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Abstract

To promote the labour participation of parents with young children, governments employ a number of fiscal instruments. Prominent examples are childcare subsidies and in-work benefits. However, which policy works best for employment is largely unknown. We study the relative effectiveness of fiscal stimuli for working parents in an empirical model of household labour supply and childcare use. We use a large and rich administrative dataset for the Netherlands. Large-scale reforms in childcare subsidies and in-work benefits in the data period benefit the identification of the parameters. We find that an in-work benefit for secondary earners that increases with income is the most cost-effective way of stimulating total hours worked of parents with young children. Childcare subsidies and a 'flat' in-work benefit for secondary earners are somewhat less cost-effective. In-work benefits for both primary and secondary earners are much less cost-effective, since the former are rather unresponsive to financial incentives.

JEL classification codes: C25, C52, H31, J22
Keywords: Discrete choice models, latent class models, household labour supply, work and care policies

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1 Introduction

In this paper we compare the effectiveness of fiscal policies targeted at working families with children which aim to promote parental labour participation. There are large differences in the mix of fiscal support for these families across countries. For example, Scandinavian countries direct much of their public support for working parents to childcare subsidies (OECD, 2014; Kleven, 2014), whereas the US and Canada rely more on in-work benefits to support this group (Immervoll and Pearson, 2009). Although these policies in part differ in their objectives, e.g. promoting skill formation among disadvantaged children versus income support for disadvantaged families, a common goal is that they aim to stimulate employment. There is a large body of literature studying the employment effects of childcare subsidies (and pre-kindergarten and pre-school programs),[1] and there is large body of literature studying the employment effects of in-work benefits for families with children.[2] However, we know very little on the relative effectiveness of these policies in terms of additional employment per additional dollar or euro spent, and hence the policy mix that works best for employment. Furthermore, there are large differences across countries when it comes to the targeting of these policies. For example, in-work benefits for families in the US and the UK are primarily targeted at low incomes (Brewer et al., 2009), whereas in-work benefits for families in the Netherlands are targeted more at middle and high incomes (see below). Targeting childcare subsidies and in-work benefits at working parents with low incomes may cause a loss in efficiency. This, however, depends on the relative importance of labour supply responses on the extensive (participation) and intensive (hours worked per employed) margin (Saez, 2002). Also here, we know very little on the efficiency loss (if any) of targeting income support more at working parents with low incomes rather than middle and high incomes.

We offer a systematic analysis of the effectiveness of childcare subsidies and in-work benefits for families with children in terms of labour participation. Specifically, we consider how these policies compare to each other in terms of additional public spending per additional (fulltime equivalent) employed, where we show that it is crucial to take into account the effects of behavioural responses on the government budget. Furthermore, we consider to what extent targeting these fiscal policies at different income groups affects their effectiveness, to study the equity-efficiency trade-off for these policies.

[1] See Blau (2003) for an excellent overview, and Lokshin (2004), Tekin (2007), Baker et al. (2008), Cascio (2009), Havnes and Mogstad (2011) and Fitzpatrick (2012) for some recent analyses.

[2] Two major in-work benefit programs that have received much attention in the literature are the EITC in the US and the WFTC in the UK. See Hotz et al. (2010) and Brewer and Browne (2006) and the references therein for the impact of the EITC and WFTC on employment, respectively.

To study the effectiveness of fiscal policies targeted at working parents we develop and estimate a structural model of parental labour supply and childcare demand in the Netherlands. We use a large and rich administrative household dataset[3] for the period 2006–2009 to estimate the preferences of couples with a youngest child 0–3 years of age (pre primary school age) and couples with a youngest child 4–11 years of age (primary school age). Specifically, we estimate the preferences using a static discrete choice model for the simultaneous choice of labour supply by the mother and the father, and the use of childcare.[4] An advantage of the discrete choice approach is that it does not require convex or piece-wise linear budget sets, so that we can take all the complexities of the tax-benefit system into account (Van Soest et al., 2002). Furthermore, quasi-concavity of preferences need not be imposed ex ante, and therefore coherency of the model does not implicitly limit the range of behavioural responses that can be obtained (MaCurdy et al., 1990). We model unobserved heterogeneity using the latent classes approach as outlined in Train (2008) and Pacifico (2009), and recently applied to a model with maternal labour supply and childcare choices by Apps et al. (2012). Latent classes are a flexible way of modelling unobserved heterogeneity, which can prove important for inference of the model (Pacifico, 2009). The identification of the structural parameters benefits from a large reform in childcare subsidies and in-work benefits for working parents in the sample period, which generates large exogenous variation in the budget sets. Hence, we go beyond an idenfitication based solely on cross-sectional variation, which may in part be endogenous, resulting in poor identification of the structural parameters and a wide range of potential biases (Blau, 2003). The reform also allows us to do a 'reality check' (Blundell, 2012) on the behavioural responses of the structural model, by comparing the simulated responses to the reform with the findings of a difference-in-differences analysis on the same reform but using a different data set (Bettendorf et al., 2012).[5]

[3]The Labour Market Panel (*Arbeidsmarktpanel* in Dutch) of Statistics Netherlands (2012).

[4]Building on the work by Van Soest (1995), discrete choice models have become a popular tool for the structural modelling of labour supply, see e.g. Keane and Moffitt (1998), Blundell et al. (2000), Gong and Van Soest (2002), Blundell and Shephard (2012) and Bargain et al. (2014). For an overview of discrete choice models that explicitly include childcare see Blau (2003). Recent applications include Lokshin (2004), Kornstad and Thoresen (2006, 2007), Tekin (2007), Blundell and Shephard (2012), Gong and Breunig (2012) and Apps et al. (2012).

[5]Our approach satisfies all the requirements set out by Meghir and Phillips (2010, p. 227) "[E]stimating incentive effects in a convincing way thus requires us to find solutions to all these problems at the same time. This calls for a sufficiently flexible approach, that allows for fixed costs of work, does not impose theory a priori everywhere in the sample (thus in a sense increasing model flexibility), uses exogenous changes to work incentives to identify their effect, and allows for taxes and benefits. This is of course a large set of requirements, but all have been shown to be important empirically; in our review of empirical

Our main findings are as follows. First, with latent classes, the structural model predicts labour supply responses for fiscal reforms over the period 2005–2009 very much in line with the results from the difference-in-differences analysis on the same reforms. When we do not allow for latent classes, the structural model predicts behavioural responses that are too small. Second, we find that an across-the-board increase in childcare subsidies is more effective in raising labour participation than in-work benefits targeted at both primary and secondary earners, and about equally cost-effective as an across-the-board increase of in-work benefits for secondary earners. Third, we find that the effect of childcare subsidies on total hours worked is not much lower when targeted more at low incomes than when targeted at middle and high incomes.[6] However, the so-called knock-on effects, changes in government expenditures and receipts due to behavioural changes, are more favourable when we target childcare subsidies more at middle and higher incomes, making them more cost-effective. Fourth, the most cost-effective fiscal stimulus for working parents is an in-work benefit targeted at secondary earners that rises with income. This provides incentives both on the extensive and intensive margin to a group of workers that is relatively responsive on both margins.

The paper makes a number of important contributions to the existing literature. First of all, we have a large policy reform in our data period. This arguably leads to more credible exogenous variation in budget sets than previous structural analyses of labour supply and childcare that relied on cross-sectional variation only. Second, the policy reform also allows for a quasi-experimental check on the behavioural responses of the structural model, and we contribute to a small but growing literature that evaluates the performance of structural models by comparing simulated policy responses with the results from quasi-experimental studies (Todd and Wolpin, 2006; Hansen and Liu, 2011; Geyer et al., 2014). Third, with the structural model, we can also study a number of issues that were not possible in the quasi-experimental analysis. We decompose the labour participation effect of the 2005–2009 reform package into the effect of changes in childcare subsidies and the effect of changes in in-work benefits. We also do counterfactual policy analysis, including a prediction for the labour participation effects of a recent cut in childcare subsidies in the Netherlands. Because our structural model is fully integrated with a detailed tax-benefit calculator, we can study the effectiveness of fiscal stimuli for working parents in terms of additional employment generated per additional public dollar or euro spent. The integrated model also allows us to go beyond back-of-the-envelope calculations on the

results we will use these criteria to judge the value of the estimates."

[6]The case for targeting childcare subsidies at low incomes is reinforced when participation in childcare benefits children from low incomes more than children from middle and high incomes, as suggested by e.g. Blau and Currie (2006) and Havnes and Mogstad (2014).

effectiveness of different types of family policies using population averages for e.g. taxes and childcare subsidies as in Blau (2003) and Lokshin (2004). Although we focus on the impact of policy reforms in the Netherlands, we argue that our findings are also relevant for the effectiveness of these policies in other developed OECD countries. Indeed, the participation rate of mothers and fathers in the Netherlands, as well as public spending on formal childcare and pre-primary education, takes an intermediate position between Scandinavia and Anglo-Saxon countries. Finally, our data set is exceptionally large and rich. Hence, we can identify preferences for a large number of subgroups, including couples with a youngest child that is in primary school. To the best of our knowledge, we are the first to estimate a structural model for labour supply and out-of-school care, next to a model for labour supply and daycare.

The paper is organized as follows. Section 2 describes the policy environment and the evolution of labour market participation by men and women in the Netherlands in an international context. Section 3 develops the structural model and outlines the empirical strategy. Section 4 describes the data. Section 5 presents the estimation results and the corresponding labour supply and childcare elasticities. In this section we also present a comparison of the simulated employment effects of the structural model for the 2005–2009 reform package with the estimated employment effects of a quasi-experimental study. In Section 6 we use the structural model to compare the effectiveness of different fiscal stimuli for working parents. In Section 7 we simulate the employment effects of recent cuts in childcare subsidies. Section 8 concludes. Supplementary material is given in the appendix.

2 Labour market and policy environment

In the mid 1970s, the participation rate of women (15–64 years of age) in the Netherlands was rather low by international standards, close to 30% (OECD, 2013).[7] However, following the economic crisis in the early 1980s, the participation rate of women in the Netherlands started to rise. The rise in participation by mothers of young children was particularly strong (Euwals et al., 2011). By 2004, the Netherlands, with a participation rate of women close to 70%, took an intermediate position between the higher participation rates in e.g. Norway and Sweden, and the lower participation rates in e.g. the US and the UK.[8]

[7] This section draws heavily on Bettendorf et al. (2012).

[8] Whereas the participation rate of women in the Netherlands has converged to other well-developed OECD countries, there remains a sizeable and stable gap in hours worked by employed women (OECD, 2013). In 2004, employed women in the Netherlands worked on average approximately 24 hours per week, while their counterparts in other OECD countries worked 5 to 10 hours per week more. Indeed, in 2004,

The participation rate of men in the Netherlands dropped from the mid 1970s to the mid 1980s. In the face of adverse labour market conditions, many men were sent into early retirement and disability. However, in the 1990s and 2000s the generosity of early retirement and disability was cut back, and participation rates returned to levels comparable to other developed OECD countries.[9]

To further promote the labour participation (in persons but also in hours worked per week) by families with children, and of mothers in particular, the Dutch government implemented a series of reforms over the period 2005–2009. Following a brief introduction into the pre-reform childcare market in the Netherlands, below we give a short historical account of the policy changes over the period 2005–2009.

Children in the Netherlands go to primary school when they turn 4, and most children are 12 years old when they go to secondary school. Before the age of 4, children can go to centre-based daycare, so-called playgroups (*peuterspeelzalen*) and informal care. Before the introduction of the Law on Childcare (*Wet kinderopvang*) in 2005, centre-based daycare was subsidized at varying rates.[10] The majority (76%) of places was subsidized directly by employers and local governments.[11] These places had lower effective parental fees than so-called 'unsubsidized' places (24%), the costs of which were however partly tax deductible for parents. To qualify for the subsidies and tax deduction, both parents for two-parent households and one parent for single-parent households need to work. The total enrollment rate of children 0–3 years of age in centre-based care was 25% in 2004 (see Figure 1). Next to centre-based care, a large number of children also go to playgroups. This is part-time care for less than 4 hours per day, mostly used by families in which one of the parents does not work. Playgroups are not a subsitute for centre-based care as they do not cover enough hours of care for the parents to work. The enrollment rate of children 0–3 in playgroups was also close to 25%. Children that are in primary school (4–12 years of age) can go to centre-based out-of-school care and informal care. Similar to daycare, before the introduction of the Law on Childcare, subsidized and unsubsidized centre-based out-of-school care places co-existed, where the costs of unsubsidized places were partly tax deductible for parents. The pre-reform enrollment rate of 4–12 year olds

the share of women working part-time in the Netherlands was 60%, by far the largest share in the OECD (OECD, 2013).

[9]Hours worked per week by employed men (36 hours per week in 2004) is also somewhat lower in the Netherlands than in other well-developed OECD countries, but the difference is much less pronounced than for women (OECD, 2013).

[10]All the data on the use of formal childcare in this section are from Statistics Netherlands (http://statline.cbs.nl).

[11]The subsidy is per hour of formal childcare.

in centre-based care was 6% in 2004.

The series of reforms started with the introduction of the Law on Childcare in 2005. This law unified the subsidies for childcare places. From 2005 onwards, all formal places qualified for the same subsidy from the central government. This increased the subsidy somewhat for parents with children going to an unsubsidized place before 2005. Care by childminders, at the home of the childminder or of the children, also became eligible for subsidies under this law. But the unification of the subsidies and the extension to care by childminders had only a minor effect on public spending on formal childcare. Indeed, the subsidy was actually reduced somewhat for the highest incomes[12], public spending actually fell slightly from 2004 to 2005, see Table 1.

More important were the changes that followed in 2006 and 2007. In these years the subsidy rate was increased drastically, in particular in 2007. Figure 2 shows the changes in the parental contribution rate for the 'first child'.[13] The parental fee depends on the income of the household. In all years, households with the lowest income receive the highest subsidy (up to 96% of the full price). For the lowest income households the subsidy rate hardly changed. For the middle income households the subsidy rate went up by 20 to 40%-points, whereas the increase in the subsidy for the highest income households was somewhat smaller than for middle income households. On average, the parental cost share in the full price dropped from 37% in 2005 to 18% in 2007.[14,15] Next to the drop in parental fees, from 2007 onwards schools were obliged to act as an intermediary for parents and childcare institutions to arrange out-of-school care.

In 2008 there were virtually no changes in childcare subsidies. 2009 then witnessed a partial reversal of the increase in childcare subsidies, as subsidies were cut back somewhat, see again Figure 2. Over the period 2005–2009, public spending on formal childcare went from 1 to 3 billion euro. By 2009, with public spending on childcare and pre-primary education of 0.5% of GDP, the Netherlands took an intermediate position between Sweden and Norway that spent respectively 1.4 and 1.2% of GDP on these policies on the one hand, and the US and Canada that spent just 0.4 and 0.2% of GDP on these policies on the other (OECD, 2014). Figure 1 shows the corresponding rise in the use of formal childcare

[12]See Plantenga et al. (2005).

[13]The Tax Office defines the first child as the child for which the parents have the highest childcare expenditures. For most households the first child is the youngest child since more hours are needed for daycare (0–3 years of age) than for out-of-school care (4–11 years of age).

[14]Source: Tax Office data provided by the Ministry of Social Affairs and Employment (personal communication).

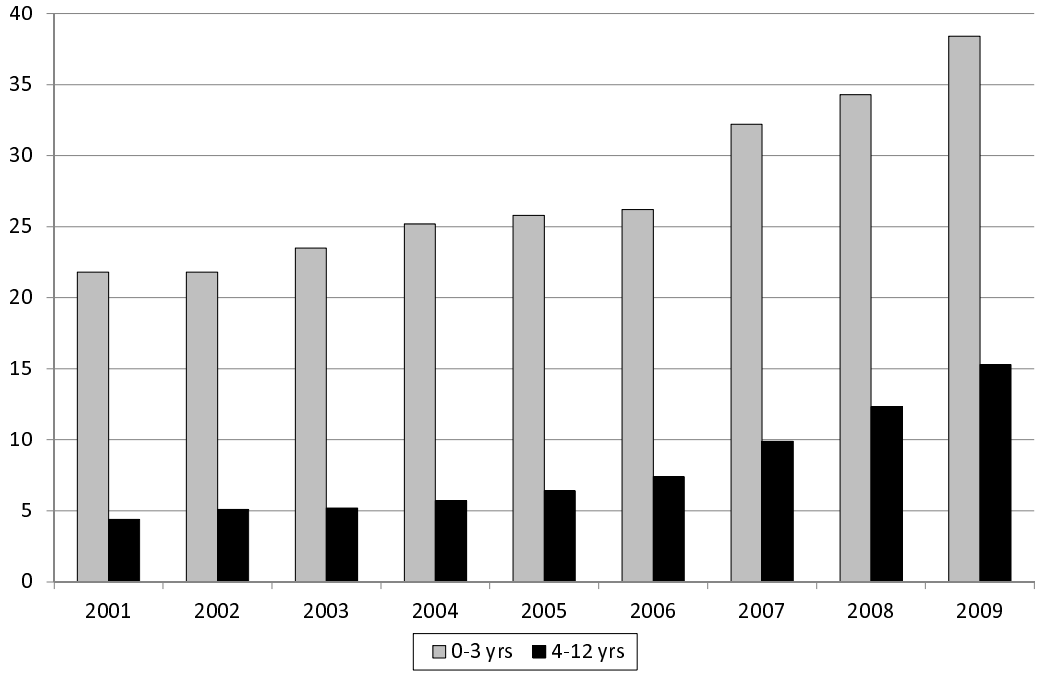
[15]Despite the steep increase in the subsidy rate, the average prices of formal childcare places grew more or less in line with the CPI.

Table 1: Public spending on childcare and in-work benefits for parents (millions of euro)

Year	2002	2003	2004	2005	2006	2007	2008	2009
Childcare subsidies	725	755	1,028	1,001	1,343	2,058	2,825	3,034
In-work benefits for parents	410	460	738	830	871	984	971	1,290
– *Combinatiekorting*[a]	410	460	479	484	314	324	247	0
– *Inkomensafhankelijke Combinatiekorting*[b]	0	0	259	346	557	660	724	1,290

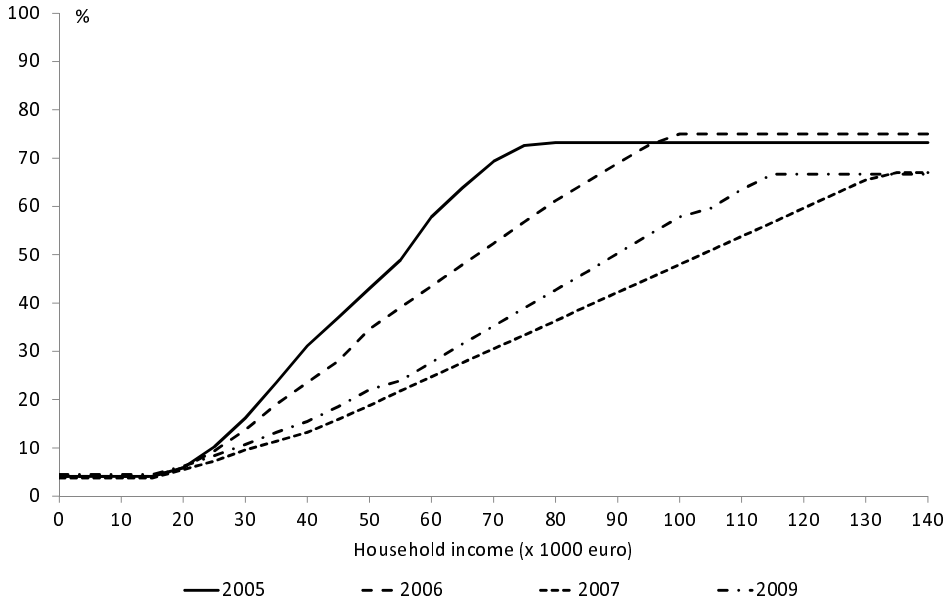
Source: Ministry of Finance (2010) and own calculations (imputation of employers' contribution for childcare up to 2007 with data from the Ministry of Social Affairs and Employment (personal communication) and split of the in-work benefits for parents in its two components using the MIMOSI model of CPB). [a]The *Combinatiekorting* applies to primary earners, secondary earners and working single parents with a youngest child up to 12 years of age. [b]The *Inkomensafhankelijke Combinatiekorting* applies to secondary earners and working single parents with a youngest child up to 12 years of age.

Figure 1: Share of children in formal childcare (in %)



Source: Statistics Netherlands.

Figure 2: Parental contribution rate for the first child



Source: own calculations using publicly available subsidy tables.

over the period 2001–2009 in the Netherlands. Following the steep drop in the parental fee in 2006 and 2007, there was a steep rise in the use of formal childcare, both for children 0–3 years of age (daycare) and for children 4–12 years of age (out-of-school care).

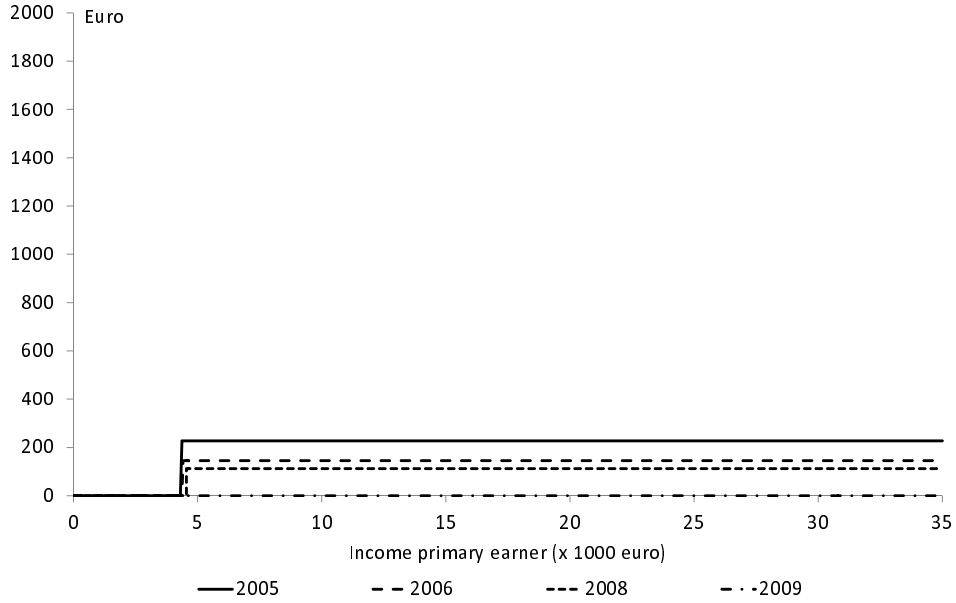
The period 2005–2009 also witnessed a number of changes in in-work benefits for working parents. Figure 3 shows the level of the Combination Credit (*Combinatiekorting*) per year over this period. All working parents with a youngest child less than 12 years of age qualified for the Combination Credit.[16] Furthermore, the in-work benefit was independent of earned income, provided earned income was above a certain (low) threshold. This benefit was introduced in the major tax reform of 2001, but was phased out over the period 2005–2009. There was a reduction in 2006, and then a smaller reduction in 2008 before it was eventually abolished in 2009.

Figure 4 shows the level of the Income-Dependent Combination Credit (*Inkomensafhankelijke Combinatiekorting*) per year by earned income over the period 2005–2009.[17] Secondary earners (and single parents) qualify for this in-work benefit, but the primary earners of secondary earners do not. This benefit was introduced in 2004. Up to 2008,

[16]The name refers to the combination of work and care.

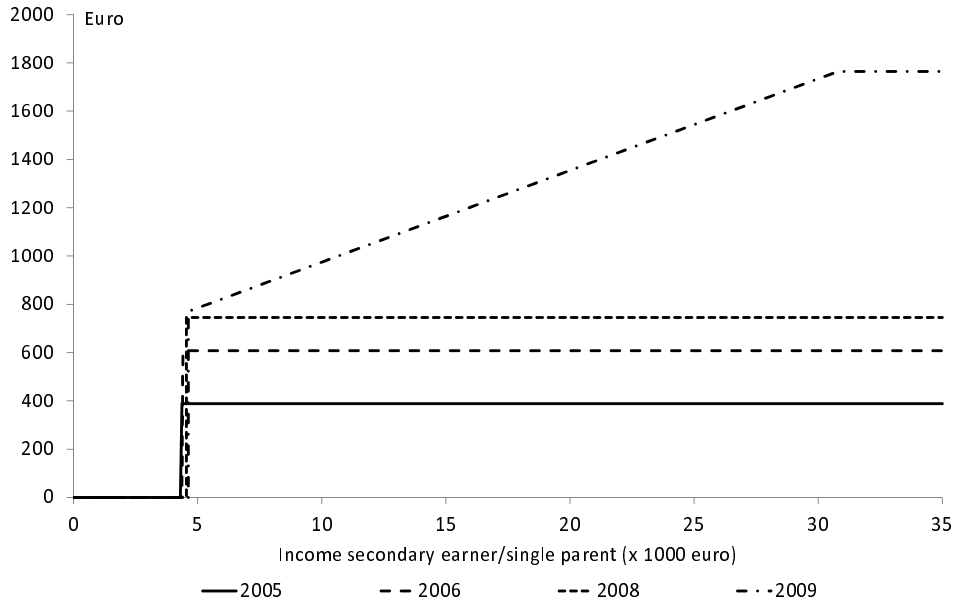
[17]Up to 2008 the *Inkomensafhankelijke Combinatiekorting* was called the *Aanvullende Combinatiekorting* (Additional Combination Credit).

Figure 3: Annual in-work benefit for primary and secondary earners with children



Source: Tax Office.

Figure 4: Annual in-work benefit for secondary earners with children



Source: Tax Office.

there was a gradual increase in the tax credit, and the credit did not depend on earned income (again provided that earned income exceeded a certain threshold). In 2009 this tax credit became income dependent, with a phase-in rate of 3.8% for income above the threshold. The maximum credit in 2009 was 1,765 euro, where the maximum was reached at a gross individual income of 30,803 euro.[18]

As Figure 3 and 4 show, there was a shift from the Combination Credit, for which both primary and secondary earners were eligible, to the Income-Dependent Combination Credit, for which only secondary earners[19] (typically mothers) were eligible. Indeed, public expenditures on the Combination Credit dropped from 484 million euro in 2005 to 0 in 2009, whereas public expenditures on the Income-Dependent Combination Credit rose from 346 million euro in 2005 to 724 million euro in 2008, and then to 1,290 million euro in 2009 as the income dependent part was added, see Table 1.[20] The motivation for these changes in in-work benefits was that secondary earners were believed to be more responsive to financial incentives than primary earners, and that policymakers wanted to stimulate mothers in the Netherlands to work more hours per week.

The reforms we simulate below are motivated by the policy reforms we witnessed in the Netherlands over the past decade. Indeed, in the analysis below we want to determine what policy seems to be the most effective in terms of labour participation. Furthermore, we want to quantify the trade-off between efficiency and equity by considering the redistributional and efficiency effects of targeting childcare subsidies and tax credits at different income groups.

3 Structural model and empirical methodology

Households are assumed to maximize a unitary household utility function. The systematic part of household utility, U^s, depends on disposable income y, hours worked by the male h_m, hours worked by the female h_f, and hours of formal childcare used c.[21] The functional

[18] For comparison, in 2009 the minimum wage of a fulltime worker was 16,776 euro.

[19] And single parents.

[20] Unfortunately, we could not find internationally comparable data on total public spending on in-work benefits for families with children.

[21] Unfortunately we do not observe informal childcare in our administrative dataset. In a robustness check we include a proxy for the use of informal childcare as an additional argument in the utility function. In the robustness check we assume that the total demand for childcare equals $c_{tot} = max((h_m + h_f - T), 0)$. We then use the following proxy for informal childcare $c_{inf} = max((c_{tot} - c), 0)$. Using this extended specification leads to similar labour supply and childcare elasticities, see the appendix.

form of U^s is log-quadratic,

$$\begin{aligned} U^s(\nu) &= \nu'\mathbf{A}\nu + \mathbf{b}'\nu + \mathbf{d}'\mathbf{1}[\mu > \mathbf{0}], \\ & \nu = (\log(y), \log(1 - h_m/T), \log(1 - h_f/T), \log(c)), \\ & \mu = (h_m, h_f, c), \end{aligned} \tag{1}$$

with $\mathbf{A}$ being a symmetric matrix of quadratic coefficients and $\mathbf{b}$ being a vector of linear coefficients corresponding to the vector of the aforementioned variables ν.[22] The vector $\mathbf{d}$ captures fixed costs of work for men and women and fixed costs of using formal childcare. Since these fixed costs are specified in the utility metric, they represent an amalgamation of different factors such as intrinsic disutility from work, or market frictions and other costs related to job search and childcare use. We allow for preference variation through observed individual and household characteristics $\mathbf{x}_2$, $\mathbf{x}_3$ and $\mathbf{x}_4$ in parameters b_2, b_3 and b_4

$$b_2 = \mathbf{x}'_2\beta_2, \quad b_3 = \mathbf{x}'_3\beta_3, \quad b_4 = \mathbf{x}'_4\beta_4, \tag{2}$$

which are the linear utility terms in leisure of the male, leisure of the female, and hours of formal childcare, respectively. The same variation is also allowed for the fixed costs parameters $\mathbf{d}$ (for a full list of covariates used, see online appendix D).

The budget constraint takes the following form

$$y = w_m h_m + w_f h_f - T(w_m, h_m, w_f, h_f; q) - TC(p_c, c; q) + S(p_c, c, y_t; q), \tag{3}$$

where w_m and w_f denote the gross hourly wage for the male and the female,[23] $T(.)$ denotes taxes and employees' premiums, q denotes individual and household characteristics, $TC(.)$ is the total cost of formal childcare, with p_c denoting the price per hour of formal childcare, and $S(.)$ is the childcare subsidy, which depends on the hourly price of formal childcare, the hours of formal childcare, taxable income y_t and household characteristics like the age distribution of the children.

Our econometric specification is based on a discrete choice model. Parents choose their preferred combination of hours of work and the hours of formal childcare from a finite set of alternatives $j \in \{1, ..., J\}$. Disposable household income depends on these choices, rising in hours worked and falling in formal childcare demanded. For workers we observe gross wages which are used to compute the work-related part of income for each alternative in their choice sets. For non-workers we estimate a Heckman-type wage equation which is

[22] Note that the parental work variables h_m and h_f in the vector ν have been transformed into indicators of leisure utilization, representing the fraction of weekly time endowment T which is spent on activities unrelated to work (including self-provided childcare and household maintenance).

[23] We assume that the gross hourly wage does not depend on the hours worked.

used to simulate their wages. We account for wage heterogeneity by taking multiple draws from the wage error distribution. Similarly, for households that use formal childcare we use observed hourly prices of formal childcare, and for non-users we simulate hourly prices using the same estimation strategy as for hourly wages. A detailed description of both simulation exercises can be found in the appendix.

Next to the systematic part $U_s(\nu_j)$, the utility function also contains alternative-specific stochastic terms ε_j:

$$U(\nu_j) = U^s(\nu_j) + \varepsilon_j. \tag{4}$$

The stochastic terms are assumed to be i.i.d. across alternatives, and to be drawn from the Type 1 Extreme Value distribution. This leads to a multinomial logit specification of the discrete choice model.

We also allow for the possibility that families which are observationally equivalent might have different tastes for work and formal childcare. We assume that there is a finite number K of latent household classes (or types), with households having homogeneous preferences within each class but heterogeneous preferences across classes. In practice, this means that we estimate a finite mixture model with K parametrizations of the utility function, corresponding to K distinct subsets of our data. All the preference parameters therefore become class-specific, which is equivalent to the assumption that they are drawn from a mass-point distribution.[24] The full set of parameters to be estimated is then

$$\theta = (\theta_1, ..., \theta_K) = (\mathbf{A}_1, \mathbf{b}_1, \mathbf{d}_1, ..., \mathbf{A}_K, \mathbf{b}_K, \mathbf{d}_K). \tag{5}$$

Since the classes are by definition unobservable, we cannot determine whether a given household belongs to a specific class or not. Instead, we have to construct household-level probabilities of class membership $P_i(class = k)$, which reflect how likely is household i to be driven by the preferences corresponding to class k, conditional on the household's choices and other observable characteristics. These probabilities are then used as individual weights for a set of class-specific multinomial logit models with separate parameter vectors θ_k. The resulting log-likelihood function of the finite mixture model has the fol-

[24] Limiting the distributional assumptions on unobserved heterogeneity by using mass points was pioneered by Heckman and Singer (1984). Recently, Train (2008) introduced a tractable way of estimating latent class discrete choice models using the EM algorithm. For a discussion of the benefits of latent class models within the domain of structural labour supply modelling, see Apps et al. (2012). For an overview of their implementation and potential computational improvements, see Kabátek (2013).

lowing form

$$\mathcal{L} = \sum_{i=1}^{I} \frac{1}{R} \sum_{r=1}^{R} \log \left(\sum_{k=1}^{K} P_i(class = k) \cdot \sum_{j=1}^{J} \left(\frac{\exp\left(U_{ij}^{s}(\nu_r, \theta_k)\right)}{\sum_{j'=1}^{J} \exp\left(U_{ij'}^{s}(\nu_r, \theta_k)\right)} \cdot D_{ij} \right) \right), \quad (6)$$

where R denotes the number of draws from the estimated wage and price equation for non-workers and non-users of formal childcare.[25] D_{ij} is an indicator function which takes the value 1 for the observed choice, and zero otherwise.

To solve the model, we use the EM algorithm, as proposed by Train (2008). This approach has been chosen since the likelihood frontier is likely to violate global concavity, which renders the solution by conventional methods based on maximum likelihood practically infeasible.

4 Data

We use the Labour Market Panel (in Dutch: *Arbeidsmarktpanel*) of Statistics Netherlands (2012). The backbone of the Labour Market Panel are the annual observations of the Labour Force Survey (in Dutch: *Enquete Beroepsbevolking*) for the period 1999–2009, which contains the education level of adult members of the household. Statistics Netherlands supplements this data set with three additional data sources. First, administrative data from municipalities for the period 1999–2009 (in Dutch: *Gemeentelijke Basisadministratie*) that contains information on individual and household characteristics like age, ethnicity, ages of the children and area of residence. Second, administrative data from the Social Statistical Panel for the period 1999–2009 (in Dutch: *Sociaal Statistisch Bestand*) on hours worked and gross income. Third, administrative data on formal childcare from the Formal Childcare Database of the Tax Office for the shorter period 2006–2009 (in Dutch: *Wet Kinderopvangtoeslag*). With respect to formal childcare, a distinction is made between daycare (children 0–3 years of age[26]) and out-of-school care (children 4–11 years of age).

[25] The number of draws in our specification is 10, and it is kept relatively low to limit the computational complexity of the model. We argue that this is sufficient since the unobserved component in the childcare price equation is negligible compared to the actual values - reflecting the fact that the majority of childcare centres charge the same price for their services. Increasing the number of draws does not qualitatively change predictions of our model.

[26] Maternity leave in the Netherlands is rather short, 3 months after the birth of the child, which can be supplemented with 3 months of parental leave for which the replacement rate is rather low however (OECD, 2014). Hence, we also include parents with a youngest child less than 1 years old in the analysis.

From the Labour Market Panel we make the following selections to arrive at the sample we use in the estimations. Childcare subsidies are available to parents up to the point where the child goes to secondary school. Most children are 12 when they go to secondary school[27], and therefore we restrict the sample to households with a youngest child 0 up to and including 11 years of age. Because we only have data on the use of formal childcare for the period 2006–2009, we further need to restrict the sample to this period. We only model the labour supply choice of couples, and hence also drop single parents. Next, we exclude couples in which at least one parent is either self-employed or has multiple sources of income, because we can not determine their budget constraint. Furthermore, we exclude couples in which at least one of the partners is on disability or unemployment benefits, assuming that they are constrained in their labour supply choice. After these selections are made, we further drop households with missing information on individual or household characteristics. This leaves us with approximately 60 thousand observations (households times periods in the sample). Given the large set of discrete choices we allow (see below), and the large set of preference parameters for each latent class, estimating the preference parameters results in a considerable computational burden. We therefore take a random subsample of 15%.[28] This leaves us with 4,170 observations for couples with a youngest child 0–3 years of age, and 5,013 observations for couples with a youngest child 4–11 years of age.

Table 2 gives descriptive statistics of our sample. Fathers in our sample are on average a few years older than mothers. Fathers and mothers in our sample are predominantly born in the Netherlands, and most of them have a level of education classified as middle. Furthermore, whereas fathers with a youngest child 0–3 years of age are slightly more likely to be higher educated than fathers with a youngest child 4–11 years of age, mothers with a youngest child 0–3 years of age are considerably more likely to be higher educated than mothers with a youngest child 4–11 years of age (a cohort effect). The majority of households lives in smaller cities and towns (<150,000 inhabitants). There is a considerable gap in the gross hourly wage between fathers and mothers, with fathers earning on average 4 to 6 euros per hour more than mothers in couples with a youngest child 0–3 and 4–11 years of age, respectively. The labour participation rate is much higher for fathers than for mothers. Furthermore, the participation rate of mothers with a youngest child 0–3 is higher than the participation rate of mothers with a youngest child 4–11. Finally, households with a youngest child 0–3 years of age are more likely to use formal childcare

[27] We do not observe whether a child is in secondary school or not.

[28] We have tested the stability of the preferences and the elasticities using different subsample sizes. Moving from smaller to larger sample sizes, preferences and elasticities appear to stabilize once we take a 15% subsample.

Table 2: Descriptive statistics by sex and age of the youngest child

	Men				Women			
	0-3 yrs		4-11 yrs		0-3 yrs		4-11 yrs	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	36.8	4.90	43.3	5.10	34.1	4.40	40.8	4.60
Native	0.84	0.36	0.86	0.35	0.84	0.37	0.84	0.37
Western immigrant	0.08	0.27	0.07	0.26	0.09	0.28	0.09	0.28
Non-Western immigrant	0.08	0.26	0.07	0.25	0.07	0.27	0.08	0.26
Lower educated[a]	0.19	0.39	0.21	0.41	0.14	0.34	0.22	0.42
Middle educated[a]	0.44	0.50	0.44	0.50	0.46	0.50	0.51	0.50
Higher educated[a]	0.38	0.48	0.35	0.48	0.40	0.49	0.26	0.44
Large city[b]	0.16	0.37	0.16	0.36	0.16	0.37	0.16	0.36
Small city[b]	0.84	0.37	0.84	0.36	0.84	0.37	0.84	0.36
Hourly gross wage	20.2	10.0	22.2	11.2	16.3	6.30	16.1	7.60
Participation rate	0.96	0.19	0.95	0.21	0.82	0.39	0.75	0.43
Hours worked per week[c]	38.7	5.20	38.7	5.50	23.0	8.20	21.2	8.50
Using formal childcare[d]	0.50	0.50	0.13	0.34	0.50	0.50	0.13	0.34
Hours formal childcare per week[e]	27.1	16.2	14.4	11.1	27.1	16.2	14.4	11.1
Number of observations	4,170		5,013		4,170		5,013	

[a]Education is classified as follows (using the Dutch abbreviations): i) lower educated = BO and VMBO, ii) middle educated = MBO, HAVO and VWO, iii) higher education = HBO and WO. [b]A city is defined as large (small) when it has 150,000 inhabitants or more (less than 150,000 inhabitants). [c]Hours worked per week per employed. [d]The share of households using formal childcare is higher than the share of children in formal childcare in Figure 1. First, Figure 1 includes more households who are not eligible for childcare subsidy such as households with unemployment or disability benefits. Second, households with many children use less formal childcare on average. [e]Hours of formal childcare per week per household using formal childcare.

than households with older children. 50% of the households with a youngest child 0–3 years of age sends their children to formal childcare, compared to just 13% for households with a youngest child 4–11 years of age. A typical school day is from 8:30 to 15:00, and many families are able to cover the remaining hours with parental time or informal care. This is also reflected in the average hours of formal childcare used per week by households that do use formal childcare.

For our discrete choice model we discretize the data. Men and women are both allowed to choose from 6 labour supply options. Labour supply is discretized in 0 to 5 days, where each day equals 8 hours.[29] For childcare, we allow for 0, 1, 2 and 3 days, where the data show that a typical day in a daycare centre equals 10 hours,[30] and a typical day in out-of-school care equals 5 hours.[31] The full choice set for each household is 6 X 6 X 4 = 144 alternatives.

To determine disposable household income in each discrete option for labour supply and formal childcare we use the MIMOSI model (Romijn et al., 2008). MIMOSI is the official tax-benefit calculator of the Dutch government for the (non-behavioural) analysis of the redistributional and budgetary effects of reform proposals. MIMOSI allows for a very accurate calculation of the budget constraints. Indeed, it takes into account all (national[32]) taxes, social security premiums, and income independent subsidies and tax credits. Furthermore, MIMOSI also calculates the childcare subsidy applicable for each household in each option. The subsidy depends on the full hourly price of childcare per type of childcare (e.g. daycare or out-of-school care) up to a maximum price beyond which parents receive no additional subsidy, household income (subsidies are lower for higher incomes), the number of children (the subsidy is higher for the second, third etc. child in formal childcare), and whether or not both parents work (both parents need to work to receive the subsidy[33]). Income that enters the household utility function is disposable household income defined as gross household income plus childcare subsidies minus taxes, employees' premiums (for the employed), the nominal health care fee, and expenditures on formal childcare.[34] We ensure that household disposable income (excluding childcare costs and childcare subsidies) can not fall below the social assistance level for couples with

[29] Classified as: $0 \in [0, 5), 8 \in [5, 13), 16 \in [13, 21), 24 \in [21, 29), 32 \in [29, 37), 40 \in [37, \infty)$.

[30] Classified as: $0 \in [0, 0], 10 \in [0, 15), 20 \in [15, 25), 30 \in [25, \infty)$.

[31] Classified as: $0 \in [0, 0], 5 \in [0, 7.5), 10 \in [7.5, 12.5), 15 \in [12.5, \infty)$.

[32] In the Netherlands local taxes account for only a small portion of total taxes (3.3% in 2007, European Union (2014)).

[33] When one of the partners becomes unemployed, they are still eligible for childcare subsidies for a limited period of time.

[34] Disposable income in the estimations and simulations is in 2006 prices. We use the CPI to convert prices in later years to 2006.

children. For each discrete option we also calculate the net transfer from the household to the government (positive or negative). This allows for an accurate calculation of the net budgetary costs of the reforms excluding and including behavioural responses. This is crucial for the comparison of the effectiveness of different fiscal stimuli for working parents.

5 Estimation results

We estimate the preferences separately for couples with a youngest child 0–3 years of age, and for couples with a youngest child 4–11 years of age. This is to acknowledge that there can be non-trivial differences in childcare requirements and labour supply incentives faced by the two groups of households (Bernal, 2008).

As discussed in Section 3, to account for unobserved heterogeneity, we allow each subpopulation to consist of a number of latent classes. In order to assess how many latent classes should be used, we have estimated a set of models allowing for 1, 2, 3 or 4 latent classes (the model with one class being a homogenous specification). The key variables of interest, the labour supply and formal childcare elasticities, prove to be relatively stable for specifications with two and more latent classes. These can be found in the online appendix (see Table A.3 and A.4). However, the models with 3 and 4 latent classes exhibit a larger share of observed choices with a negative marginal utility of income, which is not consistent with optimization behaviour, in particular for couples with a youngest child 4–11 years of age.[35] This led us to favour parsimony and opt for the specification with 2 latent classes.

The estimated preference parameters and aggregate class shares for the models with 2 latent classes can be found in the appendix (Table A.6 and A.7). However, rather than interpreting the individual coefficients, we focus on elasticities derived from the estimated structural parameters.

First, consider the labour supply elasticities in Table 3. For an increase in the gross hourly wage of the men, we find a total hours worked elasticity for men ('Labour supply men') of 0.06 (youngest child 4–11) and 0.08 (youngest child 0–3), where most of the response is on the decision whether or not to participate ('Extensive margin') and not on the decision on how many hours per week to work ('Intensive margin'). We find a sizeable negative cross-elasticity for total hours worked by women. However, note that women work fewer hours in the base than men. In the end, the overall effect on total hours worked by households is close to zero (not reported). We also find a modest elasticity of the use of formal childcare with respect to the gross hourly wage of the men.

[35] Although the observed choice in random utility models can always be rationalized with a sufficiently favourable draw for ε_j.

Table 3: Gross wage elasticities

	Hourly wage men +1%				Hourly wage women +1%			
	0–3 yrs		4–11 yrs		0–3 yrs		4–11 yrs	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Labour supply men	0.08	0.01	0.06	0.02	–0.05	0.01	–0.04	0.02
– Extensive margin	0.07	0.02	0.04	0.03	–0.02	0.01	–0.01	0.02
– Intensive margin	0.01	0.02	0.02	0.02	–0.03	0.01	–0.03	0.02
Labour supply women	–0.15	0.03	–0.08	0.02	0.40	0.03	0.47	0.03
– Extensive margin	–0.10	0.02	–0.04	0.02	0.25	0.03	0.31	0.04
– Intensive margin	0.00	0.02	0.00	0.01	0.15	0.02	0.16	0.02
Formal childcare	0.11	0.05	0.15	0.07	0.41	0.02	0.77	0.11

Bootstrapped standard errors based on 200 draws.

Table 4: Gross and net price of formal childcare elasticities

	Price of formal childcare +1%			
	0–3 yrs		4–11 yrs	
	Mean	SE	Mean	SE
Gross price elasticities				
Formal childcare	–0.66	0.03	–0.77	0.10
Labour supply men	0.00	0.00	0.00	0.01
Labour supply women	–0.14	0.01	–0.04	0.01
Net price elasticities				
Formal childcare	–0.41	0.02	–0.54	0.07
Labour supply men	0.00	0.00	0.00	0.01
Labour supply women	–0.09	0.01	–0.03	0.01

Bootstrapped standard errors based on 200 draws. The gross price of formal childcare elasticities relate the percentage change in the use of formal childcare and labour supply by men and women to the percentage change in the full price of formal childcare. The net price of formal childcare elasticities relate the percentage change in the use of formal childcare and labour supply by men and women to the percentage change in the parental fee for formal childcare.

Table 5: Comparison with DD analysis: policy reforms 2005–2009

	Structural model				DD analysis[b]	
	Childcare	Combination Credit	Income-Depend. Combi. Credit	Total	Coefficient	SE
Model with latent classes[a]			Changes in levels			
Youngest child 0-3 yrs						
Participation rate women	0.017	-0.005	0.018	0.030	0.020	0.007
Hours worked per week women	0.693	-0.098	0.566	1.185	1.222	0.223
Participation rate men	0.003	-0.002	0.003	0.004	0.006	0.004
Hours worked per week men	0.059	-0.017	0.024	0.075	–0.509	0.237
Youngest child 4-11 yrs						
Participation rate women	0.004	-0.008	0.020	0.017	0.022	0.007
Hours worked per week women	0.173	-0.133	0.566	0.616	0.750	0.221
Participation rate men	0.000	-0.001	0.002	0.001	0.003	0.004
Hours worked per week men	0.016	0.005	-0.027	-0.001	–0.180	0.234
Model without latent classes						
Youngest child 0-3 yrs						
Participation rate women	0.017	-0.005	0.018	0.030	0.020	0.007
Hours worked per week women	0.671	-0.091	0.549	1.147	1.222	0.223
Participation rate men	0.003	-0.002	0.003	0.004	0.006	0.004
Hours worked per week men	0.069	-0.030	0.045	0.091	–0.509	0.237
Youngest child 4-11 yrs						
Participation rate women	0.002	-0.004	0.015	0.013	0.022	0.007
Hours worked per week women	0.101	-0.078	0.418	0.445	0.750	0.221
Participation rate men	0.000	-0.001	0.003	0.002	0.003	0.004
Hours worked per week men	0.020	-0.029	0.061	0.056	–0.180	0.234

[a] 2 latent classes. [b] Additional estimates on the same sample as Bettendorf et al. (2012), full regression results available on request.

Turning to the results for an increase in the gross hourly wage of the women, we find much larger own-wage elasticities for women than for men. Indeed, the own-wage elasticity for mothers with a youngest child 0–3 and 4–11 is 0.40 and 0.47, respectively. About two-thirds of the response is on the extensive margin, and about one-third is on the intensive margin.[36] We also find negative cross-elasticities for men, but these cross-elasticities are considerably smaller than for women. Following the larger labour supply response to female wages than male wages, we also find a larger elaticity of the use of formal childcare with respect to the gross hourly wage of women instead of men.

Table 4 presents the formal childcare price elasticities. In the first three rows, we consider the elasticity of the use of formal childcare, labour supply by men and labour supply by women with respect to the change in the gross price of formal childcare. We see a substantial negative price elasticity of formal childcare: –0.66 for couples with a youngest child 0–3 years of age and –0.77 for couples with a youngest child 4–11 years of age. There is hardly any effect on the labour supply of men, but a significant negative effect on the labour supply of women. This is particularly true for women with a youngest child 0–3 years of age, who use much more formal childcare than women with a youngest child 4–11 years of age. The next three rows give the same elasticities with respect to the net price of formal childcare or the parental fee of formal childcare. A 1% increase in the gross price leads to more than a 1% increase in the average parental fee in part because a fraction of the parents pays a gross price that is higher than the maximum price for which they can get a subsidy. Hence, these parents have to bear the full 1% rise in the gross price. The net price elasticities are more directly comparable to other studies, that typically focus on the elasticity with respect to the parental fee. These elasticities are somewhat smaller, but still substantial with –0.41 for couples with a youngest child 0–3 and –0.54 for couples with a youngest child 4–11.[37] Our results for the net price elasticity of labour supply by women is in line with the review presented in Blau (2003, p. 492). For the studies that explicitly allow for a formal childcare choice next to a labour supply choice, and hence do not impose a 1-to-1 link between the two, the elasticity of labour supply of women with respect to the net price of formal childcare is relatively low, ranging from –0.09 to –0.20. For mothers with a youngest child 0–3 years of age, we find a similar low elasticity of –0.09. For mothers with a youngest child 4–11 the elasticity is even much lower (–0.03), but this is partly the result of the lower share of women using formal care

[36] Bargain et al. (2014) also find that intensive margin responses for women in couples are relatively high in the Netherlands. Indeed, women in the Netherlands are arguably more free to choose their working hours, given the large share of part-time working women in the Netherlands.

[37] For example, in a recent study for Australia, Gong and Breunig (2012, Table 4) calculate a net price elasticity of childcare of –0.22.

in this group.[38]

In Table 5 we present a test of our structural model. Bettendorf et al. (2012) analyse the employment effects of the reforms discussed in Section 2 using difference-in-differences (DD). The identification in Bettendorf et al. (2012) comes mostly from the intertemporal dimension, using a before–after comparison with data for the period 1995–2009. The identification in our analysis comes in part from intertemporal variation from the policy reforms in the period 2006–2009, but in part also from the cross-sectional variation. Bettendorf et al. (2012) present estimation results for mothers with a youngest child 0–11 years of age, but this includes single mothers. Furthermore, they report effects for a different classification of mothers (with a youngest child 0–3, 4–7 and 8–11 of age). To make the comparison with the DD as clean as possible, we used the same initial sample as Bettendorf et al. (2012) but we estimate responses for the subgroups we consider in our empirical analysis, that is men and women in couples with a youngest child 0–3 or 4–11 years of age. The results are given in Table 5, along with the simulation results for the estimated structural model.

Table 5 shows that the results for the structural model are very much in line with the results of the DD analysis for mothers. Indeed, we can not reject that the DD estimates for the effect on hours worked and participation of mothers are equal to the simulated effects. The estimated effects on the participation rate of fathers is again very much in line with the prediction from the structural model, and we can not reject that they are the same. For the intensive margin, for fathers with a youngest child 4–11 years of age, the DD analysis suggests a smaller negative effect on hours worked per week by the employed than the structural model, although the coefficient is not significantly different from the prediction of the structural model. The only coefficient of the DD analysis which differs significantly from the prediction of the structural model is the intensive margin response by fathers with a youngest child 0–3 years of age, for which the DD analysis suggests a larger, negative response than the structural model.

Table 5 also shows the predictions of the structural model when we do not allow for latent classes. In this case the predictions of the structural model move away from the DD estimates, in particular for hours worked per week by women in couples with a youngest child 4–11 years of age. Hence, a comparison with the DD analysis seems to favour a model with latent classes over a model without latent classes.

[38]Table A.5 in the appendix gives the resulting elasticities when we include a proxy for informal childcare. This hardly affects our results. The simulated labour supply elasticities and price elasticities of formal childcare are very similar to the model where we do not include informal care in the utility function.

6 Relative effectiveness of fiscal stimuli

The structural model allows for a simulation of counterfactual policy reforms. Specifically, we use the model to study the effects of a number of prominent fiscal stimuli for working families with children. The policy reforms we consider are motivated by the actual reforms that have occured in the Netherlands over the past decade. Since many countries have witnessed, or are considering, similar types of reforms, we believe that the relevance of our results extends well beyond the borders of the Netherlands.

We consider three types of fiscal stimuli for working parents: i) an increase in childcare subsidies, ii) an in-work benefit for secondary earners, and iii) an in-work benefit for primary and secondary earners in couples. Furthermore, for each of these fiscal stimuli we consider an across-the-board reform, where the additional subsidy does not depend on individual or household income, and we consider a reform where the stimulus rises with income, targeted more at middle and high income households and the intensive margin of labour supply. Comparing the results for the across-the-board reforms and the income dependent reforms we can study to what extent there is an equity-efficiency trade-off for the different fiscal stimuli. In all simulations we consider the effects of a reform that costs 100 million euro given the initial distribution of labour supply and childcare choices, i.e. without behavioural changes.[39] Further details of the reforms we simulate and the output we report are given below.

First we consider the following three across-the-board scenario's:

(1) An income independent increase in childcare subsidies: we increase the hourly childcare subsidy by 10.3 percentage points of the hourly price.

(2) An income independent ('flat') in-work benefit for secondary earners of 290 euro per year.

(3) An income independent ('flat') in-work benefit for primary and secondary earners in couples of 126 euro per year.

For these simulations we present the following output. First, to study the equity effects of the reforms, we present scatterplots of the redistributional effects and also report the effect on the Gini-coefficient of disposable income. Next, we report the effects on labour supply,

[39] Alternatively, we could have simulated reforms that generate the same budgetary costs after taking into account behavioural responses. However, this approach would not lead to different conclusions regarding the effectiveness of the different fiscal stimuli.

both in terms of participation (extensive margin) and in total hours worked (extensive and intensive margin). Next to the effect on labour supply and labour production we also report the effect on formal childcare use. Finally, we measure the relative effectiveness of the different fiscal stimuli by looking at public spending required to bring an additional person to the workforce.

The redistributional effects of the across-the-board reforms are given in Figure 5, 7 and 9, respectively. On the horizontal axis we have disposable household income, on the vertical axis the percentage change in disposable household income relative to the base (in %). None of these subsidies do depend on income directly, the absolute change in disposable income is the same for low and high income households that use the same formal childcare and have the same number of partners employed. However, because we present redistributional effects in percentage terms, percentage changes in disposable income are lower for high income households, ceteris paribus. For the childcare reform in Figure 5 we see a number of 'lines', as families differ in the number of children they have, as well as the number of days of formal childcare they use per child. Furthermore, for the childcare reform we further observe that although the change in the subsidy itself does not depend on income, there is quite a large mass of families with middle and higher incomes that receive susbtantially more subsidy. This is because these families are more likely to use formal childcare than lower-income families. Indeed, the effect of the reform on the Gini-coefficient (without behavioural changes), reported in column (1) in Table 6, is actually positive for the across-the-board childcare reform (inequality rises). Figure 7 shows two lines for the in-work tax credit of secondary earners. A first line lies on the x-axis and represents couples who do not receive the in-work tax credit since at least one of the partners does not work. The second line refers to couples in which both partners work and therefore receice the in-work tax credit. Looking at the percentage changes, we see that a large part of the credit goes to households with a lower income. Indeed, for this reform we see a modest decline in the Gini-coefficient for disposable incomes, see column (2) in Table 6. Finally, Figure 9 gives the redistributional effects of the in-work benefit for both primary and secondary earners. Here we see three lines, one for two-earner households, one for one-earner households and one for households in which neither of the two parents works. Looking at the percentage changes, this reform is targeted even more at lower incomes, and the Gini-coefficient falls the most in this scenario, see column (3) in Table 6.

Table 6 presents the effects on labour participation, formal childcare and government finances of these three scenario's. Column (1) gives the results for the increase in the child-care subsidy. First, consider the effects on labour participation of couples with a youngest

Effect on initial incomes: childcare subsidies

Figure 5: Across-the-board

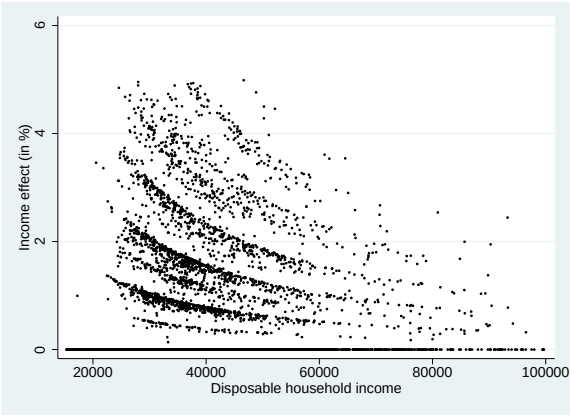
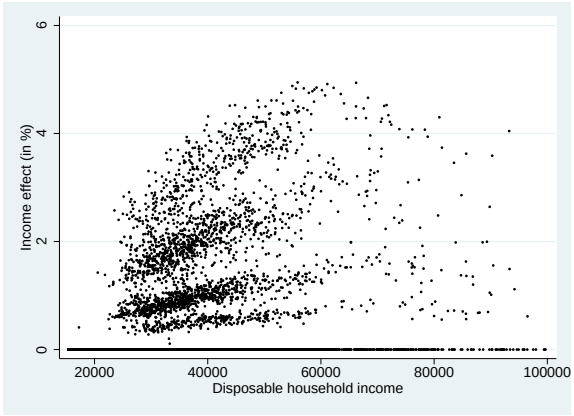


Figure 6: Targeted more at higher incomes



Effect on initial incomes: in-work benefit for secondary earners with children

Figure 7: Across-the-board

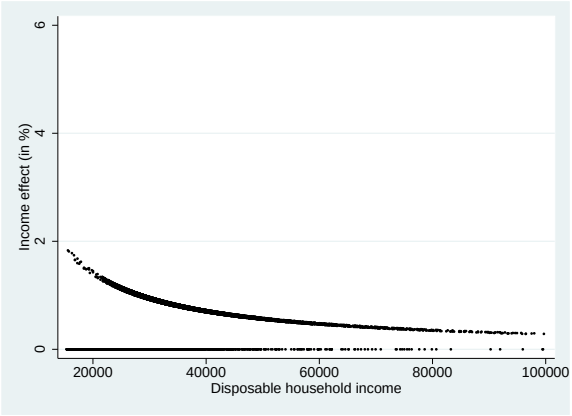
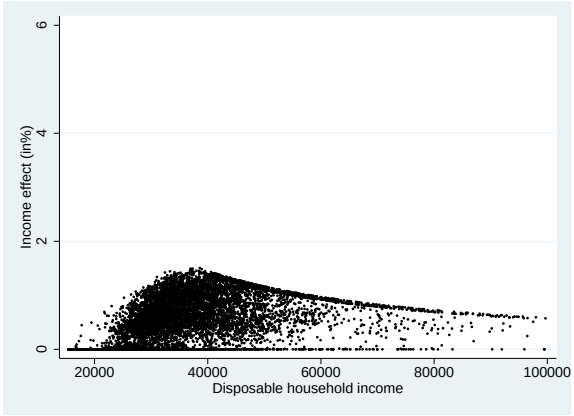


Figure 8: Targeted more at higher incomes



Effect on initial incomes: in-work benefit for primary and secondary earners with children

Figure 9: Across-the-board

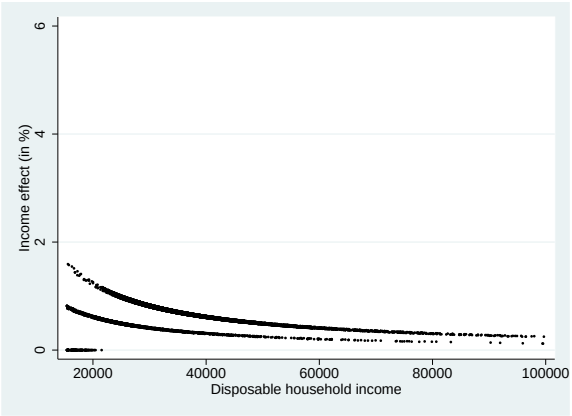


Figure 10: Targeted more at higher incomes

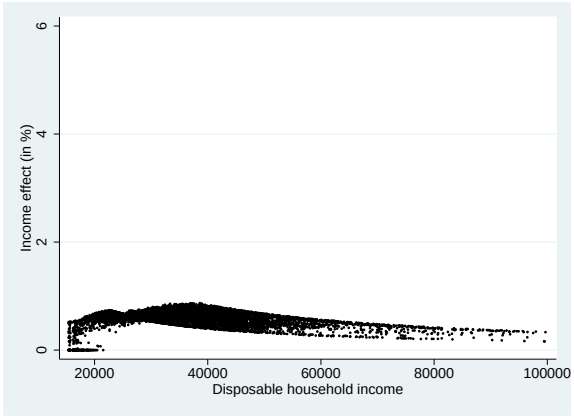


Table 6: Effectiveness of fiscal stimuli of 100 million euro

	Across-the-board			Targeted more at higher incomes		
	(1)	(2)	(3)	(4)	(5)	(6)
	Childcare subsidy	In-work benefit second. earners	In-work ben. all parents	Childcare subsidy	In-work benefit second. earners	In-work ben. all parents
	Percentage changes					
Gini coefficient	0.35	-0.10	-0.34	0.93	0.53	-0.14
Labour supply total	0.55	0.28	0.09	0.56	0.44	0.11
Labour supply youngest child 0–3						
– Men	0.04	0.03	–0.02	0.10	0.02	0.02
— Extensive margin	0.22	0.12	0.05	0.16	0.11	0.06
— Intensive margin	–0.19	–0.09	–0.07	–0.06	–0.09	–0.04
– Women	2.44	0.75	0.23	2.29	1.34	0.27
— Extensive margin	1.52	0.89	0.34	1.19	0.73	0.13
— Intensive margin	0.90	–0.14	–0.11	1.10	0.61	0.14
Labour supply youngest child 4–11						
– Men	0.03	–0.02	–0.03	0.05	–0.03	–0.01
— Extensive margin	0.02	0.07	0.03	0.02	0.06	0.04
— Intensive margin	0.01	–0.08	–0.06	0.03	–0.09	–0.05
– Women	0.89	1.02	0.44	0.91	1.49	0.41
— Extensive margin	0.39	1.24	0.56	0.35	0.80	0.23
— Intensive margin	0.50	–0.21	–0.12	0.55	0.68	0.18
Formal childcare total	12.62	1.28	0.67	11.13	2.12	0.79
Formal childcare youngest child 0–3	11.54	1.20	0.64	9.51	1.82	0.70
Formal childcare youngest child 4–11	16.28	1.54	0.80	16.61	3.12	1.09
	Millions of euro					
Additional public exp. ex ante	100.0	100.0	100.0	100.0	100.0	100.0
Knock-on effect childcare subsidies	132.4	11.0	5.8	103.4	16.8	6.3
Knock-on effect taxes and benefits	–52.7	–19.7	–4.8	–60.1	–33.5	–8.5
Additional public exp. ex post	179.7	91.3	101.0	143.3	83.3	97.8
	Euro					
Ex ante spending per FTE	28,135	55,269	179,070	27,782	35,211	142,829
Including effect on formal childcare use	65,374	61,323	189,402	56,509	41,122	151,859
Including effect on taxes and benefits	50,559	50,442	180,772	39,810	29,328	139,741

child 0–3 years of age (pre-primary school). The higher childcare subsidy draws some men into the workforce (extensive margin). But men already working reduce their hours worked (intensive margin).[40] The overall effect on hours worked by men is small. The effect on hours worked by women is much more pronounced. Indeed, there is a substantial positive effect on both the extensive and the intensive margin. Here, it is important to note that although the increase in the childcare subsidy is income independent, there is a substitution effect at work. Indeed, mothers that work more hours are also more likely to use more formal childcare, and thus have an extra benefit from the increase in the childcare subsidy. Turning to couples with a youngest child 4–11 years of age, we observe similar though somewhat smaller labour supply effects. Children in primary school are less likely to go to formal childcare, and if they do they typically go for only a few hours per day. For all couples with a child 0–11 years old, we find an increase in hours worked of 0.55%.

In absolute terms, men in couples increase their labour supply by 0.01 hours per week. The average increase is much higher for women in couples: 0.44 and 0.13 for mothers with a youngest child 0–3 and 4–11 years of age, respectively. However, the rise in formal childcare is much more pronounced than the rise in total hours worked. Couples with a youngest child 0–3 (4–11) years of age demand 1.77 (0.33) additional hours of childcare per week. This reflects the fact that there is not a 1-to-1 link with hours worked.

To conclude the analysis of reform (1), at the bottom of the table we give the effects on government finances, excluding and including so-called knock-on effects on government finances that result from behavioural changes. In case of the childcare subisdy reform, the increase in hours worked increases tax receipts and reduces expenditures on (welfare) benefits. This shift is however dominated by the increase in childcare subsidies due to substitution of other types of care for formal childcare. The average subsidy rate for formal childcare in the baseline scenario is 76% of the hourly price, making the increase in formal childcare rather costly to the government. Taking into account the behavioural responses, government expenditures rise by 180 instead of 100 million euro. As a measure of the relative effectiveness of reform (1), in the last three rows we calculate the additional public spending per additional fulltime-worker equivalent (fte) employed. Ignoring the knock-on effects, additional public spending per additional fte is 28 thousand euro. However, when we take into account the increase in formal childcare, additional public spending per additional fte rises to 65 thousand euro. Finally, taking into account the savings on benefits and the additional tax receipts, we still arrive at 51 thousand euro per additional

[40]The intensive margin also captures a composition effect, when new entrants on the labour market work different hours on average than the incumbent workforce.

fte. These calculations highlight that it is important to take into account the knock-on effects of changes in formal childcare when calculating the effectiveness of childcare subsidies.

Column (2) in Table 6 gives the behavioural responses and corresponding budgetary effects for the 'flat' in-work benefit targeted at secondary earners. First, again consider the effects on couples with a youngest child 0–3 years of age. The effect on the labour supply of men is again small, most men are not secondary earners. The effect on hours worked by women is much smaller compared to reform (1). In part, this is simply due to the fact that a larger part of the tax credit actually goes to the larger group of mothers with a youngest child 4–11 years of age than with reform (1). However, we also see that for reform (2) the intensive margin response is negative for women with a youngest child 0–3 years of age, because the in-work benefit only has an income effect on the intensive margin. Turning to the couples with a youngest child 4–11 years of age, we find a larger effect on hours worked compared to reform (1), as a larger part of the subsidies goes this group. Also for this group, the effect on the intensive margin is negative. When we look over all couples, we find that the increase in total hours worked in reform (2) is only about half of reform (1).

Since the tax credit does not affect the price of formal childcare for parents, reform (2) has only a modest effect on the use of formal childcare, following the increase in total hours worked. This is also reflected in the knock-on effects. As the flat tax credit for secondary earners is less succesful in raising hours worked, the knock-on effect of increases in taxes and savings on benefits is smaller than in the childcare subsidy reform. However, because the knock-on effect on childcare subsidy expenditures is much smaller than reform (1), reform (2) generates a positive knock-on effect of 9 million euro. Again, we calculate the relative effectiveness of the reform as additional public expenditures per additional fte employed. Ignoring the knock-on effects, additional public spending per additional fte employed is 55 thousand euro. Taking into account the knock-effects, this number becomes 50 thousand euro. When we compare the relative effectiveness of reform (2) with reform (1), we find that both reforms are about equally effective. Note however, that reform (1) goes at the expense of greater inequality, whereas reform (2) actually reduces inequality.

Finally, column (3) in Table 6 gives the results of a flat in-work benefit for both primary and secondary earners. In this senario, a large part of the subsidies goes to the men in couples with children, who hardly respond to financial incentives. As a result, the effects are much smaller than in reform (1) and (2). We still see the positive effect on the extensive margin, and the negative effect on the intensive margin (due to the income effect). The increase in total hours worked is just 0.09%. The knock-on effects are therefore also small,

and close to zero overall. This makes this the most expensive reform in terms of additional spending per additional hour worked. Indeed, additional public spending per additional fte employed is in the order of 180 thousand euro, making this policy relatively ineffective when compared to reform (1) and (2). We should note though, that this reform leads to a bigger drop in inequality than reform (2), and does not raise inequality like reform (1). With this effect on equity in mind, the results for reforms (1)–(3) suggest that the shift in the Netherlands from in-work benefits for all parents to in-work benefits just for secondary earners and to higher childcare subsidies was an effective one in terms of raising total hours worked.

Next, we consider the effectiveness of fiscal stimuli when the fiscal stimuli are targeted more at middle and higher incomes and the intensive margin. Specifically, we study the effects of the following three scenario's:

(4) An income dependent increase in childcare subsidies: we increase the hourly childcare subsidy so that the parental fee falls by 41% for all incomes. Given that middle and higher incomes pay a larger fee in the baseline, this reform targets mostly middle and high income families.

(5) An income dependent in-work benefit for secondary earners starting at 4,000 euro, and then rising with 2.2% of taxable income of the secondary earner up to a maximum of 581 euro per year at an individual income of 30,000 euro.

(6) An income dependent in-work benefit for primary and secondary earners in couples, starting at 4,000 euro, and then rising with 0.6% of taxable income of the primary or secondary earner up to a maximum of 168 euro per year at an individual income of 30,000 euro.

The redistributional effects of these reforms are given in Figure 6, 8 and 10, respectively. The subsidies now rise with income, and we see that the percentage changes in disposable income are typically smaller for lower incomes and bigger for higher incomes when compared to the reforms considered in Figure 5, 7 and 9. Indeed, reforms (4) and (5) increase income inequality, as measured by the Gini-coefficient, more than reforms (1) and (2), see Table 6. Furthermore, reform (6) reduces inequality less than reform (3). When there is a trade-off between equity and efficiency, we expect these reforms to be more effective in terms of labour supply and public spending per additional fte employed. But is this actually true, and if so, how much of a difference does it make?

Column (4) in Table 6 gives the effects of the increase in childcare subsidies targeted more at middle and high incomes. Starting with the couples with a youngest child 0–3 years of age, the effect on hours worked by men is still limited, though somewhat larger than reform (1), as the rise in the subsidy with income mitigates the negative intensive margin effect. The effect on hours worked by women is actually smaller than in reform (1). The intensive margin response is bigger, but this is dominated by a smaller effect on the extensive margin. The results for couples with a youngest child 4–11 in reform (4) are not that different from reform (1), though the effect on the extensive and intensive margin for women is somewhat smaller respectively larger. The effect on overall hours worked is quite similar in reform (4) when compared to reform (1). Hence, targeting childcare subsidies on middle and higher incomes is not necessarily better when looking at total hours worked. This suggests that the current system in the Netherlands which targets subsidies mostly at low incomes makes sense when it comes to hours worked. Furthermore, the increase in formal childcare is somewhat smaller in reform (4) than in reform (1), the reform leads to less substitution of other types of care for formal childcare for couples with a youngest child 0–3 years of age.

The knock-on effects are more favourable for reform (4) than reform (1). The additional hours worked by middle and higher incomes generate more additional tax revenue per additional hour worked. Furthermore, substitution of other types of care for formal care is less costly for the government, as the subsidy per hour of formal childcare is lower for middle and higher incomes than for lower incomes. With an about equal effect on total hours worked and much more favourable knock-on effects, it comes as no surprise that additional public spending per additional fte employed is more favourable in reform (4) than in reform (1), with 40 thousand euro in reform (4) compared to 51 thousand euro in reform (1). However, the difference comes at the expense of additional income inequality, and hence, once we take into account the knock-on effects on the government budget, there is actually a trade-off between equity and efficiency when it comes to the targeting childcare subsidies.

Column (5) gives the results for the in-work benefit for secondary earners that rises with income. Compared to the flat in-work benefit for secondary earners, reform (2), this reform has a more favourable effect on hours worked of women. Indeed, the substitution effect of this reform makes the intensive margin responses by women positive rather than negative. The effect on total hours worked is also considerably larger than reform (2), although still smaller than the childcare reforms (1) and (4). However, because this reform does not generate a large response in the use of formal childcare, the knock-on effects are rather favourable: plus 17 million euro. When we calculate the additional expenditures

per additional fte employed, reform (5) is the most effective, with 29 thousand euro per additional fte employed. This suggests that the Dutch reform in 2009, making the in-work benefit for secondary earners income dependent, was rather effective. However, also here there is a trade-off with equity, as the additional hours worked come at the expense of additional income inequality.

Finally, column (6) gives the results of the income dependent tax credit for primary and secondary earners. The overall effect on hours worked and government finances is slightly better than for the flat credit for primary and secondary earners. Again, there is a trade-off between efficiency and equity. However, this reform still has only a marginal effect on overall hours worked, and with 140 thousand euro per additional fte employed is still rather expensive.

7 Simulating the 2012-2013 childcare reform

The empirical model can also be used to simulate the effects of recent cuts in childcare subsidies which were taken by the Dutch government. Following the steep rise in public expenditures on formal childcare over the period 2005–2009, and after the Dutch economy was hit by the Great Recession, the Dutch government announced to cut expenditures on childcare in 2012 and 2013. As a result, the average contribution rate of households to formal childcare was projected to increase from 22% to 34% (Ministry of Social Affairs and Employment, 2011). The redistributional effects on disposable household income are shown in Figure 11. The simulated effects on labour participation, formal childcare use and government finances are given in Table 7.

The reform is projected to have only a small negative effect on hours worked by fathers. The effect is more pronounced for mothers, in particular for mothers with a youngest child 0–3 years of age. Their hours worked drop by 3.4%, of which a substantial part is on the intensive margin. The drop in the use of formal childcare is projected to be much bigger in percentage terms, 14% respectively 20% for households with a youngest child 0–3 years and 4–11 years of age. As a result, the knock-on effect for the government budget is actually positive. Additional savings on childcare subsidies more than offset the loss in tax receipts and the rise in benefit expenditures. We should also note that the predicted decline in the use of formal childcare is actually quite similar to what is observed following the recent cuts in childcare subsidies, with the use of formal childcare falling by 18% (Ministry of Social Affairs and Employment, 2014). However, uncertainty about trend growth absent the reform, and the effect of the Great Recession, complicate the comparison.

Figure 11: Redistributional effects childcare reform 2012–2013

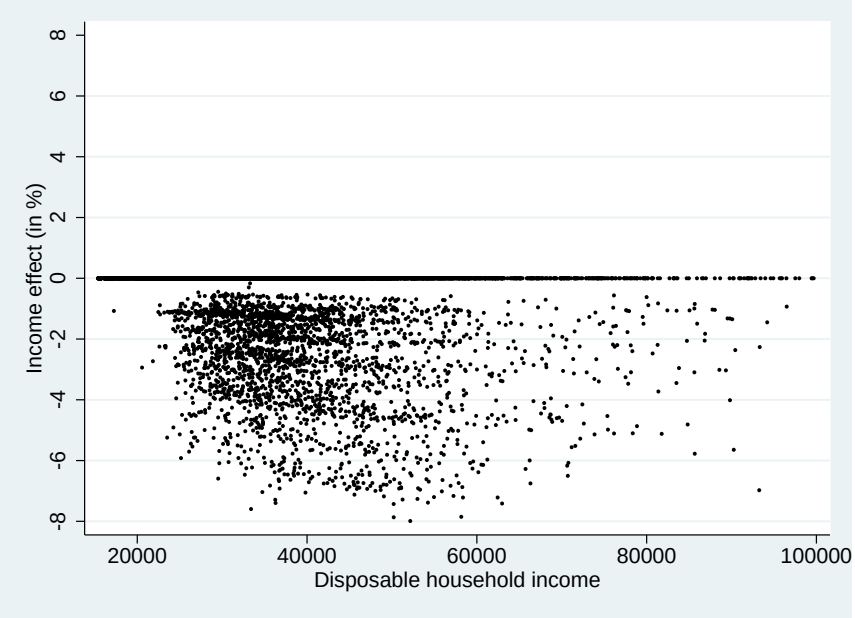


Table 7: Simulation results: childcare reform 2012–2013

Youngest child 0–3 yrs			Youngest child 4-11 yrs
	Percentage changes		
Labour supply men	–0.15		–0.05
– Extensive margin	–0.26		–0.02
– Intensive margin	0.11		–0.03
Labour supply women	–3.43		–1.12
– Extensive margin	–1.88		–0.45
– Intensive margin	–1.58		–0.67
Formal childcare	–14.24		–19.87
Overall effect			
Percentage changes		Millions of euro	
Gini coefficient	–1.05	Additional public exp. ex ante[a]	–154.4
Labour supply total	–0.79	Knock–on effect childcare subsidies	–109.2
Formal childcare total	–15.53	Knock-on effect taxes and benefits	82.8
		Additional public exp. ex post[a]	–180.8

[a] Additional public expenditures in our sample.

8 Conclusion

We have estimated a structural model for couples with a youngest child 0–3 and 4–11 years of age, where we model the simultaneous choice over hours worked by fathers, mothers and the hours of formal childcare use. Large exogenous variation in childcare subsidies and in-work benefits for working parents benefits the identification of the structural parameters. Furthermore, we account for unobserved heterogeneity by using a flexible framework of latent class models. The model produces labour supply responses to reforms over the period 2005–2009 quite similar to a DD analysis on the same reforms performed by Bettendorf et al. (2012). The model also predicts the steep decline in the use of formal childcare observed following the recent cuts in childcare subsidies.

We use this model to study the relative effectiveness of different types of fiscal stimuli for working parents with children 0–11 years of age. We find that an across-the-board increase in childcare subsidies is more effective than an across-the-board increase in in-work benefits for this group of working parents. That is, when we ignore the knock-on effects on the government budget due to behavioural responses. However, because childcare subsidies also lead to a shift from other types of childcare to formal childcare, the knock-on effect on the government budget is actually negative, despite higher tax receipts and savings on benefits. Comparing the additional public expenditures per additional hour worked, an across-the-board increase in childcare subsidies is about equally effective as an across-the-board increase of in-work benefits for secondary earners. Both policies are much more effective than an across-the-board increase of in-work benefits for both primary and secondary earners, as labour supply by primary earners is rather unresponsive to financial incentives. These results support the move from the Dutch government over the period 2005–2009 to abolish the joint in-work benefit for both primary and secondary earners, and increase childcare subsidies and the in-work benefit for secondary earners alone.

We also consider the extent to which childcare subsidies and in-work benefits targeted more at middle and higher incomes are more effective in raising total hours worked than an across-the-board increase in these policies. Indeed, we want to quantify the trade-off between efficiency and equity. Our model shows that targeting childcare subsidies more at middle and high income families has almost the same effect on total hours worked as an across-the-board increase in childcare subsidies, but of course leads to a less equitable income distribution. This finding can motivate the current setup of the Dutch system, where low income families receive higher childcare subsidies than middle and high income families. However, targeting childcare subsidies more at middle and high income families does increase hours worked by a relatively productive group, which results in higher knock-

on effects of taxes. Furthermore, as middle and high incomes receive less subsidy per hour of formal childcare, substitution of other types of care for formal care is less costly for the government. Both factors lead to lower additional public expenditures per additional hour worked for childcare subsidies targeted more at middle and higher incomes, once we take into account the behavioural effects on the government budget. So in the end, there is a trade-off between equity and efficiency when it comes to childcare subsidies.

An in-work benefit for secondary earners that rises with income is substantially more effective in terms of total hours worked and government finances than a 'flat' in-work benefit for secondary earners. So, from an efficiency point of view, introducing the income dependent part to the in-work benefit for secondary earners in 2009 by the Dutch government made sense. However, this reform came at expense of higher income inequality, and here we clearly face an equity-efficiency trade-off.

There are still a number of limitations to our current analysis that we would like to overcome in future work. An interesting next step would be to model these decisions in a life cycle model (Blundell et al., 2013). Indeed, there may be career effects extending beyond the period when the children are young. Another interesting avenue to consider is the effect of participation in formal childcare on the well-being of children and how they fare later in life, and whether or not there is a difference between children from low income and high income families (Havnes and Mogstad, 2014). Finally, the childcare reform may have been more salient than the reform of in-work benefits. Indeed, Chetty et al. (2009) stress the importance of salience in the behavioural responses to taxes and subsidies, and this too seems an interesting topic for future research.

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Appendix

A Wage equations

For the employed we use observed wages. For the non-employed we simulate wages. To this end, we run wage regressions by sex and then by level of education, where education is split into three levels (lower, middle and higher educated).

We use panel data techniques to account for unobserved individual-specific effects. We performed a Hausman test in order to test whether random effects or fixed effects are appropriate. For all groups, we reject the null hypothesis that the individual-specific effects are uncorrelated with regressor and therefore we prefer fixed effects over random effects estimation. However, we lose information on time-invariant regressors with fixed effects and therefore opt for the quasi-fixed effects model (Mundlak, 1978).

To account for the possibility of selection we first estimate the probability of participation using a pooled probit regression

$$p_{it} = x'_{it}\gamma + z'_{it}\theta + \nu_{it}, \tag{A.1}$$

where vector z_{it} contains variables that are expected to have an effect on the probability of participation but not on wages (an exclusion restriction). From this regression we determine the inverse Mills' ratio

$$invmills_{it} = \phi(p_{it})/\Phi(p_{it}). \tag{A.2}$$

The inverse Mills' ratio is then included in the quasi-fixed effects model

$$ln(w_{it}) = x'_{it}\beta + \omega_i + \bar{x_i}'\pi + \lambda_t invmills_{it} + \epsilon_{it} \tag{A.3}$$

where the individual specific effect consists of a random part, ω_i with $\sim IID(0, \sigma^2_\omega)$, and a part which is allowed to be correlated with regressors $\bar{x_i}'\pi$. Here, $\bar{x_i}$ is the average of time-varying variables such as age. A significant coefficient for an element of π provides evidence that the individual specific effect is correlated with one of the regressors.

Table A.1 shows estimation results for all subgroups. We use age splines since we expect that the relationship between wage and age is nonlinear. Table A.1 shows that age increases with age but at a diminishing rate. This is in line with other studies (Vella and Verbeek, 1998, 1999). For both singles and couples we see that the age profile is steeper for higher educated individuals. We also include cohort and year dummies in the regression. Because of perfect collinearity between age, cohort and period we use transformed time dummies following Deaton and Paxson (1994). The time dummies for 2006 and 2007 depend on the dummies for later years and are calculated manually.[41] Year dummies are

[41] t2006=-(d2007+d2008+d2009) and t2007=-2*d2008-3*d2009

Table A.1: Wage equations

	Men			Women		
	Lower educ.	Middle educ.	Higher educ.	Lower educ.	Middle educ.	Higher educ.
Age						
18–30	0.045***	0.047***	0.076***	0.037***	0.037***	0.047***
31–40	0.020***	0.029***	0.045***	0.022***	0.024***	0.035***
41–50	0.013***	0.020***	0.028***	0.024***	0.021***	0.023***
51–63	0.010***	0.008***	0.011***	0.020***	0.017***	0.013***
Cohort[a]						
1980–1989	0.085***	0.147***	0.173***	0.146***	0.126***	0.158***
1975–1980	0.025	0.074***	0.129***	0.063***	0.080***	0.118***
1970–1975	0.019*	0.034***	0.093***	0.030***	0.048***	0.077***
1960–1965	0.010	–0.017***	–0.012	–0.008	–0.019***	–0.044***
1955–1960	–0.002	–0.031***	–0.043***	0.009	–0.027**	–0.064***
<1955	0.007	0.002	–0.012	0.010	–0.019*	–0.046***
Ethnicitity[a]						
Western immigrant	0.003	–0.068***	–0.055***	0.001	–0.026***	–0.032***
Non-Western immigrant	–0.062***	–0.231***	–0.291***	–0.051***	–0.074***	–0.114***
Partner						
Married	0.015***	0.017***	0.015***	–0.011**	–0.015***	–0.025***
Year						
2006	0.005	0.005	0.004	0.006	0.004	0.002
2007	–0.006	–0.006	–0.003	–0.007	–0.005	–0.002
2008	–0.002***	–0.003***	–0.007***	–0.004***	–0.003***	–0.003***
2009	0.004***	0.004***	0.005***	0.005***	0.004***	0.002***
Mundlak averages age						
18–30	–0.008*	0.000	–0.005	–0.003	–0.002	0.001
31–40	–0.006**	–0.003**	0.000	–0.012***	–0.008***	–0.004***
41–50	–0.008***	–0.007***	–0.014***	–0.022***	–0.016***	–0.017***
51–63	–0.008***	–0.015***	–0.019***	–0.018***	–0.020***	–0.019***
Inverse Mills' ratio	–0.329***	0.452***	0.674***	–0.008	0.026**	0.098***
Attrition indicator	–0.004	–0.001	–0.001	–0.004	–0.004	0.000
Constant	1.446***	1.162***	0.618***	1.298***	1.430***	1.273***
Observations	88,997	168,316	129,663	60,824	146,294	89,859
Number of individuals	26,779	49,634	37,742	19,385	44,262	26,770

[a] Reference group: born in 1965–1970 and autochtonous.

significant in most specifications while the cohort variables are jointly significant for most subgroups. Wages are lower on average for non-Western immigrants. The coefficients for the Mundlak age averages are joinly significant in all specifications, but have no economic interpretation.

The lower part of Table A.1 shows that the inverse Mills' ratio is significant for most groups. Hence, we have evidence that selection bias is present for most groups. We also include an attrition indicator in order to test for the presence of attrition bias.[42] The attrition indicator is not significant for all subgroups.

[42]The attrition indicator is a dummy which equals 1 if an individual leaves the sample in our data period 2006-2009.

B Price equations formal childcare

For non-users of formal childcare we have to simulate a price for childcare. We have information on the use of formal childcare in the Netherlands for the period 2006–2009. Here, a distinction is made between daycare (children 0–3 years of age) and out-of-school care (children 4–11 years of age).

Again, we estimate a quasi-fixed effects model for the prices of daycare and out-of-school care.[43] Here, we follow the same procedure as for the wage estimations and estimate the following price equation:

$$p_{it} = x'_{it}\beta + \omega_i + \bar{x_i}'\pi + \lambda_t invmills_{it} + \epsilon_{it} \tag{A.4}$$

where the individual specific effect consists of a random part, ω_i with $\sim IID(0, \sigma^2_\omega)$, and a part which is allowed to be correlated with regressors $\bar{x_i}'\pi$. Here, $\bar{x_i}$ is the average of age which does not vary over time. Our dependent variable is the hourly real price.

We focus on households since childcare is consumed at the household level. As it turns out, characteristics of females are more important in predicting use and price of childcare than characteristics of men. Hence, we only include females characteristics in the regressions.

Table A.2 shows estimation results for daycare and out-of-school care.[44] Estimation results show that year dummies are significantly increasing for daycare. However, time effects are less important in the price equation for out-of-school care. Households with higher educated women or younger women pay a higher price on average. We do not find evidence that selection bias or attrition bias are present.

[43] We conduct a Hausman test in order to test whether fixed or random effects is appropriate. In all cases, the Hausman test favours the fixed effects model.

[44] Including a squared term for age, age splines, ethnicity, a dummy for age of the youngest child or a dummy for multiple children one at a time, leads to insignificant coefficients for each of these variables.

Table A.2: Price equation formal childcare

	Daycare	Out-of-school care
Year		
2007	0.058***	0.015
2008	0.123***	0.025
2009	0.153***	0.035
Higher educated women	0.000	0.020*
Age women	–0.017***	-0.031***
Single parent	0.033**	-0.047***
Mundlak age average	0.014**	0.026**
Inverse Mills' ratio	–0.032	-0.008
Attrition indicator	–0.001	0.005
Constant	5.507***	5.741***
Observations	35,675	28,938
Households	14,984	12,015

C Elasticities and shares with negative marginal utility by number of latent classes

Table A.3: Elasticities by number of latent classes: youngest child 0–3 yrs

	1 LC	2 LC	3 LC	4 LC
Gross hourly wage men +1%				
Labour supply men	0.09	0.08	0.03	0.09
– Extensive margin	0.08	0.07	0.01	0.07
– Intensive margin	0.01	0.01	0.02	0.02
Labour supply women	–0.15	–0.15	–0.21	–0.15
Formal childcare	0.10	0.11	0.05	0.05
Gross hourly wage women +1%				
Labour supply women	0.37	0.40	0.33	0.48
– Extensive margin	0.25	0.25	0.18	0.30
– Intensive margin	0.12	0.15	0.15	0.18
Labour supply men	–0.04	–0.05	–0.07	–0.06
Formal childcare	0.40	0.41	0.44	0.45
Gross price formal childcare +1%				
Formal Childcare	–0.61	–0.66	–1.09	–0.92
Labour supply men	0.00	0.00	0.00	0.00
Labour supply women	–0.13	–0.14	–0.15	–0.16
Observed choices with negative marginal utility income	0.00	0.00	0.00	0.00
Observed choices with negative marginal utility leisure men	0.74	0.39	0.00	0.08
Observed choices with negative marginal utility leisure women	0.38	0.36	0.09	0.00
Observed choices with negative marginal utility formal childcare	0.54	0.35	0.59	0.49

Table A.4: Elasticities by number of latent classes: youngest child 4–11 yrs

	1 LC	2 LC	3 LC	4 LC
Gross hourly wage men +1%				
Labour supply men	0.09	0.06	0.08	0.08
– Extensive margin	0.08	0.04	0.07	0.06
– Intensive margin	0.01	0.02	0.01	0.02
Labour supply women	–0.11	–0.07	–0.10	–0.11
Formal childcare	0.27	0.15	0.24	0.22
Gross hourly wage women +1%				
Labour supply women	0.38	0.47	0.44	0.48
– Extensive margin	0.25	0.31	0.31	0.29
– Intensive margin	0.13	0.16	0.13	0.19
Labour supply men	–0.03	–0.04	–0.07	–0.05
Formal childcare	0.45	0.77	0.71	0.83
Gross hourly price formal childcare +1%				
Formal Childcare	–0.36	–0.77	–0.70	–0.83
Labour supply men	0.00	0.00	0.00	0.00
Labour supply women	–0.02	–0.04	–0.04	–0.05
Observed choices with negative marginal utility income	0.00	0.00	0.09	0.08
Observed choices with negative marginal utility leisure men	0.78	0.17	0.26	0.41
Observed choices with negative marginal utility leisure women	0.41	0.22	0.34	0.02
Observed choices with negative marginal utility formal childcare	0.57	0.16	0.10	0.57

D Robustness check: including proxy for informal childcare

Table A.5: Elasticities for models w/o and w/ proxy informal childcare

	Couples 0-3 yrs		Couples 4-11 yrs	
	1 LC	2 LC	1 LC	2 LC
Model without proxy informal care				
Labour supply elasticity men	0.09	0.08	0.09	0.06
Labour supply elasticity women	0.37	0.40	0.38	0.47
Price elasticity formal childcare	–0.61	–0.66	-0.36	-0.77
Model with proxy informal care				
Labour supply elasticity men	0.09	0.07	0.10	0.06
Labour supply elasticity women	0.37	0.41	0.41	0.48
Price elasticity formal childcare	–0.62	-0.70	-0.42	-0.84

E Preferences and fit of preferred model

Table A.6: Preferences by latent class, youngest child 0–3 yrs

Latent class	1	2		1	2
Income	6.164**	15.812***	Fixed costs men	-8.885***	-11.758***
Leisure men	-66.223***	-74.155***	*Lower education	1.539**	0.522
*Age	0.367	0.663	*Middle education	1.483***	1.124
*Age^2	0.260	-1.393	*Non-Western immigrant	-0.830	-0.558
			*Western immigrant	-1.682***	-1.125*
Leisure female	-21.914***	-19.814**			
*Age	2.936	1.375	Fixed costs women	-2.520***	-2.550***
*Age^2	2.348	2.872	*Lower education	0.836	-0.674**
			*Middle education	0.484*	0.162
Income^2	2.250**	-3.646***	*Non-Western immigrant	-1.144***	-1.412***
Income*leisure men	21.444***	-2.799	*Western immigrant	-0.284	-0.868**
Income*leisure women	5.391	-8.189			
Leisure men^2	-48.270	-14.755***	Fixed cost childcare	0.690	0.365
Leisure women^2	-126.255***	-167.628***	*Non-Western immigr. men	-0.254	-0.466
Leisure men*leisure women	-0.392	-11.813	*Western immigrant men	0.993	-0.664
			*Lower education men	-0.428	-0.287
Childcare	-2.895***	-1.637**	*Middle education men	-0.267	-0.477**
*Urban area	0.643**	0.992***	*Non-Western immigr. women	-1.598	-1.261
*Non-Western immigr. men	-0.644	-0.135	*Western immigrant women	-0.999	-0.147
*Western immigrant men	0.841	0.587	*Lower education women	-1.737***	-0.766**
*Non-Western immigr. women	0.999	0.979	*Middle education women	-0.461**	-0.652***
*Western immigrant women	0.365	0.164	*Urban area	-0.859	-1.619**
Childcare^2	0.878	-0.135	Relative class shares	48%	52%
Childcare*income	0.943***	0.477*			
Childcare*leisure men	0.854	1.159			
Childcare*leisure women	-5.781***	-7.935***			

*** p<0.01, ** p<0.05, * p<0.1.

Table A.7: Preferences by latent class, youngest child 4–11 yrs

Latent class	1	2		1	2
Income	3.216	3.187***	Fixed costs men	1.475***	1.464***
Leisure men	13.879	14.486***	*Lower education	0.527	0.463
*Age	2.782	1.866***	*Middle education	0.630*	0.417
*Age^2	1.246**	1.216***	*Non-Western immigrant	0.622	0.484***
			*Western immigrant	0.622*	0.636***
Leisure female	7.477	7.318***			
*Age	1.362	1.428*	Fixed costs women	0.279***	0.287***
*Age^2	1.722	1.518***	*Lower education	0.271**	0.269
			*Middle education	0.232	0.235
Income^2	1.115	1.323***	*Non-Western immigrant	0.282	0.287***
Income*leisure men	5.684	6.258***	*Western immigrant	0.298	0.284
Income*leisure women	4.855	5.615***			
Leisure men^2	28.321	29.344***	Fixed cost childcare	0.469***	0.455***
Leisure women^2	12.140***	12.445***	*Non-Western immigr. men	1.863	178.637
Leisure men*leisure women	15.919	16.436	*Western immigrant men	1.226	2.655
			*Lower education men	0.378	0.357
Childcare	1.780**	1.150***	*Middle education men	0.276*	0.287
*Urban area	0.435*	0.591	*Non-Western immigr. women	0.873	0.869
*Non-Western immigr. men	1.183*	8.534	*Western immigrant women	0.696**	0.751
*Western immigrant men	0.860	1.366	*Lower education women	0.564***	0.399*
*Non-Western immigr. women	0.725	0.640	*Middle education women	0.266	0.279
*Western immigrant women	0.556***	0.823	*Urban area	0.544	0.569*
Childcare^2	0.299	0.346***	Relative class shares	42%	58%
Childcare*income	0.385	0.417***			
Childcare*leisure men	2.713***	2.860*			
Childcare*leisure women	1.495***	1.639***			

*** p<0.01, ** p<0.05, * p<0.1.

Fit labour supply men

Figure A.1: Age youngest child 0–3 yrs

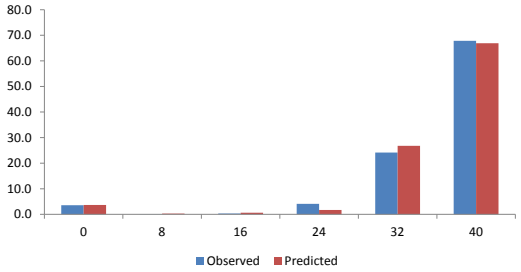
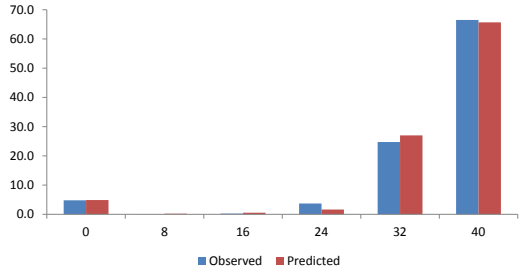


Figure A.2: Age youngest child 4–11 yrs



Fit labour supply women

Figure A.3: Age youngest child 0–3 yrs

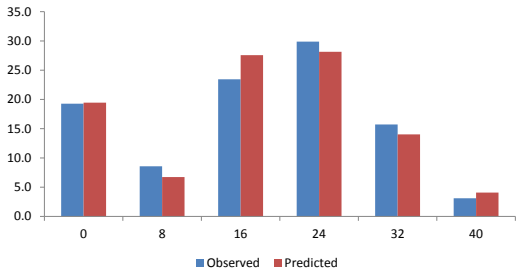
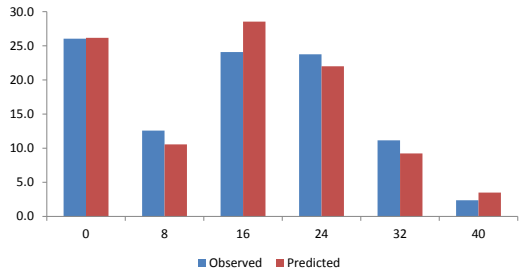


Figure A.4: Age youngest child 4–11 yrs



Fit formal childcare

Figure A.5: Age youngest child 0–3 yrs

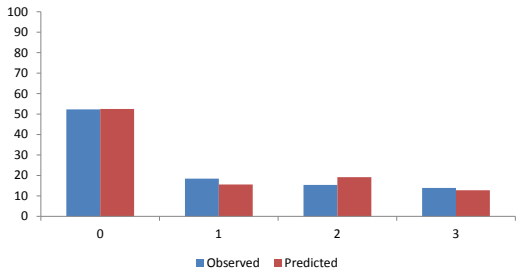
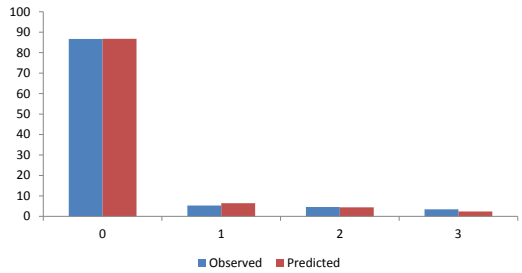


Figure A.6: Age youngest child 4–11 yrs



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