Unemployment Traps and Age-Earnings Profiles: Estimates for Australia in 2000

Bruce Chapman*
Centre for Economic Policy Research, Research School of Social Sciences,
The Australian National University
James Jordan and Ken Oliver
Department of Family and Community Services
John Quiggin
Economics Department, The Australian National University

Abstract

The relative costs of taking employment or receiving welfare are usually understood through comparisons of a person's social security entitlements and their wage alternative, known as replacement rates. In some situations it appears that the additional income from working is negligible, and this is said to constitute an 'unemployment trap'. However, conventional replacement rates ignore the fact that age-earnings profiles slope upward through the acquisition of labour market experience. We offer a dynamic reinterpretation and compare alternative calculations for Australia in 2000. The usual and incorrect approach exaggerates significantly the likelihood of unemployment traps, but the presence of children and the age of the decision-maker mitigate this considerably, and can even reverse, this assessment.

1. Introduction

Recent debates over the behavioural impact of social security policy have centred on the closely related concepts of replacement rates and effective marginal tax rate.[1] The (net) replacement rate is normally measured as the ratio of social security benefits to the (post-tax) market wage available to an individual. Assuming that the labour associated with market employment has negative utility, it is argued that replacement rates close to unity will lead individuals to reject employment in favour of reliance on social security benefits. Hence, such high replacement rates are said to generate 'unemployment traps'.

The presumed behavioural consequences for labour supply of high replacement rates and high effective marginal tax rates have had significant influences on policy. For example, the introduction of earned income tax credits in the United States can, in part, be interpreted to be a response to the presumed role of replacement rates in the context of welfare dependency.

Address for correspondence: Centre for Economic Policy Research, The Australian National University, Canberra, ACT 0200, Australia. Tel: +61 2 6125 4050, Email: bruce.chapman@anu.edu.au

* We are grateful for constructive comments from two anonymous referees, James Horne and participants at seminars given at the Institute of Applied Economic and Social Research, the University of Melbourne, the Economics Department, The Faculties, at the Australian National University and the Economics Department at La Trobe University. Tony Salvage provided research assistance and Stephanie Hancock helped in production. The authors alone are responsible for errors and the views expressed are not those of the Department of Family and Community Services.

[1] The replacement rate is a ratio of averages. The corresponding marginal concept is the effective marginal tax rate, which is the sum of the marginal tax rate faced by an individual and the reduction in social security benefits associated with a unit increase in wage income. Since individual decisions are typically discrete choices between acceptance and rejection of employment offers, the replacement rate applicable to the given individual is usually the relevant concept in determining such choices.

In their standard forms, both the replacement rate and the effective marginal tax rate are static concepts, based on a comparison between current benefits and current wage offers. However, recent literature on labour supply has emphasised the importance of dynamic, forward-looking analyses in which individuals take account of both current and future wages in making education and employment choices. A notable contribution is that of Le and Miller (1998).

Le and Miller (1998) observe that empirical studies of labour supply in Australia have been based almost exclusively on static concepts and have frequently yielded unsatisfactory results. Le and Miller argue that analysis of the work/leisure choice needs to take account of future income prospects. This point has been made previously, but not systematically explored.[2]

The object of the present paper is to extend the analysis of Le and Miller and apply the resulting model to the analysis of the incentive effects of social security policies. The paper is organised as follows.

First, we offer a generalisation of the Le and Miller model of occupational choice, with a focus on the choice between employment and reliance on social security. For reasons of parsimony in econometric estimation, Le and Miller use a simple geometric growth model of lifetime earnings. In this paper, a simulation approach is adopted, permitting the use of a more flexible and realistic representation of the time path of earnings. Earnings are modelled as a function of human capital, which follows a Markovian process incorporating learning-by-doing.

Second, the model is used to derive a dynamic counterpart to the static concept of the replacement rate used. This allows us to present an empirical method which makes operational the role of expected future incomes in the work choice. The results of this approach are then compared with the usual static method with the use of some simple examples.

Third, the analysis is applied to contemporary Australian social security rules. One of the insights generated from these exercises is that, because social security payments change with the presence of children, the work-leisure choice depends critically on current family structure and anticipated patterns of child-bearing.

2. Theoretical Framework

The framework used in the empirical illustrations can be understood with the use of figure 1. This diagram allows a comparison of two different approaches to our understanding of the role of social security payments on the work decision. The data providing the basis of figure 1 are consistent with current Australian experience.[3]

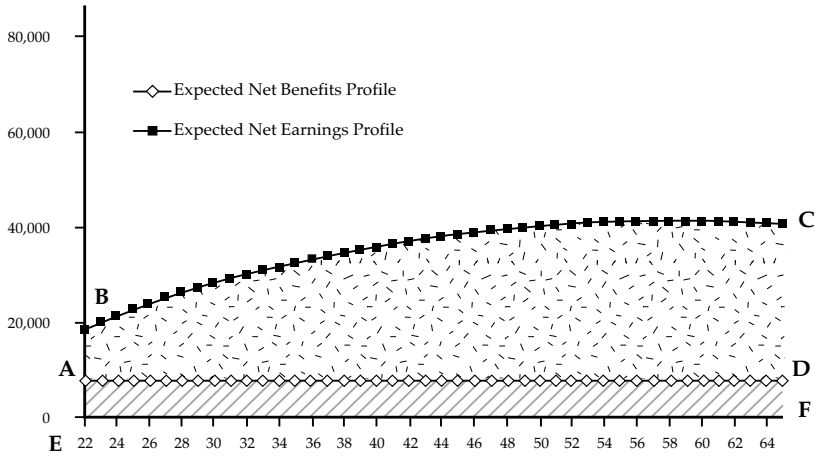
In this simple example, the choice is for an individual aged 22 contemplating the decision of whether or not to take a full-time job, or instead to be unemployed receiving a constant net income of around $8,000 per annum. This choice is assumed to be made with respect to the relative net present values of the alternative income streams.[4] The usual static replacement rate calculation ignores what might happen after the initial period and is thus given by the ratio of A to B. In this example, the static replacement rate is about 40 per cent.

[2] For example, see OECD (1995), Mitchell, Harding and Gruen (1994).

[3] The earnings profile is derived from Borland, Hirshberg and Lye (1997), and is for a relatively unskilled male, after tax. The earnings relationships presented are typical for OECD countries.

[4] It is assumed that the expected future stream of social security and earnings are known with certainty, and that the decision to take employment results in earnings by age as represented by the hypothetical profile.

Figure 1 Illustrating the Static/Dynamic Replacement Rate Issue



Calculating the dynamic replacement rate is more complicated. It requires a comparison of the net present values of the expected net lifetime benefit stream suggested by the area ADEF and the expected earnings profile suggested by the area BCEF.

Formally, the dynamic replacement rate is given by:

$$\sum_{t=0}^{T} \frac{SS_t}{(1+r)^t} \Big/ \sum_{t=0}^{T} \frac{NE_t}{(1+r)^t} \qquad (1)$$

where SS_t is expected social security assistance received in year t, NE_t is expected future earnings in year t, r is the rate of time discount and T is the year of retirement.

In the simple example illustrated, the dynamic replacement rate is about 30 per cent (for a discount rate of 5 per cent), which is much lower than that implied by the static calculation, although this will not always be the case.[5]

A more formal theoretical basis is as follows. The dynamic replacement rate may be derived from a formal model of lifetime optimisation. We consider an individual making employment choices in periods t=0,1 …T. At any time t the individual is faced with a market employment offer yielding earnings NE_t and the alternative of a social security benefit yielding SS_t. The value of the market offer is assumed to depend on the individual's stock of human capital K_t, which is determined by endowments at time t=0, reflecting, among other things, native ability, education and employment history.

It is, therefore, given as a deterministic function $NE_t=NE(K_t)$. If acceptance of the market offer is denoted by 1, and the non-market alternative is denoted by 0, the individual's employment history may be represented by a mapping E from {0,…T} to {0,1}.

[5] It should be acknowledged that taking the non-work choice implies that an individual is able to continually pass the activity test to maintain eligibility for benefits; if this is not the case, the dynamic replacement rate calculations will be overstated to some extent.

We assume that human capital (productivity) increases with employment, with the extent of the increase depending on the rate of accumulation of informal on-the-job training. The extent to which this happens is conditional on the initial stock of human capital, meaning that formal skills and employment are complements.

Hence,

$$K_t = K_{t-1} + \frac{E_{t-1}}{K_{t-1}} = K_0 + \sum_{t=0}^{t-1} f(E_t, K_t) \qquad (2)$$

where:

K_t is the stock of human capital at time t; E_t is the employment decision at time t; and, at time t, the individual must choose an employment path E:{t…T} to maximise

$$V(K_t) = \sum_{t \geq t: E_t = 0} \frac{SS_t}{(1+r)^t} + \sum_{t \geq t: E_t = 1} \frac{NE(K_t)}{(1+r)^t} \qquad (3)$$

This problem may be solved recursively. Hence, we may write $V_{t+1}^*(K_t)$ for the optimal solution at time t+1, given the level of human capital arising from the employment choice at time t. Variations in $V_{t+1}^*(K_t)$ for different choices of E_t, t=1…t reflect the impact of employment choices on human capital stocks and earnings. We obtain the iterative solution:

$$V(K_t : E_t = 0) = SS_t + V_{t=1}^* \frac{0}{K_t} \Big/ (1+r) = SS_t + V_{t+1}^{0*} \qquad (4)$$

$$V(K_t : E_t = 1) = NE(K_t) + V_{t+1}^* \frac{1}{K_t} \Big/ (1+r) = NE(K_t) + V_{t+1}^{1*} \qquad (5)$$

If the impact of current employment decisions on future earnings is ignored, the term in $V_{t+1}^*(K_t)$ is a constant which may be disregarded. In this case, individuals will choose employment if and only if the static replacement rate,

$$SRR_t = \frac{SS_t}{NE_t}, \qquad (6)$$

is less than one (when any leisure benefits of the social security alternative are taken into account). However, because individuals will care about future prospects the relevant variable is the dynamic replacement rate, given by:

$$DRR_t = \frac{V(K_t : E_t = 0)}{V(K_t : E_t = 1)} = \frac{SS_t + V_{t+1}^{0*}}{NE_t + V_{t+1}^{1*}} \qquad (7)$$

Suppose that human capital decreases with unemployment and increases with employment. Then if reliance on social security benefits is chosen in period t and neither the social security benefit nor the wage function f(K) changes, the wage offer in period t+1 will be lower than in period t, while the value of the benefit will be unchanged. Hence, the social security option will also be chosen in period t+1, and in all subsequent periods.

Similarly, if employment is chosen in period t, the wage offer will rise in period t+1 and employment will be chosen in period t and all subsequent periods. Hence, the DRR becomes:

$$DRR_t = \sum_{t=0}^{T} \frac{SS_t}{(1+r)^t} \Big/ \sum_{t-0}^{T} \frac{NE_t}{(1+r)^t} \qquad (8)$$

A more general model would allow for stochastic shocks in the wage offer arising from individual or firm-specific shocks as well as general labour market fluctuations. The individual's human capital stock K, determined by optimal employment choices, will also be a stochastic process. Although this process will in general be complex, it may possess absorbing states, such that, once the individual enters this state, they will remain in it. The most important examples of absorbing states are lifetime employment and permanent withdrawal from the labour force.

First, there may be an absorbing state in which the individual's stock of human capital is so high that the optimal choice is always to remain in employment, with a person enjoying a rising income over time. Such an absorbing state may be referred to as a 'career'. A career has the property that the dynamic replacement ratio is always less than 1. Hence, even though in some periods current earnings may be less attractive than the alternative of reliance on social security, individuals are induced to remain in employment because of the benefits in terms of future income.

On the other hand, there may exist some minimum level of human capital which is unaffected by employment or unemployment. If the wage associated with this level of human capital is always below the social security alternative, the individual will withdraw permanently from employment.

A third possibility is that human capital does not increase with labour market experience, but the wage varies stochastically, being sometimes greater than and sometimes less than the income from social security. Since, in this case, human capital and future earnings are unaffected by employment decisions, the individual will accept employment if and only if the current wage exceeds the social security alternative. In other words, if and only if the static replacement ratio (which equals the dynamic replacement ratio in this case) is less than 1.

In this terminology, the calculations of the dynamic replacement rate presented in this paper are based on the assumption that the alternative to social security is lifetime employment. Since the estimated earnings profiles are generally rising over time, this assumption seems reasonable if we disregard the possibility of involuntary unemployment. More generally - but with exceptions - however, the dynamic estimates of the replacement rate used here may be regarded as a lower bound, to be compared with the upper bound represented by the usual static replacement rate.

Conceptually there seem to be two broad conclusions. The first is that because experience-earnings profiles slope upwards, the static replacement rates will usually be greater than the dynamic replacement rates for a significant proportion of the adult population.

The important implication for policy is that the incidence and extent of unemployment traps will be exaggerated for many individuals if the static measures are used.

The second broad conceptual point is that for some groups the differences between the static and dynamic measures will be large, and for others they will be small. This is the result of the sensitivity of dynamic replacement rate calculations to assumptions concerning: the expected future earnings profile with respect to both occupation and education; the role of inherent ability as a determinant of the extent to which an individuals' potential lifetime profile varies; whether or not the choice is made as a single person or as a person in a household with dependants; the chosen discount rate; and the expected future levels of social security assistance.

The significance and contingencies associated with our alternative dynamic approach are now explored empirically. We emphasise that while contemporary Australia is the example used, the issue transcends specific institutional environments. The conceptual point is general.

3. Illustrating the Empirical Issue

Background

There are two dimensions for calculations of differences between static and dynamic replacement rates. The first concerns the numerator of equation 1, which depends on a country's social security benefit levels, and whether or not (and the extent to which) benefits are contingent on the presence and age of children. The data are now shown for Australian social security arrangements after July 2000.

Hypothetical Lifetime Social Security Benefits

In most countries, social security payments are both means-tested and contingent on family circumstances, such as the presence, number and age of children. While the size of the differences in static and dynamic replacement rates illustrated for contemporary Australian circumstances are specific to this institutional context, it is very possible that the results reflect broadly the situation for many other countries.

An important issue for the calculations is that under Australian social security arrangements, net household incomes vary with the age of children. However, static replacement rate calculations do not take into account expected changes in social security payments as children age, and thus these calculations get the numerator wrong. On the other hand—so long as people anticipate the reality of social security benefits changing as their children age—the numerator in the dynamic replacement rate calculation will be accurate.

Our illustrations of the replacement rate issues in the presence of children use the following hypothetical and very simple example. It is assumed that those expecting to become parents have two children, with the first and second being born when the parent is aged 23 and 25 respectively. Figure 2 shows the (after tax) lifetime social security payment streams for not-employed individuals with and without children.

Figure 2 2000 Australian Net Incomes of Not-Employed Individuals with and without Two Children

In many countries, welfare benefits are available for those in low paid employment, meaning that comparative replacement rate calculations for individuals faced with the choice of working or not working have to take these into account. In the Australian case, these take the form of direct transfers, while in the United States, earned income tax credits play this role. The empirical exercises take into account the Australian welfare arrangements over the lifecycle for those in low paid jobs, with social security payments including income tested family tax benefit.

The second essential aspect of dynamic replacement rate calculations concerns the denominator of equation 1, expected lifetime earnings. This is now considered.

Hypothetical Lifetime Earnings Profiles

There are a very large number of lifetime earnings profiles that could be used to illustrate the relative size of static and dynamic replacement rate calculations for Australia in 2000. To make things simple, the focus is on just a few, chosen to reflect what are likely to be feasible ranges in the data. It is worth noting that the age-earnings profiles used are very similar to those found in most OECD countries, meaning that the essence of the Australian calculations would very likely be replicated for many other countries.[6]

Six scenarios are used, derived from a variety of earnings profile sources for full-time workers, and all are adjusted to reflect 2000 real wages.[7] The age-earnings profiles are presented in appendix figures 1–6.[8]

[6] An obvious area for research would be the replication of our estimates in other countries. The differences between the static and dynamic replacement rate calculations, and what they mean for the existence or otherwise of unemployment traps, must vary between countries, in part as a consequence of international variations in the structure of earnings.

[7] In all the Appendix figures 'gross' refers to before-tax earnings, with 'net' reflecting adjustment for taxes assuming no dependants.

[8] The profiles are smooth because they are predicted from the coefficients of the relevant earnings functions.

The first two reflect very different occupations, and are as follows:

(i) Male lawyers.[9] For this group earnings over the life cycle are high, and increase quite quickly as male lawyers acquire more experience; and

(ii) Nurses, receiving legislated pay.[10] This is a relatively low paid group, and the assumed age profile is relatively flat.

The final four earnings scenarios are for both men and women with very different levels of education.[11] They are:

(iii) Average male university graduates;

(iv) Average female university graduates;

(v) Average males with no formal education beyond high school; and

(vi) Average females with no formal education beyond high school.

These age-earnings profile scenarios have been chosen because they reflect a very broad yet credible range of expected lifetime earnings. Importantly, they differ with respect to the rate at which earnings increase with labour market experience, which will be the most critical influence for static and dynamic replacement rate comparisons. In combination with social security benefits the data from these profiles are now used in various calculations and comparisons of static and dynamic replacement rates.

4. Static and Dynamic Replacement Rate Comparisons

Background

The exercises now addressed consider the question implied in the usual (static) replacement rate policy analysis: What are the financial incentives to take a job given the comparative income consequences of staying on social security benefit arrangements? Our contribution is to compare these calculations with estimates of replacement rates which take account of prospective earnings (and social security benefits) beyond the initial period.

The illustrations of the static/dynamic replacement rate point are very specific, the expectation being that our results will encourage broader analyses of the basic issues. The following hypothetical scenario is used: A 22 year old jobless person is assumed to face only the choice of remaining jobless, or taking full-time work until retirement.[12] If the static replacement rate is the basis of this decision, the person compares point-in-time welfare benefits with alternative current earnings.

However, if expected future incomes are taken into account, the dynamic replacement rate is what matters. For these calculations it is assumed that: The person believes they can contrive to be eligible for income support throughout their life; real levels of social security are assumed not to vary from the 2000 arrangements illustrated above; the person expects to earn with certainty the average net incomes of their sex by age (for the different scenarios explained above); and, a discount rate of 5 per cent per annum applies.[13]

---

[9] From Blandy and Baker (1992), derived from the 1991 Australian Census.

[10] The profile is for nurses employed in New South Wales (Australia's most populated state). Earnings rise initially because the legal (industrial award) conditions specify wage increases for each of the first eight years of experience, with no increments after that. It is assumed that the hypothetical nurse in the example receives the lowest level of legislated wages.

[11] Derived from Borland et al (1997). The non-graduates profiles have been given slightly flatter experience-earnings profiles, which is a usual earnings function result.

[12] While this seems to be a limited way of looking at the unemployment trap, it is essentially what is implied in static replacement rate calculations. Thus the comparison with our alternative dynamic replacement rates is pertinent.

[13] We explored the role of the discount rate by calculations involving a 10 per cent rate. The broad results are insensitive to the discount rate choice, at least in this range.

As is the case with most countries, the 2000 Australian social security benefit levels differ significantly according to the age of children. This turns out to be a critical dimension of the static/dynamic replacement rate comparisons, and motivates the case for separate analyses of the issue for households with and without children. We start with the former case.

Replacement Rate Comparisons for Households with no Dependants

Table 1 shows the static and dynamic replacement rate calculations for an adult with no dependants, and with respect to each of the six earnings profiles described above and presented in the appendix figures.

Table 1 Static and Dynamic Replacement Rates (per cent) for Different Scenarios: Single Adult Households with No Children

Assumed Income Stream	*Static (i)*	*Dynamic (ii)*	*Ratio (i)/(ii)*
Male lawyer	37	22	1.70
Nurse	42	34	1.23
University qualified male	53	37	1.43
University qualified female	63	42	1.50
High school completed male	70	51	1.38
High school completed female	71	59	1.20

The important points with respect to single adult households without children are as follows:

(i) The static rates are much higher than the dynamic rates in every case, on average by around 40 per cent;

(ii) There are important differences in the extent to which the static and dynamic calculations diverge within assumed earnings streams, from about 70 per cent for male lawyers to 20 per cent for an average unskilled female;

(iii) The higher are expected lifetime earnings, the less close are the static and dynamic rate estimates, a result driven by the high earnings groups having relatively steep profiles; and

(iv) Even when expected lifetime income is quite low for a full-time worker—such as with unskilled females—the difference between the static and dynamic rates still seems to be significant.

The bottom line for the groups considered is that the usual (static) replacement rate calculations overstate the extent to which welfare 'traps' people in unemployment. The role of social security as a potentially adverse influence on a jobless person's employment and earnings prospects is more benign than usually conjectured, for these examples of single people without children.

It might be argued that since no one would expect, for example, qualified lawyers to prefer social security benefits to employment, there is little benefit in considering the distinction between static and dynamic replacement rates for this group. Note, however, that the static replacement rate for nurses is quite similar to that for lawyers. The intuition that replacement rates are not a problem for lawyers rests on assumptions about earnings capacity that are only captured by the dynamic replacement rate.

There is a more general point to consider. A range of inferences about labour supply response are drawn from studies in which current wages are used as an explanatory variable. Problems analogous to the distinction between static and dynamic replacement rates will arise in all such studies and will be more severe for groups, such as lawyers, with steeply sloping earnings profiles.

Replacement Rate Calculations for Sole Parent Households

Social security benefit levels usually depend on the presence and age of children. Thus it is of interest to explore the extent to which static and dynamic replacement comparison rates are affected with children. What now follows illustrates the extent to which this matters by replicating the scenarios of table 1 changing one factor: expecting the presence of children. For simplicity the calculations are for sole parents only.

While this is clearly an unrepresentative hypothetical case, it has the following strength. Welfare support in most countries—including Australia in 2000—varies according to both household income and the number of dependants. Thus considering households expecting to have children opens up a plethora of possible complicated replacement rate comparisons. Calculations for households with two parents have considerable analytical interest and policy relevance, but they are beyond the scope of the paper.

It is worth emphasising that our goal is to establish the basis of a different replacement rate research agenda, rather than to draw out the implications of myriad family and social security policy arrangements. Even accepting this modest research context, it is clear that the presence of children is a critical factor in an understanding of comparisons of static and dynamic replacement rates, and justifies the illustrations following.

The assumptions underlying the replacement rate calculations are the same as those used for single people expecting to remain childless explained above, with the following difference. This is that the hypothetical 22 year old now expects to have children. Specifically, they assume that the first child will be born when the parent is 23, and that a second child is expected to arrive at age 25. Expectations of future income are the same as those described for those expecting no children.

Table 2 shows the static and dynamic replacement rate calculations for different scenarios for a 22 year old person expecting two children at the ages described above.

Comparisons of the results with those of table 1 reveal important changes when children are expected. The first point is that, in general, the difference between the static and dynamic calculations are reduced considerably given the expectation of children—the (unweighted) overall decrease is of the order of 30 percentage points to an average of around 10 per cent.

Table 2 Static and Dynamic Replacement Rates (per cent) for Different Scenarios: A Single Adult Household Expecting Two Children

Assumed Income Stream	*Static (i)*	*Dynamic (ii)*	*Ratio (i)/(ii)*
Male lawyer	37	31	1.17
Award nurse	42	47	0.90
University qualified male	53	48	1.10
University qualified female	63	52	1.21
High school completed male	70	58	1.21
High school completed female	71	63	1.12

The second point is that the dynamic replacement rates remain higher than the static rates for most groups even given the expectation of children. For example, for unqualified men and women expecting children, the dimensions of the unemployment trap are still exaggerated if only the static rates are used, with the extent of the difference being reduced by 17 and 8 percentage points respectively. Of course, many individuals will not take account of the financial implications of future children in making employment decisions. In such cases, the results of table 1 are appropriate.

Finally, for one of the groups considered—Award wage nurses—if there is an expectation of children the dynamic replacement rate calculations are actually less than the static. That is, taking into account both the expectation of children and future wages, the unemployment trap for this group is greater than might usually have been presumed. The extent of this difference is around 10 percentage points, which is more than trivial.

The switch in the relative size of the dynamic and static replacement rates for nurses is a consequence of the juxtaposition of two things: The relatively flat wage profile and the fact that welfare payments increase over time with children. While the expectations of children will generally reduce the dynamic replacement rates, they can even become less than the static replacement rates if the wage profile is flatter than the time profile of benefits. The relevant comparison is between the benefit time-path in figure 2 and the wage profiles in the Appendix.

Table 3 Static and Dynamic Replacement Rates (per cent) for Different Scenarios: A Single Adult Household Expecting Two Children

Assumed Income Stream	*Static (i)*	*Dynamic (ii)*	*Ratio (i)/(ii)*
Male lawyer	37	31	1.17
Award nurse	42	47	0.90
University qualified male	53	48	1.10
University qualified female	63	52	1.21
High school completed male	70	58	1.21
High school completed female	71	63	1.12

The comparison between static and dynamic replacement rates is radically different at older ages. Regardless of the education level, the wage profile is essentially flat after age 55. Hence, as shown in table 4, the dynamic replacement rate, calculated over the individual's remaining working life, will be close to the static rate. Calculation of a dynamic replacement rate including the period of retirement raises complexities including the need

to estimate conditional life expectancy and to model the relationship between retirement income and employment history. Nevertheless, it seems reasonable to assume that, in most cases, the relative income gain from remaining in employment at age 55 will diminish after retirement and therefore that the static replacement rate will exceed the dynamic replacement rate.

Table 4 Static and Dynamic Replacement Rates (per cent) for Different Scenarios: Adults with No Dependants Aged 55

Assumed Income Stream	*Static (i)*	*Dynamic (ii)*	*Ratio (i)/(ii)*
Male lawyer	16	16	1.00
Award nurse	33	33	1.00
University qualified male	29	30	0.97
University qualified female	37	40	0.94
High school completed male	41	42	0.97
High school completed female	53	56	0.95

There are several critical points for welfare analysis and policy raised by these results. One is that for most skill groups the expectation of the presence of children reduces the extent of, but does not eliminate, the error associated with the use of static replacement rate calculations. Second, while the use of the usual static replacement rate calculations as an indication of potential unemployment traps are always a mistake, for most low skill groups with children, the implications are benign. Finally, there are some groups expecting to have children for which the presumed unemployment trap is actually higher than would be presumed using the conventional and incorrect approach. This might imply a strong case for revisiting policy issues related to the behavioural consequences of effective marginal tax rates in certain circumstances.

5. An Agenda for Future Research

Background

The analysis and empirical illustrations should be seen to be the beginnings of a potentially broadly-based research program. There is much to be done with respect to theory, and there is a multitude of possible applications.

Theory

In the analysis above it has been assumed that future earnings and benefit payments are known with certainty. While the extension of the modelling to a stochastic optimisation problem is beyond the scope of this paper, a few observations may be made about the way in which the analysis would be affected if uncertainty were modelled explicitly.

The most obvious is that, since the analysis is expressed in terms of replacement rates, rather than absolute returns to employment and non-employment, there is an implicit assumption of homotheticity in preferences, and therefore of constant relative risk-aversion. Thus the assumption of a fixed relationship between benefits and expected earnings means that uncertainty about movements in average earnings has no effect on the dynamic replacement rate calculations.

Two relevant sources of uncertainty are: Possible differences in the individual's earnings and to the average cross-sectional data of the group considered; and uncertainty about benefit levels. With respect to an individual's expectations of earnings there are at least two possible sources of uncertainty, arising from: (i) the possibility that the future longitudinal earnings stream of the group will differ from the current cross-section, which can only reflect the past; and (ii) the fact that individuals have distinct inherent capacities, which will manifest itself in a person's earnings potentially being quite different to the average. The fact that earnings functions estimations typically explain less than a third of measured variation is testimony to the importance of individual effects, among other things.

In terms of the stream of expected social security benefits, there are also several possible sources of uncertainty. Among others these arise from: (i) the possibility of changes in the policy rules; and (ii) the effects of changes in the purchasing power of benefits, which will depend particularly on the vagaries of inflation in systems without indexation. Even when benefits are indexed, there will still be real effects from inflation because the indexing rules can never completely accurately ensure purchasing power protection for all people given differences in consumption patterns.

Other things being equal, the greater the uncertainty associated with either the employment or the non-employment option, the less attractive that option will be. Since the two effects will work in opposite directions, it is not possible to determine the net effect *a priori*. However, it seems likely that uncertainty about individual earnings will be greater than uncertainty about benefit rules.

It thus seems likely that high levels of risk aversion, as with high discount rates, will reduce the dynamic replacement rate relative to the static rate. As with most situations involving a trade-off between deterministic present benefits and uncertain future benefits, the effects of risk aversion and discounting reinforce each other. Formally modelling the factors associated with uncertainty is an obvious next step.

Empirical Analysis

The calculations offered above barely scratch the surface of static and dynamic replacement rate comparisons. Several obvious areas of extension are as follows.

First, our illustrations concern only the choice of lifetime employment compared to non-employment, and only for people making this choice at age 22. An obvious extension would be static and dynamic replacement rate calculations for people at different stages of the life-cycle, and with respect to many more complicated labour supply choices.

As well, interesting and policy relevant replacement rate calculations could be considered for the following labour supply choices. Among many are: (i) non-employment versus part-time employment, for different regimes of abatement rates of benefits with earnings; (ii) the timing of the resumption of employment, given periods spent in full-time child-rearing; (iii) the retirement decision, which will be affected more by superannuation arrangements and taxation than welfare; and (iv) the question of the costs and benefits of undertaking formal education for older people.

Second, our illustrations have used Australian 2000 social security arrangements. While many of the broad results will be similar for other country's systems and earnings profiles, it is of interest to know how great the variations are. In particular, countries with relatively generous means-testing rules or large welfare adjustments with children will have quite different relative replacement rates. The implications of these differences for unemployment traps are likely to be very significant for policy.

Third, the structure of earnings is fundamental to calculations of dynamic replacement rates, and these differ significantly within and between countries, across time, and with respect to technological progress. For example, countries undergoing rapid industrial transformation, such as Japan in the 1960 to 1990 period, tend to have high on-the-job training and thus steep earnings profiles.[14] On the other hand, technological stagnation, high minimum wages and perhaps union presence all tend to be associated with relatively flat profiles. These possible effects on earnings profiles will have consequences for dynamic replacement rate calculations and thus for our understanding of unemployment traps.

6. Conclusion

It has been demonstrated that conventional analyses of the influence of welfare support on employment choices are conceptually incorrect. So long as individuals care about the future, comparisons between point-in-time welfare benefits and earnings are incorrect representations of the true replacement rate, for two reasons.

The most important of these is that earnings-experience profiles slope upwards until about age 50. This means that for most people under age 50 there will be significant earning benefits in taking employment even when starting earnings are low relative to social security. The second issue relates to the fact that welfare benefits usually change for families with the presence and aging of children. Thus both the numerator (welfare payments) and denominator (current alternative wages) of the usual (static) replacement rate calculations are in error. We suggest an alternative, dynamic, replacement rate calculation.

Several simple illustrations of the relative size of the static and dynamic rates show that the differences can be very large. Moreover, they differ significantly according to a person's formal levels of education (because this affects the expected slope of the earnings profile) and the presence and age of children (because these are associated with welfare benefit variations). But we have only begun to scratch the surface of the myriad implications.

There are a significant number of possible theoretical extensions of the basic point. As well, there are a very large number of possible empirical applications, reflecting the roles of different welfare arrangements as well as wage structures that vary across time and space.

As Le and Miller (1998) observe, expectations of the nature of net future incomes make 'point in time' calculations of financial returns from work a partial, and thus incorrect, indicator of the labour supply implications of the social security system. It is critical to recognise that the circumstances under which the conventional measures are misleading are quite complicated, which means that unconditional statements on the issue are bound to be wrong. Unemployment traps are not what they seem.

[14] See Tan (1980).

Appendix 1

A Basic Description of July 2000 Australian Social Security Arrangements

The important social security rules applying in Australia in 2000 are as follows:

(i) Unemployment insurance, as understood in the US and other countries, doesn't exist. Instead, social security payments to the unemployed are non-contributory and made without reference to past earnings or employment;

(ii) An unemployed adult with no dependants is eligible for a means-tested social security payment. This payment, at July 2000, was about $A190 per week (around $US120);

(iii) If the household of an unemployed adult has children, it is eligible for additional payments which are means-tested on the basis of household income. This means, for example, that a two adult household with an unemployed husband and children will receive lower payments the higher is the income of the wife;

(iv) Low earnings households receive social security payments and tax benefits which vary with both earnings and the presence of children;

(v) There is a non means-tested tax rebate for sole parents; and

(vi) All benefits for households with children vary according to their age: Assistance increases when children are aged between 13 and 15 years, but cut out when a child reaches the age of 16.

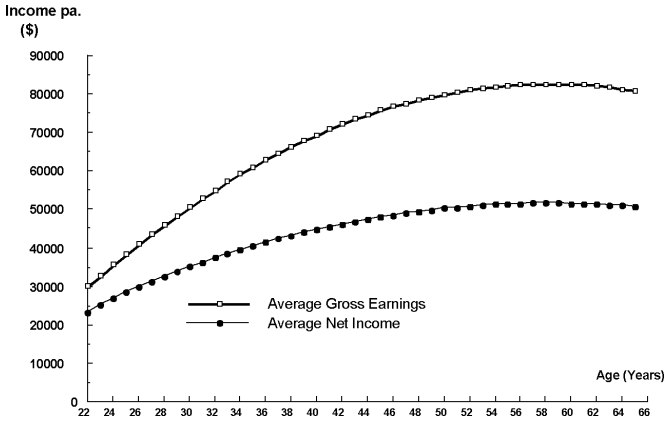
Appendix 2

Coefficients Used in Construction of Average Full-time Earnings Profiles

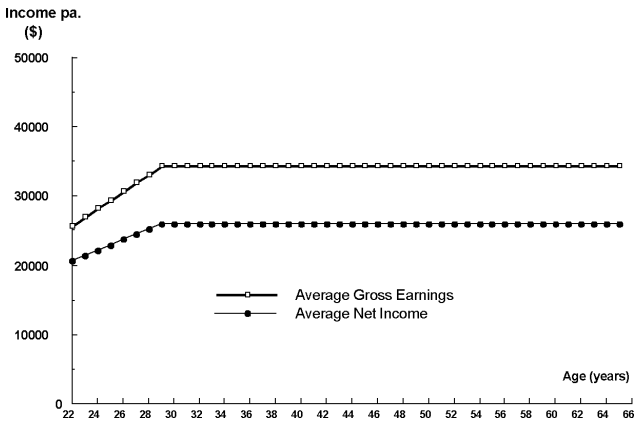
Wage equation coefficients	*Females*	*Males*
Constant	5.4165	5.4847
Labour market experience	0.0353	0.0438
Labour market experience squared	-0.0007	-0.0007
Completed High School	0.1126	0.0845
Trade Qualification	0.1169	0.0763
Certificate/Diploma	0.29	0.1583
Degree	0.4131	0.3686
Married	0.036	0.0891

Source: Borland *et al* (1997).

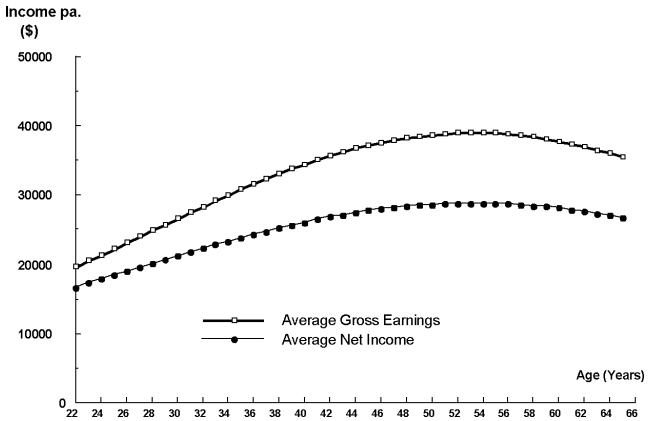
Appendix Figure 1 Male Lawyer Gross and Net Lifetime Earnings Profiles



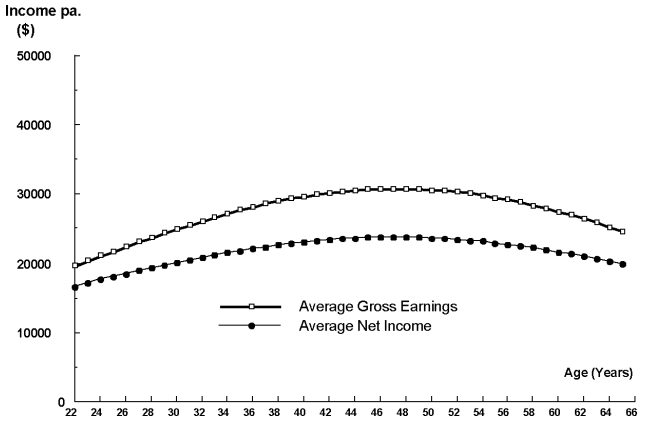
Appendix Figure 2 Gross and Net Award Wage Nurse Lifetime Earnings Profiles



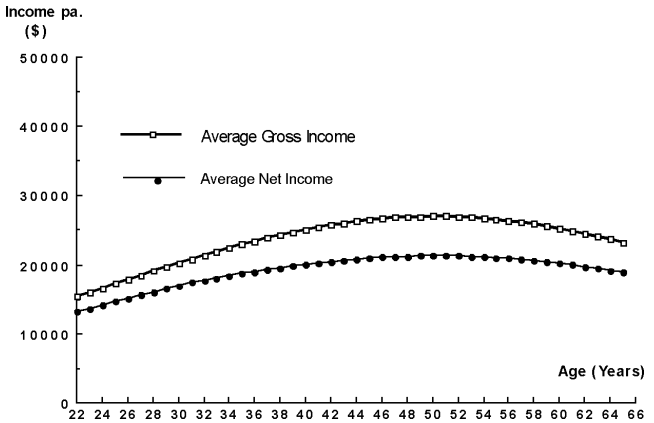
Appendix Figure 3 Gross and Net Lifetime Earnings Profiles for Males with Degrees



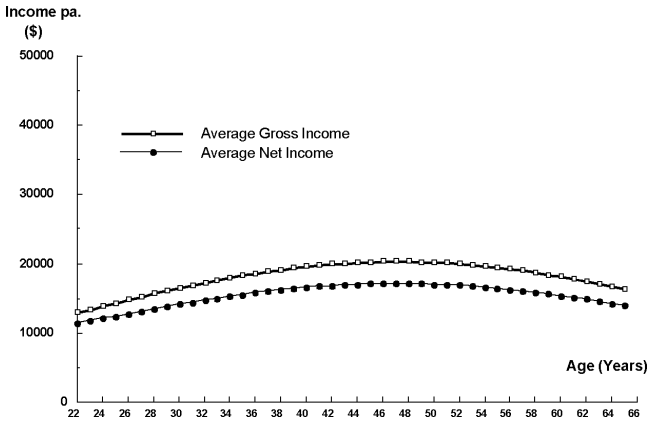
Appendix Figure 4 Gross and Net Lifetime Earnings Profiles for Females with Degrees



Appendix Figure 5 Lifetime Earnings Profiles for Males without Degrees



Appendix Figure 6 Lifetime Earnings Profiles for Females without Degrees



References

Blandy, R. and Baker, M. (1992), 'Lawyers' Incomes', paper presented to the 18th Conference of Economists, Melbourne.

Borland, J., Hirshberg, J. and Lye, J. (1997), 'Computer Knowledge and Earnings: Evidence for Australia', University of Melbourne, Department of Economics Research Paper No. 571.

Blundell, R., Duncan, A. and Meghir, C. (1992), 'Taxation in Empirical Labour Supply Models: Lone Mothers in the UK', *Economic Journal*, 102, 265-278.

Blundell, R., Fry, V. and Meghir, C. (1985), 'Lambda-constant and Alternative Empirical Models of Life-cycle Behaviour under Uncertainty', University College London Discussion Paper, 85–26.

Demers, F. and Demers, M. (1988), 'The Optimal Choice of Labour Supply under Uncertainty: a Non-expected Utility Analysis', University of British Columbia, Department of Economics Discussion Paper 88–25.

Dustmann, C. and Micklewright, J. (1993), 'Benefits, Incentives and Uncertainty' in Barr, N. and Whynes, D. (eds), *Current Issues in the Economics of Welfare*, Martin's Press, New York.

Grossberg, J. (1989), 'Labour Supply under Real Wage Uncertainty: a New Look at the Intertemporal Substitution Hypothesis', *Southern Economic Journal*, 55, 974-986.

Harding, A. and Polette, J. (1995), 'The Price of Means Tested Transfers: Effective Marginal Tax Rates in Australia in 1994', *Australian Economic Review*, 3, 100-106.

Hotz, J., Kydland, F. and Sedlacek, G. (1987), 'Intertemporal Preferences and Labour Supply', Economics Research Centre/NORC Discussion Paper, Chicago.

Ingles, D. (1997), 'Low Income Traps for Working Families', Centre for Economic Policy Research Discussion Paper No. 363, Canberra.

Le, A.T. and Miller, P.W. (1998), 'Pitfalls of Including Current Earnings in Labour Market Choice Estimating Equations', *Australian Economic Papers*, 37, 414-420.

Mitchell, D., Harding, A. and Gruen, F. (1994), 'Targeting Welfare', *Economic Record*, 70, 315-340.

OECD (1997), *Making Work Pay: Taxation, Benefits and Unemployment*, OECD Jobs Strategy Monograph, OECD, Paris.

Owen, J. (1989), 'Labour Supply over the Life Cycle: the Long Term Forecasting Problem', *International Journal of Forecasting*, 5, 249-257

Tan, Hong W. (1980), 'Specific Training and Technological Change: a Case Study of Japan', PhD thesis, Yale University.

Whiteford, P. (1995), 'The Use of Replacement Rates in International Comparisons of Benefit Systems', *International Social Security Review*, 48, 3-30.