)	74.48* (23.11)	74.30* (23.0)	75.21* (23.04)	-1.114* (0.468)	-0.013 <sup>δ</sup> (0.241)	-0.399 <sup>δ</sup> (0.463)	.206	1.95	1.24
2c. †	25-34	141.15* (44.15)	140.18* (44.01)	139.40* (43.81)	139.76* (43.80)	-0.373 <sup>δ</sup> (0.837)	-0.651 <sup>δ</sup> (0.468)	-1.114 <sup>δ</sup> (0.888)	.933	1.82	1.27
2d. †	35-44	95.07 (85.56)	94.32 (85.26)	94.16 (84.88)	95.36 (84.88)	-1.794 <sup>δ</sup> (1.432)	0.196 <sup>δ</sup> (0.913)	-0.828 <sup>δ</sup> (1.718)	.959	2.16	2.02
2e. †	45-54	73.45* (32.00)	72.98* (31.91)	72.82* (31.76)	73.74* (31.74)	-1.475* (0.737)	0.042 <sup>δ</sup> (0.341)	-0.393 <sup>δ</sup> (0.645)	.186	1.95	1.34

Notes: See Table 1 above.

The effect of education on the participation rate of other females 25-54 is difficult to determine. For females aged 25-34 the education coefficient is negative. It is positive but insignificant for the age group 35-44 and is unstable in sign for other women 45-54. When the manufacturing employment variable was removed from the analysis, the coefficient on the education variable remained negative for the age group 25-34, but was not significantly different from zero. For other women aged 35-44, it remained positive but became jointly significant with the unemployment rate at the five per cent level. In addition, the unemployment coefficient is negative and jointly significant in the regression equations for other women aged 35-44. If attention turns to the original regression results, it is evident that the number of observations in the sample period affects the signs and significance of the manufacturing employment coefficients. In equations (1c) the estimated coefficient is insignificant, but when the model is fitted to the period 1965 (1) to 1974 (4) the coefficient becomes significantly different from zero at the five per cent level and remains negative in sign. On the other hand, in equations (1d) and (2d), the manufacturing employment coefficient experiences a change of sign, but is insignificant in both equations. It seems unlikely that mutually consistent results will be obtained for this age group until a longer run of data becomes available.

### 5.5 Other Women 55 and Over

An inspection of the participation rates in Appendix 1 reveals that there have been substantial short-term variations in the behaviour of participation rates for other women aged 55 and over since 1964. The regression analysis suggests that the labour supply response to a rise in

Table 5

Regression Results, Other Women, 55 and over

Equation	Age group	S <sub>F</sub>	S <sub>M</sub>	S <sub>A</sub>	S <sub>N</sub>	U	E <sub>F</sub>	M	R	R <sup>2</sup>	DW	SE
1f. <sup>+</sup>	55-59	75.75 (42.09)	74.96 (41.80)	75.46 (41.61)	76.09 (41.68)	-1.373 <sup>δ</sup> (0.893)	0.903 <sup>δ</sup> (0.683)	-1.157 <sup>δ</sup> (0.855)	-13.39* (6.99)	.984	2.07	1.60
1g.	60-64	67.80* (24.88)	68.16* (24.68)	67.91* (24.56)	69.26* (24.60)	0.248 <sup>δ</sup> (0.554)	0.568 <sup>δ</sup> (0.411)	-1.226* (0.494)	-14.59* (3.95)	.396	1.45	1.32
1h.	65 and over	8.84 (4.91)	8.97 (4.87)	9.05 (4.84)	9.17 (4.85)	0.086 <sup>δ</sup> (0.109)	0.062 <sup>δ</sup> (0.081)	-0.109 <sup>δ</sup> (0.097)	-2.05* (0.78)	.495	2.14	0.26
2f.	55-59	140.30* (48.90)	139.52* (40.75)	139.87* (40.54)	140.20* (40.49)	-1.406 <sup>δ</sup> (0.917)	-0.396 <sup>δ</sup> (0.696)	-2.240* (0.802)	-5.649 <sup>δ</sup> (5.741)	.297	1.93	1.66
2g.	60-64	61.20 (33.92)	61.71 (33.80)	61.56 (33.62)	62.64 (33.58)	0.771 <sup>δ</sup> (0.761)	0.366 <sup>δ</sup> (0.577)	-0.993 <sup>δ</sup> (0.665)	-11.768* (4.761)	.366	1.31	1.38
2h.	65 and over	0.94 (6.10)	1.14 (6.08)	1.21 (6.05)	1.32 (6.04)	0.094 <sup>δ</sup> (0.137)	0.169 <sup>δ</sup> (0.104)	0.044 <sup>δ</sup> (0.120)	-2.385* (0.857)	.544	2.31	0.25

Notes: See Tables 1 and 2 above.

the rate of unemployment is negative for other women aged 55-59 and positive for those 60 and over (Table 5). The net effect of a one percentage point increase in the unemployment rate at 1974 (1) population levels is a 1,100 (or 1.5 per cent) fall in the female workforce 55 and over if the coefficients in (1f), (1g) and (1h) are used. The size of the discouraged worker effect falls only slightly if the alternative regression coefficients are used. In equations (1f), (1g) and (1h) the coefficient of the manufacturing employment variable is negative and significant. Furthermore, the estimates indicate that a ten per cent decline in the proportion of manufacturing employment to total employment at 1974 (1) levels will lead to approximately 9,800 other women 55 and over entering the workforce, a rise of about 14 per cent.

The retirement income variable is of particular interest since our regression results provide consistent evidence that the amount of transfer income available to persons 55 and over is a key determinant of the decision to withdraw from the workforce. At February, 1974, levels, the number of females leaving the labour force consequent to a ten per cent increase in retirement income per head would be 7,100 (or 10 per cent) if the coefficients in (1f), (1g) and (1h) are used, and nearly 4,900 (or 6.9 per cent) if the coefficients in (2f), (2g) and (2h) are used.

Considerable confidence can be attached to the direction of the relationships revealed by the regression results for these age groups, but less faith can be placed in the estimated magnitude. The hypothesized model accounts for only a small proportion of the variation in the dependent variable and the standard error associated with the estimated equations is 4,500 females (or 6.3 per cent of the workforce in this group) 55 and over at February, 1974, levels. This suggests that the model requires further modification.

### 5.6 Males 15-24

The participation rate of males 15-19 declined steeply in the first few years of the period covered, falling from 69 per cent in 1964 to 61 per cent in 1968. However, the main source of variation in the participation rate of junior males since then has been cyclical.

The regression results for the two time periods provide evidence of a net discouraged worker effect. The unemployment coefficients in equations (1a) and (2a) are very similar in magnitude but not significance (Table 6). The significant unemployment effect in (1a) results mainly from the behaviour of the participation and unemployment rate series over the four quarters of 1975. In the shorter time period we are unable to isolate the separate contribution of the level of unemployment to the explanation of variations in the participation rate because the unemployment and education variables are highly correlated. At 1974 (1) levels, the reduction in the labour force consequent upon a rise in unemployment from 3 to 4 per cent is approximately 3,400 males if we use the coefficient in equation (1a) and 3,300 if the unemployment coefficient in equation (2a) is used. Elasticity estimates<sup>31</sup> for both equations reveal that the labour force participation rate is relatively insensitive, in the short-run, to variations in the unemployment rate. At 1974 (1) levels, if unemployment rose from the previous quarter by 10 per cent, there would be an estimated decline in the size of the workforce of 700 males predicted from equation (1a) and 500 from equation (2a), or between 1.9 and 1.4 per cent.

The effect of education on the participation rate of junior males is highly significant. The negative sign indicates that extensions

---

31. See Appendix 4 for elasticity estimates using the Male regressions.

of time spent on education have resulted in a declining proportion of junior males in the workforce. The regression results show that the group participation rate is more sensitive to variations in the education variable than to changes in the unemployment rate. A 10 per cent change in the education variable will bring about a 4.3 per cent change in the labour force participation rate, or a reduction of about 15,800 males at 1974 (1) workforce levels.

In summary, tests of the equations over periods 1964 (1) to 1975 (4) and 1965 (1) to 1974 (1) show that good stability properties exist. The significance of the discouraged worker effect remains and the regression coefficients of the unemployment and education variables undergo only small absolute changes. The hypothesised model's success in explaining a large proportion of the variation in the participation rate of junior males is indicated by the high values for the coefficient of determination.

The participation rate of males 20-24 has fluctuated about a slight downward trend. In the period 1964-75 the age-specific participation rate fell 3.7 percentage points, from 94 per cent in 1964 to under 91 per cent in 1975. Serious problems were encountered in the regressions for this age group. The low value for the Durbin-Watson statistic indicates the presence of significant positive serial correlation in the residuals and when the data were transformed using the Dhrymes' scheme mentioned earlier, the regression coefficient of unemployment not only lost statistical significance but also changed sign (Table 6). However, when the regression equation is fitted to the period, 1965 (1) to 1974 (4) the coefficient of unemployment has a negative sign and is jointly significant at the 5 per cent level. This unstable relationship

Table 6  
Regression Results, Males 15-24

Equation	Age group	S <sub>F</sub>	S <sub>M</sub>	S <sub>A</sub>	S <sub>N</sub>	U	E <sub>M</sub>	R <sup>2</sup>	DW	SE
1a.	15-19	93.53* (1.40)	90.60* (1.40)	88.32* (1.40)	88.33* (1.40)	-0.575* (0.228)	-0.789* (0.042)	.932	1.63	1.21
1b. +	20-24	97.82* (2.71)	96.63* (2.69)	96.11* (2.67)	96.47* (2.66)	0.076 (0.264)	-0.135* (0.080)	.770	2.19	0.56
2a.	15-19	92.77* (1.72)	89.77* (1.71)	87.51* (1.71)	87.64* (1.71)	-0.555 <sup>δ</sup> (0.535)	-0.768* (0.054)	.920	1.60	1.20
2b. +	20-24	98.33* (2.47)	97.05* (2.46)	96.54* (2.45)	96.90* (2.43)	-0.083 <sup>δ</sup> (0.348)	-0.134* (0.074)	.887	2.17	0.56

Notes: See Table 1 above.  
E<sub>M</sub> = the proportion of 17 year old males attending educational institutions.

between changes in the level of unemployment and variations in the participation rate for males aged 20-24 may indicate a mis-specification of the labour market tightness variable. On the other hand, the regression coefficient of education is very similar in size and statistical significance in both equations and it is not surprising to find that the impact of education on the participation rate of 20-24 year old males is quantitatively less important than for the 15-19 age group.

#### 5.7 Males 25-54

The variation in the participation rates of prime-age males, those between 25 and 54 years, is quite small and may even be due largely to sampling error. For example, the participation rate of males 35-44 rose from a low of 96.8 per cent in August 1975 to a high of 97.0 per cent in November 1975. An increase of 0.8 per cent in this group's participation rate represents 6,000 men at August 1975 workforce levels. This growth should be compared to the quarter-to-quarter change sampling error of approximately 5,300 persons.<sup>32</sup> Consequently it is possible that an extremely large proportion of the recorded fluctuations in the labour force for these males can be attributed to sampling error. The main implication appears to be that under such circumstances the contribution of economic variables to an explanation of variation in the dependent variable is likely to be very weak. Our regression results for prime age males are not inconsistent with this argument. Notwithstanding these reservations and the low values of the  $R^2$ s in equations (1c), (1d) and (1e), the standard error of the residuals is extremely small, varying between 0.23 and 0.32 percentage points, suggesting quite accurate results (Table 7). Relationships between the regression results for the

---

32. See the Australian Bureau of Statistics, The Labour Force, May 1975, Ref. No. 6.20, Canberra, October 1975, p. 26 Table B.



Table 7  
Regression Results, Males 25-34

Equation	Age group	S <sub>F</sub> *	S <sub>M</sub> *	S <sub>A</sub> *	S <sub>N</sub> *	U	R <sup>2</sup>	DW	SE
1c.	25-34	98.09* (0.11)	97.94* (0.10)	97.94* (0.94)	98.04* (0.10)	-0.223* (0.041)	.417	1.43	0.23
1d.	35-44	98.00* (0.11)	97.95* (0.10)	97.96* (0.10)	97.96* (0.11)	-0.188* (0.042)	.323	1.42	0.24
1e. <sup>+</sup>	45-54	96.71* (0.25)	96.60* (0.21)	96.41* (0.21)	96.53* (0.23)	-0.538* (0.100)	.974	1.78	0.32
2c.	25-34	98.05* (0.17)	97.94* (0.14)	97.94* (0.14)	98.02* (0.16)	-0.235* (0.083)	.189	1.59	0.21
2d. <sup>+</sup>	35-44	97.85* (0.22)	97.83* (0.18)	97.87* (0.17)	97.76* (0.20)	-0.101 (0.105)	.986	2.10	0.20
2e. <sup>+</sup>	45-54	96.65* (0.40)	96.61* (0.33)	96.42* (0.32)	96.51* (0.36)	-0.537* (0.186)	.963	1.66	0.34

Notes: See Table 1 above.

three age groups indicate that the unemployment and age-specific participation rates provide considerable support for the discouraged worker hypothesis. The regression coefficients vary from  $-.188$  for males 35-44, to  $-.223$  for males 25-34 and  $-.538$  for males 45-54, and are statistically significant. The small size of the coefficients and the fact that the oldest group shows the greatest response agrees with our a priori expectations but the results of this analysis contrast with the estimates furnished in a similar study by Gregory and Sheehan,<sup>33</sup> which indicated a positive association between unemployment and participation rates. It would appear that the sign of the regression coefficient of unemployment has been affected by the acquisition of more recent labour force data in which the overall level of unemployment has shown much greater variability than previously. The coefficients of the labour market pressure variable changed only slightly in absolute size when the regression equations were fitted to the period 1965 (1) to 1974 (4), although the coefficient on unemployment for the 35-44 age group was not significantly different from zero. At February 1974 labour force levels, an increase in the unemployment rate from three to four per cent leads, according to equations (1c), (1d) and (1e) to a decrease of 7,800 men or less than half of one per cent of the prime age male workforce.

#### 5.8 Males 55 and over

The participation rate of this age group has been subject to a fairly steady downward trend. Almost by definition, the labour force attachment of males 55 and over is expected to be lower than that of prime age males, and it would not be surprising if the participation rates

---

33. Op. cit.

of older males should be more sensitive to variations in economic conditions. The regression results supported this contention, and the sign of the unemployment rate coefficient in equations (1f), (1g) and (1h) provided further evidence of the presence of a discouraged worker effect (Table 8). The empirical significance of this effect can be appreciated by comparing it with the figure estimated for prime age males, remembering that a percentage point change in the unemployment rate was estimated to bring about a change in the workforce of 7,800 prime age males at February 1974 labour force levels. The same change in unemployment would lead to a variation of 6,650 in the number of males 55 and over in the workforce : a response proportionately three times larger than for prime age males. Disaggregation of the regression results highlights the large discouraged worker effect for males 60-64. An increase in the unemployment rate from three to four per cent will decrease the participation rate by approximately 1.26 percentage points, or at 1974 (1) levels, reduce the workforce of males 60-64 by about 3,400. It appears that the labour force participation rates for older people were also greatly influenced by the magnitude of such factors as social security payments and the income available from real and financial assets as measured by the retirement income variable. Our regression results reveal that an increase in per capita retirement income will have a large and negative impact on labour force participation of males 55 and over. If retirement income rises by ten per cent then the number of retirees 55 and over is expected to increase by 7,100 (or 1.3 per cent of the workforce aged 55 and over) at 1974 (1) labour force levels, using the coefficients in (2f), (2g) and (2h) or 7,000 if the alternative regression coefficients are used.

Table 8

## Regression Results, Males 55 and over

Equation	Age group	S <sub>F</sub>	S <sub>M</sub>	S <sub>A</sub>	S <sub>N</sub>	U	R	R <sup>2</sup>	DW	SE
1f. <sup>†</sup>	55-59	94.25* (1.35)	94.21* (1.41)	94.05* (1.43)	94.45* (1.40)	-0.192 <sup>δ</sup> (0.299)	-1.960* (0.930)	.913	2.12	0.62
1g. <sup>†</sup>	60-64	89.14* (1.21)	88.95* (1.27)	88.51* (1.29)	89.08* (1.26)	-1.257* (0.303)	-5.160* (0.870)	.973	1.72	0.68
1h. <sup>†</sup>	65 and over	32.50* (1.36)	32.36* (1.41)	32.49* (1.42)	33.18* (1.40)	-0.561* (0.275)	-5.216* (0.914)	.930	2.15	0.55
2f. <sup>†</sup>	55-59	95.42* (1.32)	95.52* (1.34)	95.49* (1.35)	95.63* (1.34)	0.122 <sup>δ</sup> (0.317)	-2.897* (0.869)	.964	2.08	0.59
2g. <sup>†</sup>	60-64	89.41* (1.32)	89.38* (1.35)	89.15* (1.36)	89.43* (1.35)	-1.081* (0.405)	-5.483* (0.881)	.975	1.59	0.62
2h. <sup>†</sup>	65 and over	31.87* (1.28)	31.87* (1.30)	31.94* (1.31)	32.65* (1.30)	-0.522 <sup>δ</sup> (0.322)	-4.838* (0.823)	.942	1.94	0.49

40.

Notes: See Tables 1 and 2 above.

## 7 SUMMARY AND CONCLUSIONS

The postulated model appears to have been generally successful in accounting for variations in participation rates for particular age, sex and marital status categories in Australia between 1964 and 1975.<sup>34</sup> The lowest degree of explanatory power was obtained in some prime age male groups and some groups of older women. These do not appear to be significant handicaps overall since, in the case of prime age males the variation to be explained was quite small, and, in the case of older women, the proportion of the workforce involved was minor.

Cyclical variation in participation rates has been identified in nearly all cases. Other Australian studies have not produced such consistent evidence of cyclical variation, but they have been limited to periods in which the variation in unemployment rates was much smaller.<sup>35</sup>

In most cases, a net discouraged worker effect was revealed. As anticipated, this effect was much stronger for married women than for prime age males. The response by other women varied from net discouraged worker effects in the middle age groups, as anticipated, to net additional worker effects in the youngest and oldest age groups. This was not surprising in light of the composition of the other women group. It

---

34. Plots of actual participation rates of young, middle aged and older age groups, along with plots of the participation rates predicted by the model, are presented in Appendix 5. Turning points are reasonably well predicted in the case of married women and males but for the younger groups of other women there appears to be a possible lag in the predicted turning points. It is hoped that improvements in the specification of the industry structure variable discussed above will improve the predictive accuracy for these groups.

35. The periods analysed by Bowdler and Higgins, Gregory and Sheehan and Haig and Wood were 1964 (1) to 1970 (2), 1964 (1) to 1972 (1) and 1962 (3) to 1972 (2) and throughout these periods, it was not until 1972 that unemployment rose above two per cent.

appears that young unmarried women and elderly widowed and divorced women do attempt to supplement some family incomes when economic conditions worsen, and that this influence outweighs any discouragement effects for those women in these age groups already in the workforce.

Reasonable results also appear to have been obtained in the attempt made to model secular variations in participation rates.

The trend toward lower participation rates in the youngest male and other women age groups has been well captured by the variables used to measure participation in education. A similar downward trend in the participation rates of older males and other women has also been captured by the variable used to approximate improved provision for retirement incomes. The smaller impact of this variable on the participation rates of older married women was not unexpected.

Both the educational variable and the employment structure variable proved to be powerful explanators of variations in the participation rates of married women. Since these variables represent broad influences such as the social acceptability of female participation and the work preferences of women, it was understandable that their influence on trends in the participation rates of other women would not be as strong as for married women. Other women, particularly between the ages of 20 and 54, had strong workforce attachments from the beginning of the period surveyed. The effect of general incentives to female participation was therefore not as significant as the persistent need to obtain income.

The greatest deficiency in the results obtained was the variability in the size of the coefficients when different data periods were used. This has been a common problem of time series studies in

this area.<sup>36</sup> Nevertheless, the recent variation in unemployment rates in Australia has enabled more confidence to be placed in the estimates obtained and appears to have considerably improved the consistency of the estimation of the direction of the relationships.

The predictive accuracy of the model based on the 1965 (1) to 1974 (1) data period is illustrated in Appendix 5, Table 1. Participation rates for 1975 (2) were predicted using the shorter period coefficients and the actual 1975 (2) values for explanatory variables. In nearly all cases where significant discrepancies arose, the cause was an insignificant or perversely signed coefficient which became significant and consistent with a priori expectations when estimated from the longer data period. This suggests, once again, that the most recent data have provided a valuable source of variation which has enabled a more accurate estimation of the specified model.

Further analysis will improve the measurement of the behavioural relationships but a reasonable framework for use in the movement towards a simultaneous model seems to have been established.

---

36. See Gregory and Sheehan, op. cit.

## Appendix 1

Table 1

Labour Force Participation Rates,<sup>a</sup>  
Persons Aged 15 and Over,  
Australia, 1964 - 1975  
(Percentages)

Year <sup>b</sup>	Age Group								
	15-19	20-24	25-34	35-44	45-54	55-59 <sup>c</sup>	60-64 <sup>c</sup>	65 and over	15 and over
1964	67.4	75.0	65.3	67.3	64.7	57.7	46.1	12.1	58.7
65	66.2	76.1	65.7	67.8	65.2	58.3	46.7	12.4	59.1
66	65.8	76.1	66.5	68.6	65.9	58.8	47.2	12.4	59.5
67	64.2	76.7	67.2	69.3	66.3	59.4	47.4	12.3	59.8
68	60.9	77.2	67.7	70.1	67.1	60.2	47.4	11.9	59.9
69	60.2	77.6	68.6	71.0	67.5	59.6	46.4	12.0	60.3
70	59.6	77.7	70.1	72.0	68.5	60.0	46.8	11.8	60.9
71	57.8	76.3	69.9	73.5	69.1	59.6	46.7	11.5	60.7
72	56.7	76.4	69.9	73.8	69.9	59.8	46.2	11.6	60.8
73	57.8	76.6	71.2	74.6	70.4	59.3	45.6	10.9	61.2
74	57.6	77.2	72.4	75.4	70.5	59.5	44.2	10.2	61.4
75	58.0	77.9	72.7	75.8	70.2	59.2	42.3	9.2	61.5

a The workforce of any age group as a porportion of the civilian population in that age group.

b Annual figures were derived by averaging quarterly data.

c Figures for 1964 to 1966 were derived for these age groups by an allocation of data for the 55 to 64 age group based on the proportion of persons in the subgroups since 1966.

Source: Australian Bureau of Statistics, The Labour Force, Ref. Nos 6.20 and 6.22, Canberra 1964 to 1975.



Appendix 1  
Table 2  
Labour Force Participation Rates  
by Age and Sex, Australia 1964-1975  
(Percentages)

Year	Age Group								
	15-19	20-24	25-34	35-44	45-54	55-59	60-64	65 and over	15 and over
<b>MALES</b>									
1964	69.4	94.3	98.0	97.6	95.7	90.0	78.9	23.7	84.2
65	67.8	93.7	97.6	97.7	95.6	90.7	79.5	24.2	84.0
66	66.9	94.0	97.7	97.9	95.9	91.1	79.8	24.1	84.1
67	64.6	93.1	97.8	97.7	95.8	91.1	79.4	23.9	83.7
68	61.4	93.2	97.8	97.8	96.0	91.6	78.9	23.1	83.4
69	61.7	93.0	97.5	97.6	85.9	91.1	78.1	23.4	83.3
70	61.0	92.9	97.5	97.6	95.8	91.5	78.6	23.0	83.2
71	59.3	92.1	97.5	97.8	95.6	90.4	77.4	22.4	82.8
72	58.6	92.4	97.5	97.9	95.8	90.8	76.9	22.2	85.2
73	60.4	91.7	97.4	97.4	94.9	89.1	76.1	21.4	82.4
74	60.0	91.5	97.6	97.3	94.6	88.7	73.6	19.2	81.8
75	59.3	90.6	97.1	97.1	94.2	88.3	70.4	17.0	81.0
<b>FEMALES</b>									
1964	65.3	55.3	30.9	35.5	32.9	24.1	14.5	3.6	33.4
65	64.6	58.1	32.0	36.3	34.4	24.5	14.7	3.8	34.4
66	64.6	58.0	33.9	37.8	35.4	25.3	15.2	3.9	35.3
67	63.0	60.4	35.1	39.3	36.4	26.9	15.7	4.0	36.3
68	60.3	61.1	36.0	40.7	37.8	28.2	16.3	3.8	36.8
69	58.6	62.2	37.9	42.6	38.8	28.2	15.4	3.8	37.6
70	58.2	62.5	41.3	44.6	40.7	28.8	15.7	3.6	38.8
71	57.3	61.4	40.6	47.7	42.2	29.8	16.9	3.8	39.4
72	57.0	62.5	41.0	48.4	43.5	29.8	16.8	3.9	39.8
73	57.2	63.5	43.6	50.4	45.2	30.5	16.4	3.4	40.9
74	57.3	64.7	46.3	52.2	45.6	31.3	16.3	3.7	42.0
75	56.7	65.1	47.3	53.5	45.4	31.0	16.0	3.6	42.3

Source: As for Appendix 1 Table 1.

## Appendix 1

## Table 3

Labour Force Participation Rates  
Females by Marital Status and Age, Australia 1964-1975  
(Percentages)

Year	Age Group								
	15-19	20-24	25-34	35-44	45-54	55-59	60-64	65 and over	15 and over
<b>MARRIED WOMEN</b>									
1964	23.7	31.5	24.9	31.5	27.7	17.6	9.9	2.7	24.5
65	23.7	34.1	26.1	33.0	29.3	17.8	10.0	2.9	26.0
66	29.0	35.7	27.9	34.9	30.5	18.5	10.4	3.0	27.5
67	32.1	39.0	29.5	36.2	32.1	20.5	10.6	3.2	29.2
68	32.9	40.8	30.8	37.5	33.9	22.8	11.6	2.8	30.4
69	34.4	44.0	32.9	39.6	35.1	23.3	11.5	2.9	32.0
70	37.3	45.3	36.0	41.9	37.2	23.7	12.1	3.1	34.0
71	40.7	45.5	36.0	45.1	39.1	24.5	12.9	3.1	35.3
72	43.3	47.1	36.2	45.8	40.5	26.0	13.5	3.5	36.1
73	46.8	49.7	39.1	48.0	42.5	26.9	13.5	2.9	37.9
74	45.6	52.6	42.1	50.4	43.5	27.3	13.7	3.6	39.7
75	49.2	54.0	42.9	51.9	43.1	28.0	12.8	3.1	40.4
<b>OTHER WOMEN</b>									
1964	68.2	90.5	81.9	72.6	59.4	39.7	21.4	4.3	49.9
65	67.6	91.9	82.1	69.0	58.6	39.8	22.0	4.3	50.1
66	67.3	91.3	82.2	68.2	60.2	42.9	22.9	4.4	49.9
67	65.4	91.5	81.4	70.4	59.0	44.0	24.2	4.3	49.6
68	62.3	90.1	82.8	72.3	59.5	42.4	24.6	4.3	48.9
69	60.6	90.5	82.6	72.3	59.1	43.2	22.3	4.2	48.2
70	60.3	90.4	83.5	71.9	60.2	44.8	22.3	3.9	48.3
71	57.9	87.1	80.9	75.1	59.8	44.5	23.8	4.2	46.7
72	56.2	85.6	81.9	75.0	60.2	41.8	22.7	4.1	45.9
73	56.5	83.4	82.8	74.6	60.5	42.0	21.9	3.7	45.6
74	56.8	81.6	80.8	70.5	59.6	44.0	21.3	3.7	45.4
75	57.4	81.9	80.3	69.2	58.7	40.1	22.1	3.8	46.0

Source: As for Appendix 1 Table 1.

Appendix 2

Table 1 : Size of the Australian Workforce by Age, Sex and Marital Status, 1964, 1970 and 1975.  
( '000)

Year	Age group									
	15 - 19	20 - 24	25 - 34	35 - 44	45 - 54	55 - 59	60 - 64	65 and over	15 and over	
<b>Males</b>										
1964	348.1	362.3	696.0	753.0	610.9	230.9	160.4	92.6	3,254.3	
1970	340.7	487.7	824.4	759.6	681.3	277.7	192.3	100.9	3,664.7	
1975	362.7	512.5	993.0	757.6	735.4	263.2	191.2	80.7	3,896.3	
<b>Married Women</b>										47.
1964	6.8	71.0	146.3	204.9	142.1	30.4	10.7	5.1	617.3	
1970	17.1	146.4	251.8	269.5	219.5	54.6	18.9	6.7	984.0	
1975	25.3	182.7	371.9	341.9	273.6	61.8	24.2	7.3	1,288.6	
<b>Other Women</b>										
1964	307.8	134.1	58.4	52.7	62.0	28.0	17.9	13.1	674.0	
1970	299.6	181.6	78.4	46.8	63.6	33.6	17.8	15.0	736.5	
1975	306.5	179.2	91.2	46.2	63.3	30.9	21.1	16.8	755.2	

Source: ABS Labour Force Surveys, May 1964, 1970 and 1975.

Table 2 : Composition of the Total Workforce

Year	G r o u p			Total %
	Males %	Married Women %	Other Women %	
1964	71.6	13.6	14.8	100.0
1970	68.0	18.3	13.7	100.0
1975	65.6	21.7	12.7	100.0

Source: Derived from Appendix 2 Table 1.

Table 3 : Composition of the Female Workforce by Age  
(per cent)

Group and Year	A g e   g r o u p									
	15 - 19	20 - 24	25 - 34	35 - 44	45 - 54	55 - 59	60 - 64	65 and over	15 and over	
Married Women										
1964	0.5	5.5	11.3	15.9	11.0	2.4	0.8	0.4	47.8	
1970	1.0	8.5	14.6	15.7	12.7	3.2	1.1	0.4	57.2	
1975	1.2	8.9	18.2	16.7	13.4	3.0	1.2	0.4	63.0	
Other Women										
1964	23.8	10.4	4.5	4.1	4.8	2.2	1.4	1.0	52.2	
1970	17.4	10.6	4.5	2.7	3.7	2.0	1.0	0.9	42.8	
1975	15.0	8.8	4.5	2.3	3.1	1.5	1.0	0.8	37.0	

Source: Derived from Appendix 2 Table 1.

## Appendix 3

## DATA SOURCES

Labour force participation rates by age, sex, and marital status were obtained from the Australian Bureau of Statistics quarterly bulletin, The Labour Force (Reference No. 6.20) beginning in February 1964. These data are based on the results of a quarterly sample survey (the quarterly population survey) carried out in February, May, August and November each year, covering the six States, the Northern Territory and the Australian Capital Territory.

Each person in the survey is classified according to his activity during the week immediately preceding that in which the interview takes place, and is assigned to one of three categories : employed, unemployed or not in the labour force. The interviews are carried out during a period of four weeks, so that there are four survey weeks in each of the months to which the survey relates.

Estimates of participation rates for the age groups 55-59 and 60-64 were not available before August 1966. To produce separate participation rate estimates for both age groups it was necessary to allocate a proportion of the combined workforce to each subgroup and to divide by the age-specific population sizes. Age-specific workforce numbers were estimated by extrapolation of workforce time trends. The unemployment rate series used in this study was also obtained from The Labour Force.

In estimating the proportion of students by sex at educational institutions two different series were compiled. In the case of males, information collected on the number of 17 year old male students at school and university was obtained from the annual ABS bulletins Schools

## Appendix 3 (cont'd)

(Reference No. 13.5) and University Statistics (Reference No. 13.7).

The number of 17 year old males in the population was obtained from the ABS Intercensal Estimates of the Population (unpublished) for the period before 1966 and from the ABS bulletin Estimated Age Distribution of the Population (Reference No. 4.15) for the subsequent period. A second series showing the proportion of 17 to 22 year old university students who were female was also compiled from the University Statistics bulletin.

A series showing employment in manufacturing industries as a percentage of the total civilian employment was derived from the ABS publication Seasonally Adjusted Indicators (Reference No. 1.10). Statistics were computed for the quarters ending February, May, August and November.

An estimate of the number of children born in five year periods  $t$ ; married women in each age group was compiled from the ABS bulletin Births (Reference No. 4 4). This bulletin provides figures on the number of nuptial confinements each year by age of the mother. An estimate of the number of children born to married women in each age group was then made by recording the number of confinements for the current year and the preceding four year period. This series was then divided by the number of married women in each age group, which was estimated by applying Census figures on the proportion of females married by age to data furnished in the Estimated Age Distribution of the Population and Intercensal Estimates of the Population. The annual series was then interpolated to yield quarterly estimates.

A time series of unearned income was compiled from the ABS Australian National Accounts (Reference No. 7.1). This series includes

## Appendix 3 (cont'd)

income from dwellings, interest on life and superannuation funds, other interest, dividends and government transfer payments. The data were deflated by the Consumer Price Index and then divided by the estimated number of persons 55 and over. The annual figures of real unearned income per person over 55 was then interpolated to produce quarterly estimates.

Table 1

## Summary of Data Used

Year	Unemployment rate of per- sons 15 and over(a) %	Ratio of employees in manufacturing to total civilian employees(b) %	Female proportion of university students aged 17-22(c) %	Proportion of males aged 17 at school and university(d) %	Quinquennial confinements per married women by age(e)					Retirement income per person 55 and over(f) \$('000)
					15-19	20-24	25-34	35-44	45-54	
1964	1.4	34.65	29.18	25.8	0.91	1.07	1.06	0.32	0.018	1.414
1965	1.3	34.51	29.65	27.8	0.92	1.01	1.03	0.31	0.018	1.463
1966	1.5	34.44	30.38	27.7	0.81	0.99	0.99	0.29	0.018	1.475
1967	1.6	32.89	30.77	31.9	0.79	0.93	0.95	0.28	0.017	1.520
1968	1.5	32.53	31.71	33.9	0.77	0.92	0.92	0.26	0.016	1.579
1969	1.5	32.26	32.14	36.0	0.77	0.92	0.90	0.24	0.015	1.642
1970	1.4	31.73	33.31	37.3	0.78	0.92	0.90	0.24	0.014	1.747
1971	1.6	31.19	35.33	38.0	0.76	0.88	0.90	0.23	0.013	1.866
1972	2.3	30.48	36.41	39.2	0.74	0.87	0.90	0.22	0.012	1.975
1973	1.9	29.96	37.07	37.5	0.69	0.84	0.81	0.22	0.010	2.122
1974	2.3	29.38	38.08	36.3	0.64	0.87	0.87	0.20	0.008	2.271
1975	4.3	27.15	38.60	38.9	0.60	0.84	0.84	0.18	0.007	2.418

- Sources:
- (a) The Labour Force (Reference No. 6.20). Annual figures derived by arithmetic mean of quarterly values.  
 (b) Seasonally Adjusted Indicators (Reference No. 1.10).  
 (c) Schools (Reference No. 13.5); University Statistics (Reference No. 13.7).  
 (d) University Statistics (Reference No. 13.7).  
 (e) Births (Reference No. 4.4); Estimated Age Distribution of the Population (Reference No. 4.15).  
 (f) Australian National Accounts (Reference No. 7.1).



## Appendix 4

Table 1

Elasticities at Means<sup>a</sup> for Married Women Regression

Age group		U <sup>b</sup>	E <sub>f</sub>	M	C	R
Period		%	%	%	%	%
15-19	1	-0.089	1.17	-1.621	-0.300	d
	2	-0.026	0.14	-4.304	0.281	d
20-24	1	-0.036	-0.084	-1.096	-1.000	d
	2	-0.043	-0.042	-1.346	-0.898	d
25-34	1	c	0.154	-1.020	-0.928	d
	2	c	c	-1.774	-0.742	d
35-44	1	-0.018	1.025	-0.485	-0.206	d
	2	-0.026	1.150	-0.164	-0.249	d
45-54	1	-0.079	1.284	-1.170	0.127	d
	2	-0.048	0.903	-1.279	0.015	d
55-59	1	-0.044	0.856	-1.868	d	-0.246
	2	0.011	0.104	-1.281	d	0.320
60-64	1	-0.058	2.083	-0.190	d	-0.490
	2	-0.019	1.772	-0.194	d	-0.333
65 and over	1	-0.148	-0.821	-2.058	d	-0.151
	2	-0.003	-2.898	-3.251	d	0.797

Notes: a The percentage point change in participation rates resulting from a change of one percent in the mean value of the independent variable specified.

b Due to the size of quarterly variations in the unemployment rate (they have recently been up to 70%), the above estimates of the change in participation rates for a one percent change in the unemployment rate are not discussed in the text. Instead, the raw coefficients are used, indicating the change in participation rates resulting from a one point (or 33%) rise in the unemployment rate (from 3 percentage points).

c Since the coefficient was not significantly different from zero at the 5% level, a zero value was assumed.

d This variable was not specified for this age-sex group in the model.

1 = The period from 1964 (1) to 1975 (4) inclusive.

2 = The period from 1965 (1) to 1974 (4) inclusive.

## Appendix 4

Table 2

Elasticities at Means<sup>a</sup> for Other Women Regression

Age group	Period	$U^b$	$E_f$	M	R
15-19	1	0.082	-0.498	0.615	d
	2	0.088	-0.336	0.967	d
20-24	1	-0.004	-0.498	-0.238	d
	2	-0.011	-0.573	-0.255	d
25-34	1	-0.018	-0.114	-0.178	d
	2	-0.008	-0.266	-0.431	d
35-44	1	-0.032	0.251	-0.075	d
	2	-0.044	0.092	-0.365	d
45-54	1	-0.035	-0.007	-0.212	d
	2	-0.042	0.024	-0.210	d
55-59	1	-0.062	0.717	-0.863	-0.573
	2	-0.055	-0.309	-1.662	-0.234
60-64	1	0.021	0.843	-1.719	-1.163
	2	0.057	0.538	-1.389	-0.918
65 and over	1	0.039	0.508	-0.844	-0.902
	2	0.038	1.375	0.341	-1.030

Notes: See Appendix 4 Table 1.

## Appendix 4

Table 3

Elasticities at Means<sup>a</sup> for Male Regressions

Age group	Period	U <sup>b</sup> %	Em %	R %
15-19	1	-0.017	-0.429	d
	2	-0.015	-0.429	d
20-24	1	c	-0.007	d
	2	-0.002	-0.051	d
25-34	1	-0.004	d	d
	2	-0.004	d	d
35-44	1	-0.004	d	d
	2	c	d	d
45-54	1	-0.011	d	d
	2	-0.010	d	d
55-59	1	-0.004	d	-0.040
	2	0.002	d	-0.058
60-64	1	-0.032	d	-0.122
	2	-0.024	d	-0.127
65 and over	1	-0.051	d	-0.438
	2	-0.041	d	-0.389

Notes: See Appendix 4 Table 1.

## Appendix 5

Table 1

Actual and Predicted Participation Rates,  
May Quarter 1975

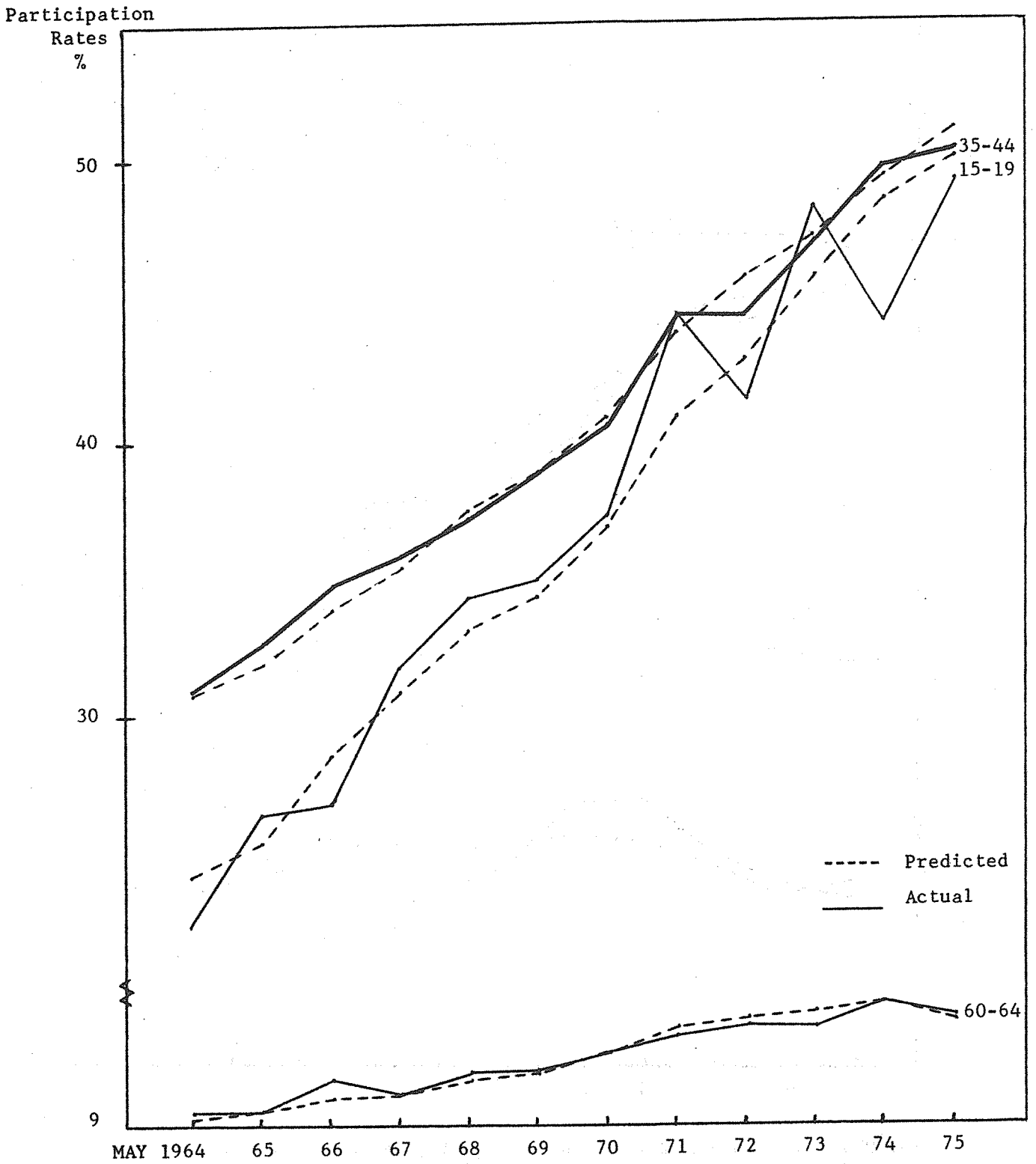
Group	Actual Participation Rates	Predicted from 1965(1) - 1974(1) coefficients	Error (per cent of actual)
Married Women			
15-19	49.3	57.4*	
20-24	53.8	54.7*	
25-34	42.4	49.0*	
35-44	50.3	50.0	
45-54	42.7	44.7*	
55-59	26.7	30.9*	
60-64	12.8	13.3	
65 and over	3.2	4.1	
Other Women			
15-19	56.6	56.9	
20-24	81.5	83.0*	
25-34	79.7	83.2*	
35-44	67.8	72.3	
45-54	57.8	58.1*	
55-59	40.9	43.9*	
60-64	22.4	23.3	
65 and over	3.8	3.5	
Males			
15-19	59.3	60.0	
20-24	90.5	91.9	
25-34	96.9	97.0	
35-44	97.2	97.4	
45-54	94.4	94.5	
55-59	88.3	89.0	
60-64	71.2	71.9	
65 and over	16.8	18.1	

\* The large discrepancies between predicted and actual rates for these age groups are the result of perverse signs or insignificant coefficients which become significant and have the expected sign when the coefficients are estimated from the longer data period.

Appendix 5

Chart 1

Actual and Predicted May Quarter Participation Rates  
Married Women Aged 15-19, 35-44 and 60-64  
1964 to 1975

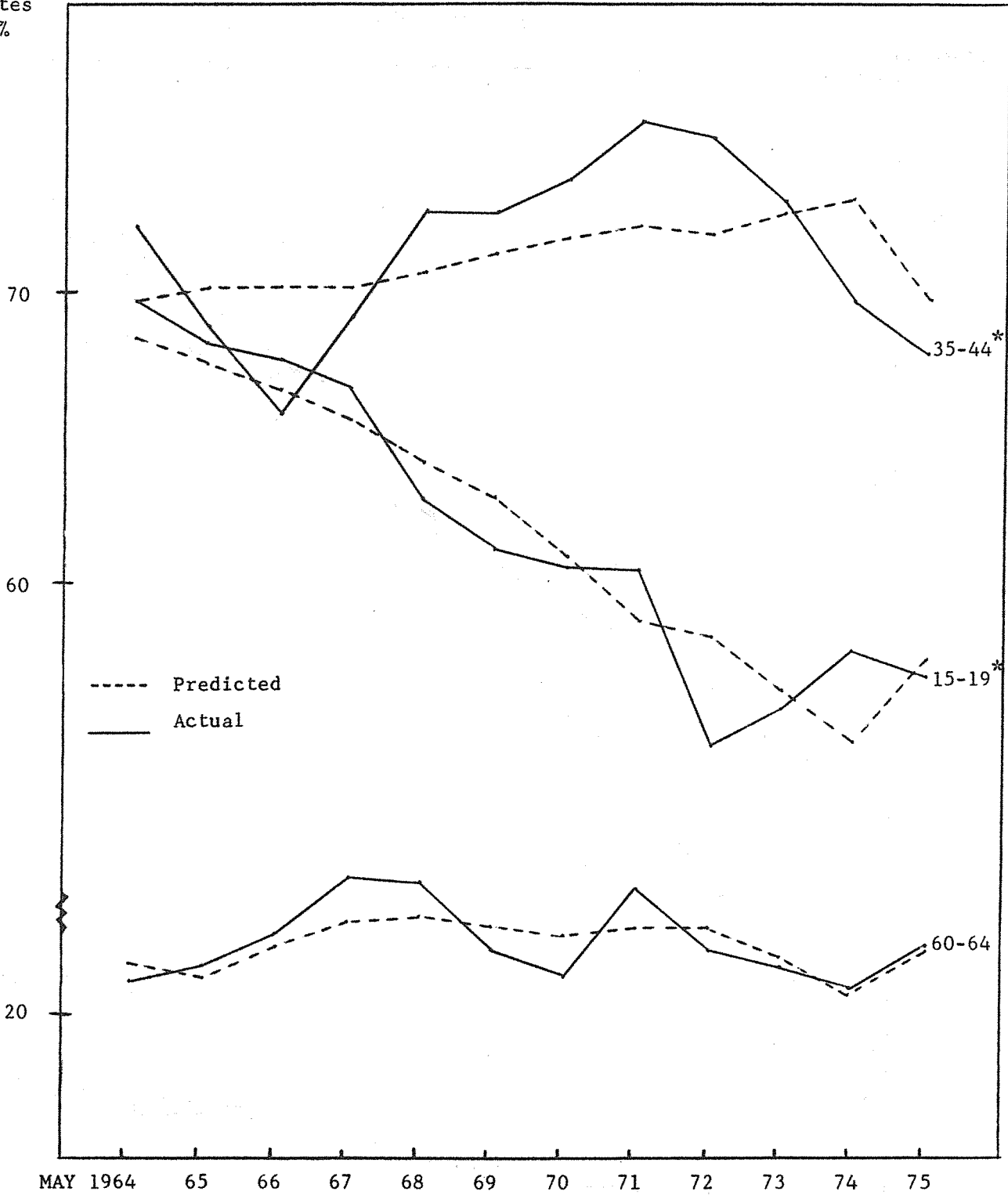


Appendix 5

Chart 2

Actual and Predicted May Quarter Participation Rates  
Other Women Aged 15-19, 35-44 and 60-64  
1964 to 1975

Participation Rates %

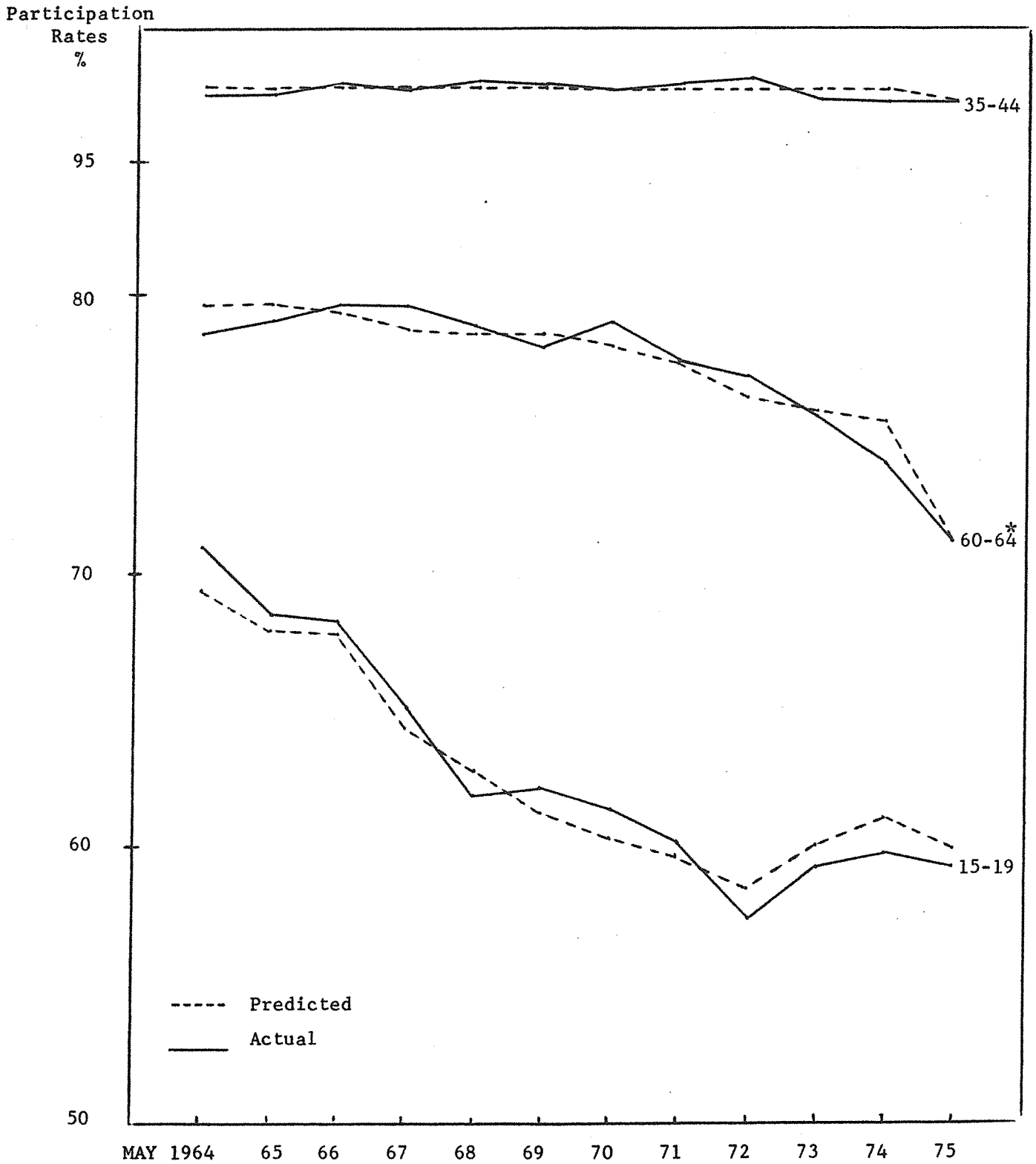


\* The OLSQ equation was plotted above despite the use of the transformation in the model. In the above cases, the difference in the sign and size of the OLSQ and transformed coefficients was only marginal and consequently the plots represent a reasonable depiction of the transformed fit.

Appendix 5

Chart 3

Actual and Predicted May Quarter Participation Rates  
 Males 15-19, 35-44 and 60-64  
 1964 to 1975



\* See Appendix 5 Chart 2.

