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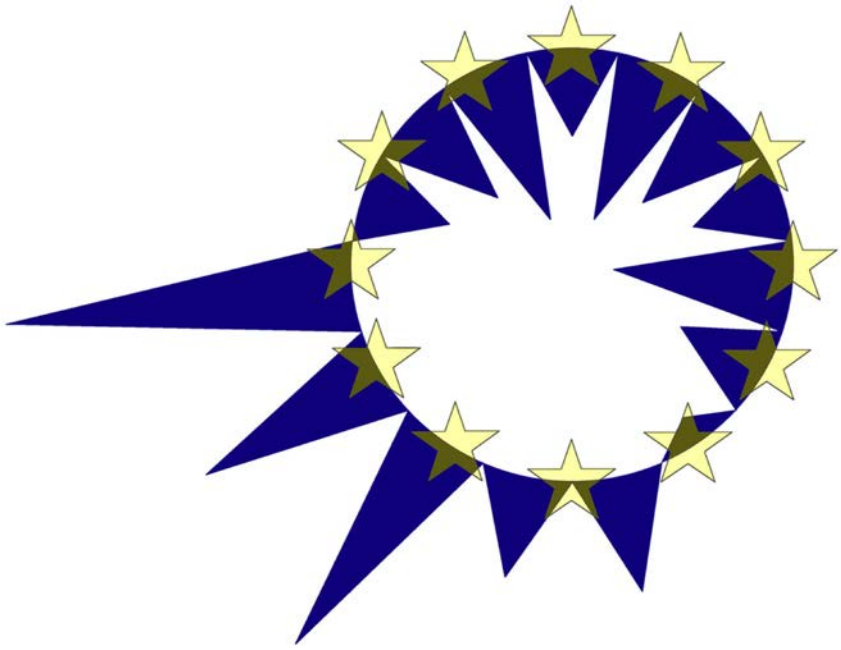

EUROMOD Working Paper No. EM 19/13

Full Childcare Coverage: Higher Maternal Labour Supply and Childcare Usage?

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November 2013

Full Childcare Coverage: Higher Maternal Labour Supply and Childcare Usage[1,2]

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Abstract

According to many studies, childcare is an important input for children's development but it is also used to free up time for parents to work. However, many households are still confronted with availability constraints in childcare. In the recent past, many governments implemented policy reforms in order to increase the coverage rate of childcare. The empirical part of this paper focuses on the Flemish childcare market and analyzes how maternal labour supply and childcare usage is affected by a new Flemish decree which provides full childcare coverage. This paper adopts a modeling framework for analyzing labour supply developed by Aaberge, Colombino and Strøm (1999) and Dagsvik (1994). To account for the possible interaction between labour supply and childcare choices the model also treats childcare type as an endogenous variable. The results of the policy reform analysis show that households switch to formal childcare when confronted with higher childcare availability. Total labour supply also increases but these effects are less pronounced as some households also reduce working hours.

JEL Classification: C35 H24 J13 J22 D10

Keywords: Labour supply, Childcare, Microsimulation

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[1] We are grateful to Rolf Aaberge, Tom Wennemo and André Decoster for their usefull comments on earlier work. We would also like to thank the Centrum voor Sociaal Beleid Herman Deleeck (CSB) for the provision of the GEZO-dataset. The usual disclaimer applies.

[2] This paper uses EUROMOD version F6.16. The process of extending and updating EUROMOD is financially supported by the Directorate General for Employment, Social Affairs and Inclusion of the European Commission [Progress grant no. VS/2011/0445]. The model is continually being improved and updated; the results presented here represent the best available at the time of writing. The author is responsible for all remaining errors.

1 Introduction

Proponents of policy reforms towards more and cheaper childcare with higher quality offer two main arguments. First, childcare is seen as a way to make time available for parents to engage in market work. As such, childcare is a key factor in the employment decision of parents, and in particular of mothers. Second, and according to many studies as important as the first argument (Jacob, 2009), childcare contributes to the cognitive and social skills of the child in early development. Hence, there have been a number of important policy initiatives towards more childcare in the recent past. For example, the Barcelona childcare targets of 2002 by the European Council state that each country should provide childcare by 2010 to at least 90% of children between three years old and the mandatory school age and to at least 33% of children under three years of age.

In line with the above arguments, in April 2012, the Flemish Parliament approved a new decree containing adjustments to the current childcare policy. The new decree has three main objectives. First, every household in need of childcare should find a suitable and affordable place within a reasonable time span and distance from their home. By 2016, the Flemish government aims at a coverage rate of 50% and by 2020, the supply of childcare must match childcare demand entirely. Making childcare more affordable for households and providing an official institution for the search of childcare are other objectives to make childcare more accessible for parents. Second, each childcare facility is obliged to have a legal authorization and to fulfill the necessary requirements related to the quality of the services provided and children's safety. Third, the current childcare sector consists of several types of care, each with their own stipulations and rules of subsidies. The new decree aims at simplifying this childcare structure. The main purpose of this paper is to analyze how the first objective; i.e. making childcare more available, affects the labour supply and childcare decisions of Flemish households.

This paper adopts the random utility labour supply model used by Aaberge, Dagsvik and Strom (1995). Aaberge et al. (1995) explicitly allow for heterogeneity in the opportunity set in which each element is characterized by the amount of hours of work, wage rate and other non-pecuniary attributes. By contrast, in the traditional discrete labour supply methodology, as suggested by Van Soest (1995) , each individual faces the same choice set and each job only contains the amount of hours and other job attributes are neglected. This paper extends the former methodology to account for the possible interaction between labour supply and childcare choice. Each household is now confronted with a household-specific opportunity set that is characterized by the amount of hours of work, wage rate, type of childcare and other non-pecuniary attributes. This type of modeling appears very convenient as the Flemish childcare sector is characterized by a large variation in childcare supply. There are indications that all three forms of non-parental childcare (informal, formal subsidized and formal non-subsidized) are confronted with excess demand. Hence, some households face larger opportunity sets than others; an element that is explicitly included in our type of modeling.

This model is estimated on a subsample of the Flemish Families and Care Survey of 2005 that contains detailed information about childcare utilization, working hours of parents, household income and other household characteristics. The estimation and simulation results suggest that Flemish

households alter their childcare and labour supply decision when the coverage rate of formal childcare increases. Parents decide to switch from informal childcare arrangements to formal childcare. Effects are observed at both the intensive and the extensive margin of the labour market. Many households that used to be rationed in their childcare choice have now the opportunity to start working. However, the labour supply effects at the intensive margin of the labour market are not straightforward. Switching to paid childcare implies two competing substitution and income effects. Switching from free childcare (informal or no care) to formal paid care implies an income effect that leads to an increase in labour supply and a substitution effect that reduces labour supply. Households now have to pay childcare costs which implies that they need to work more hours in order to obtain the same amount of income; an income effect. On the other hand, childcare leads to a decrease in wages which results in cheaper leisure and, given that leisure is a normal good, lower labour supply; a substitution effect. Therefore, it is not unambiguously clear how labour supply adjusts when the availability of childcare increases. Our results suggest that total labour supply slightly increases.

This paper contributes to the existing literature in multiple ways. First, it accounts for the simultaneous decision of childcare and labour supply, which acknowledges the fact that childcare opportunities in Flanders vary significantly across municipalities. Second, to the best of our knowledge, the simultaneous labour supply and childcare choice has never been estimated before in Belgium. Hence, this work provides a tool to investigate how policy reforms in Belgium might lead to behavioural responses of households.

This paper is organized as follows. Section 2 provides an overview of studies related to childcare and labour supply. Section 3 discusses the institutional childcare context in Flanders and provides details about the new Flemish childcare decree. The methodology is explained in Section 4 and Section 5 provides an overview of the dataset that is used in the empirical part of the paper. The estimation results and behavioural responses of the new Flemish decree are given in respectively Section 6 and Section 7. The last section concludes.

2 Literature review

There exists a large amount of studies analyzing parental labour supply decisions and childcare choices. Anderson and Levine (1999) , Brewer and Paull (2004) and Kalb (2009) provide overviews of the existing studies related to childcare and labour supply. Different methodologies have been applied to investigate the link between parental, and in particular mother's, labour supply decisions and the demand for childcare. Both ex-post methods, such as (quasi-) experimental studies, as ex-ante methods, such as reduced-form estimation and structural models, have been used to analyze this specific link.[1]

Independently from the type of methodology, the literature about labour supply and childcare demand can be broadly classified into two categories depending on the justifications for the demand for childcare. The first stream, known as the *Cost of Working approach*, considers childcare only as a way to make time available for parents to engage in market work. As such, childcare only forms part of

[1]We refer to Brewer and Paull (2004) for a detailed overview of these studies.

the costs of working and the demand for care is completely determined by the parental labour supply decision. The main advantage of this type of modeling is that it simplifies a more complicated model in the case where the main focus is not on modeling parental childcare demand but there is still a need to include childcare in a minimal way. Hence, most studies in this stream of the literature focus only on the parental labour supply decision and are therefore unable to explain why some households still demand childcare when both parents are not working. Studies whose main purpose is to model both the childcare and labour supply decision mostly allow for other justifications for childcare demand, such as the quality of different types of care and educational and development opportunities for the children. In this second stream, known as the *Simultaneous approach,* households make their employment and childcare decisions simultaneously and investigate the link between both, rather than only focusing on the former.

Many studies have put emphasis on the price of childcare to explain labour market behaviour and childcare demand. Expensive childcare might lead to situations in which parents, or at least one of the spouses, decides not to participate in the labour market to take care of their children. The main conclusion from these types of studies is that childcare costs negatively influence labour supply. In the more recent literature, the focus has shifted from the cost of childcare to its availability and accessibility. It might be that some parents are willing to use childcare at the going market price but cannot find a place, leading to an excess demand for childcare. This literature provides mixed evidence of the size and sign of the effect of these availability constraints on labour supply. For Germany, Hank and Kreyenfeld (2000) employ a multinomial logit model to estimate how the availability of public and informal day-care arrangements affect female labour-force participation. The authors find no significant effect of regional childcare provision on female labor-force participation. Wrohlich (2011), on the other hand, does find significant labour supply effects in Germany after increases in the availability of childcare. Wrohlich (2011) models labour supply and childcare demand in a discrete framework in which availability restrictions of formal childcare are explicitly taken into account in the budgetconstraint of each household. Del Boca (2002) , Del Boca and Vuri (2007) and Brilli et al. (2011) also find positive labour supply effects of childcare availability in Italy. These studies restrict the choice set according to a simulated probability of being rationed in the childcare sector. Kornstad and Thoresen (2007) assume that each household faces a household specific choice set from which they can choose. Hence, labour supply and childcare choices are outcomes of discrete choices from finite sets of jobs and childcare arrangements, where each job is assumed to have fixed working hours, a wage rate and a number of non-pecuniary attributes and each care alternative has fixed opening hours, a specific care price and different quality attributes. Excess demand of childcare is reflected in these opportunity sets where households that face a higher degree of rationing in childcare have fewer childcare options to choose from.

The approach presented in this paper has some similarities to Kornstad and Thoresen (2007) and is further explained in Section 4.

3 Institutional childcare context

The landscape of childcare in Belgium, and more specifically in Flanders, can be devided in two categories: formal and informal childcare. Within the formal childcare sector, both subsidized and non-subsidized childcare facilities exist. The former receive cost-covering subsidies while the latter do not and only need to register. The informal childcare, i.e. childcare provided by (mostly) grandparents and close relatives, is another important childcare option but its importance is decreasing over time, as discussed in Hedebouw and Peetermans (2009).

The childcare fee differs according to the type and amount of care demanded. Formal subsidized childcare providers are obliged to apply a legally determined means-tested tariff structure. The daily price per child lies between a minimum price of 1.28 Euro and a maximum price of 22.82 euro, with an average in 2005 of 13.5 Euro/day. Non-subsidized providers of formal childcare are free to determine the price they charge. According to Hedebouw and Peetermans (2009), the average daily price ranges between 17.2 Euro and 21.2 Euro, which is considerably higher than the average fee in the subsidized formal childcare sector.

A 2007-study shows that 10% of all parents that are actively searching for childcare in Flanders were not able to find a suitable childcare place after a search period of six months (MAS,2007)). Not finding childcare might have important consequences for the parental labour supply decision as these households stop working or reduce the amount of hours worked. There is evidence that households face availability restrictions in all three types of childcare, as suggested by Vandelannoote et al. (2013). First, some households do not have the option to bring their children to their grandparents. A more active ageing where grandparents are still working and do not have time to look after the children is one of the possible explanations. Living too far away from the grandparents is another possible reason for this lack of availability. Second, the supply of formal subsidized and non-subsidized childcare differs greatly among the 340 municipalities in Flanders. The average coverage rates for the subsidized and non-subsidized sectors are 24% and 11 %, leading to an average coverage rate of formal childcare in general of 35%, which is relatively high in comparison to other European countries.[2] Nevertheless, this does not mean that availability of formal childcare is not an issue in Flanders. While one small municipality has a coverage rate of formal childcare of over 100%, the 95th percentile's coverage rate is only 54% reflecting the huge variation in coverage rates among the different municipalities. Hence, there is strong evidence that different types of households face different childcare opportunities.

In the near future, the Flemish childcare landscape will face some major reforms. In April 2012, the Flemish Parliament approved a new decree containing adjustments to the current childcare policy. They are convinced that childcare is important for both children and parents for its pedagogic, economic and social function. A reform of the current childcare policy is necessary in order to fully capture these three aspects. The new decree correspondingly focuses on these three areas. First, every household in need of childcare should find a suitable and affordable place within a reasonable time span and distance from their home. By 2016, the Flemish government aims at a coverage rate of 50%

[2]The coverage rate is defined as the amount of full-time slots as a percentage of children below the age of three years living in this specific municipality.

and by 2020, the supply of childcare must equal childcare demand entirely. Making childcare more affordable for households and providing an official institution for the search of childcare are other ways to make childcare more available and accessible for parents. Second, each childcare facility will be obliged to have the legal authorization for childcare and to fulfill the necessary requirements related to the quality of the services provided and children's safety. Third, the current childcare sector consists of several types of care, each with their own stipulations and rules of subsidies. The new decree aims at a simplification of this childcare structure. The main purpose of this paper is to investigate whether parents actually alter their childcare and labour supply decisions when childcare availability increases.

4 Methodology

This section starts by presenting an overview how labour supply is modeled in the literature. The second part explains how this framework can be used to include the simultaneous choice of labour supply and childcare.

4.1 Labour supply modeling

The last decades witnessed substantial progress in modeling labour supply behaviour.[3] Up to the nineties, the traditional way of ex-ante labour supply modeling was in a continuous framework, see Hausman and Ruud (1986) and Arrufat and Zabalza (1986), where any hours of work are equally available in the market. The household selects the best combination of labour supply and consumption so as to maximize its utility function, given a time and budget constraint. However, as pointed out by Aaberge et al. (1999), this traditional way of modeling suffers from both quantitative and qualitative restrictions. The former relates to the assumption of uniformly distributed offered hours of work that is rather unrealistic as the structure of labour costs makes it less attractive to firms to offer contracts that allow for flexible work schedules and, hence, the available choice set for each individual might be severely reduced. Secondly, the traditional way of modeling labour supply faces an important qualitative restriction as households choose among jobs that are only characterized by the amount of hours. As such, other job attributes such as the sector of the job are neglected but might be important characteristics of the job that influence the household's decision.

In order to overcome these problems, several empirical studies of labour supply models tried to account for these restrictions. Van Soest (1995) applies the discrete random utility maximization model (RUM) initiated by Daniel McFadden (1974) in order to address to the quantitative restriction of the traditional way of modeling labour supply.[4] In this methodology, the optimal labour supply choice is modeled in terms of a comparison of the utility levels at different discrete labour supply points. Households do not longer have the choice from a continuous labour supply choiceset but are restricted to some discrete hours points such as inactivity, part-time and full-time work. Introducing

[3] We refer to Keane and Rogerson (2012) for a detailed overview.

[4] McFadden (1974) applied these random utility models to several transport and occupational choices. He considered these choices as discrete.

a random utility term which is assumed to be distributed according to an extreme value distribution leads to an easy expression for the probability that any particular discrete labour supply point is chosen. These models are structural in a sense that there is no reduced form labour supply function which depends on wages and the amount of hours worked but that the structural parameters for preference for consumption and leisure are identified out of an a priori functional form of the utility function. For Belgium in particular, this type of methodology has been applied in Decoster et al. (2006), Orsini (2006), Orsini (2007) and Decoster and Vanleenhove (2012).

This type of methodology, known as the *conventional discrete labour supply approach*, however, still has an important quantitative restriction. Van Soest (1995) assumes that each individual faces the same choiceset of discrete points. However, it might be that highly skilled individuals face different opportunity sets with more full-time positions than low educated individuals. Secondly, in line with the traditional way of modeling labour supply, Van Soest (1995) assumes that jobs are only characterized by the amount of hours and, hence, neglects potentially important other job attributes.

Aaberge, Dagsvik and Strøm (1995), Aaberge, Colombino and Strøm (1999) and Aaberge, Colombino and Wennemo (2009) present a methodology that gives an answer to both the quantitative and qualitative restrictions from the previous models. Each individual faces an individual specific opportunity set that contains jobs that are characterized by the amount of hours, a job-specific wage rate and other (un)observable job characteristics such as the sector of the job or the atmosphere at work. Including these individual specific opportunity sets is important as differences in choices of individuals can be assigned to both differences in preferences and/or opportunities. In contrast, in the *conventional discrete labour supply approach* the choice of each household is assumed to be driven by preferences only. For Belgium, this type of labour supply modeling has already been applied in Dagsvik et al. (2011).

The work presented in this paper extends the modeling framework developed by Aaberge et al. (1995) with the choice of childcare that can be seen as an additional job characteristic. As discussed in Section 3, there is a large variation in the supply of the different types of childcare among the municipalities in Flanders. Individuals who live in a rather rural area and/or live far away from their parents face completely different opportunities in childcare than similar households that are living near their parents in an urban area. Hence, the framework suggested in Aaberge, Dagsvik and Strøm (1995) that explicitly models these individual specific opportunity sets is very useful for modeling the simultaneous labour supply and childcare type choice in Flanders.

4.2 Labour supply - childcare model

Each single agent is confronted with an individual specific opportunity set B in which each element can be characterized by four elements:[5]

1. Amount of hours worked h

[5]Note that, for reasons of simplicity, we do not include a household specific index i. We also focus on the single agent case. As discussed in Section 5, the model is estimated on couple households with full-time working father and we only focus on the maternal labour supply decision. Hence, the single agent model is used in the empirical part of the paper.

2. Gross hourly wage w

3. Unobserved characteristics k such as commuting time and neighbourhood of workplace and childcare facility, etc.

4. Type of childcare:

$$a_j \quad = \quad \begin{cases} 1 & \text{if childcare type } j\text{is used} \\ 0 & \text{otherwise} \end{cases},$$

for $j = 1, 2, 3, 4$. Given that each child can only use 1 option, we have that $\sum_{j=1}^{4} a_j = 1$. As discussed in Section 3 and Section 5, four different childcare types are considered; no childcare, formal subsidized care, formal non-subsidized care and informal care. The amount of hours of childcare is not modeled due to lack of reliable information.

Each opportunity set B consists of market and non-market opportunities. A market opportunity is characterized by strictly positive hours h, positive wages w and type of childcare j. A non-market opportunity, on the other hand, is defined as a point in which the single agent is not working ($h = w = 0$) and chooses a type of childcare j. As such, this implies that households might have the option to demand any type of childcare, even when they are not working. Additionally, we define p_{0j} and p_{1j} as the proportion of respectively non-market and market opportunities with type of childcare j in the opportunity set B with j=1, 2, 3, 4. The sum of these proportions has to equal 1:

$$\sum_{i=0}^{1} \sum_{j=1}^{4} p_{ij} \quad = \quad 1. \tag{1}$$

Additionally, we say that B_j is the set of market opportunities with childcare type j with j=1, 2, 3, 4. The sum of these opportunity sets equals the total amount of market opportunities in the total opportunity set B. We further define $g(h, w, j)$ as the conditional density of choice opportunities with hours h, wages w and childcare type j with j=1, 2, 3, 4. As such, they represent the relative frequency of opportunities with hours h, wages w and childcare type j.

We assume that each household chooses a point in his or her opportunity set by maximizing the following utility function:

$$U\left(f(wh), I\right), h, z, k) \quad = \quad v\left(f(wh, I), h, z\right) \cdot \varepsilon(w, h, z, k), \tag{2}$$

where f represents the tax-benefit system that transforms gross income into disposable income and I equals the amount of non-labour income. Total household utility U consists of a deterministic part v, which is known to both researcher and household, and a random part ε that accounts for other

unobserved preference characteristics.[6] We assume that household utility depends on the amount of hours worked h, total net disposable income $f(wh, I)$ and the type of childcare used z with $z = 1, 2, 3, 4$.

We assume the random term ε to be independently and identically distributed according to an extreme value type I distribution. It can be shown that, given this assumption and equation (2), the probability that a household chooses a job with characteristics(w, h, z) can be written as follows:[7]

$$\begin{aligned} \varphi(w,h,z) &= \Pr\left[U\left(f(wh,I),h,z\right) = \max_{(x,y,j)\in B} U\left(f(xy,I),y,j\right)\right] \\ &= \frac{v\left(w,h,z\right)\cdot p(w,h,z)}{\sum_{j=1}^{4}\int\limits_{(x,y)\in B} v\left(x,y,j\right)\cdot p(x,y,j)\cdot dx\cdot dy}, \end{aligned} \tag{3}$$

in which $p(w, h, z)$ stands for the probability density function of jobs with wage rate w, amount of hours h and type of childcare z. Intuitively, Equation (3) reflects that the probability of a specific choice (w, h, z) can be seen as the relative attractiveness of jobs of this specific type, weighted by a measure of availability of this choice $p(w, h, z)$.

In the empirical specification of the model, we specify that:

$$p(w,h,j) = \begin{cases} p_{1j}\cdot g(w,h,j) & \text{if } h>0 \\ p_{0j} & \text{if } h=0 \end{cases}, \tag{4}$$

for j=$1, 2, 3, 4$. For the market opportunities, the probability density $p(w, h, j)$ equals the share of market jobs with childcare type j, p_{1j}, multiplied with the conditional density of jobs with wages w, hours h and childcare type j. In the non-market case where h equals zero, the proportion of non-market opportunities with childcare type j (p_{0j}) is sufficient to know the probability of this specific choice.

Given Equation (3) and (4), it can be shown that the probability density for choosing a market opportunity job with h hours, w wage rate and type of childcare z can be written as:

$$\begin{aligned} \varphi(w,h,z) &= \Pr\left[U\left(f(wh,I),h,z\right) = \max_{(x,y,j)\in B} U\left(f(xy,I),y,j\right)\right] \\ &= \frac{v\left(w,h,z\right)\cdot p_{1z}\cdot g(w,h,z)}{D} \end{aligned} \tag{5}$$

for $\{w, h\} > 0$ and z=$1, 2, 3, 4$, the probability density for choosing a non-market opportunity job with 0 hours, 0 wage rate and type of childcare z can be written as:

[6] These preference characteristics are unobserved for the researcher, not necessarily for the household.

[7] We refer to Aaberge et al. (1999) and Aaberge and Colombino (2013) for this derivation.

$$\begin{aligned}\varphi(0,0,z) &= \Pr\left[U\left(f(0,I),0,z\right) = \max_{(x,y,j)\in B} U\left(f(x,I),y,j\right)\right] \\ &= \frac{v\left(0,0,z\right)\cdot p_{0z}}{D} \end{aligned} \tag{6}$$

for $z = 1, 2, 3, 4$, where the denominator D is given by:

$$D = \sum_{j=1}^{4}\left[v(0,0,j)\cdot p_{0j}\right] + \sum_{j=1}^{4}\left[\int_{(x,y)\epsilon B_j} v(x,y,j)\cdot p_{1j}\cdot g(x,y,j)\cdot dx\cdot dy\right]. \tag{7}$$

For convenience in the next derivations, the denominator can be rewritten as follows:

$$D = v(0,0,1)\cdot p_{01} + \sum_{j=2}^{4}\left[v(0,0,j)\cdot p_{0j}\right] + \sum_{j=1}^{4}\left[\int_{(x,y)\epsilon B_j} v(x,y,j)\cdot p_{1j}\cdot g(x,y,j)\cdot dx\cdot dy\right], \tag{8}$$

in which we have split up the non-market opportunities.

In the empirical specification of the model, we assume that offered hours, offered wages and offered type of childcare are independently distributed. As explained in Aaberge and Colombino (2013), the independence of offered hours and wages can be justified by the fact that hours are normally set in rather infrequent negotiations between employers and employees associations, while there are far more wage negotiations in which hourly wages do not depend on hours worked. Hedebouw and Peetermans (2009) show that there is no evidence that the type of childcare chosen depends on the amount of hours worked and wage received. Hence, it is realistic to assume that the offered hours and offered wages are independently distributed from offered childcare type.[8]

Additionally, we specify that $q_{1j} = \frac{p_{1j}}{p_{01}}$ for j=$\{1, 2, 3, 4\}$ which can be seen as the fraction of the proportion of market opportunities with childcare type j=$1, 2, 3, 4$ over the proportion of non-market opportunities without childcare. We also define $q_{0j} = \frac{p_{0j}}{p_{01}}$ for j=$\{1, 2, 3, 4\}$ which are the fractions of the proportion of non-market opportunities with childcare type $j = 1, 2, 3, 4$ over the proportion of non-market opportunities without childcare. Thus, we specify the density of opportunities as follows:

$$q_{1j}\cdot g(w,h,j) = g_1(w)\cdot g_2(h)\cdot g_3(j) \quad , \tag{9}$$

for j=$1, 2, 3, 4$ and where $g_1(w)$, $g_2(h)$ and $g_3(j)$ are respectively the densities of wages, offered hours and childcare type for market opportunities.

For estimation purposes, we divide both numerator and denominator by p_{01}. Given these assumptions, we can rewrite Equation (5) and Equation (6) as follows:

[8]Note that their might be a link between the offered hours and offered childcare hours but as we only model type of childcare, this is not relevant for this work.

$$\varphi(w,h,z) \quad = \quad \frac{v\left(w,h,z\right)\cdot g_1(w)\cdot g_2(h)\cdot g_3(z)}{\widetilde{D}} \tag{10}$$

for $z = 1, 2, 3, 4$ and

$$\varphi(0,0,1) \quad = \quad \frac{v\left(0,0,1\right)}{\widetilde{D}} \tag{11}$$

for the non-market opportunity without childcare ($z = 1$) and

$$\varphi(0,0,z) \quad = \quad \frac{v\left(0,0,z\right)\cdot q_{0z}(z)}{\widetilde{D}} \tag{12}$$

for the non-market opportunities with $z = 2, 3, 4$, where the denominator is equal to:

$$\begin{aligned}\widetilde{D} \quad = \quad & v(0,0,1) + \sum_{j=2}^{4}\left[v(0,0,j)\cdot q_{0j}\right] \\ & + \sum_{j=1}^{4}\left[\int_{(x,y)\epsilon B_j} v(x,y,j)\cdot g_1(x)\cdot g_2(y)\cdot g_3(j)\cdot dx\cdot dy\right].\end{aligned} \tag{13}$$

Given Equations (10)-(13), the individual likelihood contributions can be constructed and the preference parameters can be estimated.

4.3 Empirical specification of the model

We denote net disposable income that results from the tax-benefit system f as follows:

$$f(wh, I) \quad = \quad C \tag{14}$$

The deterministic part of utility is specified according to a Box-Cox utility function and is given by:

$$\log v(C,h,j) \quad = \quad \alpha_2\left(\frac{C^{\alpha_1}-1}{\alpha_1}\right) + \left(\beta_0 + \beta_1 \mathrm{ch}_{46} + \beta_2 \mathrm{ch}_{79} + \sum_{j=2}^{4}\beta_{(1+j)}a_j\right)\left(\frac{L^{\alpha_3}-1}{\alpha_3}\right), \tag{15}$$

in which L is defined as the amount of leisure and equals $L = 1-(h/8736)$. The estimated coefficient for leisure is household specific as they depend on the amount of children between 4-6 (ch_{46}) and 7-9 (ch_{79}) years old and the type of childcare used.

We assume that the density of the offered wages is distributed log normal and depends on the

potential experience (Exp_{pot}) and education level (E_{low}) : [9]

$$log\, w \quad = \quad \lambda_0 + \lambda_1 \ln(\text{Exp}_{pot}) + \lambda_2 \ln(\text{Exp}_{pot})^2 + \lambda_3 E_{low} + \lambda_4 E_{high} + \xi, \tag{16}$$

in which ξ is a random term that is normally distributed.

The distribution of offered annual hours is assumed to be uniformly distributed except for possible peaks at part-time and fill-time jobs. Hence, $g_2(h)$ is given by the following expression:

$$g_2(h) \quad = \begin{cases} \gamma_1 & \text{if } h \in [52, 962[\\ \gamma_1 \exp \gamma_2 & \text{if } h \in [962, 1066[\\ \gamma_1 & \text{if } h \in [1066, 1534[\\ \gamma_1 \exp \gamma_3 & \text{if } h \in [1534, 1586[\\ \gamma_1 & \text{if } h \in [1586, 1950[\\ \gamma_1 \exp \gamma_4 & \text{if } h \in [1950, 2106[\\ \gamma_1 & \text{if } h \in [2106, 3640[\end{cases} . \tag{17}$$

The maximum amount of hours observed in the dataset equals 3640 hours/year.

Equation 18 presents the density of childcare types in which the variable Prop_{for} and the variable Cov represent respectively the proportion of formal subsidized childcare and the coverage rate of formal childcare in my municipality. The proportion of formal subsidized childcare equals the share of subsidized facilities if the total amount of formal childcare places. The coverage rate of formal childcare represents the amount amount of full-time formal childcare slots as a percentage of children below the age of three years living in this specific municipality. The variable Gr_{am} and Gr_{av} represent respectively the amount of grandparents and a grandparental availability index that take the employment status, health of the grandparents and the distance to grandparents into account.

$$\begin{aligned} \log g_3(j) \quad = \quad & \big(\rho_{20} + \rho_{21}\text{Prop}_{for} + \rho_{22} Cov\big) a_2 + \\ & (\rho_{30} + \rho_{31} Prop_{for} + \rho_{32} Cov) a_{3.} + \\ & (\rho_{40} + \rho_{41} Gr_{am} + \rho_{42} Gr_{av}) a_4 \end{aligned} \tag{18}$$

The ratios of the proportion of non-market opportunities with childcare type j for $j = 2, 3, 4$ over the proportion of non-market opportunities without childcare ($j = 1$), q_{0j} are specified as a constant:

$$\theta_j \quad = \quad \log(q_{0j}) = \log\left(\frac{p_{0j}}{p_{01}}\right) \tag{19}$$

[9] The former is defined as her age minus years of schooling minus 6.

5 Data description

This section discusses the dataset that is used for estimation and provides an overview of observed household labour supply, income and childcare choices.

5.1 Estimation sample

This paper uses data from the 2004-2005 Flemish Families and Care survey (FFCS) that contains a representative sample of 1275 Flemish households with a youngest child aged up to three years old. This survey collects detailed information about childcare utilization, working hours of parents, household income and other household characteristics.[10]

Several restrictions are imposed on the dataset in order to arrive at a subsample on which the model is estimated. First, due to the limited amount of single female and male households with preschool children, we only consider couple households. Moreover, we only consider the labour supply decision of the mother, and focus on couples in which the father works full-time. We try to keep the model relatively simple by focusing on this specific subgroup which represents the most common situation among families with preschool children. Second, the analysis is restricted to households in which both parents are potentially available for the labour market. Hence, both partners need to be aged between 18-65 years old and are not in education, (pre)retired, disabled or ill. Third, due to a lack of reliable information about hours worked, self-employed are left out of the sample. Households with children already available for the labour market but still living with their parents are also excluded from the estimation sample. For these households, it is not clear whether they see their labour supply and childcare decisions as a collective or an individual process. Fourth, we also exclude households with children younger than 3 months because maternity and parental leave regulations largely depress demand for childcare services for younger children.[11] After imposing these restrictions, the sample used in the estimation consists of 552 households with at least one preschool child between 3-35 months old. Table 13 in appendix provides some descriptive statistics.

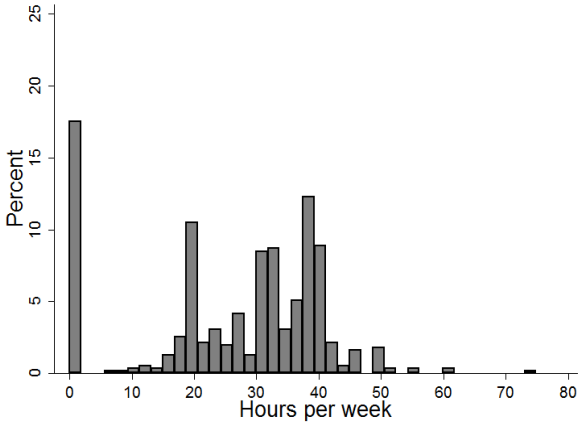
5.2 Maternal labour supply and child care usage

The survey provides detailed information about the working hours of parents. Figure 1 shows that maternal labour supply is concentrated around several points. 17% of all mothers in the subsample are observed not to work and we see peaks in the density at 20 hours of work, 30 hours of work and full-time work of 40 hours.

[10] For more information about the FFCS, see Debacker et al. (2006).

[11] Haan and Wrohlich (2011) avoid estimations for all children younger than 12 months in Germany. For Belgium, Hedebouw and Peeters (2009) clearly show that demand for childcare services in Flanders resumes at the age of 3 months old.

Figure 1: Observed working hours mothers



In the survey, households are asked which type of childcare they most frequently use during a normal week. According to Table 1, 36.8% of all households in the estimation sample are using formal subsidized childcare as most frequent type of care, 20.8% use most frequently formal non-subsidized care and 21.4% opt for informal care. 21.0% of all households report not to use childcare as most frequent type of care for their children.[12]

Table 1: Type of childcare for preschool children

	Number of households (%)	Number of children 3-35 months
No childcare	21.0	133
Formal subsidized care	36.8	220
Formal non subsidized care	20.8	121
Informal care	21.4	125
Total	100	559

Source: Own Calculations, GEZO-data 2005

Table 2 looks more closely at the link between childcare type and maternal working hours for all the observations in the estimation sample. Several remarks can be made when looking at the table. First, in the large majority of all cases in which the mother is not working, no childcare is used. We observe that 70% (= 69 of 99 households) of all households in which the mother is not working are not using childcare. Second, and not unsurprisingly, the majority of households use childcare when the mother is working. However, we still observe households that are not using childcare when both parents are working. As pointed out in Ghysels and Debacker (2007), many households with two working parents have flexible working hours and are therefore able to take care of their children and not demand childcare.[13] Third, when the mother is working full-time households opt more for formal

[12]In line with the literature and to keep the model relatively simple, we restrict to households in which the childcare choice is homogeneous among the children. Households with more than one preschool child should use the same type of care for their children. As such, 28 households are dropped from the estimation sample that report to use different types of care for their children.

[13]Note that only the most frequent type of childcare is reported. Hence, it might be possible that some of these households actually use childcare during a normal week but in a smaller amount than not using childcare.

subsidized childcare than for informal care in comparison to part-time work.

Table 2: Childcare type and maternal labour supply

Maternal labour supply	Type of childcare				
	No childcare	*Formal sub*	*Formal non-sub*	*Informal*	Total
Not working	69	14	7	9	99
Marginal part-time work	13	48	24	30	115
Part-time work	15	54	36	38	143
Full-time work	23	87	45	40	195
Total	120	203	112	117	552

Source: Own Calculations, GEZO-data 2005

The findings above might be explained by diverging preferences of households but might as well be explained by different opportunities regarding labour supply and childcare. Some households have the opportunity to bring their children to their parents, or have multiple options in both formal subsidized and non-subsidized childcare. Other households, on the other hand, only have a limited amount of formal childcare options and informal childcare is often not an option. As discussed in the previous section, the model that we estimate takes this feature into account. Table 13 and Table 14 provide information on some potential specific determinants of childcare. The FFCS-dataset contains very detailed information about the availability of grandparents for care, such as the distance, number, health and employment status. These questions are asked for each of the four grandparents, if still alive, see table 14. We also know in which municipality each household lives. Hence, we know the coverage rate of childcare and the proportion of both formal subsidized and non-subsidized care. The coverage rate is defined as the number of childcare places in full time equivalent divided by the total number of children in the age interval 0-3. On average, this coverage rate is 33% but has a relatively large standard deviation which results in the fact that some households are more limited in their childcare choice than others. These variables are included in Equation (18) when estimating the opportunities of childcare, as explained in Section 4.3.

5.3 Household income and childcare costs

The model presented in Section 4 needs net disposable household income for each element of the opportunity set. Euromod is used as microsimulation tool for the calculation of these budgetconstraints.[14] Gross household income is equal to the sum of labour earnings of all household members. The income tax and employee's social security contributions are deducted from gross income, and social transfers such as social assistance, unemployment benefits, child benefits, education benefits, education benefits for students and housing benefits are added. Lastly, childcare costs are deducted from this income concept to arrive at net disposable household income. These childcare costs are simulated in Euromod, taking into account the possibility of tax deduction.

The left hand side of Figure 2 displays the observed net disposable household income for all

[14]More information about Euromod can be found at https://www.iser.essex.ac.uk/euromod. Also, see (Sutherland and Figari, 2013).

observations in the estimation sample. Note that income is relatively high as we focus on couple households with full-time working fathers. The right hand side of Figure 2 presents the total observed childcare costs for households with at least 1 child in paid childcare. The peaks around 200 euro, 300 euro and 400 euro follow from the peaks in labour supply as shown in Figure 1. Table 3 gives an overview of observed household income and childcare costs.

Figure 2: Net disposable income and childcare costs

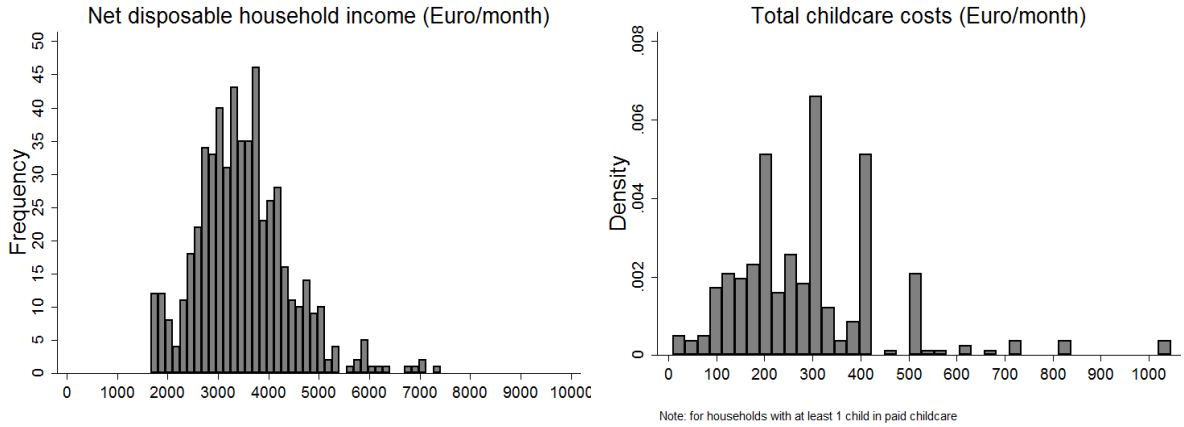


Table 3: Descriptives income and childcare costs

Variable	Mean	Std. Dev.	Min	Max
Net disposable household income without childcare cost	3676	975	1678	7730
Household childcare cost using paid care	293	159	9	1046
Net disposable household income with childcare costs	3508	910	1678	7416

Source: Own Calculations, GEZO-data 2005

6 Estimation results

This section discusses the estimation results, looks at the prediction performance of the model by comparing the observed and predicted labour supply and childcare densities and calculates labour supply elasticities both with respect to wages and childcare prices.

6.1 Estimation results and fit of the data

Table (4) presents the estimated preference parameters of the deterministic part of utility, as specified in Equation 15. According to the significant positive estimate of α_2, households value consumption positively. The consumption and leisure exponent α_1 and α_3 are both significantly lower than 1 and, hence, indicate that the utility function is concave with respect to consumption and leisure. For leisure, the curvature of the utility function is logarithmic as the estimated exponent α_3 is not significantly different from zero.

As expected, on average, households value leisure positively ($\beta_0 > 0$) and having more children between 4-6 and 7-9 years old results in a higher taste for leisure. According to the estimated

parameters of the interaction terms of childcare type and leisure, we find that households have a larger taste for leisure when not using childcare in comparison to both subsidized and non-subsidized care. No such significant difference is observed between no childcare and informal care. These preferences might be driven by the differences in childcare cost between no childcare usage and using formal childcare and/or by the fact that young mothers prefer to raise their children themselves.[15]

Tables (5) and (6) present the parameters for the job and childcare opportunities. As expected, both higher education and potential experience have a significant positive effect on wages. The estimated distribution of offered hours, see Equation 17 and γ_2, γ_3 and γ_4, clearly show a peak in the two part-time intervals and at full-time work. We also find that the logarithm of the ratio of non-market opportunities with informal, formal subsidized and formal non-subsidized care to the amount of non-market opportunities without childcare is significantly negative, see θ_2, θ_3 and θ_4. Apparently, there are more non-market alternatives without childcare than non-market alternatives with the other three types of care. The estimates of Equation 18 show that, as expected, living in a municipality with a higher coverage rate of formal childcare leads to more formal (both subsidized as non-subsidized) childcare opportunities. Having more healthy and non-working grandparents that are living nearby, i.e. a larger grandparental availability index, increases the opportunity set for informal childcare significantly.

Table 4: Estimated preference parameters

	Coeff.	**Std. Dev**
Consumption exponent *(α_1)*	0.726^{**}	0.060
Consumption *(α_2)*	10.372^{**}	1.088
Leisure exponent *(α_3)*	0.242	0.393
Leisure couple		
Constant (β_0)	45.171^{**}	3.297
# children between 4-6 (β_1)	2.680^{**}	0.890
# children between 7-9 (β_2)	4.308^{**}	1.209
Interaction formal sub care (β_3)	-10.727^{**}	1.792
Interaction formal non-sub care (β_4)	-13.996^{**}	1.917
Interaction informal care (β_5)	-3.141	2.313

*Significant at 10% level, ** Significant at 5% level

Source: Own Calculations, GEZO-data (2005)

[15]Note that the differences between formal subsidized and non-subsidized childcare are not significantly different from each other.

Table 5: Wage equation

	Coeff.	**Std. Dev**
Constant (λ_0)	2.192**	0.041
Ln (potential experience) (λ_1)	2.317**	0.545
Ln (potential experience squared) (λ_2)	−6.523**	2.043
Low educated (λ_3)	−0.237**	0.115
High educated (λ_4)	0.203**	0.020

*Significant at 10% level, ** Significant at 5% level

Source: Own Calculations, GEZO-data (2005)

Table 6: Opportunities

	Coeff.	**Std. Dev**
Peak dummies		
Peak dummy 1 (γ_2)	0.657**	0.162
Peak dummy 2 (γ_3)	1.317**	0.140
Peak dummy 3 (γ_4)	2.146**	0.142
Ratio non-market opportunities		
θ_2	−1.802**	0.489
θ_3	−2.085**	0.573
θ_4	−1.998**	0.590
Density formal subsidized childcare		
Constant (ρ_{20})	−1.315*	0.724
Proportion formal subsidzed care (ρ_{21})	0.460	0.534
Coverage rate (ρ_{22})	2.117**	1.043
Density formal non-subsidized childcare		
Constant (ρ_{30})	−0.545	0.802
Proportion formal subsidzed care (ρ_{31})	−0.627	0.616
Coverage rate (ρ_{32})	2.866**	1.193
Density informal subsidized childcare		
Constant (ρ_{40})	−1.996**	0.877
Amount of grandparents (ρ_{41})	0.170	0.146
Grandparental availability index (ρ_{42})	0.298**	0.020

*Significant at 10% level, ** Significant at 5% level

Source: Own Calculations, GEZO-data (2005)

Given the estimated preferences and opportunities, a comparison of the actually observed and simulated densities of hours of work, childcare type and consumption can be made. Given the limited amount of observations in the dataset, the model fits the data very well, see Figure (3)-(5). The model is able to reproduce the peaks at inactivity, marginal part-time work (17.5-20.5 hours/week), part-time (27.5-32.5 hours/week) and full-time (36.5-40.5 hours/week) in a very precise way. The fit of childcare type, see Figure 4, reveals that the model replicates the observed childcare usage almost

perfectly.

Figure 3: Fit labour supply

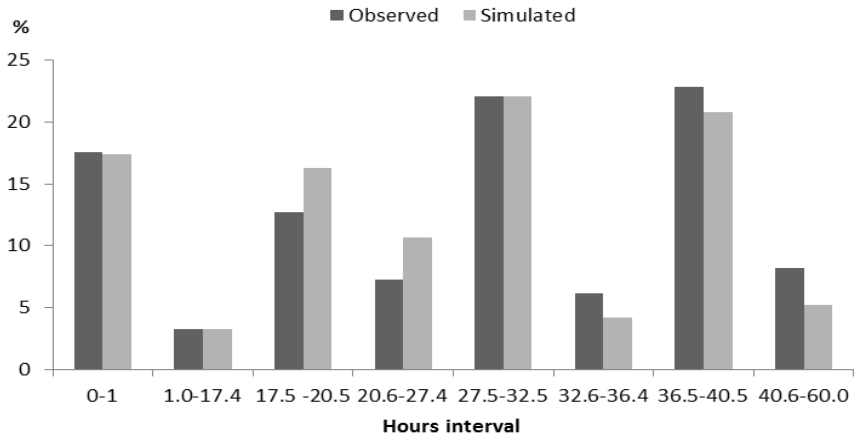


Figure 4: Fit childcare

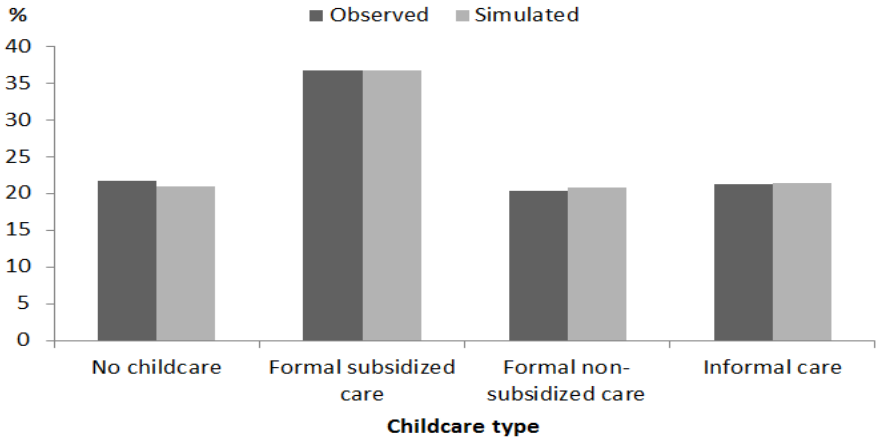
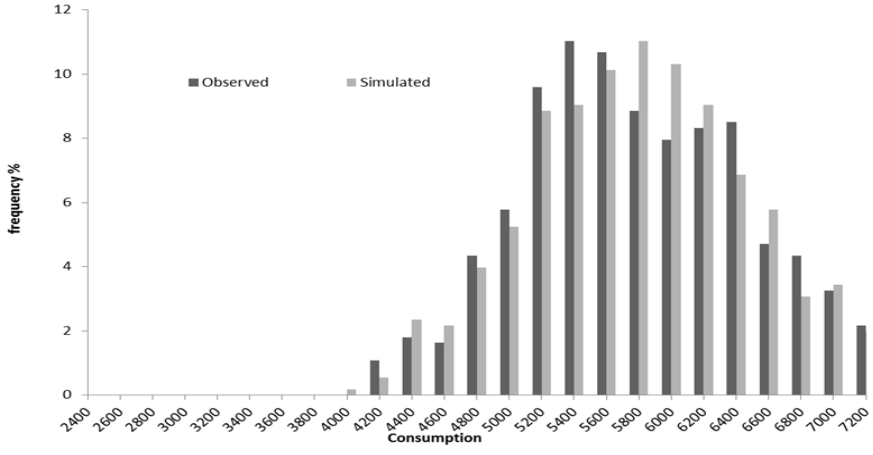


Figure 5: Fit disposable income



6.2 Labour supply responses: elasticities

An alternative way of interpreting the estimated coefficients of the previous section is by looking at the size of labour supply responses with respect to changes in budgetary constraints. The structural basis of the model implies that there is no explicit labour supply function from which an elasticity can be derived. Therefore, numerical methods are used to analyse the sensitivity of labour supply with respect to these budgetary changes. The individual's gross wage or childcare cost is increased by 10%, keeping all other characteristics constant. Euromod simulates the new budgetconstraint and the new labour supply can be derived, given the estimated coefficients. We first aggregate total labour supply of all individuals and analyze accordingly how their labour supply has changed. Table (7) and Table (8) provides the elasticities with respect to an increase in gross hourly wage and childcare price. The first column represents the unconditional labour supply elasticity that includes both the intensive and extensive labour supply responses. The second column of Table (7) and Table (8) reflects only the intensive margin of the labour market, i.e. conditional on working in the baseline situation and the third column focuses on the extensive margin, i.e. the effect on the probability of participation in the labour market.

The overall unconditional labour supply elasticity with respect to wages equals 1.07, in which both the effect at the intensive margin (0.42) and at the extensive margin (0.58) are important. Not surprisingly, the effect at the extensive margin (1.64) is of greater importance than at the intensive margin (0.92) for individuals of the first quartile. The majority of mothers in this quartile are observed not to work in the baseline situation. In line with other studies that apply a similar methodology on other datasets, see Aaberge et al. (1999) and Aaberge et al. (2011) , we find that the higher the income, the lower the labour supply responses after an increase in wages. The unconditional labour supply elasticity with respect to childcare costs is much smaller and equals only 0.17 and is again almost equally spread over the intensive (0.08) and extensive margin (0.10). In contrast to the elasticities with respect to wages, we don't observe a gradual decline in elasticity over income.

Table 7: Labor supply elasticities wrt wage increases

	Unconditional elast	**Conditional elast**	**Participation elast**
Quartile 1	3.15	0.92	1.64
Quartile 2	0.95	0.49	0.41
Quartile 3	0.70	0.31	0.37
Quartile 4	0.33	0.20	0.18
Total	1.07	0.42	0.58

Source: Own Calculations, GEZO-data (2005)

Table 8: Labor supply elasticities wrt childcare price increases

	Unconditional elast	**Conditional elast**	**Participation elast**
Quartile 1	0.32	0.17	0.10
Quartile 2	0.27	0.20	0.06
Quartile 3	0.20	0.09	0.20
Quartile 4	−0.01	−0.08	0.06
Total	0.17	0.08	0.10

Source: Own Calculations, GEZO-data (2005)

7 Childcare availability and labour supply

As discussed before, increasing childcare availability for preschool children is one of the main targets of the new decree of the Flemish government. In 2016, 50% of all Flemish preschool children should find suitable childcare and the availability problem must be completely solved by 2020. The model presented in this paper serves as an instrument to investigate how Flemish households alter their childcare and labour supply decisions when childcare opportunities change. More specifically, in a first counterfactual, we increase the coverage rate of formal childcare up to 50%. In the second simulation, we assume that each child finds childcare as we increase the coverage rate up to 100%. As discussed before, see Section 4.2 and Table 6, formal childcare coverage partly determines the childcare opportunities of each household. Hence, due to the increased availability of formal childcare, households are confronted with opportunity sets in which the share of formal childcare facilities increases in comparison to the other types of care. Given this higher coverage rate, we simulate the model by using the estimated parameters and are able to derive the new childcare and labour supply decisions of households.

Several scenarios are conceivable. First, given the estimated preferences and unobserved heterogeneity in preferences, households might decide to switch from childcare type as the relative share of formal childcare increases in their opportunity set. Second, higher childcare availability might also affect maternal labour supply decisions. Households that used to be restricted in their access to childcare and, hence, were not working, might enter the labour market. Behavioural responses at the intensive margin of the labour market might arise as well. Households that, due to restricted acces to formal childcare, had to rely on informal or no care and, hence, only worked a limited amount of hours, have now the opportunity to switch from childcare type. The sign of their labour supply response is ambiguous as two competing income and substitution effects come to the fore. Switching from free childcare (informal or no care) to formal paid care implies an income effect that leads to an increase in labour supply and a substitution effect that reduces labour supply. Households now have to pay childcare costs which implies that they need to work more hours in order to obtain the same amount of income; an income effect. On the other hand, childcare leads to a decrease in wages which results in cheaper leisure and, given that leisure is a normal good, lower labour supply; a substitution effect. Therefore, in advance, we cannot unambigiously say how labour supply changes after the

increase in coverage rate.

Table 9 presents an overview of the childcare type densities, both in baseline and counterfactual situations. We clearly see that households switch from childcare type if the coverage rate of formal childcare increases. In the baseline situation, 36.8% and 20.8% of all households made use of respectively formal subsidized and formal non-subsidized childcare. When the coverage rate grows to 50%, these percentages jump up to 41.1% and 26.8% respectively. A coverage rate of 100% even leads to a density of formal subsidized care of 45.7% and 38.4% for formal non-subsidized care. Larger opportunity sets clearly affect the household's choice of childcare. Although the parameter estimates in Table 4 suggest that households prefer leisure time when using no childcare of informal care, it appears that the random component of utility contains elements that are in favour of formal childcare. The belief of housholds that the social interaction with other children is beneficial for the development of their child might be such an element.

Table 9: Child care densities

Childcare type	**Baseline**	**50% coverage rate**	**100% coverage rate**
No childcare	21.0	16.8	8.5
Formal subsidized childcare	36.8	41.1	45.7
Formal non-subsidized childcare	20.8	26.8	38.4
Informal childcare	21.4	15.2	7.4

Source: Own Calculations, GEZO-data (2005)

Not only the childcare choice is affected by a higher coverage rate, also the labour supply decisions of households change, see Table 10. First, the participation rate of women in this subsample increases from 83.1% to 84.7% if the coverage rate equals 50% and even jumps up to 87.9% if formal childcare is available for each child. Hence, mothers decide to start working if more childcare is available. Below we provide more details on these transitions. Second, total labour supply expressed in Full Time Equivalents (FTE) increases with 2.1% in the first counterfactual and rises with 6.7% in the second simulation. However, as discussed above, it might be that some mothers reduce their labour supply, whereas others work more when being confronted with a larger coverage rate. The next tables look in detail to the different transitions between labour supply, cominded with the change in childcare type.

Table 10: Labour supply responses

Childcare type	**Baseline**	**50% coverage rate**	**100% coverage rate**
Participation rate	83.1	84.7	87.9
Labour supply in FTE (pct. change)	$47,418$	$48,409\,(+2.1\%)$	$50,584\,(+6.7\%)$

Source: Own Calculations, GEZO-data (2005); FTE is defined as total yearly hours divided by 2000

Table 11 and Table 12 look more in detail to the individual transitittions of mothers regarding to childcare type and labour supply. The first column reflects the change in childcare type, the second column presents an indicator whether the mother starts working (extensive margin) and the third whether the mother increases her labour supply (positive intensive margin). The fourth column

reflects an indicator whether the mother stops working and the last column whether she reduces her labour supply model but remains at work (negative intensive).

Looking at the counterfactual in which the coverage rate augments to 50%, several important findings can be noted. First there are both households that increase (38 out of 512) and reduce (23 out of 512) labour supply. Second, when looking more into detail to households with a positive change in labour supply (column 2 and 3), we see that 11/38 start working. These households switch from no childcare to formal care; both subsidized and non-subsidized. Hence, it might be reasonable to state that these households where restricted in their childcare choice in the baseline situation and were therefore not able to supply labour. Third, the remaining part (27/38) increase their labour supply at the intensive margin. We observe both changes from no childcare and from informal care to formal childcare. For these households, a rise in the availability of formal childcare leads to more formal care opportunities and, given the estimated preferences and opportunities, they decide to switch to formal care. However, as discussed above, this switch implies a positive income effect and a negative substitution effect. For these particular households, the former dominates the latter and labour supply increases. However, looking at the last column, we see that 21 households reduce their labour supply at the intensive level of the market. These households switch, in line with those that increase their labour supply (column 3), from no childcare or informal care to formal childcare. For these households, the negative substitution effects dominates the positive income effect.

Eventually, as stated in Table 10, total labour supply increases with 990 FTE but it is important to note that this figure is a combination of both positive and negative labour supply reactions. Table 12 leads to the same conclusions as Table 11, although the effects are more pronounced.

Table 11: Individual transitions: coverage rate to 50%

Childcare respons	Labour supply response			
	Pos. ext. margin	**Pos. int. margin**	**Neg. ext. margin**	**Neg. int. margin**
1 to 2	6	4	0	3
1 to 3	5	4	0	0
1 to 4	0	0	0	0
2 to 1	0	0	0	0
2 to 3	0	3	1	2
1 to 4	0	0	0	0
3 to 1	0	0	0	0
3 to 2	0	0	0	0
3 to 4	0	0	0	0
4 to 1	0	0	0	0
4 to 2	0	9	0	7
4 to 3	0	7	1	9
Total	11	27	2	21

Type 1: no childcare, type 2: formal subsidized care, type 3: formal non-subsidized care, type 4: informal care

Source: Own Calculations, GEZO-data (2005)

Table 12: Individual transitions: coverage rate to 100%

Childcare respons	Labour supply response			
	Pos. ext. margin	**Pos. int. margin**	**Neg. ext. margin**	**Neg. int. margin**
1 to 2	13	10	0	5
1 to 3	17	11	2	6
1 to 4	0	0	0	0
2 to 1	0	0	0	0
2 to 3	0	8	1	6
1 to 4	0	0	0	0
3 to 1	0	0	0	0
3 to 2	0	0	6	0
3 to 4	0	0	0	0
4 to 1	0	0	0	0
4 to 2	2	13	2	15
4 to 3	2	22	1	18
Total	34	64	6	50

Type 1: no childcare, type 2: formal subsidized care, type 3: formal non-subsidized care, type 4: informal care

Source: Own Calculations, GEZO-data (2005)

8 Conclusion

This paper presented a structural random utility model in which the simultaneous labour supply and childcare decision of married mothers is estimated. In contrast to the more *conventional* labour supply model as suggested in Van Soest (1995), we adopted and elaborated the framework developed by Aaberge, Dagsvik and Strom (1995) in which we assume that each household is confronted with heterogeneous opportunity sets. Each point in the opportunity set is characterized by hours of work, wage rate, type of childcare and other non-pecuniary attributes. This methodology appears very convenient as the childcare sector in Flanders is characterized by a high regional variability in childcare supply.

The model is used to simulate the potential labour supply and childcare reactions of higher childcare availability. In April 2012, the Flemish government approved a new decree in which the coverage rate of childcare increases up to 50% in 2016 and then up to 100% by 2020. We find substantial behavioural responses in the choice of childcare type. The relative importance of informal childcare declines in favour of formal childcare arragnments. Additionally, the participation rate of mothers increases further as they are less restricted in their childcare choice. However, the labour supply effects at the intensive margin of the labour market are less straightforward. Switching from childcare type implies a negative subsitution and a positive income effect. Hence, it is not unambigiously clear how labour supply adjusts when the availability of childcare increases. The simulation results suggest that the positive income effects dominate the negative substitution effects. Consequently, total labour supply increases with 2.1% in the case of a coverage rate of 50% and with 6.7% in the case of a coverage rate of 100%.

References

Aaberge, R., and U. Colombino (2011): "Empirical Optimal Income Taxation: A Microeconometric Application to Norway," Discussion Paper WP 16-11, CHILD Centre for Household, Income, Labour and Demographic economics ITALY.

Aaberge, R., and U. Colombino (2013): "Using a Microeconometric Model of Household Labour Supply to Design Optimal Income Taxes," *Scandinavian Journal of Economics*, 115, 449–475.

Aaberge, R., U. Colombino, and S. Ström (1999): "Labour Supply in Italy: An Empirical Analysis of Joint Household Decisions, with Taxes and Quantity Constraints," *Journal of Applied Econometrics*, 14(4), 403–422.

Aaberge, R., U. Colombino, and T. Wennemo (2009): "Evaluating Alternative Representations of the Choice Sets in Models of Labor Supply," *Journal of Economic Perspectives*, 23 (3), 586–612.

Aaberge, R., J. K. Dagsvik, and S. Strøm (1995): "Labor Supply Responses and Welfare Effects of Tax Reforms," *The Scandinavian Journal of Economics*, 97(4), pp. 635–659.

Anderson, P. M., and P. B. Levine (1999): "Child Care and Mothers' Employment Decisions," *NBER Working Paper Series*, 7058.

Arrufat, J. L., and A. Zabalza (1986): "Female Labor Supply with Taxation, Random Preferences, and Optimization Errors," *Econometrica*, 54, 47–63.

Bargain, O., and K. Orsini (2006): "In-work policies in Europe: Killing two birds with one stone?," *Labour Economics*, 13, 667–697.

Boca, D. D. (2002): "The effect of child care and part time opportunities on participation and fertility decisions in Italy," *Journal of Population Economics*, 15(3), 549–573.

Boca, D. D., and D. Vuri (2005): "Labor Supply and Child Care Costs: The Effect of Rationing," *IZA Discussion Paper Series No. 1779.*

Brewer, M., and G. Paull (2004): "Families and Children Strategic Analysis Programme (FACSAP) Reviewing approaches to understanding the link between childcare use and mothers' employment," *DWP working paper No. 14.*

Brilli, Y., D. Del Boca, and C. Pronzato (2011): "Exploring the Impacts of Public Childcare on Mothers and Children in Italy: Does Rationing Play a Role?," IZA Discussion Papers 5918, Institute for the Study of Labor (IZA).

Debacker, M., J. Ghysels, and E. Van Vlasselaer (2006): "Gezinnen, Zorg en opvang in Vlaanderen (GEZO)," *Technical report CSB.*

Decoster, A., K. Orsini, and G. Van Camp (2006): "Stop the grief and back to work! An evaluation of the governments plan to activate widow and widowers.," *Brussels Economic Review*, 49(2), 121–145.

Decoster, A., and P. Vanleenhove (2012): "In-work tax credits in Belgium: an analysis of the Jobkorting using a discrete labor supply model," *Brussels Economic Review*, 55(2).

Ghysels, J., and M. Debacker (2007): "Zorgen voor kinderen in Vlaanderen: een dagelijkse evenwichtsoefening?," Leuven, Acco.

Haan, P., and K. Wrohlich (2011): "Can child care policy encourage employment and fertility?: Evidence from a structural model," *Labour Economics*, 18(4), 498–512.

Hank, K., and M. Kreyenfeld (2000): "Does the availability of childcare influence the employment of mothers? Findings from western Germany," (WP-2000-003).

Hausman, J. A., and P. Ruud (1986): "Family Labor Supply With Taxes," *American Economic Review*, 74, 242–248.

Hedebouw, G., and A. Peetermans (2009): "Het gebruik van opvang voor kinderen jonger dan 3 jaar in het Vlaams Gewest," *Leuven: Steunpunt Welzijn, Volksgezondheid en Gezin*, p. 239.

Jacob, J. I. (2009): "The socio-emotional effects of non-maternal childcare on children in the USA: a critical review of recent studies," *Early Child Development and Care*, 179(5), 559–570.

Kalb, G. (2009): "Children, Labour Supply and Child Care: Challenges for Empirical Analysis," *Australian Economic Review*, 42(3), 276–299.

Kornstad, T., and T. O. Thoresen (2007): "A Discrete Choice Model for Labor Supply and Child Care," *Journal of Population Economics*, 20, No.4, 781–803.

MAS (2007): "Analyse van het zoekproces van ouders naar een voorschoolse kinderopvangplaats.," Leuven, MAS/Kind en Gezin.

MCFadden, D. (1974): "Conditional logit analysis of qualitative choice behavior," *Frontiers in Econometrics*, Chapter 4.

Sutherland, H., and F. Figari (2013): "EUROMOD: The European Union Tax- Benefit Microsimulation Model.," *International Journal of Microsimulation*, 6(1), 4–26.

Van Soest, A. (1995): "Structural Models of Family Labor Supply: A Discrete Choice Approach," *The Journal of Human Resources*, 30(1), 63–88.

Vandelannoote, D., P. Vanleenhove, A. Decoster, G. Joris, and V. Gerlinde (2013): "Maternal employment: the impact of triple rationing in childcare in Flanders," *CES Discussion paper*, DPS13.07.

Wrohlich, K. (2011): "Labor Supply and Child Care Choices in a Rationed Child Care Market," Discussion Papers of DIW Berlin 1169, DIW Berlin, German Institute for Economic Research.

Appendix

Descriptive statistics

Table 13: Descriptive statistics

Description	Mean	Min	Max	St. Dev.
Age of the child (months)	21.2	3	36	8.6
# 0-3 year old children	1.1	0.3	1	2
Age mother (years)	33.3	17	47	4.5
Age father (years)	36.9	24	57	5.1
Working hours mother	26.1	0	74.9	14.7
Working hours father	42.8	30	99.0	8.3
Hourly wage mother	17.1	4.1	40.8	5.1
Hourly wage father	18.5	4.2	71.3	7.3
Health mother (0/1)	0.99	0.10	0	1
Health father (0/1)	0.99	0.10	0	1
Child with special needs (0/1 variable)	0.02	0.1	0	1
Childcare coverage rate in municipality	0.34	0.10	0.80	0.11
Proportion formal subsidized care	0.71	0.19	1.00	0.20
Proportion formal non-subsidized care	0.29	0	0.81	0.20
Education mother:				
Low educated		1.2%		
Middle educated		34.0%		
High educated		64.7%		
Education father:				
Low educated		3.4%		
Middle educated		47.4%		
High educated		49.2%		
Type of municipality:				
Residential		21.8%		
Rural community		16.0%		
Economically centered		13.3%		
Semi urban		14.0%		
Urban		33.8%		
Touristic		1.3%		
Number of observations		552		

Source: Own Calculations, GEZO-data 2005

Table 14: Grandparents variables

Grandparents number:	1	2	3	4
Mean distance if present:				
0-5 km	42.5%	41.5%	37.9%	38.5%
5-15 km	24.9%	22.4%	25.8%	25.6%
15-50 km	18.8%	20.5%	21.3%	19.7%
50 or more	14.2%	15.6%	14.7%	15.8%
Childcare:				
Never	21.9%	31.7%	35.0%	41.7%
Rarely	20.0%	19.7%	22.1%	14.6%
Sometimes	30.0%	25.5%	24.8%	25.6%
Often	24.1%	19.9%	16.1%	15.8%
Always	3.6%	3.0%	1.8%	2.0%
Good health if present (0/1)	0.92	0.94	0.91	0.94
Employment status if presents (0/1)	0.80	0.75	0.80	0.73

Source: Own Calculations, GEZO-data 2005