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We study the effect of time allocation in a family on the macro behaviour of an economy. We use an overlapping generations model to describe an economy where children's human capital is affected by parental childcare time and where parents' preference for spending time with children are determined endogenously, via transmission of preferences between generations, within and across the families. The model exhibits multiple steady-state equilibria. A positive externality in childcare time results in an inefficiency of all competitive equilibria: too little time is spent with children, and, as a result, a competitive economy underperforms, compared to the first best outcome, where the parents' preference for childcare time is stronger, and the levels of output and human capital are higher, than in the private equilibria.

Key words: time use, human capital, externality, child care
JEL classification: A14, J13, J24

1 Introduction

The role of family decisions in the macroeconomic performance of a country, as well as the history of contribution of family economics to macroeconomics, were brilliantly summarized by Gary Becker (1988) in his presidential address delivered at the December 1987 meeting of the American Economic Association. In particular, he emphasized the role of family decision on investment in children's human capital upon economic growth and prosperity: '*... parents' investments in children are a far more important source of an economy's capital stock than are bequests or the life-cycle accumulation of physical capital.*' Much of the economic literature has focussed on the material part of investment in chidren, such as the education expenditure. However, time that parents spend with their children is equally important, and more recent studies turned to the role of unpaid parental childcare in the development of children's skills and abilities, and, therefore, their future labour productivity. Rapidly growing empirical literature on time use, based on various surveys, as well as less numerous theoretical

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studies, concentrate primarily on the optimal decision of time allocation within the family, and, in particular, the choice of unpaid childcare time, searching for its socio-demographic and economic determinants and consequences. Existing theoretical studies seem to agree on that for parents unpaid childcare time bears not only the cost of foregone labour income and leisure, but also the benefit of pure enjoyment of caring for their children. At the same time, the preference for time with children in these studies is exogenously fixed. However, time spent with children is as much a family as a social activity, and is, therefore, influenced by parents' own childhood experience, as well as by social norms, either economywide or in the parents' social network. The effect of social norms on child care has been noted in sociologial literature (Craig, 2006), but has not been modelled formally. Introducing the family and the network effect into the time use decision reveals an additional channel through which childcare time is linked to the macro behaviour, and that is the intergenerational network externality. This paper presents a theoretical model that explores this channel, which, to our best knowledge, has not been done before. We demonstrate that an economy where, other things being equal, parents have stronger preference for child care is characterised by higher level of human capital and higher aggregate income. The model predicts multiple long-run equilibria. Furthermore, a positive intergenerational network externality results in an inefficiency of all competitive equilibria: the social optimum, in which the externality is internalised, is characterised by the stronger preference of parents for child care, higher income and higher human capital, compared to the locally stable private long-run equilibrium.

2 Review of the literature

2.1 Empirical studies

The evidence of the links between human capital, measured by the education attainment, and macroeconomic performance have been well documented in the literature, particularly in the literature on economic growth, a traditional measure of macroeconomic performance (Barro and Sala-i-Martin, 2003). Here we focus on the empirical evidence of the links between unpaid parental time with children and children's education attainment, as a channel through which child care affects macroeconomic performance of a country, without considering economic growth explicitly. If time spent with children has a positive effect on their human capital, another important question arises, whether or not there is a link between parents' education attainment and time they spend with children. Thus, we are concerned with the following two questions: (*i*) Does parents' time with children, *ceteris paribus*, affect children's human capital? (*ii*) Does parents' human capital, *ceteris paribus*, affect the amount of time with children? A review of the empirical literature suggests that the answer to both questions is yes, and that in both cases the effect is positive.

A comprehensive review of earlier empirical studies of the determinants of children's attainment is provided in Haveman and Wolfe (1995), with the reference to a number of theoretical models. The survey suggests that parents' human capital positively affects children's educational attainment. One of the robust findings supported by all surveyed studies is that '*...growing up in a family in which the mother chooses to work appears to have a modest adverse effect on educational attainment, suggesting a negative effect of the loss of child care*

time.' However, in the surveyed studies time spent with children does not appear as a variable, for the reason stated in the concluding remarks: '*... there is still a serious problem of 'variable scarcity'*, ' and the first item in the list of the 'most pressing data needs' mentions '*parental time spent with children for both mother and father.*' It is worth mentioning that results on mother's time at work reviewed in Haveman and Wolfe (1995) are mixed. More recently, Ruhm (2008) established a strong negative correlation between maternal labour supply and children's cognitive development, based on the National Longitudinal Survey of Youth (USA). His explanation of the positive or neutral effect found in the previous studies is that the latter only crudely controlled for heterogeneity in child and household characteristics: '*children with working parents come from relatively advantaged family backgrounds and possess attributes that promote cognitive development*'. Bryant (1992) emphasized the role of parents' time input in the production of children's human capital and noted the inadequacy of the existing data sets for the quantitative study of this issue and related public policies. Some early studies (Bryant and Zick, 1993, 1996) used the limited survey data on parent – child shared time to establish its positive effect on the stimulation of child's human capital development. The situation has dramatically changed since this review was published, and now a large body of literature on family behaviour and investment into children's human capital is based on various surveys of time use in different countries. Folbre (2006) emphasizes the importance of the account of unpaid parental time in the analysis of the childcare sector and describes how the time use data can be used to quantify the economic contribution of childcare; she states, in particular, that '*both time and money are important 'inputs' into children, and time and money are not perfect substitutes for each other.*'

An important aspect of the parental childcare issue is the relationship between the parents' education and time spent with children, away from paid work. As noted by Craig (2006), '*Potentially, the effects are contradictory. An economic perspective suggests higher education means a pull to the market. Human capital theory predicts that, because higher education improves earning capacity, educated women face higher opportunity costs if they forego wages, so will allocate more time to market work and less to unpaid domestic labour. But education may also exercise a pull to the home. Attitudes to child rearing are subject to strong social norms, and parents with higher levels of education may be particularly receptive to the current social ideal of attentive, sustained and intensive nurturing.*' Chalasani (2007) employs the Americans' Use of Time project and the American Time Use Survey to examines differences in the time that American parents spend with their children across different levels of parental education and how these differences have changed between 1985 and 2003. The author finds that 'better educated parents used to and continue to spend more time with their children than the less educated. Although parents at all levels of education have increased their time with children over the years, the better educated have made relatively larger gains.' Craig (2006), using data from the Australian Bureau of Statistics Time-use Survey 1997, finds that in Australia, households with university-educated parents spend more daily time with children than other households in physical care and in developmental activities.

It is important to note that family and policy variables appear to explain only part of variation in parental time with children across families and countires. In a study of cross-country differences in the amount of time mothers spend with their children by Joesch and Spiess (2006), based on European data, it has been found that only a small portion of these

differences is explained by variation in socio-demographic characteristics and employment status, whereas country-specific policies aimed at reconciling parenthood and employment appear to explain some of the differences. This suggests the importance of social and cultural norms, not captured by economic and policy variables.

2.2 Theoretical models

Theoretical work on the role of family in the formation of human capital and its effect on macroeconomic performance was pionered by Gary Becker (1981). Parent care about well-being of their children and influence their human capital, and, therefore, future earnings, by devoting part of their time and wealth to children. The amount of physical and time resources invested in children is determined by parents' budget constraint and their preferences. In the standard models in this literature, parent's time devoted to child care is taken away from leisure and/or paid employment, and so presents an opportunity cost. Also, parents' decisions affect their children's decisions in the future only indirectly, by changing their endowments (in human capital and/or wealth). Fernandez, Fogli and Olivetti (2004) introduce a particular form of the direct effect on preferences (as an additional explanation of the increased female labour market participation): in their model, mother's choice of time allocated to paid work affects son's marital preferences; thus, if son of a working mother is more likely to marry a working woman, then women are more likely to work, as well as to invest in their labour market skills.

Transfer of resources within a family, in the form of bequests and time used for production of home good, was explored in Cardia and Ng (2003) and Cardia and Michele (2004), in an overlapping generations (OLG) framework with altruism; however, in their model time spent with children does not affect their future productivity. Their focus is, primarily, on the link between altruism and transfer of different types of resources (time versus bequests). Casarico and Sommacal (2008) model child care an intermediate good, produced at home, using physical good (childcare expenditures) and parents' time; the marginal productivity of parents' time is proportional to parents' human capital. In addition to serving as an intermediate input in production of chidlren's human capital, child care generates utility for parents. The authors use this framework to assess the effects of labor income taxation on growth; they find, in particular, that tax effect depends on the degree of substitutability between parental time and childcare expenditure. We adopt a somewhat similar approach, by assuming that parental time with children is an input in children's human capital, and that parents, in general, enjoy caring for their children.

3 The Model

In this paper we explore the macroeconomic effects of time allocation within a family when time spent with children affects their human capital and preference for child care are endogenous. We depart from the literature by modelling the effect of parents' choice on the future of their children both via the change in human capital endowment and via transmission of preferences. We make an assumption that parents are altruistic (care about their children's future well-being) and enjoy spending time with their children, albeit to a certain extent:

therefore, in addition to the indirect effect on parent's utility (through children's higher human capital leading to higher earnings and higher future well-being), childcare time can increase parents' utility directly. Furthermore, we incorporate in the model an intergenerational externality in transmission of childcare preferences. Thus, we assume that preference for childcare time is transmitted from parents to children and is also affected by the social norms; specifically, we assume that parents enjoy larger fraction of time spent caring for children if in the previous generation families, on average, spent more of their time on childcare. This can be interpreted as the simultaneous effect of the parental role model and of the social network externality (the community effect, see Calvo-Armengol and Jackson, 2010).

Consider an infinitely lived economy with overlapping generations. Each agent lives three periods, as a child in the first period, as an adult in the second, and as an old in the third period. In this paper we consider a benchmark model where all agents in the same cohort are identical. Without loss of generality we assume that the population is constant and that the agents consume only when they are old.

There is one physical good produced in the economy with the use of capital and labour as inputs. There is no cost of converting the output into either investment or consumption good. An agent born at time $t-1$ is an adult at time t and is from now on referred to as agent t. Each agent t is endowed by one unit of time that can be divided between leisure (ℓ_t), paid employment (L_t) in the production sector, and unpaid care (τ_t) for their children. Labour income is divided between savings (s_t) and paid child care (c_t), which can also be interpreted as an expenditure on formal schooling. The labour productivity, or the level of human capital of an adult agent is determined by the amount of care and schooling they received in their childhood, $H_{t-1} = h\left(c_{t-1}, \tau_{t-1}\right)$. Savings are invested in production by the means of a perfect credit market. Old agents consume the gross return on their savings made in the previous period.

3.1 The household decision

All the decisions in the household are made by an adult agent, whose preferences are characterized by non-paternalistic altruism and are described by a utility function of the form

$$W_t = U_t + \beta W_{t+1} = \sum_{i=0}^{\infty} \beta^i U_{t+i},$$

with the instantaneous utility function

$$U_t = u\left(\ell_t, \tau_t\right) + v\left(x_{t+1}\right),$$

where u is a weakly increasing and concave function, strictly increasing in the first argument, and v is a strictly increasing and concave function. Thus, parents enjoy (or, at least, do not dislike) time spent on child care. The degree of altruism towards the future generations is measured by β. The time constraint is

$$L_t + \ell_t + \tau_t \leq 1.$$

There is no direct physical cost of time spent with children. The budget constraints at time t and $t+1$, respectively,

$$\begin{aligned} c_t + s_t &\leq w_t H_{t-1} L_t, \\ x_{t+1} &\leq (1 + r_{t+1})\, s_t, \end{aligned}$$

combine into the life-time budget constraint,

$$c_t + \frac{x_{t+1}}{1 + r_{t+1}} \leq w_t H_{t-1} L_t.$$

Here w_t is the competitive wage rate per unit of efficient labour, and r_t is the net return on physical capital. The Lagrangean of the intertemporal optimization problem can be written as

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[u(\ell_t, \tau_t) + v(x_{t+1}) + \lambda_t \left(w_t H_{t-1} L_t - c_t - \frac{x_{t+1}}{1 + r_{t+1}} \right) \right],$$

since the time constraint in equilibrium holds with equality in every period. The state variables at time j are $\{\tau_{j-1}, c_{j-1}, x_j; w_j, r_j\}$, and the optimal choice is made for $\{\ell_t, \tau_t, c_t, x_{t+1}\}_{t=j}^{\infty}$.

The infinite sequence of first order conditions of the optimization problem has the following form:

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial \lambda_t} &= w_t H_{t-1} L_t - c_t - \frac{x_{t+1}}{1 + r_{t+1}} \leq 0 \ \ (= 0 \Rightarrow \lambda_t > 0), \\ \frac{\partial \mathcal{L}}{\partial \ell_t} &= u_t^{(1)} - \lambda_t w_t H_{t-1} \leq 0, \ \ (= 0 \Rightarrow \ell_t > 0), \\ \frac{\partial \mathcal{L}}{\partial \tau_t} &= u_t^{(2)} - \lambda_t w_t H_{t-1} + \beta \lambda_{t+1} w_{t+1} L_{t+1} H_t^{(2)} \leq 0 \ \ (= 0 \Rightarrow \tau_t > 0), \\ \frac{\partial \mathcal{L}}{\partial c_t} &= -\lambda_t + \beta \lambda_{t+1} w_{t+1} L_{t+1} H_t^{(1)} \leq 0 \ \ (= 0 \Rightarrow c_t > 0), \\ \frac{\partial \mathcal{L}}{\partial x_{t+1}} &= v'_{t+1} - \frac{\lambda_t}{1 + r_{t+1}} \leq 0 \ \ (= 0 \Rightarrow x_{t+1} > 0), \end{aligned}$$

for $t = 0$ to ∞, with initial conditions $\{\tau_{-1}, c_{-1}, x_0; w_0, r_0\}$. Here $u_t^{(1)} \equiv \dfrac{\partial u(\ell_t, \tau_t)}{\partial \ell_t}$, $u_t^{(2)} \equiv \dfrac{\partial u(\ell_t, \tau_t)}{\partial \tau_t}$, $H_t^{(1)} \equiv \dfrac{\partial h(c_t, \tau_t)}{\partial c_t}$, and $H_t^{(2)} \equiv \dfrac{\partial h(c_t, \tau_t)}{\partial \tau_t}$.

3.2 Production sector

The production sector consists of a large number of identical competitive firms producing a single physical good using a CRS technology,

$$Y_t = F(K_t, (H_{t-1} L_t))$$

and so can be replaced by a representative firm. The representative firm takes wage rate w_t and the rental price of capital r_t as given and maximizes profits. In the optimum each input is paid its marginal product and the profit is zero:

$$r_t = \frac{\partial Y_t}{\partial K_t} \equiv F_t^{(1)}, \ \ w_t = \frac{1}{H_{t-1}} \frac{\partial Y_t}{\partial L_t} \equiv F_t^{(2)}.$$

3.3 Dynamic equilibrium

The dynamic equilibrium is defined as the sequence of $\{K_t, x_t, c_t, L_t, \lambda_t, s_t; r_t, w_t\}$, $t = 0, 1, 2, \ldots$ solving the optimization problems of the household and the production sector, with given initial conditions, so that the capital and the labour markets clear in every period. We assume that the physical capital depreciates at rate δ. From now on we focus on an interior equilibrium, described by the following system of equations, obtained after straightforward manipulations:

$$\begin{aligned}
c_t + \frac{x_{t+1}}{1+r_{t+1}} &= w_t H_{t-1} L_t, \\
\frac{u_t^{(1)}}{v'_{t+1}} &= w_t H_{t-1} \left(1 + r_{t+1}\right), \\
\frac{H_t^{(2)}}{H_t^{(1)}} &= w_t H_{t-1} \left(1 - \frac{u_t^{(2)}}{u_t^{(1)}}\right), \\
\frac{\lambda_t}{\beta \lambda_{t+1}} &= w_{t+1} L_{t+1} H_t^{(1)}, \\
K_{t+1} &= \left(1 - \delta\right) K_t + s_t, \\
L_t + \ell_t + \tau_t &= 1, \\
r_t &= F_t^{(1)}, \\
w_t &= F_t^{(2)}.
\end{aligned}$$

3.4 Steady-State Equilibrium

In a steady-state equilibrium all variables remain constant over time. An interior steady-state equilibrium in this economy is described by the following system of equations:

$$\begin{aligned}
u^{(1)} &= wH \left(1 + r\right) v', \\
\frac{H^{(2)}}{H^{(1)}} &= wH \left(1 - \frac{u^{(2)}}{u^{(1)}}\right), \\
\frac{1}{\beta} &= wLH^{(1)}, \\
c + \delta K &= wLH, \\
w &= F^{(2)}, \\
r &= F^{(1)}.
\end{aligned}$$

in addition to the production functions F for the physical good and H for the human capital.

3.5 Multiple Equilibria

In this section we use specific functional forms for preferences and technology, frequently used in macroeconomic literature, to demonstrate that an economy described in the previous

section can exhibit multiple steady-state equilibria. In particular, we assume that F is Cobb-Douglas,

$$Y_t = AK_t^{\alpha} \left(H_{t-1} L_t\right)^{1-\alpha}, \ 0 < \alpha < 1,$$

and so

$$r_t = \alpha \frac{Y_t}{K_t}, \ w_t = (1-\alpha) \frac{Y_t}{L_t H_{t-1}}.$$

In the formation of human capital of a child paid care and unpaid care time provided by the child's parent can be substitutes or complements. To allow for flexibility we use a CES production function for human capital, where paid care and parent's time are two inputs, with possibly different shares, that have some degree of complementarity:

$$H_t = A_H \left[\eta c_t^{\rho} + (1-\eta) \tau_t^{\rho}\right]^{1/\rho}, \ \rho \in (-\infty, 1], \ \eta \in [0,1].$$

This form allows to consider two extreme cases, care provided only within the household, and only paid care, as well as a mixture of both. (The case when no care is provided at all, i.e. zero human capital, is ruled out.) In this model there is no accumulation of human capital; introducing the latter is straightforward and would not qualitatively change the main results.

The instantaneous utility function is logarithmic in old-age consumption,

$$v\left(x_{t+1}\right) = \theta \ln\left(x_{t+1}\right).$$

For the first term in the instantaneous utility function we assume the following functional form:

$$u\left(\ell_t, \tau_t\right) = (1-\varepsilon_t)\, \ell_t + \varepsilon_t \tau_t - \frac{1}{2}\left(\left[(1-\varepsilon_t)\, \ell_t^2\right] + 2\gamma\,(1-\varepsilon_t)\, \ell_t \varepsilon_t \tau_t + \left(\varepsilon_t \tau_t\right)^2\right).$$

Here $\varepsilon_t \in [0,1]$ measures the weight on the childcare time, and $\gamma \in [-1,1]$ measures the degree of substitutability between leisure and childcare time; higher positive value of γ reflects higher substitutability, with $\gamma = 1$ corresponding to the case of perfect substitution; negative γ means that the marginal utility of leisure declines when more time is spent on childcare, and vice versa.

The weight on childcare time in the parent's utility function is a state variable, i.e. it is taken as given when the decision on allocation of time and material resources is made. One can argue, however, that it need not remain the same across generations (it can, of course, differ across families in the same generation, but for now we assume away this heterogeneity). Parents' time with children is a form of social as well as family behavioiur, and is, therefore, affected both by social norms and by family values instilled by the previous generation in the family. Suppose, in line with this argument, that the preference for childcare time of an adult in the current generation are determined both by the preference of this adult's parents and by the current social norms in spending time with children. It is plausible to assume that the "average" form of behaviour in the previous generation becomes the social norm in the current generation. To fix the ideas, assume that parameter ε_t in an adult's utlity function is the weighted average of the value of this parameter in his parent's utility function and of some function of the childcare time spent, on average, in his parent's generation:

$$\varepsilon_t = \min\left\{1, \max\left\{0, \mu\varepsilon_{t-1} + (1-\mu)\, \varphi\left(\overline{\tau}_{t-1}\right)\right\}\right\}, \ \mu \in [0,1].$$

Thus, the preference for child care is partly inherited from parents and partly instilled by the society. In the interior steady-state equilibrium $\varepsilon = \varphi(\overline{\tau}) / (1-\mu)$,where $\overline{\tau}$ is the steady-state equilibrium value of $\overline{\tau}_t$. An individual choice of childcare time, by contributing to the average, exerts a positive network externality on the choices made by the subsequent generations. This positive externality is ignored in the individual optimisation problem, and, as a result, in the competitive equilibrium childcare time is below its efficient level.

Using the assumed functional forms one can show that the system of equations for the interior steady-state equilibrium is reduced to a non-linear equation for τ,

$$\xi L^{1-\frac{\rho\alpha}{1-\alpha}} \left[u^{(1)}\right]^{1-\frac{\rho}{1-\alpha}} - \left(Lu^{(1)} - \theta\right)^{1-\rho} = 0, \tag{1}$$

where

$$\xi = A_H^{\rho}\beta\eta \left[A_Y (1-\alpha) \left(\frac{\theta}{\delta}\right)^{\alpha}\right]^{\frac{\rho}{1-\alpha}},$$

and L solves

$$(1-\beta) Lu^{(1)} + \tau \left[u^{(1)} - u^{(2)}\right] - \theta = 0, \tag{2}$$

which is a quadratic equation. Here

$$\begin{aligned} u^{(1)} &= (1-\varepsilon)\left[1 - (1-\varepsilon)\ell - \gamma\varepsilon\tau\right], \\ u^{(2)} &= \varepsilon\left[1 - \gamma(1-\varepsilon)\ell - \varepsilon\tau\right]. \end{aligned}$$

In addition, with endogenous preferences

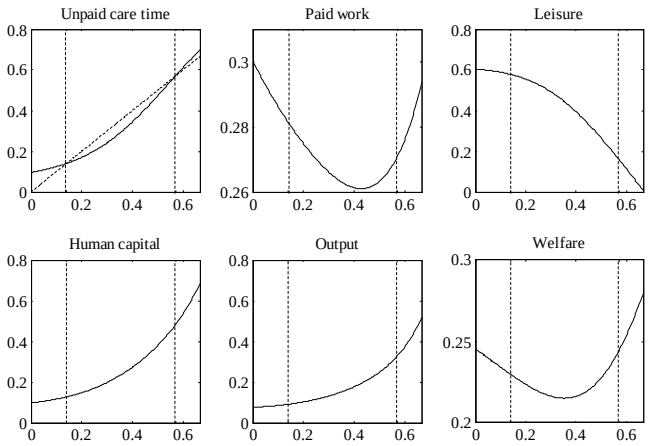
$$\varepsilon = \varphi(\tau) / (1-\mu). \tag{3}$$

For simplicity we assume $\varphi(\tau) = k\tau$.

The figure below illustrates the numerical solution of (1)-(2), as a function of ε, for the following values of the model parameters: $\alpha = 1/3$, $\beta = 0.9$, $\gamma = -1/2$, $\delta = 1/3$, $\eta = 1/2$, $\rho = -1/2$, $\theta = 1/20$, $k = 0.5$, $A_Y = A_H = 2$. There are two steady-state equilibria (marked by dotted lines), with ε equal to 0.14 and 0.57. The first equilibrium is locally stable, and, compared to the second one (locally unstable) it is characterized by less childcare time, more work and more leisure; however, the equilibrium level of human capital is also lower, so the output is lower; the welfare level is lower as well.A similar pattern obtains for various combinations of parameters, with the only difference that the level of welfare in the "lower" equilibrium (with low human capital and low output) may be lower or higher, compared to the in the "higher" equilibrium. We must know, however, that the difference in the welfare levels between the two equilibria is typically small (about 16% of the average in this example) compared to the difference in the macroeconomic variables (about 100% of the average for both output and human capital, or labour productivity, levels).

4 Welfare Implications of Endogenous Preferences

One can see from the figure is that the output and the level of human capital are increasing functions of ε, whereas the welfare behaves non-monotonically, first falling and then increasing for higher values of ε. In particular, both private steady-state equilibria are inefficient,



because of the positive intergenerational network externality. Thus, everyone in the society would benefit, in the long run, from an increase in τ: larger τ would increase ε in the next generation and result in yet larger τ; however, each family correctly believes that it is too small to affect the average τ and so does not internalise the externality. Note that the equlibrium labour supply does not change substantially, and the higher value of τ is primarily due to the decrease in leisure time. This means that imposing a limit on working hours would not be an appropriate policy solution; it is not enough to make parents work less, – they need to be persuaded to spend time not in work with children, rather than on their own leisure, or, in other words, social norms on parenting would need to change. For the sufficient degree of complementarity between the material and time inputs in human capital production higher childcare time can be achieved by taxing labour and subsidizing the material inputs in childcare.

The efficient equilibrium is obtained by maximizing the Lagrangean that takes into account the effect of τ upon ε:

$$\begin{aligned}\mathcal{L} &= \sum_{t=0}^{\infty}\beta^t\left[u\left(\ell_t,\tau_t\right)+v\left(x_{t+1}\right)+\lambda_t\left(w_tH_{t-1}L_t-c_t-\frac{x_{t+1}}{1+r_{t+1}}\right)\right.\\ &\left.+\psi_t\left(\mu\varepsilon_t+\left(1-\mu\right)\varphi\left(\tau_t\right)-\varepsilon_{t+1}\right)\right],\end{aligned}$$

so that the first-order condition with respect to τ_t is modified,

$$\frac{\partial\mathcal{L}}{\partial\tau_t}=u_t^{(2)}-\lambda_tw_tH_{t-1}+\beta\lambda_{t+1}w_{t+1}L_{t+1}H_t^{(2)}+\psi_t\left(1-\mu\right)\varphi'\left(\tau_t\right)\leq 0\ \ (=0\Rightarrow\tau_t>0)$$

and we need to add the first-order condition with respect to ε_{t+1}:

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial\varepsilon_{t+1}} &= -\psi_t+\beta\left[\mu\psi_{t+1}+\frac{\partial u_{t+1}}{\partial\varepsilon_{t+1}}\right]=0\ \Rightarrow\ \varepsilon_{t+1}\in\left(0,1\right),\\ \frac{\partial\mathcal{L}}{\partial\varepsilon_{t+1}} &< 0\ \Rightarrow\ \varepsilon_{t+1}=0,\ \frac{\partial\mathcal{L}}{\partial\varepsilon_{t+1}}>0\ \Rightarrow\ \varepsilon_{t+1}=1.\end{aligned}$$

5 Conclusions

In this paper we study the effect of time allocation in a family on macro behaviour of an economy. We construct a dynamic model where children's human capital is affected by parental childcare time and where parents' preference for spending time with children are determined endogenously, via transmission of preferences between generations, within and across the families. We have shown that in a substantial range of parameters the model exibits multiple long-run equilibria. A positive network externality in childcare time results in an inefficiency of all competitive equilibria: too little time is spent with children, and, as a result, a competitive economy underperforms, compared to the first best outcome, which is characterised by stronger preference of parents for childcare time.

The model presented here was intentionally kept simple, to demonstrate the main result and to serve as a benchmark for the further developments. Note that one can easily modify this model by introducing accumulation of human capital to consider the effect of child care on economic growth. Thus, one could follow the standard approach of endogenous growth with human capital and explore the balanced-growth path, as well as the transitional dynamics. Another obvious extension would be a separate sector of paid childcare services.

The next step is to introduce heterogeneity across families, such as random distribution of abilities leading to variation in productivity, random distribution of preference parameters, random transmission of traits from parents to children, and heterogeneity in the degree of conformity with social norms regarding child care within and across networks. These and other such extensions will allow to make the model more realistic and to test the predictions of the model using the available datasets; of particular interest would be the cross-country comparison, as it could capture the country-specific differences, potentially attributable to the multiplicity of long-run equilibria. Furthermore, an extended model can be applied for the second-best policy analysis, using numerical simulations, including agent-based computations for heterogenous agents and network effects. Work along these directions is currently in progress.

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