Comparing the effectiveness of fiscal stimuli for working parents

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Preliminary and unfinished work – do not quote

Abstract

We estimate a structural model for household labour supply and childcare use. Using the estimated structural parameters we simulate the effect of changes in childcare subsidies and in-work tax credits. We consider the effect on labour participation, the income distribution and government finances. External validation of the structural model comes from a comparison of a simulation of the policy reforms in our data period with the estimates from a difference-in-differences analysis on the same reforms. In-work credits are more effective in stimulating labour supply of young mothers than childcare subsidies. Both policies are more effective than an across-the-board reduction in marginal tax rates. (PM Targeting of childcare subsidies and in-work tax credits.)

JEL classification codes: C25, C52, H31, J22

Keywords: Discrete choice models, household labour supply, latent classes, childcare subsidies, in-work tax credits

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1 Introduction

Many countries want to increase the labour participation of women to reduce the gender gap in participation rates and to improve the sustainability of public finances. The participation rates of men and women start to diverge after children are born. Two key fiscal instruments that are used to stimulate the labour participation of especially mothers with young children are childcare subsidies and in-work tax credits. A substantial number of countries/states have expanded childcare subsidies and public pre-kindergarten programs over the past two decades[1], and/or have introduced or intensified tax credits for working parents.[2] However, what is the most effective way to stimulate the labour participation of young mothers remains rather unclear. Estimates of the labour supply effect of childcare subsidies range from basically no effect to large effects.[3] Studies on in-work tax credits typically find sizeable positive employment effects[4], but no comparison is made with the effectiveness or related fiscal policies.

In this paper we study the effectiveness of the two key fiscal policies targeted at working women, childcare subsidies and in-work tax credits, and also compare their effectiveness relative to an across-the-board reduction in tax rates. We first estimate a structural model for the simultaneous choice of household labour supply and formal childcare use. We study both couples with children and single parents. To deal with the kinks and non-convexities in the budget set (due to the tax-benefit system), we estimate a discrete choice model. We use a large administrative household panel data set on labour supply and the use of formal childcare in the Netherlands. We determine the discrete budget sets with a highly advanced tax-benefit calculator to determine net wages and childcare subsidies. The data period 2006-2009 covers a large reform of childcare subsidies and in-work tax credits for working parents. The joint reform has previously been studied by Bettendorf et al. (2012) using quasi-experimental methods (difference-in-differences), which allows for an external validation of our structural model.

Our main findings are the following. First, we find that in-work tax credits are more effective in stimulating labour participation than childcare subsidies. This is because part

[1] Examples include Argentina, The Netherlands, Spain, Sweden, the province of Quebec in Canada, and the states of Georgia and Oklahoma in the US.

[2] Examples are the Combination Credit in the Netherlands, the Working Families' Tax Credit in the UK and the Earned Income Tax Credit in the US.

[3] E.g. Lundin et al. (2008), Fitzpatrick (2010) and Havnes and Mogstad (2011) find no effect, Bettendorf et al. (2012) find small effects, and Berlinski and Galiani (2007) and Lefebvre and Merrigan (2008) find large effects.

[4] For an overview of studies into the impact of the EITC in the US see Hotz and Scholz (2003), and for an overview of studies into the impact of the WFTC in the UK see Brewer and Browne (2006).

of the childcare subsidies are 'lost' to substitution of informal by formal care. Second, both policies are more effective in stimulating labour participation than an across-the-board reduction in tax rates. Third, the predictions of the structural model are broadly in line with the quasi-experimental results. Fourth, (PM Targeting of in-work tax credits and childcare subsidies, more effective when they are targeted at the extensive margin, which also leads to lower income inequality?). Finally, (PM The modeling of unobserved heterogeneity plays an important role in the results?).

Our model builds on a large body of literature using structural models to analyze childcare subsidies and in-work tax credits. Blau and Currie (2006) review structural labour supply models with childcare. Recent applications include Kornstad and Thoresen (2007), Blundell and Shephard (2011), Gong and Breunig (2012) and Apps et al. (2012). For an analysis of changes in in-work tax credits see Brewer et al. (2006). We use a discrete choice model for household labour supply, which have become a popular way of dealing with the kinks and non-convexities in budget constraints, building on the work of e.g. Van Soest (1995), Keane and Moffitt (1998), Blundell et al. (2000) and Blundell and Shephard (2011). An important element in the empirical analysis is the role played by unobserved heterogeneity. We consider the conventional random preference specification also used in the papers cited above, and the more recent latent classes approach as outlined in Train (2008) and Pacifico (2009) and applied by Apps et al. (2012) to a model with labour supply and childcare choices. Apps et al. (2012) show that this can make quite a difference to the estimated labour supply and childcare demand elasticities. What is also of interest is that we study the effect of changes in financial incentives for working mothers in a country that has one of the highest participation rates of women in terms of persons, but with the largest share of part-time working women in the OECD.

Our paper also contributes to a small but growing number of papers that evaluate the external performance of structural models with the results from quasi-experimental studies (Todd and Wolpin, 2006; Hansen and Liu, 2011, see e.g.). Our data set contains a large reform in childcare subsidies and in-work tax credits. The effect of this joint reform is analyzed using difference-in-differences (DD) in Bettendorf et al. (2012). They consider the effect on participation, hours worked, and the decompositon of hours worked effect into the extensive and intensive margin effect (taking into account that new entrants may work different hours than incumbents). A simulation of the reform package with our structural model generates results broadly comparable with the findings of the DD study.

The structural model further allows us to study some effects of the Dutch reform of that we could not study using DD. We can split the effect of the policy reform into the effect due to the changes in childcare subsidies and the effect due to changes in in-work tax

credits. Also, we can determine the net cost of the policy reform to the government, taking into account the knock-on effects on the budget of additional tax receipts and savings on benefits for non-employed due to higher participation. Finally, with the structural model we can simulate counterfactual policy reforms, like the announced cut in childcare subsidies in the Netherlands in the coming period.

The paper is organized as follows. Section 2 develops the structural model we use in the empirical analysis. Section 3 then considers the empirical methodology used to estimate the structural parameters, including the different specifications for unobserved heterogeneity. In Section 4 we discuss the data set used in the empirical analysis, and present some descriptive statistics. Furthermore, we consider the main aspects of the policy reforms that occurred in our data period. Section 5 presents the estimation results, and the implicit labour supply and childcare use elasticities. Section 6 gives the simulation results for the different policy reforms, and compares the simulation outcomes with the findings of the quasi-experimental study. Section 7 concludes.

2 Structural model

For couples we use a (log) quadratic utility function since marginal utility of income may not be constant. In addition, the quadratic utility function is very flexible. The utility function is as follows:

$$\begin{aligned} U(y,h_i;\boldsymbol{X}) &= u(y,h_m,h_f;\boldsymbol{X})+\epsilon \\ &= \beta_1 y+\beta_2(\boldsymbol{X})h_m+\beta_3(\boldsymbol{X})h_f+\beta_4(\boldsymbol{X})c+ \\ &\quad \beta_5 y^2+\beta_6 h_m^2+\beta_7 h_f^2+\beta_8 c^2+ \\ &\quad \beta_9 y h_m+\beta_{10} y h_f+\beta_{11} y c+ \\ &\quad \beta_{12} h_m h_f+\beta_{13} h_m c+\beta_{14} h_f c+ \\ &\quad \beta_{15}(\boldsymbol{X})fc_{wm}+\beta_{16}(\boldsymbol{X})fc_{wf}+\beta_{17}(\boldsymbol{X})fc_c+\epsilon \end{aligned} \tag{1}$$

The households' choice variables are leisure men (h_m), leisure women (h_f) and hours of formal childcare (c). Preferences for leisure and childcare vary over a number of characteristics X. We also include fixed costs of work (fc_{wm}, fc_{wf}), as indicator variables (0/1 for non-working/working), in order to correct for the overprediction of small part time jobs (see Van Soest, 1995). Similarly, we include an indicator variabele for the use of childcare (fc_c), which equals 1 for the alternatives with formal childcare.

Our budget constraint takes the following form:

$$y = w_i l_i - T(w_i, l_i, \mathbf{X}) - \sum_{v=1}^{V} [C_v(\mathbf{p}, \mathbf{c}; \mathbf{X})] + S(\mathbf{p}, \mathbf{c}, y^t; \mathbf{X}) \tag{2}$$

where w is gross hourly wage, l is labour supply and $i = m, f$. $T(w_i, l_i, \mathbf{X})$ are taxes, social security contributions calculated with a tax benefit model. $C_v(\mathbf{p}, \mathbf{c}; \mathbf{X})$ is total cost of childcare which equals the sum over all children (V) at the childcare centres, where $\mathbf{p}$ is a vector with hourly prices of the two types of childcare (daycare and out-of-school care). Similarly, $\mathbf{c}$ is a vector with number of hours at the childcare centres. Finally, the tax benefit model calculates childcare subsidies $S(\mathbf{p}, \mathbf{c}, y^t)$ which depend on childcare prices, the number of hours, the number of children and households' taxable income (y^t). The time constraint is as follows:

$$l_i + h_i \leq TC_i \tag{3}$$

where $TC_i = 168$ hours.

Estimation results show that the log quadratic utility function does not perform well for single parents. Although the share of households with a negative marginal utility of income is small (1%), we do observe a large share (67%) of single parents with negative marginal utility of leisure in the observed outcome which is not consistent with optimization behaviour. An alternative utility function is the Box-Cox utility function which restricts marginal utility of income and leisure to be positive. Therefore we also estimate the following Box-Cox utility function for single parents:

$$\begin{aligned} U &= \exp(\beta_1)\left(\frac{y^{\gamma_1}-1}{\gamma_1}\right) + \exp(\beta_2(\mathbf{X}))\left(\frac{h^{\gamma_2}-1}{\gamma_2}\right) + \\ &= \beta_3(\mathbf{X})c + \beta_4 c^2 + \beta_5(\mathbf{X}) f c_w + \beta_6(\mathbf{X}) f c_c + \ \varepsilon \end{aligned} \tag{4}$$

Here, γ_1 and γ_2 are the elasticity parameters for respectively income and leisure.

3 Econometric methodology

For workers we use observed gross wages whereas for non-workers we impute wages. Similarly, for users of childcare we use observed prices whereas for non-users of childcare prices are imputed. We estimate the utility function by simulated maximum likelihood. By taking 10 draws (R) from the estimated wage and price distribution, we maximize the

average of the following likelihood:

$$L = \sum_{i=1}^{N} \frac{1}{R} \sum_{r=1}^{R} \prod_{t=1}^{T} \prod_{j=1}^{J} \left\{ \frac{\exp\left(U_{ijt}^{r}\right)}{\sum_{j=1}^{J} \exp\left(U_{ijt}^{r}\right)} \right\} d_{ijt}. \tag{5}$$

We start with a basic model without unobserved heterogeneity. Next, we allow for unobserved heterogeneity by using a latent classes approach. Here we assume that the population consists of several homogeneous groups with respect to their preferences. In this way, parameters of the utility function vary between the groups but not within these groups.

PM: Latent classes

4 Data

Section 4.1 describes the dataset and the selection criteria we used to construct our final sample. Section 4.2 gives descriptive statistics of our final sample.

4.1 Administrative data set and selection criteria

We use the Labour Market Panel (in Dutch: *Arbeidsmarktpanel*) of Statistics Netherlands. The dataset combines data from municipalities (in Dutch: *Gemeentelijke Basisadministratie*) on several characteristics, from Social Statistic Panel (in Dutch: *Sociaal Statistisch Bestand*) on income sources and from Labour Force Survey (in Dutch: *Enquete Beroepsbevolking*) on education level. The panel consists of approximately 1.2 million individuals who have been followed for the period 1999-2009. The panel is representative for the Dutch population. The dataset contains information on age, ethnicity, education, presence of children, region, labour supply, various income sources of individuals and their partners. For the period 2006-2009, we have information on the use and cost of formal childcare as well. Here, a distinction is made between daycare (children 0-3 years of age) and out-of-school care (children 4-12 years of age).

We estimate a structural model with childcare and therefore we restrict our sample to single parents, and couples, with at least one child 0-12 years of age. We exclude households with missing information on characteristics like ethnicity, age of the children, region or education. Self-employed individuals, individuals with disability benefits, or individuals with multiple sources of income (for example wages and profits) are also excluded. The

reason for this is that the budget set becomes too complex. We also drop individuals with unemployment benefits since we need to identify whether these individuals are voluntarily unemployed or not. This requires a challenging modelling approach on its own, which is beyond the scope of this study. For households with time gaps, we select the longest time period.

The tax benefit model MIMOSI[5] calculates net income for each of the alternatives. Income, wages and childcare prices are deflated to 2006 by using the consumer price index. MIMOSI calculates the corresponding childcare subsidy which depends on the type of childcare (i.e. daycare or out-of-school care), price of childcare, the number of children and the level of taxable household income. MIMOSI is a highly advanced tax benefit model which calculates the budget constraint very accurately. The model takes social security contributions, pension contributions, taxes and several tax credits into account. In addition, MIMOSI calculates health care premiums and several means tested benefits (rent subsidies, general subsidies to families with children, childcare subsidies). In this way, MIMOSI enables us to calculate budget constraints and the effect on the government budget.

4.2 Descriptive statistics

Table 1 shows descriptive statistics of the final sample. More detailed descriptive statistics can be found in appendix A. Approximately 68% of single parents participate on the labour market and the average number of working hours equals 28.4 hours per week. Non-Western immigrants and lower educated individuals appear more often in the sample with single partents compared to couples. The share of households with formal childcare is similar for single parents (31%) and couples (29%). Nearly all men in couples participate (96%) and the average number of working hours is high: 38.9 hours per week. A relatively high share of women in couples participate (78%) but the average number of working hours is low: 22.1.

For single parents, we use the full sample which consists of 8,691 individuals, or 18,964 observations. The computational burden of using the full couples' sample in the estimation is too long. Therefore we select a representative subsample of 10% by using the weight factors in the sample. Consequently, the number of couples equals 2,963 which boils down to 7,594 observations.

Table 2 shows descriptive statistics of the use and price of childcare in the period 2006-2009. Here we see that the share of households using daycare increased from 13.5% in 2006

[5]CPB, 2008, MIMOSI Microsimulatiemodel voor belastingen, sociale zekerheid, loonkosten en koopkracht, CPB document no 161 (only available in Dutch).

Table 1: Descriptive statistics final sample

	Single parents	Couples men	Couples women
Age	38.9	40.2	37.7
	(6.4)	(5.8)	(5.5)
Hourly wage	16.2	21.8	16.2
	(7.9)	(11.6)	(7.3)
Hours worked per week	28.4	38.8	21.9
	(8.4)	(5.3)	(8.4)
Participation rate	0.68	0.96	0.78
Ethnicity			
Native	0.68	0.85	0.83
Western immigrant	0.10	0.08	0.09
Non-western immigrant	0.22	0.07	0.08
Education			
Lower educated	0.36	0.20	0.15
Middle educated	0.43	0.43	0.49
Higher educated	0.22	0.37	0.36
Age of youngest child			
Below 4 years	0.22	0.48	0.48
Between 4 and 12 years	0.78	0.52	0.52
Region			
Urban area	0.30	0.15	0.15
Non-urban area	0.70	0. 85	0. 85
Childcare			
Childcare	0.31	0.30	0.30
No childcare	0.69	0.70	0.70
Number of observations	18,964	7,845	7,845
Number of households	8,691	3,017	3,017

to 19.8% in 2009. The increase in out-of-school care is even larger: from 9.5% in 2006 to 20.8% in 2009. The average number of children at the childcare centres remains constant. However, the average number of hours per child increased over this period. In 2007, the

Table 2: Use of childcare 2006-2009

	Daycare				Out-of-school care			
	2006	*2007*	*2008*	*2009*	*2006*	*2007*	*2008*	*2009*
Share households	31.8	42.2	49.4	52.5	9.8	14.7	19.7	22.6
Average number of children	1.3	1.3	1.3	1.3	1.5	1.5	1.5	1.5
	(0.48)	(0.47)	(0.47)	(0.48)	(0.59)	(0.59)	(0.60)	(0.60)
Average number of hours per child	19.3	18.5	19.4	19.7	9.4	8.6	9.3	9.7
	(9.20)	(10.35)	(10.22)	(10.30)	(6.34)	(6.39)	(6.75)	(7.34)

average number of hours initially decreases due to a composition effect. As it turns out, the average number of hours of entrants is lower thereby pulling down the total average number of hours. Finally, real hourly prices of daycare increase whereas real hourly prices of out-of-school care remain constant. We assume that hourly childcare prices are the same for all children within the households. For non-workers we impute wages and for non-users of childcare we impute childcare prices. Appendix B shows the results.

We distinguish 6 labour supply options at the individual level and 4 child care options at the household level. Labour supply options are discretized in days (0-5) where each day equals 8 hours. For childcare, we allow for 0, 1, 2 and 3 or more days. We distinguish between the two types of childcare where one day at a daycare centre equals 10 hours, whereas out-of-school care only takes 5 hours for one day. Figures 1-4 in appendix A show that we observe spikes at these hours. Single parents choose from a discrete choice set $h \in \{h_j, j = 1, ...J\}$ with $J = 24$. For couples, the number of alternatives equals 144.

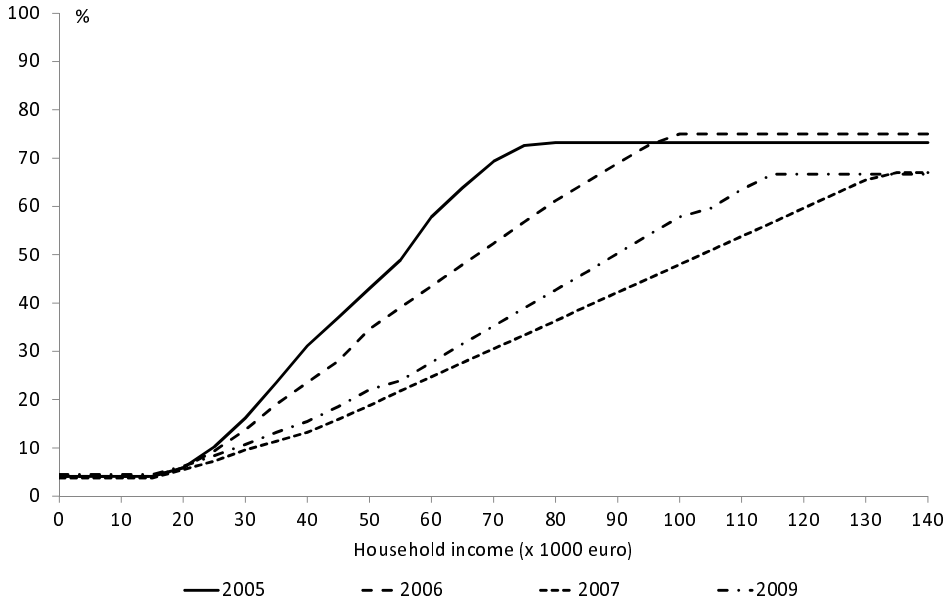
4.3 Reform of childcare subsidies and EITCs for working parents

One of the interesting features of our data set is that during our data period there was a large reform in childcare subsidies and EITCs for working parents. This gives us large exogenous variation in household budget sets. Below we outline some of the key features of the reform.

The childcare reform started with the introduction of the Law on Childcare (*Wet kinderopvang*) in 2005. Before the introduction of the Law on Childcare, centre based childcare was subsidized at different rates. Places subsidized directly by employers and local governments (76% of places[6]) had lower effective parental fees than so-called 'unsubsidized' places (24% of places), the costs of which were partly tax deductible for parents. The introduction of the *Wet kinderopvang* in 2005 unified the subsidies for childcare places.

[6]Source: Statistics Netherlands.

Figure 1: Parental contribution rate for the first child



Source: own calculations using publicly available subsidy tables.

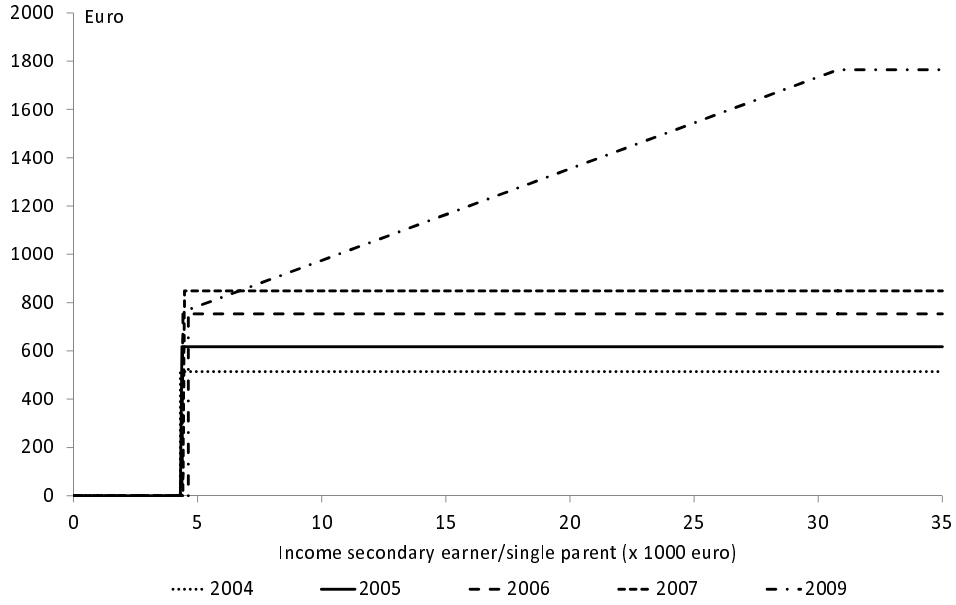
From 2005 onwards, all formal places qualified for the same subsidy from the central government. This increased the subsidy somewhat for parents with children going to an unsubsidized place before 2005. With the introduction of the *Wet kinderopvang* so-called guestparent care also became eligible for the subsidy. This is small scale care at the home of the guestparent or the children. But the unification of the subsidies and the extension to guestparent care had only a minor effect on public spending on formal childcare. Indeed, presumably because the subsidy was actually reduced somewhat for the highest incomes[7], public spending actually fell slightly from 2004 to 2005 (see Ministry of Finance, 2010).

More important were the changes that followed in 2006 and 2007. In these years the subsidy rate was increased drastically, in 2007 in particular. Figure 1 shows the changes in the parental contribution rate for the 'first child'.[8] First, note that 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

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

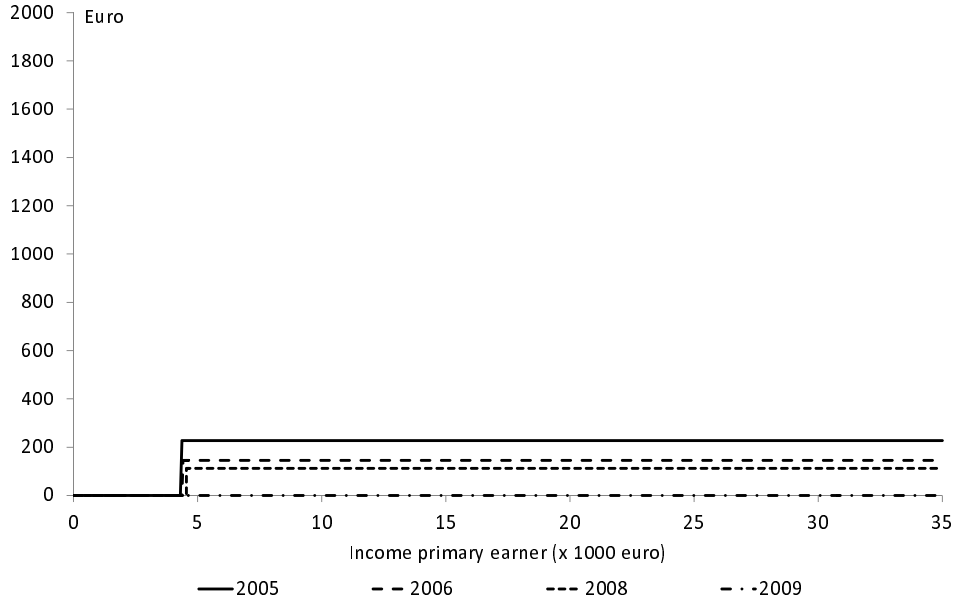
[8]The Tax Office defines the first child as the child for which the parents have the highest childcare expenditures.

Figure 2: EITC secondary earners with children and single parents



Source: Tax Office.

Figure 3: EITC primary earners with children



Source: Tax Office.

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.[9,10] 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, but then 2009 witnessed a partial reversal of the policy change, as parental fees were raised somewhat.

Over the same period there were also some changes in EITCs for parents with a youngest child up to 12 years old, the so-called *Combinatiekorting* (Combination credit) and the *Inkomensafhankelijke combinatiekorting* (Income dependent combination credit).[11] Figure 2 shows the change in the sum of the *Combinatiekorting* and *Inkomensafhankelijke combinatiekorting* for secondary earners and single parents over the period 2004–2009. Up to 2008, the credit was income independent as long as wage income exceeded a certain threshold. The sum of these two credits increased from 514 euro in 2004 to 858 euro in 2008. In 2009 the *Inkomensafhankelijke combinatiekorting* was increased for secondary earners and single parents with relatively high earnings. The maximum credit was 1,765 euro, where the maximum was reached at 30,803 euro of gross individual income (in 2009 the minimum wage of a fulltime worker was 16,776 euro).

Primary earners with children only apply for the *Combinatiekorting*, which is much smaller than the *Inkomensafhankelijke combinatiekorting*. This credit was phased out over the period 2005–2009,[12] see Figure 3. There was a reduction in 2006, and then a smaller reduction in 2008 before it was eventually abolished in 2009.

5 Estimation results

This section presents estimation results of the utility function. Subsection 1 presents results for single parents whereas subsection 2 shows the results for couples.

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

[10]Despite the steep increase in the subsidy rate, the average prices of formal childcare places grew more or less in line with the CPI, see Section 4.2

[11]Up to 2008 the *Inkomensafhankelijke combinatiekorting* was called the *Aanvullende combinatiekorting* (Additional combination credit). The name refers to the combination of work and care.

[12]The credit was left virtually unchanged from 2004 to 2005.

5.1 Single parents

5.1.1 Model without latent classes

Table 3 shows estimated preferences for single parents in the model with childcare. Results of the model without childcare are found in appendix A.4. We start with a log quadratic utility function. Negative marginal utility of income in the chosen option is not consistent with optimization behaviour, but this undesirable feature is rare in our sample: only 1% of the single parents have negative marginal utility of income.[13] The share of households with negative marginal utility of leisure is high: 67%. One may argue that workaholics attach little value to leisure but it is unlikely that it concerns such a large group.

The Box-Cox transformation ensures that marginal utility of income and leisure remains positive. The transformation parameters γ_1 and γ_2 are both smaller than 1 and therefore marginal utlity of income and leisure is decreasing in income and leisure. All interation terms in the fixed costs specification are negative. Single parents with a lower education, non-native background, a young child and/or living in an urban area have higher fixed costs of participation, i.e. relative to the base group (higher educated, native background, youngest child 4-12 years of age and not living in an urban area).

[13] Appendix A.4 shows that this share is even larger in the model without childcare: 21%.

The number of childcare hours has a positive effect on utility of single parents. However, the quadratic term of childcare is negative imlpying that marginal utility of childcare is decreasing. The Box-Cox transformation parameters are smaller than one implying that marginal utility of income and leisure is decreasing. The interaction term of age with leisure is positive (but not significant) whereas the quadratic term of age with leisure is negative. Hence, younger single parents have a higher preference for leisure whereas older single parents have a higher preference for work. The tipping point is at an age of approximately 39 years.[14]

The intuition of the indicator variable for the use of formal childcare is similar to the fixed costs specification of work. The constant term is negative implying that there are fixed cost of childcare. The interaction term of the indicator variable with education and non-Western immigrants is negative. Hence, the use of formal childcare is relatively low among single parents with a lower education or non-Western background. Single parents with a youngest child 0-3 years of age have lower fixed costs of childcare.

Figures 1 and 2 show the fit of the Box-Cox models. The horizontal axis shows the number of working hours whereas the vertical axis represents the share of single parents. Both models predict the labour supply distribution well except for the part time alternatives of 8 and 24 working hours. Figure 2 shows the distribution of the use of childcare, where the numbers of days of childcare are located on the horizontal axis. Again, the observed and predicted distribution closely resemble each other.

Table 4 presents elasticities for single parents. Elasticities are calculated by raising gross wages and prices by 10%. The log quadratic model produces relatively low elasticities (0.17) whereas our preferred Box-Cox model estimates much higher elasticities (0.55). Decomposition of the wage elasticy shows that the extensive and intensive margin are comparable in size. The increase in labour supply also increases the demand for childcare (0.13) in the Box-Cox model. Finally, the price elasticity of childcare equals -0.44. Here, an increase in the price of childcare by 1% does not come at the expense of lower labour supply (i.e. effect is 0 on average).

5.1.2 Model with latent classes

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[14] Calculated as (0.20/2*0.14)*10+38.

Table 3: Parameters utility function single parents

	Model without latent classes		Model with latent classes	
	Log Quadratic	Box-Cox	Log Quadratic	Box-Cox
Income	1.923***	0.609***		
Leisure	-48.17***	-6.906***		
*age	-0.762***	0.021	PM	
*age^2	1.016***	-0.141***		
*child 0-3 yrs	2.889***			
γ_1		0.454***		
γ_2		-41.170***		
Income^2	0.101***			
Leisure^2	-138.000***			
Income*leisure	2.439***			
Income*childcare	-0.656***			
Fixed costs work	-3.075***	-0.139**		
*education low	-1.642***	-1.387***		
*education mid	-0.484***	-0.280***		
*non-Western immigrant	-1.225***	-1.177***		
*Western immigrant	-0.578***	-0.553***		
*child 0-3 yrs	-0.519***	-1.050***		
*urban area	-0.323***	-0.320***		
Childcare	0.189*	0.200***		
*non-Western immigrant	0.588***	0.113***		
*Western immigrant	0.177**			
*child 0-3 yrs	0.411***	0.135***		
*urban area	0.251***	0.062***		
Childcare^2	-0.081**	-0.016***		
Childcare*leisure	-5.483***			
Fixed costs childcare	-1.618***	-1.946***		
*education low	-1.141***	-1.080***		
*education mid	-0.613***	-0.514***		
*non-Western immigrant	-0.340***	-0.142**		
*Western immigrant	-0.127	0.070		
*child 0-3 yrs	0.541***	0.395***		
Individuals*alternatives	453,744	453,744		
Individuals	18,906	18,906		
Log likelihood	-43,351	-1,241		
Negative mu income	1%	0%		
Negative mu leisure	67%	0%		
Negative mu childcare	16%	9%		

Figure 4: Fit single parents: labour supply

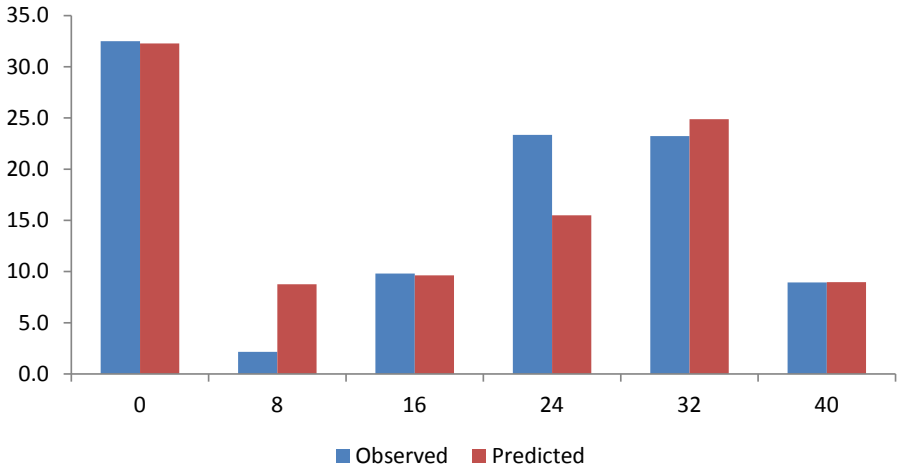

Figure 5: Fit single parents: childcare

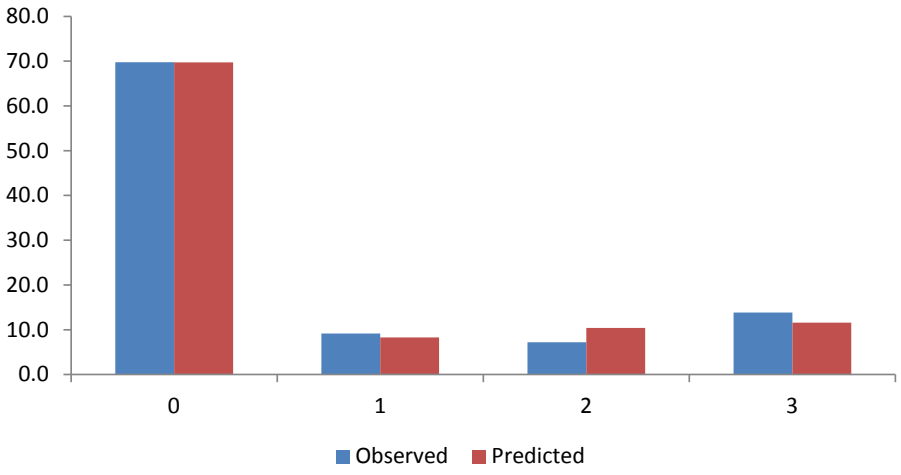

Table 4: Elasticities single parents

	Model without latent classes		Model with latent classes	
	Log quadratic	Box-Cox	Log quadratic	Box-Cox
Wage (+1%)				
Labour supply	0.18	0.55		
hspace0.4cmextensive margin	0.14	0.31	PM	PM
hspace0.4cm intensive margin	0.04	0.24		
Childcare	-0.15	0.13		
Price childcare (+1%)				
Childcare	-0.10	-0.45		
Labour supply	0.01	0.00		

5.2 Couples

5.2.1 Model without latent classes

Table 5 shows estimation results for couples for the model with childcare. Results of the model without childcare are found in appendix A.4. Unlike for single parents, the log quadratic utility function does not result in negative marginal utility of income for any of the households. The quadratic term of income is not signicant in both models. Table 5 shows that men's leisure is a normal good whereas women's leisure is not a normal good. Both models estimate a fixed costs specification interacted with observable characteristics. Men and women with a non-native background have higher fixed costs of participation. The inclusion of education in the fixed costs specification leads to mixed results. Lower and middle educated women have higher fixed costs of participation whereas lower and middle educated men have lower fixed costs of participation. This latter result is intuitively not appealing. Women living in urban areas have higher fixed costs of participation.[15]

The model with childcare adds the number of hours of formal childcare, and the corresponding interaction terms, to the utility function. Marginal utility of childcare is negative for most households (60%) in the observed outcomes. Furthermore, the interaction term of income and childcare is positive which indicates that childcare is a normal good. The final column in table 5 shows that households higher educated partners have a higher preference for childcare. Finally, households with a young child (0-3 years) and/or living in an urban area have a higher preference for childcare.

Figures 3 shows the observed and predicted labour supply distribution. The labour

[15] A dummy for urban area is not significant in the fixed cost specification for men.

supply options are located on the horizontal axis, where the first number refers to men's working hours while the second number refers to women's working hours. Here we see that both models predict the labour supply distribution quite well. Figure 4 compares the observed and predicted distribution of the use of formal childcare. Again, the model predicts well.

Table 6 presents the corresponding elasticities for couples. Wage elasticities for men are low in both models (0.07 and 0.08 in the model without and with childcare respectively). Cross elasticities show that an increase in men's wage results in a small increase in the demand for childcare (0.03) and a drop in female's labour supply by -0.15%. Wage elasticities are much higher for women. The model without childcare produces a wage elasticity of 0.60. This elasticity drops to 0.44 in the model with childcare. In both models, we find that the extensive margin is more important than the intensive margin. The price elasticity of childcare is -0.47 and a price increase of childcare only results in a small decrease in female's labour supply (-0.04).

5.2.2 Model with latent classes

PM

Table 5: Parameters utility function couples

	Model without latent classes	Model with latent classes
Income	3.185***	
Leisure men	-68.220***	
*age	1.931***	
*age^2	0.311	
Leisure female	-28.900***	
*age	1.165**	
*age^2	0.699	
*child 0-3 yrs	3.641***	
Income^2	0.535***	
Income*leisure men	3.355**	
Income*leisure women	-1.685	
Leisure men^2	-103.700***	
Leisure women^2	-145.300***	
Leisure men*leisure women	-17.740***	
Fixed costs men	-8.677***	
*education low	0.534**	
*education mid	0.759***	
*non-Western immigrant	-1.563***	
*Western immigrant	-1.281***	
Fixed costs women	-2.445***	
*education low	-0.097	
*education mid	0.187*	
*non-Western immigrant	-0.810***	
*Western immigrant	-0.225	
Childcare	-0.197	
*education low men	-0.356**	
*education mid men	-0.341***	
*education low women	0.160	
*education mid women	-0.537***	
*child 0-3 yrs	0.588***	
*urban area	0.505***	
Fixed cost childcare	-2.513***	
*education low men	0.237	
*education mid men	0.263	
*non-Western immigrant men	-0.635***	
*Western immigrant men	0.248	
*education low women	-1.629***	
*education mid women	0.080	
*non-Western immigrant women	0.182	
*Western immigrant women	0.167	
*child 0-3 yrs	1.385***	
*urban area	-0.256	
Childcare^2	-0.374***	
Childcare*income	0.195*	
Childcare*leisure men	1.255***	
Childcare*leisure women	-7.204***	
Couples*alternatives	548,496	
Couples	3,809	
Likelihood	-11,946	
Negative mu income	0%	
Negative mu leisure men	86%	
Negative mu leisure women	5%	

Figure 6: Fit couples: labour supply men

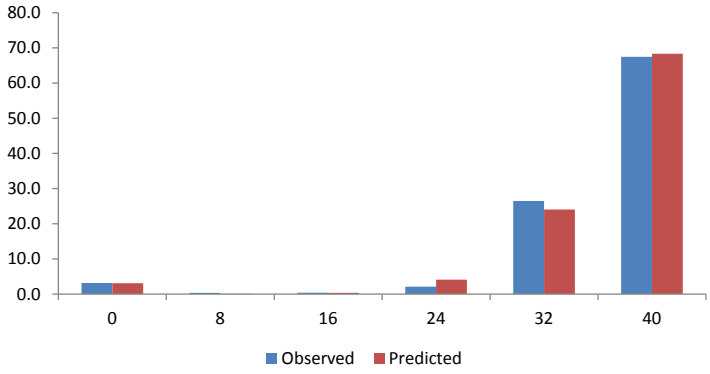

Figure 7: Fit couples: labour supply women

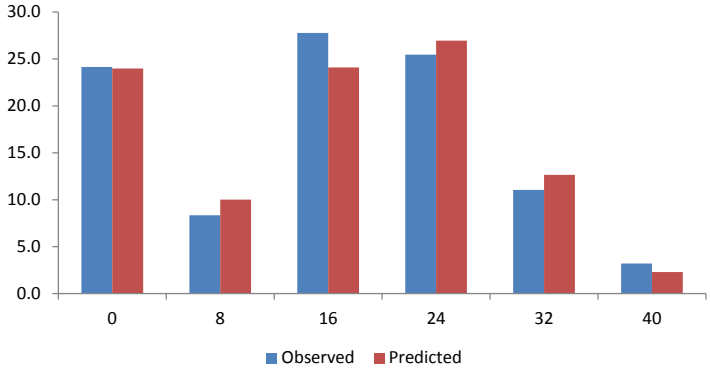

Figure 8: Fit couples: childcare

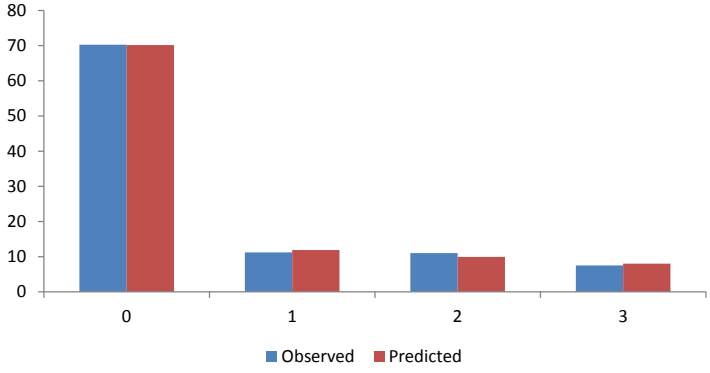

Table 6: Elasticities couples

	Model without latent classes	Model with latent classes
Wage elasticity men (+1%)		
Labour supply men	0.07	
hspace0.4cmextensive margin	0.05	
hspace0.4cmintensive margin	0.02	
Labour supply women	-0.09	
Childcare	-0.01	
Wage elasticity women (+1%)		
Labour supply women	0.35	
hspace0.4cmextensive margin	0.24	
hspace0.4cmintensive margin	0.11	
Labour supply men	-0.01	
Childcare	0.29	
Price elasticity childcare (+1%)		
Childcare	-0.41	
Labour supply men	0.00	
Labour supply women	-0.06	

6 Policy simulation

6.1 Effectiveness fiscal stimuli working parents

Single parents and couples, with at least one child at 0-12 years of age, are entitled to childcare subsidies as long as they work and use childcare. In addition, working single parents and secondary earners with young children earn an EITC (*Inkomensafhankelijke Combinatiekorting*). Both the EITC and childcare subsidy are expected to increase labour supply of especially mothers. The EITC is targeted at a larger group since it includes single parents and couples who do not use childcare as well. From a policy perspective, it is interesting to simulate whether a childcare subsidy, tax credit, or across-the-board reduction in marginal tax rates is more effective in raising labour supply. Therefore, we simulate a reduction of 1 billion euro in each of these options.

The first column in table 7 shows labour supply effects of lowering childcare subsidies by 1 billion euro. The subsidy rates are lowered in such a way that households' own contribution rates increase by the same percentage.[16] Not surprisingly, we see a substantial reduction in labour supply for relatively elastic single parents (-1.92%) and women in couples (-2.39%). The response at the extensive margin dominates the response at the intensive margin.

The second column presents labour supply effects of lowering the EITC by 1 billion euro. We simulate this scenario by comparing a baseline scenario with an alternative scenario. The baseline scenario contains an income-dependent increase of the EITC similar to the current situation. That is, the EITC rises with 6%, until a maximum of 5.621 euro is reached (2009 prices). The alternative scenario is similar to the situation in 2005, without the income-dependent rise of the EITC. That is, single parents and second earners only receive a fixed amount of 777 euro as long as their personal income exceeds the income threshold. We see that the labour supply effect is larger than the effect of the childcare subsidy. Now single parents and women in couples reduce their labour supply by 3.55% and 3.41%, respectively. In case of (formal) childcare expenditure cuts, a substantial share of households replace more expensive formal childcare with informal childcare. Based on this simulation, we conclude that the EITC is more effective in stimulating labour supply than a childcare subsidy. An important explanation is that part of childcare subsidy is 'lost' to substitution from informal to formal childcare.

Finally, we simulate an increase in the marginal tax rates with 1.2 percentage points. The final column shows that lowering marginal tax rates is the least effective way to increase labour supply. The reason for this is that an across-the-board reduction in marginal

[16] As is common in the current policy of retrenchment.

Table 7: Effectiveness fiscal stimuli

	1 billion childcare subsidy[a]	1 billion EITC[b]	1 billion tax rates[c]
Couples with children			
Labour supply men	-0.06	-0.08	-0.07
extensive margin	-0.14	-0.17	-0.05
intensive margin	0.08	0.09	-0.02
Labour supply women	-2.94	-2.91	-0.56
extensive margin	-1.66	-1.61	-0.32
intensive margin	-1.28	-1.30	-0.24
Childcare	-16.04	-2.91	-0.83
Single parents			
Labour supply	-1.05	-3.57	-0.01
extensive margin	-0.88	-1.37	0.13
intensive margin	-0.17	-1.20	-0.14
Childcare	-6.26	-0.76	-0.07

[a]Simulated by increasing parental contributions proportionally.

[b]Baseline scenario: Income-dependent EITC (6% increase, maximum at 5.621 euro); Alternative scenario: fixed amount of 777 euro.

[c]Simulated by increasing marginal tax rates by 1.2 percentage points.

tax rates is less focused, compared to for instance an EITC for secondary earners, since a large part reaches primary earners as well.

PM Effects on income inequality

PM Knock-on effects government finances

6.2 Targeting childcare subsidies and EITC

PM

6.3 External validation

Our data set contains a large reform in childcare subsidies and EITCs, enabling external validation of our simulated results. We simulate both reforms separately and compare our results with the results of the DD-analysis by Bettendorf et al. (2012). They use use a DD-analysis to study the joint reform of childcare and EITCs in the period 2005-2009. Both reforms affect labour supply of working parents but it is not possible to disentangle

Table 8: Results reforms 2005-2009

	Reforms 2005-2009			**DD-analysis**
	Childcare	*EITC*	*Total*	*Childcare + EITC*
Couples with children				
Labour supply men	0.03	0.04	0.07	-1.0
extensive margin	0.08	0.09	0.17	0.0
intensive margin	-0.05	-0.05	-0.10	-1.0
Labour supply women	1.76	2.43	4.19	6.6
extensive margin	0.96	1.50	2.46	2.9
intensive margin	0.82	0.93	1.75	3.7
Childcare	10.39	2.25	12.64	
Single parents				
Labour supply	0.19	2.94	3.13	12.0
extensive margin	0.04	1.26	1.30	8.5
intensive margin	0.15	0.68	1.83	3.5
Childcare	0.88	0.65	1.53	

these effects with a DD-analysis.

Table 8 shows labour supply effects of the childcare reform in the period 2005-2009. Single parents slightly increase their labour supply (0.20%) whereas the increase in demand of childcare is only 0.08%. The increase in labour supply is highest for women in couples: 2.97% and couples demand 21.68% more childcare. As described in section 4.3, the childcare reform 2005-2009 was targeted at middle and high income households. Household income of single parents is relatively low and therefore the labour supply effect is modest for single parents. The opposite holds for women in couples: they have a relatively high household income which, accompanied with a substantial increase in subsidy rates, results in a relatively strong increase in labour supply.

Labour supply effects of the increase in the EITC in the period 2006-2009 are found in the second column in table 8. In order to increase labour supply of especially working mothers, the Dutch government only targets the EITC at single parents and secondary earners as from 2009 (as described in section 4.3). Policy simulation shows that single parents and women in couples raise labour supply by approximate 3%.

The third column in table 8 gives the combined simulated effect of both reforms. We find similar results for women in couples, although the extensive margin is more important in our simulated results (this situation is reversed in the DD-analysis where the intensive margin is more important). The simulated labour supply effects for single parents and men in couples are lower than in the DD-analysis (**PM**).

Table 9: Results childcare reform 2011-2015

	Percentage changes
Couples with children	
Labour supply men	-0.04
extensive margin	-0.07
intensive margin	0.03
Labour supply women	-1.64
extensive margin	-0.89
intensive margin	-0.75
Childcare	-8.90
Single parents	
Labour supply	-0.57
extensive margin	-0.52
intensive margin	-0.05
Childcare	-3.67

6.4 Childcare reform 2011-2015

Recent projections show that childcare expenditures are expected to increase further in the period 2011-2015 (Ministry of Social Affairs and Employment, 2011) Consequently, the Dutch government decided to cut expenditures on childcare by 0.8 billion euro over the period 2011-2015. In this way, the average contribution rate of households increase from 22% in 2010 to 34% in 2015 (Ministry of Social Affairs and Employment, 2011). Approximately 0.5 billion euro of the expenditure cut on childcare is found by lowering childcare subsidy rates. We simulate this reduction of subsidy rates and table 9 gives the results.

For single parents, the average labour supply effect is similar (in absolute value) under the second reform (-0.5%) compared to the first reform. Women in couples, however, adjust their labour supply to a lesser extent under the second reform (-0.74% instead of 2.97%). We have two explanations for this result. First, the second reform results in a lower change (in the absolute value) in the average contribution rate of households. Second, the reform 2006-2009 was targeted at middle and high income households whereas the design of the reform 2011-2013 is more evenly spread over all households (i.e. households' contribution rates increase with the same percentage).

PM: Latent classes

7 Conclusion

PM

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A Appendix

A.1 Descriptive statistics childcare

Table A.1 shows combinations of average number of days of childcare and the number of working days for the period 2006-2009. Columns refer to the number of working days (mothers/single fathers), whereas rows represent the average number of days child care. Here we see for instance that 3 percent of the households, in which the mother works 3 days, use 1 day of daycare in 2006. Figures A.1 and A.2 show the use of daycare in 2006 and 2009. The same information is found in figure A.3 and A.4 for out-of-school care.

Table A.2 shows descriptive statistics of prices of childcare in the period 2006-2009. Unsurprisingly, nominal prices increase over time. However, the increase in real prices for out-of-school care is very small. In addition, Table A.2 shows that prices are modestly dispersed over characteristics like education, age and ethnicity. Singles pay a higher average price for daycare compared to couples but this situation is reversed for out-of-school care. Households with higher educated women pay a slightly higher price on average.

Table A.1: Descriptive statistics: use of childcare by labour supply

Daycare 2006[a]								Out-of-school care 2006[b]							
	0	1	2	3	4	5	Total		0	1	2	3	4	5	Total
0	25.7	6.0	19.0	21.4	7.3	5.8	85.2	0	26.0	6.0	19.9	24.0	8.1	6.1	90.1
1	0.4	0.1	1.5	3.0	0.8	0.4	6.2	1	0.2	0.1	1.1	2.4	0.9	0.4	5.1
2	0.2	0.0	1.0	2.9	1.1	0.5	5.8	2	0.1	0.0	0.5	1.4	0.7	0.2	2.9
3	0.1	0.0	0.1	1.0	0.8	0.3	2.4	3	0.1	0.0	0.1	0.5	0.3	0.2	1.1
4	0.1	0.0	0.0	0.1	0.2	0.2	0.5	4	0.1	0.0	0.0	0.1	0.2	0.2	0.7
Daycare 2009								Out-of-school care 2009							
	0	1	2	3	4	5	Total		0	1	2	3	4	5	Total
0	21.1	4.6	15.9	22.2	8.5	5.9	78.1	0	21.3	4.7	16.0	22.8	8.1	5.6	78.7
1	0.6	0.3	2.2	4.3	1.2	0.5	9.0	1	0.5	0.2	2.3	5.0	1.9	0.8	10.7
2	0.3	0.1	1.3	4.0	1.5	0.7	7.9	2	0.2	0.1	1.0	2.9	1.3	0.6	6.0
3	0.2	0.0	0.2	1.7	1.2	0.6	3.8	3	0.1	0.0	0.2	1.2	0.9	0.4	2.7
4	0.1	0.0	0.0	0.2	0.4	0.3	1.1	4	0.2	0.0	0.1	0.5	0.6	0.5	1.9

[a] Daycare is discretized as follows: 0-15, 15-25, 25-35, >= 35

[b] Out-of-school care is discretized as follows: 0-7.5, 7.5-12.5, 12.5-17.5,>=17.5

Figure A.1: Daycare 2006

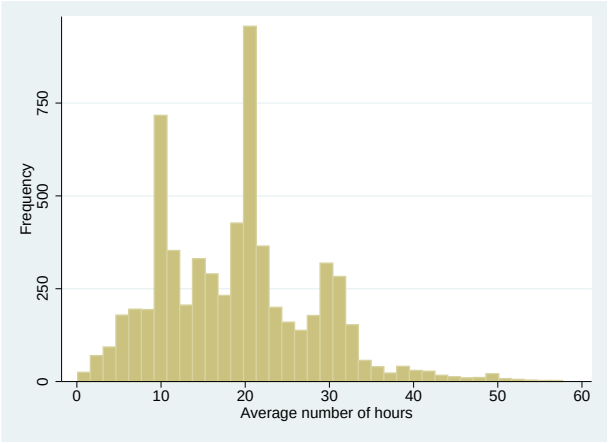

Figure A.2: Daycare 2009

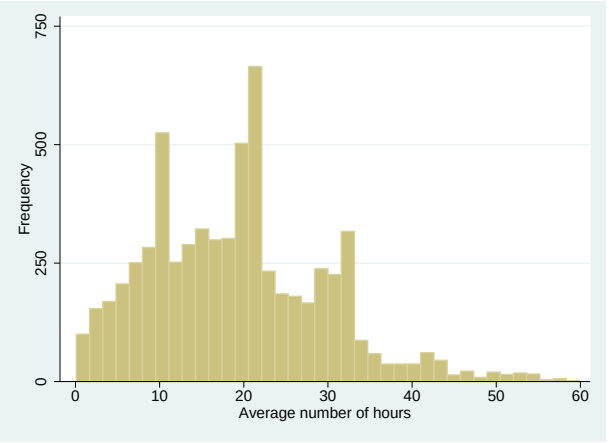

Figure A.3: Out-of-school care 2006

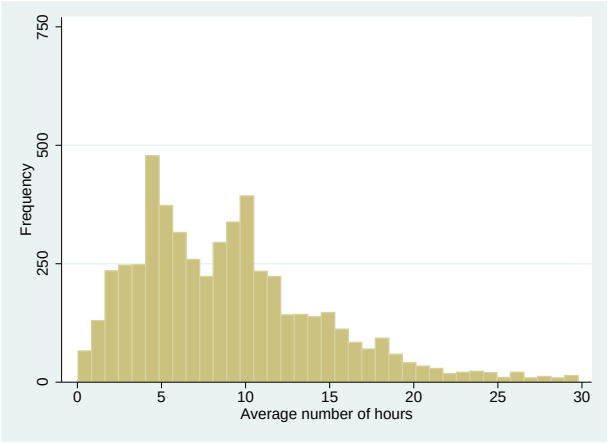

Figure A.4: Out-of-school care 2009

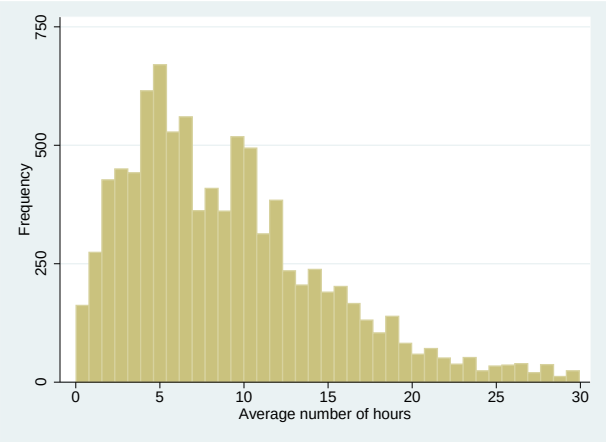

Table A.2: Descriptive statistics

	Daycare		*Out-of-school care*	
	2006	*2009*	*2006*	*2009*
Average price	5.36	5.82	5.55	5.86
	(0.45)	(0.45)	(0.57)	(0.45)
Average real price	5.36	5.52	5.55	5.56
Household composition				
Couples	5.36	5.82	5.56	5.86
	(0.45)	(0.45)	(0.57)	(0.45)
Singles	5.39	5.86	5.51	5.83
	(0.49)	(0.44)	(0.60)	(0.45)
Education				
Lower education	5.35	5.83	5.47	5.84
	(0.48)	(0.52)	(0.67)	(0.45)
Middle education	5.34	5.82	5.53	5.86
	(0.48)	(0.45)	(0.60)	(0.46)
Higher education	5.38	5.82	5.58	5.86
	(0.42)	(0.42)	(0.53)	(0.44)
Etnicity				
Authochthon	5.36	5.82	5.55	5.86
	(0.45)	(0.44)	(0.57)	(0.45)
Non Western immigrant	5.39	5.87	5.48	5.83
	(0.44)	(0.44)	(0.64)	(0.48)
Western immigrant	5.35	5.81	5.56	5.84
	(0.45)	(0.50)	(0.52)	(0.48)
Age				
Lower age	5.35	5.85	5.53	5.90
	(0.46)	(0.44)	(0.61)	(0.45)
Higher age	5.37	5.79	5.55	5.84
	(0.45)	(0.46)	(0.56)	(0.45)

A.2 Wage estimation

We only observe wages for working individuals in the sample. For non-workers we have to estimate wages. Wages are estimated separately for single men, single women, men in couples and women in couples. Here, a distinction is made between lower education (primary/elementary), medium education (intermediate vocational) and higher education (higher vocational / university). We estimate the following wage equation:

$$w_{it} = x'_{it}\beta + \eta_i + \epsilon_{it} \tag{6}$$

where w_{it} is the natural logarithm of real hourly wage, x_{it} is a vector with observable characteristics and ϵ_{it} is the error term for individual i in period t with $\epsilon_{it} \sim IID(0, \sigma^2_\epsilon)$. η_i is the individual specific effect.

First, we apply the pooled OLS estimator in which we ignore the individual specific effect η_i:

$$w_{it} = x'_{it}\beta + \mu_{it} \tag{7}$$

where $\mu_{it} = \eta_i + \epsilon_{it}$. The pooled OLS estimator is unbiased if the individual specific effect is uncorrelated with the regressors x_{it}. We use cluster robust standard errors in order to control for serial correlation of the error terms and heteroskedasticity.

Second, we estimate the Heckman two step model. The sample of non-workers may differ in an unmeasurable way from the sample of working individuals and selection bias may be present. The Heckman selection model can take this potential selection bias into account by estimating the following two equations:

$$p_{it} = x'_{it}\gamma + z'_{it}\theta + \nu_{it} \tag{8}$$

$$w_{it} = x'_{it}\beta + invmills'\lambda_{it} \ + \epsilon_{it} \tag{9}$$

The first equation estimates the probabilty of participation by a pooled probit regression. Vector z_{it} contains variables who are expected to have an effect on the probability of participation but not on wages. Hence, vector z_{it} is an exclusion restriction in order to indentify the parameters of the participation equation. The second equation is the wage equation with the inverse Mills' ratio as additional regressor:

$$invmills_{it} = \phi(p_{it})/\Phi(p_{it}) \tag{10}$$

The wage equation (4) is estimated by pooled OLS again.

Third, we estimate the two equations of the Heckman model simultaneously by maximum likelihood. In general, this method is more efficient than the two step estimator.

Fourth, we take the individual specific effect explicitly into account by estimating the following fixed effects (FE) model:

$$w_{it} = x'_{it}\beta + \eta_i + \epsilon_{it} \tag{11}$$

The fixed effects model allows for correlation between the individual specific effect η_i and the regressors x_{it}. The model is estimated by taking deviations from the mean and therefore the individual specific effect drops out. However, the same holds for time invariant regressors which obviously is an disadvantage.

Fifth, we apply the random effects (RE) estimator:

$$w_{it} = x'_{it}\beta + \eta_i + \epsilon_{it} \tag{12}$$

The random effects estimator assumes that the individual specific effect is independent of the regressors with $\eta_{it} \sim IID(0, \sigma_\eta^2)$.

Finally, we estimate a quasi fixed effects model (Mundlak, 1978):

$$w_{it} = x'_{it}\beta + \omega_i + \bar{x_i}'\pi + \epsilon_{it} \tag{13}$$

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

Table A.3 shows estimation results of all models for higher educated women with a partner. A significant attrition indicator provides evidence that selection bias is present. The results show that attrition bias is absent. Ideally, we want to use panel data estimation techniques (FE, RE, quasi FE) which enables us to take the unobserved individual specific effect into account. We performed a Hausman test in order to test whether random effects or fixed effect is appropriate. For all groups, we reject the null hypothesis that the individual specific effect is uncorrelated with regressor and therefore we prefer fixed effects over random effects estimation. With fixed effects we lose information on time-invariant regressors and therefore we opt for the quasi fixed effects model. However, the significant inverse Mills' ratio shows that selection bias is present. Hence, we need to correct for selectivity bias in our quasi fixed effects estimation. We estimate a probit model in the first stage and derive the inverse mills' ratio for each individual i at each period t. Next, we estimate wages by quasi fixed effects and include the inverse mills' ratio in the second stage. Tables A.4 and A.5 show the results of this quasi fixed effects model, with a correction for selectivity bias, for singles and couples respectively.[17]

[17] We only present results of our preferred model for all subgroups. We did estimate all models for all subgroups and the results are available on request.

We use age splines since we expect that the relationship between wage and age is nonlinear. Tables A.4 and A.5 show that age indeed increases with age but at a diminishing rate. This is in line with other studies (for instance Vella and Verbeek, 1999). For both singles and couples we see that the age profile is steepest 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.[18]. Year dummies are significant in most specifications while the cohort variables are jointly significant for most subgroups. Real wages are lower on average for non-Western immigrants. Finally, the coefficients for the Mundlak age averages have no economic interpretation but are joinly significant in all specifications.

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

Table A.3: Results wage estimation: higher educated women with a partner

	Pooled OLS	Heckman 1	Heckman 2	Fixed Effects	Random Effects	Quasi FE
Age effect						
18-30	0.044***	0.045***	0.044***	0.046***	0.047***	0.047***
31-40	0.024***	0.022***	0.024***	0.036***	0.034***	0.035***
41-50	0.002	0.003**	0.002*	0.023***	0.017***	0.023***
51-63	0.000	-0.014***	-0.002	0.017***	0.005***	0.013***
Cohort effect						
1980-1989	0.044***	0.096***	0.052***		0.212***	0.158***
1975-1980	0.030**	0.068***	0.036***		0.171***	0.118***
1970-1975	0.035***	0.057***	0.038***		0.116***	0.077***
1960-1965	-0.022**	-0.016*	-0.021**		-0.078***	-0.044***
1955-1960	-0.032**	-0.025*	-0.031**		-0.151***	-0.064***
<1955	-0.030**	-0.004	-0.026**		-0.181***	-0.046***
reference=1965-1970						
Year effect[a]						
2006	0.005	0.005	0.005	0.002	0.002	0.002
2007	-0.005	-0.005	-0.005	-0.002	-0.002	-0.002
2008	-0.005***	-0.004***	-0.005***	-0.003***	-0.003***	-0.003***
2009	0.005***	0.004***	0.005***	0.002***	0.003***	0.002***
Etnicitity						
Western immigrant	-0.013*	-0.080***	-0.024***		-0.032***	-0.032***
Non-western immigrant	-0.074***	-0.185***	-0.092***		-0.111***	-0.114***
reference = autochtoon						
Partner						
married	-0.039***	-0.091***	-0.047***	0.001	-0.025***	-0.025***
Mundlak age averages						
18-30						0.001
31-40						-0.004***
41-50						-0.017***
51-63						-0.019***
Inverse Mills' ratio		0.497***		-0.024	0.091***	0.098***
Constante	1.484***	1.410***	1.472***	1.219***	1.231***	1.273***
Observations	89859	89859	101083	89859	89859	89859
Number of individuals				26770	26770	26770
Attrition bias						
Attrition indicator				0.002	-0.001	0.000

[a] Deaton & Paxson transformed time dummies

Table A.4: Results wage estimation: quasi fixed effects singles

	Single men			Single women		
	Lower educ.	Middle educ.	Higher educ.	Lower educ.	Middle educ.	Higher educ.
Age effect						
18-30	0.035***	0.050***	0.073***	0.035***	0.043***	0.053***
31-40	0.016***	0.028***	0.046***	0.022***	0.027***	0.040***
41-50	0.009***	0.016***	0.027***	0.026***	0.020***	0.022***
51-63	0.008***	0.016***	0.015***	0.021***	0.021***	0.016***
Cohort effect						
1980-1989	0.056	0.152***	0.245***	0.070	0.146***	0.210***
1975-1980	-0.009	0.068**	0.100***	0.026	0.078***	0.149***
1970-1975	0.004	0.032**	0.068***	0.017	0.046***	0.080***
1960-1965	0.006	0.012	-0.034	0.019	-0.025*	-0.056***
1955-1960	0.014	0.026	-0.075**	0.011	-0.027	-0.107***
<1955	-0.007	-0.006	-0.039	-0.004	-0.020	-0.048**
reference=1965-1970						
Year effect						
2006	0.005	0.004	0.004	0.005	0.005	0.002
2007	-0.005	-0.005	-0.006	-0.008	-0.006	-0.002
2008	-0.004***	-0.002**	-0.001	0.000	-0.003***	-0.001
2009	0.005***	0.003***	0.003***	0.003**	0.004***	0.001*
Etnicitity						
Western immigrant	-0.029	0.012	0.018	-0.011	0.008	0.001
Non-western immigrant	-0.080*	-0.038	-0.135***	-0.025*	-0.020	-0.052**
reference = autochtoon						
Mundlak age averages						
18-30	0.000	0.000	0.006	-0.002	0.004	-0.001
31-40	-0.010**	-0.006*	-0.009**	-0.018***	-0.010***	-0.002
41-50	-0.007	-0.010***	-0.012***	-0.023***	-0.012***	-0.010***
51-63	-0.005	-0.010***	-0.014***	-0.015***	-0.023***	-0.019***
Inverse Mills' ratio	0.004	-0.219**	-0.177***	-0.028*	-0.097***	-0.191***
Constante	1.462***	1.058***	0.380	1.431***	1.084***	1.097***
Observations	14055	26511	19534	11947	27783	21358
Number of individuals	4691	8621	6300	3887	8936	6694

Table A.5: Results wage estimation: quasi fixed effects couples

	Couples men			Couples women		
	Lower educ.	Middle educ.	Higher educ.	Lower educ.	Middle educ.	Higher educ.
Age effect						
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 effect						
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***
reference=1965-1970						
Year effect						
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***
Etnicitity						
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***
reference = autochtoon						
Partner						
married	0.015***	0.017***	0.015***	-0.011**	-0.015***	-0.025***
Mundlak age averages						
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***
Constante	1.446***	1.162***	0.618***	1.298***	1.430***	1.273***
Observations	88997	168316	129663	60824	146294	89859
Number of individuals	26779	49634	37742	19385	44262	26770

A.3 Childcare prices estimation

For non-users of formal childcare we have to impute 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) and out-of-school care (children 4-11 years). For both types of childcare we know whether childcare is at the child care centre or by so-called guest parents. Only households with a child at the age of 0-11 years use childcare and therefore we restrict our attention to this group.

We focus on households since childcare is consumed at the household level. As it turns out, characteristics of females are more important in predicting use and price of childcare than characteristics of men. Hence, we only include females characteristics in the regressions[19]. We pool singles and couples due to the low number of observations for singles. The same models as for the wage estimation are estimated[20]. Here, the dependent variable is the natural logarithm of the hourly real price. Tables A.6 and A.7 show estimation results for daycare and out-of-school care respectively[21].

Estimation results show that year dummies are significantly increasing for day care. However, time effects are less important in the price equation for out-of-school care (as expected based on descriptive statistics in Table A.2). Households with higher educated women or younger women pay a higher price on average. An explanation might be that these households search for higher quality. We conducted a Hausman test in order to test whether fixed or random effects is appropriate. In all cases, the Hausman test rejected the null hypothesis that random effects is consistent. Hence, the Hausman test favours the fixed effects model. Finally, we estimate a quasi fixed effects model with Mundlak age averages included. The age averages are jointly significant which is another way to show that we should prefer fixed effects over random effects. For the panel data models we tested whether attrition and selection bias is present. The results show that attrition bias is absent in all regressions. The inverse mills ratios are not significant in most models. Again, we use the quasi fixed effects model in the final column to impute prices of childcare for non-users.

[19] Obviously we include males characteristics in case of single fathers.

[20] The Heckman model by maximum likelihood is dropped due to convergence problems.

[21] Including a squared term for age, age splines, ethnicity, a dummy for age of the youngest child or a dummy for multiple children, leads to insignificant effects in most specifications.

Table A.6: Results price estimation: daycare

	Pooled OLS	Heckman 1	Fixed Effects	Random Effects	Quasi FE
Year effect					
2007	0.063***	0.059***	0.034	0.044***	0.058***
2008	0.137***	0.131***	0.073	0.096***	0.123***
2009	0.170***	0.163***	0.081	0.113***	0.153***
Higher educated	0.014*	0.006		-0.001	0.000
Age	-0.003***	-0.003***	0.003	-0.004***	-0.017***
Single parent	0.054***	0.051***		0.033**	0.033**
Inverse Mills ratio		-0.018	-0.047	-0.035*	-0.032
Mundlak age average					0.014**
Constant	5.438***	5.459***	5.351***	5.544***	5.507***
Observations	35675	35675	35675	35675	35675
Individuals			14984	14984	14984
Test attrition bias					
Attrition indicator			0.001	-0.003	-0.001

Table A.7: Results price estimation: out-of-school care

	Pooled OLS	Heckman 1	Fixed Effects	Random Effects	Quasi FE
Year effect					
2007	0.002	-0.004	0.088***	-0.010**	0.015
2008	0.006	-0.006	0.169***	-0.025***	0.025
2009	0.000	-0.014	0.250***	-0.040***	0.035
Higher educated	0.027***	0.007		0.020*	0.020*
Age	-0.004***	-0.003***	-0.103***	-0.005***	-0.031***
Single parent	-0.044***	-0.056***		-0.045***	-0.047***
Inverse Mills ratio		-0.040**	0.015	-0.009	-0.008
Mundlak age average					0.026**
Constant	5.700***	5.734***	9.367***	5.790***	5.741***
Observations	28938	28938	28938	28938	28938
Individuals			12015	12015	12015
Test attrition bias					
Attrition indicator			0.006	-0.001	0.005

A.4 Results model without childcare

Table A.8: Parameters utility function single parents

	Log Quadratic	Box-Cox
Income	-8.091***	1.692***
Leisure	-67.140***	-7.251***
*age	-0.991***	-0.062*
*age^2	1.561***	-0.126***
*child 0-3 yrs	-0.884**	-0.027
Income^2	4.899***	
Leisure^2	-107.200***	
Income*leisure	22.830***	
γ_1		-0.375***
γ_2		-42.300***
Fixed costs	-2.832***	0.089
*education low	-1.883***	-1.609***
*education mid	-0.563***	-0.410***
*non-Western immigrant	-1.036***	-1.022***
*Western immigrant	-0.552***	-0.543***
*child 0-3 yrs	-0.522***	-0.464***
*urban area	-0.222***	-0.246***
Individuals*alternatives	113,784	113,784
Individuals	18,964	18,964
Log likelihood	-27,263	15,088
Negative mu income	19%	0%
Negative mu leisure	65%	0%

Table A.9: Parameters utility function couples

Income	4.775***
Leisure men	-66.360***
*age	2.413***
*age^2	-0.181
Leisure female	-19.700***
*age	1.304***
*age^2	0.535
*child 0-3 yrs	-1.241***
Income2	0.213
Income*leisure men	5.283***
Income*leisure women	-3.504**
Leisure men^2	-96.390***
Leisure women^2	-127.600***
Leisure men*leisure women	-8.255
Fixed costs men	-8.516***
*education low	0.453***
*education mid	0.672***
*non-Western immigrant	-1.046***
*Western immigrant	-1.244***
Fixed costs women	-1.881***
*education low	-0.550***
*education mid	-0.168**
*non-Western immigrant	-1.012***
*Western immigrant	-0.434***
Couples*alternatives	282420
Couples	7,845
Likelihood	-19144
Negative mu income	0%
Negative mu leisure men	82%
Negative mu leisure women	4%

Table A.10: Elasticties model without childcare

Single parents	Log quadratic	Box-Cox
Wage (+1%)		
Labour supply	0.14	0.48
o.w. extensive margin	0.09	0.30
o.w. intensive margin	0.05	0.18

Couples	Log quadratic	Box-Cox
Wage men (+1%)		
Labour supply men	0.07	PM
o.w. extensive margin	0.06	
o.w. intensive margin	0.01	
Labour supply women	-0.06	
Wage women (+1%)		
Labour supply women	0.42	
o.w. extensive margin	0.26	
o.w. intensive margin	0.16	
Labour supply men	-0.09	