The Impact of the "In-Work" Benefit Reform in Britain on Married Couples: Theory and Evidence from Panel Data

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Abstract

This paper examines the effect of the Working Families' Tax Credit (WFTC) on married couples in Britain. The WFTC was a generous tax credit aimed at encouraging work among low-income families with children and was introduced in October 1999. To improve the interpretation of the observed intrahousehold choices, we develop a simple model of household decisions in which the role played by the tax and benefit system is explicitly accounted for. The main implications of the model are then tested using longitudinal data drawn from the first twelve waves of the British Household Panel Survey collected between 1991 and 2002. Our results show that the financial incentives of the reform had negligible effects on a wide range of married mothers' decisions, e.g., labour market participation and full-time employment, employment transitions, welfare receipt, childcare use and expenditures and divorce rates. Women's responses, however, were highly heterogeneous, depending on their partners' labour supply and earnings. Mothers married to a low-income man (i.e., a man who did not work or worked fewer than 16 hours per week, the 16-hour cutoff being essential for receipt of WFTC) showed somewhat larger responses. Compared to childless married women, they were more likely to work (especially if they had pre-school aged children) and work 16 hours per week (especially if they had a child aged 0-10). They also were more likely to remain in the labour force and had higher rates at which they entered it. They have been more likely to receive the tax credit but also experienced a greater risk of divorce. We find virtually no effect for women whose husband worked more than 16 hours per week. Likewise, there are no statistically significant responses among married men.

Keywords. Working Families' Tax Credit, Household Bargaining, Labor Supply, Fertility, Divorce Rates.

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1. Introduction

1.1. Motivation and Overview. The Working Families' Tax Credit (WFTC) introduced in 1999 was designed to improve the work incentives for low income households with children by providing increased benefits to families with at least one member working at least 16 hours per week (Blundell [2001]). Initial research based on ex-ante simulations predicted that the program would have a relatively small effect for single mothers, increasing their labor force participation rate by 2.2 percentage points, and would have even smaller effects for married mothers and fathers (Blundell et. al [2000]). In a recent study based on ex-post evaluations, Blundell and Hoynes [2001] found comparable effects, while other analysts found somewhat greater effects for single mothers (Blundell et al. [2004], Brewer et al. [2003], Gregg and Harkness [2003]). In an analysis of single mothers, Francesconi and Van der Klaauw [2004] found considerable heterogeneity in the employment responses to the introduction of the WFTC, ranging from 5 percent for single mothers with children over 10 years old, to 12 percent for single mothers with children under 5 years old. These last effects are large, and higher than previous studies found. However, despite the efforts that have gone into assessing the effect of the WFTC, very little is known about the socioeconomic impact of the "in work" benefit reform on married couples with children.

The aim of this paper is to fill in these gaps by analyzing the following policy-relevant questions. First, are there similar employment effects amongst married mothers and fathers? So far husbands' responses have not been analyzed adequately, and yet this analysis is crucial to enhance our understanding of the overall effect of the reform. Second, did the reform have an impact on family income, divorce and fertility behavior? With benefits depending on the age and number of children as well as total household earnings, the programme may have had indirect effects on these aspects of family behavior. Furthermore, since the WFTC had powerful effect on a wide range of single mothers' outcomes, the programme may have also had an effect on family behavior by changing the intra-household allocation of bargaining power between married mothers and fathers.

This paper addresses the above issues by developing a simple household bargaining model which analyzes family outcomes, such as husbands' and wives' labor supply, fertility decisions and the incidence of divorce, and how these are likely to vary with the introduction of the WFTC and the two later tax credits. We then examine panel data from the British Household Panel Study (BHPS) to test our predictions, and interpret our findings in terms of the theoretical model.

1.2. Theory. This paper theoretically investigates the effects of the WFTC in the context of a simple microeconomic bargaining model of household behavior. Our model focuses on three important issues. First, we examine the *direct* effect of WFTC on the work incentives of women in couples. The potential of the reform to improve women's work incentives is shown to depend on their partners' labor supply and earnings. In particular, the work incentives of women whose partner work below the threshold for eligibility for in work support are shown to be positively affected by the reform; in contrast, women whose partners' work beyond the threshold for eligibility for in work support may actually show a negative response. Second, we examine whether it is possible that the introduction of WFTC has affected household decision making *indirectly* by changing the allocation of marital bargaining power. Our starting point here is the observation that the "in work" benefit reform may affect divorced women's feasible utilities when marriage ends, and may thus shift the distribution of marital bargaining power in married women's favor. This in turn may change the weights in the intrahousehold decision process to more strongly reflect the preferences of women in couples. Our model provides a clean theoretical framework in which this idea can be worked out, and generates predictions as to what type of couples are most likely to have experienced a reallocation of marital bargaining powers. Third, we ask whether we can theoretically account for the possibility that the introduction of WFTC has affected divorce decisions. This is an important question, not least because child welfare typically decreases when parents break up. We show, for example, that the introduction of the WFTC may lead to an increase in divorce. This result is shown to depend, in particular, on the employment status and earnings of married men.

1.3. Data and Empirical Methodology. Our analysis uses longitudinal data drawn from the first twelve waves of the BHPS covering the period 1991-2002. These data allow us to perform a more informative analysis of the behavioral impact of the WFTC (and WTC and CTC) than cross-sectional or other available data do. There are at least three reasons for this advantage. First, the BHPS data contain information on changes in each outcome of interest, and thus allow us to focus on a large set of transitions. Second, following individuals and their families over time is key here because it informs us on the socioeconomic circumstances of the same individuals both before and after the "in work" benefit reform took place. The long time window of the BHPS before the introduction of the 1999 reform is critical, as it allows us to control more flexibly for other changes that have occurred over time. Finally, the BHPS data will provide us with representative samples of the population in Britain as it changes over 1990s and into the 21st century.

Our empirical approach is based on multivariate comparisons of outcomes in the years before and after the introduction of the WFTC, in relation to outcomes in the same years for a comparison group. The comparison group consists of married childless men and women. We distinguish between the immediate (1999) and somewhat longer term (2000-2002) effects of the programme. Special attention is devoted to the modelling of trends in social and labor market conditions that could have affected parents' behavior independently from the reform. Besides the commonly used level difference-in-difference models, we also estimate fixed-effects differences-in-differences as well as transition models for all our outcomes.

2. Theory

To better understand the potential impact of the Working Families' Tax Credit (WFTC) on married couples, we now set up a microeconomic model of the family in which bargaining between the wife and husband forms the basis of household decisions. Our basic model rests on several assumptions. First, to keep things simple, and because evidence suggests that married men's labor supply is not affected by taxes (Heckman [1992], Eissa and Hoynes [2004]), we will examine a model of a two-person household in which the labor supply of the husband is predetermined and, hence, exogenous. The wife makes her labor supply decisions by maximizing utility, taking account of the husband's labor supply and earnings. Second, the basic model ignores all taxes and transfers except for those contained in the WFTC. Furthermore, the basic model also disregards the childcare element of the WFTC reform. However, because the childcare element could potentially have a large impact on married women's labor supply decisions, we also show how our basic results can be extended to account for the childcare component of the WFTC. Finally, the outside option which matters for household bargaining is assumed to be the 'single state' after divorce rather than a non-cooperative equilibrium within the household.

2.1. Basic Model. The economy is made up of a continuum of households. Each household comprises a husband h and a wife w, with a fixed number of children. The framework treats families' prior formation, fertility, and eduction as exogenous. Each married woman has the potential to earn an hourly market wage w_w, and the w_w's are distributed on an interval $[\underline{w}, \overline{w}]$ according to the cumulative distribution function $G(w_w)$. The variation in earnings opportunities could be due to differences in human capital, which, since it is assumed exogenous, does not appear explicitly. We assume that married men inelastically supply l_h units of labor and earn a fixed hourly wage given by w_h. Thus the earnings of married men, denoted by $m_h \equiv w_h l_h$, are predetermined and, hence, exogenous. As we shall see below, the husband's exogenous labor supply will affect the wife's labor supply decision through total family income and eligibility for in-work support.

In a household, each spouse has the same preferences over own consumption and the wife's allocation of time to non-market activities. Non-market activities are defined to include maternal childcare and other household production activity. Formally, let all women be endowed with t units of time (per week). Let l_w denote a woman's labor supply (with $0 \leqslant l_w \leqslant t$). And furthermore, let x_i, for $i = h, w$, denote member i's consumption of a private good whose price is set to unity. Preferences of the members of a household are represented by the utility functions

$$U_h = \alpha \ln(x_h) + \beta \ln(t - l_w) \qquad \text{and} \qquad U_w = \alpha \ln(x_w) + \beta \ln(t - l_w), \tag{1}$$

where $t - l_w$ represents female time devoted to non-market activities. Married couples choose the levels of female labor supply and consumption subject to a budget constraint that reflects all taxes and transfers contained in the WFTC. The budget constraint can be written as

$$x_h + x_w = w_w l_w + m_h + PB, \tag{2}$$

where m_h represents the husband's exogenously given income, and B denotes the transfers and taxes contained in in the WFTC. The variable P is an indicator that equals one if a household meets the eligibility criteria for the WFTC and chooses to participate in the programme ($P = 1$). If instead a household does not meet the eligibility criteria for the WFTC, or chooses, voluntarily, not to participate, then the indicator variable P takes on the value zero ($P = 0$).

The transfers and taxes contained in the WFTC are a function of a household's hours spent working in the labor market and earned income. More precisely, a family needs to have one member working l_{min} hours or more per week to be eligible for "in-work" benefits. Each family is potentially eligible to an maximum amount T_{max} which increases with number of children in the household. The maximum amount T_{max} is payable if the family's total income is lower than a threshold M_{min}. Income in excess of this threshold reduces entitlement to the tax credit by the "taper rate" π for every unit of excess income. Letting $M \equiv w_w l_w + m_h$ denote a family's total income, the basic schedule for the tax credit can therefore be expressed as

$$B = \begin{cases} 0 & \text{if } l_h < l_{min} \text{ and } l_w < l_{min} \\ T_{max} - \pi(M - M_{min}) & \text{if } l_h \geq l_{min} \text{ or } l_w \geq l_{min}, \text{ and } M < M_{max} \\ 0 & \text{if } l_h \geq l_{min} \text{ or } l_w \geq l_{min}, \text{ and } M \geq M_{max} \end{cases}, \tag{3}$$

where

$$M_{max} = \frac{1}{\pi}\left[T_{max} + \pi M_{min}\right]. \tag{4}$$

The assumption we make to solve for the equilibrium family resource allocation is that it is Pareto efficient. One way of doing this is to maximize one member's utility subject to a given level of the other (Clark [1999]). It turns out however that an equivalent approach to characterizing the efficient family resource allocation is more useful for our analysis. In this approach (Chiappori [2002], Iyigun and Walsh [2005]), each couple solves the following program:

$$\max_{\{x_h, x_w, l_w, P\}} \Omega \equiv \theta U_w + (1-\theta) U_h \tag{P1}$$

subject to

$$x_h + x_w = w_w l_w + m_h + PB$$

$$\begin{cases} 0 \leq l_w \leq t & \text{if } P = 0 \\ l_{min} \leq l_w \leq t & \text{if } P = 1 \end{cases}$$

where θ is a weighting factor belonging to $[0, 1]$ that reflects the marital bargaining power of women. The weighting factor θ will in general depend on the feasible levels of utility that can be achieved if the couple divorce. Since WFTC may affect the utility of single parents, it follows that any reform of the policy parameters π, T_{max} and M_{min} also affects the bargaining weight θ. Formally, the value of θ may be a function of π, T_{max} and M_{min}. For future reference, let $\theta \equiv \theta(\pi, T_{max}, M_{min})$. We shall discuss below how the exact functional form of θ could be be derived in the context of our model, but for now we simply allow for the possibility that θ depends on the policy parameters underlying the WFTC reform.

We now examine the WFTC effect on married women's labor supply. We first turn to families in which the husband does not work or works less than l_{min} hours per week (Household Type 1). We then consider families in which the husband works more than l_{min} hours (Household Type 2).

• **Household Type 1.** We now characterize married women's labor supply conditional on their partners inelastically working less than l_{min} hours per week ($l_h < l_{min}$). This assumption implies that the male partner's labor supply is below the the cut-off for eligibility for the WFTC. Examples we have in mind include situations in which the male partner is unemployed or does not participate in the labor force. In this case, a household's eligibility status is endogenous to female labor supply: a family may be ineligible for tax credit either because female labor supply is below the cut-off l_{min} or because total family income exceeds the eligibility income M_{max}.

The key to our analysis is to generate a distribution of families by female labor supply and participation in the welfare-to-work program. With the assumption of identical preferences across individuals, heterogeneity in behavior is solely due to female wage differences, differences in husband earnings, and differences in the number and ages of children which influence tax credit base amounts. The following result holds WFTC parameters, preferences parameters and husband earnings constant, and provides a categorization of the population based on female wage differences.

RESULT 1 *There exists a set of WFTC parameters, preference parameters, and husband earnings such that the population of married women can be divided into four groups, according to the wage rate that each married woman can potentially earn.*

1. *Type-1 women have a wage in the interval* $[\underline{w}, w^*]$*. Type-1 women either don't work or work fewer than* l_{min} *hours* ($0 \leqslant l_w^1 < l_{min}$) *and hence are ineligible for WFTC* ($P = 0$)*.*

2. *Type-2 women have a wage in the interval* $[w^*, w^{**}]$*. Type-2 women work just* l_{min} *hours* ($l_w^2 = l_{min}$) *in order to be eligible for WFTC* ($P = 1$)*.*

3. *Type-3 women have a wage in the interval* $[w^{**}, w^{***}]$*. Type-3 women work strictly more than* l_{min} *hours* ($l_w^3 > l_{min}$) *and are eligible for WFTC* ($P = 1$)*.*

4. *Type-4 women have a wage in the interval* $[w^{***}, \overline{w}]$*. Type-4 women choose to work strictly more than* l_w^3 *hours* ($l_w^4 > l_w^3$) *and generate earnings too high to be eligible for WFTC* ($P = 0$)*.*

The cutoff-wages w^**,* w^{**} *and* w^{***} *are functions of the policy parameters* π*,* T_{max} *and* M_{min}*.*

How can we find the cut-off wages that separate different types of women? Note that each household can choose to be in one of two "regimes". First, each household can decide not to meet the eligibility criteria for the WFTC, or decide not to participate in the programme ($P = 0$). In the absence of WFTC each family maximizes $\Omega \equiv \theta U_w + (1-\theta)U_h$ subject to $x_h + x_w = w_w l_w + m_h$ and $0 \leqslant l_w \leqslant t$. It is readily shown that if $w_w \leqslant \beta m_h/\alpha t$, then the optimal resource allocation is

$$l_w^{1,a} = 0, \quad x_w^{1,a} = \theta m_h, \quad x_h^{1,a} = (1-\theta) m_h; \tag{5}$$

If instead $w_w > \beta m_h/\alpha t$, then the optimal household resource allocation is

$$l_w^{1,b} = t - \frac{\beta[w_w t + m_h]}{w_w(\alpha+\beta)}, \quad x_w^{1,b} = \frac{\alpha\theta[w_w t + m_h]}{\alpha+\beta}, \quad x_h^{1,b} = \frac{\alpha(1-\theta)[w_w t + m_h]}{\alpha+\beta}. \tag{6}$$

The corresponding indirect utility function is the value of utility obtainable from substituting (5) or (6) into the direct utility function. Thus the indirect utility function is $\Omega^{P=0} \equiv \alpha[\theta \ln x_w^{1,k} + (1-\theta)\ln x_h^{1,k}] + \beta \ln(t - l_w^{1,k})$, where $k = a$ or $k = b$ depending on whether $w_w \leqslant \beta m_h/\alpha t$ or $w_w > \beta m_h/\alpha t$.

Second, each family can choose to meet the eligibility criteria for the WFTC and participate in the programme ($P = 1$). It is readily shown that there exists a cutoff wage

$$w^{**} = \frac{\beta[(1-\pi)m_h + T_{max} + \pi M_{min}]}{(1-\pi)[\alpha t - (\alpha+\beta) l_{min}]}, \tag{7}$$

which has the following properties. As long as $w_w \leqslant w^{**}$, it is optimal for the female partner to work just l_{min} hours to be eligible for in-work support. In this case, the optimal resource allocation is:

$$l_w^2 = l_{min}, \quad x_w^2 = \theta[w_w l_{min} + m_h + B^*], \quad x_h^2 = (1-\theta)[w_w l_{min} + m_h + B^*], \tag{8}$$

where $B^* = T_{max} - \pi[w_w l_{min} + m_h - M_{min}]$. If instead $w_w \leqslant w^{**}$, the optimal resource allocation is:

$$l_w^3 = t - \frac{\beta[w_w t + m_h + B^{**}]}{w_w(1-\pi)(\alpha+\beta)}, \; x_w^3 = \frac{\alpha\theta[w_w t + m_h + B^{**}]}{\alpha+\beta}, \; x_h^3 = \frac{\alpha(1-\theta)[w_w t + m_h + B^{**}]}{\alpha+\beta}, \tag{9}$$

where $B^{**} = T_{max} - \pi[w_w t + m_h - M_{min}]$. The indirect utility function is $\Omega^{P=1} \equiv \alpha[\theta \ln x_w^j + (1-\theta)\ln x_h^j] + \beta \ln(t - l_w^j)$, where $j = 2$ or $j = 3$ depending on whether $w_w \leqslant w^{**}$ or $w_w > w^{**}$.

To derive the cut-off wages, we have each household choose the optimal resource allocation in each of the two possible regimes ($P = 0$ or $P = 1$), determine the corresponding indirect utility levels and then pick the point with the highest utility level. Figure 1 illustrates the argument by plotting the indirect utility functions $\Omega^{P=0}$ and $\Omega^{P=1}$ against the wages different women can potentially earn. In the context of the parameter values used to construct the figure, the cutoff wages w^* and w^{***} are respectively characterized by

$$\ln\left[\frac{\alpha(w_w t + m_h)}{(\alpha+\beta)[w_w l_{min} + m_h + B^*]}\right] = \left(\frac{\beta}{\alpha}\right) \ln\left[\frac{w_w(t - l_{min})(\alpha+\beta)}{\beta[w_w t + m_h]}\right] \tag{10}$$

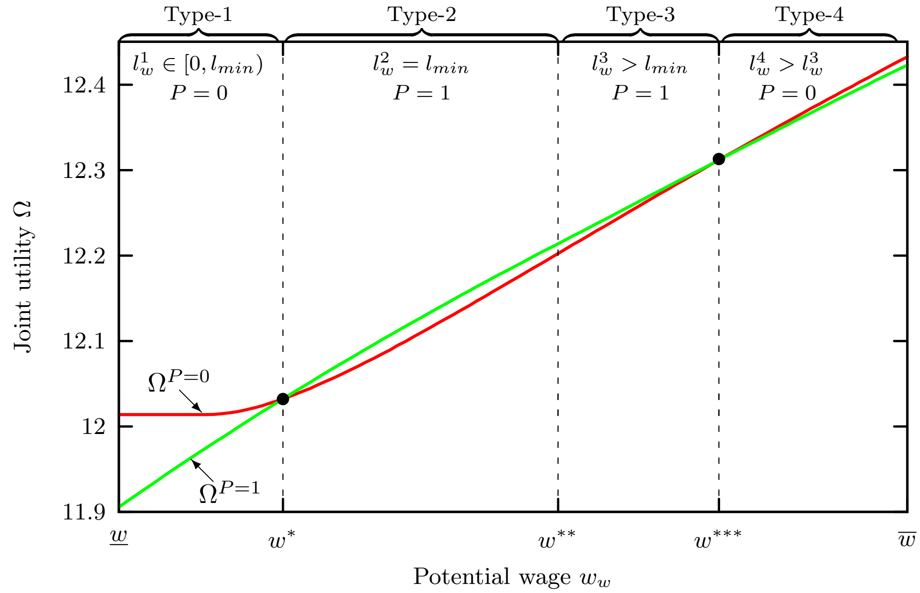

FIG.1: To construct this figure we have chosen the following general parameter values: $\alpha = \beta = 1$, $t = 60$, $m_h = 110$. The policy parameters are: $l_{min} = 16$, $T_{max} = 9$, $M_{min} = 70$, $\pi = 0.06$. The cut-off wages are given by $(w^*, w^{**}, w^{***}) = (2.41, 4.43, 5.61)$ in the context of the parameter values used for this figure. The labor supply of women classified as type-1 is $l_w^1 = 0$ if $w_w \leqslant 1.83$, and $l_w^1 \in (0, l_{min})$ if $w_w > 1.83$.

and

$$\ln\left[\frac{w_w t + m_h + B^{**}}{w_w t + m_h}\right] = \left(\frac{\beta}{\alpha + \beta}\right) \ln\Big[1 - \pi\Big]. \tag{11}$$

Figure 2 illustrates the allocation of work hours implied by our categorization of the population. The figure shows that bunching in hours occurs at the eligibility cutoff l_{min}, with a gap in the distribution of hours below that cutoff. The reason for this is simple. There are women in the population who, in the absence of WFTC, would optimally choose to work strictly less than l_{min} hours. But in the presence of WFTC, they increase their labor supply to l_{min} in order to obtain eligibility for benefits. There is also a gap in work hours at w^{***}, the cutoff wage separating those with labor supply and family income meeting the eligibility criteria and those with family income too high to be eligible. The reason is that ineligible families cease being on the taper rate π, which essentially increases the marginal wage rate. This, in turn, generates an discontinuous upward jump in work hours.

We would like to draw attention to three points about Result 1. First, it is important to note that the cutoff wages are independent of the bargaining weight θ. The intuition is as follows. Under the assumption that men and women have the same preference over their own consumption and the wellbeing of their children, there is no allocational conflict between the spouses as to how the wife should allocate her time between the labor market and maternal child care. This, in turn, implies that the equilibrium time allocation of the wife – and hence the cutoff wages – are independent of the bargaining weight θ. If we were to relax the assumption that men and women

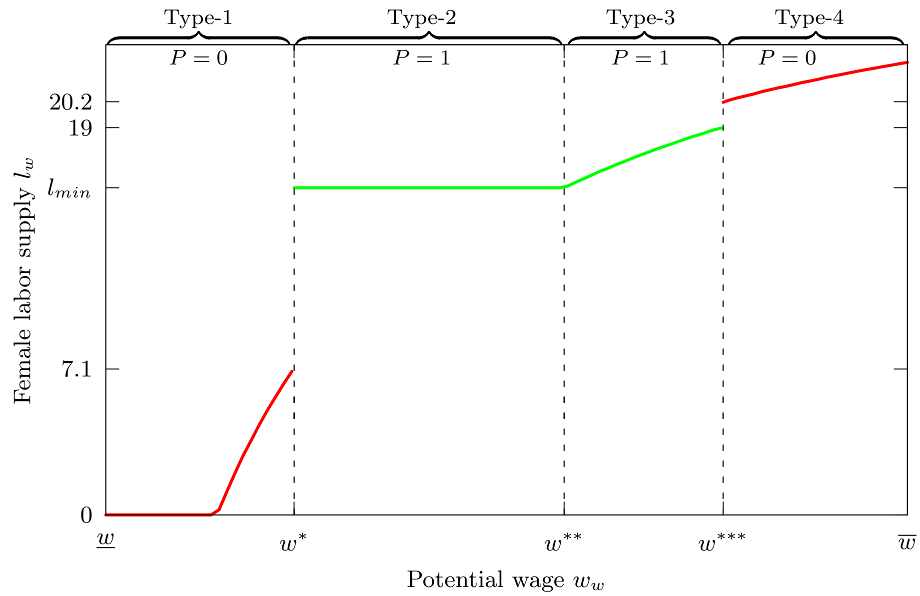

FIG.2: To construct this figure we have chosen the following general parameter values: $\alpha = \beta = 1$, $t = 60$, $m_h = 110$, $\theta = 0.5$. The policy parameters are: $l_{min} = 16$, $T_{max} = 9$, $M_{min} = 70$, $\pi = 0.06$. The cut-off wages are given by $(w^*, w^{**}, w^{***}) = (2.41, 4.43, 5.61)$ in the context of the parameter values used for this figure.

have equal preferences, then the equilibrium time allocation of the wife and the cutoff wages would be functions of the bargaining weight θ. In this case, there may be an additional effect on female labor supply from changing the WFTC parameters via its effect on θ.

Second, our main objective is to show that the WFTC reform has labor supply effects that differ for different individuals in the distribution. This requires heterogeneity in the population both in female labor supply and participation in the WFTC programme. Two types of nonparticipation are of particular importance in assessing the WFTC reform – one being the nonparticipation of those with labor supply too low to be eligible, and one being the nonparticipation of those with income too high to be eligible. Result 1 provides us with this heterogeneity and hence allows us to evaluate the WFTC reform across different individuals. We easily were able to find sets of parameter values under which Result 1 holds. We used one such set to construct Figure 1 and, throughout the paper, focus on parameter settings for which Result 1 holds. However, it is important to note that some parameter settings will lead to different classifications of the population.[1]

[1]A modification of the preference parameters can lead to situations where some of the cutoff wages are identical to each other, which would imply that some of the types may not appear in the population. For example, in the extreme case where $\alpha > 0$ and $\beta = 0$ then individuals would always work as much as possible [types 1 to 3 would not exist], while when $\alpha = 0$ and $\beta > 0$ then individuals would never work [types 2 to 4 would not exist]. In an analogous fashion, the modification of the policy parameters can lead to cases where labor supply would initially equal l_{min} up to some wage after which it discontinuously drops to a lower labor supply level [types 1 and 2 are switched]. The simplest way to see this is to consider the case with $\pi = 1$, $M_{min} = 0$, $m_h = 0$, and utility parameters such that it is optimal to work l_{min} hours at $w = \underline{w}$, and with the slope of the indifference curve at

Finally, Result 1 shows how different women (with different wage rates ceteris paribus) determine their labor supply for initial values of the credit base amount T_{max}, the threshold M_{min}, and the taper rate π. The result may be interpreted as characterizing the choices made by different women before the WFTC was implemented (the "old" or "pre-reform" regime). The next step is to consider what would happen to women classified under the old regime in case of a policy change. To do so, we examine how different women would optimally respond to a change in the policy parameters. The WFTC has increased the generosity of in-work support relative to the previous in-work benefit system in three ways: an increase in the tax credit T_{max}; an increase in the threshold M_{min}; and a reduction in the taper rate π. While the actual changes were discrete, we will focus on comparative static exercises by looking at marginal changes in each of the policy parameters.

Definition 1 *Let the WFTC reform be characterized by a marginal increase in the credit base amount T_{max}; a marginal increase in the threshold M_{min}; and a marginal decrease in the taper rate π.*

We begin by examining how the lowest-labor-supply women would respond to a policy change.

Result 2 (Effect on type-1 women) *The proportion of married women who either don't work or work fewer than l_{min} hours is increasing in the taper rate π; decreasing in the credit base amount T_{max}; and decreasing in the threshold M_{min}. Thus, conditional on not working l_{min} hours prior to the reform, the effect of WFTC is to unambiguously increase incentives to work l_{min} or more hours in response to the reform.*

Result 1 tells us that the proportion of married women working at least l_{min} hours should unambiguously increase as a consequence of the three aspects of the WFTC reform. The intuition here is that the financial benefits to participating at least l_{min} hours per week are greater post-reform than pre-reform. As a result, the levels of utility that can be achieved if the female works at least l_{min} hours per week increase, i.e., the graph labelled $\Omega^{P=1}$ in Figure 1 shifts upwards. This decreases the cutoff-wage w_w^*, which, in turn, increases the population-weighted measure of married women participating at least l_{min} hours per week.

While the WFTC reform should encourage the lowest-labor-supply women to work more, the incentives for married women already participating in the welfare-to-work program *prior* to the reform are less clear. To see this, consider the following thought experiment: take the group of women classified as either type-2 or type-3 under the old regime; randomly pick a member of this group and ask the question: what are the pre- and post-reform probabilities that the selected individual works beyond some arbitrary threshold $\hat{l} \geqslant l_{min}$?

l_{min} hours being steeper than the slope of the line connecting the $l_w = 0$ (income is zero) and $l_w = l_{min}$ (income is T_{max}) points. However, the comparative statics in this case yield insights that are qualitatively equivalent to the case we are considering in the paper.

Result 3 (Effect on type-2 and type-3 women) *The proportion of married women working $\hat{l} \geqslant l_{min}$ or more hours is given by $1 - G(\hat{w})$, where*

$$\hat{w} = \frac{\beta[(1-\pi)m_h + T_{max} + \pi M_{min}]}{(1-\pi)[\alpha t - \hat{l}(\alpha+\beta)]}.$$

The value of $1 - G(\hat{w})$ is decreasing in the tape rate π; decreasing in the credit base amount T_{max}; and decreasing in the threshold M_{min}. Thus, conditional on working $\hat{l} \geqslant l_{min}$ hours in the pre-reform regime, the effect of WFTC on incentives to work more than $\hat{l}$ hours in the post-reform regime is ambiguous.

Two forces underlie this ambiguous relationship between the WFTC reform and work incentives. On the one hand, the increase in the tax credit and threshold element of WFTC raises the financial returns to working any given hours level at or above the threshold l_{min}. This generates an income effect that unambiguously decreases work incentives. On the other hand, the reduction in the taper rate π generates a substitution effect and an income effect. The substitution effect follows from the fact that a decrease in π increases the marginal wage rate. This, in turn, increases the opportunity cost of non-market activities, and therefore increases hours of work. The income effect, by contrast, decreases hours of work. For our specific functional forms, the substitution effect is always strictly larger than the corresponding income effect:

$$\frac{\partial(1-G(\hat{w}))}{\partial \pi} = \frac{-\beta G'(\hat{w})}{\Upsilon}\Bigg[-\underbrace{\frac{m_h}{(1-\pi)}}_{Income\ E.} + \underbrace{\frac{(1-\pi)m_h + T_{max} + M_{min}}{(1-\pi)^2}}_{Substitution\ E.}\Bigg] < 0,$$

where $\Upsilon = \alpha t - \hat{l}(\alpha+\beta)$. The implication of this is that a marginal reduction in π unambiguously increases hours of work. Taken together, the above arguments imply that the three elements of WFTC generate effects that move in opposite direction. This, in turn, suggests an ambiguous effect on married women's incentive to work beyond a given threshold above the cut-off for eligibility for in-work support.

Finally, we look at how the highest-labor-supply women – i.e., those who generate an income too high to be eligible for benefits – would respond to a policy change.

Result 4 (Effect on type-4 women) *The proportion of married women classified as type-4 is decreasing in the taper rate π; increasing in the credit base amount T_{max}; and increasing in the threshold M_{min}. Thus the work incentives of the highest-labor-supply women unambiguously decrease as a consequence of the three aspects of WFTC.*

More precisely, there are women among the highest-labor-supply types who have an incentive to respond to introduction of the WFTC by making themselves eligible for benefits, reducing their labor supply from $l_w^4 = t - \frac{\beta[w_w t + m_h]}{w_w(\alpha+\beta)}$ to $l_w^3 = t - \frac{\beta[w_w t + m_h + B^{**}]}{w_w(1-\pi)(\alpha+\beta)}$ in the process. To summarize, our analysis suggests that the introduction of WFTC did not generate unambiguously desirable labor supply effects: while the reform has encouraged the lowest-labor-supply women to work more (Result 2), there is also a potential labor supply reduction among higher-labor-supply individuals, namely those who chose to locate above the eligibility income prior to the reform (Result 4). Moreover, there is an ambiguous effect for those women who chose to meet the eligibility criteria in the pre-reform regime (Result 3). A final observation relates to WFTC receipt. The combination of the effects on the lowest-labor-supply women and the highest-labor-supply women implies that the proportion of families participating in the benefit program (as measured by the value of $[G(w''') - G(w')]$) unambiguously increases after the introduction of WFTC. Hence one would expect there to be an overall increase in WFTC receipt in response to the reform.

- **Household Type 2.** We now look at work incentives for the group of married women whose partners work more than l_{min} hours per week and are therefore eligible for in-work support ($l_h > l_{min}$). Examples that we have in mind are two-adult households in which the female partner is the secondary earner. A key question in this case is whether the WFTC reform lead to incentives for secondary earners to move out of work altogether. The model considered in the previous section does not allow us to get at this question. The reason is that in the model presented above individuals can choose to work *any* desired amount of hours. Suppose instead that women choose between two limited options supplied by the labor market: not to work ($l_w = 0$); or to work part-time or full-time ($l_w = \tilde{l}$). Thus, let each household now solve program $(P1)$ subject to the modified constraint $l_w \in \{0, \tilde{l}\}$. One of the benefits of the modified model is that it allows us to examine the pre- and post-reform incentives for women to move into work or out of work. We will restrict our attention to parameter values such that $m_h < \frac{1}{\pi}[T_{max} + M_{min}] \equiv M_{max}$. This requires that households in which the female partner does not work are eligible for in-work support. It puts an upper bound on the male partner's exogenously given income. If the female partner chooses not to work, the optimal household resource allocation is:

$$l_w^{nw} = 0, \quad x_w^{nw} = \theta[m_h + B^0], \quad x_h^{nw} = (1-\theta)[m_h + B^0], \tag{12}$$

where $B^0 = T_{max} - \pi(m_h - M_{min})$. The corresponding indirect household utility is $\Omega^{nw} \equiv \alpha[\theta \ln x_w^{nw} + (1-\theta)\ln x_h^{nw}] + \beta \ln(t - l_w^{nw})$. If instead the female partner chooses to work, the household resource allocation depends on the wage that the female partner can potentially earn. Define $w' = \frac{1}{\pi \tilde{l}}[T_{max} - \pi(m_h - M_{min})]$. Suppose first that $w_w < w'$. As the female partner moves into work, household income increases by $w_w \tilde{l}$. The condition $w_w < w'$ implies that the female partner's wage is sufficiently low so that the household is still eligible for WFTC. The optimal household resource allocation is

$$l_w^{w,1} = \tilde{l}, \quad x_w^{w,1} = \theta[w_w \tilde{l} + m_h + B'], \quad x_h^{w,1} = (1-\theta)[w_w \tilde{l} + m_h + B'], \tag{13}$$

where $B' = T_{max} - \pi(w_w \tilde{l} + m_h - M_{min})$. The corresponding indirect household utility is $\Omega^{w,1} \equiv \alpha[\theta \ln x_w^{w,1} + (1-\theta)\ln x_h^{w,1}] + \beta \ln(t - l_w^{w,1})$. Suppose instead that $w_w \geqslant w'$. The condition $w_w \geqslant w'$ implies that the female partner's wage is so high that WFTC is withdrawn as she moves into work. The optimal household resource allocation is

$$l_w^{w,0} = \tilde{l}, \quad x_w^{w,0} = \theta[w_w \tilde{l} + m_h], \quad x_h^{w,0} = (1-\theta)[w_w \tilde{l} + m_h]. \tag{14}$$

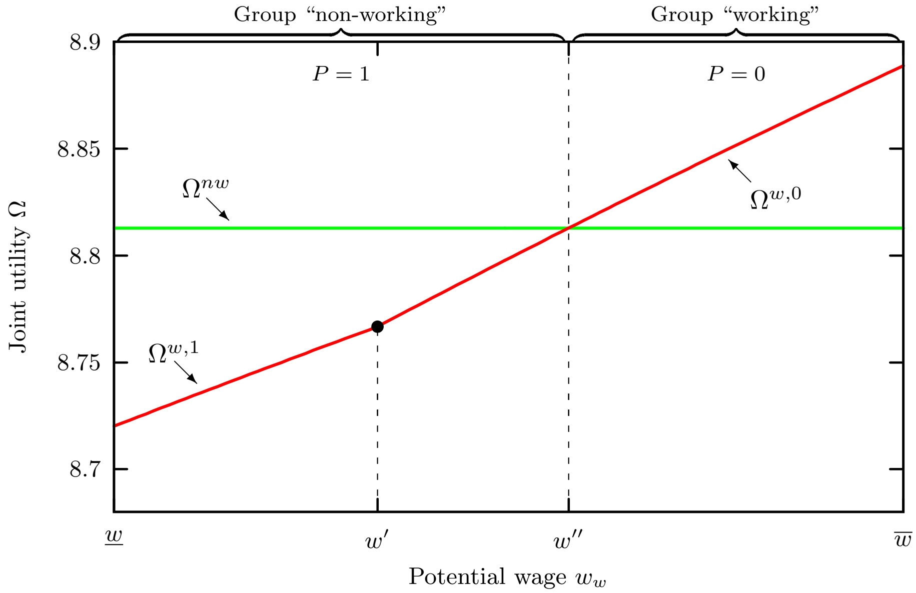

FIG. 3: Case 1: A comparison of the utility levels from working (w) and non-working (nw). For this figure the general parameter values are: $\alpha = \beta = 1$, $t = 60$, $\tilde{l} = 10$, $m_h = 210$. The policy parameters are: $T_{max} = 50$, $M_{min} = 90$, $\pi = 0.3$. The cut-off wages are given by $(w', w'') = (4.67, 5.88)$ in the context of the parameter values used for this figure.

The corresponding indirect household utility is given by $\Omega^{w,0} \equiv \alpha[\theta \ln x_w^{w,0} + (1-\theta)\ln x_h^{w,0}] + \beta \ln(t - l_w^{w,0})$. By comparing the indirect household utilities from working and non-working, we now divide the population into working and non-working married women. We then examine how the size of the two groups would change in response to the WFTC reform. Two cases may arise.

Case 1. Consider first parameter values for which $\Omega^{nw} > \Omega^{w,1} = \Omega^{w,0}$. This case is illustrated in Figure 3.[2] A married woman chooses to work if $\Omega^{w,0} > \Omega^{nw}$ and not otherwise. Thus the size of the group of working women can be measured by the cut-off wage w''. The fact that $w'' > w'$ implies that women who choose to work generate earnings above the eligibility criterium, i.e., their decision to work and choice of earnings makes their families ineligible for tax credit. The first comparative statics in this section examines the extent to which the incentives of working women have been altered in response to the WFTC reform.

Result 5 (Case 1) *The size of the group of married women who worked in the pre-reform regime is given by $1 - G(w'')$. The value of $1 - G(w'')$ is: increasing in the taper rate π; decreasing in the credit base amount T_{max}; and decreasing in the threshold M_{min}. Thus, conditional on choosing to work in the pre-reform regime, the effect of WFTC is to unambiguously increase incentives to move out of work in the post-reform regime.*

[2]The condition $\Omega^{nw} > \Omega^{w,1} = \Omega^{w,0}$ essentially requires that the male partner's income is relatively high. More precisely, it limits the male partner's income to parameters satisfying $\varphi M_{max} < m_h < M_{max}$, where $\varphi = 1 - \frac{\tilde{l}}{(1-\pi)t}$. We will consider the where the male partner's income is relatively low, i.e., the set of parameter values for which $m_h \leqslant \varphi M_{max} < M_{max}$, in the remainder of this section.

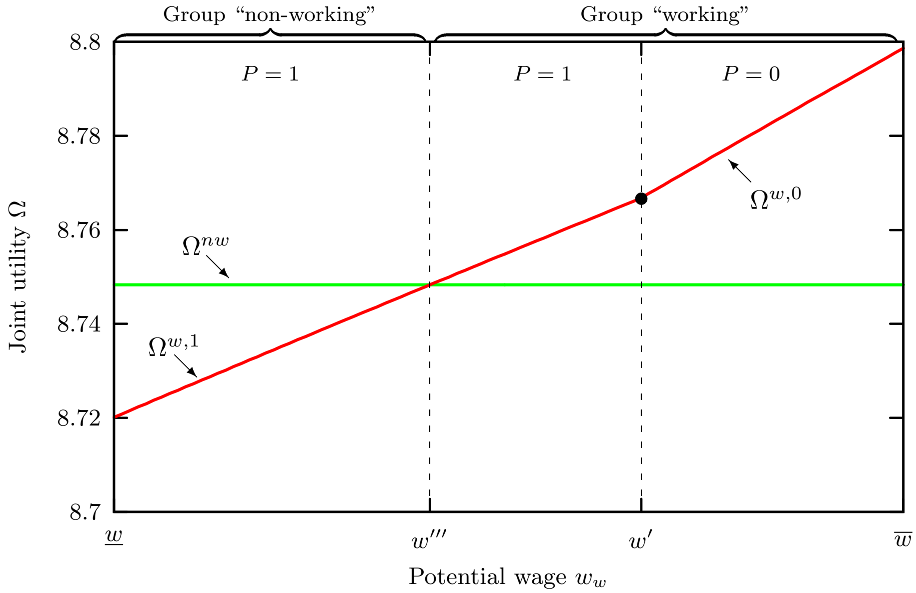

FIG. 4: Case 2: A comparison of the utility levels from working (w) and non-working (nw). For this figure the general parameter values are: $\alpha = \beta = 1$, $t = 60$, $\tilde{l} = 10$, $m_h = 190$. The policy parameters are: $T_{max} = 50$, $M_{min} = 70$, $\pi = 0.3$. The cut-off wages are given by $(w''', w') = (6.00, 6.67)$ in the context of the parameter values used for this figure.

Hence it is conceivable that there is proportion of secondary earners for whom the WFTC reform generates *unambiguously* negative work incentives. The intuition here is straightforward. For the subgroup of the population considered here, the WFTC reform actually increases the financial benefits of not working relative to working a given number of hours; as a result, the level of utility that can be achieved from not working increases, while the feasible level of utility from working remains unchanged. It thus follows immediately that more married women may actually end up not working.

- *Case 2.* Consider now parameter values satisfying $\Omega^{nw} \leqslant \Omega^{w,1} = \Omega^{w,0}$. This case is illustrated in Figure 4.[3] A married woman chooses to work if $\Omega^{w,1} > \Omega^{nw}$ and not otherwise. Thus the size of the group of working women can be measured by the cut-off wage w'''. The fact that $w''' < w'$ implies that working women with a wage in the interval (w''', w') retain eligibility for in-work support, i.e., their decision to work and choice of earnings does not alter their families' eligibility status.

Result 6 (Case 2) *The size of the group of non-working married women who worked in the pre-reform regime is given by $1 - G(w''')$. The value of $1 - G(w''')$ is decreasing in the tape rate π; decreasing in the credit base amount T_{max}; decreasing in the threshold M_{min}. Thus, conditional on choosing to work in the pre-reform regime, the effect of WFTC on incentives to move out of work in the post-reform regime is ambiguous.*

[3] The condition $\Omega^{nw} \leqslant \Omega^{w,1} = \Omega^{w,0}$ is equivalent to requiring that $m_h \leqslant \varphi M_{max} < M_{max}$, where $\varphi = 1 - \frac{\tilde{l}}{(1-\pi)t}$. It thus represents cases where the male partner's income is relatively low.

A lower π increases the wife's marginal wage rate, which, in turn, increases the opportunity cost of non-market time. This first effect tends to increase the gains from working relative to not working. In contrast, a higher T_{max} and M_{min} means that same level of income can be achieved with the wife actually working less. This income effect tends to increase the gains from not working relative to working. Thus, when considering the overall effect, one obtains an ambiguous correlation between work incentives and the WFTC reform. In summary, the two results in this section suggest a zero or negative effect of the WFTC on the work incentives of secondary earners.

2.2. Childcare Subsidy. A major omitted factor in the basic model is the childcare element of the WFTC. To remedy this omission, we now discuss how the basic model can be extended allow for the childcare credit element of WFTC over and above the standard credit. Consider a modification of the basic model where preferences are defined over own consumption and childcare quality.

$$U_h^c = \alpha \ln(x_h) + \beta \underbrace{\ln[\tau_m(t-l_w) + \tau_n l_w]}_{\textit{Childcare Quality}} \quad \text{and} \quad U_w^c = \alpha \ln(x_w) + \beta \underbrace{\ln[\tau_m(t-l_w) + \tau_n l_w]}_{\textit{Childcare Quality}}, \qquad (15)$$

Childcare quality is equal to the time the mother is looking after the child $(t-l_w)$ plus the number of hours the child is looked after by someone else during the time the mother is working (l_w). This rules out the possibility that a child is left on his or her own. Suppose that a family has to fully pay for the childcare during the time the mother is working. The childcare that may be provided by friends or relatives is thus normalized to zero. The hourly price of non-maternal childcare is p. The expression for the quality of childcare assumes that the two inputs to childcare are imperfect substitutes, with the quality of maternal care being τ_m and the quality of non-maternal care being τ_n.

The childcare credit element of the WFTC increases the standard credit by 70 percent of childcare costs. It replaces the childcare disregard in the FC and is a more generous provision to subsidize childcare costs. The childcare credit is available only if both partners work 16 hours or more per week. We now briefly sketch how a more generous childcare subsidy would affect female labor supply and paid childcare utilization. Families in which the man does not work or works fewer than 16 hours per week (Household Type 1) are not eligible for childcare credit and hence unaffected by its introduction. In contrast, for mothers who are married to men who work 16 hours or more per week (Household Type 2), the childcare element may enhance the probability of participation, as the net childcare costs of working any given hours level above 16 hours per week is lower post-reform than pre-reform.[4] To put it differently, a more generous childcare subsidy

[4]This conclusion can be derived as the outcome of our model when married women choose between non-participation ($l_w = 0$) and working a given hours level at or above the eligibility cut-off for childcare credit ($l_w = l_{min}$). In the former case, childcare costs are zero and total family income is $m_h + B^0$ [where $B^0 = T_{max} - \pi(m_h - M_{min})$]. In the latter case, childcare costs are pl_{min} and total family income is either $m_h + w_w l_{min}$ or $m_h + w_w l_{min} + B^c$ [where $B^c = T_{max} + \phi p l_w - \pi(m_h - w_w l_{min} - M_{min})$], depending on whether WFTC is withdrawn as the woman works or not. By comparing the indirect utilities from working and not-working, it is

encourages maternal employment by reducing the net price of substitute childcare ceteris paribus. Since maternal employment tends to increase the number of hours of formal childcare used on average, one would therefore also expect there to be an increase in paid childcare utilization. However, the positive participation and childcare utilization responses to the childcare credit element of the WFTC are likely to be confounded by the increase in both the credit base amount T_{max} and the threshold M_{min}. The consequence of these changes is a standard income effect that reduces the probability of maternal participation. Since lower maternal employment tends to reduce the number of hours of formal childcare used, one one expect there to be a negative effect on paid childcare utilization. The combination of the effects of all these changes leaves us with an ambiguous overall effect on maternal employment and paid childcare utilization.

2.3. A Marriage Penalty? We now modify our model to allow for the probability of divorce to be positive and endogenously determined by the level of surplus generated by marriage over divorce. Let the spouses' payoffs in marriage be $U_h + \sigma_h$ and $U_w + \sigma_w$ [rather than U_h and U_h as in (1)], where the private gains from marriage, σ_h and σ_w, are randomly drawn from a known distribution. In addition, let the payoff to the spouses in divorce be denoted by D_h and D_w. We assume transferable utility. It then follows that divorce occurs only if the joint payoffs from getting divorced exceed the sum of the payoffs associated with remaining married. Thus couples divorce if and only if

$$\Sigma \equiv \sigma_h + \sigma_w \leq -[(U_m + U_f) - (D_f + D_m)] \tag{16}$$

Is it possible that the introduction of WFTC has affected the incidence of divorce, and, if so, which types of couples are most likely to have been affected? The answer turns out to be yes: if two married individuals are eligible for fewer benefits as a couple than as two singles, then the WFTC reform may encourage divorce by making the two individuals better off apart than together. This potential 'marriage penalty' is most transparent in the following case: consider household types where the male partner is in work with an income so high that the household unit is not eligible for in-work support. The joint budget set of couples is therefore not affected by the WFTC paramters ($P = 0$). The labor supply for married women in this sub-sample is $\max\{0, t - \beta[w_w t + m_h]/[w_w(\alpha + \beta)]\}$. Accordingly, the total household income disposable for consumption is $\max\{m_h, \alpha[w_w t + m_h]/[\alpha + \beta]\}$.

Consider next the post-divorce utilities that can be achieved if two ineligible married individuals break up. As in Weiss and Willis [1985] and Clark [1999] suppose that, after divorce, couples live separately; one parent has custody, and only she spends time and resources on non-market activities such as childcare, even though both parents continue to benefit. Assuming that the wife has custody, her divorce utility is $\alpha \ln(x_w) + \beta \ln(t - l_w)$, which is maximized subject to $x_w = w_w l_w + a + PB$, where a is a transfer payment or alimony from h to w such that

readily checked that a more generous childcare subsidy (a higher value of ϕ) increases the probability of working l_{min} hours per week, provided the decision to work does not mean that WFTC is withdrawn.

$a < m_h$. The non-custodial husband spends his income $m_h - a$ on consumption x_h and gets utility $\alpha \ln(x_h) + \beta \ln(t - l_w)$. Just as the population of married women, one can divide the population of divorcing women into different groups, according to the wage rate that each woman can potentially earn. In particular, one can show that there exists two critical wages, w' and w''', such that divorcing women with a wage in the interval $[w', w''']$ will work at least l_{min} hours per week to be eligible for in-work support. The labor supply formula for divorcing women is $\max\{l_{min}, t - \beta[w_w t + a + \tau]/[w_w(\alpha+\beta)]\}$ where $\tau = [T_{max} + \pi M_{min}]/[1-\pi]$. While ineligible for benefits within marriage, there are therefore women who are entitled to benefits when divorced ('eligibility only after divorce'). Some thought now readily establishes a potential link between the WFTC reform and the incidence of divorce:

Result 7 (Marriage Penalty) *Two spouses face a marriage penalty if the utility gains from the WFTC reform are lower within marriage than after divorce. In the special case of 'eligibility only after divorce', divorce occurs iff:*

$$\Sigma < \tilde{\Sigma} \equiv (\alpha + 2\beta) \ln \left[\frac{(1-\pi)(w_w t + a + \tau)}{w_w t + m_h} \right] + \alpha \ln \left[\frac{(\alpha+\beta)(m_m - a)}{\alpha\theta(1-\theta)(w_w t + m_h)} \right] + 2\beta \ln \left[\frac{1}{1-\pi} \right],$$

where $\tau = [T_{max} + \pi M_{min}]/[1-\pi]$.[5] *The threshold* $\tilde{\Sigma}$ *is decreasing in* π*; increasing in* T_{max}*; and increasing* M_{min}*. Thus the incidence of divorce unambiguously increases in response to the introduction of the WFTC.*

The intuition is straightforward: the sum of the payoffs associated with remaining married is unaffected by the introduction of WFTC because the earnings of married couples are above the eligibility income; divorcing women, in contrast, find it optimal to work at least l_{min} hours per week in order to qualify for in work support and the feasible payoffs from doing so are positively affected by the introduction of WFTC. This decreases the gains from marriage over divorce. Since the gains from marriage over divorce are lower, it is now more likely that an arbitrary shock to marriage [as captured by an arbitrary value of Σ] leads to a separation. It is therefore conceivable that the government's introduction of the WFTC has created more divorces by making couples better of apart than together.

3. Data and Methods

The data we use are from the first twelve waves of the British Household Panel Survey (BHPS) collected over the period 1991-2002. Since Fall 1991 the BHPS has annually interviewed a representative sample of about 5,500 households covering more than 10,000 individuals. All adults and children in the first wave are designated as original sample members. On-going representativeness of the non-immigrant population has been maintained by using a 'following rule' typical

[5] This assumes that the hourly wage of the female partner is such that her optimal work hours in the states of 'marriage' and 'divorce' are respectively given by $t - \beta[w_w t + m_h]/[w_w(\alpha+\beta)]$ and $t - \beta[w_w t + a + \tau]/[w_w(\alpha+\beta)]$. Such a scenario can be constructed by using the same parameters as in Figure 1, but with $m_h = 220$, $a = 110$, and wages in the interval [4.43,5.61].

of household panel surveys. At the second and subsequent waves, all original sample members are followed (even if they moved house or if their households split up), and there are interviews, at approximately one-year intervals, with all adult members of all households containing either an original sample member, or an individual born to an original sample member whether or not they were members of the original sample. The sample therefore remains broadly representative of the population of Britain as it changes over time.[6]

Our estimation sample includes married or cohabiting couples in which the woman is at least 16 years old and was born after 1941 (thus aged at most 60 in 2002). We exclude those couples where one partner was long-term ill or disabled, or in school full time in a given year.[7] The sample includes 4,382 couples, of which 1,875 have dependent children and the remaining 2,507 do not have children. In line with the Inland Revenue's definition, a child must be aged 16 or less (or be under the age of 19 and in full-time education) to count as a dependent child for whom the single mother is responsible. Most of our analysis will focus on women. Some 42 percent of the women have been observed over the whole sample period, and almost 75 percent of them are observed for at least eight years. The resulting sample size, after pooling all twelve years for women in both types of household, is 29,830 observations (13,816 on mothers and 16,014 on childless women).

Table 1 presents summary statistics of the labour market outcomes and characteristics of couples by gender and presence of children. The first column presents the statistics for all couples without children, while the second column presents the statistics for all couples with children. There are some noticeable differences in characteristics between the two groups. Male and female partners with children are on average significantly younger, more educated, and more likely to be in social housing. There also appear to be systematic differences in the employment behaviour between the two groups. Compared to married childless women, married mothers are less likely to work 16 or more hours per week (55 versus 66 percent), as well as 30 or more hours per week (28 versus 50 percent).[8] These differences go in the opposite direction in the case of male partners, with a stronger attachment to the labour market (in terms of participation, working 16+ hours, and full-time employment) among fathers than among married men without children.

The differences between the two groups of women are mirrored in their labour market transitions: women with children have a lower probability of staying in all three labour market states, especially in eligible employment and full-time work. However, and perhaps as a result of their lower overall participation, they are more likely to enter each labour market state in any given two

[6] Of the individuals interviewed in 1991, 88 percent were re-interviewed in wave 2 (1992). The wave-on-wave response rates from the third wave onwards have been consistently above 95 percent. Detailed information on the BHPS can also be obtained at http://www.iser.essex.ac.uk/ulsc/bhps/doc . The households from the European Community Household Panel subsample (followed since the seventh wave in 1997), those from the Scotland and Wales booster subsamples (added to the BHPS in the ninth wave) and those from the Northern Ireland booster subsample (which started in wave 11) are excluded from our analysis.

[7] Eissa and Hoynes (2004) use similar sample selection criteria.

[8] Throughout the paper, worked hours are defined by usual weekly hours of work plus usual weekly hours of overtime work.

successive years. For mothers we also examine further fertility, and entry rates into motherhood for childless women.

Finally we consider a few outcomes that are measured at the household (rather than individual) level. Couples with children are more likely to be in receipt of Income Support and to break down their (marital or cohabiting) unions. The other household-level outcomes listed in Table 1 are relevant only for couples with children (i.e., FC/WFTC receipt, usage of and expenditures on childcare services).

Figures 1-4 plot the time trends for the main labour market outcomes between 1991 and 2002 for women in the two groups as a whole or distinguished by their partners' employment and earnings position in line with the model presented in Section 2. Figure 5 plots the trends for men. In each figure, panels (a), (b), and (c) respectively focus on labour force participation, eligible employment, and full-time employment. Figure 1 shows slightly increasing participation in all three outcomes among women with children and, correspondingly, decreasing trends for women without children. Among mothers whose partner does not work or works fewer than 16 hours per week (Figure 2), we observe greater increases in conjunction with the 1999 reform. To a lesser extent, this can be detected among mothers whose partners work 16 or more hours per week but have earnings in the bottom quartile of the distribution (Figure 3). The labour market outcomes of women (whether with or without children) married to men with earnings above the bottom quartile show relatively stable profiles, with the possible exception of a slight long-term increase in full-time employment for married mothers (Figure 4, panel (c)). For men, Figure 5 reveals a modest increase in all three outcomes among fathers and a correspondently more marked decline among childless married men.

These trends suggest that the labour market behaviour of couples was not systematically related to the introduction of the WFTC reform, in the sense that we cannot detect a clear-cut change in behaviour among couples who were directly affected by the reform (couples with children) after 1998. Perhaps, the only group of couples who showed labour market movements that were possibly related to the in-work benefit reform are those in which the male partner did not work or worked fewer than 16 hours per week. Overall, this evidence is in line with the main predictions of the model presented in Section 2. In the next section we examine whether the same evidence also emerges from our multivariate regression analysis.

4. Results

4.1. Basic Estimates for the Labour Market Outcomes of Married Women. Table 2 presents the estimates for our key labour market outcomes, that is, labour force participation, eligible employment and full-time employment for the whole sample of married women. These estimates are obtained from models that do not condition on partner's labour supply behaviour and earnings. For simplicity of interpretation, we only report least squares estimates based on linear probability models with and without fixed effects. Marginal effects estimates from logit and Chamberlain fixed-effects logit models were very similar, and thus not reported. The first column of the table shows constant treatment effect estimates with group-specific pre-program trends. The next three columns allow also for year-specific treatment effects.

Focussing on the fixed-effects estimates in the first column, we observe that married mothers increased their labour force participation rates by less than 1 percentage point and their full-time employment rates by about 1.4 percentage points. But they decreased their likelihood of working 16 or more hours per week by less than half of a percentage point. None of these estimates is statistically significant. The same picture emerges from the estimates that do not account for individual fixed effects (”level” estimates). These are close to those reported in Blundell et al. (2000) and Blundell and Hoynes (2004).

Despite the lack of an overall effect, there was some WFTC impact on labour force participation and full-time employment in 1999. This is documented in the other three columns of Table 2. For example, the probability of working full-time among married mothers increased by almost 3 percentage points in the year immediately following the introduction of the reform. The employment effects, however, fell substantially and had no statistical significance in the two subsequent years (2000 and 2001). Our finding of a program-introduction effect is consistent with the results reported in Blundell (2001).

Because the theory we developed in Section 2 suggests that the labour market responses of women in couples depend on the employment status and earnings of their partners, we re-estimated the previous models after stratifying the sample of women by partner's labour supply and earnings. In particular, we distinguish three groups: women whose partner does not work or works fewer than 16 hours per week; women whose partner works 16 or more hours per week and has earnings in the bottom quartile of the male earnings distribution; and women whose partner works 16 or more hours per week and has earnings above the bottom quartile of the male earnings distribution. The fixed-effects results are in Table 3, where, as before, we report constant treatment effects and year-specific treatment effects.

Women with a partner working 16 or more hours per week did not show any significant labour supply response (regardless of the man's position in the earnings distribution). We find instead strong employment effects (through labour market participation and eligible employment) among mothers with a partner who did not work or worked fewer than 16 hours per week. For example, these women increased the probability of working 16 or more hours per week by 3 percentage points over the entire post-reform period, and by 4 points just in the year following the introduction of the WFTC program. Interestingly, these results are close to those found for single mothers (Gregg and Harkness, 2003; Francesconi and Van der Klaauw, 2005).

4.2. Labour Market Outcomes Estimates by Child's Age. By eliminating the differential treatment that Family Credit had on children of different ages (achieved via a larger credit increase in favour of younger children) and by providing more generous support to childcare costs, the WFTC reform could have generated different labour market responses depending on the number and ages of children. To analyze this we estimate separate treatment effects by the number of dependent children, and distinguishing by age of the youngest child in the age intervals 0-4, 5-10, and 11-18. The fixed-effects estimates of this analysis for all women and for the three groups of women stratified according to their partners' labour supply and earnings are shown in Table 4.

Looking at the whole sample of women, we cannot detect differential labour supply responses across mothers with children in different age groups or with a different number of children. The results in the next three columns of Table 4, however, indicate that there are substantial increases in labour force participation and eligible employment among women with a partner who did not work or worked fewer than 16 hours per week and with one pre-school aged child. These are of the order of 8 and 7 percentage points, respectively. In addition, mothers with one child aged 5-10 increased their probability of working 16 or more hours per week by 5 percentage points (panel B), while mothers of two or more children with at least one aged under 5 increase their participation by 6 percentage points (panel A). These results tie in well with those found for single mothers by Gregg and Harkness (2003) and Francesconi and Van der Klaauw (2005). There is instead little variation in the labour supply responses by child's age and number of children of mothers with partners who work more than 16 hours per week, regardless of their position in the earnings distribution.

4.3. Employment Transitions. By using panel data, we can examine whether the introduction of WFTC led to changes in the rate at which married women entered and left the labour force. That is, we can directly assess the impact of WFTC on year-to-year employment transitions. For this purpose, we estimate the WFTC effect both on the probability of staying in any of the three labour market states analysed so far and on the probability of starting any job, or a job with 16 or more hours of work per week, or a full-time job. We define the former set of probabilities as persistence probabilities and latter as entry probabilities. The corresponding treatment effect estimates are shown in Table 5, in which we report estimates for the whole sample of women (first column) and for the three groups of women distinguished by their husbands' labour supply and earnings (second to fourth columns).

For the entire sample, we cannot find any significant impact of the WFTC reform on persistence probabilities in the three labour market states, nor can we can any impact on entry probabilities. But as we pointed out earlier, there is some sizable heterogeneity across women depending on their husbands' employment status and income. In particular, the introduction of the in-work benefit reform increased mothers' persistence rates in eligible employment and full-time employment by 5 and 4 percentage points respectively if their partners did not work or worked fewer than 16 hours per week. Entry rates for the same group of women show slightly lower but similarly important increases along all three labour market margins. The labour market transitions for mothers with husbands working 16 or more hours per week do not significantly differ from the transition of comparable married women without children. Overall, the pattern of these results is consistent with the findings reported earlier (see also Francesconi and Van der

Klaauw (2005) for results on lone mothers).

4.4. Labour Market Outcomes of Married Men. Table 6 displays the fixed-effects estimates of the WFTC effect on men's labour market outcomes. For the whole sample, we find no evidence of an effect of the in-work benefit reform on men's behaviour. This emerges also after distinguishing men on the basis of their partners' labour supply and earnings. We also repeated some of the analysis performed on women, such as labour market transitions, and found again no large significant effect. Thus, the WFTC program seems to have had no impact on married men.

4.5. Other Outcomes.

[TO BE COMPLETED]

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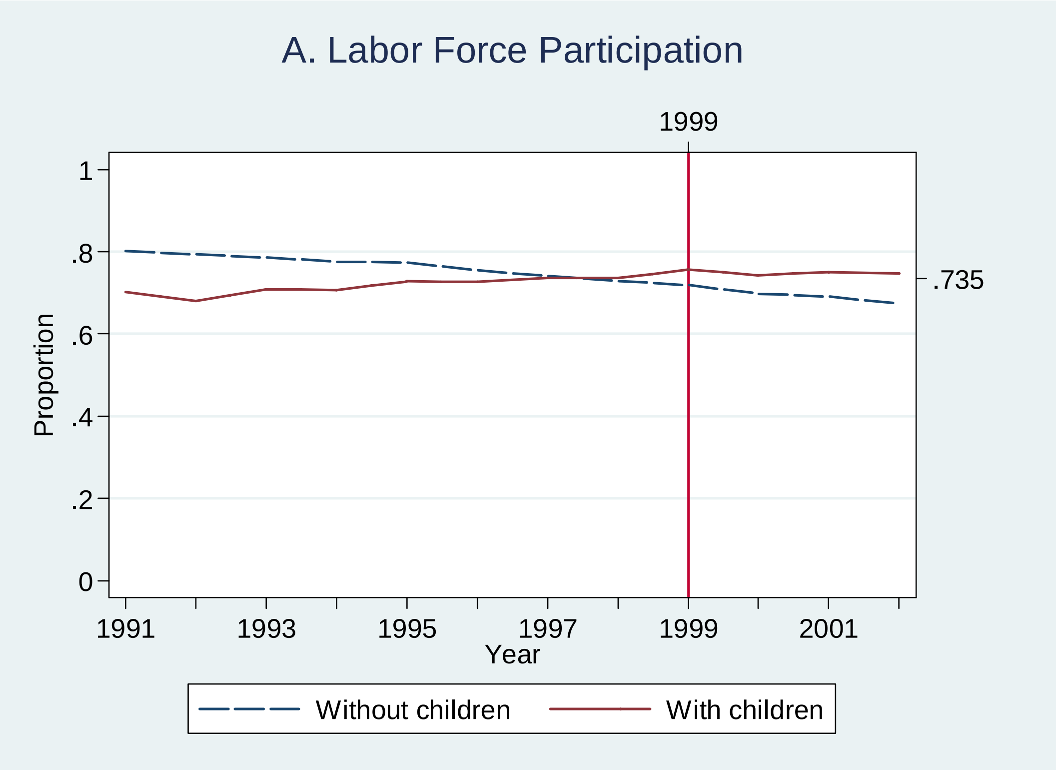
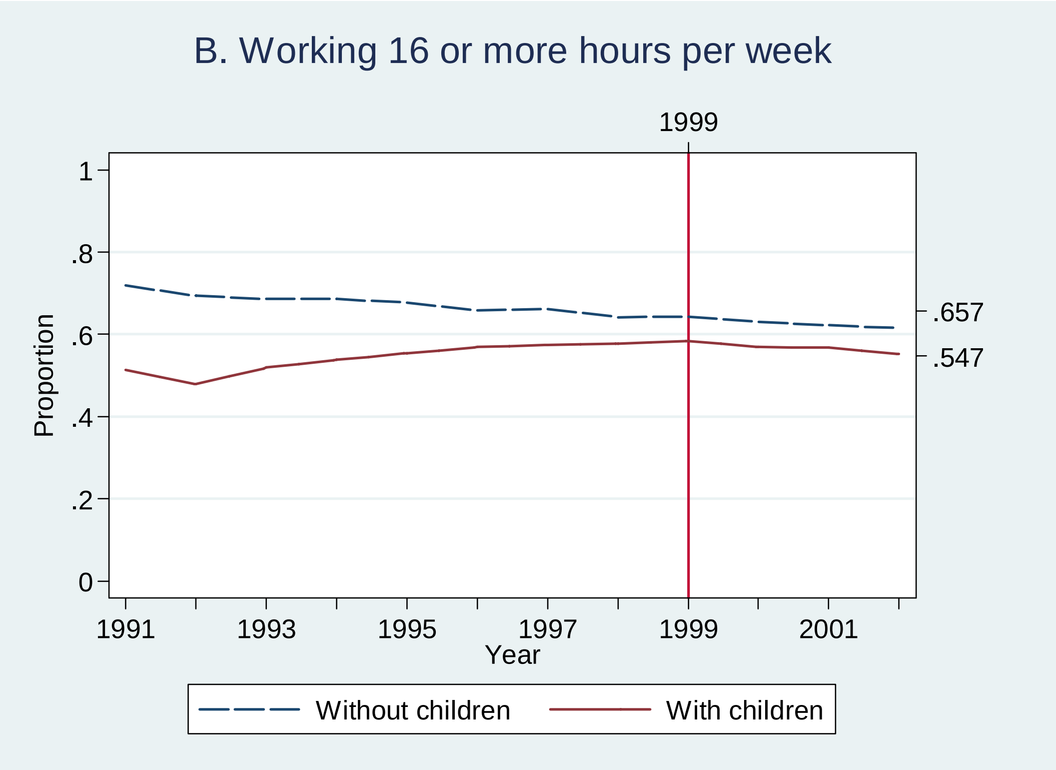
[8] Gregg, Pual and Harkness, Susan (2003). "Welfare Reform and Lone Parents Employment in the UK." Unpublished Manuscript. University of Bristol, January.

[9] Iyigun, Murat and Walsh, Randall (2005). "Endogenous Gender Power, Household Labor Supply and the Demographic Transition." Unpublished Manuscript. University of Colorado, September.

[TO BE COMPLETED]

Figure 1
Labour Market Outcomes
All married women





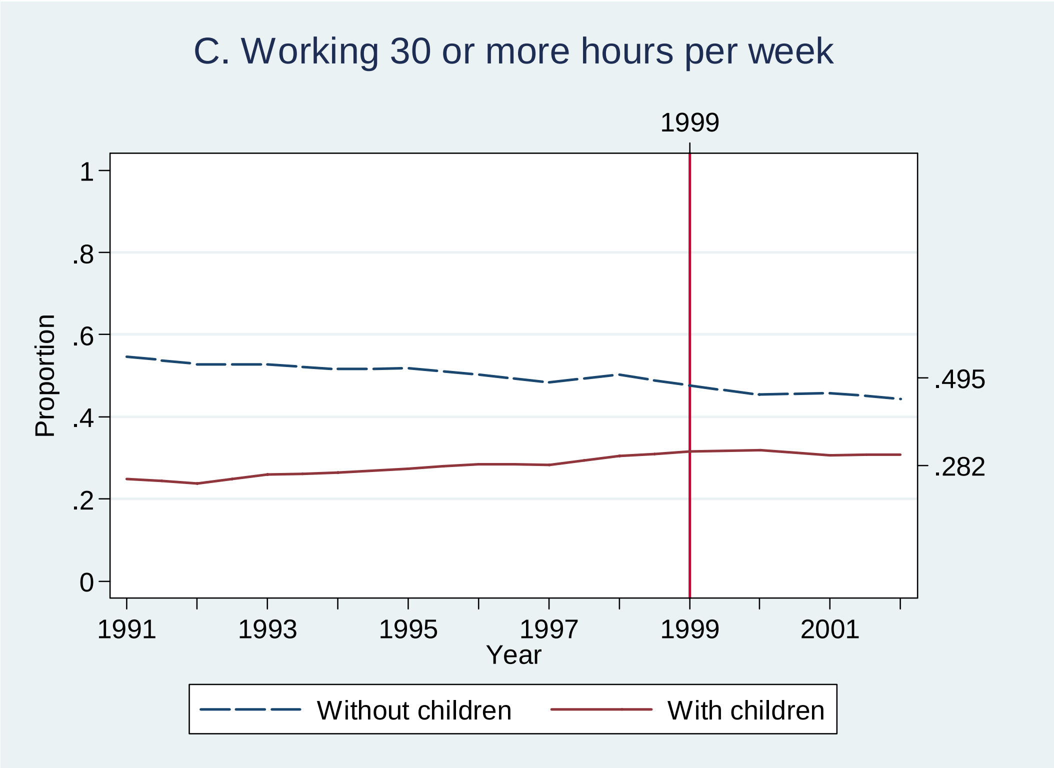
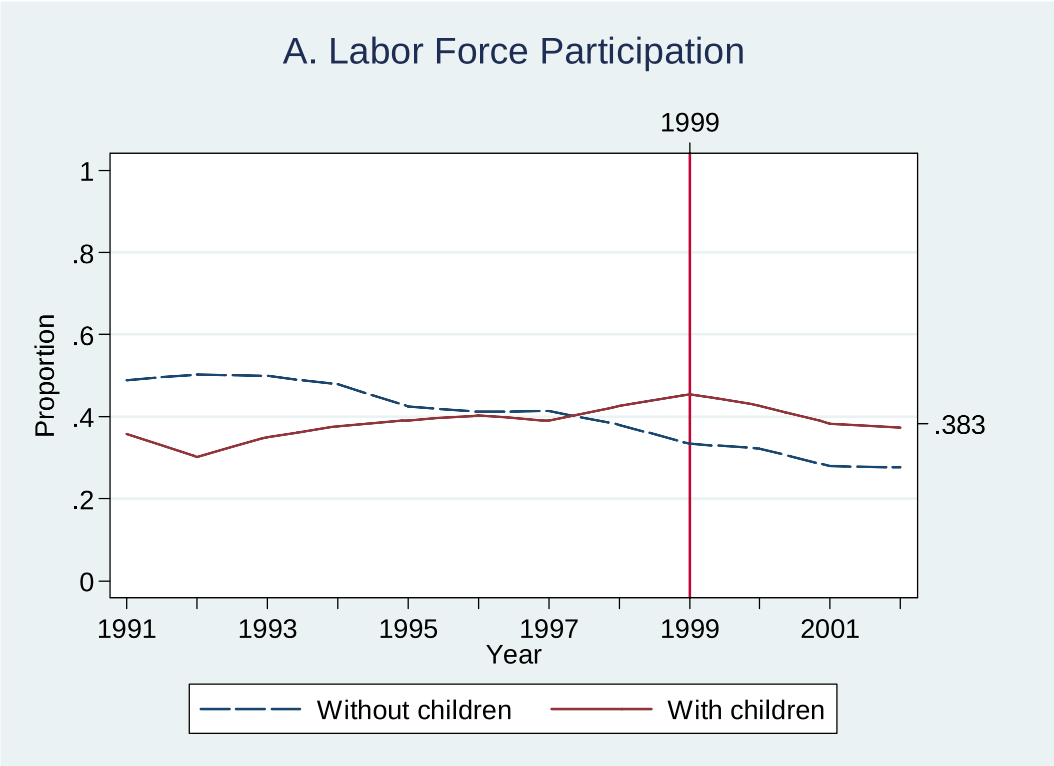
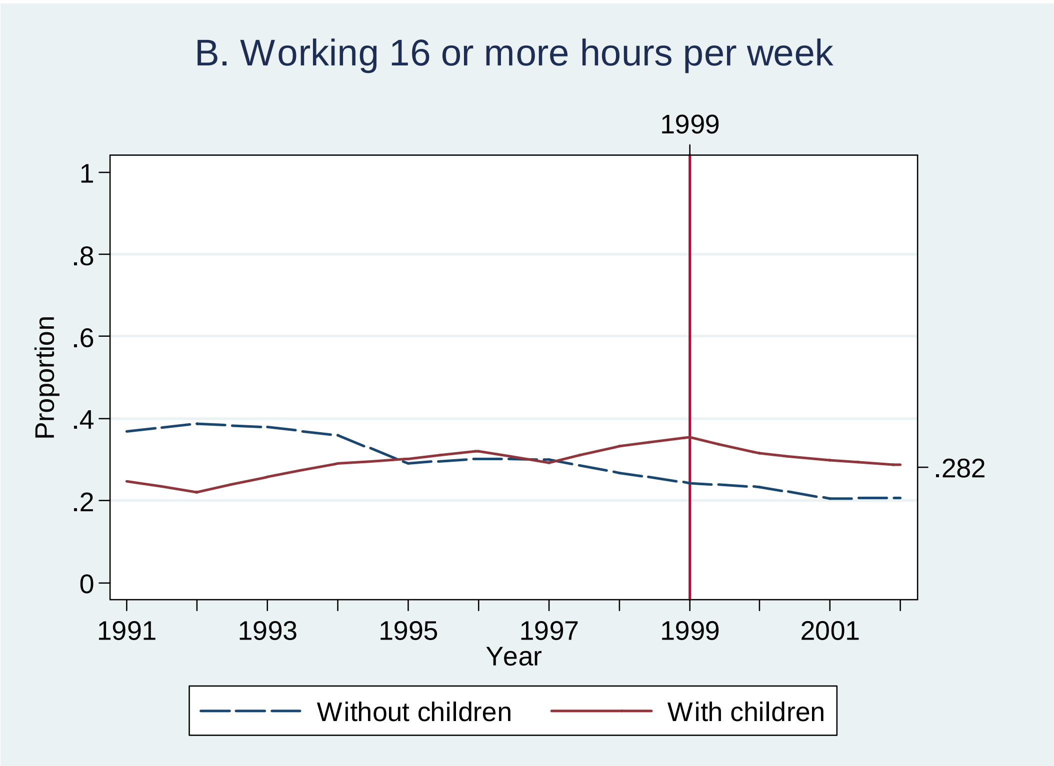
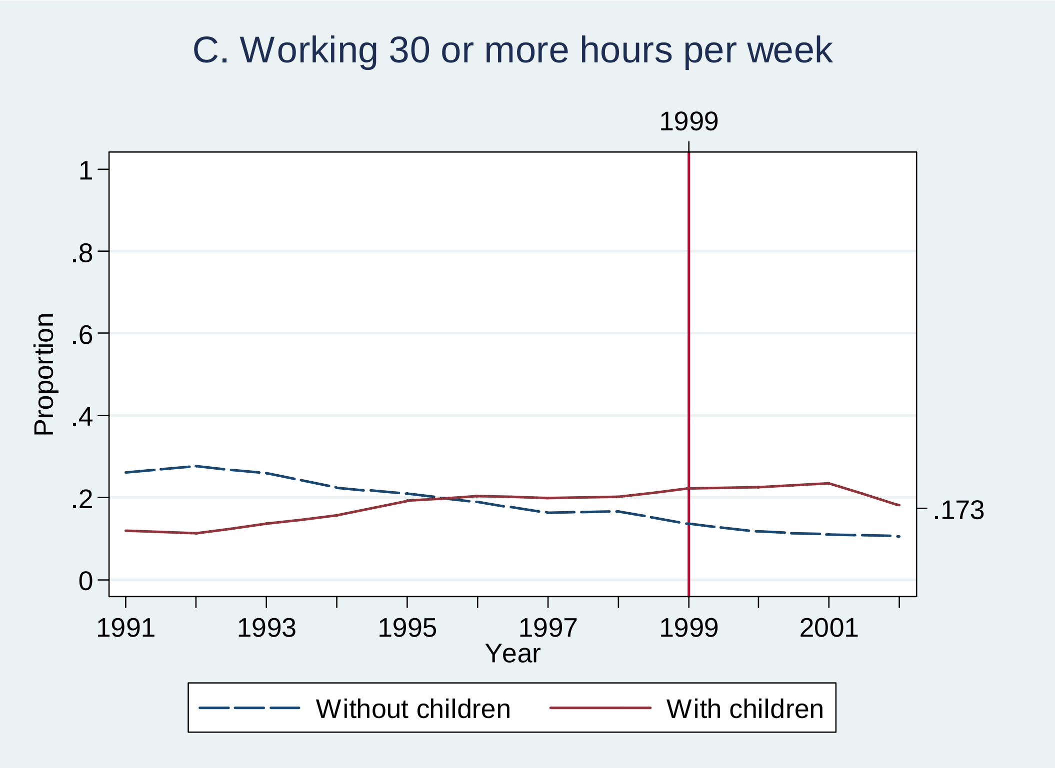

C. Working 30 or more hours per week
1999
1
.8
.6
.4
.2
0
Proportion
.495
.282
1991
1993
1995
1997
1999
2001
Year
Without children
With children

Figure 2
Labour Market Outcomes
Married women whose partner does not work or works fewer than 16 fours per week

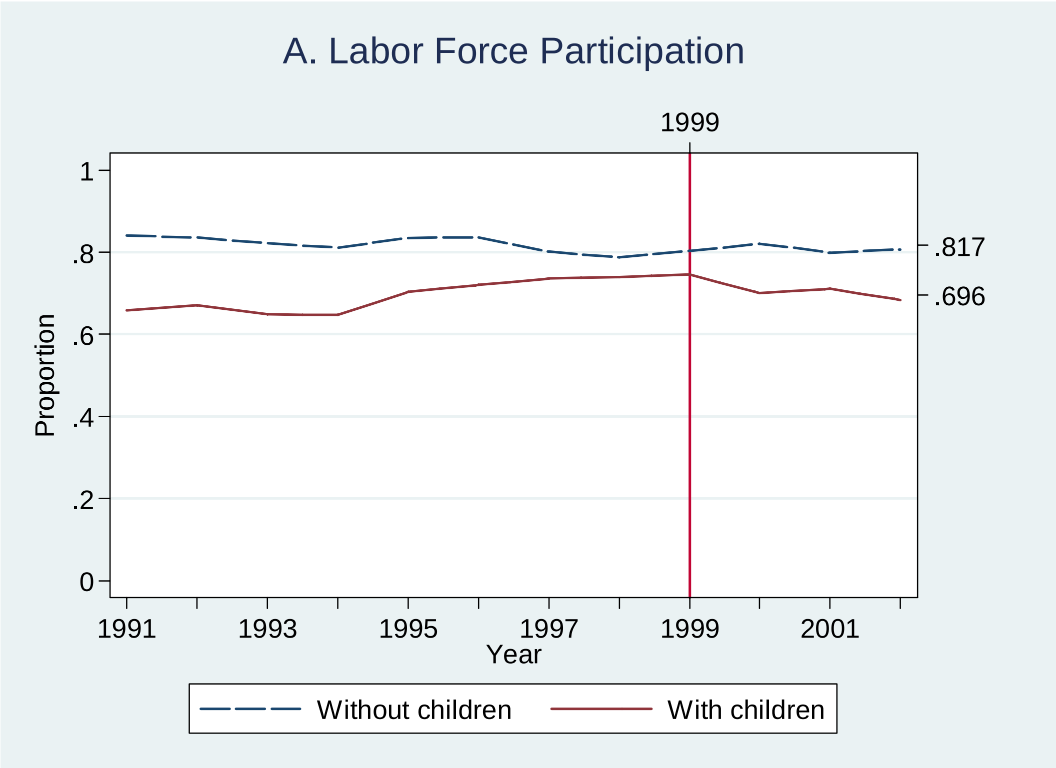


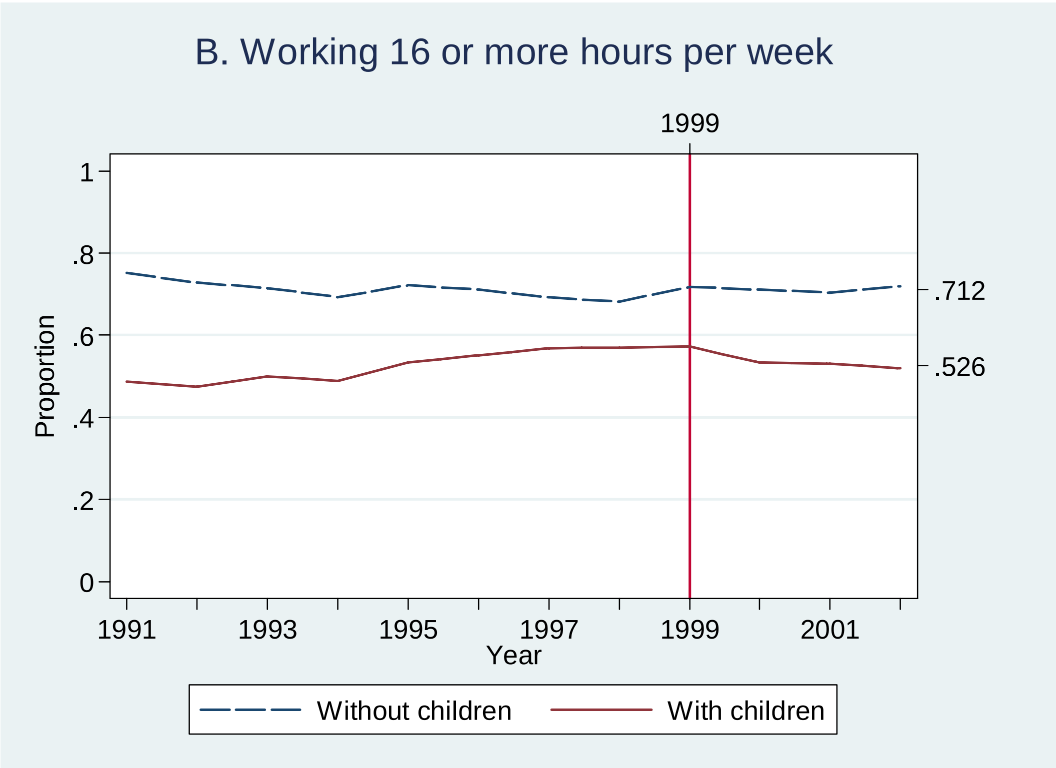




C. Working 30 or more hours per week
1999
Proportion
1
.8
.6
.4
.2
0
.173
1991
1993
1995
1997
1999
2001
Year
Without children
With children

Figure 3
Labour Market Outcomes
Married women whose partner works 16 or more hours per week and has earnings in the bottom quartile of his earnings distribution





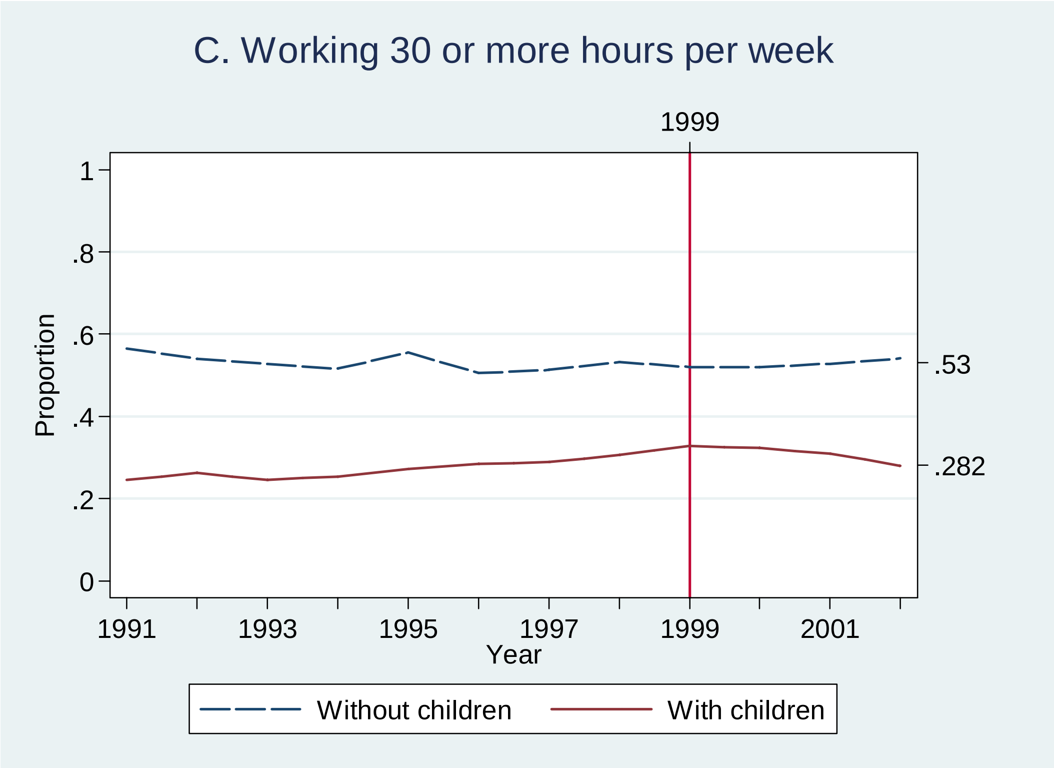
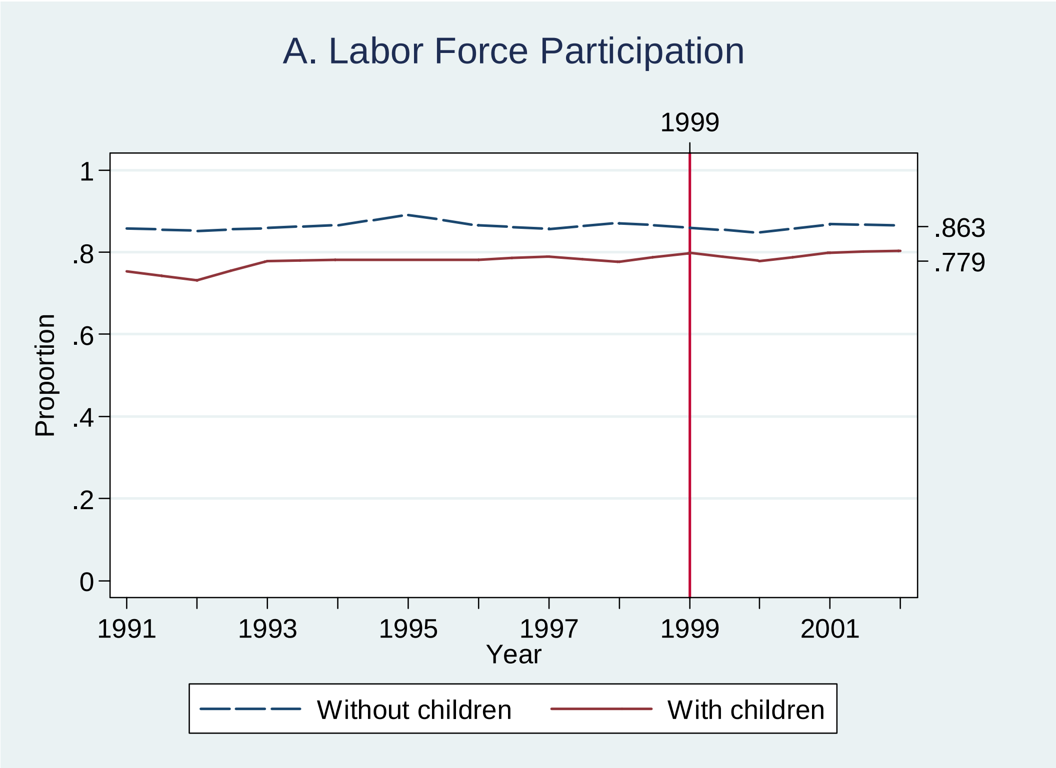
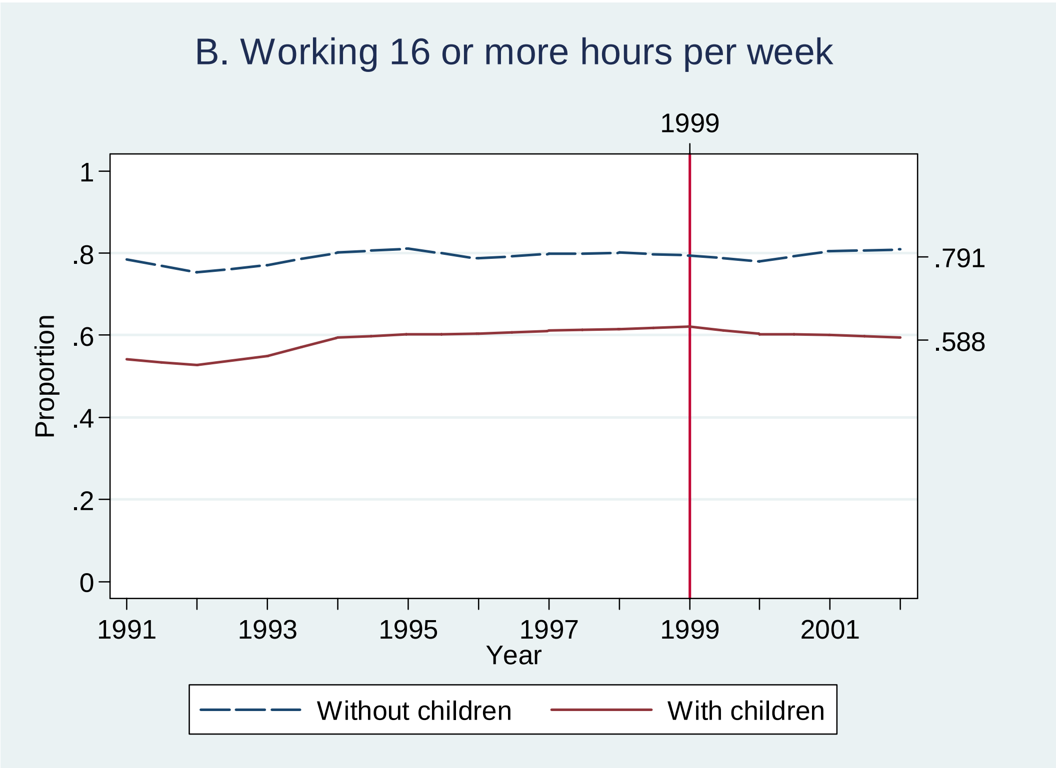
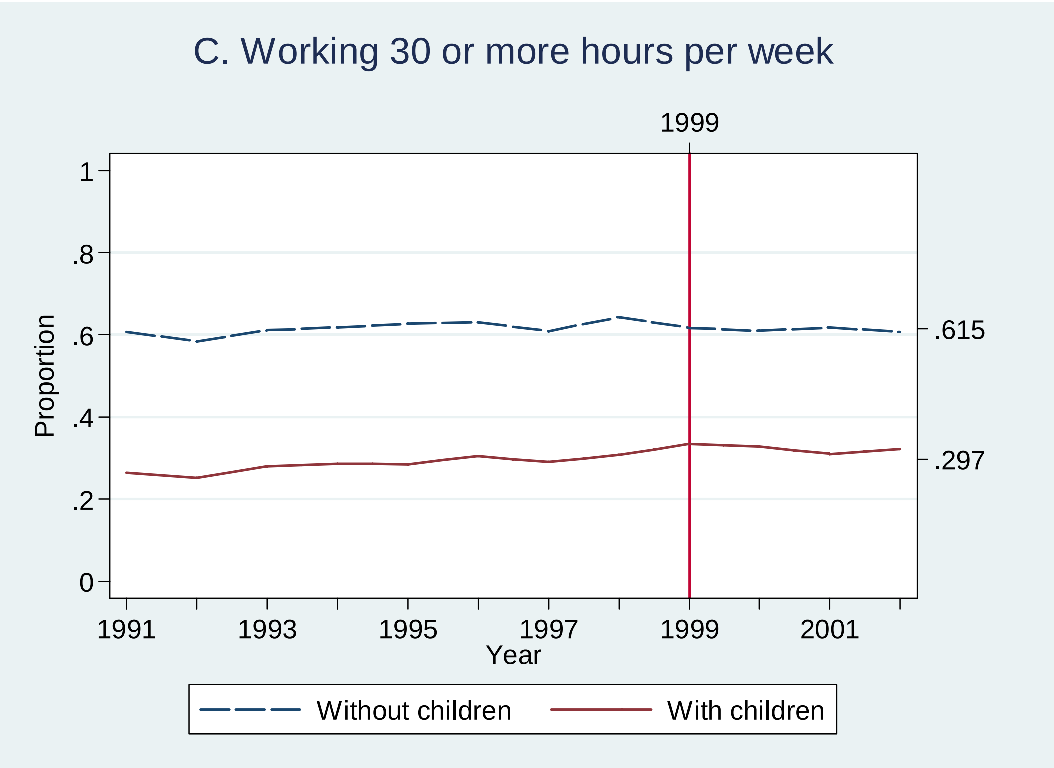

C. Working 30 or more hours per week
1999
1
.8
.6
.4
.2
0
Proportion
.53
.282
1991
1993
1995
1997
1999
2001
Year
Without children
With children

Figure 4
Labour Market Outcomes
Married women whose partner works 16 or more hours per week and has earnings above the bottom quartile of his earnings distribution

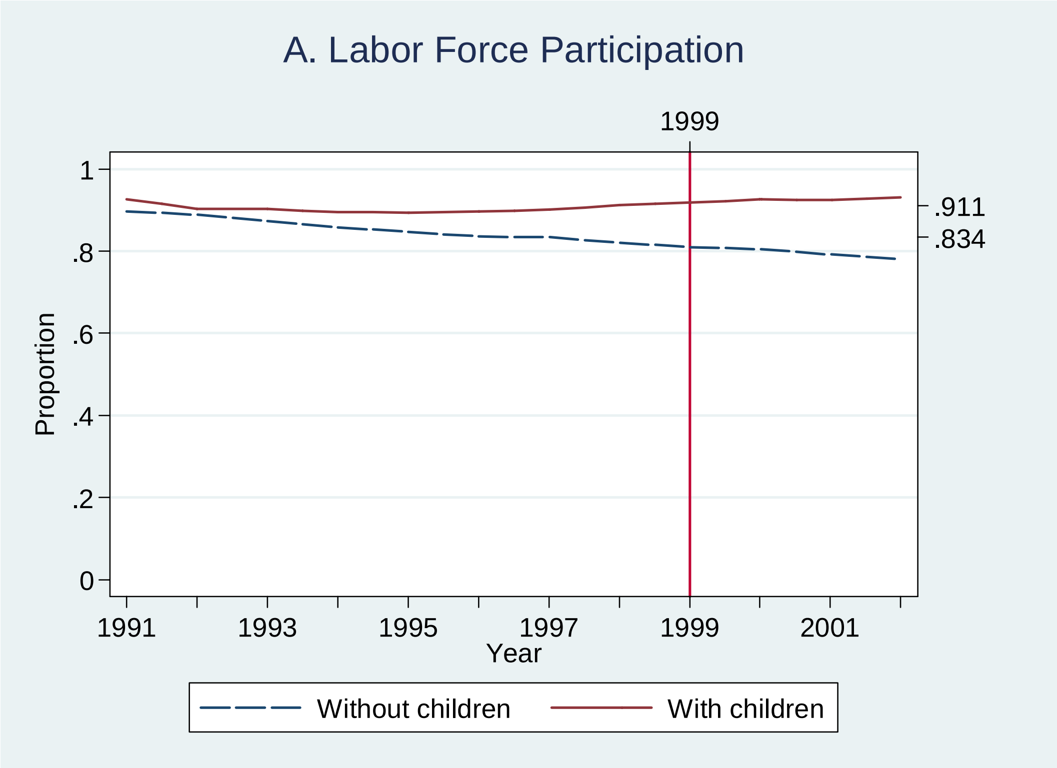


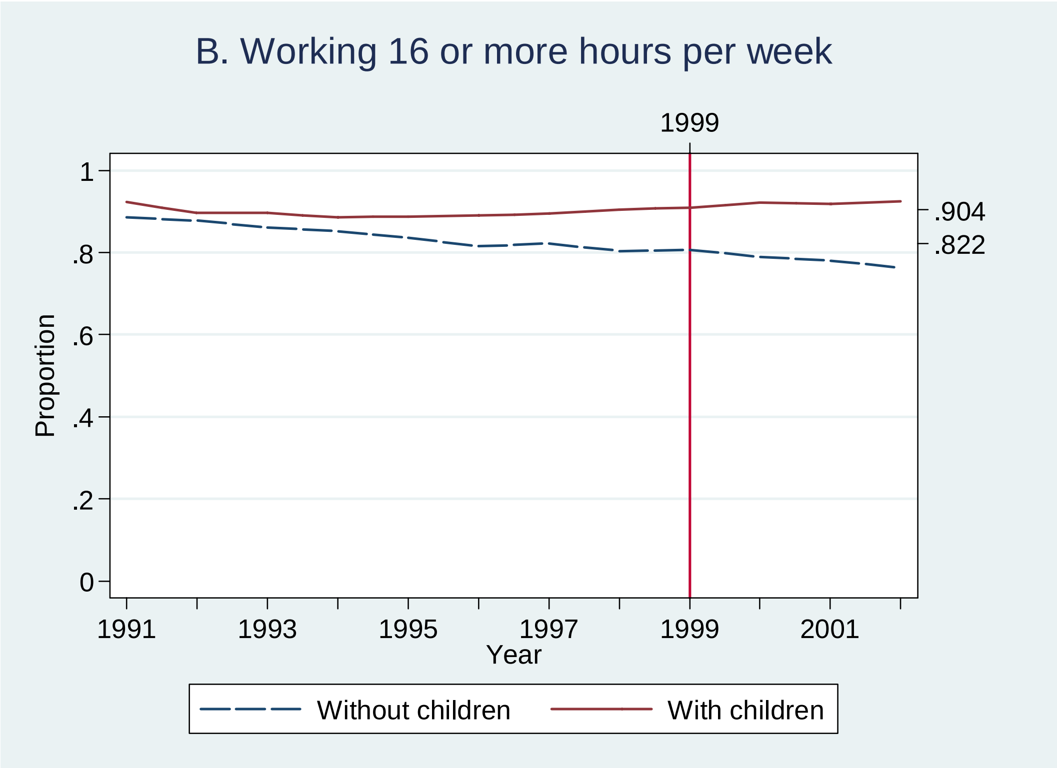




C. Working 30 or more hours per week
1999
1
.8
.6
.4
.2
0
Proportion
.615
.297
1991
1993
1995
1997
1999
2001
Year
Without children
With children

Figure 5
Labour Market Outcomes
All married men





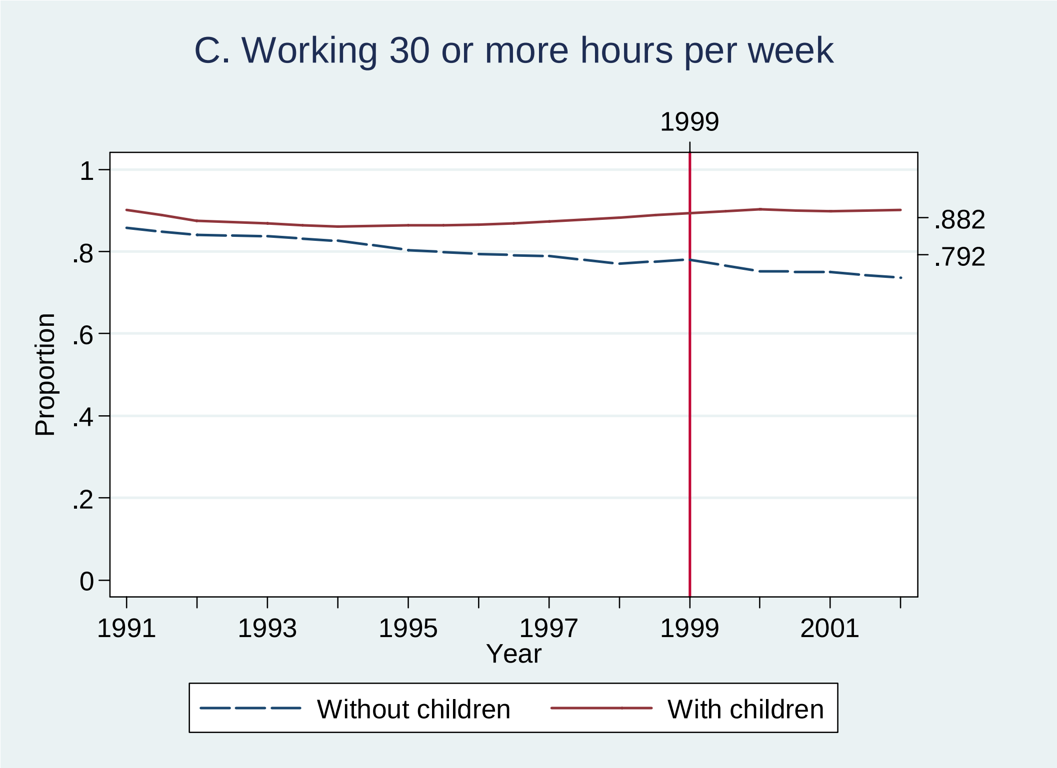

C. Working 30 or more hours per week
1999
1
.8
.6
.4
.2
0
Proportion
.882
.792
1991
1993
1995
1997
1999
2001
Year
Without children
With children

Table 1
Summary Statistics for Married Couples with and without Children

	Without children	With children
Household-level outcomes		
FC/WFTC receipt		0.063
Income Support receipt	0.018	0.047
Paid childcare utilisation[a]		0.149
Weekly childcare costs (2001 pounds)[a]		50.01 (37.79)
Divorce rates	0.016	0.026
Wife		
Outcomes		
Labour force participation	0.743	0.725
Working 16 or more hours per week	0.657	0.547
Working 30 or more hours per week	0.495	0.282
Persistence probability in:		
Labour force participation	0.952	0.930
Working 16+ per week	0.840	0.723
Working 30+ per week	0.623	0.379
Entry probability in:		
Labour force participation	0.059	0.180
Working 16+ per week	0.033	0.084
Working 30+ per week	0.017	0.029
Birth rates for married mothers		0.036
Entry into motherhood	0.031	
Main explanatory variables		
Age	43.2 (7.4)	36.7 (7.0)
Education:		
No qualification	0.264	0.172
Less than O level/GCSE	0.096	0.124
O level/GCSE (or equivalent)	0.206	0.264
A level (or equivalent)	0.095	0.103
Higher vocational qualification	0.231	0.235
University degree or more	0.108	0.102
Ethnic origin:		
White	0.977	0.954
Black	0.006	0.006
Indian	0.008	0.022
Pakistani/Bangladeshi	0.002	0.011
Chinese or other	0.007	0.007
Husband		
Outcomes		
Labour force participation	0.834	0.911
Working 16 or more hours per week	0.822	0.904
Working 30 or more hours per week	0.792	0.882

Main explanatory variables		
Age	46.8 (8.1)	39.1 (7.3)
Education:		
No qualification	0.229	0.164
Less than O level/GCSE	0.091	0.094
O level/GCSE (or equivalent)	0.165	0.194
A level (or equivalent)	0.113	0.124
Higher vocational qualification	0.275	0.283
University degree or more	0.127	0.141
Ethnic origin:		
White	0.974	0.952
Black	0.007	0.008
Indian	0.008	0.020
Pakistani/Bangladeshi	0.002	0.011
Chinese or other	0.009	0.009
Other (household-level) explanatory variables:		
Number of children by age group:		
0-4		0.477 (0.646)
5-10		0.781 (0.859)
11-18		0.495 (0.700)
Housing tenure:		
Owner	0.834	0.772
In social housing	0.092	0.173
In privately rented accommodation	0.074	0.055
Observations	16,014	13,816

[a] Computed over the subsample of couples with children where the youngest child is aged 12 or less.
[b] Averages are computed over the entire subsample of couples. If computed over the three specific subsamples of couples with children in each child group, the averages (standard deviations) are: 1.205 (0.421), 1.452 (0.630) and 1.290 (0.500) respectively.
Notes: For convenience, the table does not report summary statistics on region (16 dummies). Standard deviations are in parentheses.

Table 2
The WFTC Effect on Married Women's Labor Supply
(N=29,830)

Outcome and type of estimation	Constant post-reform effect	Year-specific post-reform effects		
	β	β_{1999}	β_{2000}	β_{2001}
Labour force participation				
Level estimates	0.008	0.014	-0.007	0.002
	(0.009)	(0.012)	(0.012)	(0.013)
Fixed effects estimates	0.008	**0.018**	-0.003	-0.004
	(0.009)	(0.008)	(0.011)	(0.013)
Working 16 or more hours per week				
Level estimates	-0.001	0.019	-0.010	-0.009
	(0.011)	(0.015)	(0.014)	(0.016)
Fixed effects estimates	-0.004	0.017	-0.012	-0.010
	(0.010)	(0.014)	(0.013)	(0.015)
Working 30 or more hours per week				
Level estimates	0.021	**0.027**	0.018	-0.007
	(0.011)	(0.012)	(0.013)	(0.014)
Fixed effects estimates	0.014	**0.028**	0.016	-0.010
	(0.010)	(0.012)	(0.012)	(0.014)

Notes: Standard errors are shown in parentheses. Estimates are obtained from linear probability models on the sample of married women without children and married women with children, which include group-specific linear trends. Estimated coefficients in bold face are statistically different from zero at the 5 percent significance level. The other variables included in each regression pertain to the wife. They are a quartic polynomial in age, number of children by age group of the youngest child (6 groups: one child aged 0-4, one child aged 5-10, one child aged 11-18; two or more children with the youngest aged 0-4, two or more children with the youngest aged 5-10, two or more children with the youngest aged 11-18), dummy variables for ethnic origin (4 dummies; white is the base category), highest educational qualification (5; no qualification), housing tenure (2; owner) region of residence (16; Greater London); and interactions between age and number of children by age group, age and the educational group dummies, and education and number of children by age group. N is the number of person-wave observations.

Table 3
The WFTC Effect on Married Women's Labor Supply
by Partner's Employment Status and Earnings
Fixed Effects Estimates

	Constant post-reform effect	Year-specific post-reform effects		
Outcome and sample	β	β_{1999}	β_{2000}	β_{2001}
A. Partner does not work or works fewer than 16 hours per week B. (N=5,011)				
Labour force participation	**0.058**	**0.065**	**0.063**	0.035
	(0.021)	(0.029)	(0.030)	(0.042)
Working 16 or more hours per week	**0.032**	**0.042**	**0.029**	0.017
	(0.014)	(0.017)	(0.015)	(0.040)
Working 30 or more hours per week	0.015	-0.008	0.023	0.019
	(0.023)	(0.019)	(0.013)	(0.033)
B. Partner works 16-plus hours per week and has earnings below the bottom quartile (N=6,033)				
Labor force participation	0.015	**0.052**	-0.001	-0.016
	(0.022)	(0.025)	(0.027)	(0.031)
Working 16 or more hours per week	0.006	0.007	-0.002	0.001
	(0.016)	(0.034)	(0.032)	(0.037)
Working 30 or more hours per week	0.027	0.040	0.038	-0.012
	(0.024)	(0.032)	(0.031)	(0.035)
C. Partner works 16-plus hours per week and has earnings above the bottom quartile (N=18,786)				
Labour force participation	0.001	0.018	-0.016	-0.002
	(0.010)	(0.014)	(0.013)	(0.015)
Working 16 or more hours per week	-0.012	0.010	-0.022	-0.019
	(0.013)	(0.017)	(0.016)	(0.019)
Working 30 or more hours per week	0.007	0.026	0.001	-0.017
	(0.013)	(0.017)	(0.016)	(0.018)

Notes: Standard errors are shown in parentheses. Estimates are obtained from fixed effects linear probability models on the sample of married women without children and married women with children, which include group-specific linear trends. Estimated coefficients in bold face are statistically different from zero at the 5 percent significance level. The other variables included in each regression pertain to the wife. They are listed in the note to Table 2. N is the number of person-wave observations.

Table 4
The WFTC Effect on Married Women's Labor Supply
by Age and Number of Children and Partner's Employment Status and Earnings
Fixed Effects Estimates

Outcome and age and number of children	All women	Partner does not work or works fewer than 16 hours per week	Partner works 16-plus hours per week and has earnings below the bottom quartile	Partner works 16-plus hours per week and has earnings above the bottom quartile
		A. Labour force participation		
One child aged 0-4	0.021	**0.077**	0.029	0.004
	(0.022)	(0.023)	(0.058)	(0.025)
One child aged 5-10	-0.008	0.050	-0.011	-0.016
	(0.020)	(0.036)	(0.055)	(0.022)
One child aged 11-18	0.016	0.028	0.026	0.011
	(0.015)	(0.039)	(0.031)	(0.017)
Two children or more,	-0.015	**0.061**	-0.009	-0.020
youngest 0-4	(0.024)	(0.027)	(0.029)	(0.016)
Two children or more,	0.008	0.035	-0.006	0.002
youngest 5-10	(0.016)	(0.043)	(0.047)	(0.018)
Two children or more,	0.011	0.022	0.010	0.009
youngest 11-18	(0.023)	(0.042)	(0.027)	(0.020)
		B. Working 16 or more hours per week		
One child aged 0-4	-0.001	**0.068**	0.017	-0.024
	(0.026)	(0.021)	(0.069)	(0.031)
One child aged 5-10	-0.002	**0.050**	0.009	-0.019
	(0.023)	(0.024)	(0.065)	(0.027)
One child aged 11-18	0.019	0.031	0.023	0.015
	(0.012)	(0.028)	(0.029)	(0.021)
Two children or more,	-0.012	0.017	-0.025	-0.016
youngest 0-4	(0.019)	(0.034)	(0.035)	(0.024)
Two children or more,	-0.020	-0.003	-0.013	-0.027
youngest 5-10	(0.019)	(0.040)	(0.052)	(0.023)
Two children or more,	0.015	0.018	0.011	0.015
youngest 11-18	(0.017)	(0.035)	(0.030)	(0.026)
		C. Working 30 or more hours per week		
One child aged 0-4	0.005	0.019	0.028	-0.006
	(0.014)	(0.036)	(0.064)	(0.020)
One child aged 5-10	0.008	0.016	0.019	0.003
	(0.021)	(0.045)	(0.031)	(0.017)
One child aged 11-18	0.022	0.018	0.040	0.017
	(0.019)	(0.022)	(0.052)	(0.023)
Two children or more,	0.0001	-0.001	0.011	-0.003
youngest 0-4	(0.018)	(0.035)	(0.070)	(0.015)

Two children or more,	0.012	-0.004	0.018	0.014
youngest 5-10	(0.014)	(0.027)	(0.052)	(0.016)
Two children or more,	0.015	0.013	0.012	0.017
youngest 11-18	(0.028)	(0.034)	(0.044)	(0.021)
N	29,830	5,011	6,033	18,786

Notes: Standard errors are shown in parentheses. Estimates are obtained from fixed effects linear probability models on the sample of married women without children and married women with children, which include group-specific linear trends. Estimates are from the specification with a constant post-reform effect. Estimated coefficients in bold face are statistically different from zero at the 5 percent significance level. The other variables included in each regression pertain to the wife. They are listed in the note to Table 2. N is the number of person-wave observations.

Table 5
The WFTC Effect on Married Women's Labor Supply Transitions

Outcome	All women	Partner does not work or works fewer than 16 hours per week	Partner works 16-plus hours per week and has earnings below the bottom quartile	Partner works 16-plus hours per week and has earnings above the bottom quartile
A. Persistence probability[a]				
Labour force participation	-0.002	0.008	0.012	-0.004
	(0.009)	(0.053)	(0.020)	(0.009)
N	18,122	1,805	3,671	12,646
Working 16 or more hours per week	-0.006	**0.054**	-0.008	-0.012
	(0.013)	(0.023)	(0.034)	(0.014)
N	14,900	1,315	3,021	10,564
Working 30 or more hours per week	0.023	**0.041**	0.018	0.023
	(0.020)	(0.020)	(0.044)	(0.023)
N	9,715	789	2,019	6,907
B. Entry probability[b]				
Labour force participation	0.017	**0.037**	-0.033	0.020
	(0.021)	(0.017)	(0.052)	(0.035)
N	6,402	2,561	1,083	2,758
Working 16 or more hours per week	0.021	**0.038**	-0.012	0.027
	(0.018)	(0.016)	(0.048)	(0.030)
N	9,624	3,051	1,733	4,840
Working 30 or more hours per week	0.014	**0.036**	0.015	0.011
	(0.010)	(0.019)	(0.027)	(0.017)
N	14,809	3,577	2,735	8,497

[a] Conditional on working (positive hours, 16 plus hours per week, or 30 plus hours per week) in the year prior to that which the outcomes refer to.
[b] Conditional on *not* working (positive hours, 16 plus hours per week, or 30 plus hours per week) in the year prior to that which the outcomes refer to.

Notes: Standard errors are shown in parentheses. Estimates are obtained from linear probability models of transitions in labour market states on the sample of married women without children and married women with children, which include group-specific linear trends. Estimates are from the specification with a constant post-reform effect. Estimated coefficients in bold face are statistically different from zero at the 5 percent significance level. The other variables included in each regression pertain to the wife. They are listed in the note to Table 2. N denotes the number of wave-on-wave state-specific transitions.

Table 6
The WFTC Effect on Married Men's Labor Supply
Fixed Effects Estimates

Outcome	All men	Partner does not work or works fewer than 16 hours per week	Partner works 16-plus hours per week and has earnings below the bottom quartile	Partner works 16-plus hours per week and has earnings above the bottom quartile
Labour force participation	0.007 (0.007)	0.009 (0.013)	0.012 (0.027)	0.005 (0.007)
Working 16 or more hours per week	0.003 (0.007)	0.004 (0.014)	0.017 (0.019)	0.001 (0.008)
Working 30 or more hours per week	0.001 (0.008)	0.006 (0.014)	0.003 (0.034)	-0.003 (0.009)
N	29,830	11,395	2,481	15,954

Notes: Standard errors are shown in parentheses. Estimates are obtained from fixed effects linear probability models on the sample of married men without children and married men with children, which include group-specific linear trends. Estimates are from the specification with a constant post-reform effect. The other variables included in each regression pertain to the husband. They are listed in the note to Table 2. N is the number of person-wave observations.

Table 7
The WFTC Effects on Married Women's Outcomes Other than Employment

Outcome	All women	Partner does not work or works fewer than 16 hours per week	Partner works 16-plus hours per week and has earnings below the bottom quartile	Partner works 16-plus hours per week and has earnings above the bottom quartile
FC/WFTC receipt[a]	0.005	**0.039**	0.026	**-0.015**
	(0.003)	(0.011)	(0.027)	(0.005)
N	13,832	2,356	3,599	7,877
Income Support receipt[b]	-0.003	-0.0004	-0.0003	-0.002
	(0.004)	(0.020)	(0.002)	(0.003)
N	29,830	5,011	6,033	18,786
Paid childcare utilisation[c]	0.011	0.010	**0.032**	-0.0004
	(0.012)	(0.028)	(0.015)	(0.014)
N	10,016	520	1,806	7,690
Weekly childcare costs[d]	0.72	0.04	-0.62	1.13
	(2.19)	(0.017)	(2.46)	(2.45)
N	2,040	134	389	1,517
Birth rates for married mothers[e]	-0.008	-0.010	-0.004	-0.005
	(0.006)	(0.019)	(0.006)	(0.007)
N	9,227	1,353	2,401	5,473
Entry into motherhood[f]	-0.0007	-0.0003	-0.002	-0.0004
	(0.0007)	(0.0010)	(0.002)	(0.0011)
N	12,926	3,237	2,655	7,034
Divorce rates[g]	0.002	**0.028**	0.012	-0.008
	(0.007)	(0.011)	(0.010)	(0.011)
N	25,481	4,173	5,076	16,232

[a] Estimates are obtained from linear probability models with individual fixed effects on the subsample of married mothers. Explanatory variables are listed in the note to Table 2, except for the term capturing the trend for married women without children.
[b] Estimates are obtained from linear probability models with individual fixed effects on the sample of childless women and mothers. Explanatory variables are listed in the note to Table 2.
[c] Estimates are obtained from linear probability models with individual fixed effects on the subsample of mothers. The dependent variable takes value one if the mother works, has at least one child aged 12 or less, and pays for childcare arrangements, and zero otherwise. Explanatory variables are listed in the note to Table 2, except for the term capturing the trend for married women without children.
[d] Estimates are obtained from linear regression models with individual fixed effects on the subsample of mothers who work, have at least one child aged 12 or less, and report positive expenditures on childcare arrangements. The weekly childcare expenditures are expressed in constant (2002) prices. Explanatory variables are listed in the note to Table 2, except for the term capturing the trend for married women without children.

[e] Estimates are obtained from linear probability models of transitions into birth on the subsample of married mothers from the second time they were observed in the panel onwards. Explanatory variables are listed in the note to Table 2, except for the term capturing the trend for married women without children.

[f] Estimates are obtained from linear probability models of transitions into motherhood for the subsample of married women without children. For each woman, the dependent variable takes value zero if the woman is married childless, and value one in the period when she has a child (after which her observations are censored). Explanatory variables are listed in the note to Table 2, except for the term capturing the trend for married women with children.

[g] Estimates are obtained from linear probability models of transitions into partnership breakdown on the sample of married childless women and married mothers. For each woman, the dependent variable takes value zero if the woman is married, and value one in the period when her partnership (marriage or cohabitation) is dissolved (after which her observations are censored). Multiple entries for the same woman are allowed. Explanatory variables are listed in the note to Table 2.

Notes: Standard errors are shown in parentheses. Estimated coefficients in bold face are statistically different from zero at the 5 percent significance level. N denotes the number of person-wave observations.