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Zeenat Soobedar

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Zeenat Soobedar*

Queen Mary, University of London, The Open University

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Abstract

This paper examines the impact of the age-eligibility rule establishing automatic withdrawal of Income Support for single mothers whose youngest child turns 16 on the disability benefits welfare participation decision of single mothers with no qualifications in the UK. Using the age discontinuity in Income Support program assignment, the study reveals that these single mothers are 4.2 percentage points more likely to claim health benefits as their youngest child turns 16, consistent with a theoretical model of benefits choice. More than a quarter of single mothers who were initially on Income Support apply for sickness and disability benefits, out of which 70% claim non-contributory health benefits.

JEL code: J12, I38, C21

Keywords: Single Mothers, Disability Benefits, Regression Discontinuity

*Department of Economics, Queen Mary, University of London, Mile End Road, Mile End London E1 4NS, UK, z.soobedar@qmul.ac.uk. I am grateful to my supervisor, Marco Manacorda, for invaluable comments and suggestions.

1 Introduction

The primary focus of this paper is to investigate how single mothers with no qualifications respond to benefit withdrawals in a variety of ways. In Soobedar (2009) it was shown that their labour supply increases when they automatically lose entitlement to Income Support (henceforth, *IS*), consistent with an income effect in a simple labour supply model. In this paper the effect of the same benefit withdrawal on Sickness and Disability Benefits (henceforth, *DB*) welfare participation is assessed. A theoretical model of the decision to apply for *DB* is offered and it demonstrates that, despite the fact that individuals can claim *DB* prior to the youngest child turning 16, for a rational agent, this does not have to be the case. While the model predicts that the likelihood of claiming *IS* falls, there is an incentive for mothers to participate in the *DB* program at the age-16 eligibility rule. An analysis of the micro data from the Quarterly Labour Force Surveys yields results that are in line with these predictions. Indeed, more than a quarter of single mothers with no qualifications who were initially on Income Support substitute away from *IS* into *DB* when their youngest offspring turns 16.

A considerable amount of research has recently been produced on the phenomenon of rising sickness and disability benefits claims in the UK (Berthoud, 1998; Beatty et al., 2000; Bell and Smith, 2004; Faggio and Nickell, 2005). The number of working age individuals claiming incapacity benefits (prior to 1995, these benefits were known as invalidity benefits) has been following an upward trend for the last 30 years from less than 1 million in 1975 to 2.7 million in 2008. If all the benefits on the grounds of sickness and disability are added¹ the numbers are even higher (McVicar, 2008). Walker and Howard (2000) cite an overall figure of 2.88 million people of working age claiming sickness and disability benefits in the UK in 1991. It is argued that this growth can be explained by underlying changes in health (Bound and Burkhauser, 1999 and Autor and Duggan, 2003 for the US; Molho, 1991 and Disney and Webb, 1991 for the UK), labour demand

¹These can include Incapacity Benefits, Severe Disablement Allowance, Disability Living Allowance, Income Support with a disability premium.

conditions and the characteristics of sickness and disability benefits (e.g. in terms of generosity and screening intensity). Higher *DB* claims in the UK also lie behind the growth in inactivity on grounds of ill health and disability (Bell and Smith, 2004; Faggio and Nickell, 2005).

Due in part to the observed rapid growth in caseloads social assistance reforms have recently been high on the policy agenda in the UK. In 2007, the Work and Pensions Secretary, John Hutton, raised concern that over one third of lone parents move on to incapacity benefits or income support on grounds of disability within 12 months after their youngest child reaches the age of 16. In particular, this points to a tendency towards welfare reliance among single parents. Gregg et al. (2006) show that around 1 in 5 workless lone parents are receiving sickness and disability benefits, with the rest mainly receiving Income Support. The government has now set a target that by 2015 the number of people who are claiming Incapacity Benefit should be reduced by one million.

The contribution of the paper is three-fold. First, it endeavours to fill in some gaps in the disability literature in the UK by analyzing labour market and welfare participation responses of women, in this case single mothers. Not only are quantitative studies on the growth of UK disability benefits limited but research on women in the disability literature is remarkably scarce (McVicar, 2008). Over the past decades, the growth in UK claims has been considered mainly a male phenomenon. However, McVicar (2008) reports that since 1995, the growth in disability claims can largely be attributed to the growing number of applications from the female population. He states that female invalidity/incapacity claimants have gone from making up for one fifth of the overall total working age claimants to close to two fifths in recent years. The analysis also focuses on single mothers because, with the exception of the disabled, they are not only the group which is most reliant on welfare, in terms of both participation rate and spell length (Casebourne and Britton, 2004; Evans et al., 2004) but is also the target of the current government in reducing their joblessness and poverty (Gregg et al., 2009). Also, lone-mother families contain a large and growing fraction of poor children (Gregg et al., 2009). Rising levels of benefits use may signal

further deterioration in the socioeconomic prospects of these children.

Second, the paper is novel in that it develops a simple theoretical model of benefits choice to show how mothers respond to *IS* benefit withdrawal in a variety of ways. The model demonstrates that despite the fact that *DB* can be claimed prior to the youngest child turning 16, it is fully rational for an economic agent to do so at the cut-off age. Indeed, the model predicts that as the youngest child turns 16, while the probability of *IS* falls, the propensity to *DB* participation rises. The reason for this is simple: when the youngest child turns 16, single mothers automatically lose their entitlement to *IS*. Obviously, fewer single mothers will claim *IS*. At the same time, their set of opportunities shrink and they readjust their labour market and welfare participation decisions accordingly. They are now faced with 3 options: either claim *DB* or face the stark choice of working or staying out of work and not claiming any benefits (henceforth, no-work-no-benefits). This may push mothers who otherwise would have stayed on *IS* onto *DB*, hence increasing *DB* claims.

The third contribution is empirical. The predictions of the model are taken to the data. As in Soobedar (2009), the age-eligibility rule in the *IS* program is exploited as a quasi-experiment for assessing the implications of the loss in the entitlement of *IS* on health-related benefits. The Regression Discontinuity (RD) approach is used because the age break provides a natural setting for analyzing its impact on the sickness and disability benefits outcome. The RD approach is "fuzzy" in this case because the probability of claiming *IS* is not likely to fall from 1 to 0 at the age-16 threshold. The probability of claiming *IS* is not equal to 1 prior to the age-16 threshold because some mothers may be working more than 16 hours per week and hence not eligible for *IS*. At the cutoff point, the probability of treatment is likely to jump by less than 1. This is because while the *IS* eligibility is mainly determined by the age-16 cut off rule for lone parents, they can still be eligible for *IS* if they fall in other categories². Quasi-experimental evidence on

²Other types of people who are eligible for *IS* are pensioners, the long and short-term sick, people with disabilities and other special groups. Special groups include people in private residential care and nursing homes, people in a local authority home, people in a hospital, asylum seekers and other types of people from abroad.

the substitutability between welfare programs for the UK is lacking and this paper aims at filling this gap.

It is important to note that checks for no manipulation around the eligibility threshold were conducted in Soobedar (2009). There was no evidence of non-random sorting around the age-16 threshold arising from single mothers keeping their child in full time education. As such the identification assumption of the RD design holds for this paper too. Changes in the UK benefits system are also not likely to substantially affect the results in the paper since the age-eligibility in the policy did not vary discontinuously over time and changes in the entitlement for other benefits (namely housing benefits, council tax benefits and the UK's welfare to work program for lone parents, the New Deal) which are also related to the age-16 eligibility rule do not alter substantially the results. The effect is likely to be either over (housing and council tax benefits) or under (New Deal for Lone Parents) estimated. Furthermore this study again uses the quarterly Labour Force Surveys between the period 1994 and 2002. Single mothers with no qualifications are again chosen mainly not only because they are more likely to be reliant on welfare and jobless but also because of a clear discontinuity in the entitlement to *IS* at the age-16 threshold for these mothers.

The main empirical findings illustrate that once unobserved differences across single mothers with no qualifications are accounted for, the age-eligibility rule in the *IS* program has a significant positive effect on the probability of claiming *DB*. This is consistent with the predictions of the theoretical model of benefits choice. The result is unchanged across a variety of specifications and after controlling for unobserved heterogeneity. This suggests that some mothers choose to stay on welfare benefits rather than to work. According to Evans et al. (2004) self-reported ill-health worsens single mothers' probability of entering work. Casebourne and Britton (2004) find that there are several constraints to work for single mothers who were on *IS*. These mothers are more likely to have very limited or no work history and it is the first time that they have to seek work. In turn, their duration of economic inactivity most likely leads to a lack of confidence and

a greater apprehension about moving back to work which act as barriers to mothers' joining the labour market.

This paper is organized as follows. The next section presents an overview of the sickness and disability benefits system in the UK. Section 3 presents a simple theoretical model of welfare program participation. Section 4 discusses the specification and identification strategy followed by a description of the data in section 5. Section 6 reports empirical results and provides insights into the channels behind the substitutability between *IS* and *DB*. Finally, section 7 concludes.

2 The Sickness and Disability Benefits System in the UK

This section provides a brief overview of the health-related benefits system in the UK. A full description can be found in the Welfare Benefits and Tax Credits Handbooks.

The health benefits programs cover all participants in the social security system. In order to qualify for *DB*, an individual must be deemed incapable of work by the Department of Work and Pensions (DWP). According to the Disability Discrimination Act 1995 an individual is disabled if "he has a physical or mental impairment which has a substantial and long-term adverse effect on his ability to carry out normal day-to-day activities" (chapter 50).

There are two main types of *DB* in the UK: contributory and non-contributory *DB*. Contributory *DB* are paid if national insurance contributions conditions are met. Eligibility therefore requires a work history. The main contributory sickness and disability benefits is the Incapacity Benefit (*IB*). It is the contributory earnings replacement benefit for those unable to work because of ill health or disability³. *IB* is currently paid at one of three flat rates depending on the length of time the individual has been unable to work. The basic long-term rate of *IB*, which stood at £64.70 per week in 1999, is now £84.50 per week. This amount is topped up by £17 if the person is under 35 or £8 if he/she is between 35 and 44. Thus, the current basic long-term rate

³It replaced Invalidity Benefits (*IVB*) in 1995 and tightened up eligibility criteria, e.g. phasing out payment to over 65s and tightened the screening (Burchardt, 1999).

of *IB* stands at £101.50 per week for someone who is less than 35 years of age. Non-contributory *DB* are benefits available for those unable to work because of ill health or disability and who do not meet the contributions based eligibility criteria, e.g. because their disabilities have prevented them building up sufficient work histories. The most common one is Income Support with a disability premium (henceforth *ISDB*), which amounted to £71.80 in 1999 and presently is £86.35 per week for someone who is 25 or above⁴. *ISDB* is different from Income Support *tout-court* whereby *ISDB* is payable to people who have a work-limiting illness or disability and it consists of the basic rate of *IS* topped up by a disability premium⁵. Similar to the *IS* program, *DB* claimants are automatically entitled to housing and council tax benefits. It should be noted that *DB* payments are unambiguously larger than *IS* payments. For example, in the simplest situation, while a lone parent who has a youngest child aged less than 16 automatically receives £60.50 per week as *IS*, she will get £86.35 per week if she is eligible to claim *ISDB*.

2.1 The Application Process

Although it is financially more advantageous to participate in the *DB* program, the procedures to claim these benefits may prove to be time consuming. To apply for *DB* an individual must submit an application form to the DWP or a Jobcentre Plus office, which is a government agency and is part of the DWP. To claim *IB* - in addition to proving his/her incapacity of work - the individual must also satisfy the national insurance contributions requirement. In addition to filling the form, the individual may be required to supply documentary proof relevant to the claim. It is normally required to provide medical evidence of the individual's incapacity of work. If this medical information is deemed insufficient, the office may refer the applicant to a medical practitioner, who can be either a Medical Service doctor contracted by the DWP or

⁴Other non-contributory benefits include the Severe Disablement Allowance (*SDA*) and the Disability Living Allowance(*DLA*). Mothers who receive these benefits are automatically entitled to *ISDB*. In this paper, *DB* include both contributory and non-contributory benefits with the purpose of having a larger sample.

⁵Income Support with a disability premium or Income Support on grounds of disability is used interchangeably in this paper.

any other approved healthcare professional (e.g. registered nurses, occupational therapists and physiotherapists), for a report and a medical examination⁶. The report by the Medical Service is then sent to the DWP decision-maker. If the DWP decision-maker finds that the applicant is incapable of work, a disability award is made. In 2005, the approval rate for *IB* claims was roughly 65% (DWP, 2009). If the original *DB* application is denied, an applicant can appeal against the decision to an appeal tribunal. According to national statistics, out of 100,000 people who fail the Personal Capacity Assessment each year, 25,000 people a year successfully appeal against a decision to deny them *IB* (BBC Channel News, 2008). This suggests that there might be some inefficiencies in the current system of assessing claimants.

3 Theoretical Framework

Since *DB* is more generous than *IS*, one will expect disabled single mothers to claim *DB* rather than *IS* irrespective of the age of their youngest child. As such, no sudden change in single mothers' propensity to participate in *DB* should be anticipated when the youngest offspring reaches 16. However, a standard economic model of decision-making can reveal otherwise. In Soobedar (2009), a labour supply model was used to explain the labour supply disincentives in-built in the Income Support program. Here, a simplified version is provided to explain how mothers react in a variety of ways to benefit withdrawals.

Suppose that an economic agent is a single mother with no qualifications with a youngest child aged less than 16. Assume that she maximizes utility by choosing amongst the mutually exclusive options of working at the expected wage offered for her characteristics (w) (the choice of being unemployed and working 0 hours is included in the work option)⁷. In this case the mother receives *JSA*. The work option, accepting either *IS* transfers or the sickness and disability transfers in

⁶The individual's incapacity of work can be determined by one of two tests: the Own Occupation test (a test conducted when the individual had an occupation at the time that he/she was deemed incapable of work) or the Personal Capability Assessment (either after 196 days of incapacity for work or if the Own Occupation test does not apply to the individual).

⁷The work option will include working 0 hours and claiming *JSA* from now on.

lieu of working (in other terms, she cannot work or claim *IS* if she applies for *DB*) or is not receiving any benefits and not working.

Let the utility function depends on consumption (C) and leisure hours per period (L):

$$U_s = U(C_s, L_s) \quad (1)$$

where $\{s = \text{work}, IS, DB, \text{no-work-no-benefits}\}$ represent the employment channel, the *IS* option, the *DB* transfer option and the no-work-no-benefits (henceforth *nwnb*) option respectively. Assume a Cobb-Douglas utility function for each of the four options as follows:

$$U_s = \ln C_s + \alpha \ln(1 - H_s) \quad (2)$$

where $C = f(w, V)$. w represents expected wage and V is non-labour income, which includes, amongst others, *IS* or *DB* plus other non-labour income (A). H denotes the predetermined hours of market work per week (equal to \bar{H} in the work option and 0 in the transfer options) and additionally, $0 \leq H \leq 1$. Her total time endowment, T , is standardized to 1. Her options are fourfold:

$$\begin{aligned} U_{work} &= \ln [(w + A) (1 - \bar{H})^\alpha] \\ U_{IS} &= \ln (IS + A) \\ U_{DB} &= \ln [(DB + A)^\phi (A - F)^{(1-\phi)}]; \quad A > F \\ U_{nwnb} &= \ln (A) \end{aligned} \quad (3)$$

Notice that the "no-work-no-benefits" option will not be chosen by the single mother who has a child less than 16 since she will always be better off claiming *IS* rather than not claiming any

benefits and being out of work, i.e. $(U_{IS} > U_{nwnb})^8$. What is crucial to this model of benefits choice is that the utility level associated to DB is not simply a function of the level of the benefits. Suppose that DB applications leads to an uncertain outcome as a percentage of applications gets rejected (where ϕ represents the probability of a successful application) with a certain opportunity cost, F (e.g. application and time costs and probably the opportunity costs arising by proving one's disability status and hence not working). For instance if a mother strongly expects that her claim will be denied (ϕ is low), she will be deterred from applying for DB . In this case, her expected benefit may be less than the costs of benefit application⁹.

This model implies that there is a critical value of ϕ which determines the mother's decision to claim either IS or DB . The Appendix presents the analytical derivation of the decisions rules and the critical values of ϕ . In fact three regimes are possible depending on the values of ϕ (low, intermediate and high). These possibilities are depicted in Figure 1, where age of the youngest child is plotted on the horizontal axis and market wage (plus non labour income A) on the vertical axis. A vertical line at age 16 is drawn to clearly indicate the cut-off age for the automatic loss in IS entitlement. It also provides insights into the labour market behavior and welfare participation decisions of the economic agent. Indeed, for low and intermediate values of ϕ ($< A_1$, where $A_1 = \frac{\ln(IS+A)-\ln(A-F)}{\ln(DB+A)-\ln(A-F)}$) (see panels a and b in Figure 1), the economic agent chooses either to work or to claim IS depending on her wage. Instead for high ϕ ($> A_1$) (see panel c of Figure 1), it is rational for the mother to choose between work and claiming DB . In other terms, the agent considers applying for DB rather than IS because she believes that there is a high chance that her application will be accepted. In either case, local labour market opportunities (w) determines the mother's final decision about claiming benefits. The lower is w , the less likely that the mother will work and hence, the more likely that she will take up benefits.

⁸Indeed, only 1.4% of mothers are inactive and not claiming any benefits in the sample.

⁹An alternative interpretation of Equation (3) is that mothers can lie on their disability status. And similar to the classical model of crime (Becker, 1968; Freeman, 1999), they face a penalty, F , if caught, where ϕ in this case is a probability of apprehension. A third interpretation is that ϕ is the latent level of disability. The higher is ϕ , the larger is the expected benefit from applying for DB . Here, F can be interpreted as the opportunity costs of applying for the benefits (or foregone earnings) assuming that they cannot do anything else.

Now consider a mother whose youngest child is 16 or older. Obviously, the mother is not entitled to *IS*. Her opportunity sets shrinks and she now has only 3 choices: either work or claim *DB* or in the extreme case, stay out of work and not claim any benefits. Her choice will depend on the probability of a successful application (which is potentially positively correlated with the latent level of health status). If $\phi < A_2$, where $A_2 = \frac{\ln(A) - \ln(A-F)}{\ln(DB+A) - \ln(A-F)} < A_1$ (refer to the Appendix for derivation), which in other terms, implies that the probability that her application will be not be rejected is low, the mother faces the stark choice of working or being inactive. If wages are low, it is more likely that she will be out of the labour market and not claim any benefits and hence, locate in region “*nwnb*”. On the other hand, if $\phi > A_2$, she has sufficient incentives to apply for *DB*.

What happens when the youngest child turns 16? Panel a of Figure 1 shows that for low $\phi (< A_2)$, i.e. the probability of a successful application is low, a rational agent who was claiming *IS*, chooses either to work or be out of work and without any benefits when her youngest child turns 16. If local labour market conditions are poor, the mother is likely to choose the latter. If ϕ is high ($> A_1$), the mother’s decision will not be affected. A high ϕ reflects a high propensity that the application will be successful and hence, she is bound to be claiming *DB* before the youngest child turns 16.

So far, these two regimes represent those applicable to inframarginal mothers, i.e. mothers whose probability of a successful application is either high or low. The third and last regime is the case of marginal mothers (Panel b), i.e. those with intermediate levels of ϕ . Panel b in Figure 1 shows that a rational agent in this marginal situation claims *IS* before her youngest child turns 16 and responds to incentives attached to the *DB* program at the cut-off age. Moreover, the model predicts that the poorer the local labour market conditions, the more incentive she has to claim *DB*. When the mother loses *IS*, her probability of finding a job is very low not only because she has very limited or no work history but also because of the larger pool of unemployed

individuals¹⁰. In this case she is better off claiming *DB* rather than staying out of work and not claiming any benefits.

In summary, the model demonstrates that the age-16 eligibility break in the entitlement to *IS* drives single mothers with no qualifications to respond to economic incentives. Table 1 provides a summary of the the comparative statics of the model. One prediction of the model (panel a of Figure 2), is that there is a discontinuous negative jump in the proportion of *IS* claimants as the youngest child turns 16. As shown in row 3 of Table 1, the probability of employment unequivocally rises for the single mothers with no qualifications at the cut-off age, a finding which has already been confirmed by the empirical analysis in Soobedar (2009). Another prediction of the model is that a proportion of mothers who were initially on *IS* is likely to transit to sickness and disability benefits (panel b of Figure 2). This effect of *IS* withdrawal on *DB* claims is among mothers whose probability of a successful application for *DB* is neither high nor low. Finally, the model predicts that mothers whose probability of a successful application is low are more likely to stay out of work and not claim any benefits when their youngest child reaches 16.

4 Specification and Identification

The main goal of this paper is to take the predictions of the theoretical model to the data in order to empirically identify the responsiveness of single mothers with no qualifications to economic incentives at the age-eligibility rule in the *IS* program. Similar to Soobedar (2009), a fixed effects model is used to purge the results from the effect of unobserved differences across mothers. In practice the following model is estimated using the "Fuzzy" Regression Discontinuity (RD) approach:

$$Y_{iat} = \beta_0 + \beta_1 Treat_{iat} + \delta(a) + \beta_2 [Treat_{iat} * \delta(a)] + m_i + \varepsilon_{iat} \quad (4)$$

¹⁰Adverse local labour market conditions suggest that there may be a large fraction of discouraged and displaced workers (Autor and Duggan, 2003).

where Y_{iat} is the probability that single mother i , whose youngest child is aged a , claims DB at time t . $Treat$ is a treatment dummy which equals 1 if the age of the youngest child ≥ 16 and equals 0 if the youngest child is aged <16 . $\delta(a)$ is a smooth, continuous function in the age of the youngest child (also called the running variable) and is approximated by a number of polynomials (up to degree 4). m_i is mother fixed effects and ε_{iat} is an error term which captures unmeasured factors. The coefficient of interest is β_1 , the fixed effects RD estimate. The identifying assumption underlying the consistency of this estimate (Lee, 2008; McCrary, 2008) is that the dependent variable is continuous in the age of the youngest child around the age-16 threshold other than at treatment, i.e. for the rule governing the automatic loss of entitlement to IS (Hahn et al., 2002). In this way, single mothers with no qualifications do not manipulate the running variable. Most notably, the causal effect of the policy can be identified when single mothers with similarly aged children are also similar in other observable and unobservable dimensions both to the left and to the right of the discontinuity. β_1 captures the change in the outcome variable at the age-eligibility threshold and according to the predictions of the theoretical model, it is expected to be positive for DB , work and no-work-no-benefits outcome variables, with the reverse being true for IS .

5 Data

For the purpose of this analysis, longitudinal datasets are used, i.e. the QLFS from 1994 to 2002. In addition to information on claims for IS and other passport benefits (i.e. Housing Benefit, Council Tax Benefits etc.), the survey collects information on contributory and non-contributory disability benefits. Hence DB includes both benefits with the purpose of having a larger sample. No-work-no-benefits is equal to 1 if the mother is out of the labour market and does not claim any benefits and 0 otherwise. The sample includes mothers who are single in the first period they

appear in the survey and who have no qualifications¹¹. Overall there are 25,148 observations. Table 2 reports descriptive statistics on all single mothers who have no qualifications and those who are disabled. Roughly 23% of the sample of mothers claim to suffer from a work-limiting disability, out of which 80% are inactive. On average, mothers are in their late thirties. Half of all mothers with no qualifications claim *IS* and about only 11% claim sickness and disability benefits, out of which about 4% claim *IB* and 4.3% claim Income Support with a disability premium. Only about 1.4% of the mothers are off-benefits and out of work and mothers whose youngest child is less than 16 accounts to only 0.7%.

6 Empirical Results

This section provides both graphs and regression estimates for the effects of the age-policy rule in *IS* on the probability of claiming sickness and disability benefits. In Soobedar (2009), it was reported that, as the youngest child turns 16 and mothers automatically lose *IS*, the probability of claiming *IS* drops sharply. Mothers substitute away from *IS* and into either work or job search. In this paper, the focal point is to see whether the predictions of the theoretical model of benefits choice in section 3 hold.

6.1 Causal Effect on Sickness and Disability Benefits

Figure 3 plots the actual and predicted proportions of single mothers with no qualifications on *DB* as a function of the age of their youngest child. While there appears to be a slight rise in the probability of claiming *DB* before the cut-off point, there is a clear positive jump at the age-eligibility break, after which the probability increases monotonically at a faster rate. Mothers

¹¹Regression (4) was run separately using the total sample of single mothers, a sample of single mothers who were graduates (8%), who had an intermediate level of education (29%), who had a low level of education (33%) and finally who had no qualifications (30%). A discontinuity at the age-16 threshold on the probability of claiming *IS* was clear for single mothers with no qualifications, hence the selection. Also, these mothers are more likely to be welfare reliant, jobless and poor.

whose youngest child is less than 16 are less likely to have acute health problems. However their disability or health status deteriorates as the child becomes older, hence a higher propensity to claim health benefits. The observed jump conforms to the intuition behind the model, whereby a proportion of mothers decide to transit onto *DB* in lieu of work at the age-eligibility threshold. To formalize the evidence in Figure 3, the fixed effects model in Equation (4) is estimated with $\delta(a)$ being modeled as a linear parametric polynomial whose shape and intercept are allowed to vary on either side of the discontinuity point. Standard errors are clustered by the age of the youngest child. Table 3 presents initial estimates of Equation (4).

Column (1) - row (1) of the top panel of Table 3 reports a 3.8 percentage points increase at the cut-off point and indicates a strong link between the age-eligibility rule and growth in the proportion of *DB* claimants. As a robustness check, rows (2) to (4) present the fixed effects estimates for the models using higher-order polynomials of $\delta(a)$. Estimates are precisely estimated and range between 3 and 4 percentage points. Essentially, as the youngest child turns 16 and mothers lose their entitlement to *IS*, roughly 25.5% of mothers with no qualifications who leave *IS* move onto *DB* compared to about 20% who increase their labour supply.

Interestingly, column (1) of Table 4 presents the fixed effects RD estimates for the probability of claiming *ISDB*, which range between 2-3 percentage points. Recall that *DB* include non-contributory benefits, *ISDB*. This shows that the increase in the probability of claiming *DB* is largely due to the increase in claiming income support with a disability premium. In fact, out of the pool of single mothers with no qualifications who lose *IS* and who move on to *DB*, about 70% of mothers transit on *ISDB*. This suggests that single mothers with no qualifications who switch from *IS* into *DB* are those mothers who may not have worked at all.

As a next step, additional covariates are included in Equation (4) to check the sensitivity of the estimates. According to the disability literature, mainly in the US, disability benefits applications are correlated with labour market conditions (Black et al., 2002). For example, Autor and Duggan (2003) demonstrate that between 1984 and 1998 during a period of deteriorating

labour market conditions in the US, disability benefits applications increased. They claim that this pattern became apparent because a growing fraction of discouraged and displaced workers claimed disability benefits. Based on the UK disability literature, the findings on the positive link are mixed. Faggio and Nickell (2005) and Molho (1991) find that the local unemployment rate does not have a significant effect on disability rolls. On the other hand, Disney and Webb (1991) find the probability of health benefits receipt to be significantly related to local unemployment rates only in 2 out of 3 years under investigation. In an attempt to examine this effect, local labour market conditions is included in the regression model as a covariate¹². Column (2) of Table 3 displays analogous fixed effects RD estimates for the *DB* program participation, after controlling for the state of the local labour market. It reports point estimates for the 4 specifications, after controlling for local labour market conditions and additive region effects and time effects. While time dummies are used to pick up the effect of business cycles common to the regions, region dummies are included in the estimation equations to capture time invariant regional variations in earnings or employment prospects. Results from Table 3 indicate that local labour market conditions do not appear to have an impact on the growth in the disability benefits claims when the youngest child turns 16. Perhaps this is not surprising as more than 60% of single mothers with no qualifications are already inactive before their youngest child reaches 16. The fixed effect estimate of the *Treat* variable remains precise and statistically significant, its magnitude is not different from the previous specification.

In the event that local labour market conditions might be correlated with other unobserved covariates, the above regression model may not absorb all the effects. For instance, in regions where labour market conditions are poorer, it could be that the application process is more stringent and application acceptance rates are lower, leading to an underestimation of the effect of the age rule on the outcome variable. In order to purge the estimate from this potential bias, Equation (4) is estimated by including the interaction of region and time fixed effects. These

¹²Local labour market conditions is measured by a standardized local unemployment rate ($UR_{rt} - \overline{UR}_t$), where r includes 12 regions and t refers to the month and year of interview.

account for any variation in the local labour market conditions over time. Column (3) in Table 3 reports the fixed effects RD estimates. They are significant and slightly higher than the ones in column (1): as the youngest child turns 16, the proportion of mothers who enter *DB* welfare programs increases by 4.2 percentage points. In this case, about 28.2% of mothers, who initially claimed *IS*, apply for *DB*.

6.2 Causal Effect on Being Off Benefits and Out of Work

Having ascertained that mothers substitute away from *IS* and into *DB* welfare programs when their youngest child turns 16, a finding which is consistent with the theoretical model in section 4, this section examines the effect on the proportion who are out of work and off benefits. The relationship is depicted in Figure 4. Interestingly, at the age of 16, the probability of no-work-no-benefits jumps from near 0 to around 1 percentage point, after which it rises. This is consistent with the predictions of the theoretical model. Table 5 reports the magnitude of the discontinuous jump, which is estimated to be about 1.6 percentage points. The estimate is statistically significant at the 5% level. Yet again, labour market conditions do not appear to have an impact on this outcome variable as displayed in column (2) of Table 5. Similarly, the fixed effects RD estimate is positive and statistically significant when local labour market conditions and additive regions and time fixed effects are controlled for. Out of total number of the single mothers with no qualifications who automatically lose *IS* when their youngest child turns 16, 8.7% of them are out of work and do not receive any benefits.

At this stage, it is important to recall that checks for no manipulation around the eligibility threshold were conducted in Soobedar (2009). There was no evidence of excess bunching of single mothers below the threshold (DiNardo and Lee, 2004; McCrary, 2008) to those just ineligible. In other terms there was no evidence of non-random sorting around the age-16 threshold arising from single mothers keeping their child in full time education to get child benefits or tax credits. Manipulation of the running variable does not appear to be responsible for the effects of the *IS*

benefit withdrawal on *DB* claims and reported fixed effects RD estimates are consistent.

6.3 Discussion and Interpretation

In this section, an interpretation of the findings in the context of the theoretical model of benefits choice is given in order to assess the magnitude of mothers' *DB* welfare participation responses. The empirical estimates in the previous section show that the age-eligibility rule has a positive effect on the probability of claiming *DB*, as predicted by the model. Not only do a proportion of single mothers with no qualifications who initially was *IS* join the labour market (20%) as their *IS* entitlement ceases, but another 25.5% out of those who leave *IS* respond to other economic incentives related to sickness and disability benefits. This is in line with previous research, which shows that people who have non-employment spells are more likely to stay on welfare (Evans et al., 2004). The fact that the increase in *DB* applications as the youngest child turns 16 is almost entirely explained by the increase in the probability of claiming *ISDB*, which is a non-contributory benefit, also suggests that mothers who have no work history are more likely to transit from one welfare benefit on another (Shaw et al., 1996).

One potential explanation for why single mothers with no qualifications do not claim *DB* before the youngest child turns 16 is related to imperfect about their own disability status or their eligibility for *DB*. As mothers' entitlement for *IS* ceases these mothers get re-evaluated by the DWP. In this process they might become aware that their health status is sufficiently poor for them to become eligible for *DB* and may therefore apply for these benefits. The incentives of the DWP bureaucrats also might give reason of such discontinuous entitlement. Based on anecdotal evidence in the 1980s in the UK, individuals who lost their jobs were advised by the Employment Service to claim invalidity benefits (National Audit Office, 1989). Beatty et al. (2000) and Webster (2002) suggest that during periods of high unemployment, the employment services may have purposely directed individuals of the long-term unemployed with health problems or disabilities off unemployment benefits and onto health benefits. Also, in the early 1990s, doctors

were influenced by their assessment of the probability of their patients finding a job (Ritchie et al., 1993) such that people who had difficulties in finding a job were identified as being sick or disabled. This suggests that the DWP bureaucrats were either to some extent altruistic towards or sluggish in assessing *DB* claimants.

Based on the above discussion, further empirical analysis was carried out which shows that the proportion of single mothers with no qualifications who self-identify as disabled rises discontinuously at the age-16 threshold. The proportion of self-reported disabled mothers by the age of the youngest child is shown in Figure 5. There is a clear jump at the age-16 eligibility break. Table 6 presents estimates of Equation (4) where the outcome variable is the proportion of mothers who self-identify as disabled. Interestingly, as the child turns 16, there is a 7-8 percentage points increase in the proportion of disabled population and the estimate is very precise and highly significant.

A potential concern arise from the fact that health and/or disability status is self reported. Individuals are asked whether they have a work-limiting health problem or disability¹³. In this way individuals may exaggerate their impairments to justify their benefits claims or labour market non-participation status (Bound and Burkhauser, 1999). There is substantial controversy over the use of self-reported health and disability indicators as explanatory variables in economic models. Several studies provide evidence that self-reported health and disability measures are biased and endogenous. The most commonly suggested explanation for these findings is that some survey respondents may inflate the incidence and severity of health problems and disabilities in order to rationalize their labour force non-participation and receipt of disability benefits. However, these "subjective" self-assessed measures have been found to be powerful predictors for a range of outcomes and behaviors, namely for labour supply decisions (Dwyer and Mitchell, 1999) and for individuals' decisions to apply for disability insurance benefits (Benitez-Silva et al., 1999).

¹³The questions posed in the Labour Force Survey are "Do you have any health problems or disabilities that you expect will last for more than a year? 1 yes, 2 no" and "Does this health problem affect the kind of paid work that you might do? 1 yes, 2 no". If the individual answers "yes" to both questions, he/she is assigned a value 1 for having a work-limiting health problem or disability.

Bound and Burkhauser (1999) conclude "measuring disability based on relatively simple self-report, while not perfect, identifies, both in the cross section and dynamically, populations with substantial difference in health status and functional limitations".

To sum up, single mothers with no qualifications who automatically lose their *IS* entitlement rely on *DB* benefits when their youngest child turns 16 in line with the predictions of the theoretical model of benefits choice. Living on benefits accentuates poverty and makes it harder to find work, as claimants become accustomed to the state providing for them. According to the model, the move off *IS* and on *DB* is fully rational. This can be explained by either a mechanical or behavioural effect. Because these justifications are hard to disentangle, the RD estimates represent net effects.

7 Summary and Conclusions

This study provides some insights into the labour market and welfare participation decisions of single mothers with no qualifications in the UK based on the age-eligibility rule in the *IS* program. A simple theoretical model of benefits choice is offered to show that it is fully rational for individuals to respond to economic incentives upon benefit withdrawal. Consistent with the predictions of the economic theory, a small percentage, about 8.7% of mothers who automatically leave *IS* move out of work and do not claim any benefits. While Soobedar (2009) revealed that a portion of single mothers with no qualifications either work or engage in job search at the age-16 threshold, this paper provides complementary evidence that poorly educated single mothers, in the margin of claiming either *IS* or *DB*, positively respond to sickness and disability benefits programs participation following the loss in *IS* entitlement. In line with the predictions of the model, the empirical estimates show a strong and discernible increase of about 4.2 percentage points in the probability of claiming sickness and disability benefits at the age-16 threshold, mainly driven by an increase in the probability of claiming income support with a disability premium.

This suggests that single mothers with no qualifications who claim sickness and disability benefits are more likely to have no work history.

In turn, the fact that mothers do not claim *DB* prior to their youngest child turning 16 is puzzling because *DB* payments are unequivocally larger than *IS* payments (Casebourne and Britton, 2004). However, the theoretical model not only shows that this is fully rational but it also provides insights about the transitional behavior of mother from *IS* to *DB* at the age-16 breaking point. In fact, about 25% of single mothers who were initially on *IS* switch into *DB* compared to 20% who choose to enter the labour market. Also, single mothers with no qualifications are 7-8 percentage points more likely to self-identify as disabled as their youngest child turns 16. This can be due to either a mechanical or a behavioural effect. On the one hand, single mothers with no qualifications have a higher propensity to claim *DB* as their youngest child turns 16 because they mechanically become more aware of their own disability status (which then translates into a lower probability of a successful application). On the other hand, with an exogenous fall in their resources, they have no other choice but to apply for the health benefits by lying on their health status¹⁴.

The rapid growth in the number of UK sickness and disability benefits claimants over the last 30 years is clearly a matter of concern for policy makers, e.g. in terms of the capacity of labour markets, costs to tax payers, the risks of poverty, social exclusion and welfare reliance. By 2015, the government aims to reduce by one million the 2.7 million people who are presently claiming Incapacity Benefit on the basis that they are too ill or disabled to work. Switching between welfare programs can lower the chance of these mothers coming off out-of-work benefits. Mothers who have been a long time on welfare may face a lot of problems when the benefits are withdrawn. Financial difficulties (includes payment of rent, mortgage, debts, living expenses), job or work-related problems (lack of experience and confidence, the job not lasting or not being the sort of work the mothers want) and over bureaucratic procedures (the time needed to receive in-work

¹⁴Another reason can be due to stigma costs (i.e. from the disutility arising from participation in the welfare program) attached to claiming benefits (Moffitt, 1983; Blundell et al., 1988).

benefits) may have an impact on the decision of mothers to make a claim for other out-of-work benefits (e.g. *DB*) the first time they are required to work. Overall, this may have the effect of increasing expenditure on welfare programs and even potentially decreasing human capital investment.

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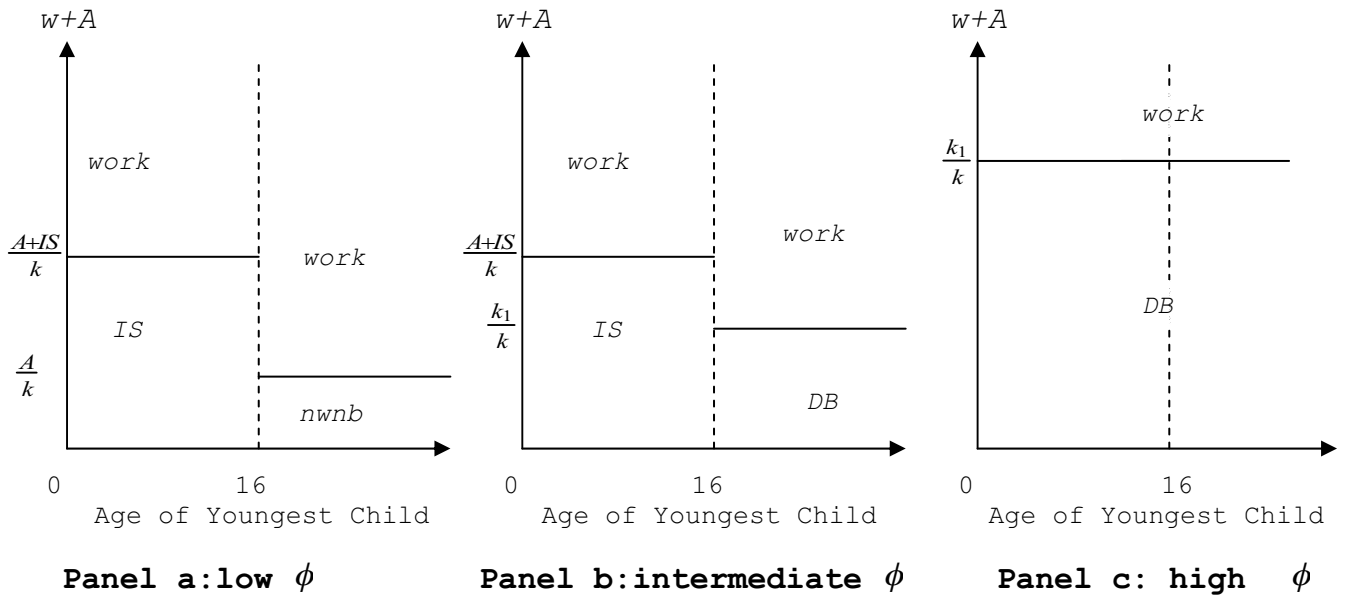
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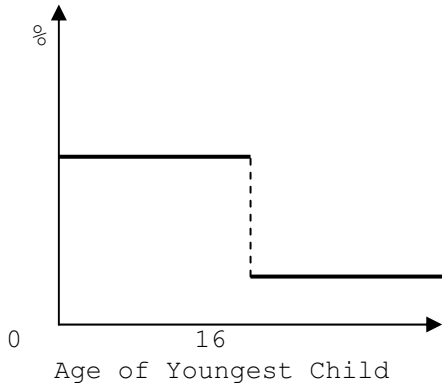
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Figure 1
A Simple Model of Sickness and Disability Benefits Choice

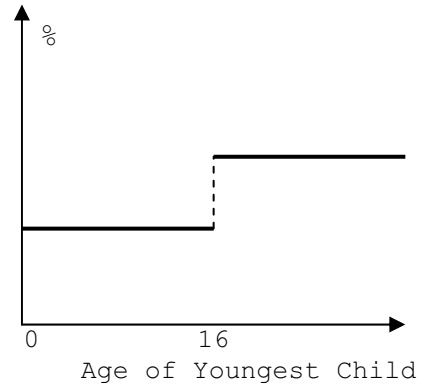


Notes: The Figure reports the decision of a representative poorly educated single mother between working at the wage offered for her characteristics (w) (including the option of being unemployed, working 0 hours per week and claiming Jobseeker's Allowance (JSA)) or accepting either income support transfers (IS) or sickness and disability transfers (DB) in lieu of working as their youngest child turns 16. The labour market and welfare participation decisions depend on ϕ . While panel a represents mothers with low ϕ and has either the option to work or be out of work and benefits ($nwnb$) as IS entitlement ceases, panel c corresponds to mothers who are too sick or disabled and are most likely to be claiming DB even before their youngest child turns 16 (high ϕ). Panel c relates to mothers who are neither too healthy to work nor too sick or disabled (intermediate ϕ) to have claimed DB earlier.

Figure 2
Predictions of the Model When The Youngest Child Turns 16



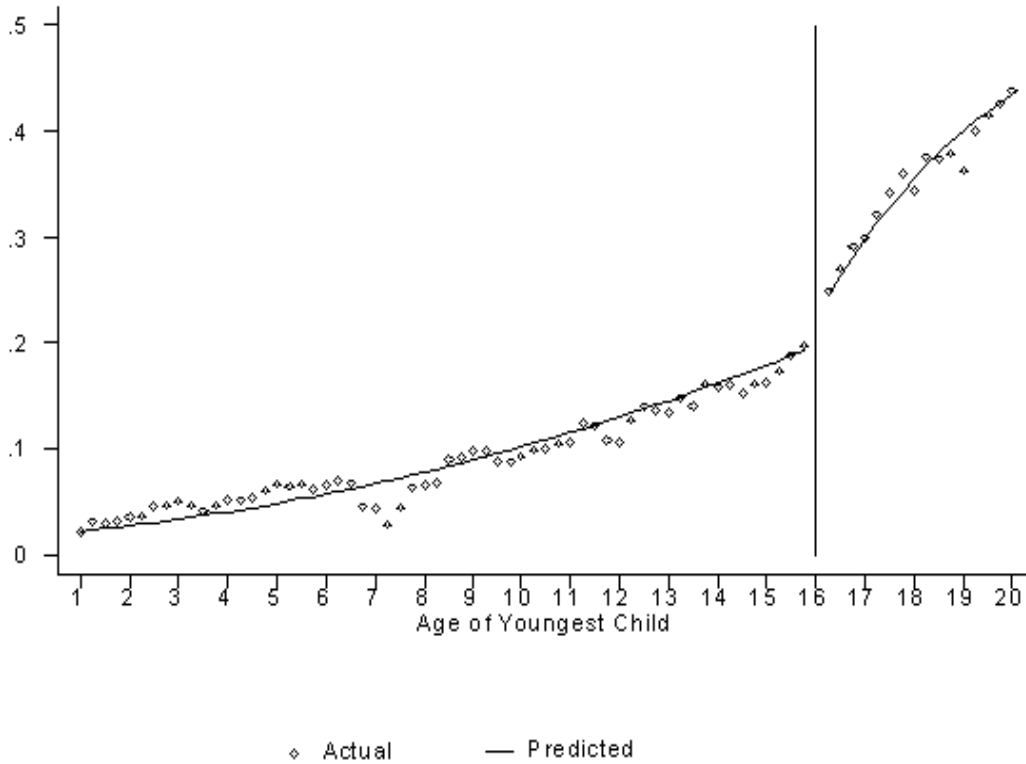
Panel a: Probability Claiming *IS*



Panel b: Probability Claiming *DB*

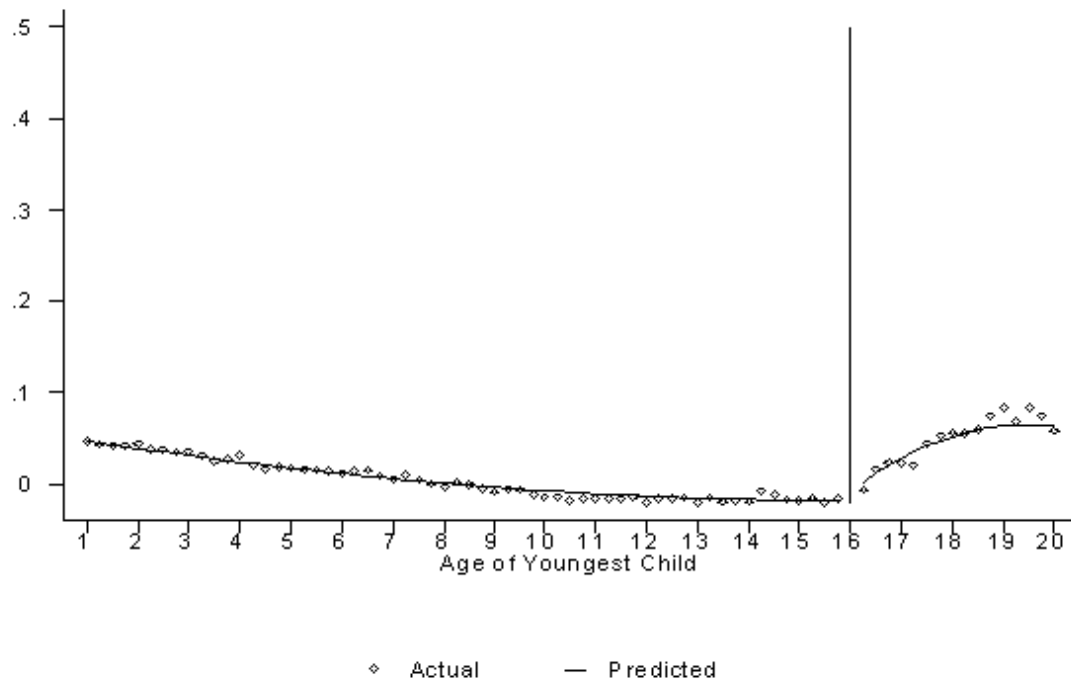
Notes: The Figure reports the predictions of the model. Panel a displays a fall in the probability of claiming *IS* at the age-16 cut-off point and panel b shows a discontinuous jump in the probability of participating in the *DB* program as the youngest child turns 16.

Figure 3
Proportion Claiming Health-Related Benefits
by Age of Youngest Child



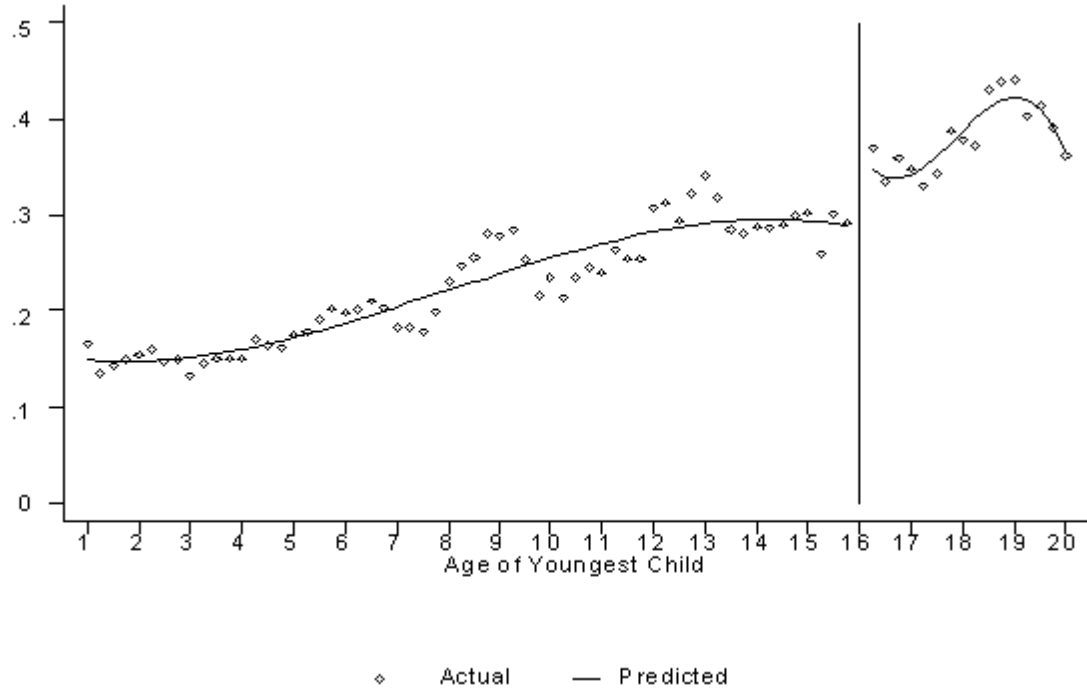
Notes: The Figure reports the proportion of single mothers with no qualifications who claim health-related benefits by the age of their youngest child. A quadratic fit is superimposed to the actual data.

Figure 4
Proportion Off Benefits and Out of Work
by Age of Youngest Child



Notes: The Figure reports the proportion of single mothers with no qualifications who are not claiming any benefits and who are out of work by the age of their youngest child. A quadratic fit is superimposed to the actual data.

Figure 5
Proportion of Single Mothers with a Disability
by Age of Youngest Child



Notes: The Figure reports the proportion of single mothers with no qualifications who self-report as suffering from work limiting health problem or disability by the age of the youngest child between the age of 1 and 20. A cubic fit is superimposed to the actual data.

Table 1
Comparative Statics When The Youngest Child Turns 16

Effect On	Low ϕ	Intermediate ϕ	High ϕ	Overall effect
P(claim <i>DB</i>)	-	↑	-	↑
P(claim <i>IS</i>)	↓	↓	-	↓
P(work)	↑	↑	-	↑
P(no-work-no-benefits)	↑	-	-	↑

Notes: The Table displays the effect of the age-eligibility rule in Income Support program on poorly educated single mothers' probability of claiming sickness and disability benefits (*DB*), the probability of claiming Income Support (*IS*), the probability of work) and the probability of being out of work and without benefits (*no-work-no-benefits*) as shown in Figure 3.1. For instance, row (1) reports the separate effect on the probability of claiming sickness and disability benefits when the youngest child turns 16 given different levels of ϕ . The last column adds up the three effects to give the overall effect. Rows (2) to (4) are read similarly.

Table 2
Descriptive Statistics

Variables	Mothers All	Youngest Child<16
1. Age of Mother	36 (9.407)	35 (8.631)
2. Work-Limiting Disability (1 = yes ; 0 = no)	0.232 (0.003)	0.211 (0.003)
3. Inactivity	0.619 (0.003)	0.635 (0.003)
Off Benefits	0.014 (0.001)	0.008 (0.001)
4. Income Support Benefits	0.504 (0.003)	0.550 (0.003)
5. Sickness & Disability Benefits	0.111 (0.002)	0.092 (0.002)
Contributory:	0.036	0.028
Incapacity Benefits	(0.001)	(0.001)
Non-Contributory:		
Income Support with Disability Premium	0.043 (0.001)	0.029 (0.001)
Disability Living Allowance	0.039 (0.001)	0.037 (0.001)
Severe Disability Allowance	0.011 (0.001)	0.009 (0.001)
Observations	25428	22209

Notes: The Table displays summary statistics on poorly educated single mothers. Column (2) reports statistics on all mothers and mothers whose youngest child is less than 16. Source: Quarterly Labour Force Surveys, Winter 1994 - Autumn 2002 (excluding Winter 1996 - Winter 1997).

Table 3
Fixed Effects Regression Discontinuity Estimates

Sickness and Disability Benefits			
	(1)	(2)	(3)
Linear	0.038*** (0.008)	0.038*** (0.010)	0.042*** (0.010)
Quadratic	0.031*** (0.006)	0.031*** (0.010)	0.034*** (0.011)
Cubic	0.023*** (0.006)	0.023** (0.011)	0.028** (0.011)
Quartic	0.026*** (0.007)	0.026** (0.012)	0.031** (0.012)
Region Effects	No	Yes	Yes
Time Effects	No	Yes	Yes
(URrt-URr)	No	Yes	No
Region-Time Effects	No	No	Yes
N	25428	25428	25428

Notes: The Table displays the fixed RD estimates of the impact of the youngest child turning 16 on sickness and disability benefits (both contributory and non-contributory) outcomes. Rows (1) to (4) refer to polynomials of degree 1 to 4 respectively. Columns (1) to (3) refer to three different specifications. Specification 1 includes controls for the age of the youngest child. Specification 2 includes controls for the age of the youngest child, time fixed effects, region fixed effects and local labour market conditions. Specification 3 includes controls for the age of the youngest child, additive region and time fixed effects. The sample includes single mothers with no qualifications who are reported to be single mothers in the first period they appear in the survey. The age of the youngest child is between 1 and 20 years. Standard errors in brackets are clustered by the age of the youngest child. ***, **, * denote significance at 1%, 5% and 10% respectively. Source: Quarterly Labour Force Surveys, Winter 1994 - Autumn 2002 (excluding Winter 1996 - Winter 1997).

Table 4
Fixed Effects Regression Discontinuity Estimates

Income Support with a Disability Premium			
	(1)	(2)	(3)
Linear	0.027*** (0.007)	0.027*** (0.007)	0.028*** (0.007)
Quadratic	0.029*** (0.007)	0.029*** (0.007)	0.030*** (0.008)
Cubic	0.025*** (0.008)	0.025*** (0.008)	0.026*** (0.008)
Quartic	0.021** (0.009)	0.021** (0.009)	0.020** (0.009)
Region Effects	No	Yes	Yes
Time Effects	No	Yes	Yes
(URrt-URr)	No	Yes	No
Region-Time Effects	No	No	Yes
N	25428	25428	25428

Notes: The Table displays the fixed RD estimates of the impact of the youngest child turning 16 on the Income Support with a Disability Premium (non-contributory health benefits) outcome. Rows (1) to (4) refer to polynomials of degree 1 to 4 respectively. Columns (1) to (3) refer to three different specifications. Specification 1 includes controls for the age of the youngest child. Specification 2 includes controls for the age of the youngest child, time fixed effects, region fixed effects and local labour market conditions. Specification 3 includes controls for the age of the youngest child, additive region and time fixed effects. The sample includes single mothers with no qualifications who are reported to be single mothers in the first period they appear in the survey. The age of the youngest child is between 1 and 20 years. Standard errors in brackets are clustered by the age of the youngest child. ***, **, * denote significance at 1%, 5% and 10% respectively. Source: Quarterly Labour Force Surveys, Winter 1994 - Autumn 2002 (excluding Winter 1996 - Winter 1997).

Table 5
Fixed Effects Regression Discontinuity Estimates
Out of Work and Benefits

	(1)	(2)	(3)
Linear	0.016*** (0.006)	0.016*** (0.006)	0.013** (0.006)
Quadratic	0.011* (0.006)	0.011* (0.006)	0.010* (0.006)
Cubic	0.012* (0.006)	0.013** (0.006)	0.011* (0.006)
Quartic	0.012* (0.007)	0.013* (0.007)	0.012* (0.007)
Region Effects	No	Yes	Yes
Time Effects	No	Yes	Yes
(URrt-URr)	No	Yes	No
Region-Time Effects	No	No	Yes
N	25206	25206	25206

Notes: The Table displays the fixed RD estimates of the impact of the youngest child turning 16 on no-work-no-benefits outcome. Rows (1) to (4) refer to polynomials of degree 1 to 4 respectively. Columns (1) to (3) refer to three different specifications. Specification 1 includes controls for the age of the youngest child. Specification 2 includes controls for the age of the youngest child, time fixed effects, region fixed effects and local labour market conditions. Specification 3 includes controls for the age of the youngest child, additive region and time fixed effects. The sample includes single mothers with no qualifications who are reported to be single mothers in the first period they appear in the survey. The age of the youngest child is between 1 and 20 years. Standard errors in brackets are clustered by the age of the youngest child. ***, **, * denote significance at 1%, 5% and 10% respectively. Source: Quarterly Labour Force Surveys, Winter 1994 - Autumn 2002 (excluding Winter 1996 - Winter 1997).

Table 6
Change in Proportion of Disabled Population

	(1)	(2)	(3)	(4)	N
Treat	0.020*	0.016	0.079***	0.067***	25131
	(0.011)	(0.016)	(0.018)	(0.016)	
R ²	0.031	0.031	0.033	0.033	

Notes: The Table displays RD estimates of the proportion of poorly educated single mothers who claim to have a work-limiting health problem or disability. Columns (1) to (4) refer to polynomials of degree 1 to 4 respectively. The specification includes controls for the age of the youngest child, additive region and time fixed effects. The sample includes single mothers with no qualifications who are reported to be single mothers in the first period they appear in the survey. The age of the youngest child is between 1 and 20 years. Standard errors in brackets are clustered by the age of the youngest child. ***, **, * denote significance at 1%, 5% and 10% respectively. Source: Quarterly Labour Force Surveys, Winter 1994 - Autumn 2002 (excluding Winter 1996 - Winter 1997).

Table 7
Fixed Effects Regression Discontinuity Estimates
with Different Age Windows

Age Window Width	(1)	(2)	N
Health-Related Benefits			
+/-			
4 years	0.032*** (0.012)	0.025* (0.013)	7492
3 years	0.030** (0.012)	0.017 (0.015)	5793
2 years	0.026** (0.013)	0.008 (0.017)	4038
1 year	0.026** (0.013)	0.008 (0.017)	2199
IS with Disability Premium only			
+/-			
4 years	0.024** (0.010)	0.025** (0.012)	7492
3 years	0.023** (0.011)	0.024* (0.013)	5793
2 years	0.026** (0.011)	0.021 (0.015)	4038
1 year	0.031** (0.013)	0.018 (0.017)	2199
No Work No Benefits			
+/-			
4 years	0.010 (0.009)	0.010 (0.010)	7492
3 years	0.012 (0.009)	0.016 (0.011)	5793
2 years	0.014 (0.010)	0.019 (0.014)	4038
1 year	0.017 (0.013)	0.015 (0.024)	2199

Notes: The Table displays the fixed effects RD estimates of the impact of the youngest child turning 16 for different age windows. Columns (1) and (2) refer to polynomials of degree 1 and 2 respectively. The specification includes controls for the age of the youngest child, additive region and time fixed effects. The sample includes single mothers with no qualifications who are reported to be single mothers in the first period they appear in the survey. The age of the youngest child is between 1 and 20 years. Standard errors in brackets are clustered by the age of the youngest child. ***, **, * denote significance at 1%, 5% and 10% respectively. Source: Quarterly Labour Force Surveys, Winter 1994 - Autumn 2002 (excluding Winter 1996 - Winter 1997).

Appendix

Utility function of the single mother:

$$U = \ln Ck \quad (1)$$

where C is consumption and $k = (1 - H)^\alpha < 1$.

Utility from Work option (including being unemployed and claiming JSA):

$$U_{work} = \ln(w + A) + \ln k \quad (2)$$

Utility from IS option:

$$U_{IS} = \ln(IS + A) \quad (3)$$

Utility from DB option:

$$\begin{aligned} U_{DB} &= \ln \left[(DB + A)^\phi (A - F)^{1-\phi} \right] \\ &= \ln k_1 \end{aligned} \quad (4)$$

where $k_1 = (DB + A)^\phi (A - F)^{1-\phi}$, $0 < \phi \leq 1$ and $A > F$.

Utility from Not Claiming Benefits and Not in Work ($nwnb$) option:

$$U_{nwnb} = \ln(A) \quad (5)$$

Note that $DB > IS$. Under the assumption that there are no intrinsic costs to applying for income support, the single mother will not consider the "no-work-no-benefits" option (i.e. U_{IS} is strictly greater than U_{nwnb})¹⁵.

¹⁵ $U_{IS} > U_{nwnb} \Rightarrow \alpha \ln(IS + A) > \alpha \ln(A)$ and hence $IS > 0$.

Decision of mother before the youngest child turns 16:

- She works if

either $U_{work} > U_{IS}$

$$\Rightarrow \ln(w + A) + \ln k > \ln(IS + A)$$

$$\Rightarrow w + A > \frac{(IS+A)}{k}$$

or $U_{work} > U_{DB}$

$$\Rightarrow \ln(w + A) + \ln k > \ln k_1$$

$$\Rightarrow (w + A) > \frac{k_1}{k}$$

- She claims income support if

either $U_{IS} > U_{work}$

$$\Rightarrow w + A < \frac{(IS+A)}{k}$$

$$\Rightarrow (IS + A) > k_1$$

or $U_{IS} > U_{DB}$

$$\Rightarrow \ln(IS + A) > \phi \ln(DB + A) + (1 - \phi) \ln(A - F)$$

$$\Rightarrow \ln(IS + A) > \ln(A - F) + \phi [\ln(DB + A) - \ln(A - F)]$$

$$\Rightarrow \phi < \frac{\ln(IS+A) - \ln(A-F)}{\ln(DB+A) - \ln(A-F)} \equiv A_1$$

where $0 < A_1 < 1$ since $0 < IS < DB$.

- She claims sickness and disability benefits if

either $U_{DB} > U_{work}$

$$\Rightarrow (w + A) > \frac{k_1}{k}$$

or $U_{DB} > U_{IS}$

$$\Rightarrow \phi > A_1$$

Decision of mother when the youngest child turns 16:

Under this circumstance, the mother has the options of either working or claiming sickness and disability benefits or in the worst case scenario, being off welfare and out of work:

- She works if

$$\text{either } U_{work} > U_{DB}$$

$$\Rightarrow \ln(w + A) + \ln k > \ln k_1$$

$$\Rightarrow w + A > \frac{k_1}{k}$$

$$\text{or } U_{work} > U_{nwnb}$$

$$\Rightarrow \ln(w + A) + \ln k > \ln A$$

$$\Rightarrow w + A > \frac{A}{k}$$

- She claims *DB* if

$$\text{either } U_{DB} > U_{work}$$

$$\Rightarrow w + A < \frac{k_1}{k}$$

$$\text{or } U_{DB} > U_{nwnb}$$

$$\Rightarrow \phi \ln(DB + A) + (1 - \phi) \ln(A - F) > \ln A$$

$$\Rightarrow \ln(A - F) + \phi [\ln(DB + A) - \ln(A - F)] > \ln A$$

$$\Rightarrow \phi > \frac{\ln(A) - \ln(A - F)}{\ln(DB + A) - \ln(A - F)} \equiv A_2$$

where $0 < A_2 < A_1 < 1$.

- She is out of work and off benefits (i.e. no-work-no-benefits) if

$$\text{either } U_{nwnb} > U_{work}$$

$$\Rightarrow w + A < \frac{A}{k}$$

$$\text{or } U_{nwnb} > U_{DB}$$

$$\Rightarrow \phi < A_2$$

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**Department of Economics
Queen Mary, University of London
Mile End Road
London E1 4NS
Tel: +44 (0)20 7882 5096
Fax: +44 (0)20 8983 3580
Web: www.econ.qmul.ac.uk/papers/wp.htm**