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Abstract

Fertility and the provision of long-term care are connected by an aspect that has not received attention so far: both are time consuming activities that can be produced within the household or bought at the market and are, thus, connected through the intertemporal budget constraint of the household that accounts for time and money. This paper models that link and analyzes the effect of intervention in the long-term-care market on female labor-market related decisions. It shows that women's fertility as well as their labor supply when young are affected by such policies. The overall effect can be decomposed into an opportunity-cost effect and a consumption-smoothing effect that each impact fertility as well as labor supply in opposite directions. Using European survey data, the paper shows that the consumption-smoothing effect is dominant.

JEL-Code: J130, D910, I130.

Keywords: long-term care, child care, female labor supply, fertility.

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1 Introduction

According to a recent OECD study on long-term care (Colombo et al. (2011)) the OECD-average public spending on long-term care was 1.5% of the GDP in 2008. Differences in these expenditures can be considerable and are a decision variable in public social spending. This can be easily seen from, for instance, France, Germany, and Sweden who are similar in numbers of old people[1] – which are the main group in need of long-term care. However, the expenditures on long-term care in these countries differ: While in 2008 Germany spent 1.3% of its GDP on long-term care, France spent 1.8% and Sweden 3.6%. These numbers will according to the OECD's assessment[2] double to quadruple until 2050 if the current level of long-term care is to be sustained. For, the share of people aged over 80 will increase in all three countries.

Thus, to ensure that such an amount of public spending actually meets its objectives, it is necessary to understand the effects of market intervention in the long-term-care sector. Accordingly, this market has received considerable attention from economists over the last decades.

Long-term care is either provided informal or community based, that is, by neighbors, friends, or family – in the latter case most of the time by a spouse or a daughter (see, for instance, Stern (1995)) – or in institutionalized form, that is, by professional outpatient care or by nursing homes. To understand the structure of the cost of long-term care, it is necessary to analyze the interaction between informal and formal long-term care. As, for instance, Moscovice et al. (1988), Pezzin et al. (1996), Lo Sasso and Johnson (2002), Charles and Sevak (2005), and Bonsang (2009) show, both ways of provision are imperfect substitutes. Van Houtven and Norton (2004, 2008) and Bolin et al. (2008) argue that informal and formal care could be substitutes or complements and that the relationship will likely vary across different types of formal care. Hanakoa and Norton (2008) showed that opportunity costs of children make a substantial difference in the use of formal long-

[1] Colombo et al. state that in Germany the share of people aged over 65 is 20% and the share of people aged over 80 is 5%, the corresponding data for France are 16.9% and 5.5%, those for Sweden 18% and 5.3%.

[2] The OECD Secretary General, Angel Gurría made a corresponding statement in January 2009 (see Gurría (2009) cited after Fernandez et al. (2011)).

term care.

In consequence, regulation that aims at institutionalized long-term care will have an effect on the provision of informal long-term care as well as on labor-market participation of informal care givers – which in turn influences tax revenues and, thus, the budget available for public spending on long-term care.

Norton (2003, chapter 3) points out that the market for institutionalized care in principal could exhibit all features of a competitive market: Market entry would be easy without regulation as the service is easy to provide and shows no economies of scale; on the other hand, consumers could gain all necessary information as – different from acute care – they have time to search the market. However, it shows that the market is not competitive for a number of reasons. In particular, consumers seem to consider institutionalized care rather as a "bad" than as a "good": People in need of care as well as potential care givers prefer community-based care systems and often consider the demand for institutional care as a signal of neglect of own duties (see Charles and Sevak (2005)). Therefore, they ignore the potential need for care which keeps them from gathering information in time as well as from saving or buying long-term-care insurance.[3] As a consequence, needing care is one of the risks of poverty among the elderly – which most OECD countries try to reduce (see, for instance, Fernandez et al. (2011)). Therefore, in most OECD countries regulation is imposed to keep prices for institutionalized long-term care affordable and at the same time quality standards above a minimum level. One means here is to pay considerable subsidies for long-term care.

These subsidies influence individual decisions on long-term care as they determine availability of institutionalized care and the expenditures for a nursing home. In other words, public spending on long-term care determines the household production function for care and the tradeoffs between informal and institutionalized care. As informal care is a time consuming activity, informal care giving substitutes time supplied to the labor market or leisure. Studies show that informal care is mostly provided by women who are either younger spouses of a husband in need or children. While care giving spouses are husbands as well as wives, care giving children are mostly daughters; therefore, the labor

[3]In some countries there is a compulsory long-term-care insurance as part of the social security system. However, it covers part of the costs only and is mostly means tested (see Colombo et al. (2011).

economics literature has analyzed the demand for informal long-term care on female labor supply. However, this literature concentrates on current labor supply, that is, of people whose spouse or parent needs care *now* (see, for instance, Stern (1995), Nocera and Zweifel (1996), the discussion in Norton (2003), Viitanen (2010), and as a recent overview Grabowski et al. (2012)). It has been shown that caregiving affect work behavior on both the extensive margin and the intensive margin.

This paper points to an additional, intertemporal, aspect of the provision of long-term care: If we concentrate on daughters who take care of their aging parents, we can well assume that these women are themselves in their forties or beyond. Thus, when the direct crowding out of labor supply takes place education and fertility decisions are already made. However, the tradeoffs between informal and institutionalized care for parents depend on these former fertility decisions. For, the latter influence the individual's wage and, thus, the opportunity costs of household-provided care. A rational decision maker should anticipate this effect and account for it in her labor-market decisions when young.

To cover this anticipation, we provide a two-period household model where labor-market activities when young determine future human capital. The woman can choose the number of children she has when young, the way she provides care for them – here, again, we assume that care can be provided by the household or bought at the market – and finally the input mix for her parents' long-term care. To model the impact of regulation in the institutionalized long-term-care market, we analyze the effect of a price change for market-based long-term care. We show that the effect of an increase in the price of institutionalized care on today's labor supply and on fertility can be decomposed into an opportunity-cost and a consumption-smoothing effect that point in opposite directions. In our model, the two periods are linked to each other by savings and adverse human-capital effects of child care. Controlling for experience, many studies have shown that a large part of the wage penalty of motherhood is explained by human capital (see, for instance, Waldfogel (1997) and Anderson et al. (2002)). Consistent with the human capital explanation to the motherhood wage penalty, Wilde et al. (2010) found larger wage penalties for women with higher skills.

To test whether the opportunity-cost or the consumption-smoothing effect is more prevalent, we provide an empirical analysis of female attitudes and labor market decisions

depending on their expectations concerning long-term care activities. The study is based on the Eurobarometer 67.3 survey on health that has been conducted in 2007 (Papacostas (2010)). We use data from that survey on number of children, socioeconomic parameters as well as attitudes towards and experiences with long-term care of women aged 25 to 49. Based on these data we can show that an increase in expected cost of long-term care actually decreases fertility which indicates that the consumption-smoothing effect dominates.

Although the focus of our study is on household behavior, the results allow for a discussion of social policies that affect family decisions. For, the study shows that policy makers should not only concentrate on immediate labor-market effects when designing subsidies for long-term care but also include the incentives for the next generation.

2 Model

We set up a two-period single-earner household model[4] of child care and long-term care. In the first period, the female head of household decides on the number of children, her own time devoted to child care, child-care services sold on the market, and savings. In the second period, she determines to which extent she contributes to her parents' care herself, buying the remaining required services on the market. In both periods, we take leisure as given but labor supply as endogenous – the latter being equal to time endowment net of leisure minus time used for care activities. Both periods are linked to each other by savings and by seniority wages. The less the woman supplies labor to the formal labor market in the first period, the faster human capital deteriorates and the lower her wage will be in the second period. We normalize the price of the consumption good at 1 and the discount factor at $1/(1+r)$, where r is the market interest rate. We denote first-period variables and functions by lowercase letters, second-period parameters by uppercase letters.

Utility in the first period, u, depends on consumption, x, and on the number of children, n; in the second period only consumption, X, is explicitly taken into account.[5] Utility is

[4]The model focusses on the tradeoff between household- and market time; therefore, intra-household time allocation is not included to keep the model as simple as possible. The setup is an extension of Nocera and Zweifel's (1996) model that covers intertemporal aspects.

[5]The integer constraint on the number of children is disregarded.

additive separable with $u_x > 0$, $u_n > 0$, $u_{nx} = 0$, $u_{xx} \leq 0$, $U_X > 0$ and $U_{XX} \leq 0$.[6] In the first period, the woman has an initial endowment, e, and labor income, wt, available, where w is the wage rate and t is time endowment minus leisure. Child care for n children combines the woman's time, h, and market-provided services, z, according to a linearly homogenous household production function $f(h, z)$ with $f_h > 0, f_z > 0$, and $f_{hz} > 0$. Parents require long-term care at a fixed level normalized to 1 produced according to the linearly homogenous production function $F(H, Z)$, with two inputs, time, H, and services, Z, sold at price P, where $F_H > 0, F_Z > 0$, and $F_{HZ} > 0$. Savings, S, can be used to shift resources across periods. The woman's wage deteriorates at rate $\delta \in (0, 1/t)$ implying a lower second-period wage W. Thus, the woman solves the following optimization problem

$$\begin{aligned} \max_{x,n,h,z,S,X,H,Z} \quad & u(x,n) + \frac{U(X)}{1+r}, \\ \text{s.t.} \quad & x = e + w(t-h) - pz - S, \\ & X = (1+r)S + W(T-H) - PZ, \\ & n = f(h,z), \\ & 1 = F(H,Z), \\ & W = w(1-\delta h)\,. \end{aligned} \tag{1}$$

The problem can be solved by backward induction. That is, in the second period the woman solves

$$\begin{aligned} \max_{X,H,Z} \quad & U(X) \\ \text{s.t.} \quad & X = (1+r)S + W(T-H) - PZ, \\ & 1 = F(H,Z), \end{aligned} \tag{2}$$

where S and W are taken as given. Inserting for X, the problem is effectively cost minimization in long-term care

$$\min_{Z,H} PZ + WH \text{ s.t. } F(H,Z) = 1\,. \tag{3}$$

The marginal rate of substitution should be equal to the relative price of inputs: $F_H/F_Z = W/P$. Finally, this yields a well behaved (per unit) cost function $C = C(P, W)$. The

[6] Derivatives are indicated by subscripts.

indirect second-period utility function could be written as $V = V[(1+r)S, W, C(P,W)]$. Going back to the first period, the complete optimization problem could be written as

$$\begin{aligned} \max_{x,n,h,z,S} \quad & u(x,n) + \frac{V[(1+r)S, W, C(P,W)]}{1+r}, \\ \text{s.t.} \quad & x = e + w(t-h) - pz - S, \\ & n = f(h,z), \\ & W = w(1-\delta h)\,. \end{aligned} \tag{4}$$

Solving for x and n, the control variables are z, h, and S. First-order conditions are

$$\begin{aligned} & u_n f_z - u_x p = 0 \\ & u_n f_h - u_x w - \frac{\delta w}{1+r}\,\frac{dV}{dW} = 0 \\ & -u_x + U_X = 0, \end{aligned} \tag{5}$$

where $dV/dW = \partial V/\partial W + (\partial V/\partial C)(\partial C/\partial W) > 0$. The woman stabilizes the marginal utility of income across periods. Furthermore, since working hours affect the future wage, the marginal rate of substitution should be larger than the relative price of inputs: $f_h/f_z = w/p\,\{1 + [\delta/(1+r)][(dV/dW)/U_X]\} > w/p$.

Since we are interested in public care policies, our analysis focusses on the impact of price changes on time allocation and fertility. Taking the properties of C and V into account, first-order conditions (5) can be used to determine the effects of price changes. Even in this simple model these effects are ambiguous. Therefore, we consider two different special cases where unambiguous comparative static results can be derived: quasi-linear utility and exogenously determined time input.

For quasi-linear utility, where $u_x = U_X = 1$ and $u_{xx} = U_{XX} = 0$, savings are indeterminate. Defining

$$\begin{aligned} \Delta_1 \;&:=\; \begin{vmatrix} u_{nn}f_z^2 + u_n f_{zz} + u_{xx}p^2 & u_{nn}f_z f_h + u_n f_{zh} + u_{xx}wp \\ u_{nn}f_z f_h + u_n f_{zh} + u_{xx}wp & u_{nn}f_h^2 + u_n f_{hh} + u_{xx}w^2 - \frac{\partial^2 C}{\partial W^2}\,\frac{\delta^2 w^2}{1+r} \end{vmatrix}, \\ \Gamma \;&:=\; p(1+r)z + hw\left(1 + r - \delta\frac{\partial C}{\partial W} + T\delta\right), \end{aligned}$$

with $\Delta_1 > 0$ and $\Gamma > 0$, and using the first-order conditions and the properties of the

linearly homogenous production and cost functions, we get:

$$\frac{\partial h}{\partial P} = -\frac{\partial^2 C}{\partial W \partial P} \frac{w\delta \left\{ f^3 p^2 (1+r)^3 u_{nn} + f_{zz} \Gamma^3 \right\}}{\Delta_1 \, f (1+r)^2 \Gamma^2} > 0, \tag{6}$$

$$\frac{\partial n}{\partial P} = -\frac{\partial^2 C}{\partial W \partial P} \frac{f_{zz} w \delta \Gamma}{\Delta_1 \, h (1+r)^2} > 0. \tag{7}$$

We define labor supply $a := t - h$ and $A := T - H$. We can state as a result:

Proposition 1 *If utility is quasi-linear,*

$$\frac{\partial a}{\partial P} < 0 \quad \textit{and} \quad \frac{\partial n}{\partial P} > 0.$$

An increase in the price of formal long-term care, induces the woman to devote more time to the care of her parents. Hence, opportunity costs of time become more important. By raising the number of births and by working less in the first period, the woman reduces indirectly and directly the opportunity costs of time in the second period. Hence, we call this effect the opportunity-cost effect

For additive-separable utility but fixed time use in the second period, so that $H = \bar{H}$, $Z = \bar{Z}$, and $\partial^2 C / \partial W^2 = \partial^2 C / \partial P \partial W = 0$, we get

$$\frac{\partial h}{\partial P} = -\frac{\partial C}{\partial P} \frac{f_{zz} u_x u_{xx} U_{XX} \Gamma^2}{\Delta_2 \, f h (1+r)^2} < 0, \tag{8}$$

$$\frac{\partial n}{\partial P} = \frac{\partial h}{\partial P} \frac{f}{h} < 0 \tag{9}$$

$$\frac{\partial S}{\partial P} = -\frac{hw + pz}{h} \frac{\partial h}{\partial P} + \frac{\partial C}{\partial P} \frac{f_{zz} u_x u_{nn} U_{XX} f \Gamma}{\Delta_2 \, h^2 (1+r)} > 0, \tag{10}$$

where

$$\Delta_2 = \begin{vmatrix} u_{nn} f_z^2 + u_n f_{zz} + u_{xx} p^2 & u_{nn} f_z f_h + u_n f_{zh} + u_{xx} wp & \\ u_{nn} f_z f_h + u_n f_{zh} + u_{xx} wp & u_{nn} f_h^2 + u_n f_{hh} + u_{xx} w^2 - \frac{\partial^2 C}{\partial W^2} \frac{\delta^2 w^2}{1+r} & \cdots \\ u_{xx} p & u_{xx} w - \delta w \left(T - \frac{\partial C}{\partial W} \right) U_{XX} & \end{vmatrix}$$

$$\begin{vmatrix} u_{xx} p \\ \cdots \quad u_{xx} w - \delta w \left(T - \frac{\partial C}{\partial W} \right) U_{XX} \\ u_{xx} + (1+r) U_{XX} \end{vmatrix} < 0.$$

As a result:

Proposition 2 *If* $H = \bar{H}$,

$$\frac{\partial a}{\partial P} > 0, \quad \frac{\partial n}{\partial P} < 0, \quad \textit{and} \quad \frac{\partial S}{\partial P} > 0.$$

To reduce expenditure in the first period, the woman gives birth to fewer children and reduces the demand for external child care if costs of long-term care increase. To increase income in the second period, the woman also increases labor supply and savings. All these effects occur because the woman equalizes the marginal utility of income across periods.[7] Thus, this is a consumption-smoothing effect.

In the general model with both endogenous input choice in long-term care and income effects, the opportunity-cost effect and the consumption-smoothing effect work in opposite directions, leading to theoretically ambiguous total effects of price changes. However, from the two special cases analyzed above some predictions on the relative size of these effects could be derived. On the one hand, the total effect is expected to be biased toward the consumption-smoothing effect if informal care is fixed or even zero which is more likely if the level of disability is very high and/or if the parent lives far away from the child. On the other hand, the opportunity cost effect is probably dominant if the human capital depreciation rate is rather large and if formal care and informal care are close substitutes.

3 Empirical analysis

Our model has established a close relationship between, on the one hand, informal long-term care of older women and, on the other hand, fertility and labor supply of non-myopic young women. Depending on the relative strength of the consumption-smoothing effect and the opportunity-cost effect subsidies to formal long-term care either boost fertility and reduce labor-supply of younger women or achieve exactly the opposite. However, in either case costs of (formal) long-term care should have opposite effects on labor-supply and birth rates of younger women.

The purpose of our empirical analysis is to test for the relative strength of the consumption-smoothing effect and the opportunity-cost effect.[8] To this end we use data from the

[7] If U_{XX} were 0, all these effects would also be 0.

[8] Since our model makes ambiguous predictions, any result on the relative strength of these effects does

Eurobarometer 67.3 survey on health care service conducted in European countries May through June 2007 (Papacostas (2010)). In this survey, respondents were asked to provide their opinion and experiences in the planning and provision of long-term care for the elderly, including the health-care costs. The survey provides also some information on socio-economic characteristics of the respondents, in particular on the number of children.

In a cross-section analysis of females aged 25 through 49, we use the existence of children (children) and the number of children (no_children) as left-hand side variables. Our main variables of interest are taken from two particular questions of the survey. The first question is "Thinking now about payment for care. Have you already had to pay, are you currently paying, or do you expect one day that you will pay for professional home care or care in an institution for either of your parents?" Possible answers are: (1) Yes, you have already paid in the past; (2) Yes, you are currently paying; (3) Yes, you are expecting to pay in the future; (4) None of these; (5) Do not know. Based on answer 3, we construct a dummy variable (ltcparentspay) that indicates expected payment in the future. Interestingly, only 16% of females aged 25 through 49 are expecting to pay; 11% of females older than 49 report that they have paid or are currently paying. The difference between expectation and realization could be explained by aging, cohort effects, and forecasting errors. The second question we mainly refer to is "Imagine an elderly father or mother who lives alone and can no longer manage to live without regular help because of her or his physical or mental health condition? In your opinion, what would be the best option for people in this situation?" The feasible answers are: (1) They should live with one of their children; (2) One of their children should regularly visit their home, in order to provide them with the necessary care; (3) Public or private service providers should visit their home and provide them with appropriate help and care; (4) They should move to a nursing home; (5) It depends; (6) None of these; (7) Do not know. The dummy variable best_care_children indicates that the first or the second alternative is the first-best or the second-best option. Alternatively, we also construct a dummy best_nursing_home if the fourth alternative is at least the second-best option. Tables 1 and 2 show summary statistics as a function of best_care_children. On average, women, who are convinced that parents in need of

not provide an empirical test of the model per se.

long-term care would benefit strongly from their children's personal effort, do not consider nursing homes as a good option for parents in need of long-term care, are more likely to have children, and also have more children than women who think that needy parents could do well without children. With a higher probability, they also have paid or are expecting to pay for their parents' long-term care.

The dummy variable ltcparentspay is our measure of formal care, through the inclusion of the dummy variable best_care_children we control for social norms and preferences. ltcparentspay only takes the value 1 if the woman expects all of the following: her parents will need help, informal care will be either not possible or not sufficient, and formal care costs will not be entirely paid by the government, by any other relative, or by her parents themselves. For a given level of formal care, an increase in the price of formal care will increase the probability that the respondent has to pay the costs, at least, partially. However, the woman is also more likely to expect paying in the future for professional care for either of her parents if her parents cannot afford formal care and if they are in very poor health. Hence, to obtain a valid estimate we assume that the parents' wealth has no direct effect on the woman's fertility and labor supply and that the woman's expectation of the parents health state in old age is equal to the prediction of the average health state of the elderly.

Table 1: Summary statistics if best_care_children = 0

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
best_nursing_home	0.726	0.446	0	1	1571
ltcparentspay	0.163	0.369	0	1	1493
children	0.773	0.419	0	1	1567
no_children	1.553	1.189	0	7	1567

In the regressions to come, we introduce several controls: the respondent's age, the squared age (age2), the age when full-time education was finished (age_education_finished)[9], the marital status (married), whether the woman lives with a partner, but is not married (cohabitation), and whether she lives in a rural area or village (rural). In addition, to con-

[9]We left out those women that had no full-time education at all.

Table 2: Summary statistics if best_care_children = 1

Variable	Mean	Std. Dev.	Min.	Max.	N
best_nursing_home	0.124	0.33	0	1	5157
ltcparentspay	0.168	0.374	0	1	4834
children	0.799	0.401	0	1	5138
no_children	1.642	1.213	0	10	5138

trol for heterogeneous institutions across countries, we merged countries to countrygroups and included countrygroup-fixed effects.[10] Furthermore, whenever feasible we clustered standard errors at the country level. In all our regressions, the controls have the expected effect on the birth rate. Age has a positive, but concave effect on the probability of having children and on the number of children; the effect of the education completion age is negative. Being married and living with a partner has a positive effect, the former is much stronger than the latter, both in terms of economical and statistical significance. Women that live in a rural area have more children. Moreover, it turns out that women in the south and in the center have fewer children than women in the east, women in the north tend to have more children. Effects of French speaking countries and the west are less clear. The countrygroup effects are not always statistically significant, but in most regressions they are.

We carry out several basic regressions. First, a linear probability model with OLS where the dummy variable children is on the left-hand side. Second, to control for wealth and migration, the same regression with the dummy variables house - indicating house ownership – and native as additional controls. Third, a simple OLS regression where we interpret the number of children as a continuous variable. In the appendix, we also report the results of a probit regression, of a tobit regression and, accepting the discrete nature of the number of children, of an ordered probit and an ordered logit.

All regressions show a negative effect of ltcparentspay and a positive effect of best_care_chil-

[10]We formed the following groups: south: es, pt, it, gr, cy, mt; north: fi, dk, se; east eunew10, bg, ro, tr, hr; west: gb_gbn, gb_nir, ie; center: de_w, de_e, at, nl; french: fr, be, lu. The east was used as reference group.

	children	children	number of children
age	0.0832***	0.0838***	0.224***
	(0.00781)	(0.00778)	(0.0228)
age2	-0.000945***	-0.000953***	-0.00242***
	(0.000101)	(0.000101)	(0.000300)
age_education_finished	-0.0119***	-0.0118***	-0.0492***
	(0.00238)	(0.00240)	(0.00799)
married	0.296***	0.298***	0.681***
	(0.0265)	(0.0262)	(0.0598)
cohabitation	0.0408	0.0421	2.96e-05
	(0.0314)	(0.0309)	(0.0543)
rural	0.0288***	0.0305***	0.167***
	(0.0101)	(0.0101)	(0.0447)
ltcparentspay	-0.0290*	-0.0286*	-0.147***
	(0.0157)	(0.0157)	(0.0381)
best_care_children	0.0116	0.0121	0.0683**
	(0.0107)	(0.0107)	(0.0272)
house		-0.0111	
		(0.0188)	
native		-0.0109	
		(0.0156)	
Constant	-0.893***	-0.892***	-2.829***
	(0.156)	(0.157)	(0.466)
countrygroup fixed effects	yes	yes	yes
Observations	6,017	5,985	6,017
R-squared	0.249	0.249	0.246
Adjusted R-squared	0.248	0.247	0.244

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3: Regression of birth rates

dren on the birth rate (see table 3 and, in the appendix, tables 5 and 6). Our main variable ltcparentspay is always statistically significant; the control variable best_care_children is significant in some estimations. We consider these results as strong support for dependence of fertility on long-term-care conditions. The variable best_care_children controls for the general attitude of the respondent towards family relations. Those women who think that help is most appropriately provided by children have more children. Although the attitude towards children's help might be affected by the existence and the number of children, this potential simultaneity is not that critical, because our main interest is in the first variable, namely ltcparentspay. Women who expect to pay for their parents long-term care are less likely to have children at all and also have fewer children. This indicates that the consumption-smoothing effect is stronger than the opportunity-cost effect.

As a test for our theoretical model, we also analyze the effect of long-term care on labor supply – at the extensive and the intensive margin. The dummy variable working indicates whether the woman works, the continuous variable weeklyhours indicates working hours in formal employment.[11] We conduct a linear-probability-model analysis and a simple OLS regression with countrygroup fixed effects. In the appendix, we also provide the results of a probit and a tobit analysis (see table 7). As only little information on the woman's professional career is provided in the survey, the results on labor supply should be used cautiously. The R^2s are quite low and just a few variables have significant effects: education increases labor supply, being married decreases it. However, regarding long-term care, we find exactly what the model predicts. The effects of long-term care on fertility and labor supply are of opposite sign. Moreover, expectations on long-term care payments have a significant effect on labor supply. Hence, according to our theory-based empirical analysis, any subsidy of long-term care will have a positive effect on birth rates, but a negative effect on the labor supply of younger women.

Since the assignment of countries to countrygroups is somewhat arbitrary and informal and formal institutions differ even within countrygroups substantially, we also run regressions with country-fixed effects. These regressions confirm our results regarding fertility

[11] Working hours of formal employment are included in the Eurobarometer 67.3 survey because the survey focussed on health and undeclared work.

	ols: working	ols: working hours
age	0.0209	0.315
	(0.0129)	(0.520)
age2	-0.000243	-0.00317
	(0.000167)	(0.00675)
age_education_finished	0.0237***	0.809***
	(0.00380)	(0.154)
married	-0.0754***	-3.981***
	(0.0249)	(0.952)
cohabitation	0.0165	0.367
	(0.0278)	(1.035)
rural	-0.0407**	-1.877**
	(0.0184)	(0.815)
ltcparentspay	0.0444**	2.363***
	(0.0161)	(0.666)
best_care_children	-0.0377***	-0.571
	(0.0136)	(0.570)
Constant	-0.0648	10.17
	(0.237)	(9.625)
countrygroup fixed effects	yes	yes
Observations	5,391	5,391
R-squared	0.083	0.093
Adjusted R-squared	0.0807	0.0907

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4: Regression of labor supply

(see, in the appendix, table 8) and labor supply (not shown).

4 Discussion of the results

The paper has provided a theoretical explanation of a possible intertemporal link between provision of market-based long-term care and (female) labor supply. To that end we have provided a two-period household-decision model. In that model women can choose the extent to which they supply labor to the formal market in both periods. In each period the formal labor market competes with household production where the commodity the household produces is care – for children in period one and for aging parents in period two. While the demand for (long-term) care is fixed in the second period, it is endogenously determined in the first period by the number of children the household chooses.

The model has addressed how fertility as well as first-period labor supply reacts to price changes in the long-term-care market – that might be caused by governmental intervention. We have shown that adaptation can be decomposed into two parts: First, an opportunity-cost effect that is caused by the depreciation of labor-market-oriented human capital if the woman reduces her labor supply in the first period. This depreciation raises the relative costs of market-provided long-term care in the second period. Second, a consumption-smoothing effect that accounts for the need to save in the first period if the woman expects to buy market-provided care in the second period.

Both effects impact on fertility and first-period labor supply. Both share the feature that they have opposite effects on each of these decisions. While the opportunity-cost effect of a decreased price for institutional long-term care would raise female labor supply and reduce fertility, the consumption-smoothing effect would reduce labor supply and increase fertility.

To test which of these two effects has a bigger impact on female labor-supply and fertility decisions, we have conducted an empirical analysis based on the Eurobarometer 67.3. The study indicates that the consumption-smoothing effect is stronger than the opportunity-cost effect. It suggests that any decrease in the price for long-term care would have a positive effect on birth rates, but – according to our model – a negative effect on the labor supply of younger women.

We have restricted our analysis of the intertemporal dimension of long-term care policy on the relationship between the woman and her parents. Obviously, subsidies for formal long-term care also directly reduce the incentive to give birth to children who could later take care of the aging mother. If formal care becomes more affordable, the woman needs less informal care provided by her own children. Similar to public old-age pensions[12], social long-term care insurance is a substitute for intra-family support and, therefore, reduces birth rates. Given this well-established inverse relationship between social insurance and fertility, the positive effect of long-term-care subsidies on birth rates that we obtained could be considered as a corrective.

Our results treat the quality of the market input for long-term care Z as well as its price P as exogenous variables. However, as stated in the introduction, these variables are the results of regulatory market intervention in the market for institutionalized care. Thus, to draw conclusions on policy effects, we need to interpret our variables as outcomes of government intervention and discuss their impact. Obviously, the amount of publicly financed long-term care as well as the intended quality depend on the social welfare function that is to be implemented by a policy maker. The paper aims at pointing to policy effects that are independent of a certain welfar function. Therefore, the discussion focusses on tradeoffs a policy maker would face according to our model when changing the price of long-term care.

Family-related political interventions can be designed to influence the size of the labor force (and, thus, tax revenues to finance public spending on long-term care) in two ways: They can aim at raising female labor-force participation or at emlarging the working population by increasing fertility. Both aspects are professed objectives of policy makers in many OECD, and particular Western European, countries. In most of these countries fertility rates are below replacement levels – albeit to a different extent.[13] In our context of long-term care, this means that the population share of people in need of long-term care will increase and the share of potential care givers as well as of payers for institutional-

[12]On the effect of social security on fertility see, for instance, Cigno and Rosati (1996), Cigno et al. (2003), and Boldrin et al. (2005).

[13]According to the OECD's (2011) collection of social indicators, the fertility rate in 2009 has been 1.99 in France, 1.36 in Germany, and 1.94 in Sweden.

ized care will decrease. This change contributes to the already mentioned increase in the fraction of GDP spent on long-term care.

Although fertility rates are influenced by a number of factors, it is widely accepted in economics that social-policy measures influence the number of children in a country (see, for instance, Cigno (1986), Del Boca (2002), Apps and Rees (2004), Cohen et al. (2007), or Salanie and Laroque (2008)). Of course, the main economic factors influencing fertility decisions are directly child-related, like allowances, generous parental-leave regulation, and a sufficient provision of day care to support working parents. However, as our analysis shows, the prospects on long-term-care arrangements also influence these decisions.

One effect of the long-standingly low fertility rate in many countries, in particular in Germany, is a decline in the active labor force that is expected to induce a significant (domestic) skills shortage within the next ten years. This shortage can be counteracted by an increase in female labor force participation.[14] As fertility rates are below the replacement rate in all OECD countries, this consequence would be highly detrimental.

However, our analysis has concentrated on a single policy measure that, in addition, affects labor-market and fertility decisions at a secondary level only. Directly child-related policies that reconcile family and market work for mothers are a means to increase fertility at any given level of female labor-market participation. This paper does not model this additional intervention. Yet, our analysis shows that a policy maker who wants to reconcile care of aging parents and market work for women should do so within a policy mix that also addresses the balance between child care and market work.

Similar to a subsidy that decreases the price of market-based long-term care is the impact of a change in the quality of the market input. In our model such a change is equivalent to a change in the household production function that makes the market input relatively more productive compared to household time. Such a change could reflect the features of a different arrangement of publicly subsidized long-term care.

This interpretation would enhance the comparison between long-term care regulation in different countries as the systems not only differ with respect to the level of subsidies of institutionalized care but also in institutions offered. In all OECD countries institutional-

[14]Including migrants into the labor market to a bigger extent is another means. However, in a recent OECD study Keeley (2009) shows the limits of such an inclusion.

ized long-term care consists of a mix of nursing homes and professional-based outpatient systems.[15] From a German perspective, Swedish family policy is largely seen as a model; for, female labor-market participation as well as fertility is higher than in Germany while other parameters are similar. So, the question is if we can conclude from our model that Germany could gain from an adoption of the Swedish institutional frame of long-term care. In a nutshell, this system is based on the idea that people in need should stay autonomous as long as possible; therefore, regulation implements incentives for physicians as well as other deciders in the health-care system to support outpatient care that connects professional and informal care. Such a network of professional and community-based care enables children to provide long-term care to their parents where a relevant part of the responsibility stays in professional hands. As a consequence, to demand institutionalized care turns from a bad into a good because children feel that they have met their duties while their budget constraint is relaxed.

So, would the implementation of such a system increase fertility and female labor supply in Germany? According to our model such an effect is not to be expected. For, the increase in productivity of the market input has technically the same effect as a decrease in its price. Thus, it would either increase fertility or labor supply with an adverse effect on the other decision. Therefore, a shift to a system that puts more weight on outpatient care would probably increase quality of life for a number of people in need and their families – which would be a positive effect in its own. To enhance fertility and female labor-market participation, it would need complementing improvements in the child-care sector.

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[15]Details on differences in these arrangements are described in Colombo et al. (2011).

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Appendix

	probit: children	tobit: number of children
age	0.270***	0.327***
	(0.0317)	(0.0272)
age2	-0.00296***	-0.00361***
	(0.000428)	(0.000350)
age_education_finished	-0.0492***	-0.0628***
	(0.00984)	(0.00994)
married	1.172***	0.948***
	(0.0842)	(0.0880)
cohabitation	0.154*	0.0382
	(0.0868)	(0.0903)
rural	0.161***	0.192***
	(0.0490)	(0.0512)
ltcparentspay	-0.130*	-0.178***
	(0.0688)	(0.0508)
best_care_children	0.0592	0.0804**
	(0.0509)	(0.0347)
Constant	-4.498***	-5.014***
	(0.641)	(0.594)
σ		1.232***
		(0.0355)
countrygroup fixed effects	yes	yes
Observations	6,017	6,017
Pseudo R-squared	0.252	0.0976

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 5: Children - probit and tobit

	ordered probit	ordered logit
age	0.278***	0.486***
	(0.0225)	(0.0385)
age2	-0.00307***	-0.00539***
	(0.000292)	(0.000500)
age_education_finished	-0.0527***	-0.0908***
	(0.00873)	(0.0159)
married	0.784***	1.445***
	(0.0735)	(0.131)
cohabitation	0.0247	0.0758
	(0.0708)	(0.127)
rural	0.172***	0.301***
	(0.0443)	(0.0743)
ltcparentspay	-0.150***	-0.246***
	(0.0414)	(0.0717)
best_care_children	0.0667**	0.110**
	(0.0284)	(0.0509)
cut1	4.499***	7.979***
	(0.496)	(0.839)
cut2	5.381***	9.509***
	(0.491)	(0.833)
cut3	6.589***	11.57***
	(0.498)	(0.845)
cut4	7.384***	13.07***
	(0.508)	(0.864)
cut5	7.897***	14.20***
	(0.508)	(0.861)
cut6	8.346***	15.33***
	(0.524)	(0.906)
cut7	8.633***	16.12***
	(0.528)	(0.923)
cut8	8.985***	17.16***
	(0.525)	(0.934)
cut9	9.315***	18.26***
	(0.543)	(1.113)
cut10	9.518***	18.96***
	(0.571)	(1.346)
countrygroup fixed effects	yes	yes
Observations	6,017	6,017
Pseudo R-squared	0.105	0.108

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 6: Children - ordered probit and logit

	probit: working	tobit: working hours
age	0.0675*	0.625
	(0.0385)	(0.752)
age2	-0.000765	-0.00678
	(0.000502)	(0.00975)
age_education_finished	0.0858***	1.201***
	(0.0122)	(0.238)
married	-0.240***	-5.350***
	(0.0769)	(1.430)
cohabitation	0.0604	0.628
	(0.0969)	(1.464)
rural	-0.123**	-2.567**
	(0.0550)	(1.127)
ltcparentspay	0.128**	3.164***
	(0.0547)	(0.907)
best_care_children	-0.115**	-1.204
	(0.0454)	(0.778)
Constant	-2.136***	-5.689
	(0.708)	(14.01)
σ		24.49***
		(0.899)
countrygroup fixed effects	yes	yes
Observations	5,391	5,391
Pseudo R-squared	0.0753	0.0131

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7: Labor supply - probit and tobit

	ols: children	ols: number of children
age	0.0863***	0.235***
	(0.00812)	(0.0234)
age2	-0.000993***	-0.00256***
	(0.000103)	(0.000306)
age_education_finished	-0.0126***	-0.0467***
	(0.00257)	(0.00803)
married	0.302***	0.681***
	(0.0259)	(0.0537)
cohabitation	0.0384	-0.00804
	(0.0311)	(0.0534)
rural	0.0239**	0.163***
	(0.0103)	(0.0453)
ltcparentspay	-0.0301*	-0.167***
	(0.0150)	(0.0362)
best_care_children	0.0122	0.0722**
	(0.0103)	(0.0269)
Constant	-0.915***	-2.738***
	(0.180)	(0.490)
country fixed effects	yes	yes
Observations	6,017	6,017
R-squared	0.269	0.267
Adjusted R-squared	0.265	0.262

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 8: Children - country-fixed effects