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Analyzing the macro economic impact of child care subsidies: An AGE approach

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1 Introduction

Recently, the Dutch government presented the coalition agreement for its four-years term. One of the policy targets is to raise the labor market participation of (married) women with children. Besides the emancipatory goal of enhancing the independence of women, this serves an economic goal. First, it prevents the loss in human capital caused by the (temporary) withdrawing of women from the labor market who have young children. Second, it strengthens the financial base of social security in the future in light of the ageing of the population in the next decennia.

In order to stimulate labor participation by (married) women, the government intends to double the public subsidies on child care costs. The extra subsidy is partly spent on enlarging the number of places that are subsidized by local governments, partly on subsidizing firms that arrange child care places for their employees, and partly on raising the deductibility of child care costs of private places. This three-sided subsidy policy reflects the opinion of the Dutch government that the costs of child care should be shared by the government, employers and parents.

This paper investigates the effectiveness of various forms of subsidies on child care costs in raising labor market participation of women with children. Although most micro-econometric research on this subject indicates that subsidizing child care does increase the labor supply of mothers, it provides insufficient evidence on the aggregate effects. Rosen (1996) argues that subsidizing child care may just provoke substitution from household and informal activities to formal activities without raising the total level of activity in the economy. The policy's only effect would then be that it monetizes the care for people: Instead of taking care of their own relatives, some women will look after the children of other women, who take care of the parents of those who are looking after the children.

In order to analyze macro economic consequences of subsidizing child care, CPB's applied general equilibrium model MIMIC is used. This model contains a highly disaggregated household model describing labor supply of households. The model of the market for child care in MIMIC describes the current situation of the Dutch child care market, including informal child care. Finally, since the demand for labor and wage formation are taken into account, MIMIC is able to analyze the impact of child care subsidies on (un)employment.

The contents of this paper are as follows. First we highlight several aspects of the Dutch child care market, like the capacity of subsidized child care places and the cost involved in hiring a child care place. Section three gives a detailed description of those parts of MIMIC that are important for the analysis of the effects of child care subsidies. Section four presents the simulation results for several types of policies. Section five investigates the robustness of the simulation outcomes by presenting

sensitivity analysis with respect to those parameters that lack a substantial empirical base. Section six discusses our results in light of some other research on the impact of child care subsidies on labor supply. The main conclusions are summarized in the last section.

2 The child care market in the Netherlands

In the Netherlands various types of child care arrangements exist. Child care can be distinguished to formal child care, informally paid child care (which we will label 'black care') and free child care.

In 1996 the total capacity in the formal child care sector was equal to 75 thousand full time places.[1] Daycare centers are usually run by private initiatives of the care providers, but regulated by the local government. Places in daycare centers are hired either by firms or local governments, who supply them to the parents, or privately by the parents themselves. In 1996, 44 per cent of the total capacity in the formal child care sector concerned subsidized places hired by local governments, 43 per cent places hired by firms and 13 per cent privately hired places. At the same time, there existed a waiting list of 30 thousand (full-time) places, indicating that capacity fell short of demand (SGBO, 1997).

In addition to the formal child care sector a large black sector of child care exists. Groot and Maassen van den Brink (1996) estimate that 26 per cent of all parents demanding child care for children between 0 to 4 years use black care, against 16 per cent formal child care. However, since the average number of hours supplied per child is about two thirds of that in the formal sector, the capacity in terms of full time places is only slightly higher than the capacity in the formal sector.

All other parents (58 per cent) use free child care. However, as in the black sector, the average number of hours supplied per child is not as large as that in the formal sector. Moreover, the relation with labor market participation is not as strong as for formal child care. The share of parents using free child care because of labor market participation is on average about 60 per cent, against more than 90 per cent in the formal sector and about 80 per cent in the black sector. The use of child care in full time places in the unpaid informal sector relevant for labor market participation, is therefore more or less the same as in the formal sector (see Table 1).

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[1] A full-time place consists of 45 hours per week for children younger than 4 years and 16,5 hours per week for children of 4 to 13 years. On average parents hire a half full-time place. The number of children taken care after in the full sector equals 140 thousand (Rapport MDW, 1998).

Table 1 Use of child care related to labor market participation

	formal	black	free
children 0-4 year (in 1995)[a]	47	50	68
labor participation rate[b]	90	74	45
children 4-13 year (in 1998)[c]	26	75	64
labor participation rate[b]	95	97	89
total use related to labor[d]	51	64	51

[a] In thousands of full-time places of 45 hours per week

[b] Of users of child care; in percentages

[c] In thousands of full-time places of 16,5 hours per week

[d] In thousands of full-time places of 45 hours per week; related to labor participation

Sources: CPB (1998); Rapport MDW (1998)

Table 2 contains information on the relationship between net family income and the costs of child care for the various types of child care. An important feature of formal child care places supplied by the local governments is that the parental fee is related to the net household income according to the so-called VWS/VNG-table, an official table set by the government. The annual parental fee for a full time place of the first child consists of a minimum contribution of Dfl 1550 plus 25 per cent of the difference between net household income and the social minimum income (which is Dfl 20,000 per year). If net household income exceeds Dfl 60,000 per year, households pay the maximum parental fee of Dfl 13,600, which is 75 per cent of total costs. For the second child, the parental fee in the child care costs equals 30 per cent of that for the first child. Hence, over a long income range the parental fee for child care substantially raises the marginal wedge because of the relationship between net household income and the subsidy offered by the government.

Since most firms also apply the VWS/VNG-table to determine the parental fee for child places, the same structure holds for child places supplied by firms. On average, the parental fee equals 45 per cent of the total costs of places supplied by firms. Of the other 55 per cent, firms may deduct 20 per cent from their social security premiums. Hence, on average the government subsidizes child care places supplied by firms for 11 per cent.

Also for private unsubsidized places the government pays part of the child care costs, since the costs in excess of the parental fee according to the VWS/VNG-table are tax deductible. Compared to the subsidized places supplied by the local

Table 2 Annual net parental fee per full time child care place[a]

net household income	minimum	1½ minimum	modal	high
Hired by local government				
parents	2	6	10	14
government	16	12	8	4
Hired by firms				
parents	2	6	10	14
firms	13	10	7	3
government	3	2	1	1
Private				
parents	12	13	14	15
government[b]	6	5	4	3
Black	11	11	11	11

[a] In thousands of guilders; source: Rapport MDW (1998).
[b] In the form of reduction of tax receipts.

governments or by firms, the parental fee for private places is, however, substantially higher.

Finally, for black care Groot and Maassen van den Brink (1996) find that the average child care costs per hour equals Dfl 5. For a full time place (of 45 hours per week and 48 weeks per year) this amounts to about Dfl 11,000 per year (against Dfl 18,000 for a formal full time place). Especially households with high net income might therefore prefer black places, because for them the parental fee for formal places exceeds the costs of a black place.

Table 3 Macro costs of formal child care[a]

households	government	firms
ƒ 450	ƒ 580	ƒ 260

[a] In millions of guilders, source: Rapport MDW (1998).

Table 3 presents the macro distribution of formal child care costs over families, government and firms. The largest share is paid by the government. The contribution

of the government consists of subsidies on child care places supplied by local governments and the loss in social premiums and income taxes because of the deductibility of formal child care cost by firms and households. In addition, the government contribution comprises a special subsidy for child care costs for lone parents and the wage sum of employees in the child care sector who participate in public employment programs.

3 The economic model

In order to analyze the labor market effects of a change in child care subsidies, we use MIMIC, the applied general equilibrium model of the CPB. In this section we describe those parts of MIMIC that are relevant for the analysis of child care. After a short introduction to the full MIMIC model, we focus on the labor supply decision, the allocation of the demand for child care, the supply and the price of various types of child care and the impact of child care costs on wage formation and human capital.

3.1   Introduction to MIMIC

Broadly speaking, four types of markets are distinguished in MIMIC, *viz.* the formal goods market, the formal labor market, the black market and the financial market.[2] Agents operating on these markets are firms, households and the public sector. On the formal goods market, firms set prices and meet the resulting demand for goods. Households and the public sector demand goods. Import prices are exogenous. By assumption, supply of foreign products is always sufficient to meet domestic demand.

   On the formal labor market, three types of labor are distinguished: unskilled, low skilled and high skilled labor. Firms and the public sector are the demanding agents whereas households supply labor. Firms produce commodities according to a CES production function, which allows some substitution between unskilled, low skilled and high skilled labor. The partial elasticity of substitution is based on time series analysis by Draper and Manders (1996) and equals 1.5. Labor supply is set by households and depends among other things on the net wage excluding child care costs (see section 3.2). Wages are set by negotiations between firms and households. The negotiated wage generally differs from the market clearing level. The equilibrium rate of unemployment depends on institutional factors, like the average and marginal tax rate and the replacement ratio (between net unemployment benefit and net wage).

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[2] For a more detailed description of MIMIC, see Gelauff and Graafland (1994), Graafland and De Mooij (1998) and Bovenberg et.al. (1998).

On the black market, households and firms exert demand for black labor-intensive services, including child care. Black labor supply is set by households and depends on the wage in the black sector relative to the wage in the formal sector. Following Graafland (1990), it is assumed that the equilibrium condition between demand and supply determines the price of black labor.

On the financial market, firms and the public sector exert net demand to finance investments and public deficits, respectively. Households offer net supply of financial assets. Interest rates and the value of the guilder are exogenous.

3.2   Labor supply and the demand for child care

The demand for child care follows from the labor supply decision of households. To give an adequate description of labor supply per skill level, MIMIC distinguishes 40 types of households among which couples with children. Couples consist of a so-called breadwinner (i.e. the individual with the highest personal income) and a partner (with the lowest personal income). Individuals within each household may differ with respect to their skill level and their job status, i.e. having a job or receiving some kind of social benefit. Per type of household we use class-frequency income distributions based on micro data to describe the gross incomes of individuals. By applying the corresponding statutory tax and premium rates to these gross incomes, we can determine net incomes and the average and marginal tax rates determining labor-supply decisions.

Household behavior in each household type can be derived from maximization of a utility function, subject to a time constraint and a budget constraint. Labor supply is selected from a limited set of discrete options on the labor market.[3] To illustrate, breadwinners can choose between 80 per cent, 100 per cent and 120 per cent of a full-time equivalent. Partners of breadwinners can choose between non-participation and a part-time job of 30 per cent, 50 per cent or 80 per cent. In the following we present the household model of a representative household consisting of a breadwinner and partner with children of type i who consider a choice between option k and option $k+1$. In order to simplify the presentation of formulas, we only present the indices i and k when required.

For each of the discrete choices the breadwinner and partner face, household utility is determined by:

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[3] The main reason to assume discrete options for labor supply is that empirical evidence for both the Netherlands and other countries suggests that jobs do not exhibit smooth continuous patterns, but rather are concentrated on certain points, see Woittiez (1990); Van Soest et al. (1990); Tummers and Woittiez (1991).

$$G = U(c,v) - \beta_b \, | \, l_b - \bar{l}_b \, | - \beta_p \, | \, l_p - \bar{l}_p \, | \qquad (1)$$

where c denotes household consumption, v household leisure, l_b and l_p labor time of the breadwinner respectively partner, and $\bar{l}_b$ and $\bar{l}_p$ some autonomous preferred labor time of breadwinner and partner. Whereas the first term U(c,v) is identical for all households, the second term on the right-hand side of (1) introduces heterogeneity. This term reflects a disutility associated with differences between actual labor supply (l) and some autonomous preference for labor supply ($\bar{l}$), related to socio-cultural aspects and the status people assign to a job. The exogenous preference for labor ($\bar{l}$) is heterogenous among households. In contrast to actual labor supply, it amounts to a continuous variable that follows from a probability density function. The loss in utility associated with a unit deviation between the actual labor supply and the preference parameter $\bar{l}$ is measured by parameter β. The labor-supply choice of a particular household will strike a balance between, on the one hand, minimizing the loss associated with deviations from the autonomous preference ($\bar{l}$) and, on the other hand, the highest value of U(.). At high values of β, labor supply is rather inelastic.

Leisure can be derived from the time constraint:

$$v = T - l_b - l_p \qquad (2)$$

where T denotes total time available.

Abstracting from savings[4], consumption follows from the following budget constraint:

$$c = (l_b w_b + l_p w_p - h \, p_h + YA) \, / \, p_c \qquad (3)$$

where w_b and w_p denote the net wage of breadwinner respectively partner, h the demand for paid child care, p_h the costs per child care place, YA other income and p_c the consumer price. The total demand for child care is assumed to equal total household working time minus the standard working time of one person (l_s), whereas

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[4] For a description of endogenous savings in MIMIC, see Graafland and De Mooij (1998).

the demand for paid child care is equal to the total demand for child care minus free child care supplied by relatives (f). This gives:

$$h = \gamma \max(0, l_b + l_p - l_s - f) \qquad (4)$$

where γ is a scaling variable that is set at such a value that the total demand for paid child care by all households equals the macro figure reported in Table 1.[5] It is assumed that for all parents the total demand for child care exceeds the free supply of child care. This implies that the marginal costs of child care are equal to the costs of paid child care. For a representative household (of type i and considering a choice between option k and $k+1$), the marginal costs of paid child care is equal to a weighted average of the costs of the various types of paid child care used by this type of household:

$$p_h = (p_b b + p_s s + p_u u)/h \qquad (5)$$

For black places (b), the costs are equal to the black market price of child care (p_b). For subsidized places supplied by the local governments or firms (s) the costs for a household are related to its net income:

$$p_s = \min[\max(p_{min}, p_{min} + \alpha\xi(l_b w_b + l_p w_p + YA - Y_{min})), \xi p_{max}] \qquad (6)$$

For households with income below Y_{min} the child care costs equal p_{min}. For households with income higher than $(p_{max} - p_{min})/\alpha + Y_{min}$ the child care costs equal

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[5] Following this procedure, we found a value of 0.25. The explanation for this rather low value is that in MIMIC households with children also comprises households with older children, for which no child care is required or only after the school time of the children. Another explanation is that a relative large share of married women work in the evening to avoid child care costs (like nurses who work on night duties). In the simulation experiments we set the value of γ at two thirds, which is based on the shares of parents with children of 0-4 year (who need 100% child care) and of parents of children of 4-13 year (who need 30% child care) as reported in CPB (1998).

p_{max}. For households with an intermediate level of income, the parental fee is related to the net family income with marginal rate α. ξ is a scaling factor that is added to correct for the parental fee for households who demand child care for more than one child.

For unsubsidized formal places (u), only the difference between the private child care cost and the parental fee for subsidized places (p_s) can be deducted from the income tax. This gives:

$$p_u = p_s + (p_m - p_s)\,(1 - \tau) \tag{7}$$

where p_u denotes the child care costs for unsubsidized formal places, p_m the market price of formal places and τ the marginal tax rate of the breadwinner.

Labor supply can be derived by determining the share of persons preferring the various discrete options distinguished. Breadwinners compare the utility of different options at given labor supply of their partner and vice versa. The share of breadwinners respectively partners choosing for option k equals:

$$f_{j;k} = H_j(\bar{l}_{j;k,k+1}) - H_j(\bar{l}_{j;k-1,k}) \qquad\qquad j = b, p \tag{8}$$

where H denotes the cumulative distribution function of $\bar{l}$. $\bar{l}_{j;k,k+1}$ denotes the autonomous preference for labor supply of a breadwinner respectively partner who is indifferent between option k and option k+1. The latter follows from equation 1 and equals:

$$\bar{l}_{j;k,k+1} = (U(c_k, v_k) - U(c_{k+1}, v_{k+1}))\,/\,2\beta_j + (l_k + l_{k+1})/2 \tag{9}$$

If child care cost increase, c_{k+1} will fall relatively more than c_k because $h_{k+1} > h_k$. Hence, some people will move from option k+1 to option k, $\bar{l}_{j;k,k+1}$ will increase and labor supply at the aggregate level will decrease. Especially partners will react because β is relatively small for them as they have a relatively high labor supply elasticity. The reduction in labor supply will cause a fall in the demand for child care places.

The probability density function of $\bar{l}$ is calibrated such that the model reproduces Dutch labor-market data in the base year 1993. The parameter β and the substitution

elasticity between leisure and consumption are calibrated so that the model reproduces labor-supply elasticities estimated in the empirical literature for the Netherlands. In particular, the uncompensated wage elasticity of labor supply by partners is set at 1.0, breadwinners feature an elasticity of around 0.1. The income elasticities of labor supply are set at 0.2 for partners and almost zero for breadwinners.[6]

Finally, it is noted that the household model in MIMIC also includes black labor supply by households, which is related to the relative wage in the black sector compared to the wage in the formal sector. Since the simulation results showed that the interaction between the total supply of black labor and child care costs is negligible, we refer for a description of this part of the model to Graafland and De Mooij (1998). The supply of black care (which only forms a small part of total black supply) is described in section 3.4.

<u>3.3</u>   <u>The allocation of the demand for child care</u>

The demand for child care which results from the labor supply decisions of households is allocated to various types of child care places: free child care, black places, subsidized child care supplied by the local governments or by firms and unsubsidized formal places. This allocation depends both on the price of the various types of child care and on supply restrictions, especially for free child care and the subsidized formal child care supplied by the local governments and firms. In order to take account of these supply restrictions, the allocation of the total demand of child care is derived in three steps.

In the first step, parents look for as much free child care as possible. It is assumed that this type of demand is restricted by the supply of free child care by relatives and neighbors and that for all families the demand for child care exceeds the supply of free child care.

Next to free child care, some parents will try to arrange a (relatively cheap) subsidized formal place, supplied by the local governments or by the firm they work at. Other parents will, however, have some preference for black care because their parental fee for subsidized places exceeds the black price. Some parents may find black care preferable to formal care, because black care providers may be acquaintances who give care similar to what the parents would provide. Moreover, these black providers may have fewer children to care for than workers at day care centers (Berger and Black, 1992). Other qualitative aspects that make people have

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[6] These elasticities are based on Theeuwes (1988), Kapteyn et al. (1989), Woittiez (1990), Van Soest et al. (1990), Theeuwes and Woittiez (1992) and Van Soest (1995).

some preference for either subsidized formal places or black places are the traveling distance to the child care place, moral reluctance against using black care, the probability of discontinuity in the supply of care, etc. Because of these qualitative aspects, we assume imperfect competition between formal and black care. Per type of household and per type of labor supply option we use a Weibull distribution to allocate the demand of paid child care to subsidized places supplied by local governments or firms and black places:

$$s_d = h \, \exp(-\mu \, (p_s/p_b)^\sigma) \qquad (10)$$

where s_d denotes the demand for subsidized places, μ a scaling variable and σ a parameter that describes the degree of substitution between subsidized formal places and black places. Equation (10) implies that households with a low household income will relatively more prefer subsidized places because of their low parental fee to subsidized places, whereas households with a high household income relatively prefer more black places because of their high parental fee. Another implication of the Weibull distribution model is that the absolute value of the own price elasticity of formal child care increases with the relative price level.[7] This fits with the intuition of Groot and Maassen van den Brink (1995) that substitution effects become more important if the formal child care is relatively expensive.

Equation (10) describes the ex-ante demand for subsidized child care supplied by local governments or firms and black care. The existence of waiting lists for the subsidized forms indicate, however, that the actual number of subsidized child care places is in most cases determined by the supply side, although in some cases also excess supply occurs because of the mismatch between demand and supply. Because of the long term character of our analysis, we abstract from such mismatch and model the actual number of subsidized places as the minimum of the aggregate demand for subsidized child care by all households (S_d) and the supply of subsidized child care by the government and firms:

$$S = \min(S_d, S_s) \qquad (11)$$

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[7] The own price elasticity equals $-\mu\sigma(p_s/p_b)^\sigma$.

where S_s denotes the supply of subsidized places. It is assumed that all households demanding subsidized child care face the same probability S/S_d of getting such a place.

In the third step, those who are restricted in their choice in the second step because of insufficient supply of subsidized places, allocate their demand for child care to either black places or unsubsidized formal places. The latter are assumed to be of the same quality as subsidized places. Since unsubsidized places are qualitatively similar to the subsidized places, we assume a Weibull distribution function with exactly the same parameters as in equation (10):

$$u = (1 - S/S_d) \, h \, \exp(-\mu \, (p_u/p_b)^\sigma) \qquad (12)$$

The scaling and substitution parameters (μ and σ) are set at such values that the aggregate demand for subsidized places and unsubsidized places equal the macro number reported in Table 1.[8]

The total demand for black places can now be defined as[9]:

$$b = (S/S_d) \, (h - s_d) \, + \, (1 - S/S_d) \, (h - u) \qquad (13)$$

The system of equations (10), (12) and (13) ensures that the model generates similar results if either the supply of subsidized places is reduced to zero (hence the ratio S/S_d becomes zero) or if the price of subsidized places is set equal to the price of unsubsidized places ($p_s = p_u$). If the distribution function for the allocation between subsidized and black places would differ from the distribution function for the allocation of unsubsidized versus black places, such an outcome would not be ensured.

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[8] Based on this criterion, we find a price-elasticity of -0.7 for subsidized child care and -1.7 for unsubsidized child care. These values lie within the range of values estimated by Baartmans et. al. (1986). However, since their findings do not relate to substitution between black and formal child care but to black and formal house-repair services, we will perform a sensitivity analysis with respect to σ in section 5.

[9] Since γ, μ and σ ensure that the total demand for paid child care respectively of subsidized and unsubsidized child care equal the figures reported in table 1, also the demand of black child care is calibrated in line with the number from table 1.

Finally, it is noted that we abstract from formal child care places hired for other reasons than labor market participation, because this only concerns 10 per cent of the total subsidized formal child care. We also abstract from black places hired for other reasons than labor market participation.[10] Although this concerns 25 per cent of all black places, this form of child care is typically demanded at more irregular times (especially in the evening) and partly provided by people (especially young people) who are not available during the daytime. Hence, there will be almost no competition with black care demanded because of labor market participation.

3.4   The supply and price of child care

The model of the market for child care is closed by the equations describing the supply and price of the different types of child care.

The supply of free child care by relatives or friends is exogenous. In the base path of the model this type of child care hardly changes, because of two opposite trends in the supply of free child care. On the one hand, the increase in labor supply of married women reduces this type of child care supply. On the other hand, the ageing of the population increases the free supply by grandparents.

The supply of subsidized formal places supplied by the local governments is also exogenous. For places supplied by firms it is assumed that the collective bargaining partners earmark a fixed proportion of the wage sum for child care costs by firms. This gives:

$$S_s = S_g + S_c \tag{14}$$

$$S_c = \varepsilon WS / ((p_m - \bar{p}_s)(1 - \nu)) \tag{15}$$

where S_g and S_c denote the number of places supplied by the local governments respectively firms, WS the wage sum of firms, p_m the market price of a child care place, ν the rate of the firms' costs for child care paid by the government and $\bar{p}_s$ the average parental fee. The denominator in equation (15) reflects the net cost of the firm

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[10] In the model we also abstract from free child care that is demanded for other reasons than labor market participation, because this type is irrelevant for the purpose of our analysis.

per child care place. Both the local governments and the firms hire child care places from the private sector. It is assumed that if $S<S_s$, both the number of places supplied by the local governments and of those supplied by firms are proportionally reduced.

It is assumed that unsubsidized child care is supplied by the private sector with no restriction. The private sector also supplies the subsidized formal places hired by the local governments and firms at the market price p_m.[11] Like other firms, firms supplying child care set their price as a mark-up over marginal costs (which consist mainly of wage costs). The marginal wage costs are positively related to the demand for child care personnel relative to the total work force. If the demand for child care personnel increases, firms will have to pay higher salaries in order to attract this work force from other segments of the labor market. However, because of the strong centralization in wage formation in the Netherlands, this kind of market forces generally have a rather weak impact. We therefore assume that the elasticity of the demand for child care personnel on wages of this group is only 0.2.

For the black market, we also assume some segmentation between different black services. In particular, the supply of black care depends on the total size of the black market and the black care price relative to the average black wage. This gives:

$$p_b = p_z \ (b/z)^{1/\phi} \qquad (16)$$

where p_z and z denote the price and the output of the total black market and ϕ the wage elasticity of the black supply of child care. For the latter, empirical estimates are lacking. In section 5 we therefore perform a sensitivity analysis with respect to ϕ. Based on the econometric research for black labor supply by Koopmans (1994), an uncompensated elasticity of 1.0 is chosen as a base value. In the alternative version in section five an elasticity of 2.0 is applied.

<u>3.5</u>   <u>Child care and wage formation</u>

Child care subsidies not only affect labor supply, but may also have an impact on wage formation. In this section we describe wage formation in MIMIC and consider three channels through which child care subsidies impact wages.

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[11] The total budgetary child care costs of the government therefore equal:
$H_g = (S/S_s)(p_m - \bar{p}_s) \ (s_g + v \ s_c) + (p_m - \bar{p}_u) \ u$, where $\bar{p}_m$ and $\bar{p}_s$ denote the average parental fee for subsidized respectively unsubsidized places.

In MIMIC wages are determined by a right-to-manage model in which employers' organizations and unions bargain over wages, whereas employers determine employment. The outcome of the wage bargain strikes a balance between the utility of the employers' organization and the utility of the union. The utility of employers depend on profits. The utility of the union depends on employment and on the after-tax wage minus the opportunity costs of taking the job, the so-called reservation wage. This reservation wage not only depends on the expected wage in other jobs, but also on the unemployment benefit and the probability of getting a job in another industry if the wage bargain breaks down. Also wages in informal sectors affect the reservation wage, since the employee may leave the formal sector and work in the informal sector or at home (which requires no child care).

Under these assumptions, the following wage equation is derived per skill type of employees (see Bovenberg, Graafland and De Mooij, 1998):

$$\log w = \log pr + \log p_y + \log[1 + \zeta_1(p_c/(p_y(1-\tau)))] -$$
$$\log[1 + \zeta_2(1 - \zeta_3(ur\,rp - (1-ur))(1-t)/(1-\tau)]$$

(17)

where pr denotes labor productivity, p_y the producer price, p_c the consumer price, t the average tax wedge, τ the marginal tax wedge, rp the replacement ratio (the ratio between net benefit and net wage) and ur the unemployment rate. Wages are positively related to labor productivity and the producer price, because it raises the employer's utility. The consumer price and average tax wedge also have a positive impact on wages, because it lowers the employees' utility by reducing the net real wage. The marginal tax has a negative impact on wages, because it reduces the marginal employees' utility from a wage increase, since a larger part of the wage increase flows to the government through higher tax revenues. The replacement ratio has a positive impact, because it lowers the employees' utility by raising the reservation wage of employees. Finally, the unemployment rate exerts a negative impact, because it reduces the reservation wage of employees by lowering the probability of finding another job if the wage bargain breaks down.

According to this wage equation, a rise in child care subsidies may affect wages in three ways. First, since child care is part of the bundle of consumer goods, raising child care subsidies will lower the consumer price and improve the net real wage. This raises the utility of employees and stimulates wage cost reduction. Unfortunately, this consumer price effect does not distinguish between the average and the marginal child care costs. Theoretically, a rise in the average or marginal child care costs will have

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an opposite impact on wages similar to changes in the average and marginal wedge. Since subsidies on child care cost will generally imply different changes in the average and the marginal child care costs, we capture this distinction by defining the consumer price exclusive of child care costs. Instead, we include the average and marginal child care costs in the average respectively marginal wedge between gross wage and net income. This gives two different channels through which child care costs affect wages. The third channel is the replacement ratio. Because unemployed persons generally can take care of their own children and therefore save child care costs, workers relatively profit from a rise in the subsidy on child care costs. Hence, the replacement ratio will fall and wages will be reduced.

The quantitative relevance of these three channels are based on estimation results for the Netherlands by Graafland and Huizinga (1996). The elasticities of the average and marginal tax wedge equal 0.6 respectively –0.1, whereas the elasticity of the replacement ratio is 0.3.

3.6   Child care and human capital

Another relevant aspect of child care subsidies is its impact on human capital formation. As Joshi and Davies (1993) stress, the expectation that women will depart from the labor force for a prolonged period in order to take care of the children, is likely to limit their acquisition of human capital. In the presence of high labor turnover of young mothers, neither firms nor workers may have much incentive to invest in firm-specific training. Moreover, actual absence of married women with young children from the labor force may lead to depreciation of the human capital they already have. Indeed, the stock of human capital depends not only on initial education and training, but also on work experience via on-the-job training and learning by doing. Child care subsidies will therefore not only stimulate labor supply, but might also affect the hourly earnings of mothers by conserving human capital and increasing earnings at later stages of the mother's life.

In order to capture endogenous changes in human capital as a result of changes in labor supply, MIMIC contains a separate intertemporal model (see De Mooij, 1997) to describe the time spent on training activities per skill type. Higher future wages due to training are traded off against the opportunity cost of training, as measured by current wage income foregone. The intertemporal model yields the following steady-state relationship between investment in human capital (T) and labor supply:

$$T = \eta_b L_b + \eta_p L_p \qquad\qquad (18)$$

where L_b and L_p denote the macro labor supply of breadwinners respectively partners (per skill type). Intuitively, if labor supply becomes more attractive, also other activities aimed at raising these labor incomes are encouraged. The parameter η is based on a time allocation survey of SCP (1995), that shows that, as a ratio of labor time, men spend more time on training than women do. Accordingly, breadwinners in MIMIC feature a higher η than partners do..

Human capital affects labor productivity in the model of the firm. The rate of return on training is set at 8 per cent, which is in line with estimates by Theeuwes et al. (1985).

3.7   An overview of the model structure

Figure 1 presents an overview of the model structure. The numbers between brackets refer to the relevant model equations described in the previous sections. In order to illustrate the degree of disaggregation in several parts of the model, we distinguish three areas.

The variables in the thick lined area are disaggregated to household type and option of labor supply. For child care 10 types of households are relevant, namely two persons households with children which are distinguished to three skill levels of the breadwinner and partner each (which makes 9 households) and lone parents. For each breadwinner and each partner in a two persons household 3 respectively 4 options of formal labor supply are distinguished and the model is solved for each option. Similarly, we distinguish 4 options for labor supply by lone parents.

In the upper area with barred lines only three types of labor are distinguished, namely unskilled, low skilled and high skilled. Hence, all information in the thick lined area is first aggregated to these three skill levels before analyzing the impact on wages and employment. Finally, the dotted lined area marks macro variables.

Starting with the thick lined area, the demand for paid child care follows from the labor supply decision of the breadwinner and partner in the household, after a correction for the share of free supply in the total demand for child care. The demand for paid child care is allocated to black and subsidized child places. The allocation depends on the ratio between the black price and the subsidized price. The latter depends on the parental fee parameters set by the government. Also the supply of subsidized places is regulated by the government, either directly through the number of the subsidized places supplied by the local governments, or indirectly through the

Figure 1 An overview of the structure of the model

Macro

Per skill type

Per household type and per option in labour supply

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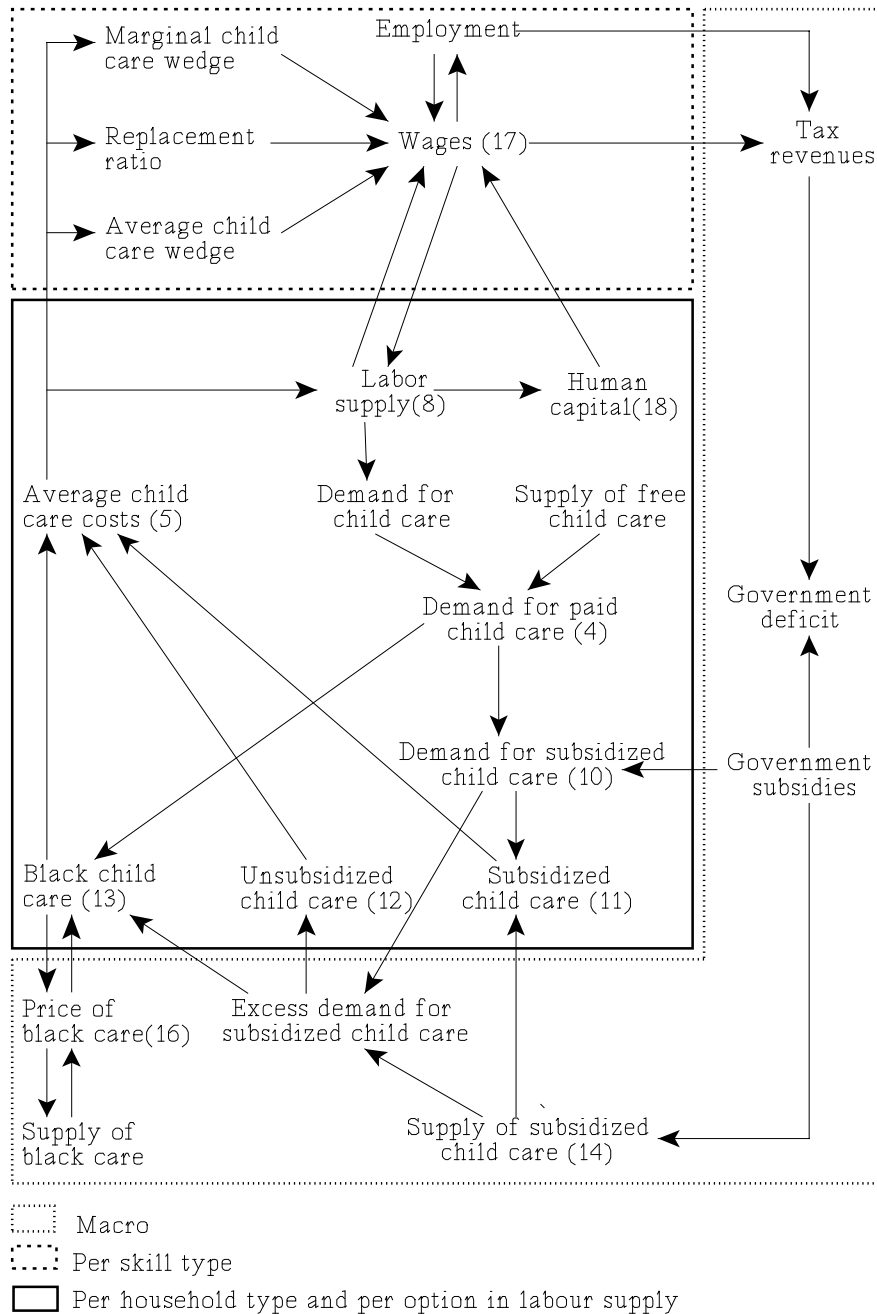
subsidy rate on subsidized places supplied by firms. Confrontation of total demand and total supply both yields the actual number of subsidized places and the number of parents who see their demand for subsidized places unfilled. This group has to reallocate the demand to either black or unsubsidized places. The price of unsubsidized places is also regulated by the government, since part of these costs are deductible from the income tax. The price of the black care is set by a flexible price mechanism and depends on the ratio between the demand for black care and the total volume of the black market. Together with the price per type of child care, the allocation of the demand for paid child care over the tree types of child care determines the average family costs of a child care place. This feeds back to the labor supply decision and has a negative impact on labor supply, both of the breadwinner and the partner (and also of lone parents). With labor supply, also human capital formation is negatively influenced.

The household model influences the upper part of the figure through various channels. First, a rise in labor supply exerts a downward pressure on wages and is almost fully transformed in a rise in employment. Second, a rise in human capital has a positive impact on wages by raising labor productivity. Third, the average child care costs has a positive influence on wages, by raising the wedge between gross wage and net income and increasing the replacement ratio between net unemployment benefit and net income. The marginal wedge, on the contrary, has a wage depressing impact which is rather small compared to the influence of the average wedge and replacement ratio. A fall in child care costs therefore generates lower wages and exerts a positive impact on employment. Through all these channels - labor supply, human capital, wedge and replacement ratio - a reduction in child care cost endogenously raises the tax revenues, causing any subsidy on child care costs to finance itself to a certain extent.

4 Labor market effects of child care subsidies: simulations with MIMIC

In this section we investigate the effectiveness of various alternative ways of raising child care subsidies. The simulations are deviations from a base projection, running from 1993 to 2018. The starting year for the simulation is 1999. For the period 2000-2018 the institutional system is maintained in its 1999 form. This means that statutory tax and subsidy rates and benefit rates are constant during this period, whereas the value of various allowances, franchises and borders of tax and subsidy rates are updated with nominal wage growth. The projected values of other exogenous variables, like foreign demand and foreign prices and population, are based on a recent long-term scenario of the Central Planning Bureau.

As a reference case, we first look at the impact of a tax reduction. Then the effects of several options for increasing child care subsidies are analyzed, like raising the number of subsidized places or lowering the maximum parental fee for subsidized places. In section 4.2 we analyze the labor market effects of abolishing the current government subsidies on child care.

4.1 Options for stimulating labor supply

The simulation results are reported in tables 4-6. Table 4 reports the effects on the child care market, Table 5 those on labor supply and Table 6 presents the macro economic effects on the goods and labor market. In all simulations, the ex-ante budgetary costs are 250 million guilders in 1999. Ex-post the government budget is balanced by a change in government consumption.

4.1.1 Tax reduction

The first column in tables 4-6 presents the effects of a reduction in the tax rate of the first bracket of the income tax system by 0,1 per cent. The Dutch income tax system consists of a general allowance of about 8.600 guilders and three tax brackets. A reduction in the tax rate of the first bracket lowers the marginal tax rate of partners, but leaves the marginal tax rate of most breadwinners unchanged. This is because most partners have part-time jobs. On the contrary, many breadwinners have a relative high income and therefore face a marginal tax rate in the second or third bracket.

A lower marginal tax rate induces partners to substitute away from leisure to consumption. Quantitatively, the effect is very small, however. As a result, the child care market is hardly affected. Also the macro-economic effects are negligible.

4.1.2 Increase in subsidized places supplied by local governments

In the second column the number of subsidized child care places supplied by the local governments (S_g in equation (14)) is increased by 100 per cent. The increase in the supply of subsidized places reduces the excess demand for this type of places. As a result, both the demand for unsubsidized places and black places, which follow from the restricted supply of subsidized places, fall. Because of the substitution of these relatively expensive places by the relatively cheap subsidized places, the average costs per child care place are reduced. This effect is enforced by a fall in the price of black places, which results from the fall in the demand for black places. In contrast, the price of formal places slightly rises, because of the increase in the sum of subsidized and unsubsidized places. These price effects also explains the fall in the demand for subsidized places: since black places become cheaper, some people will substitute a black place for a subsidized place. This further reduces the waiting list for subsidized

Table 4 Effects of Dfl 250 million child care subsidies on child care market

simulation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parental fee per child care place				percentage changes				
total	0	−17	−15	−14	−16	−16	6	−26
– unskilled	0	−27	−24	2	−10	−20	25	−19
– low skilled	0	−18	−17	−10	−16	−18	9	−25
– high skilled	0	−13	−12	−20	−20	−15	0	−28
subsidized places	0	0	0	−39	−42	−39	0	0
– unskilled	0	1	1	−12	−42	−58	0	1
– low skilled	0	0	0	−33	−45	−44	0	1
– high skilled	0	1	1	−46	−46	−34	0	1
unsubsidized places	0	2	1	−3	−4	−7	−26	−54
– unskilled	0	2	2	0	−4	−7	−27	−54
– low skilled	0	2	2	−5	−7	−7	−29	−55
– high skilled	0	2	1	−11	−11	−8	−30	−56
black places	0	−11	−10	−6	−6	−6	1	−17
Number of child care places				absolute changes[a]				
total	0	4	4	9	6	4	2	12
demand subsidized places	0	−7	−6	37	35	25	2	−10
use of subsidized places	0	46	42	0	−1	0	−96	−57
unsubsidized places	0	−32	−29	14	13	9	97	84
black	0	−10	−9	−6	−6	−5	1	−15

(1) decrease in the tax rate of the first income tax bracket by 0,1%

(2) increase in the number of child care places hired by the local governments by 100%

(3) increase in subsidy rate of places hired by firms from 20% to 44%

(4) decrease in maximum parental fee by 50%, firms are compensated

(5) decrease in marginal parental fee from 25% to 11,5%, firms are compensated

(6) increase in income level at which minimum parental fee applies, by 100%, firms are compensated

(7) replacement of subsidies on child care places by a uniform tax credit of 47% of child care costs

(8) idem, without reduction in the employers' budget on child care places

[a] In thousands of full-time places

Table 5 Effects of Dfl 250 million child care subsidies on labor supply

simulation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	absolute changes (in thousands of persons)							
Total	1	12	11	15	16	13	1	24
-unskilled	0	2	2	1	1	2	−1	2
-low skilled	0	3	3	2	3	3	0	5
-high skilled	1	8	7	12	12	9	2	17
	absolute changes (in thousands of labor years)							
Breadwinners	0	1	1	2	1	1	0	2
-unskilled	0	0	0	0	0	0	0	0
-low skilled	0	0	0	0	0	0	0	0
-high skilled	0	0	0	1	1	0	0	2
Partners	1	6	5	11	9	4	3	15
-unskilled	0	1	1	1	1	1	0	1
-low skilled	0	1	1	2	2	1	0	3
-high skilled	1	4	4	8	6	2	3	11
Total	1	8	7	13	11	6	4	19
−unskilled	0	1	1	1	1	1	0	2
−low skilled	0	1	1	2	2	2	1	3
−high skilled	1	5	5	10	7	4	3	13

(1)   decrease in the tax rate of the first income tax bracket by 0,1%
(2)   increase in the number of child care places hired by the local governments by 100%
(3)   increase in subsidy rate of places hired by firms from 20% to 44%
(4)   decrease in maximum parental fee by 50%, firms are compensated
(5)   decrease in marginal parental fee from 25% to 11,5%, firms are compensated
(6)   increase in income level at which minimum parental fee applies, by 100%, firms are compensated
(7)   replacement of subsidies on child care places by a uniform tax credit of 47% of child care costs
(8)   idem, without reduction of the employers' budget on child care places

places and explains why especially unsubsidized (and not black places) show a large fall. Especially the unskilled people benefit, because for them the difference between the subsidized child care costs and the unsubsidized and black care costs is relatively large, since their parental fee to subsidized child care is relatively low.

The fall in child care costs stimulates labor supply (see Table 5). Especially partners are induced to increase labor market participation. Since most of them opt for a part-time job, the increase in labor supply in labor years is lower than the increase in labor supply in persons. We also see a slight increase in labor supply by breadwinners, because the increased availability of subsidized child care places makes it less profitable to spend one day at home in order to take care of the children if the partner works. Hence, some of them will change from a part-time job (of 80 per cent) to a full-time job and others from a full-time job to a job which requires overwork. The increase in labor supply stimulates the demand for child care. However, total demand increases only slightly (Table 4). Hence there is a substantial deadweight loss from the substitution from unsubsidized and black places to subsidized places.

The increase in labor supply stimulates human capital growth and wage moderation (see Table 6). The wage moderation is further enforced because of a reduction in the wedge generated by the child care costs and by the fall in the replacement ratio. The fall in the wedge for workers is relatively large, because, in contrast to the first column, only workers profit from an additional subsidy on child care costs. The reduction in the wage rate improves the competitiveness of Dutch companies, stimulating exports. Also the domestic demand increases, since net household income improves. As a result, production grows and so does (formal) employment. The employment growth even exceeds that of labor supply. Therefore unemployment falls slightly. Black employment is reduced, mainly because of the reduction in the demand for black places. The positive effects on employment and value added are so large, that ex-post the policy measure causes a fall in the budget deficit. This is reflected by the increase in government consumption.

4.1.3   *Increase in subsidy rate of places supplied by firms*
In the third column the government subsidy on places supplied by firms (ν in equation (15)) is increased from 0,20 to 0,44. The economic effects are more or less similar to those in the second column. The simple reason is that in calculating the impulse on ν, we have taken into account the increase in the supply of child care places supplied by firms. Hence, the rise in the supply of subsidized places is equal to that in the second column (see Table 4).

Of course the results in the third column typically depend on the assumption that the employers' organizations and unions will keep the budget reserved for child care constant as a fraction of the total wage sum. If the collective partners use the

Table 6 Macro-economic effects of Dfl 250 million child care subsidies

simulation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prices				percentage changes				
Wage rate	−0.03	−0.14	−0.12	−0.14	−0.13	−0.11	0.01	−0.24
Production price	−0.03	−0.15	−0.13	−0.15	−0.14	−0.12	0.01	−0.26
Consumption price	−0.02	−0.09	−0.09	−0.09	−0.09	−0.08	0.00	−0.17
Volumes								
Private consumption	0.09	0.20	0.18	0.24	0.22	0.17	0.12	0.38
Public consumption	−0.42	0.15	0.13	0.24	0.20	0.01	−0.36	0.26
Exports	0.05	0.21	0.19	0.21	0.21	0.17	−0.01	0.38
Imports	0.04	0.12	0.11	0.14	0.13	0.10	0.04	0.21
Private production	0.06	0.25	0.23	0.28	0.26	0.20	0.04	0.46
Private employment	0.05	0.22	0.20	0.26	0.24	0.18	0.03	0.42
−unskilled	0.06	0.29	0.27	0.22	0.26	0.25	−0.06	0.44
−low skilled	0.05	0.23	0.21	0.24	0.25	0.22	0.02	0.41
−high skilled	0.04	0.21	0.19	0.27	0.24	0.16	0.05	0.42
Labor supply (pers.)	0.01	0.14	0.13	0.17	0.18	0.15	0.01	0.27
Labor supply (hours)	0.02	0.10	0.09	0.18	0.14	0.08	0.05	0.26
Black labor(hours)	−0.03	−0.76	−0.68	−0.59	−0.60	−0.50	−0.03	−1.28
Human capital	0.01	0.02	0.02	0.02	0.02	0.01	0.00	0.03
Ratios				absolute changes				
Unemployment rate	−0.02	−0.07	−0.07	−0.04	−0.05	−0.06	0.02	−0.09
Replacement ratio	0.00	−0.14	−0.13	−0.10	−0.12	−0.11	0.04	−0.21
Average burden	−0.05	−0.14	−0.13	−0.11	−0.12	−0.12	0.00	−0.20
Marginal burden	−0.05	−0.03	−0.03	−0.24	−0.18	−0.09	−0.19	−0.26

(1)   decrease in the tax rate of the first income tax bracket by 0,1%

(2)   increase in the number of child care places hired by the local governments by 100%

(3)   increase in subsidy rate of places hired by firms from 20% to 44%

(4)   decrease in maximum parental fee by 50%, firms are compensated

(5)   decrease in marginal parental fee from 25% to 11,5%, firms are compensated

(6)   increase in income level at which minimum parental fee applies, by 100%, firms are compensated

(7)   replacement of child care subsidies by a uniform tax credit of 47% of child care costs

(8)   idem, without reduction in the employers' budget on child care places

additional subsidy to lower their budget for child care provisions, this measure will be less effective in stimulating the supply of subsidized places and, hence, will generate a smaller impact on labor supply. If the collective partners use the full increase in the subsidy for lowering their budget on child care, the measure boils down to a simple reduction in the rate of social premiums paid by firms with more or less similar effects to those in the first column.[12]

4.1.4   *Reduction in maximal parental fee for subsidized places*
In the fourth column the maximal parental fee for subsidized child care (p_{max} in equation (6)) is reduced by 50 per cent. The resulting change in the structure of the parental fee is depicted in Figure 2. The reduction in the maximum parental fee shifts the segment b-c downwards to b_1-c_1. Hence, only people with an income above b_1 benefit.

Since the parental fee also applies to places supplied by firms, firms are compensated for the lower parental fee by an increase in the rate of the firms' costs paid by the government in such a way that the firm's budget for child care does not change.[13]

This type of measure has quite a different impact on the market for child care. The reduction in the parental fee increases the demand for subsidized places without changing the supply of these places. Hence, the excess demand increases and waiting lists grow. As a result, the demand for unsubsidized child care rises. The demand for black places falls, however. Here there are three mechanisms at work. First, as subsidized places become cheaper, less people prefer black places over subsidized places. Second, since unsubsidized places also become cheaper (since a larger share of child care costs is deductible), some parents will also substitute unsubsidized places for black places. On the other hand, as the waiting list grows, a larger share of parents will have to reallocate their initial demand for subsidized places and have to choose between black and unsubsidized places. This will increase the demand for black places, because black places are more competitive to unsubsidized places than to subsidized places. The net effect of these three mechanisms turns out to be negative. Hence we see a fall in the demand for black places, although less pronounced than in the second and third columns. As a result, the price for black places falls. This

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[12]   For a description of the economic effects of an across-the board reduction in employers' SSC, see Graafland and De Mooij (1998).

[13] If the firms are not compensated for the reduction in the family contribution, the supply of subsidized places hired by firms will fall, making the interpretation of the simulation results more complex.

Figure 2 Relation between parental fee and household income
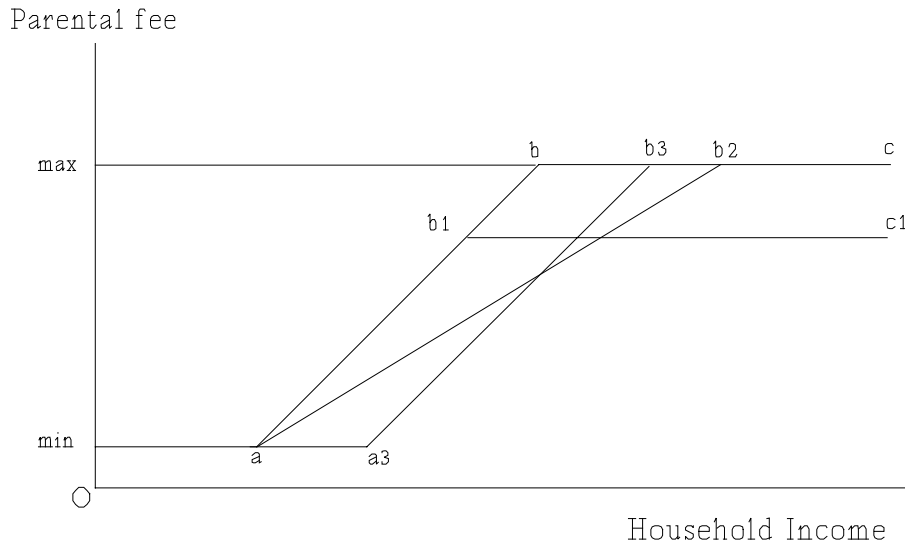
stimulates labor supply.

Surprisingly, the labor supply effect is larger than in the second and third columns. Actually, we had expected it the other way around. This expectation was based on our intuition that lowering the price of subsidized places is not very effective in stimulating labor supply as long as the demand for subsidized places is restricted by the supply of subsidized places. This would only put an extra pressure on the waiting list and forces some parents to shift from subsidized to unsubsidized places. As a consequence, the average costs of child care places would go up. However, in contrast to our expectation, this effect does not dominate the simulation result. Although the waiting list and the share of unsubsidized places do increase, the average decline in the price of child care is still comparable to that in the second and third columns. The reason is that enlarging the number of subsidized places is a relatively costly way of bringing down the average costs of child care, because it directly substitutes subsidized places for (relatively cheap) black places by shortening the waiting lists.[14]

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[14] To further clarify this point, suppose an extreme example in which p_b is only slightly higher than p_s and all parents prefer subsidized places over black places and black places over unsubsidized places. In such a case, a rise in the supply of subsidized places hardly generates a fall in the average child care costs, whereas the budgetary costs are large.

Reducing the family costs of subsidized and unsubsidized places does not result in such a deadweight loss. That labor supply increases even more than in the second and third columns is explained by the fact that the reduction in the maximal parental fee lowers the marginal child care costs. This is shown by the relative large fall in the parental fee for high skilled workers compared to that of unskilled workers. This generates a substitution effect towards larger part-time jobs. Especially high skilled partners increase their labor supply. Also breadwinners find it more attractive to accept a job that requires overwork.

Because of the relatively large growth in labor supply, wage moderation increases. This effect is, however, counteracted by the positive impact from the larger reduction in the marginal burden on wages. The increase in employment and public consumption are slightly higher than in the second and third columns.

4.1.5   *Reduction in the marginal parental fee for subsidized places*
In the fifth column the marginal parental fee for subsidized child care (α in equation (6)) is reduced from 0,25 to 0,115. Figure 2 gives a graphical illustration of this measure. As a result of the reduction in marginal parental fee, only families with household income between a and b_2 benefit. Like in the fourth column, firms are compensated for the lower parental fee by an increase in the rate of the firms' costs paid by the government in such a way that the firm's budget for child care does not change.

The economic effects of this measure are more or less the same as those in the fourth column. Again the unskilled benefit not as much as the other groups, although a little bit more than in the fourth column. On the other hand, the skilled people profit not as much. Hence, we see a lower increase in high skilled labor supply, whereas the increase in unskilled and low skilled labor supply is slightly higher. The net impact on labor supply is smaller, however, than in the fourth column, because a reduction in the marginal parental fee contributes less to a fall in marginal wedge than a reduction in the maximal parental fee.

4.1.6   *Increase in income threshold for minimal parental fee*
The sixth column presents the simulation results if the income level at which the minimal contribution applies (Y_{min} in equation (6)) is increased by 100 per cent. Now the parental fee curve shifts from a-b-c towards a-a_3-b_3-c. Hence, only parents with a household income lower than b_3 benefit. The budgetary impulse is similar to that in the other simulations. Again the firms are compensated for the lower parental fee.

As can be seen from Table 4, especially the unskilled people benefit from this measure and see their parental fee for subsidized child care fall. However, in labor years the growth in labor supply is not as large as in the fourth and fifth columns,

especially for high skilled people. For some partners in high skilled households, whose parental fee is equal to the maximal contribution, it becomes profitable to change from a large part-time job to a medium part-time job, because the parental fee of the latter has fallen (whereas that of the large part-time job is unchanged). As a result of the decline in labor supply growth, wage moderation decreases and so does employment growth (see Table 6).

Comparison of the simulation results in the fourth, fifth and sixth columns indicates that the income-dependency of the parental fee has a substantial macro-economic impact on labor supply. In order to test this finding further, we also performed a simulation in which the marginal parental fee rate was set at zero (α in equation (6)) and the minimal and maximal contribution (p_{min} and p_{max} in equation (6)) at such a value that the average parental fee remains constant. This simulation generated a decline in labor supply of unskilled people and an increase in the labor supply of high skilled. Besides this reallocation, there was a general positive impact on labor supply, which stems from the reduction in the marginal wedge. For the unskilled people, this effect compensated the impact of the rise in the parental fee. On a macro economic level, the total increase in labor supply was found to be equal to 4 thousand labor years.

4.1.7 *Replacing child care subsidies by a tax credit*

One way of abolishing the income dependence of the parental fee to subsidized child care is to replace the current child care subsidies by a tax credit that is proportional to the family child care costs. Besides the possible favorable labor market consequences, there might be various qualitative advantages to this policy. For example, it may reduce the administrative burden for local governments whose current task to organize subsidized child care places requires a lot of collective means. Moreover, demand subsidies in the form of tax credits may stimulate the competition on the child care market, because in the current situation subsidized suppliers of child care are shielded from competition of private child care centers by additional subsidies of local governments.

On the other hand, replacing the current system by a general tax credit for families that is related to their child care costs has the potential disadvantage that firms will be less inclined to arrange child care provisions in collective agreements. Indeed, if the government subsidizes the child care costs of all parents through a tax credit, there is less reason for firms to provide child care places for their employees, since labor supply of parents with children will not be hampered by lack of child care

provisions.[15] To illustrate the negative consequences of such a reaction, we assume that the child care places supplied by firms are abolished and that the money saved is partly used to lower wage costs and partly to increase net wages.

In the seventh column, the tax credit is set equal to 47 per cent of child care costs. In combination with the abolishment of subsidized places supplied by local governments and firms, the net budgetary costs equal 250 million. In spite of this additional budgetary impulse, we see the net child care costs rise on average, simply because firms reduce their budget for child care to zero. Especially unskilled parents see their child care costs increase, whereas high skilled parents experience a small reduction in average child care costs. Although on average the child care costs increase, the labor supply effect is still positive, mainly because the marginal child care costs strongly decrease as a result of the abolishment of the income dependence of the parental fee for child care cost. But, compared to columns 2-6, this increase in labor supply is relatively small.

If firms do not cut back their child care provisions, the results strongly improve. This is shown in column 8. In this simulation it is assumed that the parental fee for places hired by firms does not change. The number of places hired by firms falls, however, because the government subsidy on this kind of places is abolished. Furthermore, it is assumed that the tax credit for child care costs does not apply to parental fees for places hired by firms. Hence, the ex-ante impulse of Dfl 250 million allows a higher tax credit rate for the other places, namely of 67 per cent instead of 47 per cent. This explains the larger decline in the parental fee for private places. This generates a relatively large substitution effect from black to formal places and induces a larger reduction in the black price. As a result, child care costs fall considerable with favorable effects on labor supply and unemployment.

4.2   Abolishment of child care subsidies

In this section we investigate the effectiveness of the current child care subsidies. For this purpose we design three experiments in which the various government subsidies on child care costs are successively abolished. We also investigate what would happen

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[15]   It should be noted, however, that this effect might also occur if the government substantially extends the number of subsidized places, as in the second simulation experiment. If this leads to an excess supply of subsidized places, firms will be tempted to reduce the child care provisions agreed upon in the collective bargains. Therefore, extending the number of subsidized places is only effective as long as labor supply is restricted by lack of good child care provisions.

if the collective partners also decide to stop their contribution to child care arrangements and families would fully have to rely on the black market and unsubsidized market.

The simulation results are presented in Table 7. In all simulations, the government budget is balanced by a change in government consumption in such a way that ex-post the government deficit does not change.

4.2.1 Subsidized places supplied by local governments

Abolishment of the subsidized places supplied by the local governments yields ex-ante a reduction in government outlays by 240 million guilders (in 1999). The economic effects are more or less contrary to those in the second column in Tables 4-6. The fall in supply of subsidized places generates a large increase in the average costs of child care. Parents have to substitute relatively cheap subsidized places by black and unsubsidized places. Moreover, the additional demand for black places generates a rise in the price for black places which further increases the average costs for child care. Especially the low income groups see their child care costs increase, because for them the difference between the parental fee for subsidized places and the black and unsubsidized costs is larger than for the other groups.

As a result, labor supply of partners declines. Also some breadwinners reduce their labor time in order to take care after the children themselves during the working time of the partner. The reduction in labor supply generates some upward pressure on wages. The rise in wages is enforced by the rise in the wedge created by child care costs and the increase in the replacement ratio and only slightly diminished by the rise in the marginal wedge. Hence employment declines. The crowding out effects are so large that, ex-post, government consumption has to be reduced in order to balance the government budget, because of a reduction in tax receipts caused by the fall in employment and the rise in unemployment.

4.2.2 Subsidy on places supplied by firms

The second column in Tables 7 presents the cumulative results if both the subsidized places supplied by the local government and the subsidy on places supplied by firms are abolished. Now the reduction in government budget equals 320 million guilders.

Compared to the first column, the supply of subsidized places is further reduced because firms must allocate their budget over less places. Hence, more parents have to search for child care places in the black and unsubsidized sectors, raising the costs per child place. This further reduces labor supply.

Table 7 Abolishment of child care subsidies

simulation	(1)	(2)	(3)	(4)
Family costs per child care place	percentage changes			
Total	16	20	36	60
– unskilled	26	31	51	87
– low skilled	18	22	38	64
– high skilled	13	15	30	50
Black places	8	9	19	28
Number of child care places	absolute changes			
Total	–4	–5	–11	–16
Use of subsidized places	–45	–54	–52	–96
Unsubsidized places	33	40	24	54
Black	7	9	17	25
Macro economic effects	percentage changes			
Wage rate	0.12	0.15	0.29	0.46
Public consumption	–0.23	–0.29	–0.56	–1.56
Private employment	–0.21	–0.25	–0.48	–0.76
–unskilled	–0.28	–0.34	–0.62	–1.00
–low skilled	–0.22	–0.26	–0.49	–0.76
–high skilled	–0.20	–0.24	–0.46	–0.71
Labor supply (pers.)	–0.13	–0.15	–0.29	–0.47
Labor supply (hours)	–0.10	–0.12	–0.24	–0.38
–breadwinners	–0.03	–0.03	–0.07	–0.11
–partners	–0.40	–0.48	–0.94	–1.52
Black labor(hours)	0.62	0.74	1.56	2.34
Human capital	–0.02	–0.03	–0.04	–0.06
Ratios	absolute changes			
Unemployment rate	0.07	0.09	0.15	0.23
Replacement ratio	0.13	0.16	0.29	0.48
Average burden	0.13	0.16	0.29	0.43
Marginal burden	0.02	0.03	0.12	0.12

(1)   abolishment of subsidized places hired by local governments
(2)   (1) plus abolishment of subsidies on places hired by firms
(3)   (2) plus abolishment of deductibility of child care costs of unsubsidized places
(4)   (3) plus abolishment of subsidized places hired by firms

4.2.3   Tax deduction of child care costs of unsubsidized places
Similar effects are also obtained if, in addition, the deductibility of the difference between total child care costs and the parental fee (according to the VWS/VNG-table) is also abolished. In combination with the first and second columns, the ex-ante the budgetary revenues are 640 million guilders.

4.2.4   Complete abolishment of collective provisions
A final step towards a complete abolishment of collective provisions for child care demand and a full reliance on the private market is made if also the employers' organizations and unions withdraw their funds reserved for child care arrangements. This is simulated in the fourth column of Table 7. Once again we see a drastic increase in the average family costs for child care, which especially hits the low income groups. As a result, labor supply shows a large decline with negative consequences for wage formation and employment. This simulation result stresses again the importance of the role of the social partners in facilitating labor supply by creating funds for child care arrangement.

5 Sensitivity analysis

In this section we analyze the robustness of the simulation results by varying the values of some important elasticities for which the empirical base is rather weak. Table 8 and 9 present some selected outcomes of the sensitivity analysis for a subset of the simulations analyzed in section 4 (namely simulation 2 and 4 - 8 of section 4.1). The upper part in Table 8 reports the outcomes of the base version of the model, as presented in section 4. The other parts show the simulation results if one of the parameters of the model is changed.

5.1   Wage elasticity of formal labor supply of partners

The first alternative set in Table 8 shows the outcomes if the wage elasticity of labor supply of partners is lowered from 1.0 to 0.5. Although most econometric research for the Netherlands indicates a value of on average 1.0, some papers (like Van Soest (1995)) report a lower estimate of about 0.5. An alternative interpretation of this sensitivity analysis is that it shows the effects if the impact of child care costs on labor supply is not fully comparable with that of changes in wage rates. Indeed, in contrast to our assumption in section 3.2, one could argue that households view child care costs as temporarily and that, given some turnover costs, do not adapt labor supply as much in reaction to changes in child care costs as to (permanent) changes in the wage rate.

Table 8 Sensitivity analysis of impact of additional child care subsidies

simulation	(1)	(2)	(3)	(4)	(5)	(6)
Base model version						
average parental fee[a]	−17	−14	−16	−16	6	−26
number of black places[b]	−10	−6	−6	−5	1	−15
labor supply (hours)[a]	0.10	0.18	0.14	0.08	0.05	0.26
private employment[a]	0.22	0.26	0.24	0.18	0.03	0.42
public consumption[a]	0.15	0.24	0.20	0.01	−0.36	0.26
Wage elasticity of labor supply partners 0.5 instead of 1.0						
average parental fee[a]	−17	−16	−17	−16	6	−26
number of black places[b]	−10	−7	−7	−6	0	−16
labor supply (hours)[a]	0.07	0.11	0.09	0.06	0.03	0.16
private employment[a]	0.18	0.18	0.18	0.16	0.01	0.30
public consumption[a]	−0.01	−0.02	−0.01	−0.08	−0.44	−0.11
Wage elasticity unskilled, low, high skilled labor supply partners 2.0, 1.25 respectively 0.5						
average parental fee[a]	−17	−15	−16	−16	6	−26
number of black places[b]	−10	−6	−6	−5	0	−16
labor supply (hours)[a]	0.09	0.14	0.12	0.08	0.03	0.21
private employment[a]	0.21	0.22	0.22	0.18	0.02	0.37
public consumption[a]	0.11	0.13	0.13	0.02	−0.42	0.11
Wage elasticity of number of black places labor supply of child care is 2.0 instead of 1.0						
average parental fee[a]	−15	−13	−15	−15	7	−23
number of black places[b]	−13	−7	−8	−7	2	−20
labor supply (hours)[a]	0.08	0.16	0.12	0.07	0.04	0.22
private employment[a]	0.18	0.23	0.21	0.16	0.02	0.36
public consumption[a]	−0.09	0.09	0.03	−0.13	−0.37	−0.11

(1) increase in the number of child care places hired by the local governments by 100%
(2) decrease in maximum parental fee by 50%, firms are compensated
(3) decrease in marginal parental fee from 25% to 11,5%, firms are compensated
(4) increase in income level at which minimum parental fee applies, by 100%, firms are compensated
(5) replacement of subsidies on child care places by a uniform tax credit
(6) idem, without reduction in the employers' budget on child care places

[a] In percentage changes
[b] In thousands of full-time places

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Table 9 Sensitivity analysis of impact of additional child care subsidies

simulation	(1)	(2)	(3)	(4)	(5)	(6)
Impact of child care demand on formal wage of child care nurses 0.4 instead of 0.2						
average parental fee[a]	−17	−11	−13	−14	8	−23
number of black places[b]	−10	−4	−5	−4	1	−15
labor supply (hours)[a]	0.10	0.16	0.14	0.09	0.04	0.25
private employment[a]	0.22	0.23	0.22	0.18	0.02	0.41
public consumption[a]	−0.07	0.06	0.03	−0.09	−0.37	−0.16
Substitution elasticity between formal and black demand of child care 0.5						
average parental fee[a]	−16	−15	−16	−16	7	−24
number of black places[b]	−7	−5	−6	−5	2	−11
labor supply (hours)[a]	0.09	0.17	0.13	0.08	0.03	0.22
private employment[a]	0.20	0.25	0.23	0.18	0.02	0.37
public consumption[a]	0.13	0.22	0.16	−0.02	−0.39	0.22
No forward shifting of child care wedge in wages						
average parental fee[a]	−17	−14	−16	−16	6	−26
number of black places[b]	−10	−5	−6	−5	1	−15
labor supply (hours)[a]	0.10	0.17	0.13	0.08	0.04	0.24
private employment[a]	0.13	0.22	0.18	0.11	0.05	0.32
public consumption[a]	−0.32	0.04	−0.12	−0.40	−0.27	−0.31
Change in feedback from parental fee on labor supply						
average parental fee[a]	−17	−14	−16	−16	6	−26
number of black places[b]	−10	−6	−6	−5	1	−15
labor supply (hours)[a]	0.10	0.18	0.14	0.08	0.05	0.26
private employment[a]	0.22	0.26	0.24	0.18	0.03	0.42
public consumption[a]	0.15	0.24	0.20	0.01	−0.36	0.26

(1) increase in the number of child care places hired by the local governments by 100%
(2) decrease in maximum parental fee by 50%, firms are compensated
(3) decrease in marginal parental fee from 25% to 11,5%, firms are compensated
(4) increase in income level at which minimum parental fee applies, by 100%, firms are compensated
(5) replacement of subsidies on child care places by a uniform tax credit
(6) idem, without reduction in the employers' budget on child care places

[a] In percentage changes

[b] In thousands of full-time places

Reducing the wage elasticity of labor supply of partners causes the effect of child care costs on labor supply to go down. In almost all simulations the reduction in labor supply growth is less pronounced than the reduction in the wage elasticity. This is partly explained by the fact that part of the total labor supply change is caused by changes in labor supply by breadwinners (whose wage elasticity has not been modified). As a result of the lower labor supply growth, increasing child care subsidies generates less favorable macro-economic effects. This is illustrated by government consumption, which has to be reduced in most simulations to obtain budget neutrality. Finally, note that the change in the wage elasticity of labor supply of partners does not affect the relative effectiveness of the various alternative policies of raising child care subsidies.

<u>5.2</u>　　　　　　<u>Skill specific differentiation in wage elasticity of labor supply</u>

The second experiment concerns more differentiation in the labor supply elasticities per skill type. In MIMIC it is assumed that the wage elasticity of partners is independent of the household income. However, both Blomquist and Hansson-Brusewitz (1990) and Blundell, Duncan and Meghir (1992, 1993) find that the wage elasticity of labor supply by women declines with income. Although we lack such evidence for the Netherlands, the relative effectiveness of the simulations might well change if this income dependence would also hold for the Netherlands. This is tested by increasing the wage elasticity of unskilled and low skilled partners from 1.0 to 2.0 respectively 1.25 and lowering the wage elasticity of skilled partners from 1.0 to 0.5.

As can be seen from Table 8, this experiment has only a small impact on the simulation results. Especially the decrease in the maximum parental fee becomes less effective in stimulating labor supply. However, the ranking order of the relative effectiveness of the various measures does not change.

<u>5.3</u>　　　　　　<u>Wage elasticity of black supply of child care</u>

In the third alternative set of simulations we perform sensitivity analysis with respect to the labor supply elasticity of black care (ϕ in equation 16). This elasticity has been increased from 1.0 in the base version to 2.0. By making black care supply more elastic, the black price reactions to demand shocks become smaller. Therefore, if the demand for black places falls, the reduction in the black prices is smaller than in the base version. As a result, substitution effects from formal demand to black demand diminish, so that the fall in the volume of black care rises. Also the reduction in the average child care costs diminishes. As a result, there is less incentive to increase labor supply. Quantitatively, the effectiveness of child care subsidies falls by 10 to 20

per cent. The relative effectiveness of the various policies does not change very much, however. As the macro economic consequences become less favorable, public consumption has to decrease in some simulations to obtain budget neutrality. Only in the case of the reduction in the maximal and marginal parental fee public consumption can still increase.

5.4   Impact of formal child care on wage of child care personnel

In the first alternative set in Table 9 we varied the impact of the volume of formal child care on the wage of child care personnel (see section 3.4). This elasticity has been increased from 0.2 in the base version to 0.4. In most simulations the demand for formal places (i.e. the sum of subsidized and unsubsidized places) increases. Hence, by making the supply of formal child care less elastic, the formal market price for child care goes up. Since the parental fee for subsidized places is largely independent of the market price, labor supply is hardly affected. However, the government subsidy per place has to increase in order to bridge the gap between the higher market price and the parental fee. This explains the negative effect on the government budget as indicated by the fall in public consumption.

5.5   Substitution between formal and black demand for child care

In the second alternative set in Table 9 the substitution parameter in the allocation model of the demand for paid child care (σ in equation 10) is reduced from 1.5 to 1.0. As a result, the own price elasticity of the demand for subsidized places changes from -0.7 to -0.5, whereas the own price elasticity of the demand for unsubsidized places decreases from -1.7 to -0.9. With the decrease in the own price elasticity of unsubsidized places, the calibrated volume in the number of unsubsidized and black places in the base year increases respectively decreases (and become higher respectively lower than the actual numbers reported in Table 1). This explains why an increase in the number of subsidized places, as in the first column, causes a smaller decrease in black places. Hence, the decrease in black prices is lower than in the base version of the model and so is the decrease in the average family costs of child care. As a result, the growth in labor supply is slightly reduced, although the change in simulation results is rather modest.

5.6   Forward shifting of child care costs in wage formation

In the third alternative set reported in Table 9 the forward shifting effect of the average and marginal wedge of child care costs on wage costs is set at zero. This also

reduces the effectiveness of child care subsidies. Especially the growth in employment is reduced, since the wage reduction from the fall in the average child care costs disappears. As a result, the unemployment effects become less favorable, although in all cases we still see a small reduction in unemployment, caused by the fall in the replacement ratio. The smaller reduction in unemployment affects the government budget in a negative way by raising public expenditure on unemployment benefits. This is shown by the impact on public consumption, which becomes negative in most simulations.

5.7   Feedback from child care costs on labor supply

In the last sensitivity analysis we investigate the robustness of the simulation results with respect to a change in the model structure. In particular, we changed the feedback from child care costs to labor supply. In the base version of the model, the average costs of child care are determined as a weighted average of the costs of the unrestricted and the restricted demand for black, subsidized and unsubsidized child care (see Figure 1 and equation (5)). An interpretation of this specification is that parents base their labor supply decision on the expected child care costs and use the share of subsidized places in total formal places as the probability of being selected if they prefer a subsidized place. Another interpretation of the base specification of the model is that parents have a long term view and assume that time spent on the waiting list is related to the share of unsubsidized places in total formal places. Hence the model implies that the labor supply decision by parents is taken before they know whether they will be selected for a subsidized place. This assumption seems plausible, because most married women already work before having children. Because of turnover costs, they will have a long term view when deciding on future labor supply after they get children.

In the alternative model, it is assumed that parents will reconsider their labor supply decision when they are not selected for a subsidized place. Indeed, some parents might (temporarily) reduce their labor supply once it becomes clear that they are not selected for a subsidized place and are put on the waiting list. The resulting model structure is reflected in Figure 3. Compared to (the thick lined area in) Figure 1, the alternative model contains two separate labor supply models instead of one labor supply model. The right side pictures the labor supply decision if parents have a subsidized place. The left side pictures the labor supply decision if parents are not selected for a subsidized place and are put on the waiting list. On average, this group will supply less hours, because of the higher average child care cost. Aggregation over all households and confrontation with the supply of subsidized places gives the number of parents who belong to each of these groups.

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Figure 3   Change in feedback from child care costs on labor supply
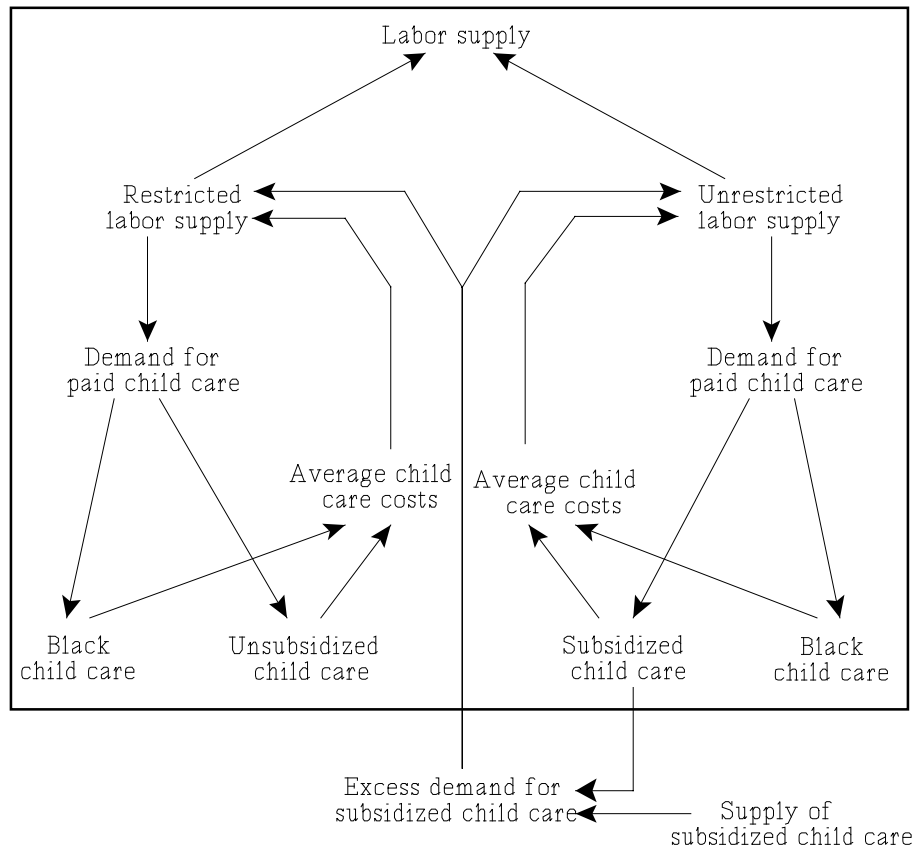

Table 9 shows that the labor supply effects of an increase in child care subsidies does not change as a result of this modification of the model structure. Also in the case of a rise in subsidy per subsidized place, like in second, third and fourth columns, we obtain similar results. The higher subsidy per subsidized place induces additional demand for subsidized child care by parents with a relatively high reservation wage. Since the supply of subsidized child care does not rise, other parents will be put on the waiting list. Those with a relatively low reservation wage will not reduce labor supply and therefore resort to unsubsidized child care, raising the share of this type of child care. Apparently, the base model forms a good approximation of this more

complex alternative model. Indeed, also in the base version the share of unsubsidized child care increases, thereby diminishing the fall in child care costs.

Concluding this section, our sensitivity analysis indicates that most changes in parameters generate a smaller impact of child care subsidies on labor supply and employment. As a result, the macro economic effects become less favorable and, in some cases, government consumption has to be reduced in order to obtain ex-post budget neutrality for the government. The changes in model results are, however, not dramatic. In all cases, child care subsidies remain more effective in stimulating labor supply and employment than a general tax reduction. Furthermore, the sensitivity analysis supports the robustness of the relative effectiveness of various alternative policies of raising child care subsidies.

6 Comparison with other research

In this section we compare our results with findings of other researchers. Unfortunately, there is a great variety in estimation results of the relationship between labor supply and child care subsidies. On the one hand, there are a lot of authors who find that the number of hours worked is rather insensitive to the costs of child care. This would imply that subsidizing child care is not very effective in stimulating labor supply. On the other hand, there are also several authors who find a substantial impact of child care subsidies on labor supply.

An example of a study that highly doubts the effectiveness of child care subsidies is Rosen (1996). In his view, the large government subsidies on child care in Sweden (almost 90 per cent of child care costs is covered by the government) have reduced the marginal private costs of child care below their true social costs and encouraged excessive production of child care at the expense of other goods and services. Although these subsidies have stimulated formal labor supply by women, Rosen (1996) argues that this has only increased the total time allocated to household production, defined as the sum of purchased time and own time. Production of other goods has actually declined because of the higher tax rate to finance the subsidies on household production.

A study for the Netherlands that is rather pessimistic about the impact of child care subsidies on labor supply is Groot and Maassen van den Brink (1992). Based on micro-econometric estimates, they conclude that the elasticity of the demand for

leisure with respect to the price of child care is close to zero.[16] A possible explanation for this result is that the average price of subsidized child care is rather low. The subsidy of the government might reduce the impact of child care costs on labor supply. However, they also find that there is little connection between labor supply and child care demand. This suggests that child care is neither a necessary nor a sufficient condition for participation in the labor market. Later research on a different data base (in Maassen van den Brink and Groot (1995), Tijdens at al (1994)) shows, however, a stronger relationship between the use of child care and labor supply. A 1 per cent increase in the probability of using child care increases the probability of working by 0,9 per cent. From this research Groot and Maassen van den Brink (1995) conclude that the government subsidies on child care (of 330 million in 1992) increase the tax revenues by 260 million as a result of additional labor supply.

Leibowitz et al (1992) find that the financial costs of child care have their greatest influence on women's work soon (three months) after the child's birth, but exert no significant impact two years after childbirth. They argue that at three months after the child's birth, many women are near the margin where the value of home production is approaching (from above) the net market wage. In such a case, a small financial gain through a child care tax credit induces a considerable number of women to return to work. By two years after the birth, most women are not at the margin at which their behavior is significantly affected. Many of the women not working after two years after the child's birth apparently have a very high value of non-market time or face a very low market wage offer.

Another study that warns for small labor supply effects of subsidies for formal child care is Michalopoulos et al (1992). They find for the U.S. that an increase in subsidy on child care stimulates labor supply, but considerably less so than child care expenditures. The primary benefit of more generous subsidies is that they allow users of informal care to shift to higher-quality market care. On a macro-economic scale, Michalopoulos estimate that an increase in subsidy by 100 million dollar (5 per cent of the total subsidy) stimulates labor supply of married mothers by 0.2 per cent,

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[16] Although estimation results in Groot and Maassen van den Brink (1991) show a very large negative impact of the price of formal child care on the use of formal child care. However, in the same paper, the price of different forms of formal child care hardly influences the allocation between these types. These results seem not very plausible and are, for example, contrasted by results of Hofferth and Wissoker (1992), who find that price differentials between different forms of child care have a significant impact on the choice of parents. Families who use care of a given type are the ones who face the lowest price for that type, on average.

whereas the quality of care increases by 0.8 per cent.[17] For single mothers the impact on labor supply is much larger, however.[18]

Other studies indicate that child care subsidies may have a larger impact on labor supply. For example, for Sweden Gustafsson and Stafford (1992) find that child care subsidies will lead to an increase in paid work, although there are also deadweight losses from substitution from private unsubsidized child care to subsidized child care. Furthermore, Blau and Robbins (1988) find for the U.S. that the decision to enter employment is sensitive to child care costs. They estimate an elasticity of employment with respect to the price of child care of –0.38. Also estimates of Ribar (1992) reveal that the cost of market child care has a strong negative effect on the labor supply of married women. The estimated elasticity of hourly market care costs on labor supply is –0.74. In later research (in Ribar (1995)), he finds much smaller elasticities, however, ranging from –0.02 to –0.08. Joshi and Davies (1993) stress that child care subsidies may not only affect labor supply of mothers, but also their hourly wage, by conserving human capital and increasing earnings at later stages of the mother's life. Taking account of this lifetime earnings effect, they find that the additional revenues from a subsidy on child care costs may exceed the costs of the subsidy. Finally, for the Netherlands Eggink et al (1990) use a micro-simulation model to show that the labor force participation of married women with children would increase substantially if adequate free child care services were available.

Discussion
On the basis of this literature, no clear picture arises with respect to the impact of child care subsidies on labor supply. However, still we can draw some conclusions by comparing our research with several findings in the literature reviewed above.

First, on basis of the simulation results in Table 4-6, we can calculate the reduced form elasticity between the average family child care costs and the labor supply of partners with children. For example, in the second column the average family costs per child care places falls by 16 per cent. The labor supply of married women increases by 2.4 per cent (not reported in the Table). This implies an elasticity of

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[17] Also Berger and Black (1992) find that additional subsidies on child care costs not only stimulates labor supply, but also dramatically raises the quality of care.

[18] Kimmel (1995) finds that especially the labor supply of white lone mothers is sensitive for child care costs. A subsidy of 50% increases the participation rate of this group from 30% to 50%. If all costs are covered by the subsidy, the participation rate even becomes 70%. For black lone mothers these effects are much smaller, however, because they relatively make more use of informal child care supplied by relatives.

−0.15. This value seems to be in line with the estimates reported in the literature, which range from −0.02 in Ribar (1995) to −0.74 in Ribar (1992). In MIMIC this estimate results from the assumption that an absolute change in the child care costs (per option) has the same impact as an equivalent change in the net wage.

A second observation from the literature is that MIMIC might overestimate the labor supply effect of child care subsidies, because it does not take account of endogenous increases in the quality of child care. On the other hand, this notion may partly be captured by the endogenous substitution between formal and informal places. Indeed, insofar the quality of subsidized places is better than of black places, the MIMIC results seem to be consistent with the studies that stress the importance of quality effects.

Third, although the labor supply effects of a subsidy on child care costs seem to be neither small nor extremely large in MIMIC, the macro effects are still very favorable, because of the general equilibrium effects on wage formation and employment. In this respect our study seem to confirm earlier conclusions by Tijdens et al (1994) that the subsidy on child care pays for itself because of an increase in tax revenues stemming from the rise in labor supply. On this point, our study seems to be in contrast with Rosen's analysis. However, also Rosen (1996) notes that larger subsidies are warranted the higher the degree of substitution between own and hired labor. Indeed, this aspect explains why in MIMIC subsidizing child care is more efficient than a general tax reduction, because a subsidy on child care costs implies a fall in the wedge for the group with the highest substitution possibilities. On the other hand, it must also be stressed that raising the government subsidy on child care costs to 100 per cent might be ineffective, also in our model, because in that case firms might reduce their budget on child care provisions. The resulting rise in government outlays will require a rise in tax rates with negative consequences on labor supply and equilibrium unemployment.

Finally, it is noted that the human capital effects are rather small in our analysis, compared with the study of Joshi and Davies (1993). They calculate that the loss in human capital accounts for about 1/3 of the total loss in earnings due to reduced labor market participation by women with children. If we compare the simulation results of labor supply in hours with those of human capital in Table 6, this ratio is about 10 per cent for MIMIC.

7 Conclusions

This paper analyzes the impact of child care subsidies on labor supply and employment in the Netherlands. For this purpose, we use the applied general equilibrium model of the CPB, called MIMIC. The advantage of using MIMIC is that

it contains a highly disaggregated household model describing the interaction between child care and labor supply. A model of the child care market is included, that describes the current situation of the Dutch child care market, including the quantity constraints that hold for subsidized child care places. Also the role of informal child care is taken into account. The general equilibrium context of MIMIC further enables us to analyze the impact of child care subsidies on wage formation and unemployment. The parameters of the model are derived from the literature on Dutch econometric research. For those parameters which lack a substantial empirical base, sensitivity analysis is performed.

In the paper we analyze several types of policies of increasing and decreasing government subsidies on child care costs. The simulation results show that, at a given budgetary impulse, in all cases an increase in child care subsidies is more effective in stimulating labor supply than a general tax reduction. An increase in child care subsidy not only reduces the wedge for partners with children, who feature the highest wage elasticity of labor supply, but simultaneously reduces the marginal wedge of breadwinners. Besides stimulating labor supply, a rise in child care subsidies has several positive side-effects. First, it both lowers the replacement ratio and the average wedge and therefore has a negative impact on wages. Second, it improves human capital formation by partners and raises labor productivity. The macro economic revenues from the increase in labor supply, employment and human capital are so large, that ex-post a rise in child care subsidies does not increase the government deficit.

Comparing various alternatives of raising subsidies on child care, we find that a rise in the number of subsidized places is less effective in stimulating labor supply than a decrease in the maximal or marginal parental fee per subsidized place. The first type of measure generates larger deadweight losses because of higher substitution from black and unsubsidized places to subsidized places. This tempers the decline in the average child care costs and slows down the increase in labor supply. A second explanation is that a decrease in the maximal or marginal parental fee per child care place strongly reduces the marginal wedge caused by the income dependence of the parental fee, whereas extending the number of subsidized places hardly affects the marginal wedge. The latter mechanism also explains why the effectiveness of a lower parental fee diminishes if it is concentrated at low income families. For some partners this makes it more profitable to change from a large part time job to a smaller part-time job, because the parental fee of the latter has fallen (whereas that of the large part-time job has not been changed). Finally, the simulation results also show that an abolishment of all current subsidies on child care has a large negative impact on labor supply.

In the sensitivity analysis seven alternative model specifications are considered. A reduction in the wage elasticity of labor supply of partners from 1.0 to 0.5 reduces the impact of child care subsidies on labor supply by about 40 per cent. The simulation results hardly change if the wage elasticity of labor supply of partners per skill type is changed to 2.0 for unskilled, 1.25 for low skilled and 0.5 for high skilled labor. Child care subsidies become 10 to 20 per cent less effective if either the flexibility in the black market increases or if the elasticity of substitution between black and formal places falls. If the impact of formal child care on wages of child care personnel is doubled from 0.2 to 0.4, the labor supply effects hardly differ. Finally, the unemployment effects of child care become less favorable if child care costs are not shifted forward into higher wage costs in the wage bargaining model. In all seven cases, the relative effectiveness of the various types of increasing child care subsidies does not change. However, in some cases we obtain an opposite impact on government consumption, indicating that child care subsidies do not pay for themselves.

Comparing our results with estimation results in the literature, we find that the reduced form elasticity of labor supply with respect to child care costs in MIMIC is in line with estimates of other researchers. In the literature the value of this key parameter ranges from -0.02 to -0.72, whereas the MIMIC result equals -0.15. The human capital effect is, however, rather low in MIMIC.

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Abstract[*]

Recently, the Dutch government announced an increase in government subsidies for child care. Advocates of this policy claim that it is an important instrument to stimulate labor market participation of women with children. Opponents, on the other hand, believe that raising subsidies for child care only stimulates substitution from informal to formal child care without generating much additional labor supply. In order to investigate the labor market effects of child care subsidies, this paper presents a model of the child care market in the Netherlands. The model is included in MIMIC, the applied general equilibrium model of CPB. Simulation results show that, notwithstanding deadweight losses from substitution from informal to official child care, an increase in child care subsidies is more efficient in stimulating labor supply than a general reduction in the income tax rate. The explanation is that child care subsidies accrue to people who feature a relatively high labor supply elasticity. Moreover, since only workers benefit from child care subsidies, this policy lowers the replacement ratio.

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