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FEMALE WORKING LIFE EXPECTANCY, CANADA 1921-1971: RESULTS FROM AN APPLICATION OF MODEL WORKING LIFE TABLES

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Résumé – L'espérance de vie active pour les femmes canadiennes, 1921-71, résultats de l'application de tables de vie active. A l'aide des tables de vie active, nous estimons l'espérance de vie active pour les femmes canadiennes entre 1921 et 1971. Nous indiquons que l'espérance de vie active augmente durant cette période. Notre analyse indique que le facteur principal dans ce changement est l'accroissement du taux de participation dans la main d'oeuvre.

Abstract – Estimates of working life expectancy for Canadian females have been generated with the help of model working life tables for the census years 1921 through 1971. It is seen that the expected working life has increased over this time period. The analysis shows that the major contributor to this increase is the increase in female labour force participation.

Key Words – **female working life, model tables, Canada**

Introduction

The most commonly used indicator of economic-demographic conditions in a country is the length of working life of its men and women. Towards this end, working life tables (WLT) are constructed. To generate the WLT, one requries information on the age specific labour force participation rates and an appropriate life table. The WLT is a type of increment-decrement table; while mortality acts as a decrement factor, labour force entry takes on the role of an increment factor. Retirement from the labour force is also a decrement factor. This and other factors such as unemployment and temporary lay offs, are not considered in the conventional WLT methodology. The number of years in 'retirement' is indirectly estimated. The conventional methodology is discussed in the United Nations (1968) manual. The methodology of increment-decrement tables for WLT construction can be seen in Schoen (1975).

Denton and Ostry (1969) and Gnanasekaran and Montigny (1971) have set up WLTs for Canadian males. Stafford and Roberts (1975) confined their attention to the province of Alberta and developed WLTs for both males and females. Female WLTs are conspicuous by their minimum presence, not only in Canada but also in other developed countries. The main reason for the dearth of WLTs for women is that no good methodology has been invented to cope with the bimodality problem in the female labour force participation (LFP) curve. With the increasing participation of women in economic activities, this bimodality problem may, as Sweet (1973) thinks, disappear or decline. Until the bimodality weakens, or disappears altogether, some methodology has to be devised to construct female WLTs for assessing the change in working life over time, or space.

Stafford and Roberts (1975) have ignored the bimodality issue in their Alberta female WLT. Terry and Sly (1972), in their study of the women in the United States, have used a clever device to construct the WLT. They categorized women into several groups on the basis of the continuity of their LFP and developed tables for each of those groups. Description is provided elsewhere in this paper. A different methodology has been attempted by Krishnan, Penning, and Kurian (1981) to construct WLT for Canadian women. Krishnan *et al.* introduce the notion of "woman year of working (economically active) life." If a woman works for a year (52 weeks, inclusive of paid holidays and vacation, working the appropriate number of hours per week as per rules), she contributes a "woman year of working life" to the economy. Employing this notion, and using the 1971 census data on weeks worked, Krishnan *et al.* (1981) have estimated age specific participation rates and set up

WLT for Canadian women. An advantage was noticed in this approach - it resulted in a reduction in the bimodality of the female LFP curve. The objective of this article is to develop another different approach to the assessment of female working life expectancy (WLE) in general and for Canada in particular with the aid of model working life tables.

Model Tables of Working Life

Model tables are an accepted set of tools in demographic studies. The methodology of model tables started off in mortality studies. The United Nations (1955) model life tables were followed by Kurup (1965), Coale and Demney (1966), Brass (1968), Keyfitz and Cummings (1968), Ledermann (1969) and Carrier and Hobcroft (1971). In the area of fertility, model tables have been suggested by Bogue and Palmore (1964), Bourgeois-Pichat (1965), Mitra (1965) and Beaujot (1973). Model nuptiality tables are seen in Coale (1971) and Roberts and Krishnan (1973). Krishnan and Kayani (1976) have developed model divorce tables and Rogers (1978) has set up model migration tables. Recently, Krishnan, Islam and Ng (1984) have shown how to construct model tables of unemployment. As the rationale behind model tables is the skillful exploitation of the meaningful correlations between the crude (or refined) indicator of a phenomenon and its age specific indicators, a system of model WLTs can also be generated. Such a system is seen in Chow, Lalu and Krishnan (1981) and Chow (1982). Since the data used for the construction of the model tables had very broad age groupings, the bimodality in the female LFP curve for developed countries was masked. The model tables are utilized here to estimate the female WLE in Canada for the period 1921-71.

Data

The data for this study are taken from the various Canadian censuses during the period 1921-71. The crude participation rates (CPR) have been computed with the data on women in the labour force and female population as yielded by the census returns. Also the 1970-72 female life tables (LT) used in the study are from Statistics Canada (1974).

Labour force is used in the same sense that Statistics Canada employs it for census and labour force survey purposes. WLE at age x is the number of years that a person aged x can expect to work during his or her lifetime at age x. For details on the methodology and the functions in the WLT, one may consult the United Nations Manual (1968).

Methodology used in this Study

Various families of model WLT's are available in Chow (1982) and Chow, Krishnan and Lalu (1986). For developing estimates for Canadian women, the North, the East and the South families of model tables are considered. One can read off, or interpolate for, the WLE from these tables, when the CPR and the level of mortality, or the life expectancy (LE) at birth of the population are known.

For 1971, using the 1970-72 LT, the appropriate WLT was developed, following the United Nations Manual. The WLE values obtained thereby are compared with those provided by the model tables. One can then judge the "goodness" or "reliability" of the estimates derived from the model tables of working life.

Estimates of Female WLE, 1921-71

Estimates of WLE for Canadian females at selected ages are shown in Table 1. The CPRs and the LEs are also indicated in that same table. The estimates are distinguished by the families of LTs (North, East or South) used.

A comment on the level of mortality used is in order. In 1921 the female LE at birth was 60.8 years. In Coale-Demney model LTs, mortality levels 17, 19, 21, and 23 for females indicate LEs of 60.0, 65.0, 70.0, and 75.0 years at birth. On interpolation, the approximate level of mortality in 1921 is 17.32. Hence, those interested in using the model tables of working life, should interpolate for the required WLE from the values of WLE tabulated for different mortality levels and CPRs. Interpolation has to be done in both dimensions – mortality and CPR. Simple interpolation will suffice.

It is clear from Table 1 that the WLEs are nearly the same, whether North, East or South models are used. From a substantive point of view, the WLE for females has shown an increase over time (almost two to three times at ages 20, 25, 45 and 55 during the 1921-71 span). Between 1961 and 1971, it has less than doubled. It may be remembered that during this 50-year period, both the CPR and the LE have steadily increased. The participation rate has more than doubled for 1921-1971 and increased by some 44 per cent for 1961-71. The LE, on the other hand, increased by some 26 per cent for 1921-71 and by only three per cent for 1961-71. We would then be interested in assessing the components of change (here, increase) in the female WLE; the respective contributions made by the changes (here, increases) in the participation rate and LE.

TABLE 1. ESTIMATED FEMALE WORKING LIFE EXPECTANCY, CANADA 1921-1971

	1921	1931	1941	1951	1961	1971
Female Crude Participation Rate (per 100)	13.2	15.0	16.7	17.2	19.7	28.3
Female Life Expectancy at Birth (years)	60.8	62.1	66.3	70.8	74.2	76.4
Approximate Mortality Level	17.3	17.8	19.5	21.3	22.7	20.6
NORTH FAMILY			WORKING LIFE EXPECTANCY			
Age						
20	7.4	8.8	10.2	10.8	12.9	19.7
25	5.3	6.6	8.0	8.5	10.5	16.8
45	2.8	3.3	4.0	4.2	5.2	8.1
55	1.5	1.8	2.0	2.2	2.6	4.0
65	.3	.4	.5	.6	.7	1.3
EAST FAMILY						
20	7.5	8.9	10.3	10.9	13.0	19.8
25	5.4	6.7	8.0	8.5	10.5	16.8
45	2.8	3.3	3.9	4.2	5.2	8.1
55	1.5	1.7	2.0	2.1	2.6	3.9
65	.3	.4	.5	.5	.7	1.3
SOUTH FAMILY						
20	7.6	9.0	10.5	11.0	13.2	19.9
25	5.5	6.8	8.2	8.6	10.6	17.0
45	2.9	3.4	4.0	4.3	5.3	8.3
55	1.5	1.8	2.1	2.2	2.7	4.1
65	.3	.4	.5	.6	.8	1.4

Source: Authors' computations, Raw data from D. Kubat and D. Thornton (1974). A Statistical Profile of Canadian Society, McGraw Hill, Table D-8, Canada Year Book, 1978-79, p. 180.

Using the model tables (say, North family), we obtain the following results.

		WLE at age 20 (in years)
(i)	1921 CPR with 1921 LE	7.4
(ii)	1971 CPR with 1921 LE	15.9
(iii)	First estimate of change due to increase in CPR (ii-i)	8.5
(iv)	1971 CPR with 1971 LE	19.7
(v)	1921 CPR with 1971 LE	8.1
(vi)	First estimate of change due to increase in LE (iv-ii)	3.8
(vii)	Second estimate of change due to increase in CPR (iv-v)	11.6
(viii)	Second estimate of change due to increase in LE (v-i)	0.7
(ix)	Best estimate of the contribution due to increase in CPR $\frac{(\text{iii} + \text{vii})}{2}$	10.05
(x)	Best estimate of the contribution due to increase in LE $\frac{(\text{vi} + \text{viii})}{2}$	2.25

From the above, we see that increasing female participation has contributed nearly five times as much as the increase in LE (10 versus 2.3 years).

Age Pattern of Working Life

From the entries in Table 1 and Figure 1, the age pattern of female WLE in Canada is clear. The pattern is nearly linear. As LE and CPR increase, a nonlinear pattern is observable, indicating a shift. Since the age pattern of WLE remains robust with respect to the family of mortality patterns (North, East, South), only one graph of the pattern is shown.

Some plausible reasons for the change/increase in female participation in the labour force and the changing age pattern of working life may now be discussed. During this 50-year period, Canada witnessed major social changes.

Involvement in World War II led to women being recruited into the labour force to man the industries directly and indirectly associated with the war effort. Following the war, the social system underwent many significant changes – values regarding marriage, family size, use of contraception, and working for money on the part of women outside of the home were all modified. More and more women began to work outside of the home to supplement their husbands' incomes. Small family size became the order of the day. Completing the reproductive behaviour early in life freed women from childbearing and rearing for a long part of their life cycle, and allowed them to enter the labour

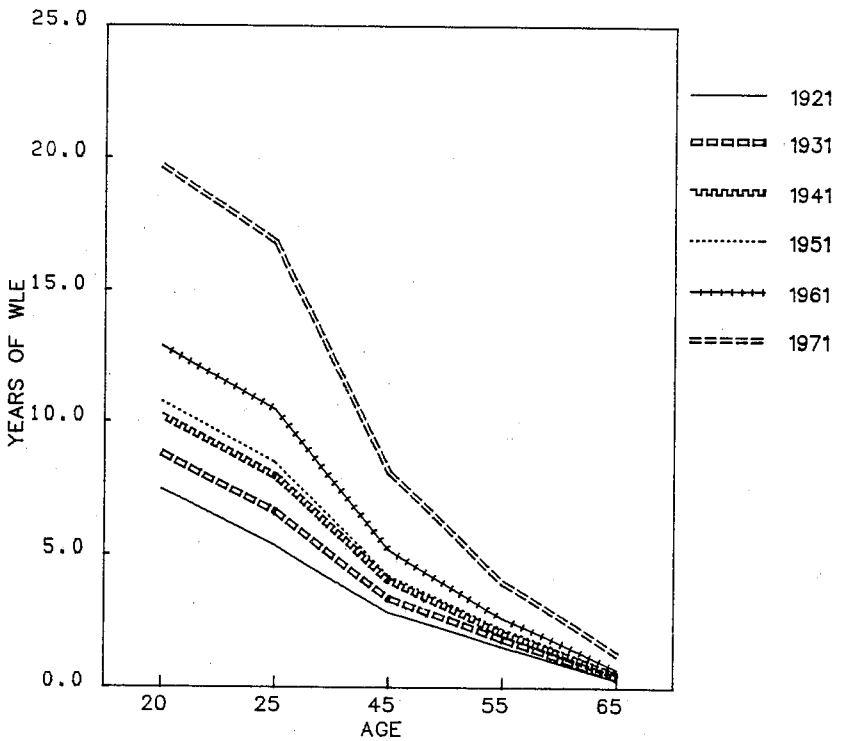

FIGURE 1. FEMALE WORKING LIFE EXPECTANCY OF CANADA 1921-1971 (MODEL NORTH)

market. The social welfare programs sponsored by the various levels of government in Canada facilitated the women's – married in particular – entry and exit from the labour force. When one looks at the percentage change in WLE during 1921-71, one sees a tripling of the WLE at age 25. To assess the increasing role of married women in labour force activities, one has to look at the changing age specific rates of women in the age groups 30-34, 35-44 and 45-54 years. Ostry (1968) finds that more and more married women entered the labour force during this period.

From a sociological perspective, the increasing female LFP is a consequence of the economic and social modernization of Canada. Social change can be noticed in many areas – women have started to assert their rights and roles in societal matters and have begun to participate in many economic activities, for financial or self fulfilment reasons, or both.

Canada vs The United States of America

Since what goes on in the United States has considerable influence on Canada, a comparative picture of the female working life in these countries is worthy of our attention. Terry and Sly (1972) have presented the estimates of female working life in the United States for 1960. The authors categorize the women into a) continuously active b) temporarily active c) temporarily inactive and d) those still working in the first work period. Separate estimates are generated for each of these groups. For women in group (a), the WLE at age 20 is 45.8 years. Women aged 20 in groups (c) and (d) have 18.6 and 22.4 years respectively as their WLE. Detailed information on LFP is needed to categorize the female workers, as Terry and Sly have done. We do not have such detailed information. Hence in Table 2, the estimates presented are for Canadian women as a whole, along with the results from Terry and Sly for the U.S. women. The Canadian results for 1961 and 1971 are from Table 1 (North Family). For 1971, results from a WLT with 1970-72 LT are also shown. It is easy to see that, in spite of similarities, women in the United States have a higher WLE compared to their Canadian counterparts. The higher working life in the United States may be traced to the higher participation rates of women, which is dependent on the economy. The U.S. economy, as we know, is larger and more diversified than the Canadian.

Discussion

We have presented here estimates of WLE of Canadian women with the help of model tables of working life. A comparison of the estimates in Table

TABLE 2. ESTIMATED FEMALE WORKING LIFE EXPECTANCY AT SELECTED AGES, CANADA, 1961 AND 1971 AND U.S.A., 1960

	Canada*		Canada+	U.S.A.++
Age	1961	1971	1971	1960
20	12.9	19.7	19.6	22.4* (18.6)***
25	10.5	16.8	16.7	18.9* (17.6)***
45	5.2	8.1	8.1	12.1** (11.1)***
55	2.6	4.0	3.9	3.0**

Source: Terry and Sly for the United States and authors' computations.

* From Model Tables North (in Table 1).

\+ 1970-72 life tables are used to generate working life tables.

++ Terry-Sly WLE's are of six types. Since continuously working group is not available for Canada, only the WLEs of comparable groups are shown here.

The WLE of first group (*) shown here is the combined working life expectancy for those still working in the first work period. The WLE of the second group (**) is the average number of years of work in the final period for the temporarily active. The WLE of the third group (***) is the future work life expectancy for the temporarily inative.

2 with those arrived at from the model tables in Table 1 reveals results that are nearly the same. The estimates are seen as robust with respect to the family of the model tables. This "confirmation" lends support to the use of model tables of working life as a quick means of estimating the WLE in any country. What is needed is an estimate of the CPR and an approximation of the mortality level (or LE at birth). Estimates of the CPR can be updated with labour force surveys and a knowledge of the mortality situation from vital registration, if the registration is good, or through other means such as sample registration and mortality surveys. Thus a country can monitor the changing WLE situation in order to assess and examine the effects of various social and economic programs.

One has to acknowledge that this system of model tables has some limitations. In the development of the model tables, it was assumed that the correla-

tion pattern between the CPR and the age-specific rates used in the regression equations will remain at roughly the same level in the future. This may not be a realistic assumption as the female LFP may increase over time in all age groups. The many factors that affect the economy of a country cannot be easily guessed, so it is felt that the model tables have to be revised periodically to take account of the changing social, economic and political conditions. Also, the model tables have masked the bimodality in the female LFP graph. This may be a less serious limitation, if more and more women in the reproductive age groups (married and not married distinctions are unimportant these days) enter the labour market (which is happening now, and may occur with greater intensity in years to come). If detailed information of the Terry-Sly type is available on LFP, the estimates of WLE will be more realistic. A revision of these model tables with refined data is the next stage in the development of model WLTs. One may say that the present set is meant to provide any population researcher with rapid and reliable estimates of working life.

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