Work Incentives and Labour Supply of Lone Parents:

Employment Credits in Australia

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ABSTRACT

Lone parents are proportionately the main client groups for many government benefit, transfer and subsidy programmes. This is the case both in Australia, and in comparable Western economies (United States, United Kingdom *etc.*). The effects of tax credit, welfare and active labour-market programmes tend therefore to be felt most strongly by this demographic group. This paper looks specifically at the potential employment responses among lone parent households in Australia to the proposed Earnings Credit as described in Lambert (2000). The results are related to broader international experience on the employment effects of tax credits and employment-contingent benefits, particularly the experience of the Working Families' Tax Credit in the United Kingdom. Finally, a possible rationale is suggested for an Earnings Credit in the context of wider reform of the Australian tax and transfer system.

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1 Introduction

The aim of a system of in-work benefits is to shift the balance between incomes in and out of work. Tax and transfer systems were, in the past, often designed solely with distributional objectives (and fiscal constraints) in mind. More recently, the burgeoning economics literature on labour supply has led policymakers to consider the effects of tax and benefit policies on work incentives. Consequently, in-work benefits, once rare, have become widespread. Countries as diverse as Canada, Finland, Italy, New Zealand and the United States have now adopted a policy of subsidising low-paid workers' wages as a way of improving work incentives. And in Australia, there is an ongoing debate over an Earnings Credit as a way of improving work incentives among low-income and workless households.

This paper looks specifically at the potential employment responses among lone parent households in Australia to the proposed Earnings Credit as described in Lambert (2000). The simulated employment responses are based on an econometric model developed by Duncan and Harris (2002), using the Melbourne Institute Tax and Transfer Simulator (MITTS). Results are related to broader international experience on the employment effects of tax credits and employment-contingent benefits on lone parents' labour supply behaviour, particularly the experience of the WFTC in the United Kingdom.

In Section 2 we examine the general structure of in-work credits, highlighting particular design issues, and how they relate to the effective delivery of employment incentives. In Sections 3 and 4 we review briefly the history of in-work financial support to low-income households in the United Kingdom (culminating in the current WFTC) and in the United States (via the Earned Income Tax Credit, EITC). In Section 5 we look at the current proposals for an Australian Earnings Credit, or EC. In particular, we examine how the proposed Earnings Credit in Lambert (2000) might promote work incentives among lone parents in Australia. We also consider variants on the proposed EC system which might further improve employment incentives. Section 6 concludes.

2 Some Design Considerations for In-Work Benefits

Most in-work transfers around the world perform have been designed with two main objectives in mind: (i) to redistribute financial resources to low-income families; and (ii) to promote employment incentives. For some in-work transfer payments, there may be

additional criteria, perhaps to redistribute towards families with children or to target more specifically low-wage rather than low-income households. So how do in-work transfer programmes achieve these twin objectives of (possibly targeted) redistribution of income and improved employment incentives?

The UK system of support for low-income working households is unusual in that it includes an explicit hours-of-work condition as well as an earnings-related 'means-test' when assessing the level of entitlement.[1] Most in-work transfers base entitlement on earnings alone, as is the case for the Earned Income Tax Credit (EITC) system in the United States.[2]

The desirability of an explicit hours condition is the subject of some debate. On the positive side, it can be argued that the hours-related eligibility condition in the WFTC improves the targeting of the benefit towards working households, and may therefore be more effective in promoting employment incentives. There may also be a higher *deadweight* cost to the EITC, since the tapers are relatively low compared with WFTC and extend higher up the earnings distribution. On the negative side, higher withdrawal rates are typically needed to pay for the greater generosity of hours-conditioned transfers. This might lead to labour market 'inertia': people have an incentive to work at or near the hours threshold, but little or no incentive to work much beyond. In contrast, EITC recipients can adjust their labour-market behaviour with a potentially smaller loss of entitlement. Indeed, they might ultimately find it less burdensome to float off receipt entirely as they acquire skills and labour market experience.[3]

Below we list a series of design considerations that are relevant when constructing a system of financial support for low-income working families. Relatively innocuous design choices can generate significant, unanticipated and potentially adverse work incentives. In the categorisation that follows we highlight where this might be so.

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[1] The Canadian Self-Sufficiency project (SSP) is perhaps the only comparable transfer programme which includes an explicit hours condition among the rules of entitlement See Card, Michalopoulos and Robins (2000) for a detailed analysis of the Canadian SSP pilot.

[2] The EITC includes three regions; a 'phase-in' region for which entitlement increases as earnings increases, a plateau where maximum entitlement is maintained, and a 'phase-out' region where the credit is withdrawn until exhausted. So, EITC entitlement depends on hours of work, but does not include a specific hours-related condition.

[3] Holtzblatt and Liebman (1998) present a useful comparison of the structure, administration and incentive implication of EITC and WFTC. Whitehouse (1996) presents a more international viewpoint.

2.1   *Structural conditions of entitlement*

There are, in general, three ways in which entitlement to an in-work benefit might be established:

- First, limits to eligible family types. Under the current Working Families' Tax Credit (WFTC) in the United Kingdom — as with its two predecessor benefits, Family Income Supplement and Family Credit — eligibility is restricted to families with children. However, the new Employment Tax Credit (with which the United Kingdom government plans to replace part of WFTC from 2003) might extend in-work support to people without children.[4] In the United States, the generosity of the Earned Income Tax Credit (EITC) is differentiated according to the presence and the number of children.

- Second, an hours-of-work condition. Compared with an earnings condition alone, this can target people working a 'desirable' number of hours at potentially lower cost to the public purse (for a given level of entitlement). However, this introduces another potential hazard: that the hours condition is exploited by employees and employers (either independently or collusively). When targeted on part-time employment, the in-work benefit can reduce incentives for full-time workers as well as increase incentives for those not currently in work.

- Thirdly, an income condition targets financial help on low-income households. It is possible, as under the EITC in the United States, to structure the income condition to provide positive employment incentives with a 'phase-in' range. However, the in-work benefit is, by definition, however, less targeted on employment *per se*, with no discrimination between high-hours/low-wage and low-hours/high-wage combinations.

2.2   *The period of assessment and payment*

Benefit structures that are, on the surface, very similar can produce markedly different incentives if they have different payment and assessment periods.[5] For the WFTC, "the assessment period is between 7 weeks and 4 months depending on the frequency of wage payments", according to Brewer (2000). Payments are then fixed for the following 26

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[4] This is certainly the case in the three countries (Australia, the United Kingdom and the United States). studied specifically in this paper.

weeks, regardless of any change in employment status. Such rules open the door to adjustments in labour market behaviour between assessments and, in the extreme, to abuse of the system. By the same token, it is difficult to see how a tax credit that is delivered annually and in arrears would have the same incentive effect as a structurally and monetarily equivalent benefit delivered more frequently throughout the year.

2.3 The unit of assessment and payment

Most in-work benefit systems around the world are assessed on household rather than individual income. This contrasts with the personal tax system, which typically operates at the level of the individual rather than the family unit.[6] However, the choice of the unit of assessment is not innocuous. Consider a household where the man is in low-wage employment and in receipt of in-work financial support. When benefits are assessed at the level of the household, any increase in labour supply by the woman will reduce the benefit payment to the household, thus acting as a disincentive to the secondary earner (in this case, the woman). On the other hand, if benefits are assessed at the level of the individual, then the positive employment incentive to the secondary earner is preserved.

In general, choosing the household as the unit of assessment tends to favour single-earner households, whereas individual assessment is relatively beneficial for the incentives of two-earner households.[7] Of course, individual assessment is much less effective at targeting financial help towards low-income households, and is therefore likely to be less desirable on equity grounds.

It can also be important to know who actually receives the benefit payment. Under Family Credit, the caring parent generally received the benefit (usually the mother). The Working Families' Tax Credit, on the other hand, is more likely to be paid to the taxpayer in the household. For two-adult households, this is more likely to be the man. Depending on the extent of income-sharing within the household, this largely

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[5] Walker (2000) provides a clear exposition of this effect in the UK context.

[6] This choice of the household as the unit of assessment introduced some complexity to the administration of the new WFTC program, given that the calculation of UK income tax liability hitherto took no account of the income of the partner.

[7] Duncan and Giles (1998b) experiment with alternative units of assessment for Family Credit, and find empirical support for this conclusion. Duncan and Reed (2000) look at the simulated employment effects among two-adult households when current levels of WFTC are increased. They find that an increase of 25 per cent in the maximum level of WFTC, when assessed on household income, will increase the proportion of single-earner households by 3½ per cent and lower the proportion of two-earner households by around 2 per cent.

administrative change in the structure of in-work financial support could have some significant behavioural consequences. *In extremis*, if there existed no income-sharing within the household, then the move from FC to WFTC could represent a significant transfer of resources away from the mother.

2.4 Assessable income, and interaction with the tax system

The distributional and employment effects of tax and benefit reform can only be examined within the context of the whole tax and transfer system. A reform can appear relatively generous when looked at in isolation, but less so once interactions with other elements of the tax and benefit system are taken into account. This is usually because income from one transfer scheme is included in assessable income for another transfer programme. In the move to the WFTC, for example, the increases in the level of adult and child credits imply significant gains for households on maximum entitlement. But these gains are not realised the many families who also qualify for Housing Benefit, since WFTC forms part of the assessable income used in the Housing Benefit means test. This interaction compromises the effectiveness of WFTC both as a redistributive tool and as a vehicle for improving work incentives.[8]

Early in-work benefits in the United Kingdom were plagued with problems of high marginal effective tax rates (METRs) over significant ranges of earned income because of the structure of the means test. Under Family Income Supplement (FIS), the level of in-work benefit was withdrawn at a rate of 50 per cent of *gross* income. With income tax and National Insurance contributions alone (at the then rates of 30 per cent and nine per cent respectively), this took overall METRs to 89 per cent for households in receipt of FIS. If Housing Benefit was also being paid, the METR could rise to levels above 100 per cent.[9] Under Family Credit, the level of in-work financial support was withdrawn at a rate of 70 per cent of *net* income. This relatively simple reform reduced METRs to 79.6 per cent under FC for households paying tax and National Insurance alone and to 92.9 per cent for households also receiving Housing Benefit.[10]

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[8] One can reduce taper rates to WFTC to an extent which would give some entitlement to those working beyond the end of the Housing Benefit taper, but this is an expensive solution which does not address the underlying structural problem.

[9] For a household in receipt both of FIS and Housing Benefit, a typical marginal effective tax rate amounted to $(0.30+0.09) +(0.5)+(0.25)*(1-0.5) = \mathbf{1.015}$.

[10] Combining FC with Housing Benefit (withdrawn at 65 per cent of applicable income) leads to a typical METR of $(0.25+0.09) + 0.7*(1-0.32)+0.65x(1-0.32-0.7*(1-0.32)) = \mathbf{0.929}$.

Nevertheless, METRs remained high for people receiving in-work financial support, not least because of the interaction between FC and other elements of the tax and transfer system (especially Housing Benefit). Any income from FC is included in the means test for Housing Benefit. This lowers considerably the level of Housing Benefit for those in receipt of Family Credit and hence reduces the potential incentive effects of the Family-Credit system.[11] Figure 2 demonstrates this problem: note how much less is the gain in overall net income at 16 hours per week than the level of Family Credit.

The structure of an in-work benefit can also influence wage progression, a point well made by Blundell and Walker (2000). When withdrawal tapers are high, the lion's share of any income gain through wage progression will be lost through reduced benefit entitlement. So the incentive for employees to develop human capital through participation in education and training programmes is much reduced, since they will see little financial gain to doing so. It is also possible for employers to exploit a generous in-work benefit to subsidise wages.[12]

2.5 Method of delivery of financial support

It has been argued that households endure a degree of *stigma* when receiving financial assistance through a Benefits Agency or Social Security office. Stigma might be sufficient to discourage claim for a transfer payment altogether. Tax credits such as the US EITC, and now the WFTC in the UK, deliver financial support through the tax code where possible, rather than through the Benefits Agency. The argument for the UK's shift of delivery method from benefits agency (under FC) to the Inland Revenue (for WFTC) is that it eases application and receipt compared with a benefit payment, and might reduce the stigma of a claim for support from the state. It is therefore possible that the shift from benefit payment to tax credit as a means of delivery of financial support for low-income workers might affect the level and pattern of take-up.[13]

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[11] Up to 65 per cent the value of any Family Credit received is deducted from Housing Benefit payment.

[12] This highlights the potential role of the minimum wage, to prevent the government from subsidising low-wage employers through an in-work benefit to employees.

[13] The choice to participate in a welfare programme forms part of an ongoing literature in the United States, Canada and the United Kingdom. See *inter alia* Blundell, Duncan, McCrae and Meghir (1999); Dickert, Houser and Scholtz (1995); Hoynes (1996); Keane and Moffitt (1997); Moffitt (1990).

2.6   Tax credits versus income/expenditure disregards

Systems of in-work financial support sometimes compensate household expenditures necessary for entering employment. In the United Kingdom, both Family Credit and the current Working Families' Tax Credit have provided additional financial support for households that purchase formal childcare. Under Family Credit, childcare expenditure up to a ceiling could be disregarded in the means test. Disregards extend entitlement to a means-tested benefit, but do not necessarily increase the level of the benefit. For those already on the maximum entitlement to Family Credit, the childcare expenditure disregard offered no additional financial support. Any effects on employment incentives are limited to those already in part-time employment, perhaps at an earnings level beyond the Family Credit taper. The childcare credit component of the Working Families' Tax Credit, on the other hand, increases the maximum payment for those already on maximum WFTC entitlement who purchase formal care. This is likely to generate a greater incentive among currently non-working households to take up paid employment, but will also be more expensive than the FC disregard, with a greater deadweight cost.

3 The Development of In-Work Benefits in the United Kingdom

The original Beveridge (1942) report on developing a social security system actually made very limited reference to the use of the benefit system to promote employment incentives. Furthermore,

> *"The Beveridge Report barely discusses the problem of poverty among working households. In this, it is very much a product of the particular time at which it was written[...]. For Beveridge it was axiomatic that anyone in employment had resources sufficient to support a wife and one child",*

<div align="right">Dilnot, Kay and Morris (1984, p.23).</div>

Family Income Supplement (FIS) was the first benefit in the UK aimed explicitly at low-earning families with children. Introduced in 1971 by the Conservative government under Edward Heath, FIS was initially intended as a temporary mechanism for alleviating in-work poverty. Two-parent families were eligible for FIS if one of them worked 30 hours a week or more: lone parents needed only to work 24 hours a week. FIS entitlement was 50 per cent of the difference between a 'prescribed amount' (which varied according to the number of children in the family) and the family's *gross* income.[14]

In 1988, FIS was transformed into Family Credit (FC). This was one of a range of benefit reforms designed to eliminate some of the more complex features of the UK transfer system. The principal aims were; first, to target low-income households with children; and second, to improve work incentives, not least by eliminating effective marginal tax rates of over 100 per cent.

FC was available to low-income working households with children. The maximum entitlement to FC depended on the number of adults and children in the household. A familiy qualified for FC if at least one member worked for at least 16 hours per week. FC was withdrawn at a rate of 70 per cent as *net* income increased beyond a prescribed amount (or "applicable" amount) compared with 50 per cent of *gross* income under FIS.

The UK Government introduced a further series of reforms throughout the 1990's.[15] In 1992 the minimum hours of work for receipt of Family Credit was reduced from 24 to

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[14] This had an unfortunate effect: an increase in gross income could actually *reduce* net income. Both FIS and Housing Benefit were simultaneously withdrawn as gross income increased. When combined with the increase in income tax and National Insurance liabilities, the effective marginal tax rate could exceed 100 per cent.

[15] These are covered in more detail in Duncan (2000).

16 hours per week for families with children. This made the benefit available to many low-paid, part-time workers previously excluded from financial support.[16] In 1995, the government added a £10 per week payment for families with at least one adult working 30 hours or more, in order to make full-time work relatively more attractive to low-income families. A childcare earnings disregard was added for low-income families purchasing formal (registered) childcare. This allowed expenditure of up to £60 per week on childcare to be disregarded from the Family Credit means test. Table 1 summarises the main events in the history of in-work support in the United Kingdom.

3.1 The Working Families' Tax Credit

Following its election in 1997, the Labour government has introduced a range of reforms to the United Kingdom's welfare and active labour market policies. One of the major elements was the introduction in October 1999 of the Working Families' Tax Credit (WFTC) as the main system of financial support for low-income working families to replace Family Credit. The WFTC costs substantially more than the old FC system.

The government has set itself specific objectives in its programme of welfare reform. These are: "to support families, to make work pay, and to tackle child poverty". The government initiated a wide-ranging review to gather evidence on the effectiveness of work-related support in promoting employment incentives and supporting families on low incomes. It is certainly true that the WFTC reform in the UK was informed to a large degree by the US experience of the Earned Income Tax Credit[17]. The Chancellor of the Exchequer, Gordon Brown, launching the review in his 1997 Budget speech, said:

> *"...I have therefore also asked Martin Taylor to consider at an early stage the advantages of introducing a new in-work tax credit for low-paid workers. It would draw upon the successful experience of the American earned income tax credit, which helps reduce in-work poverty, and now helps 19 million lower-paid workers in America. [...] Conclusions that emerge from this tax benefit review will inform the judgments in my next Budget..."*

Rt Hon Gordon Brown MP (Chancellor), Budget Speech, 2nd July 1997.

[16] Dilnot and Duncan (1992) discuss this particular reform in detail.
[17] See Eissa and Liebman (1996)

The structure of the Working Families' Tax Credit (WFTC) is similar to the earlier Family Credit regime, but it is substantially more generous. The government expected a near doubling of the number of recipients compared with FC to around 1.5 million. The main differences between WFTC and FC are:

i. increases in the adult credit: from £49.80 under FC to £53.15 under WFTC (a rise of nearly seven per cent);

ii. increases in the child credit: from £15.15 for a child under 11 to £25.60 under WFTC (a rise of nearly 70 per cent);

iii. an increase in the threshold before the payment is withdrawn: from £80.65 to £91.45 per week (a rise of over 13 per cent);

iv. a reduction in the withdrawal rate from 70 per cent to 55 per cent; and

v. a new childcare credit of 70 per cent of actual childcare costs, up to a maximum of £150 per week, to replace the childcare disregard.

A stylised comparison of WFTC and FC is shown in Figure 1. The figure shows the value of the two credits at various hours of work. It is interesting to note that the largest cash gains from WFTC go to people who are currently just at the end of the taper under FC. For them, the introduction of WFTC will create an entitlement to in-work support whereas before they were ineligible for FC. This brings more families into the WFTC caseload.

Figure 1: *Family Credit and WFTC*
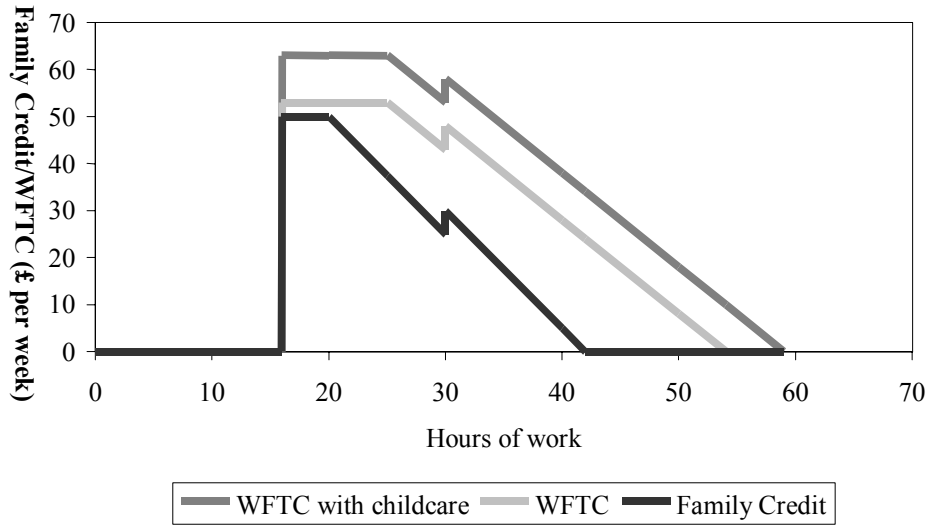
The *childcare credit* under WFTC increases the maximum entitlement by 70 per cent of childcare costs up to £100 per week for people with one child (£150 per week for people with two or more children). The effect of the childcare credit is also illustrated, as the highest line in Figure 1. In contrast to the childcare disregard in Family Credit, the WFTC childcare credit *increases* the total financial support available to mothers who work and pay for childcare. Indeed, the potential generosity of the childcare credit is one of the more interesting features of the new WFTC; at its maximum, it will be worth up to £105 per week. With such generous support available, the WFTC childcare credit is likely to have a considerable expansive impact on the childcare market in the UK. There have been simulations of the possible work-incentive consequences of the WFTC including the childcare credit (see below for illustrative results in a range of scenarios).[18] However, there has been little (if any) work on the impact of the childcare credit on the extent of use of formal childcare services.

As noted previously, households who are eligible for FC and WFTC are often also entitled to Housing Benefit and Council Tax Benefit. These last benefits interact with the in-work credits, meaning that disposable income increase by less than the value of the FC/WFTC payment. Figures 2a and 2b indicates the degree to which the increased generosity of WFTC is negated by interactions with other benefits.

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[18] Blundell, Duncan, McCrae and Meghir (2000)

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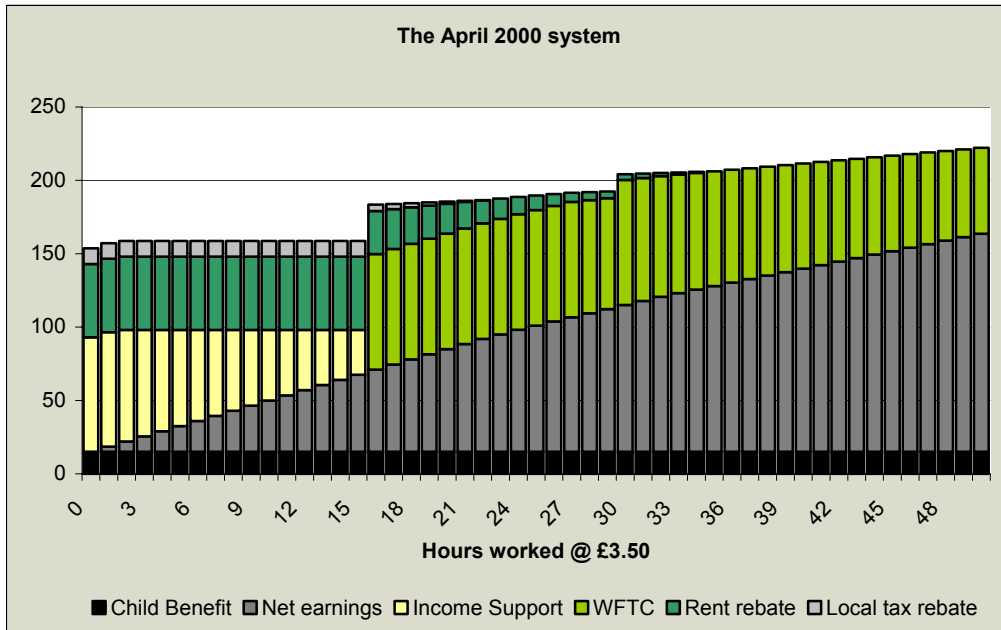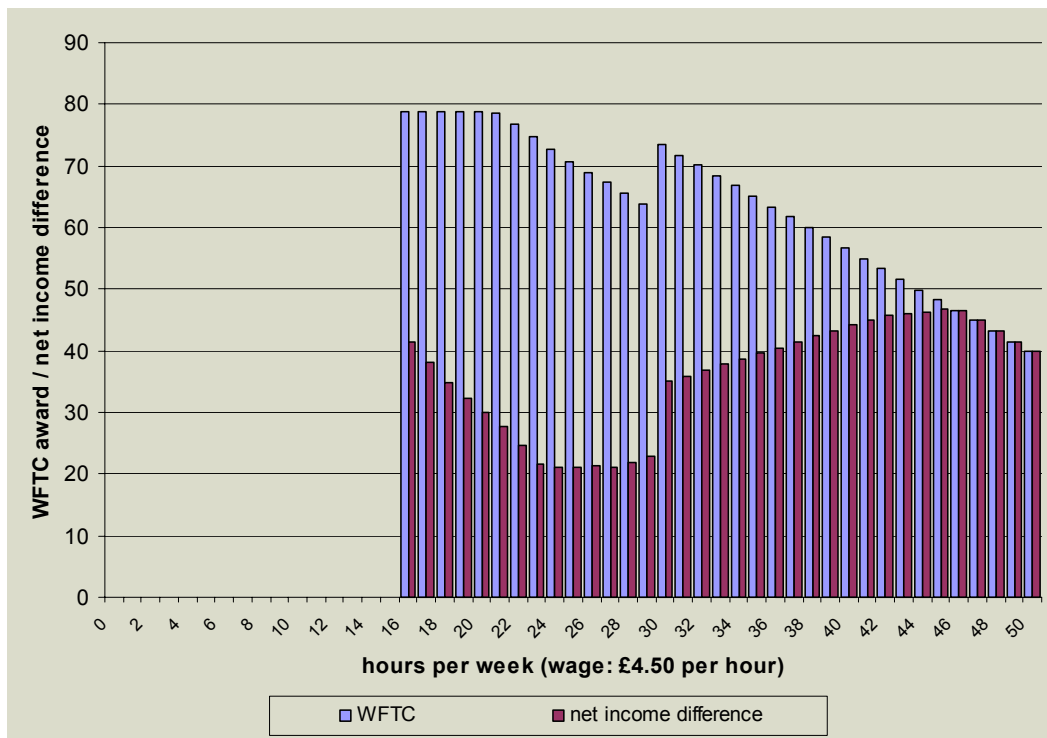**Figure 2a.** *UK budget constraint by income source, single parent, 2000*

The April 2000 system

Hours worked @ £3.50

■ Child Benefit ▨ Net earnings ☐ Income Support ▨ WFTC ▨ Rent rebate ☐ Local tax rebate

Figure 2b. *WFTC award and net income difference, single parent, 2000*

hours per week (wage: £4.50 per hour)

☐ WFTC   ▨ net income difference

4   The Development of In-Work Tax Credits in the United States

Low-income families in the United States receive support from three main programmes: Food Stamps, Temporary Assistance for Needy Families (TANF) and the Earned Income Tax Credit (EITC). TANF — which supports low-income families in and out of work — replaced the old Aid to Families with Dependent Children (AFDC) programme in 1996. States now receive a block grant from the Federal government and have considerable freedom to set the eligibility, generosity, work requirements and other TANF rules. The resulting variability makes it difficult to characterise the system facing a typical low-income family across the United States.[19] Nonetheless, most states provide a maximum credit to low-income families, subject to resource limits, time limits and work or job-search requirements. The credit is then tapered away as income rises, perhaps after an initial disregard. In addition, there are a number of means-tested programs providing subsidised healthcare, housing and childcare.

4.1   The Earned Income Tax Credit (EITC)

The EITC began in 1975 as a modest program aimed at offsetting the social security payroll tax for low-income families with children. But it has now become an important plank in the federal Government's anti-poverty strategy, following major expansions in the tax acts of 1986, 1990 and 1993 (taking effect in 1987, 1991 and 1994-6 respectively). The EITC now costs almost as much as Food Stamps and TANF combined.[20]

EITC is a refundable tax credit.[21] Families apply for it when they file their annual tax returns. Eligibility depends upon having some earned income in a year and on the number of qualifying children (children can be up to age 23 if in full-time education). The amount of credit depends on earnings, other sources of income (from investment *etc.*) and the number of qualifying children. A much smaller EITC is available for people without children. Married couples are assessed jointly. There are three regions in the credit schedule. In the phase-in region, the credit is equal to a percentage of income until

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[19] Committee on Ways and Means (1998) describes the rules that the federal government imposes on states. Gallagher et al (1998) provides a comprehensive description of the TANF rules in all states as of October 1997. The Welfare Rules database at the Urban Institute is an online database of the key parameters in states' TANF programmes.

[20] In 1999, EITC spending was $31.9bn, compared to $16.7bn on TANF and $19.0bn on Food Stamps (cited in Hotz and Scholz, 2001).

[21] Hotz and Scholz (2001) is a recent and comprehensive review of the operation and impact of the EITC.

the credit equals the maximum amount. There is then a flat region across which the maximum credit is received. In the phase-out region, the credit is tapered away to zero.

In 2000, for example, a family with two or more children received a maximum credit of $3,888 in EITC, phased in at a rate of 40 per cent. The maximum credit was reached at $9,720, and was held until incomes passed $12,690. Beyond this maximum, a taper of 21.06 per cent was applied to the level of EITC. At these rates, the EITC was withdrawn completely when income reached $31,152.

Figure 3. *The Earned Income Tax Credit in 2000*
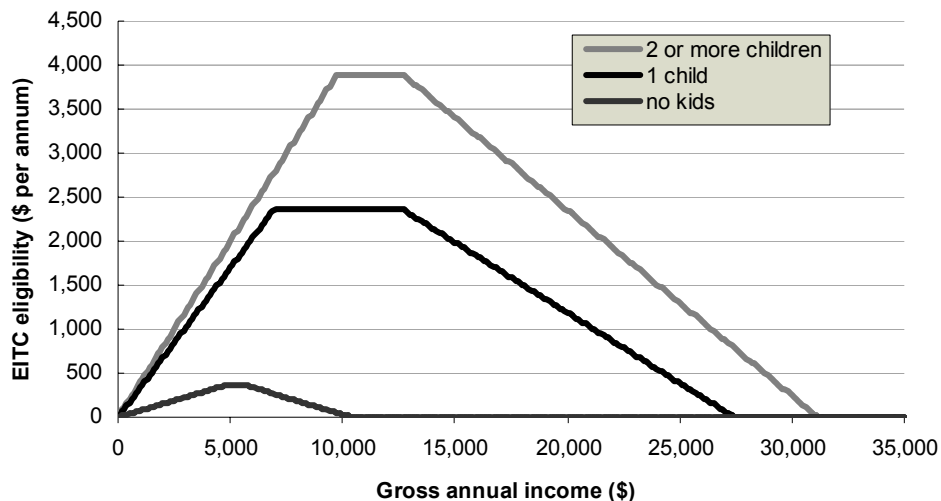
4.2   The Development of the Earned Income Tax Credit in the United States

It is instructive to see how the Earned Income Tax Credit has evolved over time in the US. In 1975, the first EITC system had a single rate structure for all families with children that did not differentiate rates according to the number of children in the household. Not until the 1990 reform did the rate for adults with two or more children exceed that for families with a single child, although the differentiation at that time was relatively modest. In 1993 and again in 1996, the rate for households with two children

was systematically increased relative to single child households. In addition, a smaller EITC was made available to childless households.

Figure 4 compares the (uprated) values of EITC systems from 1975 to 2000 (for families with two children). It is clear that the generosity of financial support under EITC has increased considerably over the period since its inception in 1975 to the most recent structure in 2000. Table 1 lists the main events in the history of in-work benefit reform in the United States and the United Kingdom.

Figure 4. *The development of the Earned Income Tax Credit from 1975 to 2000*
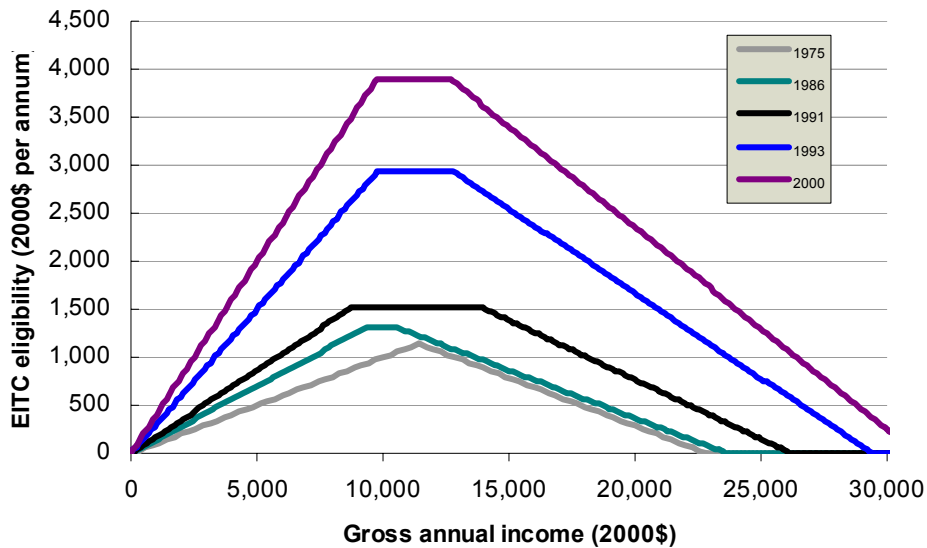
Table 1. *A history of tax credit reforms in the United Kingdom and United States*

United States	*Year*	United Kingdom
	1971	Family Income Supplement (FIS) introduced as a means-tested in-work benefit
Earned Income Tax Credit introduced for low-income working families with children (max credit: $400)	*1975*	
Tax Reform Act 86: EITC generosity increased	*1986/7*	
	1988	FIS replaced by Family Credit (FC) (increased generosity, lower overall METR). Hours condition on eligibility (24 hours per week)
Omnibus Reconciliation Act 1990: EITC generosity increased. Separate rates for 2+ children. EITC excluded from means test in other welfare programs.	*1990/1*	
	1992	Hours condition on eligibility reduced (to16 hours per week)
Omnibus Reconciliation Act 1993: EITC generosity increased for families with 2+ children. EITC extended to include workers without children.	*1993*	
	1995	Additional credit of £10 for those working 30 hours per week. Childcare expenditure disregards introduced
Personal Responsibility and Work Opportunity Reconciliation Act. AFDC replaced by TANF	*1996*	
	1997	Labour Government elected in UK. Chancellor announces intention to introduce new tax credit
	1998	SSSC visits US to examine EITC implementation issues. Chancellor pre-announces WFTC reform
	1999	WFTC replaces FC (increased generosity, reduced taper, generous support for childcare costs)
	2000	Increase in generosity. WFTC paid through the tax code
	2003	Integrated Child Credit and Employment Tax Credit to replace WFTC

Sources: Brewer (2000); Dolowitz (2000); Eissa and Liebman (1996).

5 The Earnings Credit in Australia

In October 1998, a group of five economists wrote an open letter to the Prime Minister of Australia with a range of policy ideas with which to target unemployment and promote work incentives. One of the ideas in this letter was the introduction of an Earnings Credit (EC) with which to supplement the wages of low-income working households. The design of the proposed EC borrows much from experiences elsewhere (principally the United Kingdom and the United States) on the use of in-work subsidies and tax credits. Indeed, the suggested structure of the EC presented in Lambert (2000) is very similar to the current Earned Income Tax Credit system in the United States. In particular, there is a phase-in range over which the EC increases up to a maximum level of entitlement, and a limit beyond which the EC is tapered away.

Lambert's EC is linked closely to the Family Tax Benefit (Part A). The income limits — at which an EC recipient qualifies for the maximum credit and at which the EC starts to be tapered away — are both defined by structural changes in Family Tax Benefit (Part A) entitlement. The rationale is to integrate the EC with the current tax and transfer system and to prevent the introduction of the EC from creating additional complexities in the pattern of marginal effective tax rates faced by low-income households.

5.1 The structure of the Lambert (2000) Earnings Credit

As mentioned earlier, the design of the Lambert (2000) Earnings Credit is tied closely to the existing Family Tax Benefit (Part A), which offers financial assistance to low-income families with children. In July 2000, the maximum entitlement to FTB Part A was $3,029.50 a year for children aged 0-12 and $3,839.80 a year for children aged 13-15. Minimum benefits were $974.55 per annum for children aged 0-17 and $1,306.50 for dependent children aged 18-24. For 16-24 year olds, there is no more-than-minimum entitlement.

There are two income tests. The *higher level* of FTB is withdrawn at a rate of 30 per cent beyond an income threshold of $28,200 until the minimum FTB payment is achieved. (This applies only to 0-15 year olds.) Eligible households are then able to keep this minimum amount until a higher income threshold of $73,000 a year is reached. Beyond this higher threshold, the minimum FTB Part A is also withdrawn at a rate of 30 per cent

until exhausted. Overall, these rules combine to generate a payment schedule of the form described by the darker line in Figure 5.

***Figure 5.** Family Tax Payment Part A and an Earnings Credit*
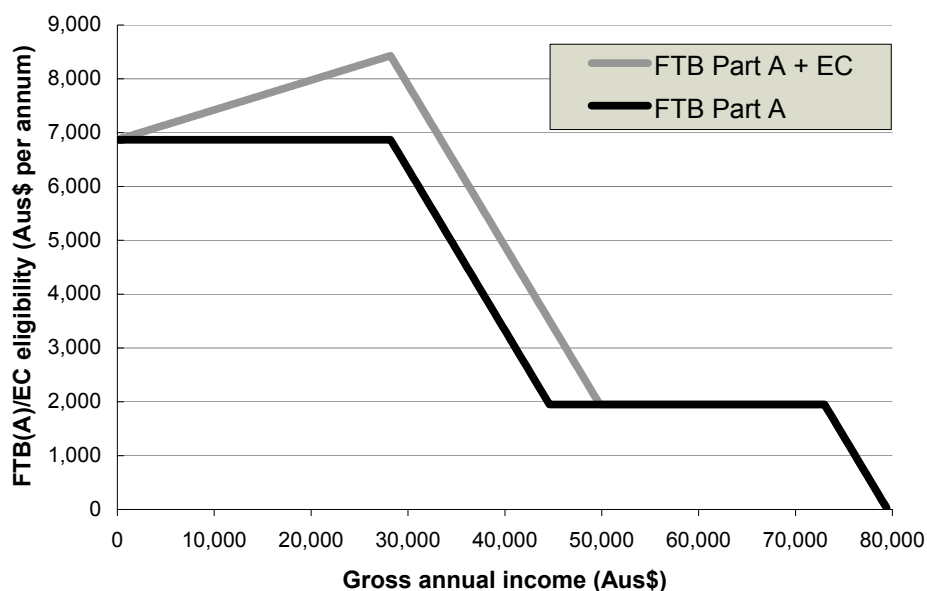
The Lambert proposal offers a maximum EC of $30 per week (or $1,560 per annum). This is phased in at a rate which guarantees that the maximum EC is attained at precisely the point at which FTB Part A starts to be withdrawn. For the cited FTB Part A parameters, the implied phase-in taper for the Earnings Credit will therefore be $1,560/28,200 =$ **5.53** per cent. The maximum Earnings Credit is then maintained until income reaches the point at which FTB Part A is withdrawn to the minimum FTB amount. In Figure 5, corresponding to a family with two children aged 8 and 13, the maximum FTB Part A will be ($3,029.50 + $3,839.80)=**$6,869.30**, and the minimum will be 2 x $974.55 = **$1,949.10**. Hence, all extra FTB Part A is withdrawn once income reaches $28,200 + ($6,869.30 – $1,949.10)/0.3 = **$44,600.67**. Lambert (2000) uses this as the income limit beyond which EC starts to be withdrawn (at a rate of 30 per cent) from its maximum level. When added to FTB Part A, the value of the Earnings Credit corresponds to the grey schedule in Figure 5. The linkage of the parameters of the two payments ensures that no *additional* non-linearities enter the overall net income schedule for credit recipients. All credit recipients will see a rise in total net income, although some will also see their marginal effective tax rates rise (specifically, those whose incomes take them just beyond the point at which more than minimum FTB is received).

It is interesting to compare this proposal with the systems of in-work support in the United Kingdom and United States both in terms of structure and value. In Figure 6 we plot a typical schedule (for a single worker with two children) for the Earned Income Tax Credit and the Working Families' Tax Credit, converting roughly to US dollars in 2000 prices. Superimposed in the same diagram is the Lambert EC, set at $30 per week per recipient.

Figure 6. Comparing the proposed Earnings Credit with EITC and WFTC
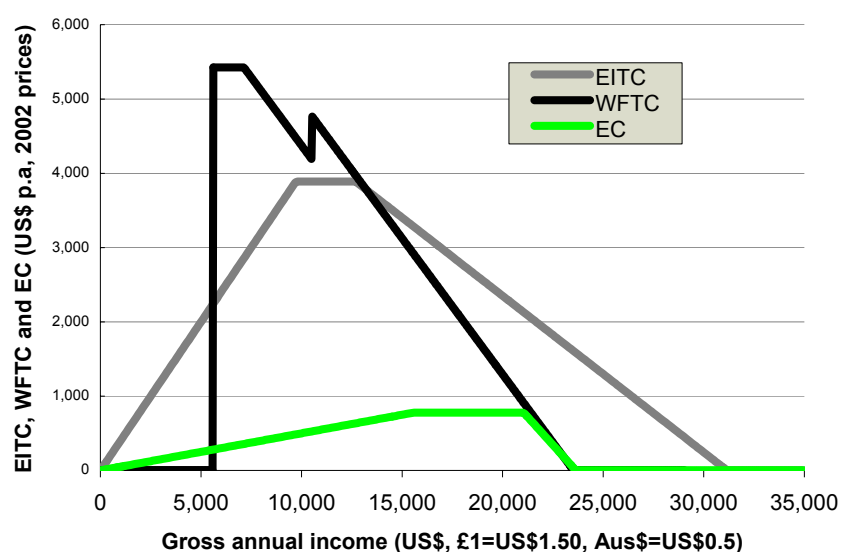
The EC looks, at first glance, to be significantly less generous than either EITC or WFTC. But this would be a misleading conclusion to draw from the stylistic comparison of schedules in Figure 6, for a number of reasons. First, the chart ignores other elements in the tax and transfer systems that assist low-income households and working households. Secondly, the apparent generosity of a tax credit does not always translate ultimately to an equivalent increase in overall net incomes. For example, WFTC is assessable as income for calculating Housing Benefit and Council Tax Benefit, as noted previously. Reductions in these last benefits offset the gains from the WFTC (*cf.* Figure 2b). In contrast, Lambert's EC proposal avoids this problem because it is attached to FTB Part A and is assessed after all other payments have been received. Therefore a $30 per week EC will translate into an increase in net income of $30 per week overall.

5.2 Hours conditions and variations in the maximum Earnings Credit

The Lambert EC proposal does not contain an explicit hours condition of the sort operating within the WFTC and its predecessors in the United Kingdom. The absence of an hours condition has advantages and disadvantages. On the positive side, it avoids labour-market 'inertia', whereby people work at or near the hours threshold, but have little or no incentive to work much beyond. On the negative side, it limits the targeting of the benefit. An income condition alone means that people with high wages and low hours of work are equally entitled to the benefit as people with a low-wage/high-hours combination. Having both an income *and* an hours condition would restrict the targeting of the Earnings Credit to people with a low-wage/high-hours combination, and would potentially sharpen the employment incentive impact of the credit, *but only* if the savings from introducing an hours condition were used to increase the maximum value of the Earnings Credit.[22]

The decision to introduce an hours condition therefore depends on the relative importance of:

• distributional objectives: helping households with low incomes is best achieved by an income test alone; and

• labour-market objectives: employment incentives are weaker (*ceteris paribus*) for low-wage than they are for high-wage workers and an hours condition means that high-wage/low-hours workers are ineligible.

Figure 7 shows the effect of introducing an hours condition among the eligibility rules for the EC, and of simultaneously increasing the maximum value of the credit. The Earnings Credit with an hours condition resembles the United Kingdom's WFTC, and this resemblance is further sharpened when one compares the Earnings Credit with the *net income difference* schedule for the WFTC, as shown in Figure 2b.

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[22] In fact, the introduction of an hours condition onto an Earnings Credit with otherwise equal generosity may *reduce* employment incentives for those who would originally have preferred to work below the hours limit for entitlement.

Figure 7. *Earnings Credits with an hours condition*
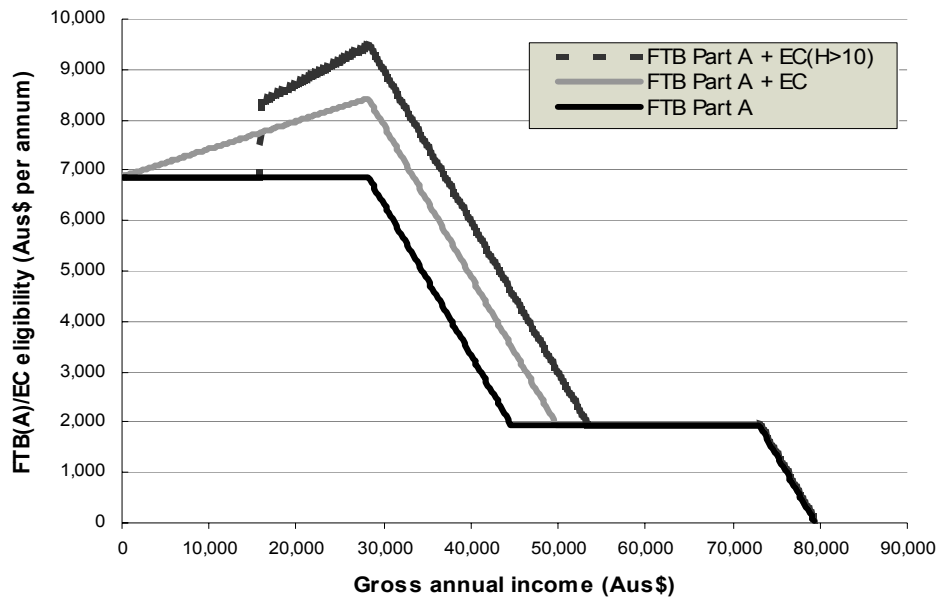
5.3 Coherency in the development of tax and transfer systems

Tax and transfer systems around the developed world are typically products of *incremental* changes or additions. It is much rarer to find that a country's tax and transfer system has been designed as a coherent and integrated entity. Nevertheless, it can be useful to consider the range of objectives on which a government's tax and welfare policy is based, and to reflect on whether the incumbent system of taxes, subsidies and transfer payments is either effective or efficient in delivering on those objectives. This is particularly true in periods in which fundamental reforms are being considered.

It is easy to see how difficulties can emerge when public policies are introduced or amended in order to deliver on stated objectives. Whether through inertia, or because of administrative complexity, there is a natural tendency to compromise on structural public policy reforms in order to fit easily into an existing policy framework. And of course, the motivation for fundamental reform is tempered by political considerations, most obviously the desire to limit the number of 'losers'. It would be naïve not to recognise that these are real and powerful pressures. However, the consequences of such practical considerations on the coherency of a tax and transfer system can be significant.

To develop the concept of *coherency*, it is instructive to examine recent proposals which have been put forward to overhaul the current system of family payments in the United Kingdom. Following its election in October 1997, the incoming UK government set a number of specific objectives. These were:

"to support families, to make work pay, and to tackle child poverty".

To deliver on these objectives, the government introduced a series of labour market reforms during their first period of office, most notably the Working Families' Tax Credit (WFTC), together with a range of active labour market policies. The WFTC is innovative to a degree in the context of the UK tax and welfare system, in the sense that it is delivered as a tax credit, and includes generous additional support for working families who purchase formal childcare. However, it is also a compromise, in the sense that it replicates many of the eligibility criteria for Family Credit, the previous in-work benefit aimed at low-income working households with children. Most crucially, the credit is targeted at working families *with children*. As a result, the WFTC is both a *partial* and an *inefficient* instrument with which specifically to deliver employment incentives. Firstly, the WFTC can only promote employment among households with children. And secondly, the WFTC is intrinsically bound up with the first and the third objective ("*supporting families with children*", and "*alleviating child poverty*"). Hence, there is an inevitable overlap between the WFTC and other instruments in the government's portfolio designed to target families with children. As a design idea, it seems more logical and coherent to identify *separate* policy instruments with which to deliver on specific objectives.

The UK will introduce two major reforms of the tax and benefit system in 2003: the integrated child credit and the employment credit. While some important features of the system have yet to be announced, a consultation paper sets out the basic structure (Inland Revenue, 2001). The aim is to streamline and simplify the existing system. For example, the integrated child credit will combine three sources of support for families with children into a single instrument paid directly to the caring parent.

This is illustrated in two charts (Figures 8 and 9). The first shows the situation in 2001-02. There are currently four sources of child support:

- universal child benefit;

- premiums for children in means-tested benefits for people out of work (income support and job-seekers' allowance);

- credits for low-paid parents in work (working families' tax credit); and

- children's income tax credit.

The second chart shows how the last three might be unified into a single integrated child credit. This has been designed to match the features of the current system. In particular, there are two ranges over which the integrated child credit is phased out. These two tapers correspond to the withdrawal of WFTC and the child income tax credit (from higher-rate taxpayers) respectively in the current system. The second change is that the basic credit of the WFTC becomes the new Employment Tax Credit.

Comparison of the two charts shows that the new regime might be much simpler than the old, with attendant benefits in making the system easier to understand and to administer. It will also make the system more coherent, in the sense that there are separate instruments for different objectives. The WFTC, for example, is designed both to support families with children and to encourage parents to work. In the new system, separate employment and integrated child credits are each focused on a single distributional or labour-market objective. This makes the logic of the system easier to understand: child support will be paid directly to the caring parent while the employment credit will be paid with wages by employers. This coherence also makes it easier for governments to alter the parameters of the regime to achieve particular goals.
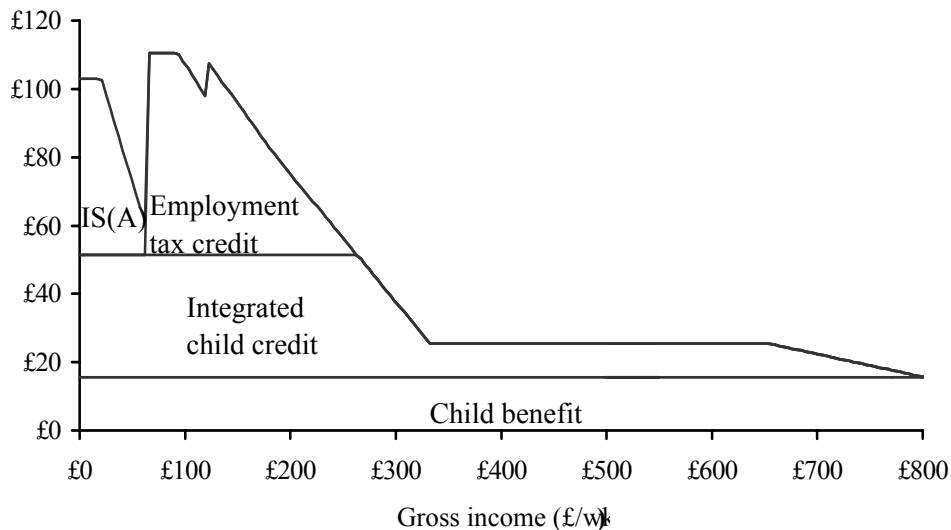
Figure 8. *Current support for families with children in the United Kingdom, 2001-02*
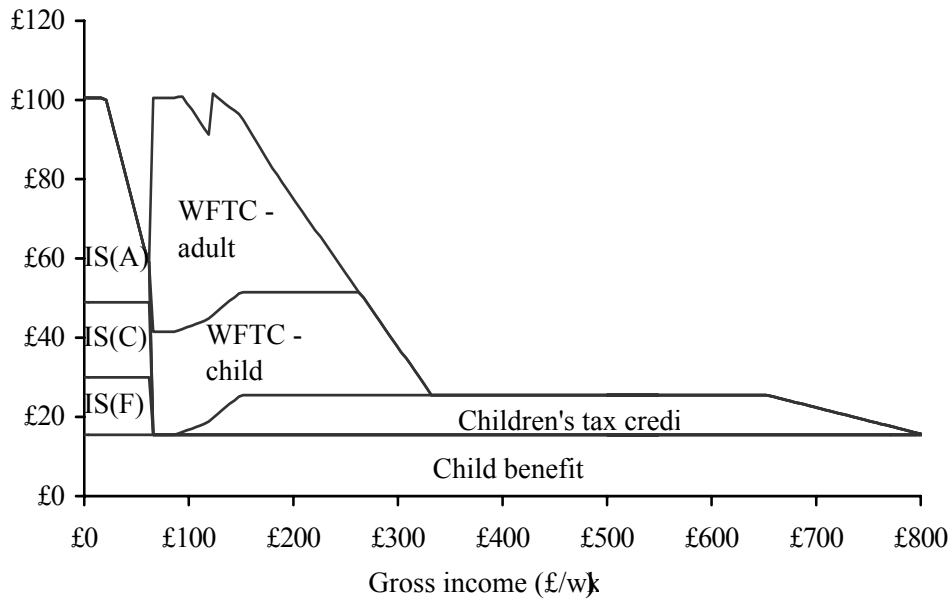
Note: Assumes family qualifies for WFTC at a weekly wage of £65.60, corresponding to 16 hours of work at the minimum wage. IS(A): adult income support; IS(F): family premium in income support; IS(C): child additions in income support

Source: Brewer, Clark and Myck (2002)

Figure 9. *Potential structure of employment tax credit/ integrated child credit in the United Kingdom*

Note: Assumes new tax credits equalise support for families with children on low incomes; that the family qualifies for employment tax credit (at weekly wage of £65.60, i.e., 16 hours of work at the minimum wage)

Source: Brewer, Clark and Myck (2002)

5.4 Coherency in the Australian tax and transfer system

The idea of coherency is a useful framework within which to consider some new policy ideas that have entered the Australian welfare reform debate, most recently in the publication of the "five economists" letter and in the formation and deliberations of the Reference Group on Welfare Reform. Simplification (and indeed, coherency) forms part of the background to this debate. Among a range of specific policy proposals, the five economists recommended the introduction of a tax credit with which to alter the wage-tax tradeoff among working families. More recently, Michael Keating and Simon Lambert fleshed out the recommendation through a proposal for an Earnings Credit, tied initially to the current Family Tax Benefit (Part A), and resembling the structure of the US EITC.

So how might one view the position of a tax credits in general, and Lambert's (2000) proposal in particular, in the ongoing debate in Australia? Is it an effective instrument with which to deliver employment incentives? Does the proposal respect the idea of coherency? Can it be viewed as a step towards the simplification of the welfare system in Australia?

5.4.1 Employment incentives among lone parent households

The model of labour supply used to simulate the employment effects of Earnings Credits for lone parent households in Australia is described fully in Duncan and Harris (2002) and Kalb (2002). For a discussion of how econometric models of this form are used in simulation routines in general, and in the Melbourne Institute Tax and Transfer Simulator in particular, see Creedy and Duncan (2002) and Creedy, Duncan, Harris and Scutella (2001). A brief description of the methodology is included in the Appendix to this paper.

The model allows for quite flexible preferences over hours of work and net incomes, and accounts for fixed costs (including childcare costs) that affect the likelihood of employment. These costs differ by the age and number of children. An important feature of the models we use is that they allow preference heterogeneity across household types. That is, preferences and costs are allowed to vary with observable factors such as age and demographic composition. Moreover, they are also allowed to depend on unobservable characteristics.

We use the model to generate a *probability* that a person with a certain set of observed characteristics will participate or work a certain number of hours. This probability should be interpreted as the proportion of people in the population with these characteristics that carry out the action being evaluated (e.g. participation in the labour market). Simulating the effects of the reform involves estimating the changes in these probabilities (proportions) as a result of the policy being introduced.

The basic Earnings Credit proposal of Lambert (2000) offers a maximum credit of $30 per week to working lone parent households. The credit is phased in such that the maximum credit becomes payable once the lone parent's income is sufficient to take them to the limit of eligibility for the maximum payment of FTB Part A. There are no specific hours conditions for EC eligibility. For the series of simulations presented in this paper, we experiment with the structure of the EC, both by varying the level of the maximum EC, and by introducing specific hours conditions for entitlement, of the form that currently limit entitlement in the UK WFTC system. Specifically, we examine a range of variants to the EC that restrict entitlement to lone parents who choose to work 10, 20 and 30 hours. And we consider the effects of increasing the maximum entitlement to EC to $40 per week.

Table 2a summarises the overall costs of these EC variants (expressed in Aus$ millions), using the Melbourne Institute Tax and Transfer Simulator (as described in Creedy, Duncan, Harris and Scutella, 2001). It is important to note that these simulated costs are *static*, in the sense that they *do not* include any adjustments for changes in labour market behaviour following the introduction of the EC. The Lambert (2000) proposal is modelled to cost around **Aus$2.5billion,** or around 22% of the overall cost of FTB payments. By introducing hours conditions for entitlement, these (static) costs are reduced to a degree. For example, if entitlement were restricted to those working 20 hours or more, then the overall cost of the credit reduces to around **Aus$2.3billion.** These cost savings are relatively modest, since many households will lose much or all of their entitlement to EC before reaching the hours condition for eligibility. The cost of the basic Lambert (2000) credit increases significantly, from Aus$2.5billion to **Aus$3.5billion** if the maximum credit is increased to $40 per week. Not only does the EC increase for those previously eligible for the $30 credit, but there will be some previously non-eligible workers who are entitled to the more generous credit.

Table 2a. **The simulated cost of the Lambert (2000) Earnings Credit and variants (in Aus$millions, and as a proportion of the cost of FTB payments)**

| | Value of Earnings Credit (Aus $ per week) | | | |
	30		40	
Hours condition				
	Δcost	Δ%	Δcost	Δ%
no limit	+2482	*+22%*	+3518	*+31%*
Hours>10	+2460	*+21%*	+3488	*+30%*
Hours>20	+2310	*+20%*	+3281	*+28%*
Hours>30	+2088	*+18%*	+2969	*+26%*

Turning now to the employment effects of the Earnings Credit, Table 2b reports the results of a series of simulations of the labour supply responses of lone parents to different variants of the Lambert (2000) proposals. The basic $30 per week EC, linked to FTB Part A, is modelled to increase employment rates among lone parent households by around **5.1 per cent,** using the parameterisation of labour supply reported in Kalb (2002), with average hours increasing by around 1.5. So, the main effect of the EC is on participation, a feature common to many equivalent simulations of the effects of tax credits on lone parents' employment incentives in the US (for example, in Eissa and Liebman, 1996) and the UK (see Blundell, Duncan, McCrae and Meghir, 2000a). As hours conditions are introduced to the $30 credit, we see a reduction in the simulated employment response, for reasons explained earlier in the paper. Restricting eligibility to those who choose to work 20 hours is modelled to result in a **4.1 per cent** increase in employment among lone parents.

One can see how hours conditions and increases in the level of entitlement can be combined to improve the efficiency of the Earnings Credit in promoting employment. If, for example, entitlement to the EC were limited to those lone parents who choose to work for 20 hours or more, then the employment gain reduces from 5.1 per cent to 4.1 per cent. However, if the maximum EC is then increased from $30 to $40 per week, the simulated increase in employment rises to **5.9 per cent** among lone parent households.

Table 2b. **Employment effects of the Earnings Credit among lone parents**
(proportional increase in employment, and average hours change)

	Value of Earnings Credit (Aus $ per week)			
	30		40	
Hours condition				
	Δ emp(%)	Δ hours	Δ emp(%)	Δ hours
no limit	+5.1%	+1.5	+6.4%	+1.8
Hours>10	+4.7%	+1.5	+6.3%	+1.9
Hours>20	+4.1%	+1.5	+5.9%	+2.0
Hours>30	+2.6%	+1.3	+3.6%	+1.7

Finally, Table 2c compares the costs of the EC among lone parent households when one ignores behavioural responses to those which take full account of the simulated increases in employment. As lone parent households move into employment to take advantage of an Earnings Credit, their entitlement to other allowances, and the amount of tax they pay, will adjust also. If one measures the change in the overall net cost to the Australian government of an Earnings Credit (as a proportion of the net cost of payments minus taxes paid), the basic Lambert (2000) plan ($30 per week, no hours condition) would increase net costs in respect of lone parents by around **2.6 per cent** when behavioural responses are ignored. However, if one factors the likely increases in employment into this assessment, the *adjusted* net cost is only **0.2 per cent**..[23]

5.4.2 Coherency of the Earnings Credit

Is the Earnings Credit proposed by Lambert (2000) coherent in the sense described above? That is to say, is it an instrument that can be used specifically to target the objective of promoting employment incentives? Overall, I think it can, but with one caveat. The simulations reported here do suggest that the Earnings Credit is relatively efficient at increasing participation rates among lone parent households, although future research is required to assess whether this positive feature extends to other demographic groups. The general structure may be adapted and modified to improve targeting, and to

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[23] It is unlikely that such flowbacks would be repeated for other demographic groups, whose employment responses are likely to be more modest.

Table 2c. **The adjusted net cost of the Earnings Credit among lone parents**

	Value of Earnings Credit (Aus $ per week)			
	30		40	
Hours condition				
	Static(%)	Adjusted (%)	Static(%)	Adjusted (%)
no limit	+2.6%	+0.2%	+3.6%	+0.4%
Hours>10	+2.6%	+0.0%	+3.5%	+0.3%
Hours>20	+2.6%	-0.6%	+3.2%	-0.5%
Hours>30	+1.8%	-1.2%	+2.4%	-1.5%

increase efficiency, and there are readily identifiable parameters of the EC system with which to deliver additional employment gains. However, the Lambert (2000) EC system is linked very closely to the structure of FTB Part A, the parameters of which do vary with the number and ages of children in the household. Specifically, the phase-in and phase-out regions of the EC are defined by the income tests for FTB Part A, and the withdrawal of the EC depends on the difference between maximum and minimum FTB Part A and the withdrawal taper for FTB Part A.

This strong linkage has been proposed with good reason; by doing so, the introduction of the EC does not increase the *number* of effective marginal tax rates (EMTRs) faced by EC recipients as their labour supply or earnings change[24]. However, the overall coherency of the Australian tax and transfer system may be compromised as a result. Firstly, the EC definitionally depends on the age structure of children in a household, through its dependence on the parameters of the FTB Part A system. And secondly, a reform to FTB Part A designed with other policy objectives in mind, for example to support the incomes of families with children, will also affect the employment incentives delivered by the Earnings Credit.

That said, there is nothing to prevent an Earnings Credit from being parameterised independently of other elements of the Australian tax and transfer system, as is the case for the US EITC or the proposed ETC in the United Kingdom. The structure could be maintained (and amended) without affecting other payments. However, by doing so, there is a danger that the EC would increase the complexity of the Australian tax and

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[24] Although the EC will alter the *level of earnings/hours* at which EMTRs change.

transfer system rather than simplifying it. For this reason, it is instructive to consider how an Earnings Credit might fit into the wider debate on simplification of the welfare system.

5.4.3 Earnings Credits as a route to simplification

Some commentators have argued that the proposed Earnings Credit does nothing to simplify the Australian welfare system. Indeed, it has been argued that the EC actually *increases* complexity by adding an additional payment structure to the existing range of payments available to low-income households. This is true in a mechanical sense, although the proposed linkage to FTB Part A has minimised the additional complexity. However, it would be fallacious to use this as a reason for opposing the idea out of hand. Consider again the parallels with the recent proposals for reform to the UK welfare system, where the current WFTC is to be replaced by a more streamlined Employment Tax Credit. In the UK reform proposals (*cf.* Figure 9), the ETC sits in a more coherent structure of payments with separate instruments to target low-income households (via Income Support, or IS), families with children (via Child Benefit and the Integrated Child Credit) and those working families who purchase formal childcare (via the Childcare Tax Credit). This separation of instruments with which to deliver on different objectives is one shared by the proposal in Australia of a move towards an Earnings Credit. Indeed, the similarity between the ETC in the UK and the EC in Australia is striking.

Because of its proposed position as the last in the hierarchy of taxes and payments in the Australian tax and transfer system, the Earnings Credit does not alter entitlements or eligibilities to other payments to which EC recipients might be entitled. One can therefore see how the EC would feature in larger scale welfare reforms which simplify payments elsewhere in this hierarchy.

6 Summary and Conclusions

This paper considers the general role of employment tax credits in promoting employment incentives, concentrating specifically on the potential employment responses among lone parent households in Australia to the proposed Earnings Credit (EC) as described in Lambert (2000). The concept of *coherency* in tax and transfer systems was discussed, whereby separate policy instruments can be identified and adjusted to target a variety of specific policy objectives. Using international experience on the

development of tax credits, the paper shows how existing tax credit structures might been refined to bring about an improvement in the coherency of existing welfare systems.

Using an econometric model developed by Duncan and Harris (2002), and implemented in the Melbourne Institute Tax and Transfer Simulator (MITTS), the Earnings Credit was found to have a positive impact on employment rates among lone parent households. The effectiveness of the Earnings Credit was found to vary with the level of the maximum credit, and by introducing alternative conditions of eligibility into the basic EC system.

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Appendix: Simulating the Employment Effects of the Earnings Credit

A1. Modelling Preferences and Income Opportunities

For each working individual from the sample of lone parents, we use data from the Australian Income Distribution Survey (IDS) and the Melbourne Institute Tax and Transfer Simulator (MITTS) to calculate net incomes at any choice of hours of work. For non-workers additional information on their hourly wage rate is required to complete the net income calculations. These hourly wages are calculated from the predictions of a log hourly wage regression. This regression includes education, age, demographic and regional dummy variables and is estimated using the IDS data.

For each individual in our sample we now know the net income that would be associated with any choice of hours of work. The budget sets are non-convex. Hence conventional labour supply schedules cannot capture the incentive effects of the reforms, that involve potentially large changes in hours (say from zero to 20). Given the budget constraint facing each individual, the approach taken is to describe preferences over a *subset of discrete hours points,* reflecting the diverse incentives created by the benefit system. This will be described in more detail below. First we need a functional form for preferences. For each lone parent in the sample, preferences are written in terms of hours of work, net income, a set of observable demographic factors and unknown preference parameters.

Suppose we let *Y* represent the net income available to a particular lone parent who works *h* hours, including his/her earnings. We represent the preference trade-off between hours and this net income using a quadratic utility function of the form:

$$U(h,Y) = \alpha_{yy}Y^2 + \alpha_{hh}h^2 + \alpha_{yh}Yh + \beta_y Y + \beta_h h$$

The α and β parameters are preference parameters. It is the β parameters that are allowed to depend on observable and unobservable factors according to:

$$\beta_y = \beta_{y0} + \beta_x'x + v_y$$
$$\beta_h = \beta_{h0} + \beta_x'x + v_h$$

where the **x** represent a vector of observable demographic and other household characteristics. The **v** represent unobservable random terms. These unobservable terms are allowed to be correlated but are assumed to be jointly normally distributed.

A2. Modelling Discrete Choices over Hours

Hours of work choices are summarised by a finite set of points, e.g. {0, 10, 20 30, 40}. To allow for preferences to vary quite widely over these hours choices, the utility level for each hours point is allowed to vary stochastically over individuals according to an extreme value distribution. This implies that, conditional on the **v** terms, choices across discrete hours points can be written as a multinomial logit model:

$$\Pr[U_i \geq U_j | \text{all } j] = \frac{\exp U(H_i, Y_i : \alpha, \beta)}{\sum_k \exp U(H_k, Y_k : \alpha, \beta)}$$

where the subscript represents a discrete hours point.

If there were no unobserved heterogeneity terms represented by the **v** terms then these probabilities would be exactly analogous to the terms in a multinomial logit model. However, the additional unobservable variables imply that to calculate the probabilities we first have to integrate over the range of the **v** variables. In doing this we effectively relax the otherwise strong distributional assumption. The integration is done by simulation methods assuming a multivariate normal distribution for the **vs** in our estimation and simulation routine.

This simple multinomial discrete choice preference model is not sufficient to adequately describe the observed outcomes in the data, and for the simulations presented in this paper we additionally control for fixed costs of work in the model structure.

A3. Fixed Costs of Work

Fixed costs are the costs that an individual has to pay to get to work. For many families they are made up in part by childcare costs. However, there are additional costs, e.g. transport, which will vary by household type and by region. These are modelled as a once off weekly cost. In the model they are subtracted directly from net income for any choices that involve work.

They are modelled in a similar way to preferences, in terms of a set of observable factors and an unobservable heterogeneity variable

$$FC = \gamma' x + \omega$$

These terms will now enter the utility comparisons for each individual in their work – non-work choice. Consequently, they will also enter the probability terms described above. To calculate the probability of any observed hours point, the heterogeneity term ω will be integrated out in estimation along with the v terms, and the parameters γ will add to the list of parameters, along with the α and β parameters, to be estimated.

A4. Estimation and simulation

Estimation is by maximum likelihood. For each observed family there is a probability term generated from the above model. This can be written in terms of the unobservable parameters to be estimated. Taking the whole data set together generates the sample likelihood. To evaluate the probabilities entering the likelihood, simulation methods have to be used to integrate out the unobservable terms described above. Consequently maximum likelihood estimation is by simulation.