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Earned income tax credit policies: Impact and optimality The Adam Smith Lecture, 2005

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Abstract

In this lecture I consider the impact and optimality of Earned Income Tax Policies. The policy issue addressed is the low labour market attachment and high incidence of poverty among certain groups. These policies have taken a central position in EU labour market policy debate and I focus on reforms over the last decade in the UK.
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'No society can surely be flourishing and happy in which part of the members are poor and miserable. Thus far at least seems certain, that, in order to bring up a family, the labour of the parent must be able to earn something more than what is precisely necessary. Indeed poverty, though it does not prevent the generation, is extremely unfavourable to the rearing of children.' **Adam Smith: An Inquiry into the Nature and Causes of the Wealth of Nations.**

1. Introduction

The policies analysed in this lecture are those directed towards addressing low labour market attachment and low wages of among certain groups of parents with children. The aim of the research agenda reported on in this lecture is to evaluate the impact and assess the optimality of Earned Income Tax Credits policies specifically for lone parents.[1] These policies have been at the centre of welfare to work reforms in the UK, in the US and increasingly in continental Europe.

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[1] Although earned income tax credit policies have been implemented for couples in the UK and in the US, I will focus on the design of such policies for lone parents. The issues are similar but, for couples, we need to consider a model for *joint* labour supply decisions in families. A number of alternative models exist; see Blundell et al. (2005a) for example. However, the implementation and estimation of collective models for the analysis of tax and welfare reform is still in its infancy, see Bargain et al. (in press).

They are in the class of 'make work pay' reforms highlight a 'work condition' in welfare policy. The objective is to balance poverty reduction in families with children and employment incentives. In the context of policy in the UK lone parents have been a key group. This has also been the case for the US; see Blundell and Hoynes (2004), for example.

There are two key questions considered in this lecture. First, what is the impact of such in-work benefit reforms on labour supply and to what extent does a standard labour supply model capture the main impact? Second, to what extent are such tax credits policies optimal, that is do they constitute an optimal income transfer for low income people?

As part of this lecture I also want to address a pronounced puzzle in the comparison of tax credit policies in the UK and the US. As we will see, on face value, the UK policy appears about twice as generous as the US policy. That is the maximum transfer available in the UK system is twice in real terms that available through the US system. Yet the impact of this policy on labour supply responses among key eligible groups in the UK looks to be about half what it was among similar groups in the US. Why so? As we will show the puzzle can be convincingly resolved, and not in the trivial sense of attributing the differences to US workers being more responsive to incentives. Far from it, in fact labour supply response elasticities across the two countries seem about the same. Rather it is the design of the expansions in the generosity of these policies and the interaction of tax credits with other parts of the tax and benefit system that hold the answer. As we shall see the resolution of this puzzle highlights some of the key design issues in earned income tax credit policies both in terms of their impact and their optimality.

The growing popularity of earned income tax policies has stemmed from changes in the economic environment during the late 1980s and early 1990s. Specifically, the secular decline in the relative real wages of the low skilled[2], and the resilience of child poverty rates in both the US and the UK.[3] To combat these two issues, welfare to work policies turned to in-work credits for lone parents. As a result the last decade has seen the increasing reliance in welfare policy on in-work benefits, and more specifically on earned income tax credits, see for example Inland Revenue (2001). The aim of such policies is to break the 'iron triangle' of welfare policy - that is the three, often conflicting, goals: raising the living standards of those on low incomes; encouraging work and economic self-sufficiency; and keeping government costs low.

There is an expanding theoretical literature examining the role of work requirements in the design of optimal income transfer programmes. In a dynamic model the important issue relates to incentives for poverty reducing investments and investments in human capital. Besley and Coate (1992) derive conditions under which workfare can be optimal. Cossa et al. (2002) develop a dynamic model with time limits and human capital investment. In a more static setting the recent contribution by Saez (2002) shows that, where labour supply responses are concentrated along the extensive margin (participation in work), an earned income tax-credit system with transfers that increase with earnings at low levels can be optimal and justifies the move away from negative income tax schemes. Moffitt (2005) argues that paternalistic social welfare functions that include a social value placed on work are best able to motivate such reforms. It is these static optimality results that form the background to the analysis reported here, although I will return to the more dynamic aspects at the end of the lecture.

Using estimates of structural models of labour supply responses at the extensive and intensive margin, I will pose the question: can the existing tax credit systems we observe be considered 'optimal' for reasonable social welfare weights? As a precursor to the analysis I will have to

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[2] Gosling et al. (2000).
[3] Brewer and Gregg (2001).

convince you of the validity of the structural model estimates. For this I will make a comparison with a simple difference in difference evaluation strategy. Although not providing sufficient information for policy simulation or the assessment of optimality, simple difference in difference evaluations can be valuable for validating the specification of more fragile microeconometric models. Provided the comparison groups can be reasonably argued to experience the same macroeconomic trends, and there are no systematic composition changes before and after the programme, a difference in differences methodology can provide a useful guide to the extent of a policy impact. With a validated structural labour supply model I then turn to the optimality of the tax credit policies. It turns out that for the samples of lone parents we examine, an earned income tax credit *is* likely only to be optimal for those families on low incomes with children of school age. For those with pre-school age children and for reasonable social welfare weights it is much more difficult to justify allocating a larger transfer to those in work as a tax credit implies even if heavily means tested.

The layout of the remainder of the discussion is as follows. In the next section I will briefly consider the relationship of earned income tax policies with other wage subsidy policies. Then I will move on to the policy context for the earned income tax credit policies. Section 4 will examine the nature of the UK reforms in comparison with the US policies. In Section 5 I will turn to the dual questions of impact and optimality. Finally Section 6 will conclude and draw together some lessons for earned income tax policy design.

2. Earned income tax credits and their relationship with wage subsidy policies

To some extent earned income tax credit policies can be seen within the general set of wage subsidy policies but there are important differences. The wage subsidy is typically individually based, not means-tested and has limited duration, see Katz (1998) and Phelps (1994). Where wage subsidies are provided to individuals, rather than directly to firms, eligibility is usually dependent on a certain duration unemployment insurance (or welfare) receipt. The earned income tax credit, on the other hand, is typically subject to a family income based means-test and does not have a time limit. For the later, the WFTC in the UK, the EITC in the US[4] and the In-Work Tax Credit in Belgium[5] are prime examples. For the wage subsidy case, the New Deal for Young People in the UK and Work First[6] in the US are leading examples.

There are, of course, many welfare to work policies that fall somewhere in between these two extremes. For example, the Self-Sufficiency Project (SSP)[7] in Canada, although an in-work tax credit like the WFTC or EITC, has a three year time-limit and eligibility depends not only on overall family income and family composition but also on a minimum welfare duration and a minimum hours requirement. The New Hope[8] tax credit programme in the US also has a three-year time limit and a minimum hours condition. Both programmes provide job search assistance at least for some of programme participants.[9] The Minnesota Family Investment Program

[4] See Eissa and Liebman (1996).
[5] See Gradus and Julsing (2001), who also review similar schemes and proposals in Germany, the Netherlands, Ireland and Finland.
[6] See Holcomb et al. (1998) for a review of these schemes. In particular the Work Mandate designs which are very close to the design of the New Deal.
[7] See Card and Robins (1998).
[8] See Bos et al. (1999).
[9] Quets et al. (1999) provide a careful evaluation of the effect of adding job search services to the SSP. This evidence is used later in our discussion of job search assistance in financial incentive programmes.

(MFIP)[10], is similar to the SSP, however the job search assistance is mandatory as in the New Deal for Young People in the UK. An additional feature of these Canadian and US programmes is that many were the subject of randomised experimental evaluation, the results of which provide a vital source of information in the discussion below. Finally, the earnings supplement and job search provisions within the many US State run additions to the Temporary Aid for Needy Families (TANF) programme in the US have similar characteristics to the New Deal programme (see Card and Blank, 2000).

An essential characteristic of an earned income tax credit like the WFTC and EITC is the long term commitment to redistribution and the high implicit tax rates that are a consequence of the means testing principle on which such tax credits are based. But what of their impact and their optimality? Can we think of means testing combined with a work condition as an optimal component in a tax and benefit system? To address these issues we first turn briefly to the motivation for the introduction and expansion of earned income tax policies in the UK and the US during the 1990s and in to the new millennium.

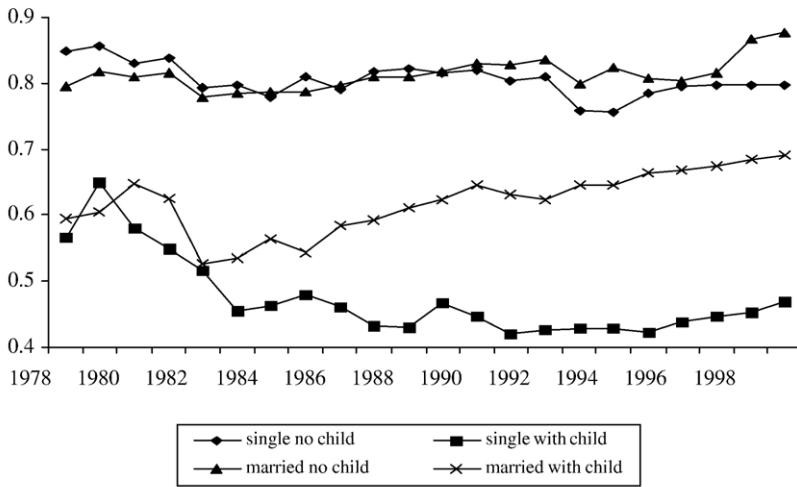## 3. The labour market background for the shift towards in-work benefits

The low levels of employment, experienced by certain specific demographic groups of working age in Europe and North America during the early 1990s, were a strong motivation for the introduction and expansion of earned income tax policies over this period. For example, one central stimulus for the Working Families Tax Credit in the UK was the stubbornly low levels of attachment to the labour market by single mothers in the 1990s - at a time when for other groups of similar women attachment was generally been increasing. Fig. 1 shows the secular change in female employment across four household types in the UK over the 1980s and 1990s. The growth in the attachment by women in couples with children was as noticeable as is the fall for single women with children.[11] This low level of labour market attachment was even more pronounced for those with low levels of education. Blundell and Hoynes (2004) document this change and examine the similarities between demographic trends for single mothers in the UK and US.

Another distinguishing characteristic of the UK labour market over this period was the growth in workless couples with children. This is documented in Fig. 2 and provided a strong argument in the debate over the WFTC reform. Indeed, for women in couples with unemployed partners employment rates have stayed no higher than 30% over the past two decades - even lower than employment rates for the single parent group (see Gregg et al., 1999). The (non-) employment rates for these two groups show clearly why they have been singled out as two target groups for tax and benefit reform. Unlike earned income tax reforms in the US, couples with children were given similar incentives to single parents. However, because the level of the credit was means-tested against *family* income, there were perverse incentives to work for individuals in couples where there was already one spouse in work.

In the US there is a relatively small credit for couples but nonetheless Eissa and Hoynes (2004) still document a perverse negative income effect on the wives of low income working men. This has been an important feature of the family income based means-testing component of earned

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[10] See Miller et al., 1997. Continuation of the MFIP in work is conditional on accredited training for workers who do not have children under one year old and who are in jobs of less than 30 hours per week.

[11] These figures are drawn from the repeated cross-sections of the British Family Expenditure Survey. As such they refer to different people over time and will therefore exhibit systematic composition changes according to birth cohort, education and other factors.

Proportion in Work

Notes: FES Data, working age.

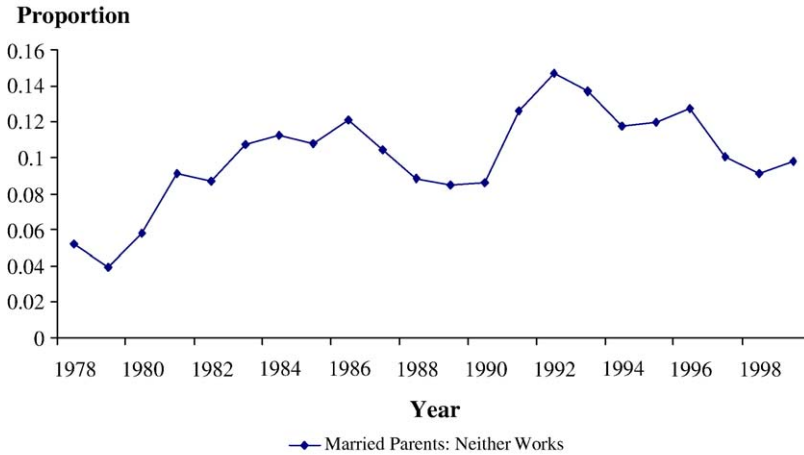Fig. 1. Employment Trends for Women in the UK: Proportion in Work.

income tax credits and there is strong evidence of negative employment effects in the UK among working wives in low income families where both adults work, see Blundell et al. (2000). Here I focus on lone parents, where this effect is irrelevant, although the issue of individual versus joint income assessment in the overall design of earned income tax credits for married couples is one that deserves serious attention.[12]

4. The earned income tax credit reforms: WFTC and EITC

The 1999 reform, in which the UK government introduced WFTC, provided an increased generosity of the existing in-work benefit in the UK - Family Credit. The Working Families Tax Credit had its antecedents in the Family Credit (FC) system introduced in the late 1980s. Indeed earned income tax credit policies in the UK and the US date back more than two and half decades.[13] The Family Credit policy in the UK was designed to provide modest support for low wage working families. There were three main eligibility criteria: work eligibility, which for lone parents required a job with 16 or more hours per week; family eligibility, which required children in full time education or younger; income eligibility, which required a family's net income is below a certain threshold. In this system each eligible family was paid a credit up to a maximum amount which depended on the number of children. There was also a small addition if in full time work. As income increased above the threshold the credit was withdrawn at a rate of 70%. In 1996, just before the WFTC reform, average FC payments were comparable to payments to those who were not working and take-up rates stood at 69% of eligible individuals and 82% of the potential expenditure.

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[12] An important start on this has been made in Kleven et al. (2005) and for a discussion of collective models see Bargain et al. (in press).

[13] See Blundell (2002) and references therein.

Proportion

Notes: FES Data. Working age head.

Fig. 2. Proportion of Workless Couples in the UK.

The WFTC policy retained the main eligibility criteria of the Family Credit policy. However, the generosity of the system was expanded in a number of ways. It increased the credit for younger children and the overall income threshold, see Table 1. It reduced the benefit reduction rate from 70% to 55%. Finally, the reform incorporated a childcare credit. This was worth 70% of actual childcare costs up to £150 per week (for two children, £100 for one child). The largest cash gains went to those people were currently just at the end of the benefit reduction taper. The transfers underlying the WFTC expansion are illustrated in Fig. 3.

On the face of it, the UK system was and remains a very generous tax credit, more generous than the US equivalent, as shown in Fig. 4 which provides a direct comparison with EITC. As with the WFTC, eligibility for the EITC policy requires dependent children, positive earned income, and having income below the limit. By the end of the 1990s the EITC was phased in at a 34 (40) percent rate, phased out at a rate of 15.98 (21.06) percent for families with one child (two or more children). Fig. 4 presents the two systems in terms of their gross transfers in 2001. These are evaluated for a minimum wage single parent with one and with two eligible children in both systems. Assuming that eligibility and receipt continued for complete year. The broad similarities in the programs include larger credits for two child families and the phasing out of the benefits.

Table 1
Adult and child elements of the WFTC

	Adult	Child awards by age		
		Child		
		0 to 10	11 to 15	16 to 18
Mar-99	£58.80	£16.40	£22.60	£28.00
Oct-99	£56.60	£21.50	£22.60	£28.00
Mar-00	£56.60	£22.60	£22.60	£28.00
Jun-01	£61.90	£27.30	£27.30	£28.00
Jun-02	£64.40	£27.30	£27.30	£28.00
Increase	19.70%	66.40%	20.50%	0.00%

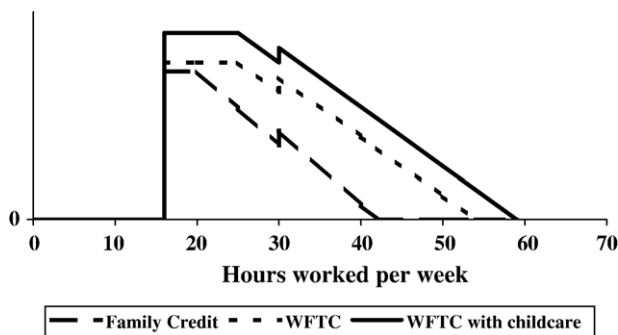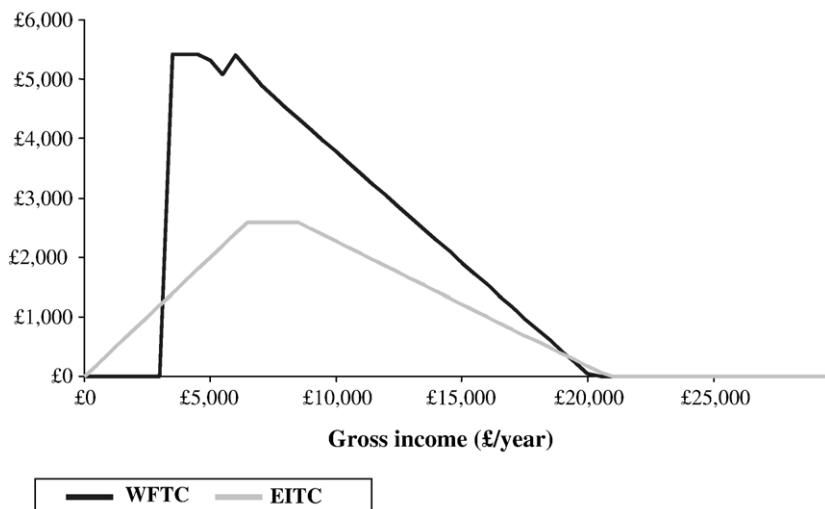Note: All monetary amounts are expressed in April 2003 prices.

Fig. 3. The WFTC Expansion.

The differences are also clear from the figure. The vertical rise in eligibility in the UK system corresponds to the minimum hours eligibility at 16 hours. At 16 hours the UK recipient receives the maximum she is eligible to. This contrasts with the US proportionate tax credit up to the maximum amount. The UK system also displays a much steeper withdrawal reflecting a higher benefit reduction rate. This provides for a greater degree of targeting in the UK system but the potential for higher implicit tax rates. There are any additional specific idiosyncrasies to each of these systems (see Brewer, 2001 for an in depth recent comparison). Overall for low earning families the UK system appears to be quite generous and significantly more so than the US system.

A key feature of the UK policy is that the tax-credit is based on net (rather than gross) family income and we show that it is important when assessing the impact and design of the reform to allow for the interaction with other benefits and taxes. In contrast to the EITC in the US, the WFTC interacts fully with other benefits, most especially housing benefit. A majority of those

Note: All monetary amounts are expressed in April 2003 prices. Source: Brewer (2001).

Fig. 4. The WFTC and EITC Compared.

individuals eligible to WFTC are also in receipt of housing benefit. Since income from the earned income tax credit is counted as income in the computation of Housing Benefit, the overall impact on net income of reforms to the system can be substantially reduced. This significantly reduces the incentive to work in the WFTC for families with large housing costs in the private or public rented sector, the large majority of single parents. Fig. 5 illustrates these interactions for a 'typical' single parent on the minimum wage post-WFTC.

Despite the dampening effect of these interactions with other benefits, there does seem to be some prima facie evidence of an impact on behaviour. A look at the histogram of weekly hours worked for single parents presented in Fig. 6a, for example, shows a strong peak in hours worked at 16 hours. This is not evident for ineligible groups such as single childless low educated working women as reported in Fig. 6b. Of course, there will be a large number of so called 'windfall beneficiaries' and there may also be those who decide to reduce their working hours in response to the incentive at 16 hours.

What actually happened when WFTC was introduced? The number of recipients increased markedly after its introduction in October 1999, and continued to rise at a much faster growth rate than seen under Family Credit (see Inland Revenue, 2003, 2005). A year after its introduction, caseload had risen by 39%, and the majority of this increased caseload seems to have come directly from the increased generosity making more families entitled, rather than from families moving into work. The caseload of lone parents on out-of-work benefits (income support) has declined steadily and slowly since late 1996, with no discernible change in trend around 1999–2000. Analysis of administrative data that tracks individuals across income-related programmes shows that the net inflow of lone parents from out-of-work benefits to WFTC in the 12 months from November 1999 to November 2000 was 50,000, 17,000 higher than the last 12 months of FC. Overall, the number of children in families on either out-of-work welfare benefits or FC/WFTC has increased since early 1999.

The take-up of WFTC was roughly the same as it had been for FC for lone parents. Overall take-up among eligible lone parents was around 70% but varied in important ways with eligible entitlement level. Nonetheless as Fig. 7 suggests take-up is an important characteristic of the
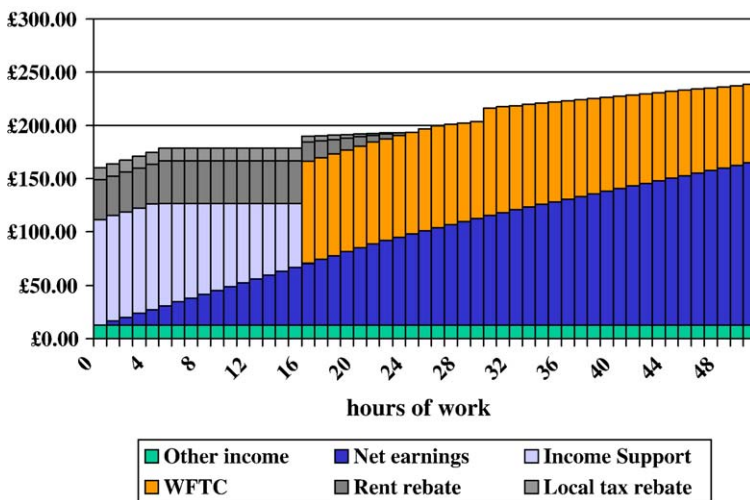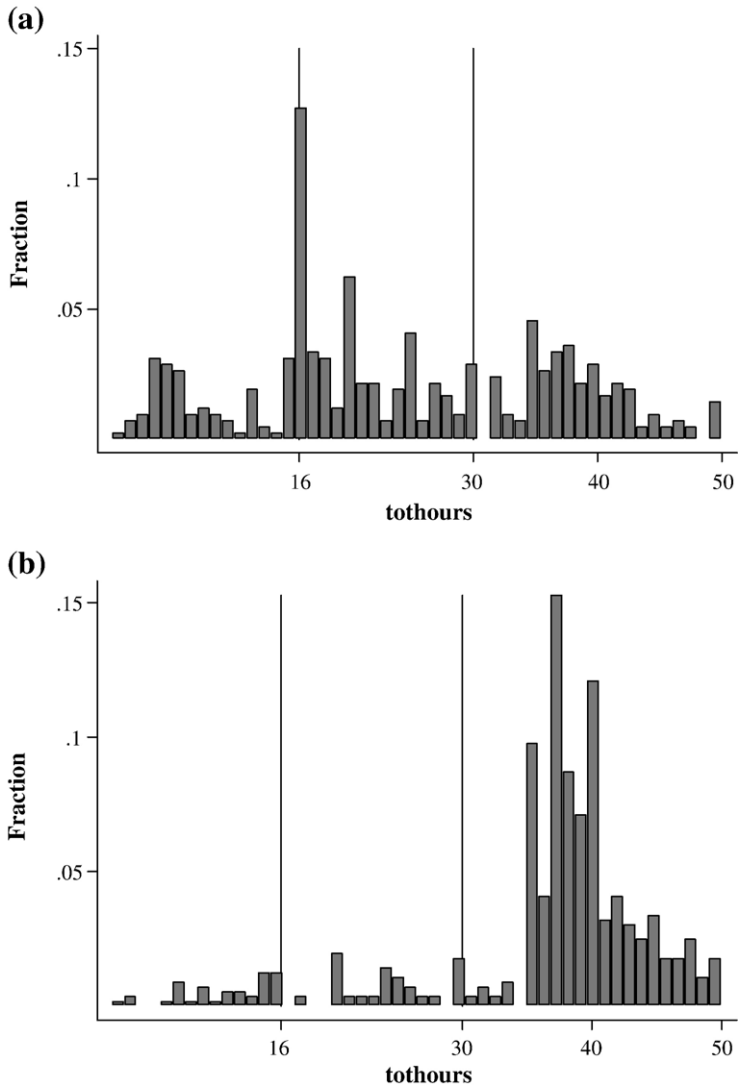

Fig. 5. WFTC and the Interaction with Other Taxes and Benefits.

(a)

(b)

Notes: Family Resources Survey, 1998/99; Blundell and Hoynes (2001).

Fig. 6. a: Weekly Hours Worked: Low Education Single Parents in the UK. b: Weekly Hours Worked: Low Education Single Women without children in the UK.

WFTC system, with the take-up rate rising with the level of financial entitlement. In modelling any reform the trade-off between stigma and financial benefits in individual decision making is an important characteristic of behaviour.[14]

As a final point it is important to note that other reforms occurred at the same time as the WFTC policy. This coincidence of reforms is crucial in understanding the impact of the reforms. It is also key in interpreting the degree to which child poverty relief as much as work incentives
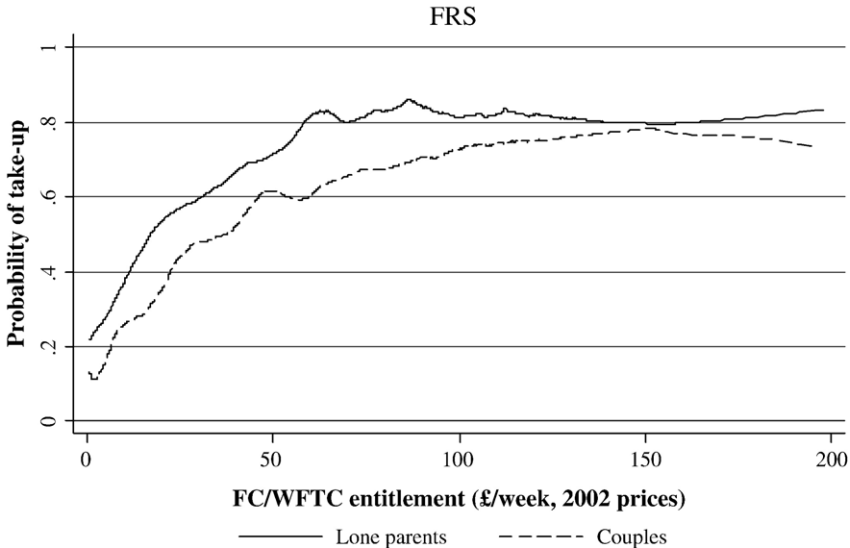
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[14] See Moffitt (1983).

Fig. 7. Take-Up Rates and the WFTC. Source: Adam and Brewer (2005).

were an important design feature of the WFTC reform. At the time of the WFTC reform, there were three other main ways that the UK tax and transfer system provided support for children: Child Benefit, child allowances in Income Support, and a non-refundable income tax allowance. The changes in the child rates of Income Support are documented in Table 2 and provide a further clue to the resolution of the puzzle in the comparison of impacts between the EITC and WFTC. Indeed the typical budget constraint for a single parent will have changed, but only as is documented in Fig. 8. Thus providing some incentive for a move to full time work but little overall strong incentives to work for many single parents facing relatively high costs of work.

5. The impact and optimality

It is often the case that evaluation studies in modern labour economics restrict themselves to the simple average impact of any reform. In thinking about an earned income tax credit this seems too limited an objective. Especially as the reform itself is supposed to be balancing work disincentives and efficiency costs against redistribution and child poverty alleviation. In this lecture I want to pose a broader evaluation question: what is the impact of such policies and in what sense are they 'optimal'? That is, do they constitute an optimal income transfer for low income people?

In terms of optimal design, much theoretical work has focussed on the intensive margin of labour supply responses. However, recent work, notably Saez (2001, 2002), has developed a theory that combines decisions at the extensive and the intensive margins - employment and effort (hours).[15] If extensive and intensive elasticities differ, then the optimal structure of taxes and benefits can be to transfer more to those with low income but in work than those out of work, even with welfare weights that decline monotonically with income. Exactly the structure of an earned income tax credit.

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[15] See also Chone and Laroque (in press), Beaudry and Blackorby (2000), Liebman (2002).

Table 2
Child rates of income support

	Child		
	0 to 10	11 to 15	16 to 18
Mar-99	£21.90	£28.00	£33.50
Oct-99	£27.00	£28.00	£33.50
Mar-00	£28.40	£28.40	£33.80
Mar-01	£33.00	£33.00	£33.80
Oct-01	£34.50	£34.50	£35.40
Mar-02	£34.50	£34.50	£35.40
Increase	57.50%	23.30%	5.70%

Note: All monetary amounts are expressed in April 2003 prices.

To assess optimality we need robust estimates of elasticities at extensive (participation) and intensive (hours and weeks of work). These are structural parameters. Typically quasi-experimental or experimental provide estimates of average treatment effects from specific policy reforms which, while robust, bare only indirect relation to the elasticities needed.[16] On their own quasi-experimental approaches do not identify all the parameters necessary to assess optimality. But they can be argued to provide useful measures of average impact effects, see Blundell and Costa-Dias (2000, 2006) and Heckman et al. (1999), for example. As a consequence they can be used to assess the validity of structural estimates of the elasticity parameters. This is the approach taken in Blundell et al. (2005a,b) where a difference in differences estimator of the average impact of the WFTC reform is used to validate the structural simulation model required for the optimality analysis. The structural model is a stochastic choice model of labour supply and programme participation building on the earlier work of Hoynes (2000), Keane and Moffitt (1998), Blundell et al. (2000) and van Soest et al. (2002).

As we will see the structural evaluation results of the WFTC policy reform do show smaller impact effects than may have originally been expected given the generosity of the reform. But results appear robust - the quasi-experimental difference-in-differences estimate does not reject structural model. To pre-empt: the small effects are due to interaction of WFTC with other taxes/benefits and the rise in family allowances which are given without a work condition, rather than 'small' response elasticities. Moreover, under reasonable welfare weights the general design of the WFTC policy do line up with an optimal earned income tax credit design.

5.1. Impact

There was no piloting or randomised demonstrations to assist in the evaluation of the WFTC policy reform. To evaluate the impact, two approaches are adopted. The first uses the simulation model developed in the ex-ante structural evaluation study of Blundell et al. (2000) and further developed in Brewer et al. (in press). This model was based on earlier structural labour supply research by Hoynes (2000) and by Keane and Moffitt (1998). In particular, it allows for child care demands to vary with hours worked and it allows for fixed costs of work. It also accounts for take-up by incorporating welfare stigma costs following on from Keane and Moffitt (1998). In the second approach we use data from before and after the reform to provide a quasi-experimental difference in differences estimate of the average impact of the reform. A simple difference in

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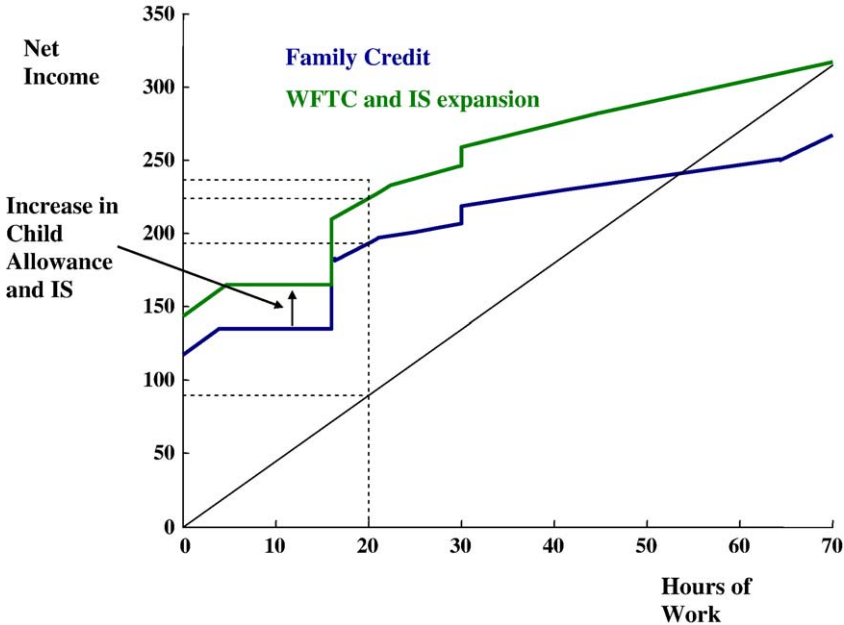[16] See Blundell and MaCurdy (2000).

Fig. 8. Transfers and Taxes under Family Credit (lone parent, min wage).

differences methodology can provide a useful guide to the extent of a policy impact. Here we follow the Eissa and Liebman (1996) study of the EITC expansion in our choice of comparison group. This involves comparing outcomes of (potentially) eligible versus those single women without children who are not eligible. From this we identify average impact on eligibles by *assuming* a structure on unobservables. There are three key assumptions (i) separability, (ii) common trends across groups and (iii) invariance in group heterogeneity over time. In our implementation we follow Blundell et al. (2004) and adopt a 'matching differences in differences' strategy which means that these assumptions only need to be valid conditional on a set of (matching) covariates.

The data on single mothers and childless single women used in the difference-in-differences analysis comes from two sources. The Family Resources Survey (FRS) which is the data used also for the structural analysis. This is a cross-section household-based survey drawn from postcode records across Great Britain: around 30,000 families each year are asked detailed questions in face to face CAPI interviews about earnings, other forms of income, family composition and labour market status. It is the data set most often used to micro-simulate tax and benefit reforms in the UK, and was used to model labour supply in Blundell et al. (2000). The second source is the Labour Force Survey (LFS) which is much bigger than the LFS but has much less accurate measures of income and hours and is not suitable for a structural analysis which requires careful measurement of the potential budget constraint for all individuals.

The data spans the period Spring 1996 – Spring 2003. We drop Summer 1999 – Spring 2000 inclusive as this covered the period when the WFTC policy was introduced. We also drop individuals aged over 45. The outcome variable reported in Table 3 is the employment rate expressed as a percentage. The matching covariates include age, education, region and ethnicity. Overall Table 3 points to a 3.5 to 4 percentage point increase in single mothers labour supply attributable to the WFTC policy. We also conducted a sensitivity analysis which considered alternative groups. For

Table 3
Difference-in-differences results

Single women	Marginal effect	Standard error	Sample size
Family resources survey	3.57	*0.81*	74,959
Labour force survey	3.81	*0.33*	233,208

Data: Spring 1996–Spring 2003.
Drop: Summer 1999–Spring 2000 inclusive; individuals aged over 45.
Outcome: employment. Average impact ×100, employment percentage.
Matching covariates: age, education, region, ethnicity.
Source: Blundell et al. (2006).

lower education groups we found a slightly larger response from a lower base level of employment. These were the group most likely to eligible to larger transfers under the WFTC policy. We also examined sensitivity to the choice of pre-treatment years. The results are robust to changing the pre-treatment time window and also choice of 'hypothetical' reform on pre-reform years. For example, a hypothetical reform in spring 1997 would yield an impact effect of .07 *(.11)*.

Next we turn to the structural analysis and the validation of the structural model. It should be noted that even if the difference in differences assumptions were not valid the structural model will allow us to simulate the moments underlying the diff-in-diff estimator anyway and this in turn would still provide a validation of the structural model. The underlying variation which is used to identify the structural model comes from variation across location and time in taxes and benefits as well as well as an exploitation of the precise rules of the tax and benefit system. Specifically variation in housing costs and local taxation provides useful variation in the potential budget constraints across individuals in our sample. Of course this requires that individuals use this information in the same way as we do in constructing their counterfactual budget constraints.

There are a number of key features of the structural model.[17] There is the budget constraint which reflects tax and benefit interactions as well as take-up. There are also the modelling of preferences where discrete hours choices. Heterogeneity is allowed by demographic and ethnic group as well as a broad set of unobserved heterogeneity. The model pays particular attention to fixed costs of work, to the specification of stigma/hassle costs and to childcare costs.

The overall stochastic specification is a mixed-multinomial specification across discrete choices over ranges of hours. It builds directly on the work of Hoynes (2000) and Keane and Moffitt (1998). Individuals are assumed to maximise their utility subject to a budget constraint, determined by a fixed hourly wage and the tax and benefit system. The utility function is approximated with a second degree polynomial expansion in hours of work and net income with unobserved heterogeneity. In addition to preference heterogeneity in the marginal rate of substitution between work and consumption, the model allows for unobserved heterogeneity in program participation 'costs', childcare costs and fixed costs of work.

Given the considerable non-convexities in the budget constraint generated by the tax and transfer system, individuals are assumed to choose from a small subset of hours corresponding to the hours ranges 0, 1–15, 16–22, 23–29, 30–36 and 37+ respectively. Blundell and MaCurdy (2000) give the arguments for modelling labour supply with a discrete choice model: the main advantage is that it easily permits the highly non-convex budget constraints created by welfare benefits and in-work support. For each choice of hours, there is also an additive stochastic component on the utility of each hours choice assumed to follow a standard (Type-I) extreme-

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[17] These are summarised here, for a full description see Blundell et al. (2000) and Brewer et al. (in press).

value distribution. This assumption is common, see Blundell et al. (2000) and Keane and Moffitt (1998). van Soest et al. (2002) discuss some possible interpretations of the errors (unobserved alternative-specific utility components, or errors in perception of the alternatives' utilities, for example); their main advantage is in providing positive probabilities that are continuous in the parameters.

Empirically, a number of studies have shown that estimating labour supply models without unobserved work-related costs is more likely to lead to estimates of preferences that are non-convex; conversely, allowing for work-related costs tends to lead to estimates of preferences which are convex (see references in Heim and Meyer, 2004). Inferring parents' labour supply preferences from observed behaviour without considering childcare is likely to lead to biased conclusions. As WFTC provides financial support for formal childcare costs for families where all adults are working, evaluating the impact of WFTC on labour supply requires us to specify the childcare costs of working parents. The model allows explicitly for childcare costs, assuming a linear relationship between hours of childcare per child and hours of work h. This relationship is allowed to vary with the number and age of children.

Unobserved heterogeneity enters in several places. Through the take-up or programme participation cost, the childcare expenditure costs, and the fixed work-related costs. Unobserved heterogeneity also affects preferences directly through the linear income and hours terms in the quadratic utility specification. In estimation, the integrals in the log-likelihood are approximated using simulation methods (see Blundell et al., 2006), integrating out the random preferences by drawing a number of times from the distribution, and computing the mean pseudo-likelihood across these realisations. The unobserved preference heterogeneity terms are assumed independently normally distributed, and we approximate the distribution of childcare prices with 6 discrete mass points. The estimated parameter values for the model are broadly consistent with economic theory. In particular, for lone parents 99.0% of lone parents have positive marginal utility of net income at their observed state. Overall elasticities line up quite well too. With an average extensive elasticity of .81 (.13) and an intensive elasticity of .31 (.09).

The first step in simulating the WFTC policy reform is to estimate a choice probability distribution (over the combination of hours and programme participation) for each individual under a given tax and transfer system: we do this by numerically averaging over the unobserved components in the model. To simulate the impact of a change in the tax and benefit system, the same numerical draws are used to compute the choice probabilities under both tax and benefit systems, and combine these into a matrix of transition probabilities over the choices. This gives the (estimated) expected value of the transition matrix given the parameter estimates, where the expectation is over all random components. Confidence intervals around these expectations are estimated by the bootstrap.

As noted above one important aspect of the WFTC reform was the accompanying increase in out of work incomes for families - income support. In fact unlike with similar expansions of the EITC in the US there were almost matched increases in the generosity of income support for families with children. For single parents the WFTC reform did unambiguously increase the incentive to work. However, together with the interactions with other benefits outlined above, this considerably dampens the underlying incentive to work. For this reason we might expect relatively small impact measures.

Two main reforms to the tax and benefit system are simulated. Table 4(a) presents the effect on labour supply of moving from Family Credit to Working Families' Tax Credit, holding all other things equal. It turns out to be important to disaggregate the simulation results according to the age of the youngest child. To compute these impact transitions effects requires integrating over the

Table 4(a)
Structural evaluation results: WFTC expansion alone by age of youngest child

	All	y-child	y-child	y-child	y-child
		0 to 2	3 to 4	5 to 10	11 to 18
Change in employment rate:	5.95	3.09	7.56	7.54	4.96
	0.74	0.59	0.91	0.85	0.68
Average change in hours:	1.79	0.71	2.09	2.35	1.65
	0.2	0.14	0.23	0.34	0.2

Source: Blundell et al., 2006.

unobserved heterogeneity in the structural model. In Table 4(b) we present the same transition table but for **all** reforms directed to lone mothers and introduced during the WFTC reform period. The increases in participation are systematically lower compared to when WFTC was considered alone, and this is likely to reflect that the contemporaneous increases in Income Support dulled the positive labour supply impact of WFTC. This confirms that it is not the elasticities that are unusually small for the British case but simply the interactions with other taxes and benefits and the coincidence of off-setting reforms to those benefits accessible to lone parents who do not work.

Note that the simulated diff-in-diff parameter from the structural evaluation model does not differ significantly from the diff-in-diff estimate in Table 3. A difference-in-differences methodology cannot identify the labour market impact of WFTC alone because other taxes and benefits changed at the same time as its introduction. Comparing the simulated moment for the all reforms case with diff-in-diff moment the difference yields a p-value of .42. The *simulated* diff-in-diff parameter from the structural evaluation model is precise and does not differ significantly from the diff-in-diff estimate. We find similar results for comparisons with low education groups. So it appears that the structural model does present a reasonably accurate description of responses to the reform. As argued above the small effects of the reform are due to interaction of WFTC with other taxes and benefits and the rise in family allowances (all reforms) - which are given without a work condition, rather than 'small' response elasticities.

5.2. Is the design optimal?

The structural labour supply model provides an appropriate framework for considering problems related to the optimality of the tax schedule. Using parameter estimates from a structural model of labour supply, such as that presented above, the labour supply behaviour of individuals can be simulated as the parameters of the tax and transfer system are varied. With these endogenous and heterogeneous labour supply responses allowed for, the structural model

Table 4(b)
Structural evaluation results: all reforms by age of youngest child

	All	y-child	y-child	y-child	y-child
		0 to 2	3 to 4	5 to 10	11 to 18
Change in employment rate:	3.86	0.65	4.53	4.83	4.03
	0.84	0.6	0.99	0.94	0.71
Average change in hours:	1.02	0.01	1.15	1.41	1.24
	0.23	0.21	0.28	0.28	0.22

Notes: Simulated of FRS data; Standard errors in italics.
Source: Blundell et al. (2006).

provides all the necessary information to maximise any well-behaved social welfare function, subject to a government budget constraint.

Imagine that we want to redistribute some specific sum to low skilled lone parents. We can turn to a Mirrlees optimal tax computation and ask given the implied elasticities at extensive and intensive margin corresponding to estimated structural model, is the WFTC design 'optimal' for reasonable social welfare weights? Rather than using the Saez (2002) approximation, Blundell et al. (2006) work directly with the structurally estimated preferences and choose the optimal allocation by maximising a welfare function that depends on the distribution of tastes and budget constraints.

In this analysis, the social welfare function is given by the sum of individual (transformed) utilities, with the utility transformation function determining the governments relative preference for the equality (or otherwise) of utilities. We set the social welfare transformation function $\Gamma(U|\theta) = \frac{1}{\theta}\{(\exp U)\theta - 1\}$. When θ is negative, the function favours the equality of utilities; when it θ is positive the reverse is true. $\theta = 0$ corresponds to the linear case. The government then maximises social welfare choosing a tax schedule.

The tax schedule is such that each individual chooses their hours of work to maximise their utility and the government satisfies its budget constraint. Conditioning on demographic characteristics the tax schedule will be parameterized by a level of out-of-work income (income support), and the different marginal tax rates. In this analysis four marginal tax rates are chosen corresponding to weekly earnings over five regions.[18] The parameters of the optimal tax schedule will be a function of demographic characteristics, the distributions of wages, preference parameters, preference errors, and the social welfare transformation function. Marginal tax rates are restricted to lie between -100% and 100%. Given flexible preferences and state specific errors, a non-decreasing budget constraint is a restriction, rather than a necessary consequence of the utility maximisation process. The problem is particularly numerically intensive to solve and a grid in the parameter space is constructed to calculate the preferred labour market choice of each individual using the estimated structural model. The results of these simulations then allow the evaluation of both the government budget constraint and social welfare function(s). The government budget constraint is also used to restrict the parameter search space. The feasible set therefore contains many pair wise tax schedules that differ only in the marginal rate applied to the highest level of earnings. Blundell et al. (2006) solve the schedule for parameter values $\theta = \{-.2, 0.0, 0.2\}$. Here we simply present those for $-.2$ which, as we will see, accords closest with the implicit weights underlying tax credit policy in the UK.

The optimal tax schedule is solved separately for three different groups on the basis of the age of youngest child. For each of these groups the value of government expenditure is set equal to the actual expenditure on this group within our sample. Conditioning upon this level of expenditure (which implicitly represents a preference for the relative welfare of the different groups) the tax schedule that maximises social welfare is calculated.

Some initial results from this analysis are presented in Fig. 9(a) and (b) and show some clear and interesting conclusions. The schedules are drawn over the five ranges of earned income described above. In all cases the welfare function has $\theta = -.2$ and therefore displays mild inequality aversion. As the age of the youngest child increases there is a shift toward relatively more support in-work that out of work. This can be interpreted as an increase in the extensive elasticity or a decline in the value of time spent at home by the lone parent. A comparison of the optimal constraint between a lone parent who has a child aged 0–4 and one whose child is aged

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[18] Up to £80, between £80 and £140, between £140 and £220, and £220 and above respectively.
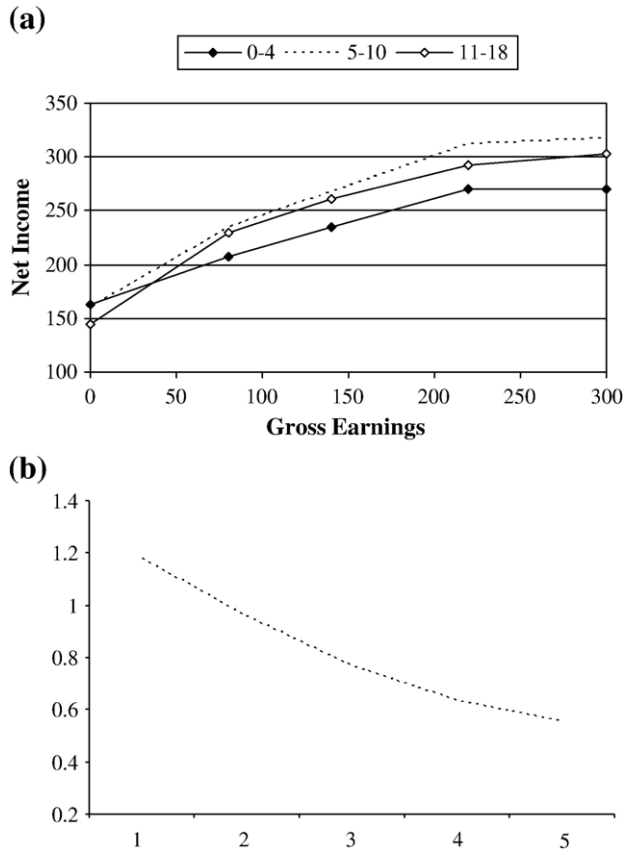
(a)

(b)

Fig. 9. (a): Optimal Tax Schedules for Lone Parents by age of youngest child. (b): Social welfare weights for θ=−.2 for lone parent with child less than 4 years old. Source: Blundell et al. (2006).

11−18 is probably most stark. The slope at low earned incomes is sharply steeper for the lone parent with the older child.

In all cases presented in Fig. 9(a) the welfare weights on incomes are set with θ=−.2 and the weights decline with income monotonically. These weights, displayed in Fig. 9(b) are computed directly from the minimised social welfare function. These weights are reasonable and compare with the type of weights used in the Immervol et al. (2004) study. In Blundell et al. (2006) a variety of θ values are considered. Even with θ=0 the overall conclusions in terms of optimal design remain.

Fig. 10 derives the optimal constraint for a specific type of lone parent, defined by hourly wage, housing costs and childcare costs. Against this is plotted the actual WFTC policy with all its interactions with the rest of the tax and benefit system in the UK. Remarkably the optimal tax function and the WFTC constraint show a degree of similarity. Suggesting that the WFTC policy for social welfare weights with θ=−.2 may well be an optimal design. A consequence of Fig. 9(a) is that the existing WFTC policy probably does not contain a sufficiently strong a tax credit for lone parents with older children. Another implication of this analysis is that the WFTC policy itself, without the simultaneous increases in Income Support could only have been optimal with

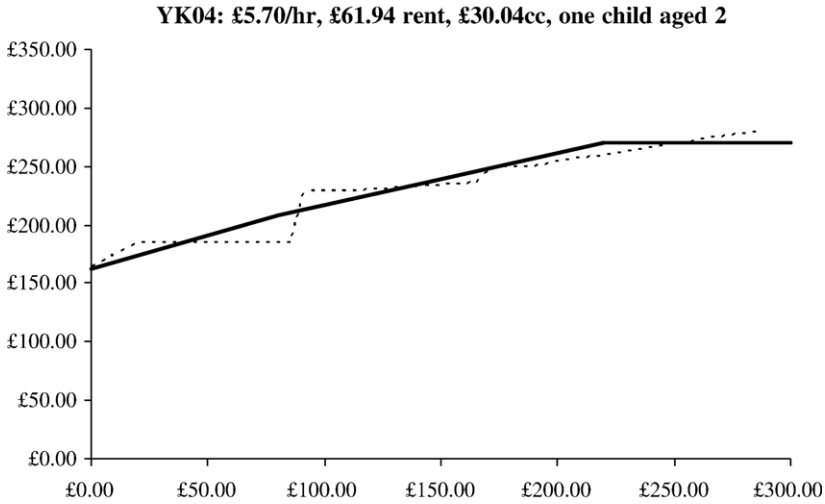**YK04: £5.70/hr, £61.94 rent, £30.04cc, one child aged 2**

Fig. 10. Optimal Tax Schedules in a specific case relative to WFTC. Source: Blundell et al. (2006).

much lower weight on redistribution. The comparison with the expansions in generosity of the EITC in the US suggest that, although the EITC expansion provided much of the motivation for the WFTC policy in the UK, the implicit social welfare weights were much more redistributive in the UK than those implicit in US welfare policy toward lone parents.

6. Conclusions: designing a welfare to work policy using tax credits

This lecture has drawn on a new line of research that transcends the boundaries of labour economics and public finance. The aim has been to evaluate the responses to employment tax credit reforms and the optimal design of such reforms. Specifically, a comparison of the reforms in the UK and the US. To gauge the optimality we need specific set of treatment effect parameters from a structural model of economic responses. But structural models are fragile and I have argued for the need to validate them through comparison with experimental and quasi-experimental evaluations. I have also shown how a structural evaluation model with take-up and unobserved heterogeneity can provide a reasonably accurate description of labour supply behaviour.

With empirically robust elasticities and knowledge of the full tax and benefit system we can easily reconcile EITC and WFTC 'puzzle' - the smaller impact of the WFTC in the UK in comparison to its apparent generosity relative to the EITC policy in the US. We have also shown that empirically robust elasticities can easily justify an earned income tax credit policy even with social welfare weights that decline monotonically with income. This lines up well with the cross-country analysis in Immervol et al. (2004) and Eissa et al. (2004). Moreover, the UK reform is close to an optimal earned income tax credit policy, provided relatively high social welfare weights are placed on families with children.

There are many remaining questions concerning the adequacy of the empirical specification and the dimensions over which optimality is measured. The fact that the structural model has been shown to line up well with the quasi-experimental impact provides some comfort but what of more dynamic impacts. Cossa et al. (2002) make a strong case for analysing passive and active

human capital responses as earned income tax credits place potentially important disincentives on human capital investment. This is surely deserving of further analysis and the broader dynamic benefits of encouraging work are often cited as important motivations for the expansion of earned income tax credit policies. Nonetheless the evidence for some aspects of these dynamic effects is limited. The recent work by Gladden and Taber (2000) and Card and Hyslop (2002) find only small or insignificant impacts of work experience on wages.

Another important margin may well be the impact on fertility but the evidence for a significant impacts of tax credits on fertility seems small, see Hoynes (1997a,b). In line with the title of this lecture it seems appropriate to leave this last word on fertility to Adam Smith: 'Poverty, though it no doubt discourages, does not always prevent marriage. It seems even to be favourable to generation. A half-starved Highland woman frequently bears more than twenty children, while a pampered fine lady is often incapable of bearing any, and is generally exhausted by two or three. Barrenness, so frequent among women of fashion, is very rare among those of inferior station. Luxury in the fair sex, while it inflames perhaps the passion for enjoyment, seems always to weaken, and frequently to destroy altogether, the powers of generation.' Adam Smith (1776).

Acknowledgements

References

Adam, S., Brewer, M., 2005. Take-up of Family Credit and Working Families' Tax Credit: final report, June. HM Revenue and Customs. 51 pp.

Bargain, Olivier, Beblo, Miriam, Beninger, Denis, Blundell, Richard, Carrasco, Raquel, Chiuri, Maria-Concetta, Laisney, François, Lechene, Valérie, Moreau, Nicolas, Myck, Michal, Ruiz-Castillo, Javier, Vermeulen, Frederic, in press. Does the representation of household behavior matter for welfare analysis of tax-benefit policies? Review of the Economics of the Household.

Beaudry, P., Blackorby, C., 2000. Taxes and Employment Subsidies in Optimal Redistribution Programs. Discussion Paper 22. UBC. October.

Besley, T., Coate, S., 1992. Workfare versus welfare: incentive arguments for work requirements in poverty alleviation schemes. American Economic Review 82, 249–261.

Blundell, R., 2002. Welfare to work: which policies work and why? Keynes lecture 2001. Proceedings of the British Academy 117, 477–524.

Blundell, R., Costa Dias, M., 2000. Evaluation methods for non-experimental data. Fiscal Studies March.

Blundell, R., Costa-Dias, M., 2006. Alternative Approaches to Evaluation in Empirical Microeconomics. mimeo, IFS, April.

Blundell, R., Hoynes, H., 2004. Has in-work benefit reform helped the labour market? In: Blundell, Richard, Card, David, Freeman, Richard (Eds.), Seeking a Premier League Economy. University of Chicago Press.

Blundell, R., MaCurdy, T., 2000. Labour supply: a review of alternative approaches. In: Ashenfelter, Card (Eds.), Handbook of Labor Economics, vol. 3a. Elsevier, North Holland.

Blundell, R., Duncan, A., McCrae, J., Meghir, C., 2000. The labour market impact of the working families tax credit. Fiscal Studies 21 (1), 65–67. http://www.ifs.org.uk/publications/fiscalstudies.

Blundell, R., Costa Dias, M., Meghir, C., Van Reenen, J., 2004. Evaluating the employment impact of a mandatory job search assistance program. Journal of European Economic Association (June).

Blundell, R., Brewer, M., Shephard, A., 2005a. Evaluating the Labour Market Impact of Working Families' Tax Credit Using Difference-In-Differences, June. HM Customs and Revenue. http://www.hmrc.gov.uk/research/ifs-did.pdf.

Blundell, Chiappori, Pierre-André, Meghir, Costas, 2005b. Collective labour supply with children. Journal of Political Economy 113 (December).

Blundell, R., Brewer, M., Shephard, A., 2006. Earned Income Tax Credits: The Evaluation and Optimality of the WFTC Reform in the UK. mimeo, Institute for Fiscal Studies, May.

Bos, J., Houston, A., Granger, R., Duncan, G., Brook, T., McLoyd, V., 1999. New Hope with Low Income. MDRC, Washington, DC.

Brewer, M., 2001. Comparing in-work benefits and the reward to work for low-income families with children in the US and UK. Fiscal Studies 22 (1), 41–77.

Brewer, M., Duncan, A., Shephard, A., Suárez, M.-J., in press. Did the working families' tax credit work? Analysing the impact of in-work support on labour supply and programme participation. Labour Economics.

Brewer, M., Gregg, P., 2001. Eradicating Child Poverty in Britain: Welfare Reform and Child Poverty since 1997. IFS Working Paper 01/08.

Card, D., Blank, R. (Eds.), 2000. Labor Markets and Less-Skilled Workers. Russell Sage Foundation, New York.

Card, D., Hyslop, D., 2002. Estimating the Dynamic Treatment Effects of an Earnings Subsidy For Welfare-Leavers. CLE Working Paper. Berkeley, March.

Card, David, Robins, Philip K., 1998. Do financial incentives encourage welfare recipients to work? Research in Labor Economics 17, 1–56.

Chone, P., Laroque, G., in press. Optimal Incentives for Labor Force Participation. Discussion Paper 25, CREST-INSEE. Journal of Public Economics.

Cossa, Ricardo, Heckman, James, Lochner, Lance, 2002. Learning-By-Doing vs. On-the-Job Training: using variation induced by the EITC to distinguish between models of skill formation, NBER Working Papers 9083, National Bureau of Economic Research, Inc.

Eissa, N., Hoynes, H., 2004. Taxes and the labor market participation of married couples: the earned income tax credit. Journal of Public Economics 88, 1931–1958.

Eissa, Nada, Liebman, Jeffrey, 1996. Labor supply response to the earned income tax credit. Quarterly Journal of Economics CXI, 605–637.

Eissa, N., Kleven, H.J., Kreiner, C.T., 2004. Evaluation of Four Tax Reforms in the United States: Labor Supply and Welfare Effects for Single Mothers. NBER Working Paper no. w10935.

Gladden, T., Taber, C., 2000. Wage progression among less skilled workers. In: Card, David, Blank, Rebecca M. (Eds.), Finding Jobs: Work and Welfare Reform. Russell Sage Foundation, New York.

Gosling, A., Machin, S., Meghir, C., 2000. The Evolution of male earnings in Britain 1984–94. Review of Economic Studies 67 (4), 233, 635–666.

Gradus, R.H., Julsing, J.M., 2001. Comparing Different European Income Tax Policies: Making Work Pay. OCFEB Research Memorandum 0101, Erasmus University.

Gregg, P., Hansen, K., Wadsworth, J., 1999. The rise of the workless household. In: Gregg, P., Wadsworth, J. (Eds.), The State of Working Britain. Manchester University Press.

Heckman, J., LaLonde, R., Smith, J., 1999. The economics and econometrics of active labour market programs. In: Ashenfelter, A., Card, D. (Eds.), Handbook of Labour Economics, vol. 3. Elsevier, Amsterdam.

Heim, B.T., Meyer, B., 2004. Work costs and nonconvex preferences in the estimation of labor supply models. Journal of Public Economics 88, 2323–2338.

Holcomb, P.A., Pavetti, L., Ratcliffe, C., Riedinger, S., 1998. Building an Employment Focused Welfare System. Urban Institute, June.

Hoynes, H., 1997a. Does welfare play any role in female headship decisions? Journal of Public Economics 65 (2), 89–117 August.

Hoynes, H., 1997b. Work, welfare, and family structure: what have we learned? In: Auerbach, Alan (Ed.), Fiscal Policy: Lessons From Economic Research. MIT Press, Cambridge, MA, pp. 101–146.

Hoynes, H., 2000. The employment, earnings ad income of less skilled workers over the business cycle. In: Card, D., Blank, R. (Eds.), Finding Jobs: Work and Welfare Reform. Russell Sage Foundation.

Immervol, H., Kleven, H., Kreiner, C., Saez, E., 2004. Welfare Reform in European Countries. CEPR DP No. 4324, March.

Inland Revenue, 2001. New Tax Credits: Supporting Families, Making Work Pay and Tackling Poverty. Inland Revenue, London.

Inland Revenue, 2003. Working Families' Tax Credit Statistics Quarterly Enquiry. February Inland Revenue, London.

Inland Revenue, 2005. Working Families' Tax Credit Estimates of Take-Up Rates in 2002–03. Inland Revenue, London.

Katz, L.F., 1998. Wage subsidies for the disadvantaged. In: Freeman, Richard, Gottschalk, Peter (Eds.), Generating Jobs. Russell Sage Foundation, New York, NY, pp. 21–53.

Keane, M.P., Moffitt, R., 1998. A structural model of multiple welfare program participation and labor supply. International Economic Review 39 (3), 553–589.

Kleven, H.J., Kreiner, C.T., Saez, E., 2005. The Optimal Taxation of Couples. mimeo, Berkeley.

Liebman, J., 2002. The optimal design of the earned income tax credit. In: Meyer, Bruce, Holtz-Eakin, Douglas (Eds.), Making Work Pay: the Earned Income Tax Credit and Its Impact on American Families. Russell Sage Foundation, New-York.

Miller, C., et al., 1997. Making Welfare Work and Work Pay: Implementation and 18-Month Impacts of the Minnesota Family Investment Program. Manpower Demonstration Research Corporation, September.

Moffitt, R., 2005. Welfare Work Requirements with Paternalistic Government references. mimeo, Johns Hopkins University, April.

Moffitt, R., 1983. An economic model of welfare stigma. American Economic Review 73 (5), 1023–1035.

Phelps, E.S., 1994. Raising the Employment and Pay of the Working Poor: Low wage Employment Subsidies vs the Welfare State. AER Papers and Proceedings, May, 54–58.

Quets, G., Robins, P.K., Pan, E.P., Michalopoulos, C., Card, D., 1999. Does SSP Plus Increase Employment? The Effect of Adding Services to the Self Sufficiency Project's Financial Incentives, SRDC, May.

Saez, E., 2001. Using elasticities to derive optimal income tax rates. Review of Economic Studies 68, 205–239.

Saez, E., 2002. Optimal Income Transfer Programs: Intensive Versus Extensive Labor Supply Responses. Quarterly Journal of Economics 117, 1039–1073.

van Soest, A., Das, M., Gong, X., 2002. A structural labour supply model with flexible preferences. Journal of Econometrics 107 (1–2), 345–374.

Further reading

Blundell, R., Meghir, C. 2003. Active labour market policy vs employment tax credits: lessons from recent UK reforms, Scandinavian Working Papers in Economics (No 2002:1), Swedish Economic Policy Review.

Blundell, R.W., Ham, J., Meghir, C., 1987. Unemployment and female labour supply. Economic Journal 97, 44–64.

Blundell, R., Fry, V., Walker, I., 1988. Modelling the take-up of means-tested benefits: the case of housing benefit in the United Kingdom. Economic Journal 98, 58–74.

Blundell, R.W., Duncan, A., Meghir, C., 1992. Taxation and empirical labour 37 supply models: lone parents in the UK. Economic Journal 102, 265–278.

Blundell, R., Duncan, A., Meghir, C., 1998. Estimating labour supply responses using tax policy reforms. Econometrica 66, 827–861.

Eissa, N., Kleven, H.J., Kreiner, C.T., in press. Welfare effects of tax reform, and labor supply at the intensive and extensive margins. In: Agell J., Sørensen, P.B. (Eds), Tax Policy and Labour Market Performance. MIT Press, Cambridge, MA.

Moffitt, R., 2002a. The economics of means-tested transfer programs. Tax Policy and the Economy 16, XX–YY.

Moffitt, R.A., 2002b. Welfare programs and labor supply. In: Auerbach, A.J., Feldstein, M. (Eds.), Handbook of Public Economics, vol. 4. Elsevier, Amsterdam.

Organisation for Economic Co-operation and Development, 2000. Make Work Pay: Special Issue. OECD Economic Studies, No 31, 2000/II.