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Henk-Wim de Boer
Egbert L.W. Jongen
Jan Kabatek

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Henk-Wim de Boer
CPB Netherlands Bureau for Economic Policy Analysis
and VU University Amsterdam

Egbert L.W. Jongen
CPB Netherlands Bureau for Economic Policy Analysis

Jan Kabatek
Tilburg University, IZA and Netspar

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

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ABSTRACT

The Effectiveness of Fiscal Stimuli for Working Parents*

To promote the labor 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 effectiveness of different fiscal stimuli in an empirical model of household labor supply and childcare use. We use a large and rich administrative data set for the Netherlands. Large-scale reforms in childcare subsidies and in-work benefits in the data period facilitate the identification of the structural parameters. We find that an in-work benefit for secondary earners that increases with income is the most effective way to stimulate total hours worked. Childcare subsidies are less effective, as substitution of other types of care for formal care drives up public expenditures. In-work benefits that target both primary and secondary earners are much less effective, because primary earners are rather unresponsive to financial incentives.

JEL Classification: C25, C52, H31, J22

Keywords: discrete choice, household labor supply, latent classes, differences-in-differences, work and care policies

Corresponding author:

Henk-Wim de Boer
CPB Netherlands Bureau for Economic Policy Analysis
P.O. Box 80510
2508 GM The Hague
The Netherlands
E-mail: H.W.de.Boer@cpb.nl

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1 Introduction

In this paper we compare the effectiveness of different fiscal policies targeted at working families with children which aim to promote parental labor 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 related programs like pre-kindergarten and pre-school)[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 labor 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 stimulation of parental labor supply. Specifically, we consider how these policies compare to each other in terms of additional public spending required per additional (fulltime equivalent) employed, where we show that it is crucial to take into account the effects of behavioral responses on the government budget. Furthermore, we consider to what extent targeting these fiscal policies at different income

[1] See Blau (2003) for an 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 Earned Income Tax Credit (EITC) in the US and the Working Families' Tax Credit (WFTC) in the UK. See Meyer (2010) and Brewer and Browne (2006) and the references therein for empirical studies on the impact of the EITC and WFTC on employment, respectively.

groups affects their effectiveness, which highlights the equity-efficiency trade-off for these policies.

To study the effectiveness of fiscal policies targeted at working parents we develop and estimate a static structural model of parental labor supply and childcare use in the Netherlands. We use a large and rich administrative household data set[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 discrete choice model for the simultaneous choice of labor 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 behavioral 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 labor 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 identification 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 behavioral responses of the structural model, by comparing the simulated responses of the reform with the findings of a differences-in-differences analysis on the same reform but using a different data set (Bettendorf et al., 2015).[5]

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

[4]Building on the work by e.g. Van Soest (1995), discrete choice models have become a popular tool for the structural modelling of labor 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

Our main findings are as follows. First, we find that the structural model with latent classes predicts labor supply responses for fiscal reforms over the period 2005–2009 very much in line with the results from the difference-in-differences analysis. When we do not allow for latent classes, the structural model predicts behavioral responses that are too small. Second, we find that the most 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 (participation) and the intensive (hours per week) margin to a group of workers that is relatively responsive on both margins. Third, we find that childcare subsidies are less effective than in-work benefits for secondary earners, as substitution of other types of care for formal care drives up public expenditures, though childcare subsidies are still much more effective than in-work benefits that target both primary and secondary earners, because primary earners are rather unresponsive to financial incentives. Finally, 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. However, the knock-on effects, changes in public expenditures and receipts due to behavioral changes, are more favorable when childcare subsidies are targeted more at middle and high incomes, making childcare subsidies more effective per euro spent when targeted more at middle and high incomes.

The paper makes several contributions to the existing literature. 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 labor supply and childcare use that relied mostly on cross-sectional variation. Furthermore, the policy reform also allows for a quasi-experimental check on the behavioral 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; Geyer et al., 2014; Hansen and Liu, 2015). Also, with the structural model, we can study a number of issues that we could not study in the quasi-experimental analysis (as in Bettendorf et al., 2015). We can decompose the labor 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.[6] Furthermore, because our structural model is fully integrated with a detailed tax-benefit calculator, we are also able to study the effectiveness of fiscal stimuli for working parents in terms of additional employ-

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

[6]The structural model also allows us to predict the labor participation effects of a recent cut in childcare subsidies in the Netherlands, see appendix F.

ment generated per additional public euro spent. The integrated model allows us to go beyond back-of-the-envelope calculations on the effectiveness of different types of family policies (Blau, 2003; 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 labor supply and out-of-school care, next to a model for labor supply and daycare.

The paper is organized as follows. Section 2 describes the labor market and policy environment in the Netherlands. 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 labor 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 the differences-in-differences study. In Section 6 we use the structural model to compare the effectiveness of different fiscal stimuli for working parents. Section 7 concludes. An appendix contains supplementary material.

2 Labor 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 somewhat higher participation rates in e.g. Norway and Sweden, and the somewhat lower participation rates in e.g. the US and the UK.[8]

[7] This section draws heavily on Bettendorf et al. (2015).

[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 labor 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 labor 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 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. In 2004, 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 enroll-

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 (on average approximately 36 hours per week in 2004) are 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.

ment rate of 4–12 year olds 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], and 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 0.4 and 0.2% of GDP on these policies on the other (OECD, 2014).

[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 than for out-of-school care.

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

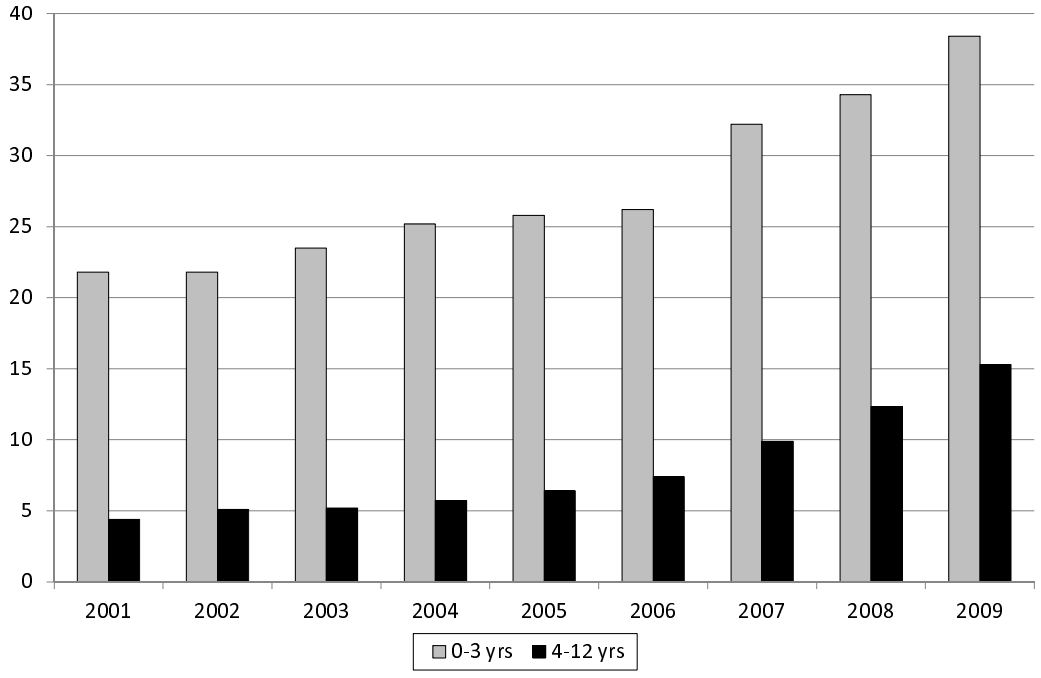
[15] Despite the steep increase in the subsidy rate, the average prices of formal childcare places grew more or less in line with the CPI.

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

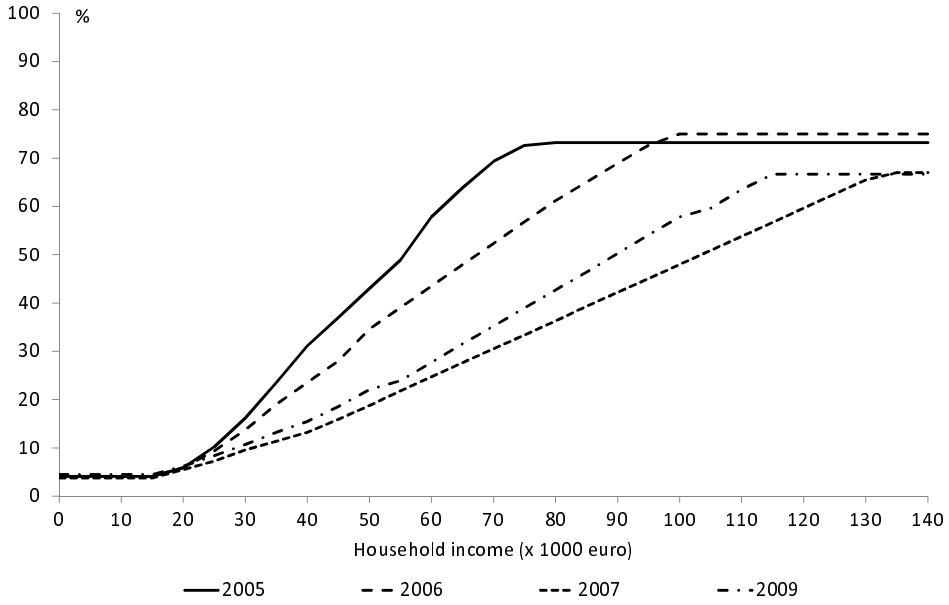
Source: Ministry of Finance (2010) and own calculations (imputation of employers' contribution for childcare up to 2007 with data from the Ministry of Social Affairs and Employment (personal communication) and split of the in-work benefits for parents in its two components using the MIMOSI model of CPB). [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.

Figure 1 shows the corresponding rise in the use of formal childcare 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).

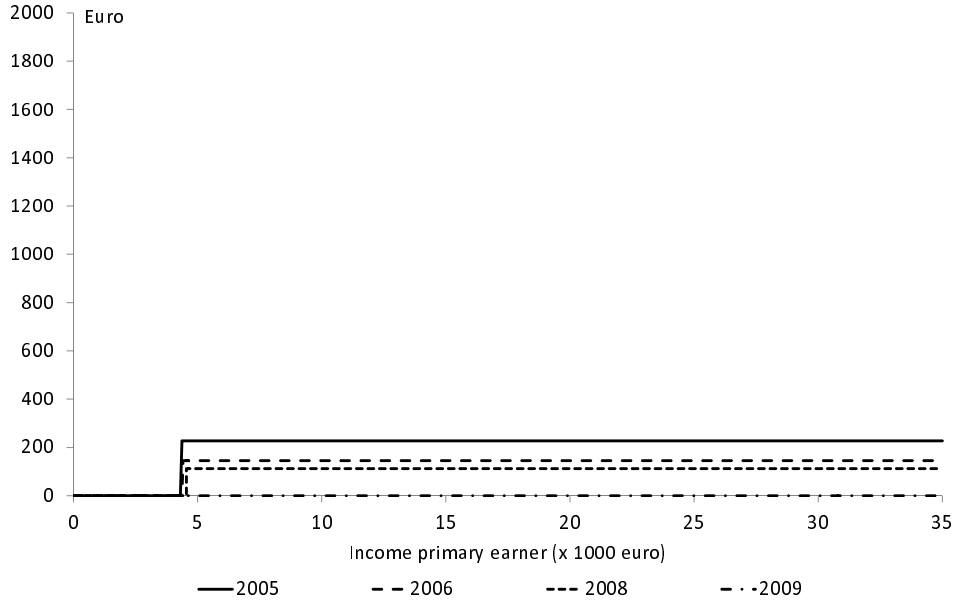
The period 2005–2009 also witnessed a number of changes in in-work benefits for working parents. Figure 3 shows the level of the Combination Benefit (*Combinatiekorting*) per year over this period. All working parents with a youngest child less than 12 years of age qualify for this in-work benefit.[16] Furthermore, the in-work benefit was independent of the level of earned income, provided earned income was above a certain (low) threshold (approximately 25% of the annual gross minimum wage). The Combination 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 Benefit (*Inkomensafhankelijke Combinatiekorting*) per year by earned income over the period 2005–2009.[17]

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

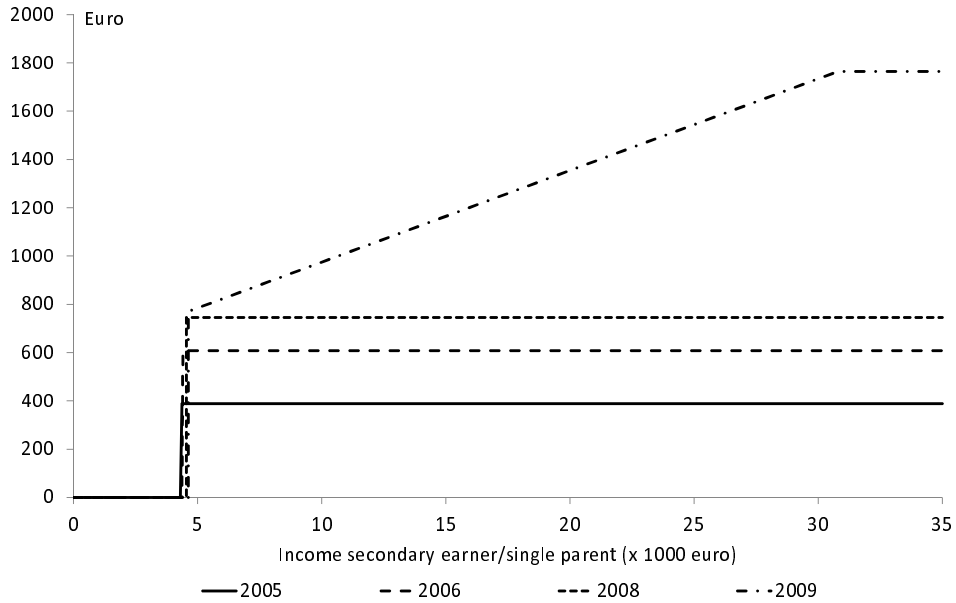
[17]Up to 2008 the *Inkomensafhankelijke Combinatiekorting* was called the *Aanvullende Combinatiekorting* (Additional Combination Benefit).

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.

Secondary earners (and single parents) qualify for this in-work benefit, but the primary earners do not. This benefit was introduced in 2004. Up to 2008, there was a gradual increase in the benefit, and the size of the benefit did not depend on earned income (again provided that earned income exceeded a certain low threshold of approximately 25% of the annual gross minimum wage). In 2009 this benefit became income dependent, with a phase-in rate of 3.8% for income above the threshold. The maximum benefit 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 Benefit, for which both primary and secondary earners were eligible, to the Income-Dependent Combination Benefit, for which only secondary earners (and single parents), typically mothers, were eligible. Indeed, public expenditures on the Combination Benefit dropped from 484 million euro in 2005 to 0 in 2009, whereas public expenditures on the Income-Dependent Combination Benefit 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.[19] 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.

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.[20] For the

[18] For comparison, in 2009 the annual gross minimum wage of a fulltime worker was 18,013 euro.

[19] We could not find internationally comparable data on total public spending on in-work benefits for families with children.

[20] We do not observe informal childcare in our administrative data set. In a robustness check we include a proxy for the use of informal childcare as an additional argument in the utility function. We assume that parents coordinate their hours worked so as to minimize the use of childcare. Total demand for childcare then equals $c_{tot} = \max((h_m + h_f - \overline{h}), 0)$, where $\overline{h}$ equals hours per week in a fulltime job. The demand for informal childcare is then given by $c_{inf} = \max((c_{tot} - c), 0)$, where for simplicity we do not distinguish between informal care and hours spent at school for households with a youngest child 4–11 years of age. Including informal childcare leads to similar labor supply and childcare elasticities as the base model, see appendix E.

functional form of U^s we use the flexible log-quadratic specification

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

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.[21] 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 appendix C).

Disposable household income is given by

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

where w_m and w_f denote the gross hourly wage for the male and the female,[22] $T(.)$ 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 (e.g. the ages of the children).

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

[21] 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 other household production).

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

a Heckman selection model. We account for wage heterogeneity by taking multiple draws from the estimated 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 a Heckman selection model for gross hourly childcare prices, again taking multiple draws from the estimated gross hourly price error distribution.[23]

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 (McFadden, 1978).

We also allow for the possibility that families which are observationally equivalent might have different tastes for work and formal childcare. Specifically, 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

[23] A detailed description of the empirical specification and the estimation results for the Heckman selection models for gross hourly wages and gross hourly childcare prices can be found in appendices A and B, respectively.

[24] Limiting the distributional assumptions on unobserved heterogeneity by using mass points was pioneered by Heckman and Singer (1984). Recently, Train (2008) has shown that the Expectation-Maximization (EM) algorithm offers a tractable way of estimating latent class discrete choice models. Indeed, the likelihood frontier is likely to violate global concavity, which renders the solution by conventional methods based on maximum likelihood practically infeasible. For a discussion of the benefits of latent class models within the domain of structural labor supply modelling, see Apps et al. (2012). For an overview of their implementation and potential computational improvements, see Kabátek (2013).

vectors θ_k. The resulting log-likelihood function of the finite mixture model has the following form

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

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.

4 Data

We use the Labour Market Panel (LMP, *Arbeidsmarktpanel* in Dutch) of Statistics Netherlands (2012). The LMP is a large administrative household panel data set with annual data for the period 1999–2009. The LMP contains a rich set of individual and household characteristics, including gender, month and year of birth, the highest completed level of education and ethnicity for all adult members of the household, the ages of the children and the area of residence. The LMP also contains administrative data on hours worked and gross income from different sources (wages, profits, benefits etc.). Furthermore, the LMP contains administrative data on the use and gross hourly price of formal childcare for each child participating in formal childcare. Unfortunately, the data on formal childcare is only available for the shorter period 2006–2009, hence we restrict the analysis to this period.

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[26], and therefore we restrict the sample to couples with a youngest child 0 up to and including 11 years of age. We exclude couples in which at least one parent is either self-employed (8% of observations) or has multiple sources of income (7% of the remaining observations), 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 (3% of the remaining observations), assuming that they are constrained in their labor supply choice.

[25] The number of draws in our specification is 10, and it is kept relatively low to limit the computational complexity of the model. Increasing the number of draws did not change the predictions of our model.

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

Table 2: Descriptive statistics by gender and by 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	0.50	0.50	0.13	0.34	0.50	0.50	0.13	0.34
Hours formal childcare per week[d]	27.1	16.2	14.4	11.1	27.1	16.2	14.4	11.1
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]Hours of formal childcare per week per couple using formal childcare.

After these selections are made, we further drop couples with missing information on individual or household characteristics (7% of the remaining observations). This leaves us with 61,220 observations (couples 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%.[27] This leaves us with 4,170 observations for couples with a youngest child 0–3 years of age (pre-primary school age)[28], and 5,013 observations for couples with a youngest child 4–11 years of age (primary school age).

[27]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 stabilize once we take a 15% subsample.

[28]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.

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. 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. However, 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 that also contributes to the relatively high participation rate of mothers with a youngest child 0–3 years of age compared to mothers with a youngest child 4-11 years of age. In general, cohort effects should be kept in mind when interpreting the estimation results for both samples. The majority of couples lives in smaller cities and towns (<150,000 inhabitants).[29] 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 participation rate is 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 (due to the cohort effect discussed before). Finally, couples with a youngest child 0–3 years of age are more likely to use 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[30], compared to 13% for couples 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 couples that do use formal childcare, which is much lower for couples with a youngest child 4–11 years of age.

We discretize the data for the discrete choice model. Both parents can choose from 6 labor supply options: working 0, 1, 2, 3, 4 or 5 days per week, where each day equals 8 hours.[31] For childcare, we allow for 0, 1, 2 and 3 days[32], where the data show that a typical day in a daycare centre equals 10 hours[33], and a typical day in out-of-school care

[29]Most cities in the Netherlands have less than 150,000 inhabitants.

[30]The share of households using formal childcare is higher than the share of children in formal childcare in Figure 1. Figure 1 also includes children from households who are not eligible for childcare subsidies such as households with disability benefits. Furthermore, households that have many children typically use less formal childcare on average.

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

[32]The data show that using formal childcare for more than 3 days per week is rare in the Netherlands. The remaining childcare needs are usually accomodated by informal carers or parental time.

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

equals 5 hours.[34] The full choice set for each household is $6 \cdot 6 \cdot 4 = 144$ alternatives.

To determine disposable household income in each discrete option we use the advanced tax-benefit calculator MIMOSI (Romijn et al., 2008). MIMOSI is the official tax-benefit calculator of the Dutch government for the (non-behavioral) 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[35]) 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 gross 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[36]). 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.[37] In accordance with the law, we ensure that household disposable income (excluding childcare costs and childcare subsidies) can not drop below the social assistance (subsistance) level for couples with 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 behavioral responses.

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 labor supply incentives faced by the two groups of households (Bernal, 2008).

As discussed in Section 3, to account for unobserved heterogeneity, we allow each group

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

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

[36] When one of the parents becomes unemployed, the couple is still entitled to childcare subsidies for the remainder of the fiscal year.

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

of households to be further divided into several unobserved types (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 labor supply and formal childcare elasticities, prove to be relatively stable for specifications with two and more latent classes, see Table A.5 and A.6 in appendix D. Therefore we have decided to use the most parsimonious model which would generate elasticities qualitatively similar to those of more-stratified models, opting for the specification with two 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.3 and A.4). Rather than interpreting the individual coefficients, we focus on elasticities derived from the estimated structural parameters. First, consider the labor supply elasticities in Table 3. For an increase in the gross hourly wage of 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.[38] We also find a modest elasticity of the use of formal childcare with respect to the gross hourly wage of men.

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.[39] We also find negative cross-elasticities for men, but these cross-elasticities are considerably smaller than for women. Following the larger female labor 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 than 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, labor supply by men and labor 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 labor supply of men, but a significant negative effect

[38] However, note that women work fewer hours than men. In the end, the effect on total hours worked by both spouses is therefore close to zero (not reported in the table).

[39] 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.

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 labor 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 labor 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] DD estimates drawn from the same sample as in Bettendorf et al. (2015), full regression results available on request.

on the labor 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 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.[40] Our results for the net price elasticity of labor 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 labor supply choice, and hence do not impose a 1-to-1 link between the two, the elasticity of labor 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 lower (–0.03), which is partly a result of the lower share of women using formal care in this group.[41]

Table 5 compares the predictions of the structural model with the results of a quasi-experimental study. Bettendorf et al. (2015) analyse the employment effects of the reforms discussed in Section 2 using difference-in-differences (DD). The identification in Bettendorf et al. (2015) 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. (2015) 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. (2015) 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

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

[41] Table A.7 in appendix E gives the resulting elasticities when we include a proxy for informal childcare. The elasticities are similar to the base model.

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 favor a model with latent classes over a model with homogenous treatment of preferences.

6 Relative effectiveness of fiscal stimuli

We use the empirical model to study the effectiveness of different fiscal stimuli for working couples with children. The policy reforms we consider are motivated by the actual reforms that have occured in the Netherlands over the past decade. However, 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) the introduction of an (additional) in-work benefit for secondary earners, and iii) the introduction of an in-work benefit for both primary and secondary earners. For each of these fiscal stimuli we consider two types of reforms: a) a subsidy/benefit that does not depend on income, and b) a subsidy/benefit that rises with income. Comparing the results for the income independent and income dependent subsidy/benefit we can study to what extent there is an equity-efficiency trade-off for the different types of fiscal stimuli.

The baseline scenario is the subsidy scheme of the childcare subsidy in 2009, applied to all years in our data set, with an average subsidy rate for childcare of 76%. To make the impulses comparable, in all simulations we consider the effects of a reform that costs 100 million euro given the initial distribution of labor supply and childcare choices. Then, when we calculate the effectiveness of the different policies, we compare the increase in

total hours worked to the public expenditures including behavioral responses. Indeed, so-called knock-on effects on public expenditures will play an important role in the relative effectiveness.

First, we consider the results for the following three reforms:

(1) An increase in the childcare subsidy by 10.3%-points of the hourly price.

(2) An annual in-work benefit for secondary earners of 290 euro.

(3) An annual in-work benefit for primary and secondary earners of 126 euro.

Figure 5, 7 and 9 give the redistributional effects of these reforms, respectively. On the horizontal axis is initial disposable household income, on the vertical axis is the percentage change in disposable household income. None of these reforms depends directly on income: 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 their number of children, and the number of days of formal childcare they use. Although the change in the subsidy itself does not depend on income, it is implicitly targeted more at middle and higher incomes because they use more formal childcare than lower-income families. Accordingly, there is a positive effect of the reform on the Gini-coefficient for disposable household income (before behavioral changes), reported in column (1) in Table 6. Figure 7 shows two lines for the in-work benefit for secondary earners. One line on the horizontal axis for couples in which at least one of the partners does not work, and a second, higher line for two-earner couples. As low income households benefit more in percentage terms, this reform leads to a decline in the Gini-coefficient, 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. This reform is targeted even more at lower incomes, in percentage terms, and the Gini-coefficient falls the most in this scenario, see column (3) in Table 6.

Table 6 presents the effects on labor participation, formal childcare and public finances. Column (1) gives the results for the increase in the childcare subsidy. First, consider the effects on labor participation of couples with a youngest child 0–3 years of age. The overall effect on hours worked by men is small. However, there is a substantial positive effect on both the extensive and the intensive margin for women.We observe similar though

Effect on initial incomes: childcare subsidies

Figure 5: Not targeted

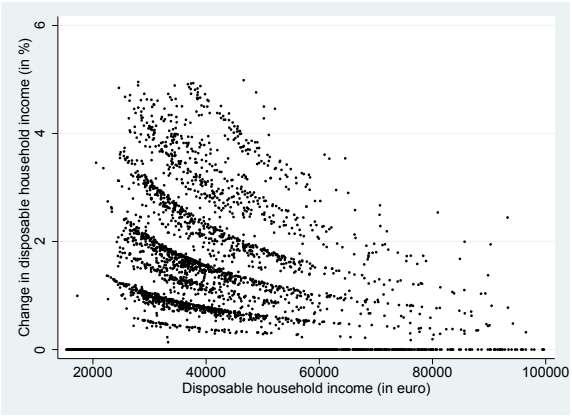
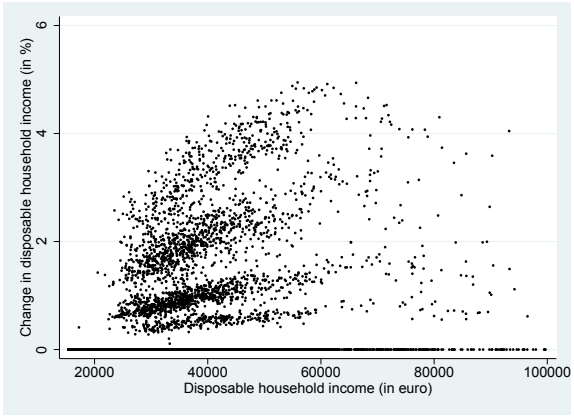


Figure 6: Targeted more at higher incomes



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

Figure 7: Not targeted

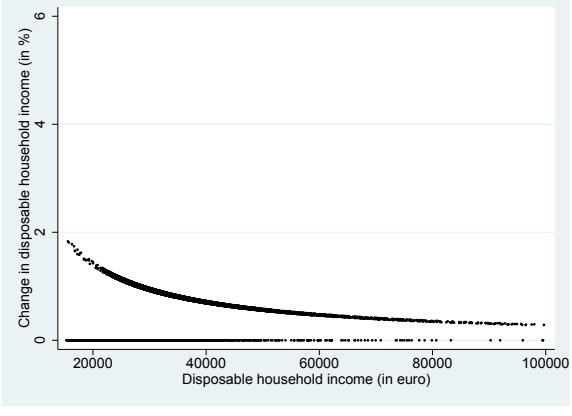
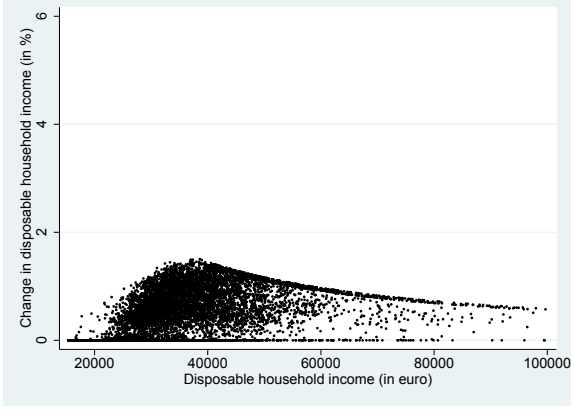


Figure 8: Targeted more at higher incomes



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

Figure 9: Not targeted

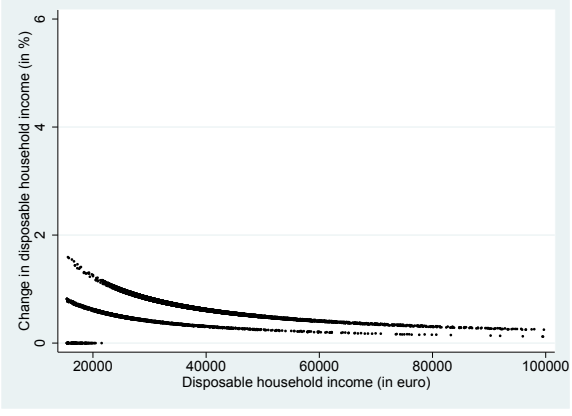


Figure 10: Targeted more at higher incomes

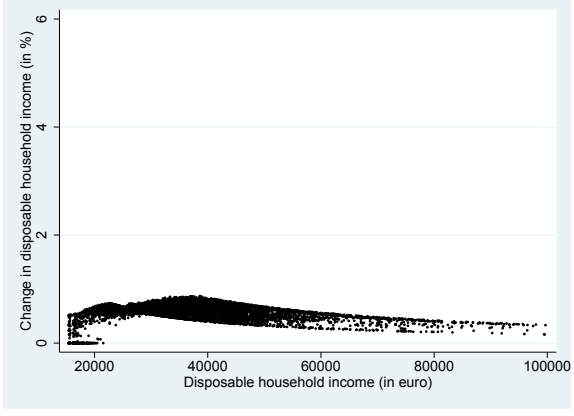


Table 6: Effectiveness of fiscal stimuli of 100 million euro

	Not targeted			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					
Inequality						
Gini coefficient	0.35	-0.10	-0.34	0.93	0.53	-0.14
Labour supply						
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						
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
Effectiveness			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

somewhat smaller labor supply effects for couples with a youngest child 4–11 years of age. 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. Overall, total hours worked by couples with a youngest child 0–11 years of age increases by 0.55%.

Couples with a youngest child 0–3 years of age increase their demand for childcare by 11.54%, whereas couples with older children demand 16.28% more childcare. This corresponds to an increase in hours of childcare per week of 1.77 and 0.33 hours, respectively. Men in couples increase their labor supply by just 0.01 hours per week. The average increase for women is 0.44 and 0.13 for mothers with a youngest child 0–3 and 4–11 years of age, respectively. Hence, the rise in formal childcare is much bigger than the rise in total hours worked, which underscores that there is not a 1-to-1 link with hours worked.

Finally, we consider the effects on public finances, excluding and including knock-on effects. The increase in hours worked increases tax receipts and reduces benefit expenditures by 53 million euro. However, this effect is dominated by the sizable increase of childcare subsidy expenditures (132 million euro).[42] Indeed, many couples switch to formal childcare, and with an average subsidy rate for formal childcare in the base of 76% of the gross hourly price, this makes the childcare reform rather costly to the government. In the last three rows we calculate the additional public spending per additional fulltime equivalent (fte) employed. Ignoring knock-on effects, additional public spending per additional fte is 28 thousand euro. Taking into account the increase in formal childcare, additional public spending per additional fte rises to 65 thousand euro. Finally, taking into account additional tax receipts and savings on benefits, we arrive at 51 thousand euro per additional fte.

Column (2) in Table 6 gives the behavioral responses and corresponding budgetary effects for the in-work benefit targeted at secondary earners. The effect on the labor supply of men is again small. In contrast to reform (1), the effect on hours worked by women with children 0–3 years of age is smaller than the effect for women with older children. This is due to the fact that the benefit is not conditioned on the use of formal child care. A large part of the in-work benefit therefore goes to the mothers with a youngest child 4–11 years of age who, due to their lower utilization of childcare, were not among the main beneficiaries of the first reform. It is interesting to note that the intensive margin response is negative for women with children in both age groups (for working women the in-work benefit only generates an income effect).

Since the in-work benefit does not affect the price of formal childcare for parents, reform (2) has only a modest effect on the use of formal childcare. This is also reflected

[42]The 132 million euro is in addition to the initial 100 million euro.

in the knock-on effects for the government. Because reform (2) leads to lower overall stimulation of hours worked, the knock-on effect in terms of taxes and benefits is smaller than for reform (1). However, more important is the smaller knock-on effect in terms of childcare subsidy expenditures. In the end, reform (2) generates a positive knock-on effect of 9 million euro. For reform (2), ignoring knock-on effects, additional public spending per additional fte employed is 55 thousand euro. Taking into account the positive and negative knock-on effects, this becomes 50 thousand euro. Hence, taking into account the knock-on effects, we find that reforms (1) and (2) are about equally effective in raising additional labour supply per additional euro spent.[43]

Column (3) in Table 6 gives the results of the in-work benefit for both primary and secondary earners. In this senario, a large part of the subsidies goes to men in couples with children, who hardly respond to financial incentives. As a result, the effects are much smaller than in reforms (1) and (2). We still see a positive effect on the extensive margin, and a 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 the third scenario the most expensive reform in terms of spending required per marginal full time worker. Indeed, additional public spending per additional fte employed is close to 181 thousand euro.[44] We should note though, that this reform leads to a bigger drop in inequality than reform (2). With this effect on inequality in mind, the results for reforms (1)–(3) suggest that the Dutch shift from the system of in-work benefits for all parents to the system combining in-work benefits for secondary earners and higher childcare subsidies was effective in terms of raising total hours worked.

Next, we consider the trade-off between equity and efficiency by simulating reforms

[43]Note however, that reform (1) goes at the expense of greater inequality, whereas reform (2) actually reduces inequality.

[44]Even less effective for labor supply by couples would be an EITC along the lines of the EITC in the US. The EITC in the US depends on household income and is targeted at low incomes, see e.g. Meyer (2010) for an extensive discussion of the EITC in the US and the resulting behavioral responses. For couples, this EITC increases the effective tax rate for the elastic group of secondary earners, both on the extensive and the intensive margin. We simulate the introduction of the following EITC in our sample. For households with one child, the phase-in range of the EITC runs from €0 to €8,971, with a phase-in rate of 34%, until the maximum level of €3,051 is reached. Next, the EITC remains constant from €8,971 to €16,457. The phase-out range runs from €16,457 to €35,545, with a phase-out rate of 16%. For households with more than one child, the phase-in range of the EITC runs from €0 to €12,607, with a phase-in rate of 40%, until the maximum level of €5,043 is reached. Next, the EITC remains constant from €12,607 to €16,457. The phase-out range runs from €16,457 to €40,402, with a phase-out rate of 21%. We find that this EITC actually reduces labor supply by couples with children by 3.3%. These results are in line with the findings of Eissa and Hoynes (2004), who report a large negative effect of the EITC on labor participation by women in couples in the US.

that are targeted more at middle and higher incomes. Specifically, we study the effects of the following three reforms:

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

(5) An in-work benefit for secondary earners starting at zero at an annual gross labor income of 4,000 euro, and then rising with 2.2% per euro of income up to a maximum of 581 euro at an income of 30,000 euro.

(6) An in-work benefit for primary and secondary earners in couples, starting at zero at an annual gross labor income of 4,000 euro, and then rising with 0.6% of income up to a maximum of 168 euro per year at an income of 30,000 euro.

The redistributional effects of these reforms are given in Figure 6, 8 and 10, respectively. 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). If there is a trade-off between equity and efficiency, we would expect these reforms to be more effective in terms of labor 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. The effect on total labour supply is quite similar to reform (1), with the effect on men being more favorable and the effect for women being less favorable. There is no apparent trade-off for childcare subsidies when looking only at hours worked. This suggests that the current system in the Netherlands, which targets subsidies mostly at low incomes, is not detrimental to hours worked.[45] However, the knock-on effects are more favorable 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 more favorable knock-on effects, additional public spending per additional fte employed is more favorable 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

[45]The case for targeting childcare subsidies at low income households becomes stronger when participation in childcare benefits children from low income households more than children from middle and high income households, as suggested by the empirical evidence presented in e.g. Blau and Currie (2006) and Havnes and Mogstad (2015).

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 of childcare subsidies.

Column (5) shows that the in-work benefit for secondary earners that rises with income has a bigger effect on hours worked than reform (2). 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 favorable. Indeed, 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, there is also a trade-off here 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 in-work benefit for primary and secondary earners. The overall effect on hours worked and government finances is slightly better than for the flat benefit 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 the costs per additional fte employed of 140 thousand euro are still rather unfavorable.

Reforms (4)–(6) show that there is indeed a trade-off between equity and efficiency, targeting fiscal stimuli more towards working parents with a middle or higher income leads to a larger increase in hours worked per additional public euro spent. However, the trade-off is less pronounced for childcare subsidies than for in-work benefits.

We conclude the discussion of the policy simulations with two important caveats. First, we consider reforms starting out of a base in which the average childcare subsidy rate is 76%. This makes a further increase in childcare subsidies rather costly for the government, because for each additional hour of formal childcare the government has to pay 76% on top of the increase in the childcare subsidy. To study the extent to which the effectiveness of childcare subsidies falls with the level of the subsidy rate we have simulated two more reforms: i) reducing childcare subsidies by 50%, and ii) reducing childcare subsidies by 100%. The corresponding savings for the government per fte lost are 40,375 and 29,933 euro, respectively. This shows that when we start from a very low initial childcare subsidy rate, the marginal effectiveness of childcare subsidies can be

comparable or even higher than in-work benefits for secondary earners.[46] Second, childcare subsidies and in-work benefits for secondary earners that increase in income may be more effective in the Netherlands than in other countries. Indeed, Bargain et al. (2014) show that intensive margin responses of women in couples in the Netherlands are relatively large when compared to other developed countries. However, it is a priori unclear to what extent this affects the relative effectiveness of childcare subsidies versus in-work benefits for secondary earners.

7 Conclusion

We have estimated a structural model for 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), where we model the simultaneous choice over hours worked by fathers, hours worked by mothers and the hours of formal childcare use. Large exogenous variation in childcare subsidies and in-work benefits facilitates the identification of the structural parameters. Furthermore, we account for unobserved heterogeneity by using a flexible framework of latent class models. The model produces labor supply responses to reforms over the period 2005–2009 similar to a difference-in-differences analysis.

We use this model to study the relative effectiveness of different types of fiscal stimuli for working parents with young children. We find that the most effective fiscal stimulus for working parents is an in-work benefit targeted at secondary earners that rises with income. Childcare subsidies are less effective than in-work benefits for secondary earners, because substitution of other types of care for formal care drives up public expenditures. However, childcare subsidies are still much more effective than in-work benefits that target both primary and secondary earners. Primary earners are rather unresponsive to financial incentives. We also find that there is a trade-off between equity and efficiency for these fiscal stimuli, the effect on hours worked per additional public euro spent is bigger when we target the policies more at middle and high incomes. However, the trade-off is less pronounced for childcare subsidies than for in-work benefits.

An interesting direction for future research 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

[46] This is in line with the findings of (Blau, 2003, pp. 506-507), who shows that starting from a base where there is no childcare subsidy, a marginal increase in childcare subsidies is likely to be more cost-effective than an in-work benefit for mothers (which is closely related to the income independent in-work benefit for secondary earners we consider).

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, 2015). 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 behavioral 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 gender 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 perform 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 the 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 the wage increases with age but at a diminishing rate. 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.[47] Year dummies are significant in most specifications while the cohort variables

[47] 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
Individuals	26,779	49,634	37,742	19,385	44,262	26,770

[a] Reference group: born in 1965–1970 and autochtonous. *** p<0.01, ** p<0.05, * p<0.1.

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 straightforward 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.[48] The attrition indicator is not significant for all subgroups.

[48]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.[49] 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 the use and gross 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.[50] 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.

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

[50] 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[a]	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

[a] Reference group: lower educated women in couples.
*** p<0.01, ** p<0.05, * p<0.1.

C Preferences and fit of preferred model

Table A.3: 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.4: Preferences by latent class, youngest child 4–11 yrs

Latent class	1	2		1	2
Income	3,313***	-10,189***	Fixed costs men	-4,935***	-27,306***
Leisure men	-22,692	-301,521***	*education low	0,504*	-0,098
*age	-2,875	17,586***	*education mid	1,067***	-0,503
*age^2	2,597**	-3,716***	*non-Western immigrant	-0,520	-2,961***
			*Western immigrant	-1,132***	2,719***
Leisure female	-11,029	-61,631***			
*age	0,301	2,436*	Fixed costs women	-1,205***	-2,684***
*age^2	-1,426	6,689***	*education low	-0,557***	-0,044
			*education mid	-0,236**	0,064
Income^2	-0,981**	11,441***	*non-Western immigrant	0,405**	-1,752***
Income*leisure men	-3,274***	59,227***	*Western immigrant	-0,398	0,313*
Income*leisure women	-2,971***	26,830***			
Leisure men^2	-12,534	-425,783***	Fixed cost childcare	-3,484***	-2,257***
Leisure women^2	-57,708***	-201,181***	*non-Western immigr. men	-0,778**	-0,327
Leisure men*leisure women	-17,181	25,459	*Western immigr. men	1,008	-1,847**
			*education low men	0,065*	-0,101
Childcare	-2,637**	-4,094***	*education mid men	-0,534*	-0,113
*urban area	0,748*	-0,571	*non-Western immigr. women	0,109	0,991
*non-Western immigr. men	2,075*	-2,146	*Western immigr. women	1,441**	0,482*
*Western immigr. men	-0,176	1,396	*education low women	-2,247***	-0,703*
*non-Western immigr. women	-1,074	0,960	*education mid women	-0,256	-0,287
*Western immigr. women	-1,742***	-0,304	*urban area	-0,686	1,086*
Childcare^2	-0,468	-1,017***	Relative class shares	44%	56%
Childcare*income	0,170*	1,425***			
Childcare*leisure men	-7,435***	-5,463*			
Childcare*leisure women	-7,980***	-13,451***			

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

Fit labor supply men

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

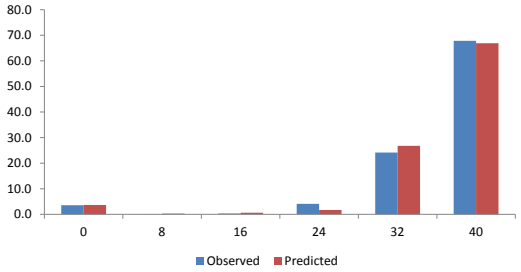
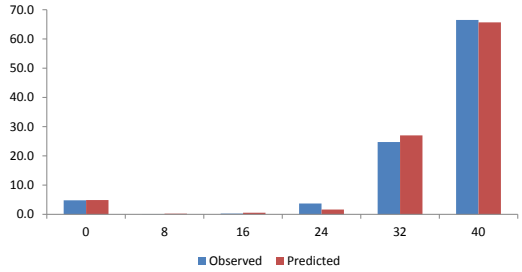


Figure A.2: Age youngest child 4–11 yrs



Fit labor supply women

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

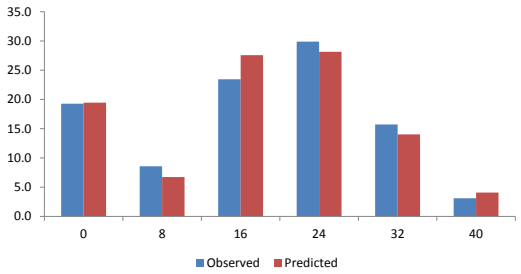
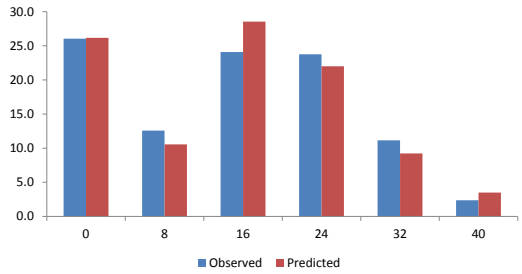


Figure A.4: Age youngest child 4–11 yrs



Fit formal childcare use

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

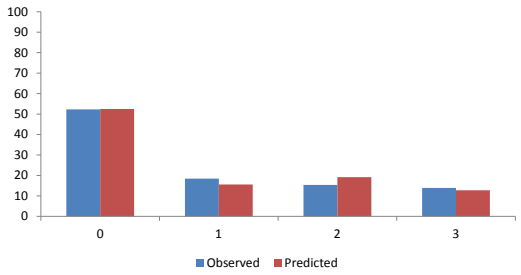
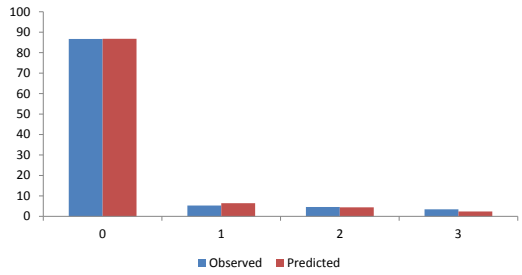


Figure A.6: Age youngest child 4–11 yrs



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

Table A.5: 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.6: 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

E Robustness check: including proxy for informal childcare

Table A.7: 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

F Simulating the 2011-2013 childcare reform

With the empirical structural model we can also simulate the effects of recent cuts in childcare subsidies. 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 subsidies over the period 2011–2013. 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 A.7. The simulated effects on labor participation, formal childcare use and public finances are given in Table A.8.

The reform is projected to have only a small negative effect on hours worked by fathers. The effect is projected to be 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 A.7: Redistributional effects childcare reform 2011–2013

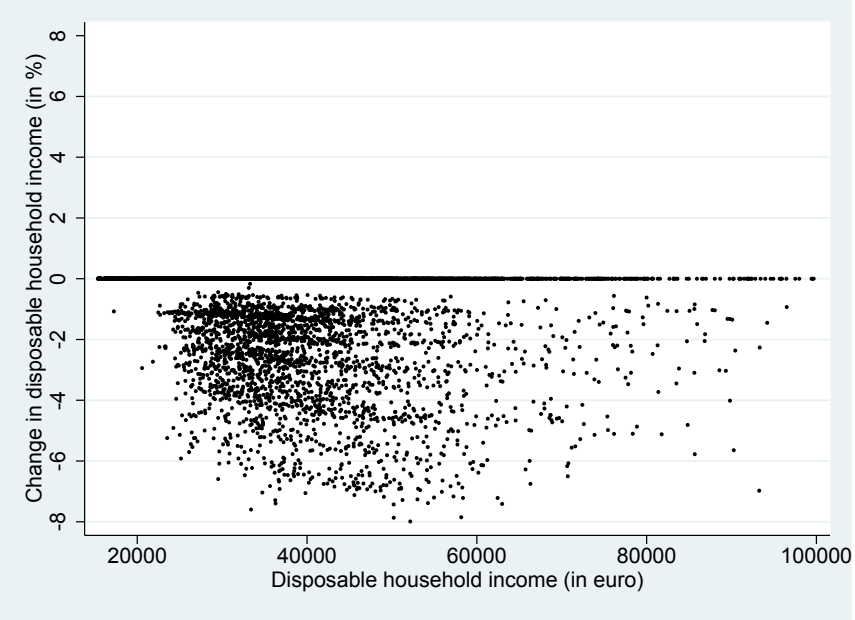


Table A.8: Simulation results: childcare reform 2011–2013

	Youngest child 0–3 yrs		Youngest child 4-11 yrs
	Percentage changes		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.