Postponing retirement age and labor force participation : The role of family transfers*

Pascal Belan[†] François-Charles Wolff[‡] Pierre-Jean Messe[§]

November 30, 2006

Preliminary draft
Proposal for the Forum Retraite, Bordeaux, 2007

Abstract

Drawing on an overlapping generations model with domestic production and parental transfers in the form of grandchild care, this paper examines the consequences of delaying retirement. We show that a change in age at retirement has an impact on the employment rates of both the young and the old. This interdependency stems from the provision of family transfers. Postponing retirement may either increase or decrease time devoted to grandchild care transfers, whichs allow the young to work more on the labor market. Hence, prolonging activity for older workers may have a positive impact on the labor participation of young workers and we study the conditions under which this positive family externality holds.

*Remaining errors are ours. The usual disclaimer applies.

[†]LEN, Université de Nantes, France. Email: pascal.belan@univ-nantes.fr

[‡]Corresponding author. LEN, Faculté des Sciences Economiques et de Gestion, Université de Nantes, Chemin de la Censive du Tertre, BP 52231, 44322 Nantes Cedex 3, France ; CNAV and INED, Paris, France. Email: wolff@sc-eco.univ-nantes.fr

[§]LEN, Université de Nantes, France. Email: pickwik@hotmail.fr

1 Introduction

Many European countries have been characterized by a trend towards early retirement over the last three decades. This seems highly problematic in a setting where fertility rates tend to fall and life expectancy is steadily increasing, thereby putting a strong pressure on the financing of pension schemes[1]. Given the expected growth of the demographic dependency ratio, solutions have to be found to make pay-as-you-go social security sustainable. While raising taxes or increasing the social security debt are clearly unplausible solutions, several authors have suggested to increase the activity rates of older workers (ideally along with a reduction in social security benefits).

In an influential contribution, Cremer and Pestieau (2004) show that postponing retirement may lead to a so-called "double dividend". First, delaying retirement is expected to restore at least partially the financial balance of the pension system. Second, it may lead to more income equality among the retirees, at least if the system operates redistribution within generations. A good understanding of the consequences of postponing retirement is then needed if the challenge of aging in developed countries may only be solved through a reform aimed at increasing age of retirement. Such a policy would itself have an impact on economic growth (Futagami and Nakajima, 2001, Echevarria, 2004).

Assuming that delaying retirement will be helpful to avoid a financial crisis of social security means that this reform is indeed effective in terms of worker's employment. Economists certainly agree that a reform of labor market rules is needed to prolonge activity. However, even if we put this argument related to the functioning of the labor market aside, we argue that postponing retirement may strongly influence the pattern of employment not only of older workers, but also of younger workers. The idea is simply to account for intergenerational relationships. In many families, at a given date, two generations take part in the labor market. Clearly, the labor force partipation of these two generations cannot be disconnected as long as one observes substantial flows of family transfers, either financial or in time.

If a change in the labor supply of old workers affects their own transfer decisions, this may in turn lead to a change in the employment rate of younger workers. That family matters in the context of retirement issues is not a new idea. For instance, it has been shown that there is a strong tendency of husbands and wives to retire together and that each spouse values retirement more once their spouse has retired (Gustman

[1] Delaying retirement is subject to an implicit tax: prolonging activity implies paying additional payroll taxes and it also leads to a reduction in pension rights. Casamatta et alii (2006) show that this implicit tax on continued activity may result from some political process.

and Steinmeier, 2000). Instead of focusing on spousal relationships, we account here for intergenerational links and family transfers to investigate how a public policy aimed at postponing retirement influence employment rates.

Several microeconomic studies have focused on the interplay between private transfers and labor supply decisions[2]. In the upward drection, individuals who have to care for their elderly parents may be induced to increase their number of worked hours if they have for instance to pay for formal services and housing retirement Conversely, their labor participation may be reduced if they provide time transfers in the form of caregiving activities or visits (Ettner, 1996, Wolf and Soldo,1996). Family transfers are also likely to affect the behavior of recipients. Joulfaian and Wilhelm (1994) find that inheritances lead to a small decrease in the labor supply of women. Using samples of teenagers, Dustmann and Micklewright (2001) and Wolff (2006) examine whether the provision of financials transfers reduces the labor participation of children still enrolled in school.

Parents may also rely on non-financial transfers to help their children. Ermisch and Ogawa (1996) and Sasaki (2002) account for intergenerational co-residence and find that the labor supply of young women is much higher when they live with their parents. Dimova and Wolff (2006) consider time transfers in the form of grandchild care. Using the SHARE European data, they show that the receipt of grandchild care has a positive impact on the labor force participation of young mothers. Conversely, the receipt of monetary transfers does not affect the decision of young mothers to have a paid job. Importantly, grandchild care is much more frequent than the receipt of financial gift, around one-third of households in Europe being concerned by such time transfers.

In this paper, we wonder on the consequences of postponing retirement on the labor participation of both young and old workers when grandchild care matters. For that purpose, we consider an overlapping generations model with domestic production and intergenerational transfers. Both the old and young generations take part in the labor market. Young workers have children and have to care for them. They personally devote time to raise their children. During their period of activity, they may either pay for formal child care or benefit from grandchild care from their parents. In this setting, we study the relationship between the provision of parental transfers and retirement age.

As expected, when the older workers provide more grandchild care to their children, the latter are more likely to have a paid job. The question worth is then to determine the role of postponing retirement on the parental transfer decisions. We show that an increase in the length of the working period for older workers is more likely to have an

[2]For an overview of the consequences of endogenous labor supply in models of family transfers, see the survey of Laferrère and Wolff (2006).

offsetting effect on the labor participation of the younger workers. As the latter will benefit from less time-related resources, they will have to spend more time by themselves with their children and thus will reduce their labor participation. However, for some cases, we evidence the reverse result. Older people will both work longer and care more for their grandchildren, which will in turn improve the employment rate of their children.

A close look at this family externality is of the highest importance in terms of public policy. Increasing the labor rates of older workers is most often viewed as a way for a goverment to spend less resources on pensions through two different channels. On the one hand, by postponing age of retirement, this will delay the receipt of the pension for all the workers who have to work longer. On the other hand, in the case of a pay-as-you-go pension system, a goverment will receive additional taxes from the workers still involved in the labor market. Unfortunately, once private transfers are taken into account, a different picture may emerge, owing to the expected withdrawal of younger workers with children. This in turn reduces the labor contribution to the financing of the pension system. Whatsoever, it matters to assess the sign and the magnitude of this family externality on the labor participation of young adults.

This attempt to account for intergenerational transfers in the context of retirement decisions using an overlapping-generations model is quite innovative with respect to the previous literature. Despite of their apparent importance, transfers in the form of grand-child care has been widely neglected by economists so far, Cardia and Ng (2003) and Dimova and Wolff (2006) being two noticable exceptions.

Both studies provide empirical support that time transfers increase the labor supply of the young adults, which is a prediction of our theoretical model. Our contribution is more closely related to the one of Cardia and Ng (2003), who also consider an overlapping generations model with domestic production and both time and monetary transfers. However, contrary to these authors who calibrate this model to the US economy, we do not focus on capital accumulation and macroeconomic effects of child care policies. Our primary interest only lies in the choice of retirement age and its consequences on employment.

The reminder of the paper is organized as follows. In Section 2, we present a theoretical model with two generations which accounts for domestic production and grandchild care. We investigate in Section 3 the consequences of postponing age of retirement on the pattern of parental transfers and wonder whether delaying retirement decreases the labor force participation of young workers. We study the conditions under which this family externality on the labor market through the channel of intergenerational transfers is positive. Finally, concluding comments are in Section 4.

2 The model

We consider an overlapping generation model with two generations, the young (children) and the old (their parents). We assume that the young adults have themselves some children, so that there is implicitly three cohorts of agents in the model. However, as grandchildren are young babies, they do not play any significant role in economic decisions, so that we focus in what follows on behaviors within a two-period context. We denote by 1 and 2 as upscript decisions related respectively to the young and to the old, each generation being summarized by one representative agent. As in Cardia and Ng (2003), we introduce domestic production and family transfers, but contrary to these authors, we restrict our attention to grandchild care. The setting is as follows.

During the first period, the young adult allocates his time between a paid activity and domestic tasks. Let h_t be the labor supply and e_t^1 the number of hours devoted to domestic tasks, which includes among others child care and time spend raising the young children (to help for homework for instance). Endowment of time for the young is normalized to one, so that we have $h_t + e_t^1 = 1$. The second period is made up of both working time and retirement. We denote by θ_{t+1} the fraction of time devoted to labor activities, so that $(1 - \theta_{t+1})$ is the length of the retirement period. Let e_{t+1}^2 be time spent in domestic production by the parent, and let T_{t+1} be a transfer in the form of grandchild care. Keeping the same normalization for time endowment, the time constraint for the parent is simply $\theta_{t+1} + e_{t+1}^2 + T_{t+1} = 1$.

Several remarks are in order. First, we assume that the parents are interested in caring for their grandchildren both during the working period and during retirement. Note that this assumption is certainly not unrealistic. Grandparents often enjoy spending time with very young babies, so that waiting till being retired would not be a valid option as the grandchildren would be older. Second, we only consider transfers in the form of grandchild care given by parents. In so doing, we neglect the possibility of home-sharing arrangements and financial transfers. This restriction is in fact mainly empirically driven, as grandchild care transfers are much more frequent than cash gifts for young adults and represent a substantial number of hours per week (see Cardia and Ng, 2003, Dimova and Wolff, 2006)[3]. Third, we have to "motivate" the provision of grandchild care.

Several motives for private transfers have been suggested in the literature (Laferrère and Wolff, 2006). A first possibility is that the parent is influenced by the utility level of the child, which is the spirit of the altruistic model (Becker, 1991). While the basic

[3]Furthermore, the labor supply decisions of young adults seem to be quite insensitive to the provision of financial transfers from parents, at least in France (Wolff, 2006).

altruistic model usually only accounts for financial transfers as in Altonji et alii (1997), it can be easily extended to the case of services from parents to children (Sloan et alii, 2002). A second model relies on exchange considerations (Cox, 1987). This would lead to a framework where parents help their children through grandchild care, but expect a transfer of money in exchange of their services. A third possibility is the demonstration effect theory (Cox and Stark, 2005), according to which the child's propensity to care for parents is conditioned by parental example. This leads to a derived demand for grandchildren and grandchild care may be seen as a way to elicit this demand.

In what follows, we restrict our attention to an impure form of the altruistic motive. Specifically, we rely on the warm-glow motive described in Andreoni (1990). The underlying idea is that parents obtain satisfaction not from the well-being of their children per se, but instead from the act of giving time. The donor's utility is furthermore rising with the amount given. In so doing, we depart from the specification of Cardia and Ng (2003) which assume some beckerian altruism between generations, parents caring for the well-being of their children.

Let us now turn to the budget constraints. In the first period, the child's resources are devoted to a private consumption c_t and savings s_t. Denoting by w the wage rate and considering a pay-as-you-go pension scheme with payroll tax rate of τ, the budget constraint for the young is :

$$c_t + s_t = \left(1 - e_t^1\right)(1 - \tau)\, w \tag{1}$$

Let r be the interest rate on the financial markets, and $R = 1 + r$. During the second period, the parent consumes the level d_{t+1}. Resources are given by $\theta_{t+1}(1 - \tau)\, w$ while working and by $(1 - \theta_{t+1})\, b(\theta_{t+1})\, w$ once being retired, $b(\theta_{t+1})$ being the replacement rate. We assume that the replacement rate of earnings guaranteed by the pension system is a continuous function, increasing in its argument θ_{t+1}. Accounting for the returns on first-period savings $(1 + r)\, s_t$, the budget constraint for the parent is :

$$d_{t+1} = \left[(1 - \theta_{t+1})\, b(\theta_{t+1}) + \theta_{t+1}(1 - \tau)\right] w + R s_t \tag{2}$$

We introduce domestic production in the model following Cardia and Ng (2003). This means that we make a difference between the levels of private consumption c_t and d_t and the augmented levels of consumption $\bar{c}_t$ and $\bar{d}_{t+1}$, which accounts for the production of family-oriented goods.

For the young, we define $\bar{c}_t$ as the consumption of a composite good, which is itself produced through the means of the consumer market good $c_t - z_t^1$ and of the domestically produced good q_t^1. Let g^1 be a family production function, whose arguments are purchased inputs z_t^1 used to produce the non-market good q_1^t, leisure time e_t^1 and grandchild care transfers T_{t+1}[4]. We rely on the following form for the production function $q_t^1 = g^1\left(z_t^1, e_t^1 + T_{t+1}\right)$. We assume that the time values e_t^1 and T_{t+1} are perfectly substituable. What matters for instance for the young baby is to be with an adult, which could be either a parent or a grandparent. We make no assumption a priori concerning the complementarity or substituability of z_t^1 and $e_t^1 + T_{t+1}$. Finally, the composite good $\bar{c}_t$ is itself the result of a production function f^1 such that :

$$\bar{c}_t = f^1\left(c_t - z_t^1, g^1\left(z_t^1, e_t^1 + T_t\right)\right) \tag{3}$$

In a similar way, the second-period consumption $\bar{d}_{t+1}$ is obtained by combining the market good $d_{t+1} - z_{t+1}^2$ and the produced good q_t^2. This family production is achieved through the production function $q_t^2 = g^2\left(z_{t+1}^2, e_{t+1}^2\right)$. Then, $\bar{d}_{t+1}$ is given by:

$$\bar{d}_{t+1} = f^2\left(d_{t+1} - z_{t+1}^2, g^2\left(z_{t+1}^2, e_{t+1}^2\right)\right) \tag{4}$$

For the different functions f^1, g^1, f^2, g^2, we rely on homogenous functions of degree one. Furthermore, the marginal productivities are strictly positive and strictly decreasing, so that $f_1^i > 0$, $f_{11}^i < 0$, $f_2^i > 0$, $f_{22}^i < 0$, $f_{12}^i > 0$ and $g_1^i > 0$, $g_{11}^i < 0$, $g_2^i > 0$, $g_{22}^i < 0$, $g_{12}^i > 0$ $(i = 1, 2)$. The only difference between the parent and the child specifications for the extended consumption is related to the receipt of grandchild care, which is an additional input in the production function of the young.

In this setting, each individual seeks to maximize the intertemporal utility function U_t defined in the following way :

$$U_t = u\left(\bar{c}_t\right) + \delta v\left(\bar{d}_{t+1}\right) + \gamma\Phi\left(T_{t+1}\right) \tag{5}$$

where δ is a subjective discount factor, $u(.)$ and $v(.)$ are two utility functions supposed to be continuous, twice differentiable and quasi-concave. Note that the utility functions per period depend on the extended consumption $\bar{c}_t$ and $\bar{d}_{t+1}$. Finally, the term $\gamma\Phi\left(T_{t+1}\right)$ picks up the warm-glow motive for providing grandchild care (Andreoni, 1990), the parameter γ being strictly positive[5]. The individual problem is hence to maximize (5) subject to the time constraints $h_t + e_t^1 = 1$ and $\theta_{t+1} + e_{t+1}^2 + T_{t+1} = 1$ and to the financial constraints (1) and (2), given the definitions (3) and (4) of $\bar{c}_t$ and $\bar{d}_{t+1}$.

[4]Purchased inputs z_t^1 could be private spending on education or simply expenditures related to formal child care services.

[5]The satisfaction function Φ is also supposed to be continuous, twice differentiable and quasi-concave.

3 The optimal pattern of labor supply and transfers

We now examine the consequences of delaying retirement. Specifically, we consider an increase in the current retirement age θ_t. We proceed as follows to study the optimal pattern of labor force participation and family transfers. First, we evidence how a change in parental transfers affects the labor supply of the young. Second, we focus on the relationship between an increase in age of retirement and the provision of time transfers. Finally, we analyze the overall effect of prolonged activity on the labor participation of both generations.

3.1 Grandchild care and child's labor supply

We focus on the maximization program of the young. Given the satisfaction function :

$$u\left[f^1\left(c_t - z_t^1, g^1\left(z_t^1, e_t^1 + T_t\right)\right)\right]$$

subjet to the budget constraint $c_t + s_t = (1 - e_t^1)(1 - \tau) w$, we get the following first-order conditions respectively with respect to e_t^1 and z_t^1 for an interior solution :

$$-(1 - \tau) w f_1^1(.) + g_1^2(.) f_2^1(.) = 0 \tag{6}$$

$$-f_1^1(.) + g_1^1(.) f_2^1(.) = 0 \tag{7}$$

The interpretation is as follows. From (6), the marginal benefit of a rise in leisure $g_1^2 f_2^1$ is equal to its marginal cost resulting from the loss of income $(1 - \tau) w f_1^1$. From (7), the marginal disutility f_1^1 involved by an increase in purchased inputs z_t^1 used to produce the non-market good is equal to its marginal benefit $g_1^1 f_2^1$. By combining (6) and (7), we deduce that :

$$\frac{g_2^1}{g_1^1} = (1 - \tau) w \tag{8}$$

When the marginal rate of substitution between leisure e^1 and the purchased input z^1 is different from $(1 - \tau) w$, the child can reach a higher level of satisfaction by reallocating e^1 and z^1. We then get the following result.

Proposition 1 *The child's labor supply is an increasing function of grandchild care , i.e.* $\partial h_t / \partial T_t > 0$*, when* $\partial s_t / \partial T_t > 0$.

Proof : Given the definition of the marginal rate of substitution between leisure and purchased input $MRS = g_2^1(z^1, e^1 + T) / g_1^1(z^1, e^1 + T)$, we can express the optimal combination of e^1 and z^1 as :

$$\frac{g_2^1\left(\frac{z^1}{e^1+T}, 1\right)}{g_1^1\left(\frac{z^1}{e^1+T}, 1\right)} = (1 - \tau) w$$

Let $\eta = \frac{z^1}{e^1+T}$. From the first-order condition (6), it follows that :

$$\frac{f_1^{1\prime}\left(\frac{\left(1-e^1\right)(1-\tau)w-s}{e^1+T} - \eta, g^1(\eta,1)\right)}{f_2^{1\prime}\left(\frac{\left(1-e^1\right)(1-\tau)w-s}{e^1+T} - \eta, g^1(\eta,1)\right)} = g_1^{1\prime}(\eta,1)$$

which implies that :

$$\frac{\left(1-e^1\right)(1-\tau)w-s}{e^1+T} = \zeta$$

where ζ is a positive constant. From

$$e^1 = \frac{(1-\tau)w - s - \zeta T}{(1-\tau)w + \zeta}$$

we get the following derivative :

$$\frac{\partial e^1}{\partial T} = \frac{-1}{(1-\tau)w+\zeta}\left[\frac{\partial s}{\partial T} + \zeta\right]$$

Since $\zeta > 0$, an increase in the provision of grandchild care necessarily leads to a decrease in leisure and then to a rise in the child's labor participation when $\partial s/\partial T > 0$. ∎

Let us now investigate the sign of the derivative $\frac{\partial s}{\partial T}$. Given the maximization program during the period of youth, we get $\bar{c} = f^1\left(h-\eta, g^1(\eta,1)\right)\left(e^1+T\right)$ from the definition of η (see the proof of Proposition 1) and deduce the following expression for $\bar{c}$:

$$\bar{c}_t = f^1\left(\zeta - \eta, g^1(\eta,1)\right)\frac{(1-\tau)w(1+T)-s}{(1-\tau)w+\zeta}$$

In the sequel, we simplify the notation as $\tilde{c}_t\left[(1-\tau)w(1+T_t)-s_t\right]$, $\tilde{c}_t$ being increasing in its argument $(1-\tau)w(1+T_t)-s_t$.

Proposition 2 *Savings increase with the intensity of grandchild care, i.e.* $\partial s_t/\partial T_t > 0$.

Proof. Let $\omega(\theta_{t+1}) = \left[(1-\theta_{t+1})b(\theta_{t+1}) + \theta_{t+1}(1-\tau)\right]w$. In $t+1$, the problem for the agent is to maximize $V_{t+1} = \delta v\left(\bar{d}_{t+1}\right) + \gamma\Phi(T_{t+1})$ with respect to z_{t+1}^2 and T_{t+1}, subject to the constraint $\bar{d}_{t+1} = f^2\left(\omega(\theta_{t+1}) + Rs_t - z_{t+1}^2, g^2\left(z_{t+1}^2, 1-\theta_{t+1}-T_{t+1}\right)\right)$. The optimal solutions for z_{t+1}^2 and T_{t+1} may be expressed respectively as $\tilde{z}^2\left(\omega(\theta_{t+1})+Rs_t, 1-\theta_{t+1}\right)$ and $\tilde{T}\left(\omega(\theta_{t+1})+Rs_t, 1-\theta_{t+1}\right)$. By replacing in the objective function, we get the following form for the indirect utility function associated to V_{t+1} :

$$\begin{aligned}&\tilde{V}\left(\omega(\theta_{t+1})+Rs_t, 1-\theta_{t+1}\right)\\ &= \delta v\left[f^2\left(\omega(\theta_{t+1})+Rs_t-\tilde{z}^2, g^2\left(\tilde{z}^2, 1-\theta_{t+1}-\tilde{T}\right)\right)\right] + \gamma\Phi\left(\tilde{T}\right)\end{aligned}$$

The optimal decision concerning savings is then given by :

$$\max_{s_t} u\left\{A\left[(1-\tau)w(1+T_t)-s_t\right]\right\} + \tilde{V}\left(\omega(\theta_{t+1})+Rs_t, 1-\theta_{t+1}\right)$$

with A being a constant. Let $\tilde{u}(s_t, T_t) = u + \tilde{V}$. The first-order condition leads to:

$$-Au_1 \left(A\left[(1-\tau)\, w\,(1+T_t) - s_t\right]\right) + R\tilde{V_1}\left(\omega\left(\theta_{t+1}\right) + Rs_t, 1-\theta_{t+1}\right) = 0$$

where u_i and $\tilde{v}_i$ stand for the first-order derivatives with respect to their i^{th} argument. Denoting by $\tilde{u}_{ij}$ the second order derivative with respect to i^{th} and j^{th} arguments, we have $\tilde{u}_{11}ds_t + \tilde{u}_{12}dT_t = 0$. Since $\tilde{u}_{11} < 0$ for a maximum, it follows that $\operatorname{sgn} ds_t/dT_t = \operatorname{sgn} \tilde{u}_{12}$ and thus :

$$\operatorname{sgn} \frac{ds_t}{dT_t} = \operatorname{sgn} \; - A^2\,(1-\tau)\, w u_{11}\,(.)$$

The derivative ds_t/dT_t is then necessarily positive. ∎

Note that this prediction is quite intuitive. With more parental services related to young babies, children are able to spend more time on paid employment and much simpler models of transfers with endogenous labor supply lead to very similar conclusions (see Dimova and Wolff, 2006). Interestingly, this predition receives some empirical support in the literature. For instance, in Europe, estimates from simultaneous equation models indicate that the coefficient of the endogenously treated grandchild care variable has a positive impact on the labor force participation of young mothers.

3.2 The parental decision of transfer

We now study the parental decisions. Savings s accumulated during the first period leads to an exogenous income Rs. The problem for the parent is :

$$\max_{T,z^2} \delta v\left(\bar{d}\right) + \gamma\Phi\left(T\right)$$

subject to the constraint $\bar{d} = f^2\left(\Omega - z^2, g^2\left(z^2, L-T\right)\right)$, the second-period income Ω being defined as $\Omega = \left[(1-\theta)\, b\,(\theta) + \theta\,(1-\tau)\right] w + Rs$ and $L = 1-\theta$. In this context, we are interested in understanding how a change in age at retirement will influence the provision of grandchild care. It is straightforward to see that there are two offsetting effects. On the one hand, with an increase in labor participation, the parent has less time to devote to grandchild care, which will reduce T. On the other hand, when θ increases, the second-period parental income also increases since $d\Omega/d\theta > 0$. Owing to these time and income effects, the impact of θ on T cannot be signed in the general case.

Let us formally investigate the effect of θ on T. For the above maximization program, the first-order conditions for an interior solutions may be expressed as :

$$h_z\left(z^2, T, \Omega, L\right) = 0$$

$$h_T\left(z^2, T, \Omega, L\right) = 0$$

with $h_z(z^2, T, \Omega, L) = (-f_1^2 + f_2^2 g_1^2)\,\delta v_1$ and $h_T(z^2, T, \Omega, L) = -\delta v_1 f_2^2 g_2^2 + \gamma \Phi_1$. Let H be the corresponding Hessian matrix :

$$H = \begin{pmatrix} h_{zz} & h_{zT} \\ h_{zT} & h_{TT} \end{pmatrix}$$

It can be shown that the determinant $\Delta = h_{zz}h_{TT} - (h_{zT})^2$ is positive. By differentiating the first-order conditions with respect to z^2, T, Ω and L such that $h_{zz}dz^2 + h_{zT}dT + h_{z\Omega}d\Omega + h_{zL}dL = 0$ and $h_{Tz}dz^2 + h_{TT}dT + h_{T\Omega}d\Omega + h_{TL}dL = 0$, we deduce that :

$$\frac{dT}{d\Omega} = \frac{h_{zT}h_{z\Omega} - h_{T\Omega}h_{zz}}{\Delta} \tag{9}$$

$$\frac{dT}{dL} = \frac{h_{zT}h_{zL} - h_{TL}h_{zz}}{\Delta} \tag{10}$$

Proposition 3 *An increase in parental leisure time L increases time devoted to grand-child care, i.e. $dT/dL > 0$. A rise in parental resources during the second period has an ambiguous impact on time transfers, i.e. $dT/d\Omega \geq 0$ or $dT/d\Omega \leq 0$.*

Proof : We first calculate the different second-order derivatives for h_z and h_T. We denote by σ_g and σ_f the elasticity of substitution respectively for the production function g^2 and f^2. From the definition of σ_g such that :

$$\sigma_g = -\frac{d\left(\frac{z^2}{L-T}\right) / \left(\frac{z^2}{L-T}\right)}{d\left(\frac{g_1^2}{g_2^2}\right) / \frac{g_1^2}{g_2^2}}$$

we deduce from the properties of the homogenous functions that[6] :

$$\sigma_g = \frac{g_2^2 g_1^2}{g_{12}^2 g^2}$$

In the same way, we get the following formula for σ_f :

$$\sigma_f = \frac{f_2^2 f_1^2}{f_{12}^2 f^2}$$

Now, recalling that $-f_1^2 + f_2^2 g_1^2 = 0$ for an interior solution, we obtain :

$$\begin{aligned} h_{zz} &= \delta v_1 \left[f_{11}^2 - 2 f_{12}^2 g_1^2 + f_{22}^2 \left(g_1^2\right)^2 + f_2^2 g_{11}^2 \right] \\ &= -\delta v_1 f_{12}^2 g_{12}^2 \left[\frac{g^2}{\Omega - z^2} \frac{1}{g_{12}^2} \left(1 + \frac{\Omega - z^2}{g^2} g_1^2\right)^2 + \frac{f^2}{f_1^2} \sigma_f \frac{L-T}{z^2} \right] < 0 \end{aligned}$$

[6]Since f^2 is homogenous of degree 1, this implies that f_1^2 and f_2^2 are homogenous of degree 0 and hence $f_1^2(\lambda x, \lambda y) = f_1^2(x,y)$ and $f_2^2(\lambda x, \lambda y) = f_2^2(x,y)$. When differentiating with respect to λ, we get $x f_{11}^2(\lambda x, \lambda y) + y f_{12}^2(\lambda x, \lambda y) = 0$ and $x f_{12}^2(\lambda x, \lambda y) + y f_{22}^2(\lambda x, \lambda y) = 0$ from which we deduce $\frac{x}{y} f_{11}^2(x,y) = -f_{12}^2(x,y) = \frac{y}{x} f_{22}^2(x,y)$. In the same way, we get $\frac{x}{y} g_{11}^2(x,y) = -g_{12}^2(x,y) = \frac{y}{x} g_{22}^2(x,y)$.

$$h_{zT} = \delta v_1 \left[\left(f_{12}^2 - f_{22}^2 g_1^2 \right) g_2^2 - f_2^2 g_{12}^2 \right] = \delta v_1 \left[\left(1 + \frac{\Omega - z^2}{g^2} g_1^2 \right) g_2^2 f_{12}^2 - f_2^2 g_{12}^2 \right]$$

$$h_{z\Omega} = \delta v_1 \left[-f_{11}^2 + f_{21}^2 g_1^2 \right] = \delta v_1 \left[\frac{g^2}{\Omega - z^2} + g_1^2 \right] f_{12}^2 > 0$$

$$h_{zL} = \delta v_1 \left[-f_{12}^2 g_2^2 + f_{22}^2 g_1^2 g_2^2 + f_2^2 g_{12}^2 \right]$$

$$h_{TT} = \delta v_{11} \left(f_2^2 g_2^2 \right)^2 - \delta v_1 \left[-f_{22}^2 \left(g_2^2 \right)^2 - f_2^2 g_{22}^2 \right] + \gamma \Phi_{11} < 0$$

$$h_{T\Omega} = -\delta v_{11} f_1^2 f_2^2 g_2^2 - \delta v_1 f_{12}^2 g_2^2 = -\delta v_1 \left[\frac{v_{11}}{v_1} f^2 \sigma_f + 1 \right] f_{12}^2 g_2^2$$

$$\begin{aligned} h_{TL} &= -\delta v_{11} \left(f_2^2 g_2^2 \right)^2 - \delta v_1 f_{22}^2 \left(g_2^2 \right)^2 - \delta v_1 f_2^2 g_{22}^2 > 0 \\ &= -\delta v_{11} \left(f_2^2 g_2^2 \right)^2 + \delta v_1 \left[\frac{\Omega - z^2}{g^2} f_{12}^2 \left(g_2^2 \right)^2 + f_2^2 \frac{z^2}{L - T} g_{12}^2 \right] \end{aligned}$$

Let us begin with dT/dL. After some manipulations, we get :

$$\begin{aligned} & \frac{\Delta}{\sigma_g \sigma_f \left(\left[\Omega - z^2 + \frac{g^2}{g_1^2} \right] \delta v_1 f_{12}^2 g_{12}^2 \right)^2} \frac{dT}{dL} \\ = & -\frac{v_{11}}{v_1} f^2 \frac{1}{\Omega - z^2} \frac{g^2}{g_1^2} \left[\sigma_g + \frac{\sigma_f}{1 + \frac{1}{\Omega - z^2} \frac{g^2}{g_1^2}} \frac{(L - T) g_2^2}{z^2 g_1^2} \right] \\ & + \left[1 + \frac{1}{\Omega - z^2} \frac{g^2}{g_1^2} \right] \frac{z^2 g_1^2}{(L - T) g_2^2} \left[1 + \frac{1}{1 + \frac{1}{\Omega - z^2} \frac{g^2}{g_1^2}} \frac{(L - T) g_2^2}{z^2 g_1^2} \right]^2 \end{aligned}$$

which is always positive. In a similar way, calculation of $dT/d\Omega$ leads to :

$$\begin{aligned} & \frac{\Delta}{\sigma_f \left(\delta v_1 \right)^2 \left(f_{12}^2 \right)^2 g_{12}^2 \left[\Omega - z^2 + \frac{g^2}{g_1^2} \right]} \frac{dT}{d\Omega} \\ = & -\frac{v_{11}}{v_1} f^2 \left[\sigma_g \frac{g^2}{\Omega - z^2} + \sigma_f \frac{g^2}{z^2} + \left(\sigma_g - \sigma_f \right) g_1^2 \right] - \left[\frac{g^2}{\Omega - z^2} + \frac{g^2}{z^2} \right] \end{aligned}$$

so that $dT/d\Omega$ can be either positive or negative depending on the magnitude of the two terms on the right-hand side of the previous equality. ∎

Let us now study the consequences of Proposition 3. The effect of an increase in retirement age on family transfers is given by :

$$\frac{dT}{d\theta} = \frac{dT}{d\Omega} \frac{\partial \Omega}{\partial \theta} - \frac{dT}{dL} \tag{11}$$

Then, since the derivative $\partial \Omega / \partial \theta$ is always positive, there are three cases depending on the values of the derivatives $dT/d\Omega$ and dT/dL :

1. when $dT/dL > 0$ and $dT/d\Omega < 0$, then $dT/d\theta$ is unambigously negative : postponing retirement is expected to lessen the provision of grandchild care ;

2. when $dT/d\Omega > 0$, then the derivative $dT/d\theta$ can be either positive or negative, depending on the magnitude of $dT/d\Omega$ and $dT/dL > 0$:

   2.1. when $dT/d\Omega$ is sufficiently small with respect to $dT/dL > 0$, then a rise in θ has a negative effect on T ;

   2.2. when $dT/d\Omega$ is large with respect to $dT/dL > 0$, then the provision of grandchild care is increasing with the length of the second-period working period.

How can we interpret these findings ? As evidenced in the proof of Proposition 3, the sign of $dT/d\Omega$ depends on both elasticities of substitution σ_g and σ_f. From the definition of $dT/d\Omega$, it is straightforward to see that this derivative will be positive only if σ_g is sufficiently high. So, when the purchased input z^2 and time devoted to domestic activities $1-\theta-T$ are strongly substituable, postponing retirement will lead to a rise in private downward transfers.

The rise in θ is associated to an income effect such that the parent has now more financial resources. Since z^2 is a normal good and owing to the strong substituability, parents will essentially devote this supplement of revenue to purchase additional units of z^2 and lessen time devoted to domestic tasks. Parents will therefore spend more time with their grandchildren, an activity from which they derive some intrinsic utility. Conversely, in situations where z^2 and leisure $1-\theta$ are not very substituable, then the reverse conclusion holds. Parents have less time to devote to personal use and not enough additional resources to buy purchased domestic inputs instead of providing domestic time. Children will then benefit from less time transfers related to grandchild care.

Finally, we turn to the overall impact on the labor market of a change in θ. Recalling that the child's participation depends on the parental transfer and that postponing retirement influences the pattern of grandchild care, this means that delaying retirement will affect the labor supply decision of both the parent and the child. In the second period, the fraction of people having a job is given by $1-e^1$ for the young and θ for the old generation. The impact of a change in θ is then given by :

$$\frac{\partial\left(1-e^1+\theta\right)}{\partial\theta}=1-\frac{\partial e^1}{\partial T}\left[\frac{\partial T}{\partial\Omega}\omega'\left(\theta\right)-\frac{\partial T}{\partial L}\right] \tag{12}$$

Combining results from Propositions 1, 2 and 3 sheds light on the interplay between the pattern of family transfers and employment on the labor market.

Corollary 1 *Postponing retirement may increase the overall participation (i.e. old and young employment rates) on the labor market.*

Proof: Since $\frac{\partial\left(1-e^1+\theta\right)}{\partial\theta} = 1 - \frac{\partial e^1}{\partial T}\frac{\partial T}{\partial\theta}$, this implies that $\frac{\partial\left(1-e^1+\theta\right)}{\partial\theta}$ is lower than 1 when $\frac{\partial T}{\partial\theta}$ is negative since $\frac{\partial e^1}{\partial T}$ is always negative. However, in some circumstances, parents may give more time despite of a postponment of retirement age. Specifically, the derivative $\frac{\partial\left(1-e^1+\theta\right)}{\partial\theta}$ will be higher than 1 when the following condition holds :

$$\frac{\partial T}{\partial\Omega} > \frac{1}{\Omega'(\theta)}\frac{\partial T}{\partial L}$$

In a situation where z^2 and e^2 are strongly substituable and the additional income effect due to the postponed retirement has a large impact on grandchild care, then the overall employment rate increases. ∎

With respect to the previous literature (see Cremer and Pestieau, 2004), our model exhibits the potential for a new "dividend" of a public policy aimed at postponing retirement. The provision of grandchild care transfers gives rise to an intergenerational externality. Owing to this interdependency within the family, a change in the labor participation of the old generation will have a direct impact on the labor supply of the young generation. In many cases, parents will reduce time devoted to children in response to a rise in θ, as they have less time for leisure and domestic activities. This will in turn reduce the participation of children on the labor market, since they have now to care for their own children instead of relying on the parental support.

However, postponing retirement may also increase the provision of time transfers. By working more, parents are in a position to buy more purchased inputs related to domestic production. If these purchased inputs and their own domestic time are strongly substituable, they will spend more time with the grandchildren. This is then the reverse story. Adults with young children have now more time to devote to non-domestic activities, and they will presumably spend part of this extra-time in paid activities. A modification in θ has now an unintended, albeit beneficial, consequence. Delaying retirement increases employment of both the old and young generations.

Although we do not focus on the sustainability and the financial balance of the pension scheme in our model, it is clear that delaying retirement will be helpful for the pension system in terms of additional payroll taxes. A question worth is then to assess the magnitude of the 'crowding-out' or 'crodwing-in' effects occuring through intergenerational linkages. If postponing retirement improves the labor participation of the old, but reduces at the same time employment for young adults, then the expected increase in payroll taxes will be much lower than initially expected. Knowing the overall effect of a change in θ on $(1 - e^1 + \theta)$ is then an empirical matter.

4 Conclusion

The purpose of this paper was to study the consequences of prolonging activity in a setting where family transfers matter. We show that owing to intergenerational linkages, a change in the labor participation of one generation is expected to affect the employment rate of the other generation. Interestingly, we find that this family externality may be either positive or negative. In some circumstances, postponing retirement may have a boosting effect on the labor market, in that it increases the labor force participation of both the young and the old. This finding, which is new with respect to the previous literature, is of importance with respect to the financing of pension scheme, as delaying retirement will impact the amount of expected additional payroll taxes.

As our primary aim was to show that intergenerational relationships and family redistribution have to be taken into account when studying the functioning of the labor market, we have restricted our attention to a simple framework with only one type of transfer, i.e. grandchild care. Several extensions of this model may come to mind. First, it would be useful to account for financial gifts made by the parents to their children. Second, transfers may flow in the reverse direction and it could be that children pay for the services and time transfers provided by the parent. Third, older workers have also themselves alive parents, which may give rise to a tradeoff between caring for elders and helping children. This suggests that the consequences and magnitude of the underlying family externality have to be examined within an extended framework, and we leave this issue for future research.

References

Altonji J.G., Hayashi F., Kotlikoff L.J., (1997), "Parental altruism and inter vivos transfers: Theory and evidence", *Journal of Political Economy*, vol. 105, pp. 1121-1166.

Andreoni J., (1990), "Impure altruism and donations to public goods: A theory of warm-glow giving", *Economic Journal*, vol. 100, pp. 464-477.

Becker G.S., (1991), *A Treatise on the Family*, Enlarged Edition, Harvard University Press, Cambridge.

Casamatta G., Cremer H., Pestieau P., (2006), "Is there a political support for the double burden on prolonged activity ?", *Economics of Governance*, vol. 7, pp. 133-142.

Cardia E., Ng S., (2003), "Intergenerational time transfers and childcare", *Review of Economic Dynamics*, vol. 6, pp. 431-454.

Cox D., (1987), "Motives for private income transfers", *Journal of Political Economy*, vol. 95, pp. 508-546.

Cox D., Stark O., (2005), "On the demand for grandchildren : Tied transfers and the demonstration effect", *Journal of Public Economics*, vol. 89, pp. 1665-1697.

Cremer H., Pestieau P., (2004), "The double dividend of postponing retirement", *International Tax and Public Finance*, vol. 10, pp. 419-434.

Dimova R., Wolff F.C., (2006), "Do downward private transfers enhance maternal labor supply ? Evidence from around Europe", *Mimeo*, Brunel University.

Dustmann C., Micklewright J., (2001), "Intra-household transfers and the part-time work of children", *CEPR Discussion Paper*, 2796.

Echevarria C.A., (2004), "Life expectancy, retirement and endogenous growth", *Economic Modelling*, vol. 21, pp. 147-174.

Ermisch J.F., Ogawa N., (1996), "Family structure, home time demands and the employment patterns of Japanese married women", *Journal of Labor Economics*, vol. 14, pp. 677-702.

Ettner S., (1996), "The opportunity cost of elder care", *Journal of Human Resources*, vol. 31, pp. 189–205.

Futagami K., Nakajima T., (2001), "Population aging and economic growth", *Journal of Macroeconomics*, vol. 23, pp. 31-44.

Gustman A.L., Steinmeier T.L., (2000), "Retirement in dual-career families : A structural model", *Journal of Labor Economics*, vol. 18, pp. 503-545.

Joulfaian D., Wilhelm M.O., (1994), "Inheritance and labor supply", *Journal of Human Resources*, vol. 29, pp. 1205-1234.

Laferrère A., Wolff F.C., (2006), "Microeconomic models of family transfers", in Kolm S.C., Mercier Ythier J., eds, *Handbook on the Economics of Giving, Reciprocity and Altruism*, North-Holland, Elsevier.

Sasaki M., (2002), "The causal effect of family structure on labor force participation among Japanese married women", *Journal of Human Resources*, vol. 37, pp. 429-440.

Sloan F.A., Zhang H.H., Whang J., (2002), "Upstream intergenerational transfers", *Southern Economic Journal*, vol. 69, pp. 363-380.

Wolf D., Soldo B.J., (1994), "Married women allocation of time to employment and care of elderly parents", *Journal of Human Resources*, vol. 29, pp. 1239-1276.

Wolff F.C., (2006), "Parental transfers and the labor supply of children", *Journal of Population Economics*, vol. 19, pp. 853-877.