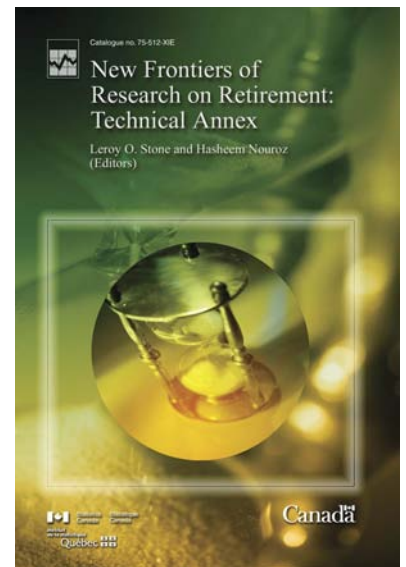




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New Frontiers of Research on Retirement: Technical Annex

Leroy O. Stone and Hasheem Nouroz
(Editors)



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Appendix A. A new perspective on retirement processes: Trajectories of transitions from work to retirement¹

by

Leroy O. Stone, Hasheem Nouroz,
Alexandre Genest and Nathalie Deschênes

Introduction

This chapter introduces features of what we believe is a useful policy-relevant innovation in connection with the retirement processes followed by workers. We refer to these processes as “work-to-retirement transitions”.²

What is this innovation? It is a new mapping and classification of long sequences of positions occupied by persons over periods that may cover many months, and which comprise steps in their work-to-retirement transitions (or their retirement processes). Other mappings and classifications exist (Blau 1994, Gustman and Steinmeier 1986, Gustman and Steinmeier 2000, Han and Moen 1999, Quinn, Burkhauser and Myers 1990); but ours is unprecedented in the detailed time intervals and activities that it includes (as shown below). These details are useful in making it easier to link the analysis of work-to-retirement transitions to a wide range of policy concerns. They also permit much improved understanding of the pathways by which people carry out one of life’s major transitions, at least in socio-cultural contexts where the institution of retirement exists.

1. The authors thank the peer reviewers for their contributions to improving earlier drafts of this chapter. The comments of Stéphane Crespo, Hervé Gauthier and Georges Langis were especially helpful. Assistance from Harpreet Randhawa is gratefully acknowledged. All opinions and errors herein are our sole responsibility.

2. Many readers will insist that retirement is only a process. Current usage in the literature indicates that “retirement” has different meanings depending on the context created by the sentence in which it is being used.

A central concern here is the sensitivity of the probabilities of specific types of retirement processes to aspects of the prevailing policy environment. Information about this sensitivity is vital when it is necessary to simulate the impacts of policies upon retirement processes. Ample evidence of this point can be found in the literature coming out of Europe, mostly, on the subject of pathways to retirement (see Dahl, Nilsen and Vaage 2000, Flippen and Tienda 1999, Guillemard 1995, OECD 2001, Riphahn 1997).

A key feature of our concept of trajectory of transition to retirement is its attention to the duration of stay in specified positions (possible states occupied as parts of a trajectory – such as spells of unemployment). This is achieved by using a relatively fine time interval such as a quarter of a year (some of the positions in our trajectories involve measuring changes from one month to another within a single quarter).³

Another important innovation in our work is that it presents the first display of several different properties of the said trajectories, which become bases for classifying large numbers of trajectories into small and meaningful categories. Eight properties of work-to-retirement trajectories are defined, and the text below presents indicators for measuring several of them.

We illustrate applications of the innovations cited above by presenting, in chapters 15 and 16, descriptive analyses focused on two areas of current interest: the distinctive retirement patterns of the self-employed, and differences in these patterns between public-sector and private-sector employees.

The purpose of this chapter is to exposit the innovations mentioned above. The focus will be on the concept, mapping and classification of trajectories of transition to retirement. In connection with the proposed indicators for use in measuring properties of trajectories, the chapter also presents some basic information about how the trajectories are distributed over categories of selected properties.

3. While at least two other studies (Blau 1994, Quinn 2003) contain information which states or implies that quarterly time intervals were used, neither of them provides descriptions of trajectories that allow anyone gaining access to their lists of trajectories to compute a variety of useful measures of durations of stay.

Key concepts

Retired

An almost bewildering variety of definitions of “retirement” exists in the literature (Burtless and Moffitt 1985, Gustman and Steinmeier 1984, Gustman and Steinmeier 2000, Honig and Hanoch 1985, Ruhm 1990a, Ruhm 1990b, Smeeding and Quinn 1997, Stein 2000, Stone 2003).⁴ A key issue is whether it is best to regard retirement as a state of being (thus a “position” that one may occupy at a moment of time) or whether it is a process (for related discussion see Han and Moen 1999). It is both, depending on the context in which the word is used.

When you see the word “retirement” used within the context of the phrase “transition to retirement”, think of the state of being retired – a person “transits” toward the state of being retired. We identify the state of being retired in terms of a prolonged departure from the labour market, combined with the reception of some form of retirement-related income. (See Smeeding and Quinn 1997.) The people who return to the labour market after such a prolonged departure, are said to have “un-retired”.⁵

Transition to retirement

Before formally defining “transition to retirement”, a few words about the process that the term is designed to represent seem to be in order. Imagine a person who spends a major part of

4. The definitions of “retirement” in the literature tend to focus upon one or more of the following: either (a) individuals’ attitudes and intentions known via their declarations, or (b) individuals’ behavior relative to the labor market, or (c) individuals’ commencement of reception of pension or other retirement-related income. One key feature of the widely used definitions is that they refer, at least implicitly, to a process in which a person departs either from a long-held “career job” or from the paid-labor market.

5. Adding subjective information (peoples’ sense of their life stage, and their related plans and expectations) would greatly improve this definition. This dimension is omitted here because gaps in our data source prevent its application.

her (henceforth “her” will mean a woman or a man) waking hours selling her services in the job market or seeking to do so. Often that effort also involves preoccupation with plans and activities designed to enhance her competitiveness or increase her degree of success in the job market (training, seeking promotions or experience-enhancing opportunities, professional networking, etc.). Let us use the phrase “high commitment to employment” to refer to this combination of (a) activity in the labor market and (b) preoccupation with things to do to increase the chances of success in that activity.

After carrying on in this manner for many years, suppose the person begins to think about a different pattern of daily life, one that would involve no activity of selling one’s services (or seeking to do so) and no preoccupation with things to do so as to enhance one’s competitiveness or marketability in the labor market. This different way of life, a new stage in the person’s life course, is what we have in mind when using the term “retired” above. But to reach this new stage of the life course, if the passage to that stage is voluntary, the person needs to undertake a series of decisions, plans and activities at the end of which she will find herself in the new stage of life.

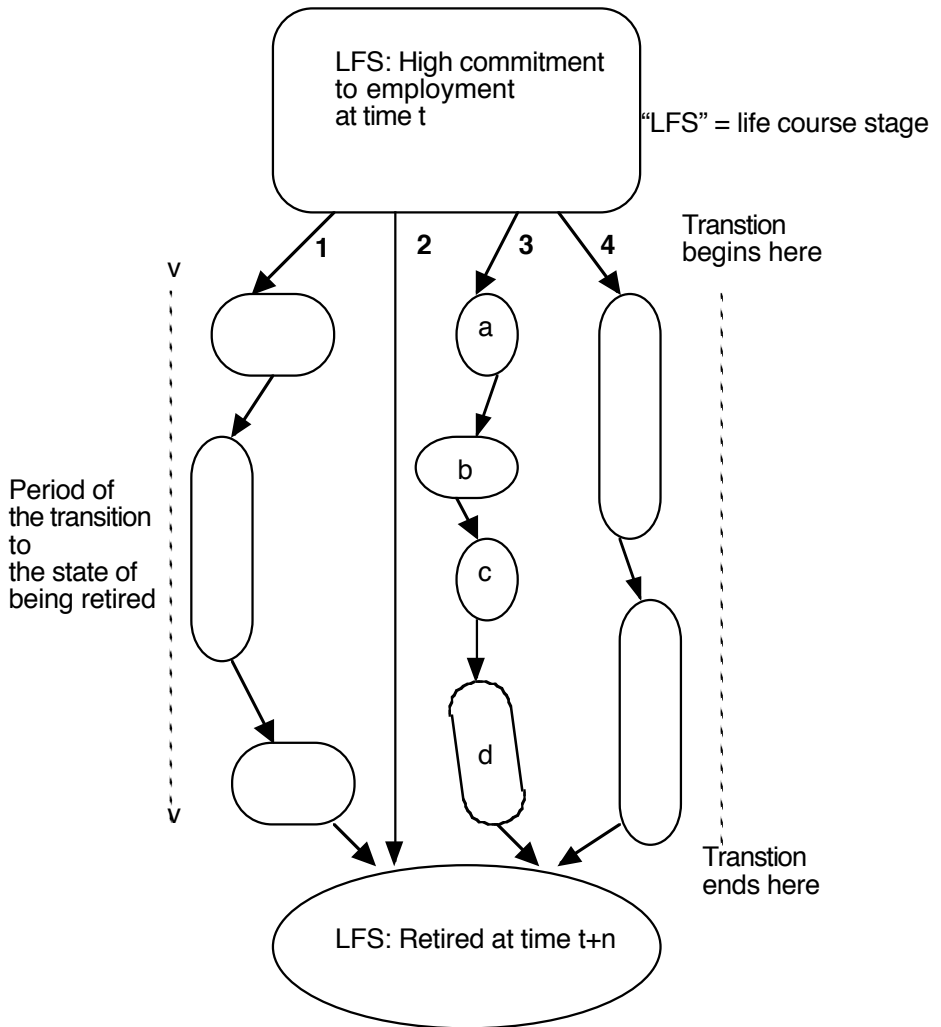
Thus our formal definition of “transition to retirement” is that the phrase means a combination of *decisions, steps and activities* that leads a person from the stage of life in which she has high commitment to employment to a new one where one is in the state of being retired. This is a conceptual definition, as distinct from an operational one.⁶ (For related discussion see Han and Moen 1999, Moen et al. 2000.)

Figure A.1 illustrates our concept of transition to retirement. It is a schematic diagram that represents four transitional patterns, running from time t to time $t + n$, and the period n may be many months covering a number of years. The decisions, steps and activities which comprise the transition often cause the person engaged in the transition (whom we will often call “the transiter”) to occupy a sequence of identifiable positions. These positions

6. We acknowledge that such decisions, steps or activities are not always voluntary. In many persons’ lives, they may be forced upon the persons by circumstances beyond their control.

are represented as semi-circles in Figure A.1, and they stand for components of her transitional pattern. The leftmost pattern illustrated in Figure A.1 indicates three positions, with the second one being occupied for a much longer period of time than the other two positions. The degree of elongation of the semi-circle indicates the length of time the position is occupied.

Figure A.1: Schematic diagram of four patterns of transition to retirement



In almost all of the literature the usage of “transition” causes the reader to think of just two states, and a transition is the passage between those two states. The first arrow you see in Figure A.1 illustrates this kind of transition. In contrast, here the term “transition” refers to the whole *sequence of positions* from the first one to the last one occupied.

Trajectory of transition to retirement

Figure A.1 and the last paragraph highlight the notion of a sequence of positions occupied in the course of making the transition to the state of being retired. That is exactly what we intend to reference when using the phrase “trajectory of transition to retirement”.

The third sequence, going from left to right, in Figure A.1 has letters of the alphabet within the semi-circles to suggest four labeled positions. The first one (with the label “a”) could be a full-time bridge job, the second a spell of unemployment, the third a part-time job and the fourth a longer spell of unemployment. It is followed by the prolonged departure from the labor force discussed above. This is a schematic diagram of a trajectory.

Thus, by “trajectory of transition to retirement” we mean a sequence of designated “positions” that are occupied in the process of making this transition, including the duration of stay in each position. There may be a large number of positions occupied over several time points ($t, t + 1, t + 2, \dots, t + n$).

This means that you would not normally try to analyze variations among individual trajectories. Instead, trajectories should be grouped into a few broad classes, depending on their designated properties, as we will illustrate below.

Identifying the start of the retirement process using a scale named “TRANSCOR”

To present data about the kind of multi-state transition process discussed above, the researcher first needs to decide who,

among a sample of potential retirees, has entered the process during a given time period.

Making this decision requires the use of a variety of indicators. Any indicator will be constrained by limitations of the available data. Our work uses the Canadian Longitudinal Survey of Labour and Income Dynamics (SLID), which suffers from a major defect relative to the requirements of a good indicator.

Unlike Wave 1 of the University of Michigan's Health and Retirement Survey (HRS), SLID provides no direct questions about retirement plans or intentions.⁷ Thus it is necessary to devise an indirect procedure to make inferences concerning who was in transition to retirement during a designated time period.

Other researchers that have faced this problem have used one or two variables to identify who has begun the retirement process (see Gustman and Steinmeier 1984, Honig and Hanoch 1985, Ruhm 1990a, Ruhm 1990b, Quinn and Kozy 1996). However, an attempt to define "transition to retirement" operationally brings one to the conclusion that a larger set of dimensions needs to be taken into account, as done in this appendix.

Using a set of partial indicators suggested in the literature and keeping in mind limitations of the SLID data such as the key one cited above, we developed a multi-dimensional "retirement transition scale" to measure the degree of a person's involvement in a transition to retirement. We hypothesize that the higher a person's scale score, the greater is the probability that the person is engaged in transition to retirement.

Components of the scale

A detailed definition of this multi-dimensional scale, which we have named "TRANSCOR", follows. We begin with a list of factors that the scale takes into account.

7. In subsequent waves of the HRS, questions about retirement plans and intentions were not repeated. Thus researchers starting with any HRS wave other than Wave 1 have the same limitation we are now identifying in SLID.

- (1) Receipt of retirement-related income, e.g. work-related pension income (see Han and Moen 1999:199, Smeeding and Quinn 1997).
- (2) Departure from the labor market – in North American terminology, the person moves from either employment or unemployment to being outside the labor force market (see, e.g., Gendell 2001, Gunderson 1980, Habtu 2003, Knuth 2002, Meghir and Whitehouse 1997, Oswald 1999, Taylor and Urwin 1999, Vanderhart 2003).
- (3) Change in the job of the person from her *career* job to another kind of job, including self employment (see Quinn and Kozy 1996:363, Quinn, Burkhauser and Myers 1990, Ruhm 1990a:100).
- (4) Reduction in hours of paid work, including reduction of hours in the same job (see Blau 1994, Gustman and Steinmeier 1984:403-415, Honig and Reimers 1987).
- (5) Reduction in earnings beyond that caused by job change or fewer hours of work (Honig and Hanoch 1985:24).
- (6) Onset of long-term unemployment after job loss among older workers (see Blau 1994, Guillemard 1995, Knuth 2002, Manning and Burdett 1996, Meghir and Whitehouse 1997, Oswald 1999, Pedersen and Westergaard-Nielsen 1993, Rowe and Nguyen 2003, VandenHeuvel 1999).
- (7) Encounter with a major health or other life event, if associated with a nearby (in time) change in a relevant aspect of employment status (see Crossley, Schelhorn and Au 2003, Honig and Hanoch 1985, Marshall 2003, Marshall and Clarke 1997).
- (8) Change in the place of residence, if associated with a nearby change in a relevant aspect of employment status.

The design of TRANSCOR

As stated above, the design of TRANSCOR has had to respect the limitations of the SLID data. Thus TRANSCOR relies entirely upon objective behavior of respondents, recognizing that often the meaning of a behavior is accurately ascertained only by asking questions about it.

Some TRANSCOR components (called “scale items” in psychometrics, where scaling methodology is most highly developed) measure change between two consecutive years because SLID provides only annual observations for the variable in question. In what follows, the first year is called, “Base Year”, and the second, “Year Two”. Our aim is to identify those who started their transitions to retirement between the beginning of Base Year and the end of Year Two.

A person’s retirement transition scale score (her TRANSCOR value) will be the sum of the scores accorded to that person in the eight tests named below. The tests are labelled from S_1 to S_8 . The value assigned to a test will be called its “weight”.

The weights assigned initially to scale components. At first, the weights were assigned to the components based solely on judgment (informed by literature review) concerning their order of importance. The weights were later on adjusted, so that they would better reflect the relative statistical importance of the components in predicting who would have retired by the end of the six years of observation. Also, the sensitivity of the main findings to moderate changes in the weights was examined. Below is the list of the tests (the scale components) and the final weights assigned.

$$TRANSCOR = \sum_{i=1}^8 S_i \dots\dots\dots(1)$$

where

$S_1 =$ (a) or (b) or (c)

(a) 4.0 if the person *began* receiving income from a stream normally associated with retirement from paid work between the beginning of the first year of observation (Base Year) and the end of the second year (Year Two);
or

(b) 3.0 if the person received in Base Year any of the kinds of income identified above and had a job in the first quarter of Base Year, or

(c) 0 if neither (a) nor (b) is true.

$S_2 = (a) \text{ or } (b) \text{ or } (c)$

- (a) 0.8 if the person was outside the labor market at the end of Year Two but was in the labor market at the beginning of Base Year, and was *either* disabled during Base Year or Year Two, *or* had encountered a major health or other life event during Base Year or Year Two, and was outside the labor market throughout another month during Base Year and Year Two; or
- (b) 0.1 if the person was outside of the labor market at the end of Year Two but was in the labor market at the beginning of Base Year, and was *either* disabled during Base Year or Year Two *or* had encountered a major health or other life event during Base Year or Year Two, and was in the labor market in all other months during Base Year and Year Two; or
- (c) 0 if neither (a) nor (b) is true

$S_3 = (a) \text{ or } (b) \text{ or } (c)$

- (a) 2.5 if the person was outside of the labor market at the end of Year Two but was in the labor market at the beginning of Base Year, and was *neither* disabled during Base Year or Year Two *nor* had encountered a major health or other life event during Base Year or Year Two and was outside the labor market throughout another month during Base Year and Year Two; or
- (b) 0.3 if the person was outside the labor market at the end of Year Two but was in the labor market at the beginning of Base Year, and was *neither* disabled during Base Year or Year Two *nor* had encountered a major health or other life event during Base Year or Year Two and was in the labor market in all other months during Base Year and Year Two; or
- (c) 0 if neither (a) nor (b) is true.

$S_4 = (a) \text{ or } (b)$

- (a) 0.3 if the person ended her job of longest duration during either Base Year or Year Two and moved to another job, or changed jobs (moved from one employer to another, or from employment to self-employment or vice-versa)

during the same period, and if the job of longest duration had been held continuously for at least 10 years in the case of a man or five years in the case of a woman.

(Women are assigned this weight with only five years because of their greater tendency to have work histories marked by job interruptions); or

(b) 0 if (a) is not true.

$S_5 = (a) \text{ or } (b)$

(a) 0.1 if the person reduced hours of paid work from full-time levels to part-time levels, or by at least 40% while still working full time, at some time during Base Year and Year Two (job change is not required for eligibility to get this score); or

(b) 0 if (a) is not true.

$S_6 = (a) \text{ or } (b) \text{ or } (c)$

(a) 1.0 if the person had an earnings reduction of 50% between Base Year annual earnings and Year Two annual earnings and had no positive score on any of items S_2 , S_3 , S_4 or S_5 above; or

(b) 0.8 if the person had earnings reduction of 50% between Base Year annual earnings and Year Two annual earnings and had a positive score on any of the items S_2 , S_3 , S_4 or S_5 above.

(c) 0 if (a) is not true.

$S_7 = (a) \text{ or } (b)$

(a) 0.3, if the person was employed in the first month of Base Year, and at the end of Year Two she had been unemployed for six consecutive months; or

(b) 0 if (a) is not true.

$S_8 = (a) \text{ or } (b)$

(a) 0.3 if the person changed residence during Base Year or Year Two (although the principles stated in Appendix A imply that residence change needs to be associated with some other condition more directly indicative of transition to retirement, the scale weight given to this variable is so low that it was decided to program the rule as if only

residence change matters); or
(b) if (a) is not true.

One of these tests merits further comment here. Test S_1 refers to the receipt of income from a stream normally associated with retirement from paid work. Drawing upon the SLID database, the income streams in question are private pension income, Canada or Quebec Pension income, and RRSP withdrawals. However, some CPP/QPP payments may be received for reasons other than retirement. Also, RRSP withdrawal need not be for retirement purposes.

Condition (b) of test S_1 violates our basic principle of focusing on identifying those that began their transitions after the start of Base Year. However, it is reasonable to the extent that it allows us to assign a non-zero score to those who actually began receiving such income during that year. We increase the chances of identifying that subset by requiring that the person had a job in the first quarter of Base Year. There is no SLID variable that identifies the month when the person began receiving the kinds of income just cited.

Distribution of the scale levels

Table A.1 presents unweighted distributions of TRANSCOR (the TRANSCOR value of zero is a lower bound; but the maximum of 7.7 is simply the highest score observed in the two samples). We hypothesize that the distribution of TRANSCOR is a proxy for an underlying distribution of the probability of being engaged in transition to retirement in 1993-1994 and 1996-1997, for the two cohorts respectively. Given this hypothesis, the higher the value of TRANSCOR, the more likely it was that the person had initiated her transition to retirement.

Thus, in order to judge who, among the SLID respondents in Panel Two (1996 cohort), had begun their transitions to retirement during the 1996 to 1997 period, it seemed reasonable to chose a threshold within the range of TRANSCOR values. Persons with TRANSCOR values above that threshold were judged to have begun their transitions to retirement during the 1996 to 1997 period. We initially set the TRANSCOR threshold at 3.3; but, under

pressure from unduly small sample sizes for some key population subgroups, the threshold was lowered to 3.0, provided that persons be in the labor force in the first quarter of the two-year period with respect to which their TRANSCOR ratings are computed.

Table A.1: Distribution of cohort members among levels of TRANSCOR, persons aged 45 to 64 in 1993 and 1996 respectively, Canada, 1993 to 1994 and 1996 to 1997 (Unweighted)

TRANSCOR	Cohort One		Cohort Two	
	Number	%	Number	%
0	2629	56.7	2818	54.3
0.1 to 2.49	774	16.7	1048	20.2
2.5 to 2.99	166	3.6	172	3.3
3.0 to 3.29	451	9.7	447	8.6
3.30 to 4.9	391	8.4	456	8.8
5.0 to 5.9	90	1.9	83	1.6
6.0 to 6.9	90	1.9	114	2.2
7.0 or more	45	1.0	56	1.1
Total	4636	100	5194	100

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

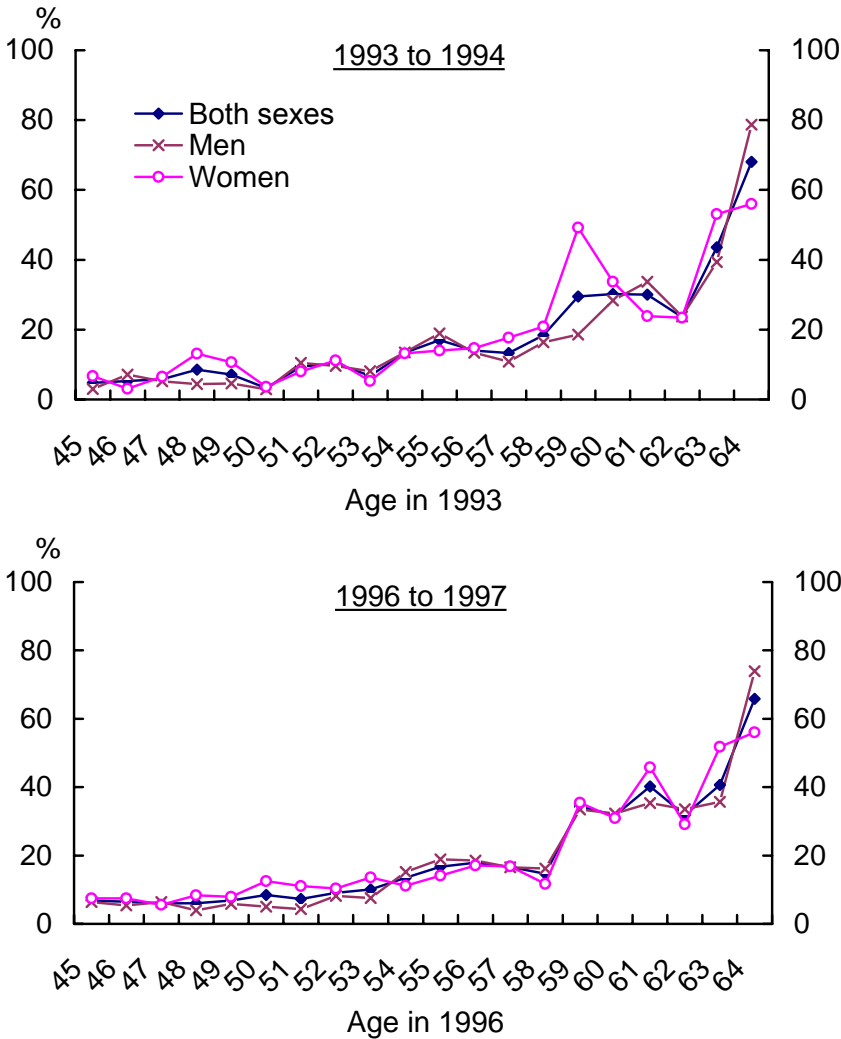
Since those with ages close to 45 in 1996 were very unlikely to have begun their work-to-retirement transitions during 1996 to 1997, it is important to show the percentages of persons above the TRANSCOR threshold by age. Chart A.1 does so, and identifies men and women separately. For both sexes, the percentage found to be in transition to retirement ranges from under 10% at age 45 to over 65% at age 64.

A crude check on the reasonableness of our classification of the sample of those that began their transitions during 1996 to 1997 and those that had not done so, is available by way of *roughly* comparable data from two other surveys. Charts A.2 and A.3 present data from the Health and Retirement Survey (HRS) of the USA and the General Social Survey (GSS) of Canada.

Based on Wave One (1992) of the HRS, Chart A.2 shows percentages by age and sex of those who reported either that they were partially retired or that they expected to retire within the next year. These two groups would include most or all of those who were in transition to final withdrawal from the labor force (the definition

Chart A.1: Percentage who started their transitions to retirement during the 1993 to 1994 and 1996 to 1997 periods, by sex and age, Canada

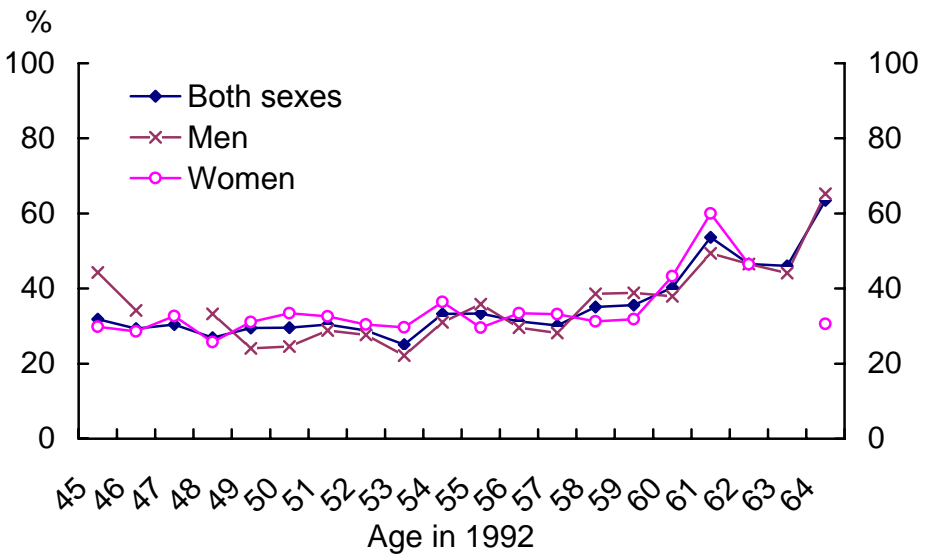
(Only persons who were in the labour force in the first quarter of 1993 and 1996 respectively)



Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

Chart A.2: Percentage who were partially retired or will retire within the next year, United States, 1992

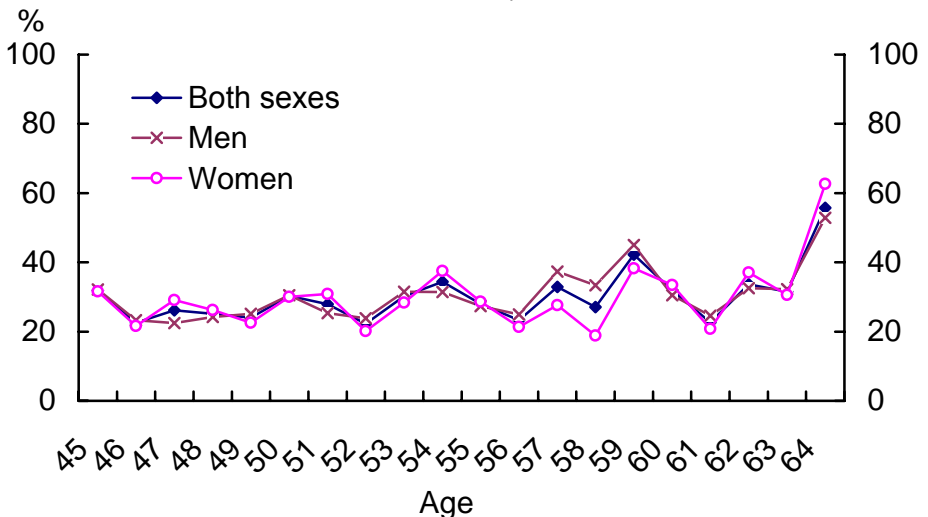
(Subjective data based responses of persons who had a job at the survey date)



Source: Health and Retirement Survey, Wave 1, University of Michigan, USA.

Chart A.3: Percentage who plan to retire within the next year or who have changed the nature of their work in planning for retirement, Canada, 2000

(Subjective data for those who said they had not retired, and who worked for at least 11 months in 1999)



Source: Statistics Canada, General Social Survey, Cycle 16, 2002. Statistics Canada, Catalogue No. 75-512-XIE

of “retirement” used in this paper) at the time they were asked the questions in Wave One of the HRS.

Chart A.3 is based on a battery of retirement planning questions that were asked of persons who said they were not retired in the 2002 round of the Canadian General Social Survey. It shows percentages for those who reported either that they had changed the nature of their work as part of their plans for retirement or that they planned to retire within the next year. These two groups would include most or all of those who were in transition to final withdrawal from the labor force at the time they were asked the questions in the 2002 GSS.

Clearly, no direct comparisons of numbers should be pursued among Charts A.1 to A.3 for several reasons. These charts come from quite different policy and cultural environments; they involve different survey questions asked in different years. Unlike Chart A.1, Charts A.2 and A.3 show results of subjective responses about retirement plans or intentions in a context where each respondent was left free to define what “retirement” meant to her.

Thus we should only ask whether the “broad drift” of the curves in Charts A.2 and A.3 suggest that the estimates in Chart A.1 are reasonable. All three figures show a prominent upward “spike” at age 64, and a generally flat trend up to the mid-50s in age. The HRS agrees with the estimates in Chart A.1 in showing a distinct upward turn in the curve below but near age 60, while that is seen in the GSS curves only in the 60s.

Despite the major differences among the data sources, the orders of magnitudes of the percentages are broadly similar across all three figures at ages 62 to 64. This is in sharp contrast to the younger ages where the percentages for the GSS and HRS are very much higher than those of the estimates in Chart A.1. This divergence at the younger ages could be a result of the fact that the HRS and GSS respondents often defined “retirement” as leaving their perceived career jobs (often to go to other kinds of jobs); whereas the SLID-based estimates focus on departure from the paid labor market and receiving retirement-related income.

In summary, our concept of the work-to-retirement transition requires, for its application in statistical analyses, an identification of who has entered the transitional process within a given time period. This is done most easily when survey respondents are asked about their retirement-related expectations, plans and activities; although this subjective information needs to be combined with observations of their behavior. However, SLID has no such questions, and consequently a multi-dimensional index that relies entirely upon observations of behavior is unavoidable.

Mapping trajectories of work-to-retirement transitions

Since a trajectory of transition to retirement is a *sequence* comprising a number of changes among the members of a defined class of “positions”, an initial task in identifying trajectories is to define the list of positions. For this study the positions are defined in terms of (a) labor force states occupied throughout a quarter (three consecutive months) and (b) changes in labor force states from one month to another within a quarter.⁸ The adopted definitions are

8. Since the list that follows implies extensive manipulation of monthly data, it is worthwhile to comment on why there is so much focus on the time interval of one quarter. We felt that where one wishes to refer to a respondent holding down a new job, or to the person leaving the labor market, the duration of stay in either of these two states should be long enough to prompt an analyst to think that the respondent was on the way to settling into the state. One month seemed too short a period, and three months seemed more useful. It is recognized that these are only judgments.

such that in any quarter a person may be in one and only one of the following positions.

1. Employed full time and with no job change throughout the quarter⁹.
2. Employed part-time and with no job change throughout the quarter.
3. Employed in the first and last month of a quarter, and had a voluntary job change during the quarter.
4. Employed in the first and last month of a quarter and had an involuntary job change during the quarter.
5. Unemployed throughout the quarter.
6. Unemployed or outside of the labor force in the first month of the quarter but employed in the last month.
7. Employed in the first month of the quarter but unemployed in the last month
8. In the labor force in the first month of the quarter but outside the labor force in the last month.
9. Not in the labor force in all three months of the quarter, and receiving some kind of pension or old-age security income during the current year (the income conditions are added here to increase the chances that a person in this position is on the way to retirement).
0. Unclassified.

Thus our study defines positions in terms of different aspects of the respondent's orientation to the labor market. It is herewith acknowledged that in certain studies, key life events and changes in family responsibilities should be considered in mapping trajectories. The list of positions shown here was developed for a study where it was desired to include key life events and changes in family responsibilities among the explanatory variables that help to explain the changes of positions defined solely in terms of labor-market-related behavior.

9. The number that precedes each position described in this list is used below in describing trajectories.

It is also important to note that although trajectories of transition to retirement are defined relative to the last four of the six-year observation period (thus a total of 16 quarters) for SLID Panel Two, there is no necessary restriction of trajectory measurement and mapping to 16 quarters. We have already computed 24-quarter trajectories that cover all six years. These are useful when one needs to know who actually began closing their trajectories — concept defined below — during the 1996 to 1997 period, as was the case in Chapter 13 above. However, all text below refers to the 16-quarter trajectories.

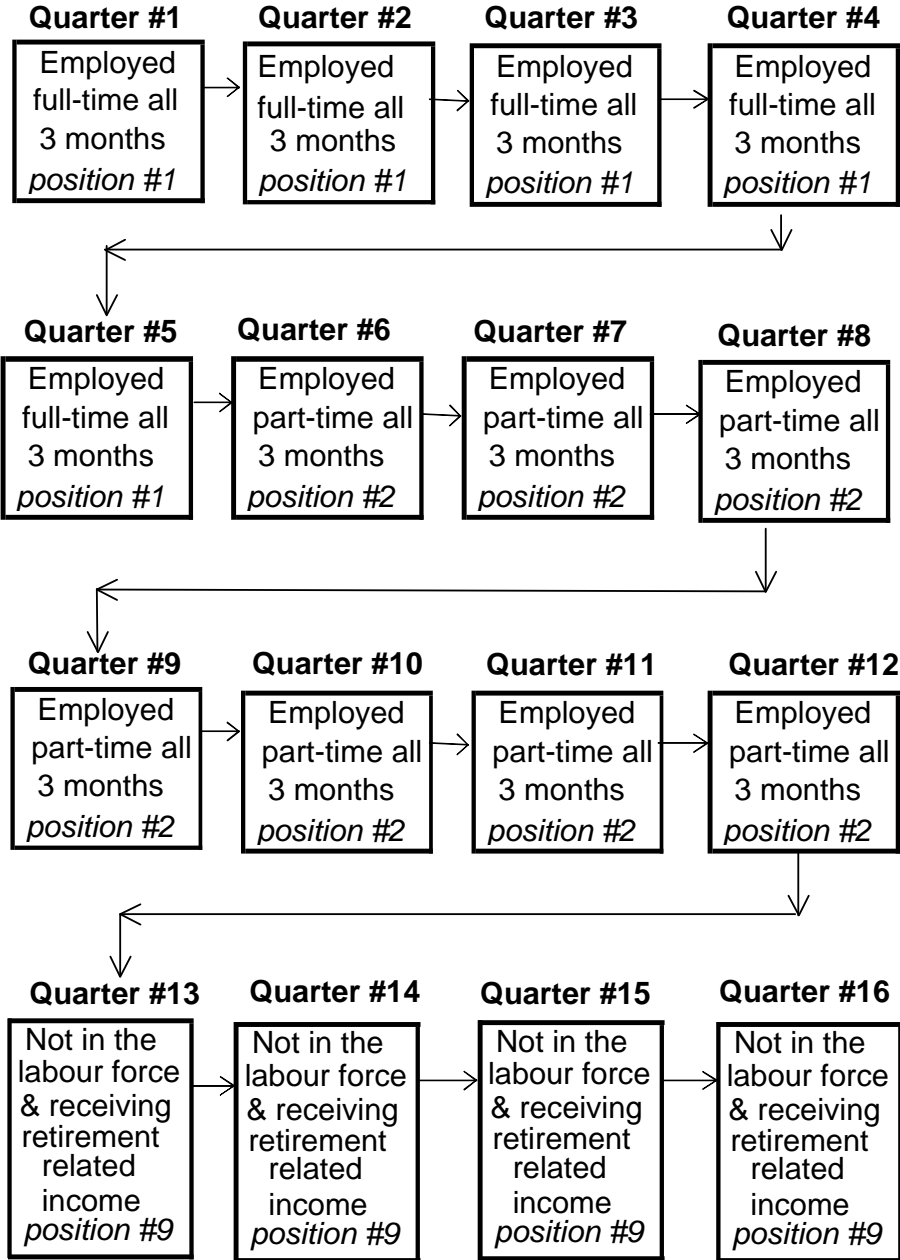
In each of the 16 quarters that comprise the last four years of observation, a respondent who remained in the survey throughout the four years is assigned to one of the ten positions listed above, based on her attributes.¹⁰ *This sequence of 16 positions is the operationally defined trajectory of transition to retirement for that respondent during those four years.* In their study of persons' career trajectories, Han and Moen (1999) also used a sequence of code numbers to map a trajectory. Charts A.4 and A.5 illustrate two of the trajectories found among the respondents judged to be in transition to retirement as of 1996-1997.

The trajectory in Chart A.4 comprises the following sequence of 16 code numbers: **[1111222299999999]**. Each code number refers to the respondent's position in a single quarter, and the number is interpreted by referring to the list of positions provided above. This remark will now be clarified by reference to the more complex trajectory in Chart A.5.

This trajectory comprises the following sequence of codes **[9656145155675555]**. During the first quarter of 1998, the person was out of the labor force throughout the quarter, and received some kind of retirement-related income during 1998 (position #9). During the first month of the second quarter, she was unemployed but, in the last month of this quarter, was employed (position #6). The person then became unemployed during all months of the third

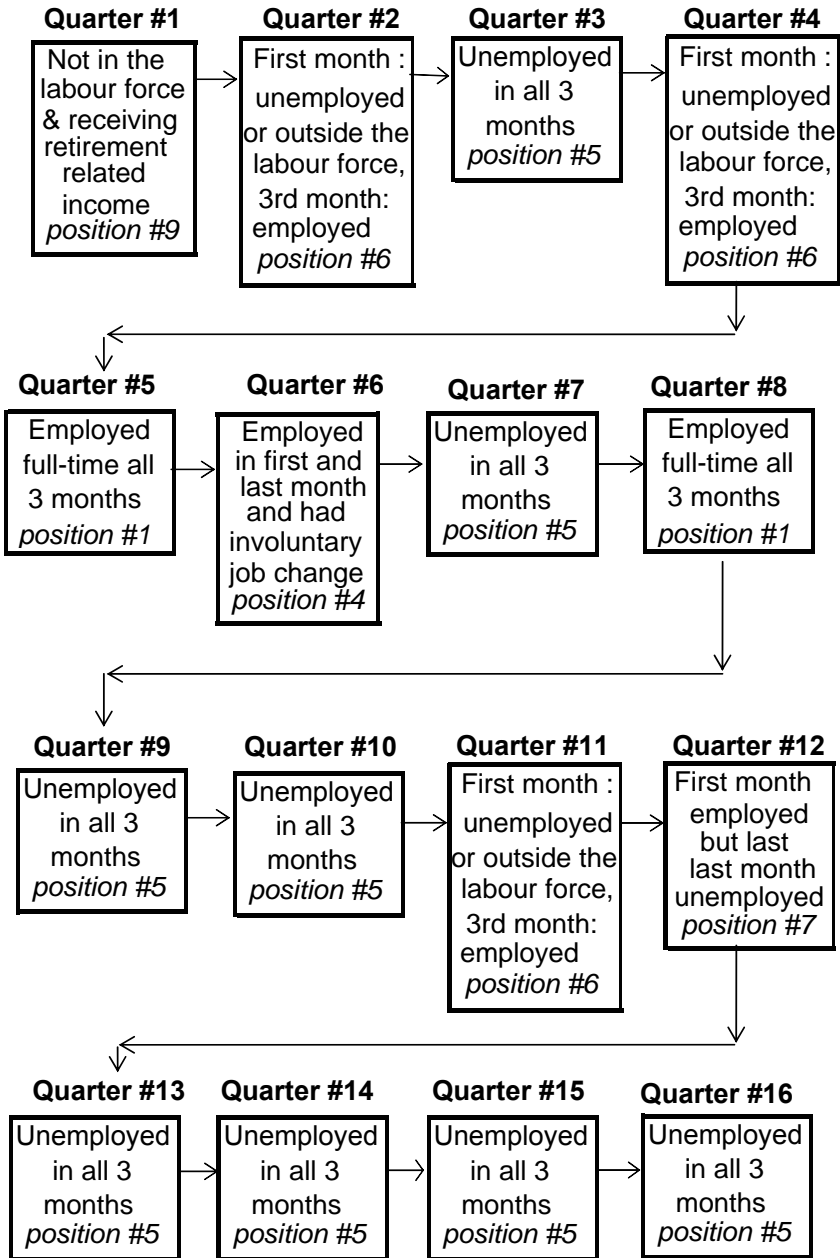
10. Sixty-three of 709 respondents in the 1996 cohort who were judged to be in transition were lost from the survey (due to death, for example) over the four years.

Chart A.4: Example of a simple trajectory: 1111122222229999¹



1. This string of code numbers is the statistical representation of the trajectory.

Chart A.5: Example of a complex trajectory: 9656145155675555



quarter (position #5). During the first month of the fourth quarter, she was unemployed but, in the last month of this quarter, was employed (position #6). In the fifth quarter she was employed full time throughout the quarter (position #1). In the sixth quarter the person was employed in the first and last months and had an involuntary job change in the quarter (position #4). The person then became unemployed throughout the seventh quarter (position #5). However, throughout the eighth quarter the person had the same full-time job (position #1). In the ninth and the tenth quarters the person was again unemployed throughout the quarters (position #5). In the eleventh quarter the person was unemployed or was outside the labor force in the first month but was employed in the last month (position #6). In the twelfth quarter the person was employed in the first month but became unemployed in the last month (position #7). From the thirteenth to the sixteenth quarters the person was unemployed in all the months (position #5).

Charts A.4 and A.5 are presented here as concrete examples of the notion of trajectory of transitions to retirement, which was defined as an abstract concept earlier. Table A.2 illustrates in detail many trajectories from the 1996 cohort. All the trajectories have a certain feature in common. They represent the classic retirement transition pattern – a direct move (between two consecutive quarters) from the same full-time job held during three consecutive months into a position where the person was outside the labor market in the next three consecutive months and was also in receipt of some kind of retirement-related income. Furthermore, she did not return to the labor market up to the end of the observation period (December 2001).

Chart A.6 shows the age pattern of the prevalence of this class of trajectories among the members of the SLID cohort of 1996. Chart A.6 shows that the classic pattern of transition from work to retirement was most likely to be found in the 55 to 59 age group, and that the magnitude of concentration in this age group was notably higher for women than for men. The second highest probability of using this pattern is found in the 60 to 64 age group.

All the trajectories listed in Table A.2 are said to be “closed” because for six consecutive months at the end of the six years

Table A.2: Selected trajectories found among members of the 1996 cohort, Canada, 1998 to 2001

(These trajectories include a move from a full-time job to outside of the labour force in two consecutive quarters, with no return to the labour force up to the last period of observation)

Trajectory	Relative frequency ¹	Quarter when closure ² began
1111199999999999	0.3%	7
1119999999999999	0.3%	5
2221111999999999	0.1%	9
1101119999999999	0.3%	7
1111111111111119	0.2%	15
1111111111111199	0.2%	14
1111111111111999	0.1%	13
1111111111999999	0.3%	11
1111111199999999	0.3%	9
1111199999999999	0.0%	7
1111199999999999	0.2%	6
1111999999999999	0.1%	5
1199999999999999	0.1%	3
1561555519999999	0.2%	10
2222111111111999	0.1%	13
222222221111119	0.1%	15
5561999999999999	0.0%	5
5617861811119999	0.0%	13
9611111199999999	0.1%	9
Sum of relative frequencies	3.0%	
Percentage of all trajectories ³	5.6%	

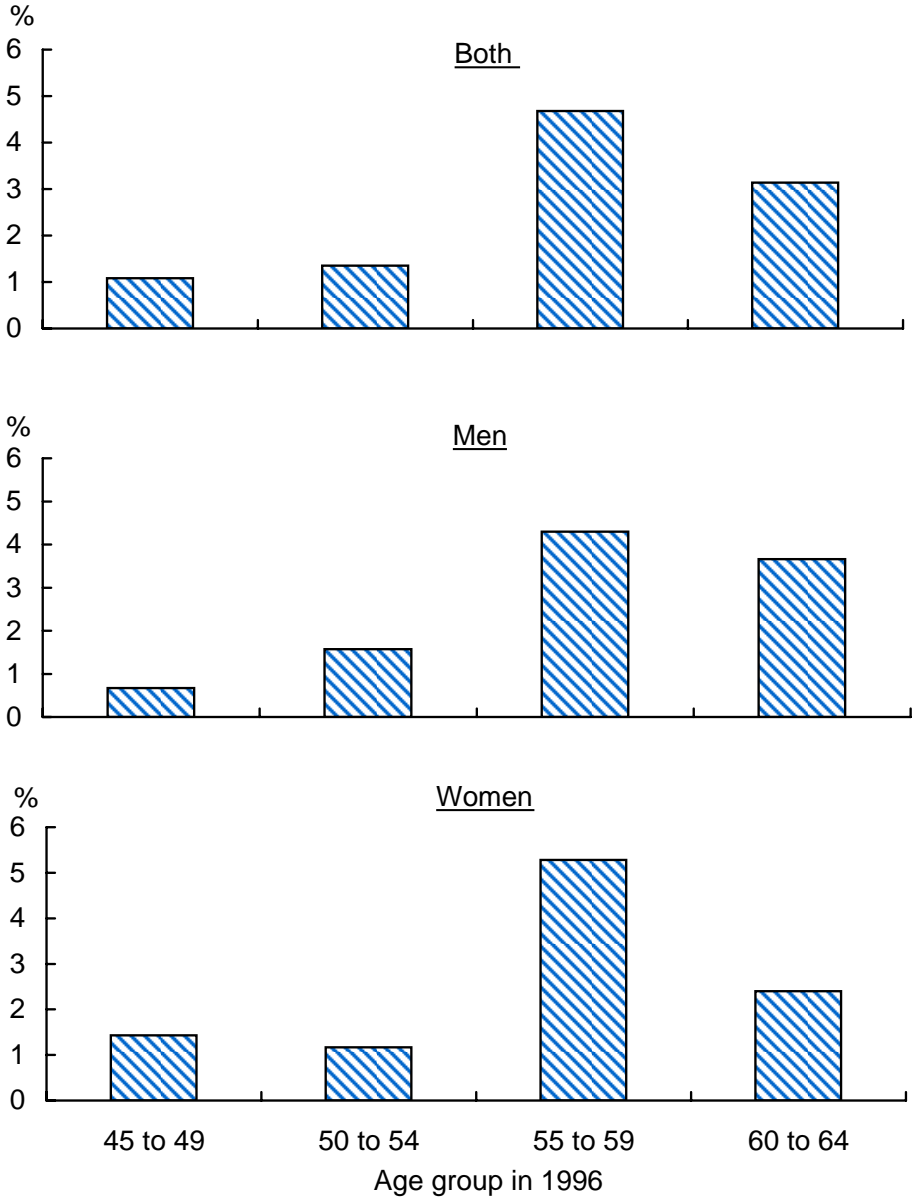
1. Percentage of all persons, aged 45 to 64 in 1996, judged to have started their transitions during 1996 to 1997.

2. A trajectory is closed when it has an uninterrupted string of code "9" ending in "99" in the last two quarters (Q15 and Q16).

3. This is the total of all trajectories listed above (19) divided by the grand total of unique trajectories (342) found for the population described in note (1), expressed as a percentage.

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

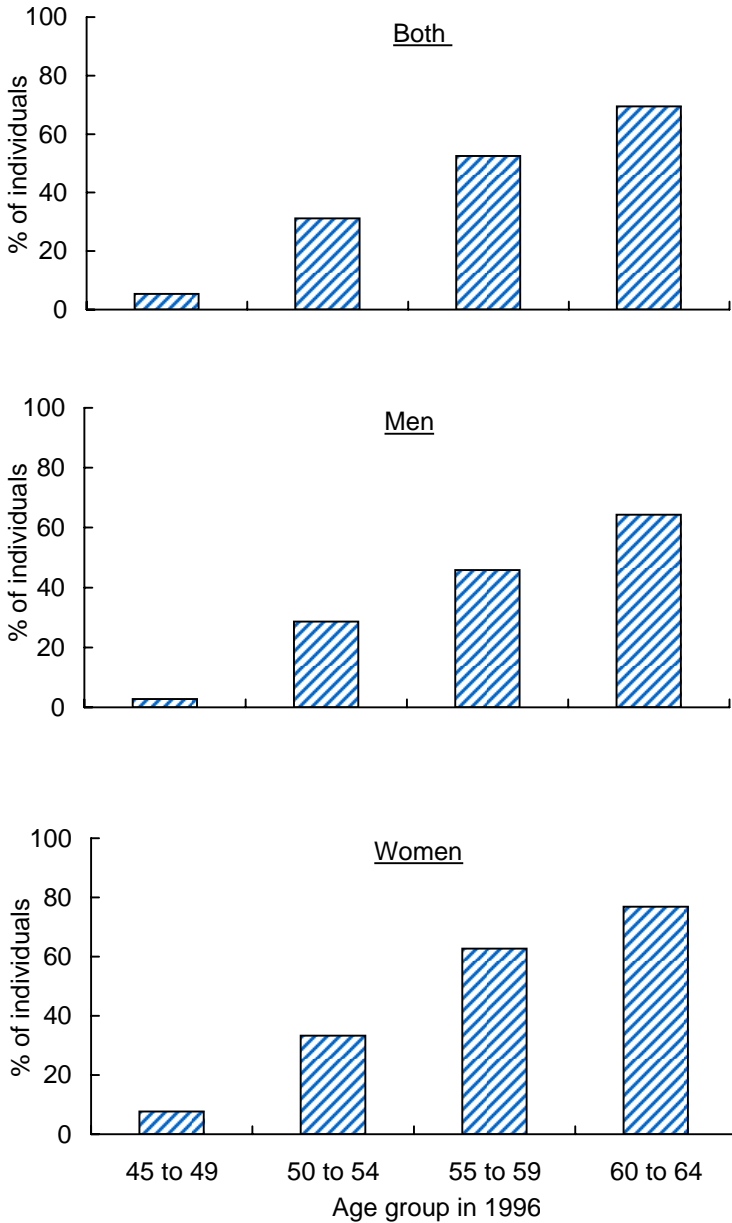
Chart A.6: Percentages with trajectories that represent the classic pattern¹ of work-to-retirement transition, among those who began their transitions to retirement during the 1996 to 1997, by age and sex, Canada, 1998 to 2001



1. Defined in the text.

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

Chart A.7: Percentage with closed trajectories¹ among those who began their transitions to retirement during 1996 to 1997, by age and sex, Canada, 1998 to 2001



1. A trajectory is closed when it has an uninterrupted string of code "9" ending in "99" in the last two quarters (Q15 and Q16).

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

of observation, the persons were outside the labor market and in receipt of some kind of retirement-related income. However, some of these persons may have returned to the labor market after those six months (i.e., after December 2001); with the probability of doing so varying inversely with age (Quinn, Burkhauser and Myers 1990: ch. 5).

Due to the wide age range covered in the data, a substantial percentage of trajectories are unclosed at the end of the six years. Chart A.7 shows the proportion of closed trajectories according to age at the beginning of the observation period.

As one might expect, Chart A.7 shows a strong upward trend in the percentage with closed trajectories as age in 1996 increases from 45 to 49 to 60 to 64. Chart A.7 shows that a very small percentage (5.4% for both sexes) of individuals in 45 to 49 age group had closed trajectories by the end of the last year of observation in 2001. This is in sharp contrast to a figure close to 70% for the 60 to 64 age group. The figure for the 45 to 49 age group illustrates the fact that a great majority either had not left the labor market up to the end of 2001 or had come back to the labor force after having left it.

In introducing the concept of closure of a trajectory, we have begun to move toward procedures whereby trajectories could be classified into a small set of meaningful classes for analysis. Chapter 13 has used a stricter definition of closure in developing its classification of trajectories into six broad groups. How to classify trajectories is the topic to which we now turn.

Classifying trajectories

In his 1995 review of the state of the art of classifying trajectories in various fields of research, notably that of personal life histories, Abbot (1995) cited two approaches. Within each approach a variety of specific methods is in use (see also Abbot and Tsay 2000). The first approach is based upon specifying an overall measure of distance or similarity between two trajectories. Using pair-wise comparisons, groups are then generated so

as to maximize the within group similarity and between-group differences. The term “optimal matching” is now used to refer to the techniques that use this approach.

The second approach relies upon sets of rules for grouping that are specified by experts, and it is often called “judgment-based grouping” or “rules-based grouping”. A notable feature of rules-based grouping is that the same set of trajectories will be grouped in different ways, depending upon the rules that are adopted. Blau (1994), Quinn, Burkhauser and Myers (1990), and Gustman and Steinmeier (2000) use rules-based rules to generate their groupings of trajectories of work-to-retirement transitions. In dealing with career trajectories, Han and Moen (1999) used a combination of optimal matching and rules-based grouping.

Our opinion is that the results of the grouping trajectories of transitions to retirement should facilitate research focused on major matters of public-policy concern that involve later-life transitions involving the labor market, changes in health and functional capacity, shifting family responsibilities and standard of living. A focus upon such concerns tends to lead to considerable priority for rules based grouping.

Concerns expressed in the scientific and policy literature about retirement include the following:

- The progressive abandonment of the classic pattern of going straight from a career job into retirement
- The influence and relative importance of government policies in stimulating decisions to seek early retirement
- Gradual retirement, where people leave their career jobs and then move to part-time or full-time bridge jobs before finally exiting the labor market
- Patterns of retirement by older workers who are forced out of their jobs
- Patterns of re-entry to the labor market by persons who left it in order to “retire”
- Patterns of transition to retirement by those looking for a job and not finding it (especially the long-term unemployed among older workers)
- Gender differences in patterns of transition to retirement followed by men and women

- Patterns of transition to retirement among persons that never had a career job as this is usually defined (a job held for at least ten years and departed in connection with making the transition to retirement).

Such a list of concerns suggests that work-to-retirement trajectories have a variety of properties that can be defined conceptually and operationally so as to form bases for classifying them. A list of eight possible properties of trajectories follows. They are called:

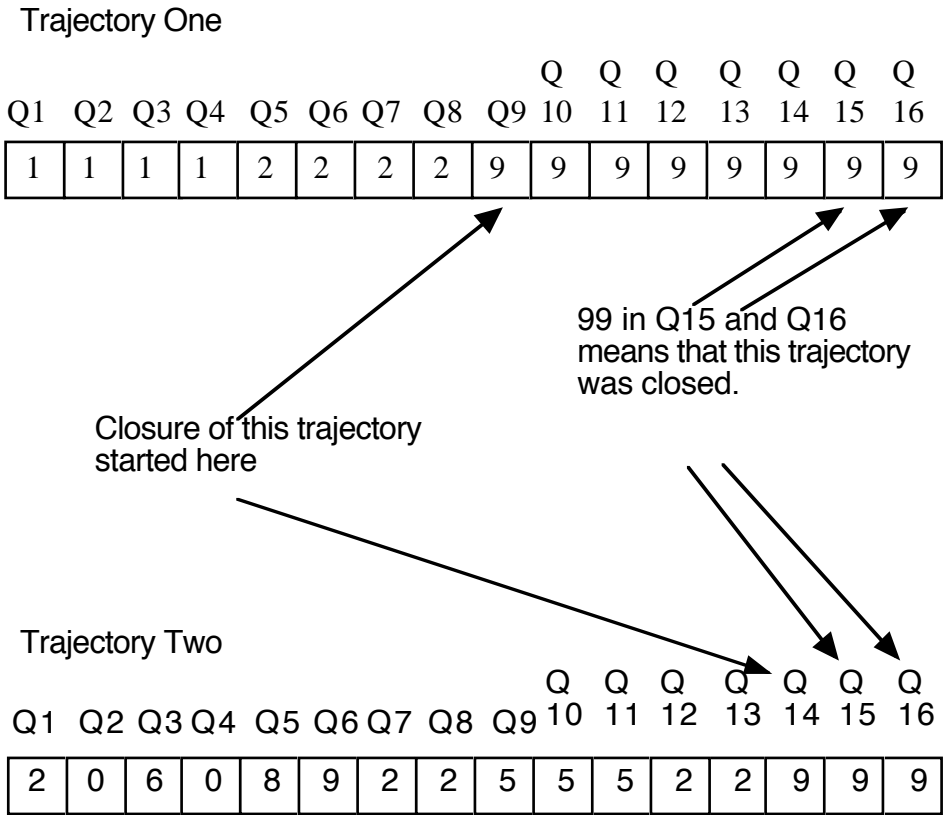
- Speed of closure of trajectory
- Presence of indications of enhanced market-based vulnerability
- Presence of indications of enhanced total vulnerability
- Instability of market-related status
- Presence of flexibility among options for transition to retirement
- Propensity for bridging
- Propensity for returning to the labor market after departure
- Propensity to un-retire.

Speed of closure of trajectory

A person is said to have closed her trajectory when (a) she has left the labor market and has been in receipt of some form of retirement-related income for at least six-consecutive months, and (b) following those six months she did not return to the labor market up to the end of the period of observation. As already suggested in an earlier comment about Table A.2 (which presents many closed trajectories that involve the classic pattern of retirement), in terms of the sequence of code numbers used to define a trajectory, a closed trajectory has a string of uninterrupted code 9s including “99” in the last two of the 16 quarters over which trajectories are measured. See Figure A.2 for an illustration.

Figure A.2 is a schematic diagram designed to illustrate the concept of speed of closure of a closed trajectory. Trajectory One began closing in the ninth quarter, whereas closure began in fourteenth quarter for Trajectory Two. Trajectory One closed faster

Figure A.2: Illustration to clarify “closure” and “speed of closure” of a trajectory



Legend:

- 1 = full-time job in all 3 months
- 2 = part-time job in all 3 months
- 5 = unemployed in all 3 months
- 9 = outside the labour force in all 3 months, and receiving some kind of retirement-related income

Q1 = January to March 1998

Q2 = April to June 1998

...

Q16 = September to December 2001.

than Trajectory Two. Generally, the sooner the person begins the period of uninterrupted departure from the labor force the faster is her speed of closure.

However, those classified as having the fastest speed may in some cases represent persons that had left the labor market before the first quarter of 1996 – in the case of our data their period of uninterrupted departure from the labor market began before the start of 1996.

Information presented in Chapter 13 indicates that the size of this bias may be negligible, however. For that chapter, the definition of TRANSCOR was modified so that points could be earned due to receiving retirement-related income in year T only if that kind of income was zero in year $T - 1$. Despite this restriction, the distribution of speed of closure still had a strong local mode in the first few quarters after respondents were judged to have begun making the transition to retirement.

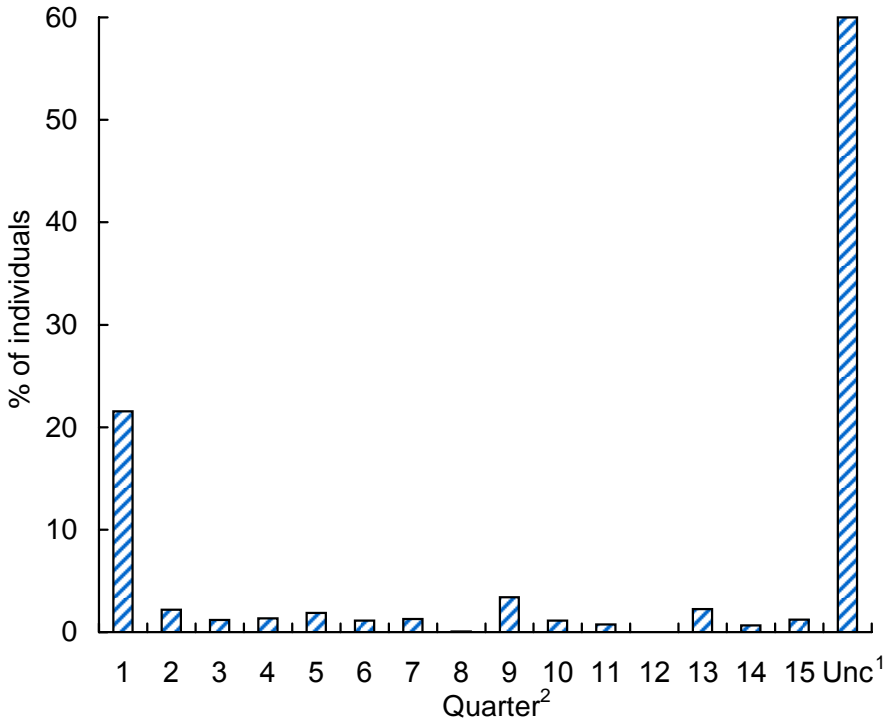
Using the concepts just presented, we can classify trajectories according to the speed of closure, as Chart A.8 illustrates. The sample for this chart is limited to those who began their transitions during the 1996 to 1997 period, and who were wage and salary earners in *both* 1996 and 1997.¹¹ In this chart scores of distinct trajectories are grouped into sixteen classes of speed of closure. The vast majority of trajectories were either closed in or before the first quarter of 1998 or were unclosed at the end of 2001. Three small local modes in the distribution are located at the first quarter of each year from 1999, 2000 and 2001 (quarters 5, 9 and 13, respectively).

Presence of indications of enhanced market-based vulnerability

In this text “vulnerability” means *risk* of loss, or setback or damage in or to a desired state of affairs or a plan; where the risk arises from an event or an experience. Here we are referring to risk of setback or damage to whatever plans or arrangements the

11. By restricting the sample to those that were paid employees in both years, we greatly reduce the potential bias from accidentally including persons that in fact began their transitions before 1996.

Chart A.8: Time pattern of the speed of closure of trajectories for persons who were wage and salary earners in 1996 and 1997, cohort aged 45 to 64 in 1996, Canada, 1998 to 2001
 (Only those who were judged to have started their transitions during 1996 to 1997)



1. "Unc." means unclosed trajectory. A trajectory is closed when it has an uninterrupted string of code "9" ending in "99" in the last two quarters (Q15 and Q16).
2. Quarter 1 is January to March, 1998
 Quarter 2 is April to June, 1998

 Quarter 16 is October to December, 2001.

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

person has made concerning standard of living in retirement. For example, an event such as a job loss can be said to heighten or enhance vulnerability when it is deemed to have *increased the risk* of setback or damage to plans or arrangements of the kinds just cited.

Our index of vulnerability (called “VULSCORE”) focuses on the presence within a trajectory of indications of enhanced market-based vulnerability. The following trajectory positions are pertinent:

Position 4: Employed in the first and last month of a quarter and had an involuntary job change during the quarter.

Position 5: Unemployed throughout the quarter.

Position 6: Unemployed or outside of the labor force in the first month of the quarter but employed in the last month.

Position 7: Employed in the first month of the quarter but unemployed in the last month.

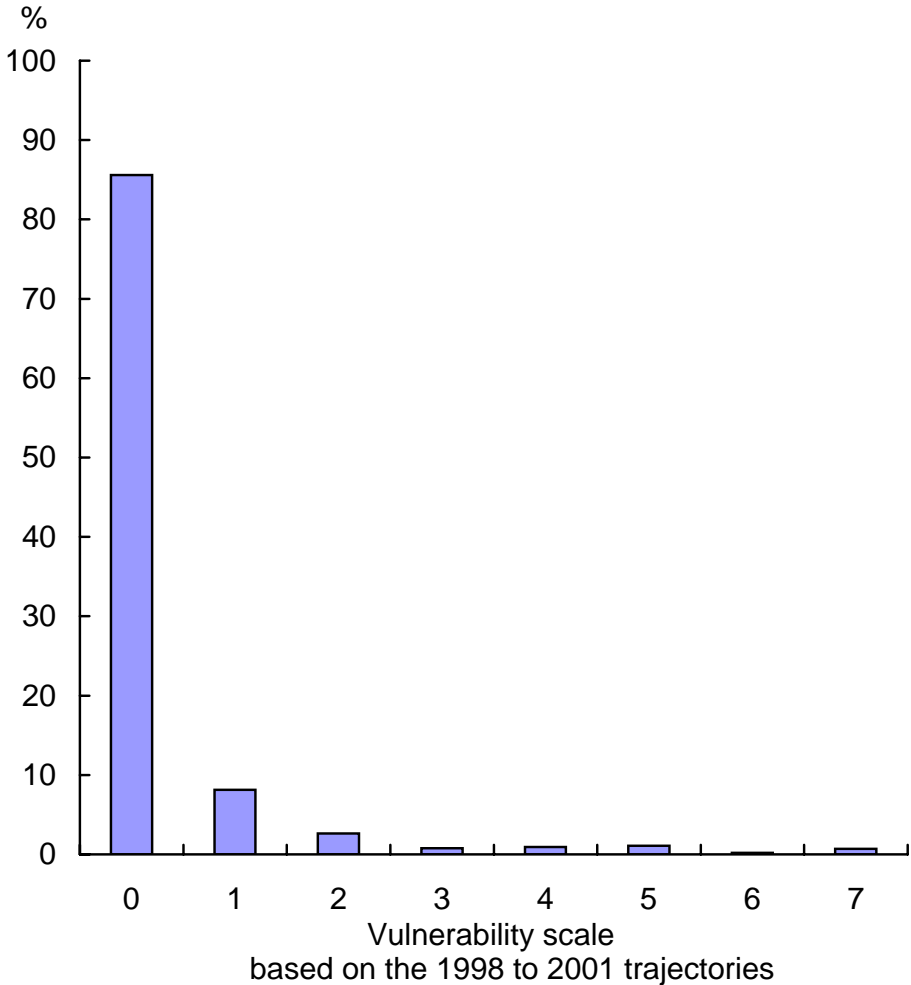
Position 0: Unclassified, and there is an experience of unemployment within the quarter.

Although we have emphasized reliance upon the properties of trajectories (aspects of specific positions such as those listed above), it is important to take into account at least one “auxiliary variable”, in defining levels of our vulnerability scale. This variable involves the business climate within which a person experienced a setback such as unemployment, since the consequences of the unemployment will be worse in a business cycle downturn than in a business cycle upturn. This factor was taken into account by special weighting of the VULSCORE value obtained by someone that experienced unemployment. Details of this idea are presented in Appendix A.3.

Chart A.9 shows how those who began making the transition during the 1996 to 1997 period, and who were employed throughout the last quarter of 1997, were distributed according to multiple levels of the index of vulnerability. The distribution of the sample among scale scores forms a steeply sloped “inverted J” curve. Just over 85% of the sample had a zero score on the

Chart A.9: Distribution of the index of exposure to events that raise the risk of reduction in standard of living, cohort aged 45 to 64 in 1996, Canada, 1998 to 2001

(Persons employed throughout the last quarter of 1997, and who started their transition to retirement during 1996 to 1997)



Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

scale, and this is called the “Low” level in the main text. The vast majority of the remaining persons were focused at scores of 1 or 2 (accounting for about 10% of the sample), on a scale whose maximum is 7.

Presence of indications of enhanced total vulnerability

The expression “total vulnerability” is meant to extend the vulnerability index just discussed so as to take into account certain damaging events that do not involve the labor market. Trajectories with enhanced total vulnerability are trajectories in which there was (a) some enhanced market-based vulnerability (the concept discussed above) and (b) the coincidence of a major life event such as onset of disability or loss of a key family member. No statistical work has yet been done with this property of trajectories.

Instability of market-related status

The greater the number of quarter-to-quarter changes of position within a trajectory, the greater is its index of market-related instability. The measure for this concept simply counts the number of such changes within a trajectory. Much higher than average instability may have negative consequences for certain aspects of quality of life in retirement (see Marshall 2003 and chapter 17 in this book).

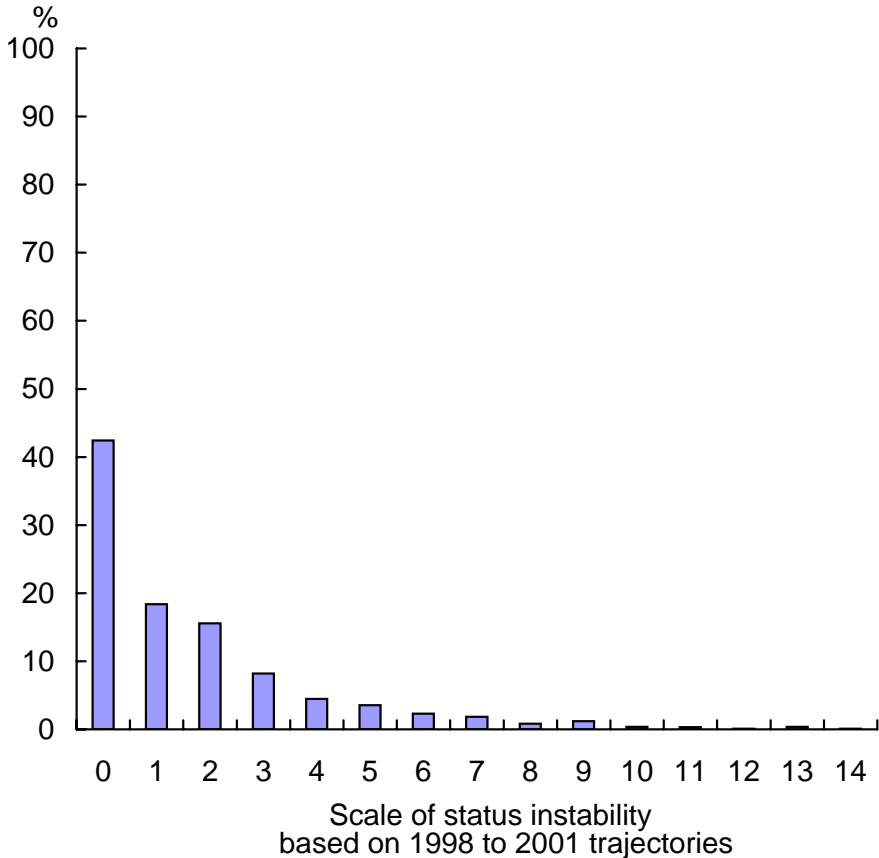
Chart A.10 shows how those who began making the transition during the 1996 to 1997 period were distributed according to multiple levels of the index of instability. The distribution of the sample among scale scores forms a gently sloped “inverted J” curve. Just over 40% of the sample had a zero score on the scale, and this is called the “Low” level in the main text. Just over one-third of the sample were concentrated at scores 1 and 2 of the scale, which has a few scores at the maximum value of 14.

Presence of flexibility among options for transition to retirement

Although the notion of flexibility of retirement options has subjective and institutional components that cannot be gleaned from the study of the movements that comprise a trajectory, the presence (and their frequency) of certain kinds of movements could be used as an indirect indicator of the said flexibility. An example would be the presence of voluntary job changes. The absence of disruptions such as involuntary job change or unemployment could also be regarded as enhancing flexibility.

Chart A.10: Distribution of the index of frequency of changes of labour market status, cohort aged 45 to 64 in 1996, Canada, 1998 to 2001

(Persons who started their transitions during 1996 to 1997)



Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

The score on our flexibility scale, named “FLEXSCORE”, arises from a complex set of criteria involving several trajectory positions (see Appendix B for the details). In essence, a person’s FLEXSCORE is increased each time there is either:

- A voluntary job change, or
- A reduction in hours of work within the same job, or
- A move from a fulltime job throughout one quarter to a part-time job throughout the next quarter, or
- Certain reductions of hours of work found along with Positions 0 or 8. (Defined earlier.)

However, the FLEXSCORE value is then reduced by one-half if the trajectory has a non-zero value on VULSCORE (the vulnerability scale). This is because of our notion that job-loss or involuntary job change detract from flexibility.

There is a further weighting of FLEXSCORE that takes speed of closure into account. The longer the person delays closure of her trajectory, the greater is the indication of flexibility. Thus delayed closure gives a slight boost to FLEXSCORE, (see Appendix B for the details).

Chart A.11 shows how those who began their transitions during the 1996 to 1997 period were distributed according to multiple levels of the index of flexibility. The distribution of the sample among scale scores forms a steeply sloped “inverted J” curve, though not quite as steep as that found for the index of vulnerability above. Roughly 80% of the sample had a zero score on the scale. This is called the “Low” level in the main text. The first range of non-zero scores (from 0.5 to 1.0) contains nearly 15% of the sample.

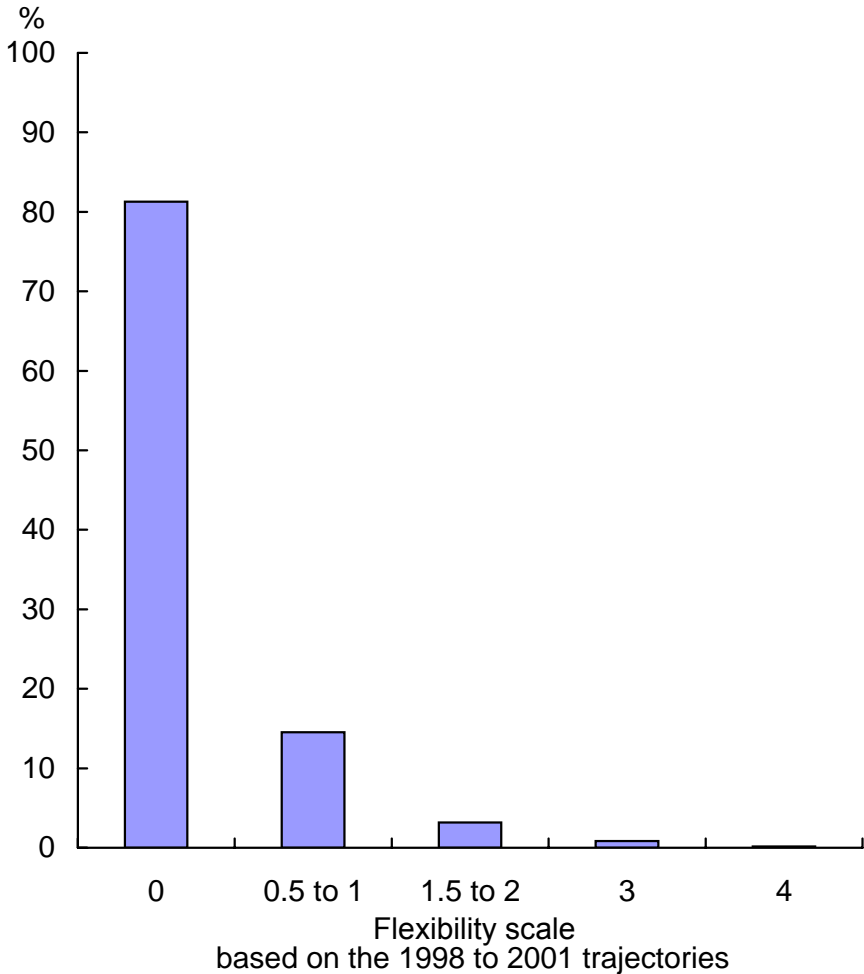
Propensity for bridging

Among those who are identified as leaving career jobs, the frequency and duration of employment in other jobs would measure their propensity for resorting to bridge jobs over the course of the transition to retirement. Quinn, Burkhauser and Myers (1990), seem to be the innovators of this concept.

No statistical work has yet been done for this trajectory property, despite the substantial block of literature concerning bridge jobs. This is because we have wished to avoid a heavy focus on people who are seen as departing a career job in later life, in order to give due weight to groups among whom a relatively low percentage have had career jobs, according to the usual definition (a job held for at least 10 years, from which they left in order to begin making the transition to retirement). For related literature see Quinn, Cahill and Giandrea (2005).

Chart A.11: Distribution of the index of flexibility in the work-to-retirement transition, cohort aged 45 to 64 in 1996, Canada, 1998 to 2001

(Persons who started their transitions during 1996 to 1997)



Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

Propensity for returning to the labor market after departure

Among those who are identified as leaving the labor market while receiving some form of retirement-related income, we can measure the proportion who subsequently returned to the labor market. Our measure for this concept (called “RETMARKET”) begins by identifying whether a trajectory has a quarter in

Position 9. Then, in such a trajectory, it finds later quarters with any of positions 1, 2, 3 or 4 – since all of these involve having a job for at least one month.

Also, among those who return to the labor market, the longer the time spent in the market before making the final exit, the greater is the value of RETMARKET. See Quinn, Burkhauser and Myers (1990), for an application of this concept.

This dimension also includes those who were outside of the labor force in the first month of the quarter but employed in the last month (Position 6), as well as those with the sequences of the type (,,8,,(1,2,3,4,)). This symbol means that following any quarter where the respondent was in Position 8, she subsequently occupied any of positions 1, 2, 3 or 4 – since all of these involve having a job for at least one month.

Appendix B has related details concerning the design of the measure for this concept. Essentially, each separate return to the labor market (from being outside of it) increases RETMARKET by one, and there is a multiplier of certain of these returns according to the number of quarters in which the person held the same job for three consecutive months.

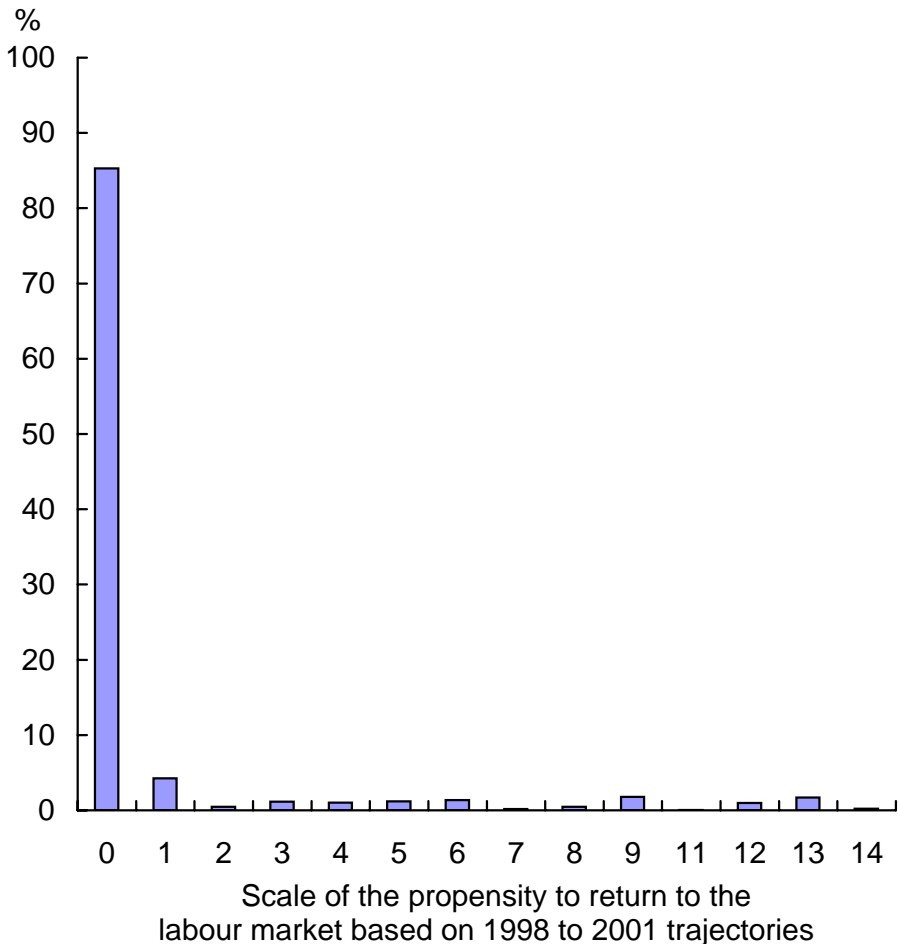
Chart A.12 shows how those who began making the transition during the 1996 to 1997 period, and who left the labor market during that same period, were distributed according to multiple levels of the index of propensity to return to the labor market. The distribution of the sample among scale scores forms a very steeply sloped “inverted J” curve. Roughly 85% of the sample had a zero score on the scale, and this is called the “Low” level in the main text. The other scale positions tend to have similar very small percentages of respondents.

Propensity to un-retire

This feature is embedded in the one just defined — propensity for returning to the labor market after departure — but it presupposes an operational definition of being retired.

Chart A.12: Distribution of the index of propensity to return to the labour market after leaving it during 1996 to 1997, cohort aged 45 to 64 in 1996, Canada, 1998 to 2001

(Persons who started their transitions during 1996 to 1997, and who left the labour market at some time during 1996 to 1997)



Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

Chapter 13 illustrates the use of such a definition. It defines as “retired” a person who was outside the labor market for a whole year, and during that time was receiving some kind of retirement-related income. In terms of our trajectory, that would be a string

of four consecutive code 9s, and no return to the labor market following that string.

To find those that un-retired, we would modify this definition so as to consider a person who had such a string, but who subsequently returned to the labor market. Having identified the trajectories that show un-retirement and we could ask several questions about labor market activity following un-retirement — e.g. duration of stay before retiring again, number of job changes, number of spells of unemployment, etc. However, no statistical work has yet been done with this property of trajectories.

Summary regarding the classification of trajectories

Thus a wide array of classifications of trajectories can be developed. Eight different classifications can be supported by the concepts presented above. Each one would be designed to facilitate research on an important question, including those that are related to policy issues being debated.

In the retirement literature, describing and classifying trajectories of transitions to retirement is a neglected subject, despite its importance. We have found only four articles that focus on classifying trajectories of transition to retirement, where the trajectories are defined as sequences of movements among *multiple* positions defined in terms of aspects of labor market participation. (See Blau 1994, Gustman and Steinmeier 1986, Gustman and Steinmeier 2000, Quinn, Burkhauser and Myers 1990.) Han and Moen (1999) have published a related article that deals with classification of lifetime career trajectories.

Gustman and Steinmeier (1986:560-566) used the term “retirement sequence” to represent what we call “trajectory of transition”, and their sequences involved movements among three possible positions: working full-time, partially retired, fully retired. Their time interval was one year. In a sample of 494 Retirement History Survey respondents, they identified 22 distinct trajectories.

Quinn, Burkhauser and Myers (1990:ch. 5) implicitly indicate an attention to sequences in using the term “exit pattern” to refer to movements toward the state of being retired made by RHS respondents after leaving their defined career jobs. They identify

four classes of patterns (or “types of trajectory” in our terminology) in terms of whether the movements involve: doing part-time work in the career job, doing part-time work in a new job, taking a new full-time job and fully exiting the labor force upon leaving the career job. The authors do not, however, display the detailed trajectories (as defined above) underlying the first three patterns.

Blau (1994) studied quarterly movements from 1969 to 1979 of older men among “labor force states defined by full-time employment (F), part-time employment (P), and out of the labor force (O).” (Apparently, the database he used did not permit identification of unemployment as a separate labor force state.) He identified 18 types of sequences of movements (or trajectories) where, at the last observation, the person was outside the labor force. However, he did not formulate any criteria for judging which of those 18 sequences should be considered to have ended in retirement. Also, his trajectories contain no information on the duration of time spent in a particular state.

Gustman and Steinmeier (2000) studied movements of Health and Retirement Survey (HRS) respondents, all born between 1931 and 1941 and between pairs of four waves of the survey. The movements are among the following positions: “retired” (R), “partially retired” (P), “not retired” (F), and “question not relevant” (X). (Table A.3) The authors used the respondents’ subjective assessments of their retirement status. As regards duration of time spent in any of the states defined above, Gustman and Steinmeier’s article provides little information.

The duration of time spent in a given state (such as months of continuous unemployment), the return to a key state after departing it (such as going back to paid employment after leaving the labor market for a while), the number of times a particular kind of move takes place (e.g., the number of involuntary job changes) are all policy-relevant aspects of trajectories. Yet, among the four papers just cited, only Quinn, Burkhauser and Myers (1990) pay systematic attention to these aspects of trajectories of transitions to retirement.

Table A.3: Selected "retirement sequences" based on four waves of the Health and Retirement Survey, United States, 1992 to 1998

(Only those that were not retired in Wave 1)

Sequence ¹	Proportion of the sequences listed
FFR	0.3
PFR	0.0
RFR	0.0
XFR	0.0
.FR	0.0
FPR	0.1
PPR	0.0
RPR	0.0
XPR	0.0
.PR	0.0
FRR	0.2
PRR	0.0
RRR	0.2
XRR	0.0
.RR	0.0
FXR	0.0
PXR	0.0
RXR	0.0
XXR	0.0
.XR	0.0
F.R	0.0
P.R	0.0
R.R	0.0
X.R	0.0
..R	0.0
Total	1.0

1. F= Not retired

P= Partially retired

R= Completely retired

X= Question not relevant

. = Not available

Source: Gustman, A. L. and T. L. Steinmeir. 2000. "Retirement Outcomes in the Health and Retirement Study." Working paper 7588, National Bureau of Economic Research.

Quinn, Burkhauser and Myers (1990) seem to have paid explicit attention to durations of stay in different states. However, they do not identify specific trajectories or “retirement sequences” in the terminology of Gustman and Steinmeier.

In short, the current gap in published information about trajectories of transition to retirement across the spectrum of OECD countries is quite major, and perhaps serious in terms of handicapping the policy-development processes concerning issues linked to pathways to retirement and gradualness of transition to retirement in preparation for managing the effects of the massive wave of transitions that the Baby Boom Generation will unleash during the second decade of this century.

Principles and procedures for mapping and classifying a large number of trajectories are presented and illustrated above. It is proposed that classification be primarily rules-based, where there is a focus on defined properties of trajectories. However, combinations of rules-based grouping and optimal matching would, in some research contexts, be desirable.

Key limitations and issues

Key limitations of this work arise in connection with concepts, data source, estimation and analysis method, at least. The following is a listing of some of the limitations.

Concepts

At the conceptual node of limitations there are key problems connected with the central concepts:

- Retirement — it is not a purely behavioral (objectively measurable) variable; it is intrinsically a social institution that includes norms and collectively supported values as well as behavior
- Transition to the state of being retired — the component events are highly subject to analysts’ choices and whether that has a well defined commencement point is an issue for debate

- Closed trajectory — why choose exactly six months of absence from the labor market with reception of retirement-related income to identify closure, and what should we make of the person who seems to re-open her trajectory after the end of the observation period?

Data source

Our data source creates problems for analysis at both ends of the six-year observation period. At the start, there is insufficient information about respondents' reception of certain kinds of income and labour market behaviour in the preceding year. This has made difficult a precise identification of the start date of the transition for certain respondents. In this connection, knowing the month in which a person began receiving certain kinds of retirement-related income would be very useful — for example, it would allow us to use only one calendar year's data for determining who had begun the transition to retirement.

Although it would be prohibitively expensive to correct this defect, it is worthy of note that problems arise in the analysis because of trajectories that are unclosed in December 2001. Knowing what happened in these trajectories after that date would be very useful, especially for measuring the durations of transitions. Without this information an interval-level measurement is not possible.

As pointed out with emphasis earlier, the data source fails to include the crucial subjective dimension of retirement processes, and provides a sample that is too small for several key population subgroups.

Finally, it badly needs improved coverage of the work-history, health, social-participation and family-caring dimensions of respondents' lives.

Despite these limitations, SLID is an extremely valuable data resource for studying labor-market-related behaviour of people in the prime ages for making the transition to retirement. For explanatory models, it contains a wealth of auxiliary variables

that no administrative data source has any chance of matching. We note particularly the data on life events and on cultural background – the latter being covered in a manner superior to any other Statistics Canada database in our opinion.

Estimation

Linked partly to the data source limitations are substantial shortcomings in measurement/estimation procedures:

- Issues exist regarding identifying who is making the transition to retirement and when they began the process, and who really has a very low probability of re-entering the labor market after being absent from it, while receiving retirement-related income, for six months right at the end of the observation period (our measure of closure).
- Although durations of stay are computable, we could greatly improve their accuracy by timing all events down to their month of occurrence, and if we had questions that allowed us to identify certain starting dates that occurred before the first reference date of the survey.
- There is a key duration-measurement issue regarding speed of closure – we should have timed departure from the labor market along with reception of retirement-related income down to the month, including months before the January 1996.
- There is an issue of inappropriate omission concerning people who have retired in all reasonable senses except they are not receiving any form of retirement-related income. An effort should be made to tease out an estimate of how many people of this kind are in our data set and what are certain features among their attributes.

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Appendix B. Detailed definitions of major new concepts¹

by

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Presence of indications of enhanced market-based vulnerability

In this text “vulnerability” deals with events that are components of trajectories and which increase the risk of setback or damage to whatever plans or arrangements the person has made concerning standard of living in retirement. The measure used here focuses on the onset of unemployment or of involuntary job change. The following trajectory positions are pertinent:

Position 4: Employed in the first and last month of a quarter and had an involuntary job change during the quarter.

Position 5: Unemployed throughout the quarter.

Position 6: Unemployed or outside of the labor force in the first month of the quarter but employed in the last month.

Position 7: Employed in the first month of the quarter but unemployed in the last month.

Position 0: Unclassified, and there is an experience of unemployment within the quarter.

It is important to take into account at least one “auxiliary variable”. This variable involves the business climate within which a person experienced a setback such as unemployment, since the consequences of the unemployment will be worse in a business cycle downturn than in a business cycle upturn.

The scale is named “VULSCORE”, and each respondent begins with a value of zero. Then points are added depending on attributes of the respondent’s trajectory. However, points arising

1. Speed of closure is one of the major new concepts; but it is not covered in this appendix because there is sufficient detail about its definition provided in Appendix A and Volume 1 of the book.

from unemployment are weighted depending on the index of the business climate within which the unemployment took place. This index is named “URATIO”, and in each quarter it has a separate value for each sex. The detailed definition that implements these concepts follows.

In every quarter, the respondent may get points toward her final value of VULSCORE depending on the following formula:

$VULSCORE = VULSCORE + 5 * URATIO$ if the respondent was unemployed throughout the quarter.

$VULSCORE = VULSCORE + 2$ if the respondent was employed in the first and last month of the quarter and had an involuntary job change during the quarter.

$VULSCORE = VULSCORE + 3 * URATIO$ if the respondent was employed in the first month but unemployed in the last month.

$VULSCORE = VULSCORE + 3$ if the respondent was unemployed at some time in the first quarter, and if either (a) the respondent was unemployed or outside of the labour force in the first month but employed in the last month, or (b) the trajectory position is unclassified.

URATIO is the ratio of unemployment rate for a specific quarter to the average of unemployment rate for the year.

Group the values into three ranked levels

The resulting scale score was rated as Low, Medium or High according to the following rule:

<u>Rank</u>	<u>Scale score</u>
Low	0
Medium	1 - 10
High	11 or more

A second grouping was made in order to create Chart A.9. It is as follows:

<u>Rank</u>	<u>Scale score</u>
0	0
1	1 - 5
2	6 - 10
3	11 - 15
4	16 - 20
5	21 - 30
6	31 - 40
7	41 or more

Presence of flexibility among options for transition to retirement

The present index of flexibility is based on movements that are components of a trajectory. These movements are treated as indirect indicators of flexibility. An example would be the presence of voluntary job changes. The absence of disruptions such as involuntary job change or unemployment are also regarded as enhancing flexibility.

The scale is named "FLEXSCORE", and each respondent begins with a value of zero. Then points are added depending on attributes of the respondent's trajectory. The detailed definition that implements these concepts follows.

However, the FLEXSCORE value is then reduced by one-half if the trajectory has a non-zero value on VULSCORE (the vulnerability scale). There is a further weighting of FLEXSCORE that takes speed of closure into account. The longer the person delays closure of her trajectory, the greater is the indication of flexibility. Thus delayed closure gives a slight boost to FLEXSCORE.

The score on our flexibility scale arises from criteria involving several trajectory positions. In essence, a person's FLEXSCORE is increased each time there is either:

- A voluntary job change, or
- A reduction in hours of work within the same job, or
- A move from a fulltime job throughout one quarter to a part-time job throughout the next quarter, or
- Certain reductions of hours of work found along with Positions 0 or 8. (See Appendix A for the details.)

Step One

In every quarter, the respondent may get points toward her final value of FLEXSCORE depending on the following formula:

Add 2 if the respondent was employed in the first and last month of a quarter, and had a voluntary job change during the quarter.

Add 1 if the average number of hours worked in a week in first month of the quarter has decreased by 10% in the last month of the quarter and the respondent was employed full time or part-time and with no job change throughout the quarter.

Add 1 if the average number of hours worked in a week in first month of the quarter has decreased by 10% in the last month of the quarter and the trajectory position is unclassified and the respondent was not unemployed in the quarter.

Step Two

Add 1 if the respondent was employed full time and with no job change throughout the quarter and in the next quarter employed part-time and with no job change throughout the quarter.

Step Three

Cut FLEXSCORE by half when vulnerability score is not zero.

Group the values into three ranked levels

The resulting scale score was rated as Low, Medium or High according to the following rule:

<u>Rank</u>	<u>Scale score</u>
Low	0
Medium	1
High	2 or more

Propensity for returning to the labor market after departure

“RETMARKET” is the name given to our index of propensity to return to the labour market after leaving it. Essentially, each separate return to the labor market (from being outside of it) increases RETMARKET by one, and there is a multiplier of certain of these returns according to the number of quarters in which the person held the same job for three consecutive months. The detailed definition, which follows, depends upon the respondent’s occupancy of certain sequences of positions within their trajectory.

Each respondent begins with a scale value of zero. Then increments are added according to the following procedure:

Step One

Determine if the respondent left the labour market in any of the 16 quarters.

If the respondent left the labour market then, for each subsequent quarter, add 1 to the scale if the respondent was working full time or part-time with no job change throughout the quarter.

Step Two

If the respondent had left the labour market but was not working full time or part-time with no job change throughout the quarter then, add 1 to the scale if in any of the subsequent quarters the respondent was employed in the first and last month of a quarter.

Step Three

If for any of the 16 quarters, the respondent was outside the labour force in the first month and employed in the last month but had no unemployment in that quarter, then, add 1 to the scale for each such quarter.

Group the values into three ranked levels

The resulting scale score was rated as Low, Medium or High according to the following rule:

<u>Rank</u>	<u>Scale score</u>
Low	0
Medium	1-4
High	5 or more

Instability of market-related status

The greater the number of quarter-to-quarter changes of position within a trajectory, the greater is its index of market-related instability. The measure for this concept simply counts the number of such changes within a trajectory.

Each respondent begins with a scale value of zero. Then increments are added according to the following procedure:

Add 1 to the scale for each of the 15 quarters, if the position in the current and the next quarter are not the same.

Group the values into three ranked levels

The resulting scale score was rated as Low, Medium or High according to the following rule:

<u>Rank</u>	<u>Scale score</u>
Low	0
Medium	1-2
High	3 or more

Cultural background

Five very broad categories of cultural background have been defined. They are: (1) “Anglo charter group”, (2) “Franco charter group”, (3) All others born in Canada, (4) Immigrants who arrived after 1959 and (5) Immigrants who arrived before 1959.² It is understood that except possibly groups 1 and 2, these groups are in fact heterogeneous collections of more meaningfully defined categories of cultural background. Limitations of the sample prevent the definition of useful subgroups of all others born in Canada, and of immigrants.

The criteria used to define each of these five classes are provided in the following steps.

Step One

If the respondent (a) was born in Canada, (b) reported being of British, English, Scottish or Irish ethnic origin, and (c) had a mother tongue that was English, English and French, English and Italian, or English and Ukrainian, then she was classified to the first cultural background group called the “Anglo Charter Group”.

Step Two

If the respondent (a) was born in Canada, (b) reported being of French, Québécois, or French Canadian ethnic origin, and (c) had a mother tongue that was French, English and French, French and Italian, French and Spanish, or French and Portuguese, then she was classified to the second cultural group, “Franco Charter Group”.

2. This date was set taking into account not only the historic waves of immigration but also the distribution by year of immigration for members of the SLID cohort that comprise the sample. This distribution is split near the middle by using the 1959 date. While there is great interest in breaking down the more recent immigrants according to the major waves of immigration since the 1960s, the sub-sample sizes are so small as to be unusable within the subset of self-employed who began transitions between 1996 and 1997.

Step Three

All others born in Canada were classified to the third group.

Step Four

If the respondent was born outside Canada and immigrated to Canada after 1959, then she belongs to the fourth group.

Step Five

If the respondent was born outside Canada and immigrated to Canada during or before 1959, then she belongs to the fifth group.

Collapse two of the five categories

The five categories were collapsed down to four categories by aggregating groups 1 and 3 for the purposes of the modeling work. The patterns of partial association for these two groups were similar. The four groups are:

1. Anglo and other Canadian born group
2. Franco charter group
3. Immigrants arriving after 1959
4. Immigrants arriving before 1959.

Wealth rank in 1996

One of two wealth indicators used in the model targets the respondents who were homeowners and had high income in 1996. The second indicator deals with non-home owners and had moderate household income in 1996. These two groups were defined on the basis of a wealth rank scale that makes use of three variables: household income, major source of income and ownership status of the dwelling in which the household lives in. These groups are found at the highest and fourth highest of the wealth ranks described below.

The combinations of attributes that form each level of the ranking are as follows: All of the second to fifth ranks are limited to persons not previously classified to a higher rank.

Highest rank:

Sources of income: wages and salaries, investment income or retirement pension.

Household income quartile: Fourth (highest).

Home ownership: Dwelling is owned.

Second highest rank:

Sources of income: wages and salaries, investment income or private retirement pension.

Household income quartile: First to third quartiles.

Home ownership: Dwelling is owned.

Third highest rank:

Home ownership: Dwelling is owned.

Fourth highest rank:

Household income quartile: Second, Third or Fourth.

Home ownership: Dwelling is not owned.

Lowest rank:

Household income quartile: First (lowest).

Home ownership: Dwelling is not owned.

Work history

The work history variable is an index of the extent to which the person's paid-work life since her first full-time job was concentrated in time spent doing full-time jobs. SLID permits only a rough proxy; however, because its coverage of full-time work history is only in terms of the number of years the person worked full time for at least half of the year.

The variable creates a ranking of persons. At the top level are those for whom all years since that of their first full-time job

were years in which they worked full time for at least half of the year. Lower ranks are based on how closely the respondents approximated the top rank. Generally, it is thought that the lower the rank, the more likely the person was exposed to non-standard work over the course of her working life.

The work history index is divided into three levels according to a standard work history ratio, which is defined as follows:

Standard work history ratio = (Number of years of full time work of six months or more) / (Number of years since first started working full time).....(1)

Level One

The respondents who have a standard work history ratio of less than 0.85. That is, at least 16% of the years, since they first worked full time, were years in which they did not work full time for at least one-half of the year.

Level Two

The respondents who have a standard work history ratio between 0.85 and 0.99. That is, between 1% and 15% of the years, since they first worked full time, were years in which they did not work full time for at least one-half of the year.

Level Three

The respondents who have a standard work history ratio of one. That is they have been working full time for six months or more every year since they first worked full time.

Care change

The variable “care change” is a proxy for the occurrence of an increase in caring responsibility in the year before closure of the trajectory began. The respondent is first assigned a level on a

ranking of personal caring responsibility (another proxy, as shown below) in each year. Care change is then measured by using (a) the personal caring rank for the respondent in two consecutive years and (b) the year when the closure of the trajectory began.

Care change is a dichotomy. It is equal to one when the personal caring rank in the current year is higher than the personal caring rank in previous year, and the closure of trajectory begins in the next year. For example, the care increase took place between 1996 and 1997, and the trajectory began closing in 1998. Care change is valued at zero for all trajectories that do not have this kind of pattern, including unclosed trajectories.

The personal caring rank is grouped into three levels (a) low (b) medium or (c) high, using the personal caring scale which is calculated using the following procedure:

Each respondent begins with a value of zero on the personal caring scale. Then increments are added according to the following procedure:

Step One

Add 2 to the scale if the respondent's major activity during the reference year is caring for other family members (including young children).

Step Two

Add 0.5 to the scale if the respondent has between one to 10 family members who are of age 16 or older and who have a disability.

Step Three

Add 0.025 to the scale if the respondent's parent moved in with the respondent's family (i.e., a move took place which resulted in the person living with one or more of her parents).

Step Four

Add 0.5 to the scale if the respondent is living with one or more of her children (natural or adopted in some way).

Step Five

Add 0.25 to the scale if (a) the respondent is living with one or more of her parents and (b) the respondent's parent did not join the family (i.e. a move did not take place which resulted in the respondent living with one or more of her parents).

The maximum scale value found was 3.0 in 1996. This is an empirical result that can change according to the sample examined and the reference year.

Grouping to produce personal caring rank

Low	0 (if the scale is 0)
Medium	1 (if the scale is between 0.25 to 0.524)
High	2 (if the scale is higher than 0.524)

The Low, Medium and High values represent 38%, 50% and 12% of the distribution of the scale values in 1996. In order to get the value 1 on the care change variable, a person must move up one level in this ranking over a two-year period.

Reception of retirement income by another economic family member³

A two-valued index (values of 1 or 0) was created to test whether another member in the respondent's economic family had started to receive retirement-related income in the year before the closure of the trajectory began. This was done by using (a) retirement-related income in two consecutive years for the respondent and for her household and (b) year when the closure of the trajectory began.

3. A person is a member of the respondent's economic family when she lives in the same household and is related by blood, marriage or adoption. In the definition that follows, there is no specific test for this condition because household members in the age range under consideration are almost certain to be in the same economic family.

In any year, it was judged that another member in the respondent's economic family was receiving retirement-related income when the household's total retirement-related income exceeded that of the respondent. The first year when that excess is found is judged to be the year when another member in the respondent's economic family had started to receive retirement-related income. If following that year the respondent began closing her trajectory then the respondent received a value of one on the index.

For example, if the said excess did not exist in 1996 and was found in 1997, and closure of the person's trajectory began in 1998, then this indicates that another member in the family had started to receive retirement-related income in the year before that in which closure began.

The individual retirement related income consists of the following components:

1. Canada Pension Plan and Quebec Pension Plan benefits. Includes disability, death and child benefits.
2. Total of Old Age Security benefits, i.e., the Old Age Security pension plus the Guaranteed Income Supplement.
3. Private retirement pensions. Excludes RRSP withdrawals, but includes RRSP annuities and RRIF withdrawals.
4. RRSP withdrawals.

The corresponding household-level figures pertain to these variables.

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Appendix C. Multivariate modeling of properties of trajectories of transition to retirement

by

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Introduction

Eight properties of trajectories of transition to retirement were introduced in Appendix A. For each property an indicator can be devised to measure the level or position of a trajectory relative to the property. Using this indicator it is possible to generate a distribution of trajectories over the levels of the property. Based on hypotheses concerning the forces that shape that distribution, it is possible to model the probability that a person's trajectory will be within a given subset of the levels of the indicator. For example, it is possible to model the probability that speed of closure will be fast.¹

In developing Chapters 15 and 16 we modeled predicted probabilities for four of the eight properties of trajectories: speed of closure, flexibility of the work-to-retirement transition, exposure to events that increase vulnerability to reduced standard of living in retirement, and propensity to return to the labour market after leaving it. Data are presented in these chapters only for categories of the predictor variable that was the focus of attention in each chapter. The purpose of this appendix is to present some of the models that generated those results, and provide data for some of the other predictor variables,

An important point about the purpose and context of development of these models needs to be indicated here. The context is that of the quasi-experiment where there is a focus of

1. The phrase "model the probability" means that the probability is represented as a function of a selection of predictor variables (also called "explanatory variables" and "independent variables") and associated coefficients (also called "parameters"). When we have estimates for the parameters, we can identify combinations of values of the predictor variables where the probability of fast closure is above a chosen value, such as 0.25.

interest in the association of a specific variable upon a deemed dependent variable. In this context, other variables in the models should be regarded as being there because of the experimenter's effort to create statistical controls. As a result several issues that must be addressed in a serious effort to understand why the distribution of a dependent variable takes on a specific shape can be acknowledged as relevant for this study; but not of such priority as to require being addressed now. Also, because of the said context, we can avoid a systematic effort to formulate and underlying theory about the forces that shape that distribution. It is sufficient to have good reason for including a variable in the model, for the purposes of statistical control, without having first articulated at a theoretical level what that reason happens to be. We can, for example, simply point to the work of other researchers as support for inclusion of specific variables in the model.²

Originally it was planned to organize this appendix into four sections, each one devoted to one of the specific properties of trajectories listed above. However, shortage of space and time lead to the necessity to present the modeling work for only one property that received greatest focus in the main text — speed of closure. For this property, the text below presents information concerning aspects of the underlying theory about the processes that determine a respondent's speed of closure, the mathematical structure of the model, definitions of key variables used, a review of goodness of fit and of the relative importance of the predictor variables as contributors to the goodness of fit, and these predictor variables' patterns of association with the dependent variables (more properly called "predictands" in the context of prediction logic, which is that of our work – see Hildebrand, Laing and Rosenthal 1977). However, the presentation on each sub-topic will need to be brief, due to space limitations.

2. It is notable that the vast majority of articles that present modeling results concerning aspects of retirement are lacking in comprehensive theories that rationalize their selections of more than a small subset of variables, and use very brief and informal argumentation and references to the work of other researchers when they attempt to justify the inclusion of particular variables in a model. Moreover, it is common to find no justification given for including any more than a small fraction of the variables used in a model.

In presenting the definitions of variables, we will not repeat information already provided carefully in Chapters 15 and 16 or Appendix B. The text below will provide only additional information needed for reasonable completeness in presenting the models.

The dependent variable

Initially speed of closure is measured in terms of 16 categories based on the four quarters of each year, covering the period 1998 to 2001 (see Appendix A). Later these were collapsed into four broad categories, and these four have been used in the multivariate analysis. They are:

- (1) closure during or before the first three quarters of 1998 is termed “fast” closure,
- (2) closure between the last quarter of 1998 and the first quarter of 2000 is termed “moderately fast”,
- (3) closure between the second quarter of 2000 and the third quarter of 2001 is termed “slow”,
- (4) unclosed trajectories are termed “very slow”.

The underlying theory about processes generating the speed of closure of a trajectory

At the individual level we postulate that the speed of closure is the outcome of three processes. These apply to individuals with probabilities that vary from one person to the next. They are:

- (A) constrained choosing to reach goals (for example, see Parker and Rougier 2004),
- (B) negotiating or adjusting in response to behaviour changes made by significant others in the person’s social network (see Rasmusen 1995, Lin 2003), and
- (C) coping with major intrusive events and their consequences (see Ma and Zhang 2004, Clark et al. 2004).

Processes in class A have been the subject of much theoretical literature and mathematical models, mostly dealing with the maximization of a lifetime consumption utility function subject to budget constraints. Essentially, the models predict that individuals will choose to retire at the age where the function is maximized.

It is possible to write down a mathematical model that takes into account all the three processes A, B and C. However, the component that applies to each process needs to include the probability that a person will be exposed to that process. Such an individual-level probability is essentially not estimable, since it requires multiple observations of behaviours by the same person.

A practical model is estimable only for a sample of persons. In demography, we would regard the distribution that it generates as a set of group-specific rates. In the case of this work, the model would predict how a cohort of persons will be distributed among a set of alternative speeds of closure. The cohort would be limited to those judged to have begun their transitions to retirement in time period t . Their distribution over alternative speeds of closure would be assessed at a later time period $t + n$.

Structure of the models used

Since these speeds comprise a discrete variable with rank-ordered categories, ordinal regression is an appropriate strategy. From the alternative formulations of ordinal regression models (see Hosmer and Lemshow 2003:288-292), we initially chose one readily available in SAS with a wide variety of outputs useful for interpreting the results – the proportional odds model. However, because a key assumption of this model is violated seriously with our data, we supplement this model with a set of nested sub-models, each of which is an ordinary binary logistic model. This set is so defined that aggregating across its log-likelihood and chi-square statistics produces the values very similar to those shown from the proportional (or cumulative logit) odds model (see Friendly 1991 for related discussion).

Suppose there are $N + 1$ categories of the response variable (in the case of speed of closure $N + 1 = 4$). Let “ $P(Y \leq j | x)$ ” mean the probability that the response will be at level j or lower. The logit for the proportional odds model is defined as $\ln [P(Y \leq j | x) / P(Y > j | x)]$; a ratio of two conditional probabilities, where x represents a vector of conditions.

The model is specified as a set of equations:

$$\begin{aligned}
 c_j(x) &= \ln [P(Y \leq j | x) / P(Y > j | x)] \\
 &= \ln [\emptyset_0(x) + \emptyset_1(x) + \dots + \emptyset_j(x)] - \ln [\emptyset_{j+1}(x) + \emptyset_{j+2}(x) + \dots + \emptyset_N(x)] \dots \dots \dots (1)
 \end{aligned}$$

$$\emptyset_j(x) = \alpha_j + \beta_1 x_{j1} + \dots + \beta_k x_{jk} \dots \dots \dots (2)$$

where $j = 1, 2, \dots, N$

Notice that in equation (2) it is assumed that the coefficient β is independent of j -- this is the proportional odds assumption. The explanatory variables ($x_{j1}, x_{j2}, \dots, x_{jk}$, where j represents the j^{th} category of the response variable) along with their estimated parameter values predict the logit defined in expression (1), and from it conditional probabilities are derived. The model is estimated by the maximum likelihood method in the SAS PROC LOGISTIC procedure, using the “clogit” option on the MODEL command.

Notice also that j ranges over a set of values, each one representing a level of the response variable. It may be useful to visualize that what we really have is a set of logits, as defined by equation (1):

$$\{ c_j(x) \}_{j = 1, 2, \dots, N}$$

Assuming that the parameters are independent of the response level (the proportional odds assumption) may lead to misleading parameter estimates, or at least they may hide a lot of valuable information and be very hard to interpret. Thus a test of this assumption has been devised – called the “Score test” and its value is generated in SAS’s PROC LOGISTIC procedure.

The Score test of the proportional odds assumption is a test of the null hypothesis that the corresponding coefficients at each level of response are equal. When the p-value associated with the Score statistic is very low, e.g. < 0.05 or less, the proportional odds assumption is untenable. Our models consistently had p-values far below 0.05.

Because SAS PROC LOGISTIC has a wide array of useful output tables (unlike SAS CATMOD, for example) we decided to continue using the proportional odds model (called the “full model” in the tables below). To gain information about patterns of values of parameter estimates at different levels of the response variable j , information that is not available under the proportional odds assumption, we added a set of nested binary models. Aggregates of chi-square statistics for the nested models are very similar to corresponding statistics in the full model; while individual nested models give us parameters and odds ratios that are sensitive to the pertinent response levels, and are much more easily interpreted than those of the full model.

A good way to exposit our augmentation of the proportional odds model (a procedure outlined by Friendly 1991) using nested binary models is with a concrete example. In the case of speed of closure there are three nested models. The logits for these models, each of which is a standard binary logistic model, are as follows (the numbers within the parentheses represent levels of the speed-of-closure variable):

- 1 $\ln[P(Y=2|x) / P(Y=(1 \text{ or } 3 \text{ or } 4)|x)]$
- 2 $\ln[P(Y=3|x) / P(Y=(1 \text{ or } 4)|x)]$
- 3 $\ln[P(Y=1|x) / P(Y=(4)|x)]$

They are said to be “nested” because of their applicable network of sub-samples:

- for no. 1, it is the whole sample
- for no. 2, it is the whole sample less those who have level 2 of speed of closure
- for no. 3, it is only those who have either level 1 or level 4 of speed of closure.

Here we have chosen the logits so that there is one that compares two very important response categories – fast closure versus no closure, the third logit listed above. This is called the “key nested model” in the main text, and a review of the tables for the sub-models confirm that the vast bulk of ‘explanatory power’ in the overall model is coming from that key nested sub-model.

In short, our overall model is comprised of an augmented proportional odds ordinal regression model, with the augmentation comprising a set of nested sub-models whose chi-squares aggregate to values very similar to those of the full model.

Selected predictor variables

Due to space limitation, the text that follows covers only a selection of the full set of predictor variables. Readers who need more details concerning the definitions of the variables are invited to contact the authors.

Two-year class of worker

As the reader will recall, two separate two-year class-of-worker variables were the primary focuses of attention in the chapters 15 and 16 where small portions of the results of modeling effort are presented. These variables have already been defined at a conceptual level in detail in those chapters. We add below only a few remarks about their usage in the context of the modeling work.

In the model that focused on self-employment (Chapter 15), we used one dummy variable. It has the value 1 for those that were self-employed during 1996 and 1997 or those who moved from that category into being employed in 1997, instead of being limited to those who were self-employed in both years. This was done to increase sub-sample size and thereby improve the reliability of parameter estimates. It was a reasonable step because those who switched from being self-employed in 1996 to being employed in 1997 showed patterns of association with speed of closure that were very similar to those that were self-employed in both years.

In the model focused on the public sector (Chapter 16) a five-level categorical variable was used. All levels take into account respondents' statuses in both 1996 and 1997. These levels have already been defined in Chapter 16 (see Table 16.1). The reference category for the multivariate analysis comprised those who were in the labour force in 1996 but were outside of it in 1997.

As noted above, the class-of-worker variable was the 'experimental variable', all others being treated as control variables. Below we present some of the latter, the ones that entailed notable conceptual innovation undertaken for this study. Some of these have complex definitions at the level of programming, and readers who would like to study these definitions are invited to contact the authors.

Caring responsibility

Family caring responsibilities, especially their sudden increase, is considered a key factor in explaining timing of retirement, notably among women, as Chapters 10 to 13 have emphasized. SLID does not provide information to allow direct measurement of the presence and level of those responsibilities. However, a rough indirect indicator is possible. For the model, we used the indicator to identify whether there was such an increase in the year just before the person began closing her trajectory.

A number of SLID variables reflect the presence of the said responsibilities. We combined them into one indicator using judgment-based weights as follows:

- If a person's major activity is caring for other family members then a value of 2 was added to the person's score for the caring variable.
- If a person had a disabled member in the family then the caring variable was increased by a value of 0.5.
- If a person was living with one or more of her children then the caring variable is assigned a value of 0.5.
- If a person's parent joined the family then the person was assigned a value of 0.025 for the caring variable.

We then defined a dummy variable that reflects increase in care burden. It has the value 1 if the person's score on the care

variable increased over two consecutive years just before the year when she began closing her trajectory. The technical definitions of these variables are in Appendix B.

Index of spousal retirement

The retirement-related behaviour of the spouse or partner is increasingly being recognized to be a powerful factor in explaining persons' retirement timing, as Chapter 11 and 12 have emphasized. SLID does not identify the spouse/partner or her attributes directly. However, there are a number of variables that allow one to make inferences about employment and income reception by a second member of a household, and we have only to ascertain that there is an economic family in that household to be able to infer with high probability that the person is a spouse/partner.

For our model, we constructed a variable that, in effect, makes an inference as to whether, over a two-year period, there has been an increase in the number of household members receiving retirement-related income. Such an increase would point to spouse/partner having taken a key retirement-related decision.

We defined a dummy variable in this connection, and its value is 1 only when that increase took place in the year just before the respondent began closing her trajectory. The technical definitions of all these variables are in Appendix B.

Cultural group

Cultural background can be expected to have some influence on the timing of retirement in terms of its influence upon tastes and of the presence of a family tradition concerning retirement-related behaviour. Also, it may be an important index of broad social or institutional forces that create different retirement-related opportunities or incentives for persons, depending on the perceived cultural heritage. However, there is little effort to measure this variable in retirement-related studies, though some in the USA have featured a break-down of their samples into White, Black and Hispanic.

For our model, we use a five-level categorical variable. Its detailed definition has already been given in Appendix B.

Health

The impact of health status upon the timing of retirement has been the subject of several articles – see, for example, Bound et al. 1998. It has been found important to distinguish between the possible influence of health status at a point in time, and changes (especially deterioration) between two time points. A severe setback in health could lead an individual to retire. If there is a gradual deterioration in an individual's health then the individual might choose to retire.

The measurement of health, however, presents a number of issues. The common health measures that have been used to model retirement are self-reported health status, presence of acute or chronic health condition, activities of daily living. Their relative merits have been discussed in the literature (e.g., Bound et al. 1998), and research findings suggest that the key factor here, as regards retirement timing, is a *change* of health status.

In our model, we focus on change of health status, based upon five categories of self-reported health status: excellent, very good, good, fair and poor. We ascertained whether from one year to the next there was a self-reported deterioration of health status. However, we constructed a dummy variable whose value is 1 only when the deterioration took place in or just before the year that the person began closing her trajectory.

Wealth

Theoretical work and model fitting about the timing of retirement are perhaps most extensively focused on two aspects of wealth – wealth accumulated at a point in time (including the value of pension rights, if they exist), and the potential accrual to wealth from working for pay one additional year. Several key articles on these variables and related theories have been published – see especially Stock and Wise 1990, Samwich 1998, Parker and Rougier 2004, Hatcher 2002, Quinn 1977, Burtless and Moffit 1985, Gustman and Steinmeier 2002.

Various aspects of wealth at a point of time have been the subject of attention – for example, financial wealth (Burtless and Moffit 1985), and pension and social security wealth (Quinn 1977).

Parker and Rougier (2004) compute a comprehensive measure of lifetime wealth to estimate its impact on retirement. They used the data from the British Retirement Survey. The components of this variable are: housing and financial wealth, capitalized values of state pension, private and occupational pension entitlements, future expected earnings, expected future business resale values.

Such sophisticated measurement of wealth is not possible from the data in SLID. The best that can be done is to devise a proxy for wealth *ranking* in broad categories, rather than an estimated of wealth level. Also, our index implies dividing the population into two broad classes – homeowners versus others. Each class then has its own ranking. Putting these rankings together into one categorical variable implies that we have created a partially ranked set of wealth-related classes. Drawing upon these categories, we have created two dummy variables for use in the model.

The first is an indicator of high wealth rank among homeowners. It has the value 1 when all of the following are true: the home is owned, the level of household income is in the highest quartile, and income sources include one or more of wages and salaries, investment income or private pension income.

The second dummy variable focuses on non-homeowners, and is in fact a household-income index. It is valued 1 when household income is above the first quartile. Its primary function is to isolate the non-homeowners that have very low income, and thus probably low wealth.

As noted above, perhaps more important (for explaining the timing of retirement) than wealth at a point in time is the issue of whether one more year of work will add to wealth sufficiently to make work worthwhile from a financial viewpoint. Much effort has been placed on modeling the retirement decision as if people retire when the marginal benefit of working another year equals

marginal cost (Hatcher 2002). This notion leads to focus upon a widely discussed “accrual variable” – the incremental value from deferring retirement for another period (see Stock and Wise 1990, Samwich 1998, Gustman and Steinmeier 2002). Measuring this variable correctly requires knowing details of the pertinent pension and social security program rules as they apply to each survey respondent – data not collected in SLID.

It should be noted that for the self-employed and for others where pension-income rights are not major, focusing on accruals arising from social security and pension rules may not be especially useful. There is a growing consensus that there will be a strong rise over future years in the proportion of pre-retirees who have no or negligible rights to employment pension-income (see Chapters 6, 19 and 20). Increasingly, retirement research must address the situations of people without claims to substantial work-related pensions or conventionally defined career jobs.

In any event, we are forced, based on data from SLID, to construct a very crude proxy for the accrual variable. It is a dummy variable based on reported personal-income change in the year just before the one in which the person closed her trajectory. The variable is valued at 1 when there was at least a 10% increase in personal income after taxes over the two-year period that preceded the one in which closure began.

Our underlying hypothesis, in devising this variable, is that such increases in income tend to be absent when trajectories are being closed. However, this is probably a meaningful variable primarily for workers with pension plans whose benefits are minor or with no pension plans. For those with pension plans, both theory and research findings indicate that what matters is the accrual of pension wealth that would come from working an additional year. As noted above, there is no way to measure this important variable with SLID data.

Pension eligibility

There is considerable evidence that pension eligibility is a key factor in the timing of retirement. For related discussion, see

Honig and Hanoc 1985, Burtless and Mofitt 1985, and Fuchs 1982. Our model measures pension eligibility with a dummy variable. This is valued at 1 when the person either has a pension plan in her main job for the year in question, or is employed in the public administration industry, or has one of the following occupations: Senior Management Occupations, Natural and Applied Sciences and Related Occupations, Professional Occupations in Health, Nurse Supervisors and Registered Nurses, Occupations in Social Science, Government Service and Religion, Teachers and Professors, and Machine Operators and Assemblers in Manufacturing, including Supervisors.

Clearly, this variable does not measure the onset of eligibility to receive income from a pension scheme, which involves a change variable of some kind. Our measure considers only the presence of pension eligibility at a point of time. As noted above in connection with the wealth accrual variable, this change variable may be much more pertinent in studies of the timing of retirement decisions.

However, because pension eligibility is greatly determined by one's sector of employment, we really require a more sophisticated model than that whose results are shown below. In those results, the dependence of pension eligibility upon class of worker is not taken into account. Ideally, we would design two- or-more steps of computations so to allow this and other causal interdependences among the predictor variables to be taken into account.

Work history

The literature contains some focus on the issue of whether a person's work history has been marked by disruptions, especially where women's retirement is being studied. It is thought that as women tend to have disrupted work history, this will have an impact on their speeds of closure.

Our focus in dealing with work history is on a measure of how standard it was. A 'fully standard' work history is one where close to 100% of the jobs held were full-time jobs. As one moves away from this degree of commitment of working time to full-time jobs, we consider work history to have been less and less standard.

Our work history variable involves defining a work history ratio. This is the ratio of (a) the number of years a person has worked for full-time for at least six months within the year to (b) the total number of years since she *first* worked full time.

Values for this ratio were then grouped into four classes, based on studying its distribution among women. For about 25 per cent of women transiting to retirement the work history ratio was below 0.85, while for another 25 per cent it was below 1.00. Based on this distribution a three-level categorical variable was devised: those with work history ratio below 0.85, those with work history ratio between 0.85 and below 1.00, and those for whom the ratio was 1.00 or more. For the detailed definition see Appendix B.

Results

The goodness of fit of the adopted model is adequate. It achieves a nearly 20% reduction in the error of prediction of the null hypothesis model. $(100 * (3118.71 - 2515.35) / 3118.71)$ – see Table C.1). Another measure of goodness of fit is the value of 0.35 for tau-a, a pseudo R-square statistic.

However, the reasonably good fit is the result of the presence of age among the predictor variables, as Table C.2 shows. If the variables in Table C.2 had been mutually independent, the relative size of each Wald statistic to the total would be a good index of the relative *statistical* importance of each variable in accounting for the overall goodness of fit.

However, in these data the relative sizes of the Wald statistics are only approximate indicators; because there is intercorrelation among some of the predictor variables. A more accurate gauge of the variables' relative importance would involve proposing a theory of the network of causal links among the predictor variables, and a related redesign of the computational steps so as to respect the hierarchy of causal priority among the predictor variables. (See the foregoing comments about the causal link flowing from class of worker to pension eligibility.)

Table C.1: Goodness of fit of models that predict speed of closure of trajectories of transition to retirement, Canada, 1998 to 2001

	Chapter 15, self-employed versus employees	Chapter 16, public sector versus private sector
Type of model	clogit	clogit
Number of response levels	4	4
Weight variable	NormWeight ¹	NormWeight
Number of observations used	1337	1337
Sum of weights used	1337	1337
Response frequencies		
Closed Q1 to Q3	345	345
Closed Q4 to Q9	170	170
Closed Q10 to Q15	116	116
Unclosed	706	706
Testing the global null hypothesis: beta=0		
-2 Log L ² for beta = 0	3118.71	3118.71
-2 Log L for model	2515.35	2466.33
Chi-Square	603.36	652.38
Degrees of freedom	25.00	28.00
Association of predicted probabilities and observed responses		
Percent concordant	77.30	77.80
Percent discordant	22.50	22.00
Percent tied	0.20	0.20
Tau-a	0.35	0.35

1. The original SLID general longitudinal weight for each respondent is divided by the average of all weights in the sample, to provide an approximate adjustment of estimated standard errors of parameters, to take into account complex survey design.

2. Minus 2 times the log-likelihood statistic.

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

Thus the network of numbers shown here is essentially provisional relative to an approach that involves specifying the structural equations that would correspond to a suitable causal model. Let us review some of these provisional results, keeping in mind the context of a quasi-experiment cited above. The data in the first two columns arose when we were examining whether the difference between being self-employed and being employed had a substantial statistical impact on the odds of having an unclosed trajectory (Chapter 15). The data in the last two columns arose when we were examining whether the corresponding difference between public sector and private sector employment (Chapter 16). The pertinent variables are shown on the last two lines of Table C.2.

The variable that reflects class of worker (for Chapter 15 see the second-to-last line of Table C.2, and for Chapter 16 see the last line of Table C.2) is the second most important (statistically) of the predictors, after age. And this is so even though we failed to allow its parameter to reflect the variable's causal linkage and priority relative to pension eligibility, work history and wealth. However, the consequent deflation of its statistical impact may be offset by the fact that this variable is causally posterior to education and occupation. Most of these variables have substantial Wald chi-squares and have been found to be useful as explanatory factors in other studies of the timing of retirement.

Also important, in terms of contribution to the model's goodness of fit, are cultural group, and whether another economic family member began receiving retirement related income in the year before closure of the trajectory began. These are also variables found to be useful as explanatory factors in other studies of retirement patterns.

It is notable that the indicated relative contribution of sex to the model is negligible. This could be a result of having several variables in the model that are causally posterior to sex, and our failure to take these causal links into account by way of structural-equation model.

The dominance of age is worthy of a further comment. Several articles reporting similar dominance of age in the timing of retirement leave the reader with the image that this is a pure "demographic effect" flowing from chronological age. On the

Table C.2: Relative contributions of predictor variables to goodness of fit of models that predict speed of closure of trajectories, Canada, 1998 to 2001

Predictor variable ¹	Degrees of freedom	Self-employed versus employees		Public sector versus private sector	
		Wald chi-square ²	Pr (ChiSq) ³	Wald chi-square	Pr (ChiSq)
Sex	1	0.6	0.42	1.0	0.31
Age group in 1996	2	245.7	<.0001	252.0	<.0001
Moderate wealth in 1996 - non homeowner	1	17.6	<.0001	14.4	0.00
High wealth in 1996 - homeowner	1	13.2	0.00	15.8	<.0001
Wealth increase proxy	1	1.0	0.32	1.2	0.27
Pension eligibility in 1996	1	1.3	0.26	3.0	0.09
Cultural background	3	11.8	0.01	19.5	0.00
Standard work history index in 1996	2	24.1	<.0001	17.0	0.00
Marital status in 1996	3	6.1	0.11	6.2	0.10
Marital status change	1	5.6	0.02	7.5	0.01
Care responsibility change index	1	0.0	0.90	0.1	0.81
Other family retirement income reception	1	14.0	0.00	17.5	<.0001
Health status change	1	4.8	0.03	8.9	0.00
Education in 1996	2	12.4	0.00	9.5	0.01
Occupation group in 1996	3	27.6	<.0001	34.6	<.0001
Self-employed in 1996	1	32.3	<.0001		
Class of worker in 1996 to 1997	4			80.6	<.0001

- All names without a date refer to change over time. The reference date for all change measures is the year before closure of the trajectory began. These are all dummy variables, and an unclosed trajectory yields a value of zero. The value is 1 when the change began in the year just before closure started.
 - The rank ordering of Wald chi-square values is a *rough* indicator of the relative importance of each variable in the contributing to the overall goodness of fit of the model.
 - Statistical significance indicated in the column named "Pr (ChiSq)" is only approximate; because the underlying estimates of standard errors are not fully adjusted for the complexity of the survey design. Here the adjustment comprises transforming the respondents' weights so that their average is 1.0. Tests using more appropriate adjustment via bootstrap computations indicate that when the Wald chi-squares are 6.0 or greater, it can be considered that they are statistically significant at the 5% level or better, in the event that bootstrap standard errors were computed. When the Wald chi-squares shown above are between 3.0 and 6.0, they can be considered to be statistically significant at a level between 15% and 5%. Thus, when the Wald chi-square is less than 3 it should be assumed that the parameter estimate is seriously subject to variability due to either sample size or to inter-correlation with other predictor variables in the model.
- Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

Table C3: Relative contributions of predictor variables to goodness of fit of nested models of the association of self-employment with speed of closure of trajectories, Canada, 1998 to 2001

Predictor variable ²	Degrees of freedom	Type 3 analysis of effects - Wald chi-square ¹		
		logit = (speedcls is 2)/ (speedcls is 1,3,4) ³	logit = (speedcls is 3)/ (speedcls is 1,4) ⁴	logit = (speedcls is 1)/ (speedcls is 4) ⁵
		B	C	D
Sex	1	4.5	0.0	0.9
Age group in 1996	2	34.0	4.1	169.6
Moderate wealth in 1996 - non homeowner	1	0.1	2.6	14.5
High wealth in 1996 - homeowner	1	4.7	0.0	16.7
Wealth increase proxy	1	2.5	0.3	2.8
Pension eligibility in 1996	1	4.4	0.8	0.9
Cultural background	3	12.4	1.9	15.4
Standard work history index in 1996	2	11.2	3.0	26.8
Marital status in 1996	3	8.4	8.8	5.3
Marital status change	1	0.3	0.5	1.0
Care responsibility change index	1	2.6	32.5	2.0
Other family retirement income reception	1	0.1	0.3	13.7
Health status change	1	0.3	1.7	4.4
Education in 1996	2	7.7	8.2	15.1
Occupation group in 1996	3	1.4	9.6	27.6
Self-employed in 1996	1	2.3	5.5	27.1

1. The rank ordering of Wald chi-square values is a rough indicator of the relative importance of each variable in contributing to the overall goodness of fit of the model. (To be accurate the variables must be mutually independent.)
2. Several of these variables are defined in the text of Appendix B.
3. See table 15.3 notes 1 to 3.
4. See table 15.3 notes 1 to 3.
5. See table 15.3 notes 1 to 3.

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

contrary, we must not forget that systemic forces arising from culture and institutional rules target specific chronological ages in such a way that it is inevitable that this age variable is partially reflecting them, as well as any pure demographic effect. It is, therefore, important to do a good deal of the modeling within more narrow age groups (as was illustrated in Chapter 16), unless the model contains variables that allow one to remove from age the influence of these “environment and policy factors”.

The data in Table C.2 arise from the full model described above. As already noted, when its proportional odds assumption

fails the parameter estimates are very hard to interpret, and consequently we added a set of nested binary models where this problem does not exist. Table C.3 provides the same kind of information as Table C.2; but for the three nested sub-models in the case of the work done for Chapter 15 (where class of worker is represented by the dummy variable named “Self-employed”). The 2-log-likelihood statistics and chi-squares from these sub-models should add, except for rounding, to those of the full model, which we just showed (Table C.2).

Among the sub-model, one is dominant in the sense that its Wald chi-squares are the major contributors to those of the full model (shown in Table C.2). We call this the “key sub-model”, and here it is the one in column D. This column is based upon a logit that contrasts fast closure with non-closure. After the hugely dominant statistical effect of age, strong contributions are coming from class of worker (represented by the dummy variable “Self-employed in 1996”), occupation, work history, wealth, cultural group, education, and whether another economic family member began receiving retirement-related income in the year before closure began.

Tables C.2 and C.3 allow us to address the relative statistical importance of the different predictors in the model’s goodness of fit. What about the patterns of partial association³ of specific categories of these variables with speed of closure? This kind of information is given in the odds ratios shown in Table C.4.

Table C.4 allows us to see the directions of partial association for the categories of variables in the key sub-model. In this model we instructed PROC LOGISTIC to predict the probability of having an unclosed trajectory, relative to that of closing rapidly (that is, in or before the first three of the 16 quarters of observation). For example, persons aged 45 to 54 in 1996 were many times more likely than those aged 60 to 69 to have such trajectories. However, at the level of detail shown in this table, careful attention to the Wald chi-squares is in order (see note 2 to the table).

3. “Partial association” refers to the fact that several variables are held constant statistically in the process of measuring the association, via the odds ratios.

Table C.4: Odds ratios for predictor variables in the key sub-model pertaining to speed of closure, Canada, 1998 to 2001(logit = (speedcls is 1)/(speedcls is 4))¹

Predictor variable ²		Self-employed versus employees		Public sector versus private sector	
		Odds ratio	Wald chi- square ³	Odds ratio	Wald chi- square
Sex					
Male.....1	1 vs 2	0.8	0.9	1.4	1.7
Female.....2	ref.				
Age in 1996					
Age 45 to 54.....1	1 vs 3	5.9	133.9	13.5	142.9
Age 60 to 69.....2	2 vs 3	0.1	142.2	0.2	145.1
Age 55 to 59.....3	ref.				
Moderate wealth 1996 - non homeowner					
		5.9	14.5	5.5	12.1
High wealth 1996 - homeowner					
		0.3	16.7	0.2	21.4
Wealth increase proxy					
		1.4	2.8	1.2	1.0
Pension eligibility 1996					
		0.8	0.9	0.8	1.8
Cultural background					
"Anglo & Other Can-born"...1	1 vs 4	0.3	1.8	0.5	2.3
"Franco".....2	2 vs 4	0.1	14.2	0.1	18.2
Immigrated after 1959.....3	3 vs 4	0.2	0.2	0.5	0.1
Immigrated before 1959.....4	ref.				
Standard work history index					
Non-standard work history....1	1 vs 3	0.8	11.7	1.2	8.2
Fairly standard work history...2	2 vs 3	0.2	26.7	0.4	21.5
Standard work history.....3	ref.				
Marital status					
Never married.....1	1 vs 4	0.2	1.8	0.4	3.2
Separated or divorced.....2	2 vs 4	0.5	1.8	1.1	3.1
Widowed.....3	3 vs 4	0.3	0.8	0.6	0.8
Married.....4	ref.				
Marital status change					
		0.5	1.0	0.5	1.6
Care responsibility change index					
		1.6	1.0	1.4	1.3
Other family retirement income reception					
		0.5	1.0	0.5	11.8
Health status change					
		0.6	1.0	0.6	5.8

Table C.4 continued: Odds ratios for predictor variables in the key sub-model pertaining to speed of closure, Canada, 1998 to 2001
(logit = (speedcls is 1)/(speedcls is 4))

Predictor variable	Self-employed versus employees		Public sector versus private sector	
	Odds ratio	Wald chi-square	Odds ratio	Wald chi-square
Education in 1996				
Less than high-school graduation.....1	1 vs 3	0.3	14.7	0.2
University degree.....2	2 vs 3	0.8	6.3	1.7
Other.....3	ref.			7.3
Occupation group in 1996				
Management.....1	1 vs 4	0.5	5.0	1.0
Professional Type A.....2	2 vs 4	0.1	8.3	0.3
Clerical & Technical.....3	3 vs 4	0.2	6.6	0.3
Other.....4	ref.			7.9
Self-employed in 1996		3.4	27.1	
Class of worker in 1996 to 1997				
Public-sector employee.....1	1 vs 5		5.2	3.4
Private-sector employee.....2	2 vs 5		5.5	9.4
Self-employed.....3	3 vs 5		7.5	16.2
Switched status from 1996 to 1997.....4	4 vs 5		1.7	14.0
Left the labour force after 1996..5	ref.			

1. PROC LOGISTIC is modeling the probability that speedcls is 4.
2. Several of these variables are defined in the text of Appendix B.
3. Tests using more appropriate adjustment via bootstrap computations indicate that when the Wald chi-squares are 6.0 or greater, it can be considered that the parameter estimate is statistically significant at the 5% level or better, in the event that bootstrap standard errors were computed. When the Wald chi-squares are between 3.0 and 6.0, they can be considered to be statistically significant at a level between 15% and 5%. Thus ratios with Wald chi-squares below 3.0 should be ignored, unless there is independent evidence that what they show is robust despite the indicated high level of variability.

Source: Statistics Canada, Survey of Labour and Income Dynamics, longitudinal file.

Those with a high value on the scale of home-owner-based wealth are much less likely than average to have unclosed trajectories – far more likely to have closed their trajectories. In contrast, those with only moderate levels of non-homeowner wealth (they are not home owners) are far more likely than average to have unclosed trajectories – i.e., delayed retirement. This pattern is consistent with the widely reported wealth effect on the timing of retirement, although we recall that our wealth measures are crude proxies.

Relative to immigrants who arrived before 1959, all the other cultural groups are much less likely to have unclosed trajectories, and especially the native-born Francophone group. However, only for the Francophone group (defined in Appendix B) is the Wald chi-square substantial, indicating a stable estimate.

Finally, among the categories of the class of worker variable, the one that stands out is being self-employed. The self-employed are far more likely than the reference category to have unclosed trajectories – i.e., to have delayed retirement.

It is tempting to close this review with a discussion of what this network of patterns implies about predicting speed of closure. However, it is best to await the use of a structural equation model that suitably takes into account the causal linkages among the predictor variables.

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Appendix D. Definitions of variables for Chapter 13 — The probability of reaching the state of retirement

by
Nathalie Deschênes

The dependent variable is the first to be discussed in this appendix. We shall then address the independent variables. Among the latter are two control variables: time spent in transition, and age group. Selection of the other independent variables was influenced by what we found in the literature. We classified them into two main groups.

First, variables related to work and the person, including the highest level of education attained, the number of years of work experience, personal income, category of worker and whether the respondent reported a disability.

Next came variables related to family, such as marital status, the presence in the home of parents or children, or both, the presence in the home of a person reporting a disability, the presence in the home of a person receiving retirement income (CPP/QPP, a private pension or RRSP withdrawals) and finally, household income.

Retiree status

We began by creating a variable identifying the year in which the respondent achieved retiree status. With monthly data on activity status for each year of the survey, it was possible to identify those months in which a respondent was inactive. We also knew whether, during the years in which a respondent was inactive, she or he received CPP/QPP or private pension benefits, or RRSP withdrawals.

For example, if a respondent was active in January and February 1997, and inactive in each remaining month of that year, and for the rest of the survey, and if that respondent received retirement income during that period of inactivity, we judged that retiree status was achieved in 1998.

Time spent in transition

This is the time actually spent in transition, in years. The maximum time a respondent could spend in transition was four years, and the minimum was one year. We first created a variable giving the number of years spent in transition by each respondent. This was obtained by subtracting the exit year — the year in which the event occurred, or the year in which the survey ended — from the year in which transition began.

A respondent for whom transition began in 1997 and who achieved retiree status — reached retirement — in 1998 thus spent a year in transition (*1998 - 1997*). A respondent for whom transition began in 1998 and who did not reach retirement before the end of the survey spent three years in transition (*2001 - 1998*).

Age group

In the SLID, it was possible to determine a person's age at December 31 of the reference year. Using this variable, we were able to construct an age variable that changes over time, and break it down into four groups: 50 to 54, 55 to 59, 60 to 64 and 65 or older.

Highest level of education attained

This variable reflects the highest level of education attained for the year in which a respondent began the transition to retirement (year 0). We created three categories for this variable: those with no secondary school diploma (or SSD); those with a secondary school diploma (SSD); and lastly, those with postsecondary education, including university.

Number of years of work experience

This variable changes over time, and gives the number of years of work experience (or equivalent in completed full-time

years). It includes all jobs (full-time and part-time), beginning with the first full-time job. A value of zero was attributed to respondents with less than one year of full-time work experience and those who had never worked full time.

Personal income

This is another variable the value of which can change over time. It uses total after-tax income. In our analyses, we divided it into quartiles, according to sex.

Category of worker for the base year

We took into consideration the situation of a worker during the year in which the transition to retirement began (year 0). A worker could be a union member, non-union or self-employed.

Whether the respondent reported a disability

This is a dichotomous variable changing over time for which the value is 1 when, in any given year, a respondent reports a disability. Otherwise, the value is 0.

Having a disability means that a person has difficulty in carrying out any activity of daily living, or that they have a mental or physiological condition or a health problem that limits the number or kind of activity they can engage in various types of situation.

Marital status

Marital status is a dichotomous variable that changes over time and has a value of 1 when a respondent is one of a couple, and 0 otherwise. "Couple" includes those who are married and those in common-law unions. Those who were

not one of a couple could be separated, divorced, widowed or unmarried.

The presence in the home of parents or children

This is also a dichotomous variable that changes over time and has a value of 1 when a respondent reports at least one parent or child present in the home in the reference year. Otherwise, the value is 0.

The presence in the home of a person reporting a disability

This is also a dichotomous variable that changes over time. The value is 1 when, in any given year, a person other than the respondent was present in the home and reported a disability. Otherwise, the value is 0.

The presence in the home of a person receiving retirement income

This dichotomous variable changes over time, and has a value of 1 when there is a person in the home, other than the respondent, who is receiving retirement income (CPP/QPP or private pension benefits or RRSP withdrawals); otherwise, the value is 0.

Household income

This is also a variable whose value can change over time. It reflects total household income after taxes. Like the personal income variable, it was divided into quartiles by sex in our analyses.

Appendix E. A new measure of the diversification of the sources of income of the elderly, for Chapter 21 — The diversification and the privatization of the sources of retirement income in Canada

by
Long Mo

The concept of “the diversification of the sources of income of the elderly” concerns the tendency of the sources of income of the elderly to diversify. This phenomenon has essentially two features: with the diversification, the elderly possess more sources of income on the one hand, and count in a more balanced manner on those that are available on the other hand. This concept has been proposed by Rein and Rainwater in 1986, in the framework of the approach called “income package”. From its beginnings, this innovative concept has been applied widely in studies on related problems about the income of the elderly. Nevertheless, we have not found until now, in the literature, an indicator that provides for measurement of the said tendency. For the purpose of measuring statistically this phenomenon in a single indicator, we propose “the index of diversification of the sources of income” (IDSI) as follows.

Suppose that the income available to the elderly is classified into n types of sources, and that the income available (R) of an aged person of is composed, in order importance, of income R_1, R_2, \dots, R_n , which arise from n types from source respectively. For convenience, if the person has no income from source number i , it is understood that $R_i = 0$. Then, for this person, we define

$$IDSI = 1 - G = \frac{1}{n * R} \sum_{i=0}^{n-1} (a_i + a_{i+1}) \dots\dots\dots(1)$$

where,

G = Gini coefficient, which reflects the degree of concentration of the distribution of disposable income (R) among the n types of sources.

$$R = \sum_{i=1}^n R_i \dots\dots\dots(2)$$

R_i = Income arising from the source number $i, i = 1, 2, \dots, n$

$$R_1 \geq R_2 \geq \dots \geq R_n$$

$$a_0 = 0$$

$$a_i = \sum_{k=1}^i R_{n-k+1}, i = 1, 2, \dots, n \dots\dots\dots(3)$$

By using the same principle, this index can be calculated at the level of the totality the population to measure the intensity of the diversification of the sources of income of the totality of the aged persons studied.

Given the nature of Gini coefficients, one knows that

$$\frac{1}{n} \leq IDSI \leq 1 \dots\dots\dots(4)$$

Broadly speaking, for a given classification of sources of income, the more the sources of income are diversified, the greater is the value of the IDSI. As an example, in the case where the income is classified into five sources, $IDSI = 1/5$ for the person whose income concentrates in just one source. On the other hand, it is equal to one, if the income of the person comes in equal parts from all the five sources. In the end, reality is situated between these two extreme cases, the IDSI varying thus between 0.2 and 1.

Indeed, the IDSI is based on the Gini coefficient, a well-documented index and commonly used to measure the concentration of the distribution of a variable. That allows the IDSI to be an indicator of the regularity of the distribution of the income relative to the various sources, and thus of the above mentioned essential characteristic of the diversification of the sources of income.

Appendix F. Glossary of technical terms used in Theme Four

Terms defined

Actuarial valuation
Annuity
Child Rearing Drop-Out Provision (CRDO)
Contingent worker
Defined benefit (DB) pension plan
Defined contribution (DC) pension plan
Low Income Cut-off
Money purchase pension plan
Nominal GDP
Occupational pension plan
Price index
Price-indexed pension
Purchasing power
Unfunded pension plan liability
Year's Basic Exemption (YBE)
Year's Maximum Pensionable Earnings (YMPE)

Definitions

Actuarial valuation

Examination of a pension plan by an actuary to assess the solvency of the plan and determine the level of contributions required to maintain or improve its solvency.

Annuity

The payment of a regular pension or similar benefit for a contracted number of years, or for the lifetime of the beneficiary, paid out from an invested lump sum of capital.

Child Rearing Drop-Out Provision (CRDO)

This is a provision of the Canada Pension Plan (CPP) whereby the years when a person was raising her children under the age of seven are omitted when calculating the amount of her CPP benefit. The result is to raise the level of benefit received.

Contingent worker

A person employed for a fixed period or a specific project. The employment is terminated when the period or the project ends.

Defined benefit (DB) pension plan

A DP plan provides a pension that is generally calculated on the basis of final average or best average annual earnings and the number of years of service (subject to a maximum number). The amount of defined benefit pension that can be provided under a plan registered under the Income Tax Act is limited, in general terms, to the lesser of 2% of the employee's best average earnings and \$1,722 per year of service. The \$1,722 limit will be indexed to increases in the average wage starting in 2005.

Defined contribution (DC) pension plan

A DC plan that provides, at the designated time of retirement, a pension income based upon the accumulated contributions plus the return on their investment. Total annual contributions are limited to 18% of earnings up to a maximum of \$13,500.

Low Income Cut-off

“Low Income Cut-off” means a level of family income below which the family is often considered to be at high risk of income inadequacy. The level varies according to the composition of the family and its place of residence in Canada.

Money purchase pension plan

This is another name for a defined contribution pension plan (defined above).

Nominal GDP

The value of goods and services produced for exchange during a year, with output being valued at current year prices.

Occupational pension plan

A pension plan generated by a company or organization for the benefit of its employees. In 'contributory' plans both the employer and employee contribute to a fund which grows free of tax during the savings period. In 'non-contributory' plans, only the employer contributes.

Price index

A price index is a single number summarizing price levels. It is calculated from a representative sample of prices and quantities over a period.

Price-indexed pension

A pension plan in which payments are increased when there is a general rise in prices, as indicated by a price index.

Purchasing power

Purchasing power measures the value of money in terms of the quantity of goods and services it can buy.

Unfunded pension plan liability

This liability is an obligation to pay, as a pension, at a future date for services already rendered by former and present employees. It is said to be "unfunded" to the extent that the assets

of the pension plan are deemed to be insufficient to cover the amount of the liability.

Year's Basic Exemption (YBE)

This is an amount of annual income below which no contribution is required to be made to the Canada Pension Plan.

Year's Maximum Pensionable Earnings (YMPE)

The YMPE is the maximum amount of earnings used to compute the contribution that a person is required to make to the Canada Pension Plan.

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