CESifo Working Papers
www.cesifo.org/wp

Gender Power, Fertility, and Family Policy

Alexander Kemnitz
Marcel Thum

CESIFO WORKING PAPER NO. 3798
CATEGORY 1: PUBLIC FINANCE
APRIL 2012

PRESENTED AT CESIFO AREA CONFERENCE ON PUBLIC SECTOR ECONOMICS, APRIL 2012

CESifo *Working Paper No. 3798*

Gender Power, Fertility, and Family Policy

Abstract

The birth of children often shifts the power balance within a family. If family decisions are made according to the spouses' welfare function, this shift in power may lead to a time consistency problem. The allocation of resources after the birth of children may differ from the ex-ante optimal choice. In a model of cooperative decision making within a family, we show that this time consistency problem leads to a systematic downward bias in fertility choices. By keeping fertility low, families try to mitigate the ex-ante undesired shift in the power balance. This bias in fertility choices provides scope for welfare enhancing policy intervention. We discuss the extent to which existing measures in family policy are suitable to overcome the fertility bias.

JEL-Code: D130, H310, J130.

Keywords: fertility, family policy, household allocation.

Alexander Kemnitz
Technical University Dresden
Faculty of Business and Economics
01062 Dresden
Germany
alexander.kemnitz@tu-dresden.de

Marcel Thum
Technical University Dresden
Faculty of Business and Economics
01062 Dresden
Germany
marcel.thum@tu-dresden.de

April 2012
We are very grateful for helpful comments and suggestions from Marie-Louise Leroux, Volker Meier, Helmut Rainer, Christian Thater and the seminar participants at TU Dresden, the Social Policy Council of the German Economic Association and the CESifo Area Conference on Public Sector Economics.

1 Introduction

Family policy is a contentious topic throughout the developed world. Facing fertility rates around or below replacement levels, politicians in many countries call for an active family policy that slows down or even reverses this demographic trend to improve growth perspectives and public finances. However, most of the measures introduced in the last decades have shown very little effect on families' willingness to raise children.

Economists are usually cautious in recommending pro-natalist policy measures. Most papers focus on the positive aspects, e.g., analyzing the link between fertility and female labor market participation (Galor & Weil, 1996; Apps & Rees, 2004). Welfare-based recommendations for fertility enhancing policies presuppose the identification of market failures. However, it is far from obvious that the family's fertility choice is suboptimal. The costs and benefits of raising children accrue largely within the family.[1]

Moreover, cooperation among family members is a major characteristic of the family. This is not only driven by their altruistic feelings but also by their repeated interaction and continuous communication, which makes agreeing on and committing to efficiency facile. This reasoning lies at the heart of both the early unitary model (Becker, 1991) and the collective approach pioneered by Chiapiorri (1992), according to which household members agree on efficient solutions despite conflicting individual preferences.[2] Inefficiencies in household decisions are therefore virtually nonexistent.

While it is beyond dispute that the general view of the family as an institution to foster cooperation is warranted, this view has recently come under some scrutiny. In particular, a number of contributions have identified environments in which this institution may fail because commitment does not work.[3]

[1]There is one major exception: children generate a significant positive fiscal externality, in particular with large pay-as-you-go (PAYG) pension systems where the present value of contributions exceeds the present value of pension benefits. Sinn (2001) estimates that each additional child in Germany yields a net benefit to the pension system of around € 90,000. This net contribution to the public coffer is not accounted for in a family's decision regarding the number of children to have. Moreover, the PAYG pensions system also has a more direct negative effect on fertility as biological children are no longer needed for securing old-age consumption (Cigno, 1992). The generosity of pensions depends on the total fertility of a society but not on the individual number of children. See Fenge & Meier (2005) for a discussion on how to address this specific problem and Cigno et al. (2003) for a general treatment of family policy in the presence of fiscal externalities.

[2]In contrast to the unitary approach, collective models are consistent with the empirical observation that not only the total amount of household income but also its distribution among family members matters for household decisions (Lundberg et al., 1997; Hener, 2010).

[3]While these approaches combine cooperative and non-cooperative elements, there is also a strand of the literature presuming non-cooperative behavior of family members (Konrad & Lommerud, 1995; Lechene

All of these approaches rest on dynamic arguments. One explanation for lacking cooperation or commitment is that decisions have already been made before the household forms. Concerning fertility choice, Iyigun & Walsh (2007) consider efficient Nash bargaining at the spouse level where the threat points are determined non-cooperatively by pre-martial investment in education. This creates an incentive for excessive investment in human capital to improve later bargaining positions – an argument originating in Konrad & Lommerud (2000). Moreover, as argued by Lundberg & Pollack (2003) it is hard or even infeasible to enforce contracts among spouses compensating the partner who is becoming worse off. In the context of deciding on a relocation of the family which would provide greater benefit to one spouse than harm to the other, Lundberg & Pollack (2003) show that an inefficient split of the family can result when spouses decide autonomously on whether to move or not. Rasul (2008) analyzes female investment in fertility when future renegotiations of family transfers are expected where both over- and underinvestment in fertility can result. Such renegotiation may also occur because cooperation vanishes over the course of time. In Hyee & Robledo (2009), spouses decide first jointly on how many children to have. However, this family public good is not durable because utility from children disappears once they have grown up. In the absence of any other benefits from marital cooperation, intra-family transfers will cease at that stage; the partner bearing the cost of rearing the children anticipates an insufficient compensation for his/her efforts.

In all of these approaches, inefficiencies arise because single household members take unilateral actions and/or the family loses its welfare-enhancing role as the provider of public goods. At least for established partnerships, both premises are somewhat unsatisfactory. Spouses typically share more family public goods than just raising children, and unilateral decisions conflict with the general inclination to exhaust all possibilities for mutual improvements.

Taking account of this critique, we present a model where all choices are efficient from the perspective of the family at the time decisions are made. Nevertheless, inefficiencies may arise because current decisions affect future bargaining power. As this change is deemed inappropriate from today's perspective, decisions are distorted. In this respect, we adopt the idea by Basu (2006) of a mutual, but possibly delayed interdependence of household decisions and bargaining power, and apply it to fertility choice.[4] We show that the endogeneity of the bargaining power leads to a systematic downward bias in fertility. This bias in fertility choices provides scope for welfare enhancing policy interventions. We discuss the extent to which existing measures in family policy are suitable to overcome

& Preston, 2011).

[4]Basu (2006) uses the approach for analyzing questions of female labor participation and child labor.

the fertility bias.

In the first stage of our model, the spouses decide on the number of children they will have based on a family welfare function. This welfare function depends on the consumption of husband and wife and on the number of children. Once the children are born, the parents decide on the mode of child care (internal or external), which affects their labor market participation and the distribution of consumption in the second stage. The time-consistency problem arises as the distribution of resources depends on the relative income earned by the spouses. If the wife stays at home to raise the children, this reduces her market income and thus shifts the distribution of resources towards the husband.[5] This potential shift in intrafamily distribution makes the couple reluctant to have children in the first place.

We show that this problem arises whenever the wife chooses to work part-time, which is the case for a medium female wage level. We discuss three policy options to address this inefficiency: child allowances, maternal care benefits, and subsidies for external care. These measures, which are widely used in actual family policies around the world, differ with respect to their conditionality on the organization of child care. While the child allowance is paid irrespective of whether child care is internal or external, the maternal care benefit and the external care subsidy privilege the former and the latter option, respectively. In particular, they have a direct impact on the wife's contributions to family income, either by the maternal benefit itself, or by the enhanced labor market participation due to subsidized external care.

All three policies have the potential to correct the inefficiency, but have different implications for the public purse. Child allowances are shown to be inferior to maternal care benefits because they require more resources to restore efficiency. Whether maternal care benefits are superior to external care subsidies depends on the female wage level. If the female wage is low, the fertility-induced change in gender power is minor. Therefore, only a small maternal benefit is required to restore the efficient fertility choice. If the female wage is high, only a low subsidy on external care is needed to achieve efficiency and the government will prefer the subsidy for external care over maternal care benefits.

The paper is organized as follows. Section 2 introduces the basics of the model. Section 3 derives the conditions for efficient family decisions, whereas Section 4 presents the time-consistency problem. The family policies are analyzed in Section 5. Section 6 concludes.

[5]Throughout the paper, we refer to the person taking care of the children as 'wife' and to the full-time worker as 'husband'. Obviously, this is simply nomenclature to facilitate reading.

2 The Model

We develop a simple model in the spirit of Apps & Rees (2004) to analyze essential allocative choices of fertility, labor market participation and consumption within a family. The family – rather than its members – is the decision making unit. Hence, we view the family as a cooperative entity. If the family can engage in long-term commitments with regard to fertility and consumption, it can maximize its welfare (see Section 3). The planned allocation, however, may be distorted by a time-consistency problem (see Section 4). Fertility often leads to the abstention of one spouse from the labor market for the purpose of raising children. As the power structure within the family is determined – among others – by relative incomes, fertility *ex post* changes the weights of the welfare function.

A couple consisting of a husband and wife has preferences regarding their own consumption $c_i, i \in M, F$ and the number of children n according to

$$U_i = \alpha \log c_i + (1-\alpha)\log n \tag{1}$$

, with $\alpha > \frac{1}{2}$ to ease the exposition. Hence, individual consumption is a private good whereas children are family public goods.

Both parents are endowed with one unit of time, which can be split for work and child care activities. Let each child require $1/\phi$ time units to be taken care of, such that n/ϕ is the total amount of time to rear children. Work yields a wage w_i per unit of time. As an alternative to child care at home, external care is available at a price or fee p per child and per unit of time. Let x be the total amount of time bought in the market.

We assume that the partners differ in their abilities to earn wages in the labor market. For notational convenience, we always label the spouse with the higher wage as the husband. Moreover, for external care to be a relevant alternative, we assume that its price is lower than the husband's wage. Otherwise, care would always be undertaken by the parents only. Hence, we posit: $w_M > max(w_F, p)$. However, we impose no restriction on the relation between w_F and p.

In the following sections, we focus on a setting where children are taken care of either by the wife or externally. As will become apparent below, this occurs whenever $\alpha \geq w_M/(w_M+p)$. Then, the preference for children is sufficiently low that the family will never want to supplement full time female child care by external purchases. This focus is only for ease of exposition. All main findings of our upcoming analysis can also be reproduced for the alternative case ($\alpha < w_M/(w_M+p)$) where internal and external child care are used simultaneously (see Appendix 4).

Due to these assumptions, the time constraint for raising children is given by $\frac{n}{\phi} = t + x$, where t is the wife's time investment, which is obviously limited from above $[t \leq 1]$. The cost of child care can be determined by

$$C(n) = w_F \cdot t(n) + p \cdot x(n). \tag{2}$$

Here, $t(n)$ and $x(n)$ are the respective inputs to raise n children. The family resource constraint

$$c_M + c_F = w_M + w_F - C(n), \tag{3}$$

claims that total consumption must equal potential earnings net of the child care cost.

3 Pareto-efficient Allocations

In the first step, we analyze the optimal allocation, which a family would choose if it could make a long-term commitment to labor market participation and to the distribution of resources. In line with the collective approach (Chiappiori, 1992), the set of Pareto-efficient allocations can be derived by maximizing the family welfare function

$$\theta \cdot U_F + (1 - \theta) \cdot U_M,$$

subject to the resource constraint (3). Family welfare is a weighted sum of both spouses' utilities. $\theta \in [0, 1]$ measures the wife's relative welfare weight, which is also the relative importance of her preferences in family decisions. Therefore, we refer to θ as gender power or female marital bargaining power. Solving the respective problem yields the following

Proposition 1. *The efficient allocation of fertility and child care depends on parental wages and on the price of external care. If $w_F \geq p$, full external care is efficient and the number of children should be*

$$n_I^* = (1 - \alpha)\phi \frac{w_M + w_F}{p}. \tag{4}$$

If $p > w_F$, the wife should engage in child care. For $p > w_F > \frac{1-\alpha}{\alpha} w_M$, she should both work and provide care. The number of children should be

$$n_{II}^* = (1 - \alpha)\phi \frac{w_M + w_F}{w_F}. \tag{5}$$

For $\frac{1-\alpha}{\alpha} w_M \geq w_F$, she should fully specialize in child care. No additional external care should be used and the number of children should be

$$n_{III}^* = \phi \tag{6}$$

.

Proof. Whatever the fertility choice and the distribution of income, efficiency requires minimization of the cost of rearing children (2). Taking into account the upper bound on the female time endowment gives

$$C(n) = \begin{cases} \dfrac{p \cdot n}{\phi} & : \; w_F \geq p \\ \dfrac{w_F \cdot n}{\phi} & : \; w_F < p, n < \phi \\ w_F + p\left(\frac{n}{\phi} - 1\right) & : \; w_F < p, n \geq \phi \end{cases} . \tag{7}$$

Letting λ denote the Lagrange-multiplier of the family resource constraint, the first-order conditions for consumption and fertility are

$$\frac{\theta\alpha}{c_F} = \lambda, \tag{8}$$

$$\frac{(1-\theta)\alpha}{c_M} = \lambda, \tag{9}$$

$$\frac{1-\alpha}{n} = \lambda C'(n). \tag{10}$$

Combining (8) and (9) with the resource constraint gives

$$\lambda = \frac{\alpha}{w_M + w_F - C(n)}. \tag{11}$$

Using (11) in (10) yields

$$\frac{\alpha}{1-\alpha} C'(n) \cdot n + C(n) = w_M + w_F. \tag{12}$$

First, let $w_F \geq p$ such that $C'(n) = p/\phi$. Hence, (12) is solved by (4). Suppose, next, that $w_F < p$. Then, under the premise that $n < \phi$, (5) solves (12), which is consistent with the premise only when $w_F > \frac{1-\alpha}{\alpha} w_M$. For very low wages $w_F \leq \frac{1-\alpha}{\alpha} w_M$, the family can either have such a large number of children that external care is needed in addition to the wife's care at home or the family can choose the corner solution with $n = \phi$ children who are raised by child care at home only. When $n > \phi$, we have $C'(n) = p/\phi$ and $C(n) = p\left(\frac{n}{\phi} - 1\right) + w_F$. Hence, (12) is solved by $n = (1-\alpha)\phi \frac{w_M + p}{p}$, which is always lower than ϕ due to our assumption $\alpha > w_M/(w_M + p)$. This contradicts the initial condition that $n > \phi$. Thus, the efficient number of children will never require simultaneous maternal and external care. For $w_F \leq \frac{1-\alpha}{\alpha} w_M$, the family chooses $n = \phi$.□

Except for corner solutions, fertility depends positively on potential family income $w_M + w_F$ and negatively on the relative price of raising children. Both factors depend, in turn, on the cost-minimizing mode of providing child care. Figure 1 illustrates the optimal fertility choice. For very low wages $w_F \leq \frac{1-\alpha}{\alpha} w_M$, it is efficient that the wife stay out of the

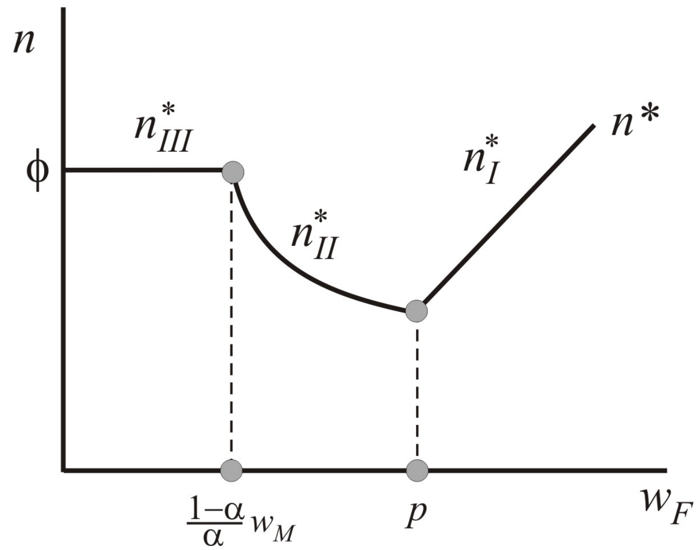

Figure 1: Efficient Fertility

labor market completely, which allows her to care for ϕ children. For intermediate wages $\frac{1-\alpha}{\alpha}w_M < w_F < p$, she works part-time. Thus, provided this is the only source of child care, her wage determines both full income and relative price. Fertility is reduced by a higher female wage, as the relative price effect of increasing w_F dominates the income effect. When $w_F \geq p$, external care is cheaper than maternal care and the wife participates full-time in the labor market. Hence, the price of child care is p. Here, the relative price effect vanishes because child care is external.[6]

This simple microeconomic model of family decisions predicts that the fertility choice should be u-shaped with respect to family income. The highest number of children are typically found in households at the bottom and top end of the skill distribution where skill is a good proxy for potential income (see Hazan and Zoabi (2011) for empirical evidence in the U.S.). Other factors, such as child related benefits, may also contribute to this pattern. The key point, however, is that the u-shaped pattern reflects the socially optimal fertility rate even in the absence of state interventions.

Concerning the role of gender power on efficiency, we have the following

Corollary. *Gender power has no impact on the efficient number of children and mode of child care, but does affect spouses' private consumption levels. Each parent consumes a fraction of the family's full income corresponding to his/her bargaining weight*

$$c_F^* = \theta \cdot \alpha \cdot (w_M + w_F), \quad c_M^* = (1-\theta) \cdot \alpha \cdot (w_M + w_F). \tag{13}$$

[6]Strictly speaking, external and maternal care are equivalent from the efficiency perspective when $w_F = p$. Our assumption that care is external in that case serves to tighten the exposition.

Proof. It follows immediately from Proposition 1 that the child-related decisions are independent of the bargaining power. With respect to consumption levels, combining (8), (9) and the resource constraint (3) yields

$$c_F^* = \theta \cdot [w_M + w_F - C(n^*)], \quad c_M^* = (1-\theta) \cdot [w_M + w_F - C(n^*)]. \tag{14}$$

Each spouse receives resources according to the sharing rule θ and $1-\theta$ of the family income net of the costs of rearing children. The fraction α of potential income is spent on consumption. □

Bargaining power is important for the allocation of resources for private consumption. However, it does not affect the organization of child care. If a family relies on maternal care instead of external care, the wife receives a transfer compensating for her earnings loss. The fact that gender power does not affect the number of offspring is due to the identical fertility preferences of the husband and wife.[7]

4 Sequential Decisions

Fertility and consumption are not determined simultaneously. Due to the long-term nature of rearing children, the decision on the number of children should be considered to be made prior to consumption. This raises the possibility that future consumption may deviate from what is planned today. Change in relative power among spouses is a natural reason for such a process. Here we adopt the idea of Basu (2006) that the relative power of a spouse is determined by his or her relative contribution to the family income. Letting $e_F = \frac{E_F}{E_M}$ denote the ratio of the wife's to husband's earnings (with $E_M = w_M$ and $E_F \in \{0, (1-t(n)) \cdot w_F, w_F\}$), we define female bargaining power as

$$\theta = \theta\left(e_F\right), \tag{15}$$

with $\theta(1) = \frac{1}{2}$, and $\theta(0) = \underline{\theta} \geq 0$. If both spouses contributed the same amount to the family income, they would have equal bargaining power, whereas a wife without any labor income has less say in the family than the husband. As the female wage is lower than the male wage, the wife always receives the smaller share of net family income $\theta(w_F/w_M) < \frac{1}{2}$. We assume that female income translates positively into gender power, but at a diminishing rate $\theta'(e_F) > 0 > \theta''(e_F)$ in the interval $e_F \in (0, \frac{1}{2})$.

[7]This property facilitates the upcoming analysis significantly. With different preferences, θ would affect the efficient number of children. As we focus on the effects of a change in female bargaining power, the distinction between ex-ante and ex post efficient fertility would obscure the main message of the paper.

This opens up a channel for fertility to influence the future division of resources via the ratio of earnings between spouses. We analyze this mechanism in a setup where fertility is decided by maximizing family welfare in period 1, anticipating its impact on bargaining power in period 2. In a sense, the period 1-family plays a game with the period 2-family. We show that this can lead to a reduction of fertility compared to the efficient level.

4.1 Period 2: Family Decisions Once Children are Born

Given the fertility choice in period 1, the family decides in period 2 how to organize child care and how to apportion the resulting family income among the spouses. According to (15), the sharing rule depends on relative earnings, which in turn are affected by the chosen mode of child care. This requires a mutual consistency of choices in equilibrium: the economic choices must generate a distribution of gender power for which these economic choices must be optimal. Note that family decisions are efficient from the current perspective due to the maximization of family welfare. Hence, there are no distortions arising from strategic considerations by either spouse.

The family maximizes

$$V_2 = \theta(e_F)\left[\alpha \log c_F + (1-\alpha)\log n\right] + (1-\theta(e_F))\left[\alpha \log c_M + (1-\alpha)\log n\right] \tag{16}$$

for a given n subject to the budget constraint that total consumption equals family net income I_N

$$c_F + c_M = I_N = E_M + E_F - p \cdot x, \tag{17}$$

and the restrictions $t \in [0,1], x \geq 0$.

Proposition 2. *(a) If $w_F \geq p$, both spouses work full time and rely on external child care irrespective of the number of children. The net family income is $w_M + w_F - pn/\phi$, of which the wife receives the share $\theta\,(w_F/w_M)$.*
(b) If $w_F < p$ and $n < \phi$, the wife works part-time generating a net family income of $w_M + w_F(1-\frac{n}{\phi})$, of which she receives the share $\theta\,(w_F(1-n/\phi)/w_M)$.
(c) If $w_F < p$ and $n \geq \phi$, the wife specializes in child care and receives the fraction $\underline{\theta}$ of the net family income $w_M - p(1-n/\phi)$.

Proof. Conditional on the bargaining weights, economic decisions must maximize (16) and, hence, the net family income. This requires minimizing the cost of caring for the offspring. External care is used only if $w_F \geq p$. The mother takes care of the children if $w_F < p$, which is supplemented by external care if the female time constraint binds. This is the same solution as in Section 3 because the family faces the same technology and gender power θ does not affect the cost-minimization by the family in this case.

These cost-minimizing choices yield a net family income

$$I_N = \begin{cases} w_M + w_F - pn/\phi & : \quad w_F \geq p \\ w_M + w_F(1 - n/\phi) & : \quad w_F < p, n < \phi \\ w_M - p(1 - n/\phi) & : \quad w_F < p, n \geq \phi \end{cases} . \tag{18}$$

Letting λ denote the Lagrange-multiplier of the family resource constraint, the first-order conditions for consumption are

$$\frac{\theta\alpha}{c_F} = \frac{(1-\theta)\alpha}{c_M} = \lambda, \tag{19}$$

such that $c_F + c_M = \alpha/\lambda$ holds. According to (17), total consumption equals net family income, hence, $\lambda/\alpha = I_N$. Combining this with (19) shows that spouses consume shares of net family incomes according to their bargaining weights. These shares are determined by relative earnings, which amount to

$$e_F = \begin{cases} \frac{w_F}{w_M} & : \quad w_F \geq p \\ \frac{w_F}{w_M}\left(1 - \frac{n}{\phi}\right) & : \quad w_F < p, n < \phi \\ 0 & : \quad w_F < p, n \geq \phi \end{cases} \square. \tag{20}$$

These results are very close to the findings derived above for the efficient solution. In fact, all decisions are efficient given the number of children. The main difference with respect to the above result lies in the fact that relative earnings pin down relative weights to well-defined levels.[8]

It should be noted at this stage that two equilibria exist when $w_F = p$: one with external and one with maternal care. Both equilibria are equivalent in terms of total family income and welfare but, of course, not with respect to the distribution of resources. When resorting to external provision, the wife receives the share $\theta(w_F/w_M)$, whereas she gets only $\theta((\alpha w_F - (1-\alpha)w_M)/w_M)$ of the family income when looking after the children herself. Analogous to Section 3, we assume in the following sections that the family resorts to external care in that case. This keeps the analysis neat without losing any important insight.

4.2 Period 1: Fertility Choice

In period 1, the couple decides on fertility n to maximize utility

$$V_1 = \theta_1 \left[\alpha \log c_F + (1-\alpha)\log n\right] + (1-\theta_1)\left[\alpha \log c_M + (1-\alpha)\log n\right], \tag{21}$$

[8] Due to the simplicity of the model, the mutual consistency of child care and gender power stipulated above turns out to be one sided only. The mode of child care affects the division of resources, but the division of resources does not affect the mode of child care.

where θ_1 denotes the initial bargaining power before children are born. When the decision on the number of children is made, the couple takes into account the consequences for net family income and for the distribution of individual consumption in period 2. Using the results of Proposition 2, we depict these dependencies by

$$c_F = c_F(n) = \theta(n) \cdot I_N(n), \quad c_M(n) = (1-\theta(n)) \cdot I_N(n) \tag{22}$$

with

$$\theta(n) = \theta(e_F(n)) = \begin{cases} \theta\left(\frac{w_F}{w_M}\right) & : \; w_F > p \\ \theta\left(\frac{w_F}{w_M}\left(1-\frac{n}{\phi}\right)\right) & : \; p > w_F, n < \phi \\ \theta(0) & : \; p > w_F, n \geq \phi \end{cases} \tag{23}$$

and $I_N(n)$ given by (18).

The family's decision in period 1 depends on the distribution of power within the family, which is shaped by current earnings. Due to the absence of any utility from leisure, both partners work full time in period 1, which means that the relative say of the wife in current decisions is given by $\theta_1 = \theta(w_F/w_M)$.[9]

Before characterizing the chosen fertility level and its efficiency properties in detail, it is worthwhile to elaborate on the general determining factors behind this decision. Differentiating the family utility function with respect to n yields after some manipulation

$$\frac{1-\alpha}{n} + \frac{\alpha}{I_N}\frac{\partial I_N}{\partial n} + \alpha\frac{d\theta}{dn}\frac{\theta_1 - \theta(n)}{(1-\theta(n))\theta(n)} \geq 0, \tag{24}$$

with a strict inequality possibly arising for $n = \phi$. The first term reflects the marginal utility from increasing fertility, whereas the second term measures the utility losses from lower private consumption due to the resources to be spent on child care. The third term measures how gender power reacts to fertility.

Because child care decisions are cost-efficient in period 2, the second term corresponds to

$$\frac{\alpha}{I_N}\frac{\partial I_N}{\partial n} = \begin{cases} \dfrac{-\alpha \cdot p/\phi}{w_M + w_F - pn/\phi} & : \; w_F \geq p \\ \dfrac{-\alpha \cdot w_F/\phi}{w_M + w_F(1-n/\phi)} & : \; w_F < p, n \leq \phi \\ \dfrac{-\alpha \cdot p/\phi}{w_M - p(1-n/\phi)} & : \; w_F < p, n > \phi \end{cases} . \tag{25}$$

Considering the first two terms only, we are back to the Pareto-efficient number of children by equating the marginal utility gains from fertility to the marginal utility loss from having

[9] An extended model would consider explicitly utility from period 1 consumption and savings decisions. As this would not affect the central message of our model, we have omitted this aspect for the sake of brevity.

to spend more on (cost-minimized) child care. In contrast to Section 3, however, we also have the third term arising from the shift in bargaining power. To abbreviate notation, we denote this third term by

$$\Delta_\theta(n) \equiv \frac{d\theta}{dn}\frac{\theta_1 - \theta(n)}{(1-\theta(n))\theta(n)}. \tag{26}$$

This gender power effect is either zero or negative: $\frac{d\theta}{dn} < 0$ implies $\underline{\theta} < \theta(n) < \theta_1$ and $\frac{d\theta}{dn} = 0$ implies either $\theta(n) = \underline{\theta}$ or $\theta(n) = \theta_1$. In Appendix 1, it is shown that $\frac{\partial \Delta_\theta}{\partial n} < 0$ if $\frac{d\theta}{dn} < 0$, which means that the change in bargaining power increases in the number of children. Because of this property, the second-order condition to (24) is unambiguously fulfilled.

Proposition 3. *There is underinvestment in fertility whenever the wife works part-time. In these cases, having children triggers a sufficient change in gender power so that the family has fewer than the optimal number of children.*

Proof. We obtain the following pattern of fertility choices. For $w_F \geq p$, the first-order condition is

$$\frac{1-\alpha}{n} - \frac{\alpha p/\phi}{w_M + w_F} = 0, \tag{27}$$

which is solved by (4). For $w_F < p$, the first-order condition is

$$\frac{1-\alpha}{n} - \frac{\alpha w_F/\phi}{w_M + w_F(1-\frac{n}{\phi})} + \alpha \cdot \Delta_\theta(n) = 0 \quad : \quad n < \phi \tag{28}$$

$$\frac{1-\alpha}{n} - \frac{\alpha w_F/\phi}{w_M} = 0 \quad : \quad n = \phi \tag{29}$$

$$\frac{1-\alpha}{n} - \frac{\alpha p/\phi}{w_M - p(\frac{n}{\phi} - 1)} = 0 \quad : \quad n > \phi. \tag{30}$$

Whenever the wife works part-time, additional children shift the intra-family bargaining power to her disadvantage. This effect vanishes once she specializes in child rearing.

Because (30) is solved by some $n < \phi$ (see the proof to Proposition 1), (30) can be ruled out as a solution. Hence, for $w_F < p$, the family has either exactly ϕ children or fewer. Let n° denote the solution to (28). Then, collecting terms, the family welfare from having n° and ϕ children amount to

$$\begin{aligned} V_1(n^\circ) &= \alpha \log\left(w_M + w_F(1 - n^\circ/\phi)\right) + (1-\alpha)\log n^\circ \\ &\quad + \theta_1 \alpha \log \theta(n^\circ) + (1-\theta_1)\alpha \log(1-\theta(n^\circ)) \quad \text{and} \end{aligned} \tag{31}$$

$$V_1(\phi) = \alpha \log w_M + (1-\alpha)\log\phi + \theta_1\alpha\log\underline{\theta} + (1-\theta_1)\alpha\log(1-\underline{\theta}) \tag{32}$$

respectively. Because $V_1(n^\circ) = V_1(\phi)$ for $n^\circ = \phi$, the corner solution, $n = \phi$, will be chosen whenever

$$V_1'(n^\circ)\big|_{n^\circ=\phi} = \frac{(1-\alpha)}{\phi} - \alpha\frac{w_F/\phi}{w_M} + \alpha \cdot \Delta_\theta(\phi) \geq 0$$
$$\iff \left(\frac{1-\alpha}{\alpha} + \phi \cdot \Delta_\theta(\phi)\right) w_M - w_F \geq 0. \tag{33}$$

Because $V(\phi) > V(n^\circ)$ for $w_F = 0$, and $\frac{\partial V_1(n^\circ)}{\partial w_F} > \frac{\partial V_1(\phi)}{\partial w_F}$ for all w_F, there is a unique female wage $\hat{w}_F$ for which (33) holds with equality. For $w_F \leq \hat{w_F}$, the family has ϕ children. Due to $\Delta_\theta(n) < 0$, $\hat{w}_F$ is lower than $(1-\alpha)w_M/\alpha$, the respective threshold in the efficient case. For $w_F > \hat{w}_F$, (33) is not fulfilled and fertility n° is given by (28). Comparing these decisions with the efficient ones from Proposition 1 shows that fertility is distorted downwards whenever $w_F \in (\hat{w}_F, p)$. □

Figure 2 compares the outcome of the sequential choice with the first best solution. For very low wages $w_F \leq \hat{w}_F$, the optimal solution and the sequential choice coincide. The wife devotes her entire time to raising the ϕ children. Here, the wife's wage is so low that the shift in bargaining power is not worth a reduction in the number of children. For wages $w_F \in (\hat{w}_F, p)$, the wife works part-time and takes care of the n° children at home. The number of children is always smaller than optimal for the family. This distortion occurs because the couple has to trade off the disadvantages from too few children with the ex-ante welfare loss from a shift in bargaining power. If the couple reduces the number of children, the wife can work more hours in the labor market and, thus, maintain part of her bargaining power. Finally, for $w_F \geq p$, the wife stays in the labor market and the children are in external care. As there is no shift in bargaining power, there is also no need to adjust the number of children compared to the first best.

In a sense, the period-1 couple – acting cooperatively – is eager to maintain the status quo. Any current action that induces changes in the future objective function leads to a loss of family welfare from today's perspective. This mechanism is at work when fertility affects the balance of power in the family. The period-2 family will choose a consumption pattern different from the one deemed optimal by the period-1 family. This time inconsistency distorts the incentives to have children downwards. This holds no matter whether children tilt the power towards the husband, as we have assumed here, or towards the wife.

We would like to stress that our results do not emerge from some arbitrary societal welfare function but directly from the couples' preferences. It is the impending change in bargaining power that forces the couple to have fewer children compared to the first best. If the shift in the bargaining power is an important driving force behind the (inefficiently) low fertility in modern society, this immediately raises the question of which policy measures

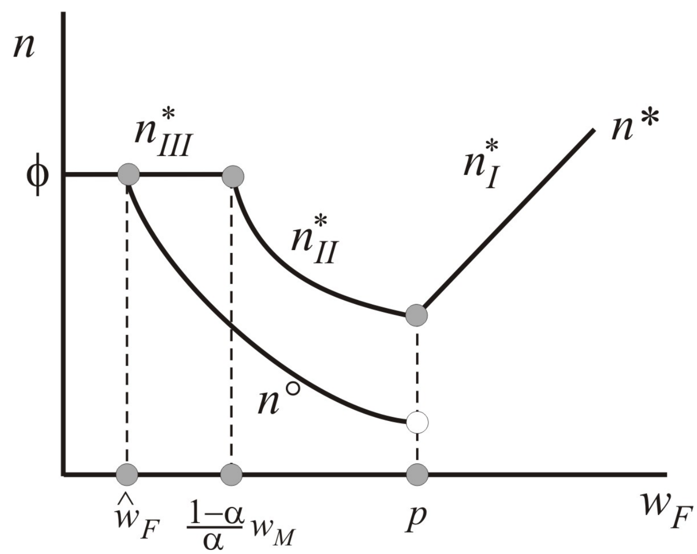

Figure 2: Fertility with Sequential Choices and Optimal Fertility

may help to stabilize the gender balance.

5 Family Policy

The previous section has shown that the couple suffers from inefficient fertility decisions when the wife has an intermediate wage. This establishes the possibility of efficiency-enhancing family policies. We consider three options, which enjoy much popularity in the discussion: child allowances, paid irrespective of the mode of child care chosen; maternal care benefits, accruing only to those families caring for their children at home; and, finally, subsidies of external care. We restrict ourselves to those cases where private decisions are inefficient in the absence of public intervention, that is $w_F \in (\hat{w}_F, p)$. Because of the microeconomic focus of our analysis, we do not model the revenue side of the public budget and disregard taxes at the household level. However, we determine and compare the funds required by the different policies.

5.1 Child Allowances

We start our analysis with the child allowance. Letting g denote the payment per child family resources in period 2 are $w_M + w_F - C(n) + g \cdot n$. Because this payment is not tied to a specific form of child rearing, it diminishes the marginal cost of a child by g for both maternal and external care. Child allowances have no immediate effect on gender power because they cannot be assigned directly to either spouse's contributions to family income. Child allowances affect the intra-family balance of power only via the number of children: $e_F^g = w_F(1 - n/\phi)/w_M$.

Proposition 4. *A properly chosen child allowance leads to efficient investment in fertility. The level of this payment can exceed the loss in female earnings due to child care.*

Proof. As the efficient number of children is at most ϕ, we restrict our attention to the case of maternal care. When fertility choices are inefficient, the first-order condition for fertility is

$$\Lambda_g \equiv \frac{1-\alpha}{n} - \frac{\alpha(w_F/\phi - g)}{w_M + w_F(1-\frac{n}{\phi}) + g \cdot n} + \alpha \cdot \Delta_\theta(n) \geq 0 \tag{34}$$

with strict equality for $n < \phi$. Rearranging (34) yields

$$g = \frac{w_F}{\phi} - \frac{(w_M + w_F)(1 - \alpha + \alpha n \Delta_\theta(n))}{n(1 + \alpha n \Delta_\theta(n))}. \tag{35}$$

as the level of the child allowance required for the family to have n children. The efficiency inducing allowances result from inserting n_{II}^* and n_{III}^* in (35). The denominator of the second term in (35) is always positive because

$$\begin{aligned} \frac{d\Lambda_g}{dg} &= \frac{\overbrace{\alpha(w_M + w_F(1-n/\phi) + gn) + n\alpha(w_F/\phi - g)}^{(>0)}}{(w_M + w_F(1-n/\phi) + gn)^2} \\ &= \frac{1 + \alpha n \Delta_\theta}{w_M + w_F(1-n/\phi) + gn} > 0, \end{aligned}$$

where the second step utilizes (34). Thus, the allowance is higher (lower) than the foregone female earnings per child w_F/ϕ if $1 - \alpha + \alpha n \Delta_\theta(n) < (>) 0$. □.

General child allowances stimulate fertility by increasing family income and lowering the cost of having children. Hence, they can serve as an instrument to even out the utility loss from changing gender power. The generosity of the allowance depends on the strength of the change in bargaining power. It is therefore possible that the optimal allowance exceeds the income loss due to rearing children at home. This is the case when the gender power effect exceeds the gross marginal utility of fertility: $\alpha\Delta_\theta(n^*) < (1-\alpha)/n^*$.

5.2 Maternal Care Benefit

Consider next the maternal care benefit. The benefit s per child is granted only when children are taken care of at home. This conditionality creates two differences with regard to the general payment analyzed above. First, it obviously favors home over external care because the income increase and the cost reduction are feasible only for the former type of care. This feature is of minor importance here because the period-2 family opts for maternal care anyway, facing income $w_M + w_F(1 - n/\phi) + s \cdot n$ and a per child cost of $w_F/\phi - s$. The second difference is more crucial. Because the benefit is designed as a compensation for the loss in female working time, it exerts a straight effect on her relative financial position in the family. We take this effect into account by setting $e_F^s = (w_F(1 - n/\phi) + s \cdot n)/w_M$. Thus, we can write the change of gender power as $\Delta_\theta(n, s)$. As shown in Appendix 2, the maternal care benefit mitigates the shift in bargaining power: $\frac{\partial \Delta_\theta}{\partial s} > 0$.

Proposition 5. *A proper maternal care benefit leads to efficient investment in fertility. This benefit does not fully compensate for the fertility-induced female income losses.*

Proof. The first-order condition for fertility in the presence of a maternal care benefit reads

$$\Lambda_s \equiv \frac{1-\alpha}{n} - \frac{\alpha(w_F/\phi - s)}{w_M + w_F(1 - n/\phi) + s \cdot n} + \Delta_\theta(n, s) \geq 0, \tag{36}$$

holding with equality when $n < \phi$. According to (36), fertility increases monotonously in s:

$$\frac{dn}{ds} = -\frac{\overbrace{\frac{\alpha(w_M + w_F)}{[w_M + w_F + n(s - \frac{w_F}{\phi})]^2}}^{(>0)} + \overbrace{\frac{\partial \Delta_\theta}{\partial s}}^{(>0)}}{\underbrace{\partial \Lambda_s / \partial n}_{(<0)}} > 0. \tag{37}$$

For $s = 0$, fertility is inefficiently low, and for $s = w_F/\phi$, fertility is inefficiently high: both the second and the third term in (36) vanish in that case. Thus, there is a unique positive, but not a fully income-compensating benefit leading to efficiency, which is implicitly characterized by

$$s - \frac{w_F}{\phi} + \frac{(w_M + w_F)(1 - \alpha + \alpha n \Delta_\theta(n, s))}{n(1 + \alpha n \Delta_\theta(n, s))} = 0. \tag{38}$$

with $n = n^*_{II}$ and n^*_{III}, respectively. □

This targeted benefit exerts two positive effects on fertility. First, it increases the net family income and reduces the cost of child rearing given gender power, similar to the general benefit. Second, it also strengthens the wife's bargaining position, alleviating the distortion of gender power. As the distortion of fertility decisions is rooted in the wife's bargaining position, the efficient benefit must compensate for the loss in female earnings only partially: a complete offset would eliminate the gender power effect by preserving the pre-fertility distribution of power, but provide additional incentives for having children by affecting income and cost. Hence, the number of children would be inefficiently high.

This effect on gender power renders the maternal care benefit a more appropriate tool than general child payments.

Proposition 6. *The maternal care benefit requires fewer resources to induce efficient fertility than the general child allowance.*

Proof. The maternal care benefit inducing the family to have a generic number n of children is characterized by (38), whereas the child allowance leading to the same fertility is given by (35). The difference between these payments for given n amounts to

$$\begin{aligned} s - g &= -\frac{w_M + w_F}{n} \left[\frac{1 - \alpha + \alpha n \Delta_\theta(n, s)}{1 + \alpha n \Delta_\theta(n, s)} - \frac{1 - \alpha + \alpha n \Delta_\theta(n)}{1 + \alpha n \Delta_\theta(n)} \right] \\ &= \frac{\alpha(w_M + w_F)}{(1 + \alpha n \Delta_\theta(n, s))(1 + \alpha n \Delta_\theta(n))} \left[\Delta_\theta(n) - \Delta_\theta(n, s) \right]. \end{aligned} \tag{39}$$

Due to $\frac{\partial \Delta_\theta}{\partial s} > 0, \Delta_\theta(n) < \Delta_\theta(n, s)$ and (39) is negative for all n, including the efficient fertility levels. □.

5.3 Subsidies for External Child Care

Finally, consider subsidization of external care. Families can purchase child care in the market at a price $\rho \leq p$. Doing so leads to total income $w_M + w_F - \rho \cdot n$. Because the wife works full time when care is external, having children does not affect the distribution of earnings: $e_F(n) = w_F / w_M$. Of course, external care will only be chosen if it is superior to maternal care from the perspective of period 2.

Proposition 7. *Efficient fertility can be induced by proper subsidization of the price of external care.*

Proof. Cost-minimization in period 2 leads to external child care whenever $w_F \geq \rho$. The respective number of children is characterized by

$$\Lambda_\rho \equiv \frac{1 - \alpha}{n} - \frac{\alpha \rho / \phi}{w_M + w_F - \rho n / \phi} = 0, \tag{40}$$

because neither is gender power affected ($\Delta_\theta(n) = 0$) nor is the number of children limited by a time constraint. The solution to (40) is

$$n_\rho = \frac{(1 - \alpha)\phi(w_M + w_F)}{\rho},$$

which coincides with the efficient number of children if

$$\rho = \begin{cases} w_F & : \ w_F \geq \frac{1 - \alpha}{\alpha} w_M \\ (1 - \alpha)(w_M + w_F) & : \ w_F < \frac{1 - \alpha}{\alpha} w_M. \end{cases} \qquad \square$$

With external child care, the shift in gender power, which is the source of inefficiency, is eliminated in a straightforward manner. Parents have to face the same income and cost of children as if they looked after the children themselves. That cost per child equals the female wage which is unambiguously lower than the market cost of external care. Hence, this policy requires resources in amount $p - w_F$ per unit of time needed for child care.

Proposition 8. *Subsidizing external care for efficient fertility requires fewer resources than maternal care benefits when the female wage is sufficiently high. When the female wage is sufficiently low, however, maternal care benefits require fewer resources than subsidies for external care.*

Proof. The cost of the external care subsidy is monotonously decreasing in w_F and goes to zero when $w_F \to p$. The maternal care benefit results in zero cost for $w_F = \frac{\alpha}{1-\alpha} w_H$ and is strictly positive for higher female wages. Hence, there must be at least one critical threshold where the costs of the two policy measures are identical. For $w_F \to \frac{\alpha}{1-\alpha} w_H$, maternal care benefits are cheaper. For $w_F \to p$, the external care subsidy is less expensive. □.

The intuition is as follows. If the female wage is high, the external care subsidy, which is necessary to induce the woman to work, is small. In contrast, the maternal care benefit is high as it has to compensate the change in bargaining power. Hence, external care subsidies are advantageous in this case. If the female wage is low, the subsidies for external care would have to be substantial. As the fertility-induced distortion of gender power is fairly small, only a minor maternal care benefit is needed to restore efficiency. Here, maternal care benefits are the cheaper alternative.

The Proposition 8 enables us to rank the two policies when the female wage is either at the upper or the lower bound of the interval considered. Unfortunately, no contentious comparisons are possible for intermediate female wages. This holds because w_F exerts countervailing effects on the optimal maternal care benefit. First, a higher female wage increases the relative price of children, so a higher benefit is necessary to achieve a given fertility level. Second, the efficient fertility level declines with w_F, which reduces the benefit required. And third, the shift in gender power can generally increase or decrease with the wife's earning opportunities. Appendix 3 presents sufficient assumptions on $\theta(n)$ establishing $\frac{\partial \Delta_\theta}{\partial w_F} < 0$, that is, a higher female wage aggravates the shift of gender power for any given number of children. However, still, the net impact of w_F on s remains ambiguous. Only if the first and third effect dominated the second one, would there be a unique threshold for the female wage below (above) which maternal care benefits (external care subsidies) would be cost-minimizing for the government.

6 Conclusion

The effectiveness of family policies may depend to a large extent on their impact on intrafamily bargaining. We have noted a specific channel where gender power is influenced by the relative incomes of spouses. We believe that this approach may prove to be quite useful for a better understanding of the success or failure of policy measures aiming at fertility behavior.

We admit that our simple model is just a first step. There are many open questions which will require further research. For instance, we have employed simple linear technology to describe child rearing; scale economies in child care may play an important role and affect the corner solutions in our setup. Furthermore, there are many more policy measures that might be used to reach efficient fertility levels such as the design of the tax system (Meier & Wrede, 2008) or mandatory parental leave.[10] Mandatory parental leave forces both spouses to spend some time with the children to qualify for the benefit. The concomitant decrease of male in favor of female earnings may help to maintain the original balance of power on the one hand, but reduce total family income and hence the demand for children on the other.

Moreover, gender power may be affected by potential earnings rather than actual earnings (Pollack, 2005). Under these circumstances, the policies investigated here appear to be equivalent because none of them affects potential earnings. However, suppose that staying out of the labor force diminishes productivity as in Hyee and Robledo (2009). Then, the mode of child care will still affect future earnings and bargaining power. The efficacy of the maternal care benefit would be diminished substantially because staying at home would deteriorate the female bargaining position without any opposite effect from accepting the benefit. In such a model, the case for external child care would be strengthened.

We also have taken a purely microeconomic view of a single representative household. Answering the policy question of how to raise fertility effectively requires a more comprehensive analysis of heterogeneous households where the government has only partial information about the household types. The number of children, the mode of child care and the market income are easily observable. However, the government may have greater difficulties in measuring the potential income of a household when one of the spouses stays home and raises the children. To increase fertility to the efficient level, the government has to pay transfers that depend on the type of household. It is far from obvious how the inefficient fertility choice can be corrected at lowest costs when the government has only incomplete information about the household type.

[10] See Wrede (2003) and Gugl (2009) for the effects of taxation in the context of intra-family bargaining.

Appendices

Appendix 1: Gender Power and the Number of Children

When fertility increases, the gender power effect changes according to

$$\begin{aligned}\frac{\partial \Delta_\theta}{\partial n} &= \frac{\partial^2 \theta}{\partial n^2}\Big[\frac{\theta_1 - \theta(n)}{(1-\theta(n))\theta(n)}\Big] \\ &\quad - \left(\frac{\partial \theta}{\partial n}\right)^2 \Big[\frac{(1-\theta(n))\theta(n) + (\theta_1 - \theta(n))(1-2\theta(n))}{[(1-\theta(n))\theta(n)]^2}\Big]. \qquad (41)\end{aligned}$$

From (23), $\frac{\partial \theta}{\partial n} = 0$ holds when either $w_F > p$ or $w_F < p$ and $n \geq \phi$, rendering (41) zero. For $w_F < p$ and $n < \phi$, we have

$$\frac{\partial \theta}{\partial n} = -\theta'(e_F) \cdot \left(\frac{w_F}{\phi}\right) < 0, \quad \frac{\partial^2 \theta}{\partial n^2} = \theta''(e_F) \cdot \left(\frac{w_F}{\phi}\right)^2 < 0.$$

Moreover, the square bracketed terms in (41) are positive because $\frac{1}{2} > \theta_1 > \theta(n)$. As a consequence, (41) is unambiguously negative.

Appendix 2: Maternal Care Benefit and Gender Power

The impact of the maternal care benefit on the gender power effect (26) amounts to

$$\begin{aligned}\frac{\partial \Delta_\theta}{\partial s} &= \frac{\partial^2 \theta}{\partial n \partial s}\frac{\theta_1 - \theta(n)}{(1-\theta(n))\theta(n)} \\ &\quad - \frac{\partial \theta}{\partial n}\frac{\partial \theta}{\partial s}\Big[\frac{(1-\theta(n)\theta(n) + (\theta_1 - \theta(n))(1-\theta(n))}{[(1-\theta(n))\theta(n)]^2}\Big] \qquad (42)\end{aligned}$$

By the definition of relative earnings: $e_F = (w_F(1-n/\phi) + s \cdot n)/w_M$, we obtain

$$\frac{\partial \theta}{\partial s} = \theta'(e_F) \cdot \frac{n}{w_M} > 0, \quad \frac{\partial^2 \theta}{\partial n \partial s} = \frac{\theta'(e_F)}{w_M} + \theta''(e_F) \cdot \frac{n}{w_M}\left(s - \frac{w_F}{\phi}\right) > 0.$$

In combination with the properties listed in Appendix 1, both terms in (42) are positive. Hence, the negative effect of home care on the wife's bargaining power is dampened by the maternal care benefit.

Appendix 3: Gender Power and the Female Wage

The gender power effect reacts to an increase in w_F as follows:

$$\begin{aligned}\frac{\partial \Delta_\theta}{\partial w_F} &= \frac{\partial^2 \theta}{\partial n \partial w_F}\frac{\theta_1 - \theta(n)}{(1-\theta(n))\theta(n)} - \frac{\partial \theta}{\partial n}\frac{\partial \theta}{\partial w_F}\Big[\frac{(1-\theta(n))\theta(n) + (\theta_1 - \theta(n))(1-\theta(n))}{[(1-\theta(n))\theta(n)]^2}\Big] \\ &\quad + \frac{\partial \theta}{\partial n} \cdot \frac{\frac{\partial \theta_1}{\partial w_F} - \frac{\partial \theta(n)}{\partial w_F}}{(1-\theta(n))\theta(n))}.\end{aligned}$$

When $\frac{\partial\theta}{\partial n} \neq 0$, the above expression can be reformulated by using (26) as

$$\frac{\partial \Delta_\theta}{\partial w_F} = \Delta_\theta \cdot \Big[\frac{\partial^2\theta}{\partial n \partial w_F} / \frac{\partial\theta}{\partial n} - \frac{1-2\theta(n)}{(1-\theta(n))\theta(n)} \frac{\partial\theta}{\partial w_F} + \frac{\partial\theta_1/\partial w_F - \partial\theta(n)/\partial w_F}{(1-\theta(n))\theta(n)}\Big], \quad (43)$$

with

$$\frac{\partial\theta}{\partial w_F} = \theta'(e_F)\cdot\frac{1-n/\phi}{w_M}, \quad \frac{\partial^2\theta}{\partial n\partial w_F} = -\frac{\theta'(e_F)+\theta''(e_F)\cdot e_F}{w_M\phi}, \quad \frac{\partial\theta_1}{\partial w_F} = \theta'\left(\frac{w_F}{w_M}\right)\cdot\frac{1}{w_M}.$$

Hence, (43) equals:

$$\frac{\partial \Delta_\theta}{\partial w_F} = \frac{\Delta_\theta}{w_F}\left[1 + \frac{\theta(n)}{1-\theta(n)}\frac{\theta'(e_F)\cdot e_F}{\theta(e_F)} - e_F\left(\frac{\theta'(e_F)}{\theta(e_F)} + \frac{\theta''(e_F)}{\theta'(e_F)}\right)\right] \quad (44)$$

$$+\frac{\Delta_\theta}{w_M(1-\theta(n))\theta(n)}\left[\theta'\left(\frac{w_F}{w_M}\right) - \left(1-\frac{n}{\phi}\right)\theta'\left(\frac{w_F}{w_M}\left(1-\frac{n}{\phi}\right)\right)\right]\frac{\partial\theta}{\partial w_F} \quad (45)$$

Sufficient assumptions for this expression to be negative are $\frac{\theta'(e_F)}{\theta(e_F)}+\frac{\theta''(e_F)}{\theta'(e_F)} < 0$ and $\theta'(e_F) > \lambda\theta'(\lambda\cdot e_F)$. These assumptions are fulfilled, for example, for a bargaining weight $\theta(e_F) = \underline{\theta} + e_F^\beta, \beta < 1$ when $\underline{\theta}$ is sufficiently large.

Appendix 4: High Fertility Preference

The analysis in the main text has supposed that $\alpha > w_M/(w_M + p)$. This Appendix derives reports on the main findings of the analysis in the case that this assumption is violated. Then, the preference for children is so high that maternal and external care are used simultaneously.

With respect to efficiency, we have

Proposition 1'. *The efficient allocation of fertility and child care depends on parental wages and the price of external care. If $w_F \geq p$, full external care is efficient and the number of children should be*

$$n_I^* = (1-\alpha)\phi\frac{w_M + w_F}{p}. \quad (46)$$

If $p > w_F$, there should be

$$n_{IV}^* = (1-\alpha)\phi\frac{w_M + p}{p} \quad (47)$$

children, raised by both external and internal care. The wife specializes in child care.

Proof. This proof is analogous to the Proof of Proposition 1 because conditions (7)-(12) remain valid. The only difference is that n_{IV}^* is now viable as the solution to (12). □

Now, the wife spends all her time in child care when her wage is lower than the cost of external child care. Again, fertility is determined by full income and the cost of children.

The cost of external care affects both factors, as the market value of the female time endowment equals the price of buying that time in the market.

The efficient pattern of child care also results in a straightforward manner from the cost-minimization problem of the period-2 family, so Proposition 2 is unaltered. The fact that the wife reduces her labor market participation creates the time-consistency problem:

Proposition 3'. *There is underinvestment in fertility whenever the wife works part time. In these cases, having children triggers a sufficient change of gender power so that the family has less than the optimal number of children.*

Proof. For $w_F > p$, the first-order condition for fertility equals (27), which is solved by n_I^*. Hence, the efficient number of children are born. For $w_F \le p$, the first-order condition reads

$$\frac{1-\alpha}{n} - \frac{\alpha w_F/\phi}{w_M + w_F(1-n/\phi)} + \alpha\Delta_\theta(n) = 0 \quad : \quad n \le \phi \tag{48}$$

$$\frac{1-\alpha}{n} - \frac{\alpha p/\phi}{w_M + p(1-n/\phi)} = 0 \quad : \quad n > \phi. \tag{49}$$

The first option is to have at most ϕ children. As (48) equals (28), (48) is solved by n° which provides family welfare

$$\begin{aligned} V_1(n^\circ) = \theta_1 \cdot \alpha \log\left[\theta\left(n^\circ\right) \cdot \left(w_M + w_F\left(1 - \frac{n^\circ}{\phi}\right)\right)\right] \\ + (1-\theta_1)\cdot \alpha \log\left[\left(1 - \theta\left(n^\circ\right)\right) \cdot \left(w_M + w_F\left(1 - \frac{n^\circ}{\phi}\right)\right)\right] + (1-\alpha)\log n^\circ. \end{aligned} \tag{50}$$

Alternatively, the family could decide to have more than ϕ children. This requires that the wife stay out of the labor market completely and $\theta(n) = \underline{\theta}$. Then, an additional child does not create any further distortions in gender power, and the efficient number of children n_{IV}^* solves (49). The respective family welfare amounts to

$$\begin{aligned} V_1(\phi) = \theta_1 \cdot \alpha \log\left[\underline{\theta} \cdot \left(w_M - p\left(1 - \frac{n_{IV}^*}{\phi}\right)\right)\right] \\ + (1-\theta_1)\cdot(1-\theta_1)\cdot \alpha \log\left[\left(1 - \underline{\theta}\right) \cdot \left(w_M - p\left(1 - \frac{n_{IV}^*}{\phi}\right)\right)\right] + (1-\alpha)\log n^*. \end{aligned} \tag{51}$$

The family chooses either n_{IV}^* or n°, depending on whether (51) is higher or lower than (50). As $\frac{\partial V(n^\circ)}{\partial w_F} > \frac{\partial V(\phi)}{\partial w_F}$, there exists a unique $\hat{w}_F'$, such that for a lower female wage the family has n° children and the wife works part time, and for a higher female wage the family raises n_{IV}^* children by both the full time endowment of the mother and external care. □.

Here, the same mechanisms are at work as in the case $\alpha > w_M/(w_M + p)$. The only difference is the discontinuity of fertility with respect to the female wage at $\hat{w}'_F$. This discontinuity results because the preference for children is so high that efficient fertility requires more than the mother's full time endowment: $n^*_{III} = \phi < n^*_{IV}$. Irrespective of α, a couple deciding to have so many children that the wife specializes in child care opts for the efficient fertility level because the gender power effect is zero at the margin.

Similar to the analysis in the main text, fertility decisions are inefficient when $w_F \in [\hat{w}'_F, p]$. Therefore, the discussion of family policy is absolutely analogous to the one provided in Section 5 with $\hat{w}'_F$ replacing $\hat{w}_F$.

References

Apps, P. & R. Rees (2004): Fertility, Taxation and Family Policy, Scandinavian Journal of Economics 106, 745-763

Basu, K. (2006): Gender and Say: A Model of Household Behaviour with Endogenously Determined Balance of Power, Economic Journal 116, 558-580

Becker, G. (1991): A Treatise on the Family, Harvard University Press

Chiappori, A. (1992): Collective Labor Supply and Welfare, Journal of Political Economy 100, 437467.

Cigno, A. (1992): Children and Pensions, Journal of Population Economics 5, 175-183

Cigno, A., Luporini, A. & A. Pettini (2003): Transfers to Families with Children as a Principal-Agent Problem, Journal of Public Economics 87, 1165-1172

Galor, O. & D. Weil (1996): The Gender Gap, Fertility, and Growth, American Economic Review 86, 374-387

Fenge, R. & V. Meier (2005): Pensions and Fertility Incentives, Canadian Journal of Economics 38, 2848

Gugl, E. (2009): Income Splitting, Specialization, and Intra-family distribution, Canadian Journal of Economics 42, 10501071

Hazan, M. & H. Zoabi (2011): Do Highly educated Women Choose Smaller Families?, CEPR Discussion Paper No. DP8590

Hener, T. (2010): Do Couples Bargain over Fertility? Evidence Based on Child Preference Data, Ifo Working Paper 92

Hyee, R. & J.R. Robledo (2009): Specialization in the Bargaining Family, Queen Mary University of London, School of Economics and Finance, Working Paper 640

Iyigun, M. & R.P. Walsh (2007): Endogenous Gender Power, Household Labor Supply and the Demographic Transition, Journal of Development Economics 82, 138-155

Konrad, K.A. & K.E. Lommerud (1995): Family Policy with Non-cooperative Families, Scandinavian Journal of Economics 97, 581-601

Konrad, K. A. & K. E. Lommerud (2000): The Bargaining Family Revisited, Canadian Journal of Economics 33, 471487

Lechene, V. & I. Preston (2011): Noncooperative Household Demand, Journal of Economic Theory 146, 504-527

Lundberg, S., R. Pollak & T. Wales (1997): Do Husbands and Wives Pool their Resources? Evidence from the United Kingdom Child Benefit, Journal of Human Resources 32, 463480

Lundberg, S. &. R.A. Pollack (2003): Efficiency in Marriage, Review of Economics of the Household 1, 153-167

Meier, V. & M. Wrede (2008): Reducing the Excess Burden of Subsidizing the Stork: Joint Taxation, Individual Taxation, and Family Tax Splitting, CESifo Working Paper 2470

Pollack, R.A. (2005): Bargaining Power in Marriage: Earnings, Wage Rates and Household Production, NBER Working Paper 11239

Rasul, I. (2008): Household Bargaining over Fertility: Theory and Evidence from Malaysia, Journal of Development Economics 86, 215-241

Sinn, H.W. (2001): The Value of Children and Immigrants in a Pay-As-You-Go Pension System: A Proposal for a Partial Transition to a Funded System, ifo-Studien 47, 77-94

Wrede, M. (2003): Income Splitting Is it Good for Both Partners in the Marriage? German Economic Review 4, 203 - 216